DUNBEG SOUTH WIND FARM

FURTHER ENVIRONMENTAL INFORMATION 2023 (LA01/2022/0981/F)

Further Environmental Information, July 2023
Rotor Diameter Amendment

powering change

Table of Contents

SECTION 1

Preface for

LA01/2022/0981/F

Preface

This Document should be read in conjunction with the Environmental Statement which was submitted on 28th June 2023 (LA01/2022/0981/F).

This FEI has been prepared by RES in consultation with Causeway Coast & Glens BC, various consultees and in collaboration with the subject specialists outlined below.

Specialism	Author
Introduction & Planning Policy; Proposed Development (including Electromagnetic Interference and aviation); Design Evolution & Alternatives; and Transport.	RES
Archaeology and Cultural Heritage	Gahan and Long
Ecology	Blackstaff Ecology
Ornithology	David Steele
Fisheries	Paul Johnston Associates
Geology and Water Environment Peat Slide Risk & Peat Management Plan	McCloy Consulting Natural Power
Socioeconomics	Oxford Economics
LVIA	Shanti McAllister Landscape Planning

The proposal of the rotor diameter increase will not alter the findings of several of the impact assessments completed for the original Environment Statement Chapters submitted for the previously consented development in LA01/2018/0200/F, including Archaeological & Cultural Heritage impact assessment; Ecological impact assessment; Ornithology impact assessment; Fisheries impact assessment; Geology and water impact assessment; Traffic and transport assessment; and Socioeconomic assessment.

The proposed amendment of the rotor diameter will allow consideration of a wider range of turbine models for installation at the site. Given that alternative turbines may now be considered, which were not considered during the submission of impact assessments for the LA01/2018/0200/F development; necessary impact assessments have now been conducted in relation to the use of alternative turbine models not previously considered.

The impact assessments which have been revisited include: Landscape and Visual, Shadow Flicker, and Noise. These impact assessments have been submitted to Causeway Coast & Glens Borough Council Planning Department on the 29th of June 2023 within an Environmental Statement (LA01/2022/0981/F). This document should be read in conjunction with the aforementioned Environmental Statement.

SECTION 2

FEI PROVIDED IN 2019 OF CONSENTED LA01/2018/0200/F APPLICATION

DUNBEG SOUTH WIND FARM

Further Environmental Information (2019)

Volumes 1 - Non Technical Summary

CONSENTED (LA01/2018/0200/F)

Contents

CONSENTED (LA01/2018/0200/F)

Preface

This Further Environmental Information 2019 has been prepared in support of the planning application for the proposed Dunbeg South Wind Farm.

The FEI has been prepared by Renewable Energy Systems Limited (RES) in collaboration with the various specialists outlined below.

FEI Technical Support

Technical Specialism	Organisation
Outline Habitat Restoration Managemnt Plan	Blackstaff Ecology David Steele Ornithology McCloy Consulting
Construction Environmental Management Plan	McCloy Consulting Natural Power

An electronic version of the FEI 2019 and other details about the project can be viewed at www.dunbegsouth-windfarm.co.uk.

Reference copies of the full ES (2018), FEI (October 2018) and planning application may be viewed and or purchased during normal opening hours at the following location

Viewing Location	Address
Limavady Library	5 Connell Street Limavady County Londonderry BT49 0EA Phone: 028 7776 2540

The FEI 2019 is available free of charge on CD or in paper form from the address above, or by contacting RES.

Renewable Energy Systems Ltd

Williowbank Business Park

Willowbank Road

Millbrook

Larne

County Antrim

BT40 2SF

CONSENTED (LA01/2018/0200/F)

An electronic version of the reports supporting the application, including the ES and FEI, are available to download free of charge from http://www.dunbegsouth-windfarm.co.uk

CONSENTED (LA01/2018/0200/F)

Introduction

1.1 This Non-Technical Summary (NTS) has been prepared in support of a planning application by RES Ltd for the proposed Dunbeg South Wind Farm, hereinafter referred to as 'the Development', which is located approximately 6 km north east of Limavady, County Derry/Londonderry.

1.2 A planning application has been submitted to Causeway Coast & Glens BC in accordance with the Planning (Environmental Impact Assessment) Regulations, 2017. The regulations require an Environmental Impact Assessment (EIA) to be carried out and the results of the EIA to be included in an Environmental Statement (ES) to accompany the planning application. The application follows a detailed assessment of the environmental and technical aspects of the site's suitability for development.

1.3 Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[1]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens District Council area.

The Applicant

1.4 RES is one of the world's leading independent renewable energy project developers with operations across Europe, the Americas and Asia-Pacific. At the forefront of renewable energy development for over 30 years, RES has developed and/or built almost 12,000 MW of renewable energy capacity worldwide. In the UK alone, RES currently has more than 1,000 MW of projects either constructed, under construction or consented. RES is active in a range of renewable energy technologies including onshore and offshore wind, solar, as well as enabling technologies such as energy storage.

1.5 RES has developed 16 onshore wind farms in Northern Ireland totalling 229 MW, which equates to 36% of Northern Ireland's onshore wind capacity. RES currently operates over 83 MW of wind capacity across Northern Ireland, has secured planning permission for a further 112 MW awaiting construction and has 92 MW in the planning system.

[1] This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

CONSENTED (LA01/2018/0200/F)

Non-Technical Summary

1.6 The purpose of this FEI is to update and complement, where appropriate, the environmental information previously submitted. The ES (Volumes 1 – 4) submitted in February 2018 together with the FEI (2019), will comprise the environmental information before Causeway Coast & Glens Borough Council (CC&G BC).

1.7 The information contained in the Further Environmental Information (2019) Volumes 1 – 3 has been produced to present revisions to previously submitted information and addenda (where relevant) to take into account comments received from CC&G BC in their letter dated 28th January 2019 and relevant correspondence from consultees (See Appendix 1 of Volume 2: Main Report & Appendices).

1.8 This document is a 'non-technical' summary of the Further Environmental Information (2019) with detailed information being presented in the ES (2018) and FEI (2019).

Structure of the FEI

1.9 This FEI has been prepared in accordance with the EIA Regulations and comprises the following volumes:

- Volume 1 - Non Technical Summary;
- Volume 2 – Main Text & Appendices;
- Volume 3 - Figures;

1.10 Volume 2 is organised as follows:

- Introduction: sets out the purpose of the FEI, provides detail of any revisions to the project and provides an overview of supplementary chapters.

1.11 Supplementary Sections report the finding of each of the topics included within the FEI (2019). The topics are covered in the following structure:

- Section A – Outline Habitat Restoration & Management Plan;
- Section B - Outline Construction Environmental Management Plan.

Revised Proposal

The Project

1.12 Excepting the changes described herein, the elements of the proposed Dunbeg South Wind Farm remain as described in Chapter 3 of the Dunbeg South Environmental Statement (February 2018).

1.13 The proposed project comprises which comprises 9 three-bladed, horizontal axis wind turbines, each up to a maximum of 149.9 m to tip height, with a total installed capacity of up to 29.7 MW. The Development would include associated external electricity transformers, underground cabling, a newly created site entrance, access tracks, turning heads, crane hardstandings, control building and substation compound and energy storage containers. During construction and commissioning there would be a number of temporary works including a

CONSENTED (LA01/2018/0200/F)

construction compound with car parking, temporary parts of crane hardstandings and welfare facilities.

1.14 This Further Environmental Information (FEI) has been prepared by RES Limited (RES) to supplement the planning application made to Causeway Coast & Glens BC for permission to construct, operate and decommission a wind farm known as Dunbeg South Wind Farm, hereinafter referred to as 'the Development'.

1.15 The application site is located approximately 6 km northeast of Limavady, Co. Derry/Londonderry, as shown in Figure 1 - Site Location. The proposed layout is illustrated in Figure 2: Infrastructure Layout.

FEI Request

1.16 CC & G BC requested Further Environmental Information by letter on 28th January 2019 (see Appendix 1 of Volume 2: Main Report & Appendices), requiring clarification in relation to the following:

- Aviation;
- Transport;
- Habitat Management, and;
- Construction Environmental Management Plan (CEMP).

Aviation

1.17 City of Derry's (CODA) initial consultation response of 2nd March 2018 advised that the Development would impact on CODA operations and that they were in discussions to determine suitable mitigation to minimise the impact. Following a meeting on 26th April 2018 and further discussions with CODA regarding a suitable suite of planning conditions, CODA responded on 3rd August 2018 (See Appendix 1 of Volume 2: Main Report & Appendices) to advise that subject to the inclusion of stated conditions that they have no objection.

Transport

1.18 Transport NI advised in their consultation response dated 22nd June 2018 (see Appendix 1) that they would require more detail of the site entrance:

1.19 Accordingly the Site Entrance Drawing – Figure 2.8 has been revised to reflect the above requirements and Figure 2.8 - Revision A is included in Volume 3 – Figures.

The Supplementary / Additional Assessments

<u>Revised Outline Habitat Restoration Management Plan</u>

1.20 Appendix 6.9 of ES – Outline Habitat Management Plan has been revised and supercedes the previous version as submitted with the Environmental Statement (February 2019).

1.21 The main change made as part of FEI (2019) is the significant increase of habitat enhancement proposed as part of the development is that an additional 75 hectares

CONSENTED (LA01/2018/0200/F)

of habitat enhancement is now incorporated into the current proposal covering an area of approximately 90 hectares.

1.22 Habitat management is proposed within land under the applicants control and comprises a combination of measures with the aim of improving the conservation status of said habitat so that at the end of the 30 year – lifetime of the project that it meets the criteria as an NI Priority Habitat. With the successful implementation of the OHMP there should be 'Net Gain' in biodiversity terms, which more than offsets for any habitat lost or damaged during the construction and operation of the wind farm.

Outline Construction Environmental Management Plan

1.23 The outline CEMP identifies and co-ordinates all of the mitigation recommended in the various chapters of the Environmental Statement (2018) and details the implementation of the identified measures and how these will be monitored and reported during construction, operation decommissioning.

The Need for the Proposed Wind Farm

1.24 A key policy driver for the development of renewable energy in Northern Ireland is the need to increase security of supply. There are also potential adverse impacts on local populations and the economy through high volatile fuel costs, contributing to fuel poverty and high energy costs for businesses and industry. In addition, increasing focus on renewable energy can deliver environmental and climate change gains, reductions in carbon emissions, as well as investment and employment opportunities. With a lack of indigenous fossil fuel and no nuclear power stations, Northern Ireland is keen to develop the full range of its available renewable energy resources to optimise the contribution that renewables make to the overall energy mix.

1.25 Northern Ireland's current renewable energy target is that 40% of electricity consumption should be met from renewable sources by 2020 (DETI 2010). The 40% target is the equivalent of 1600 MW. Wind energy will be the main focus of renewable electricity development on the island of Ireland, and certainly in Northern Ireland.

1.26 If approved, the proposed Dunbeg South Wind Farm could account for up to 29.7 MW, a material contribution to achieving the 40% renewable energy target for 2020 and will positively contribute towards the wider UK's Renewable Energy Strategy target. This is the equivalent of approximately 23,000 homes based on an output of 29.7 MW.[2]

[2] The 23,000 homes equivalent has been calculated by taking the predicted annual electricity generation of the site (based on RES studies at Dunbeg South Wind Farm has a predicted capacity factor of 36% - based on the 3.3MW turbine) and dividing this by the annual average electricity consumption figures from the Department of Business, Energy and Industrial Strategy (3994 kWh).

CONSENTED (LA01/2018/0200/F)

1.27 It is also important to highlight that energy production is not static and additional renewable generation will be required to be connected to achieve and maintain the NI targets and subsequently achieve and maintain the UK renewable targets.

Summary

1.28 The potential effects of the proposed Dunbeg South Wind Farm have been assessed in accordance with regulatory requirements and good practice. The ES (2018) and FEI (2019) incorporate technical assessments of the proposed development based on requisite legislation and relevant planning policy framework and have demonstrated that significant environmental effects associated with the construction, operation and decommissioning of the proposed wind farm have been avoided or minimised through the use of the iterative design process and with the application of mitigation measures.

1.29 The Dunbeg South Wind Farm will provide a number of benefits. The scheme will result in a reduction in greenhouse gas emissions from the electricity generating industry by harnessing wind, as an alternative to the burning of fossil fuels, in line with the local government's energy goals and wider UK energy targets.

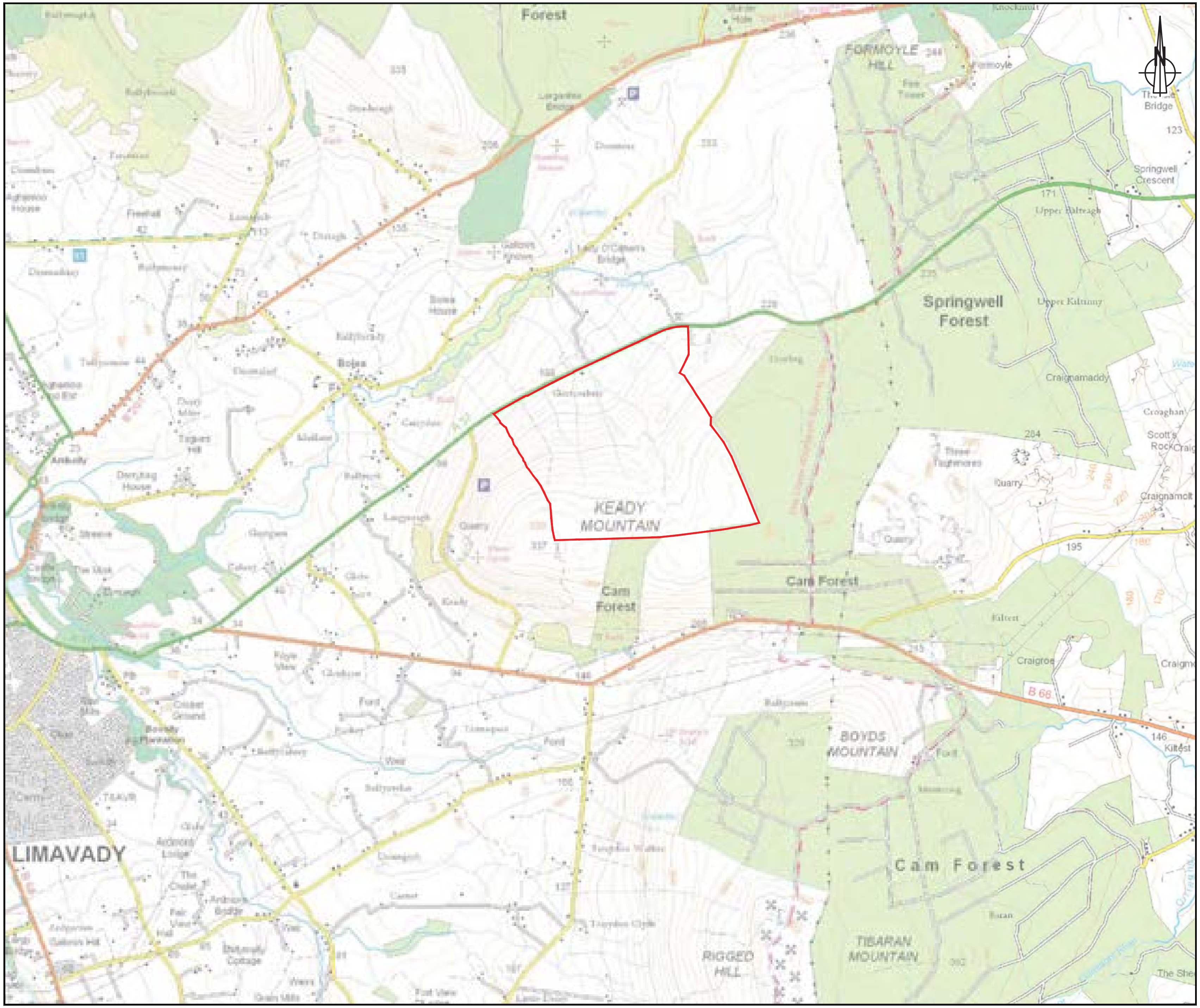
1.30 Paragraph 5.72 of SPPS states "Planning authorities should be guided by the principle that sustainable development should be permitted, having regard to the local development plan and all other material considerations, unless the proposed development will cause demonstrable harm to interests of acknowledged importance". RES are firmly of the opinion that the Dunbeg South Wind Farm is a suitable location for a wind farm development and that the ES (2018) and FEI (2019) demonstrate that to be the case.

1.31 Onshore wind is now the cheapest form of any new generation bar none and Dunbeg South, if approved, would play an important part in helping to make the important transition to a low cost, low carbon future for Northern Ireland.

CONSENTED (LA01/2018/0200/F)

Figures

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 1

SITE LOCATION MAP

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

SITE LOCATION

LAYOUT DWG N/A

T-LAYOUT NO. N/A

DRAWING NUMBER

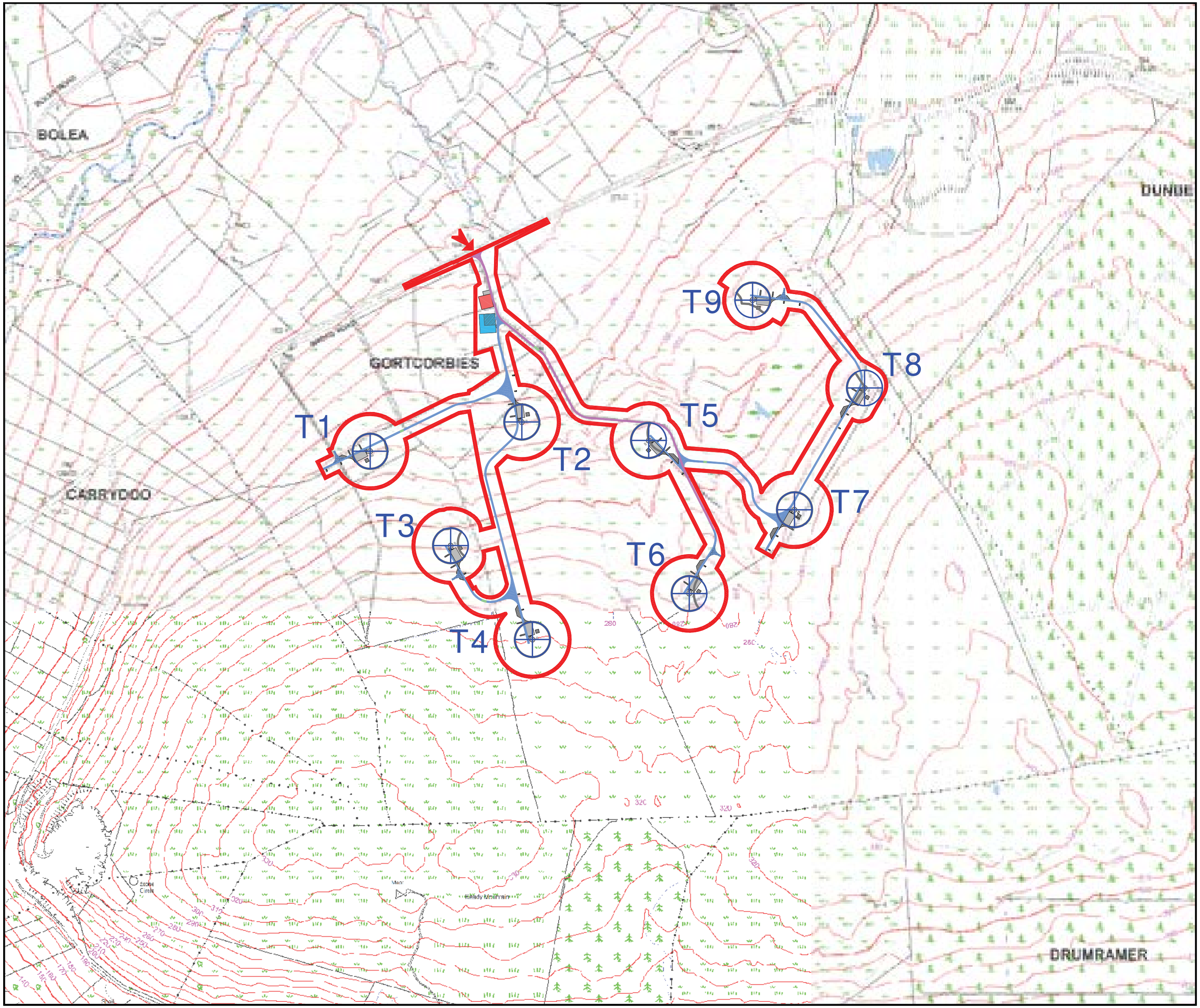
03219D1001-02

SCALE - 1:50,000 @ A4

NON-TECHNICAL SUMMARY 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2

INFRASTRUCTURE LAYOUT

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

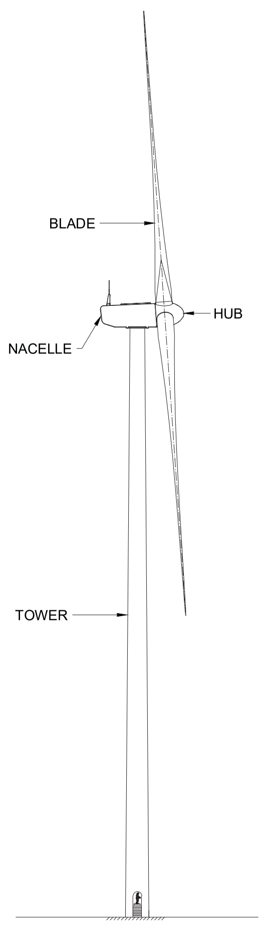
KEY

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

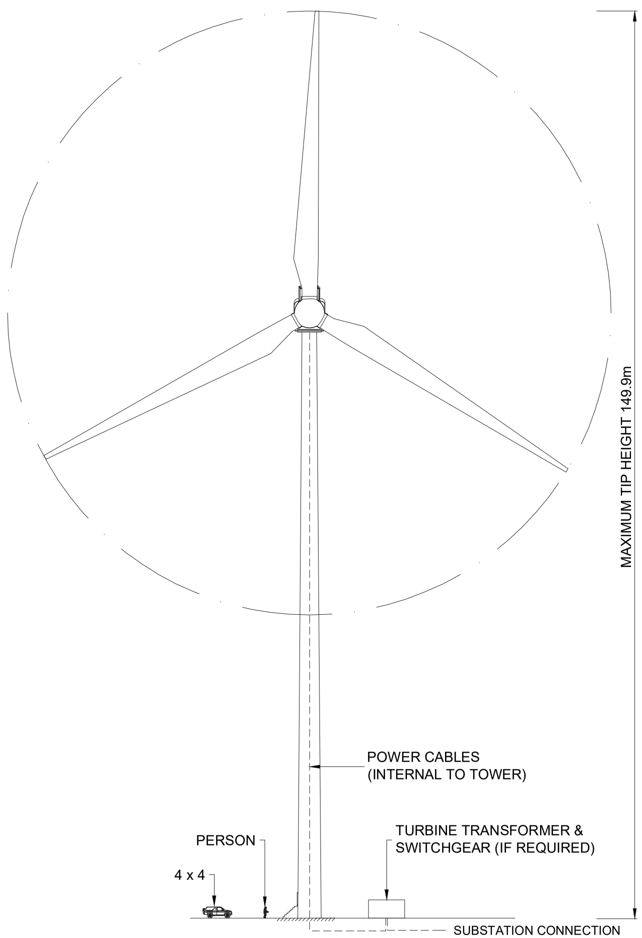
LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028
DRAWING NUMBER 03219D1001-02	
SCALE - 1:15,000 @ A4	
NON-TECHNICAL SUMMARY 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SIDE VIEW



FRONT VIEW

PHOTOGRAPH OF TYPICAL TURBINE

res

DUNBEG SOUTH WIND FARM

FIGURE 3

TURBINE ELEVATION

LAYOUT DWG N/A	T-LAYOUT NO. N/A

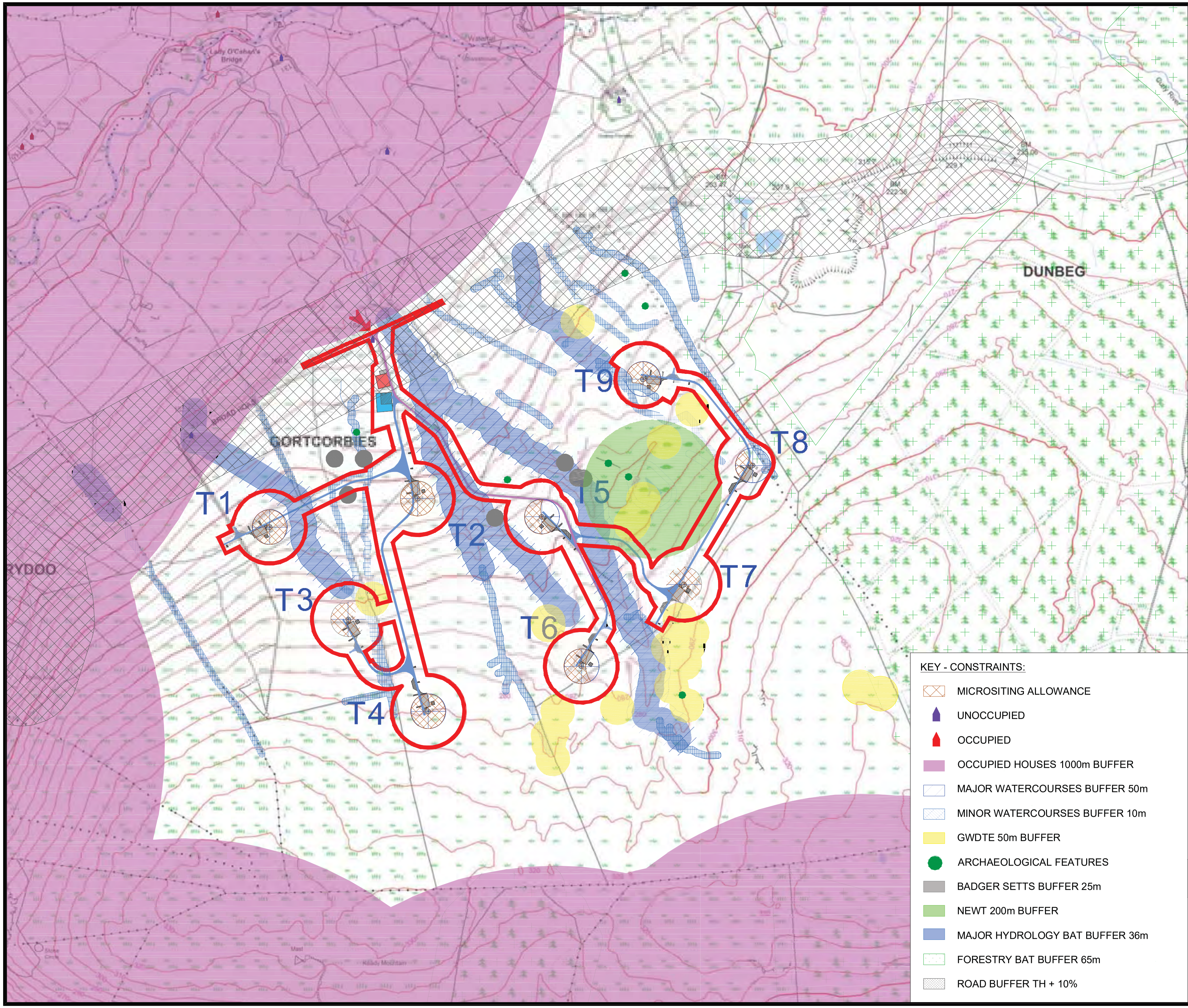
DRAWING NUMBER **03219D2901-01**

SCALE - 1:1250 @ A4

NON TECHNICAL SUMMARY 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4

COMBINED CONSTRAINTS & INFRASTRUCUTRE

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY - INFRASTRUCTURE:

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG	03219D0001-06	T-LAYOUT NO.	PNIRdbx028

DRAWING NUMBER: 03219D2237-01

SCALE - 1:15,000 @ A4

NON TECHNICAL SUMMARY
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

DUNBEG SOUTH WIND FARM
Further Environmental Information (2019)

Volumes 2 - Main Report & Appendices

powering change

CONSENTED (LA01/2018/0200/F)

Contents

CONSENTED (LA01/2018/0200/F)

1 Introduction

Background

1.1 In February 2018, Renewable Energy Systems (RES) submitted an application (planning reference LA01/2018/0200/F) to Causeway Coast & Glens Borough Council (CC & G BC), Northern Ireland for permission to erect a 9-turbine wind farm, near Limavady, Co. Derry.

1.2 The application was subject to Environmental Impact Assessment (EIA) under the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017. Environmental information in the form of an Environmental Statement to accompany the planning application was prepared by RES. A full project description, including a range of technical and environmental studies were prepared to allow CC & G BC to assess the environmental impacts, and these were reported in the Dunbeg South Wind Farm Environmental Statement (ES) which accompanied the planning application.

1.3 CC & G BC requested Further Environmental Information on 28th February 2019 following consultation with statutory and non-statutory bodies.

Purpose of the FEI

1.4 The purpose of this FEI is to update and complement, where appropriate, the environmental information previously submitted. The ES (Volumes 1 – 4) submitted in February 2018 together with the FEI (2019), will comprise the environmental information before Causeway Coast & Glens Borough Council (CC&G BC).

1.5 The information contained in the Further Environmental Information (2019) Volumes 1 – 3 has been produced to present revisions to previously submitted information and addenda (where relevant) to take into account comments received from CC&G BC in their letter dated 28th January 2019 and relevant correspondence from consultees (See Appendix 1).

Structure of the FEI

1.6 This FEI has been prepared in accordance with the EIA Regulations and comprises the following volumes:

- Volume 1 - Non Technical Summary;
- Volume 2 – Main Text & Appendices;
- Volume 3 - Figures;

1.7 Volume 2 is organised as follows:

- Introduction: sets out the purpose of the FEI, provides detail of any revisions to the project and provides an overview of supplementary chapters.

1.8 Supplementary Sections report the finding of each of the topics included within the FEI (2019). The topics are covered in the following structure:

- Section A – Outline Habitat Restoration & Management Plan;

CONSENTED (LA01/2018/0200/F)

- Section B - Outline Construction Environmental Management Plan

Revised Proposal

The Project

1.9 Excepting the changes described herein, the elements of the proposed Dunbeg South Wind Farm remain as described in Chapter 3 of the Dunbeg South Environmental Statement (February 2018).

1.10 The proposed project comprises which comprises 9 three-bladed, horizontal axis wind turbines, each up to a maximum of 149.9 m to tip height, with a total installed capacity of up to 29.7 MW. The Development would include associated external electricity transformers, underground cabling, a newly created site entrance, access tracks, turning heads, crane hardstandings, control building and substation compound and energy storage containers. During construction and commissioning there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and welfare facilities.

1.11 This Further Environmental Information (FEI) has been prepared by RES Limited (RES) to supplement the planning application made to Causeway Coast & Glens BC for permission to construct, operate and decommission a wind farm known as Dunbeg South Wind Farm, hereinafter referred to as ‘the Development’.

1.12 The application site is located approximately 6 km northeast of Limavady, Co. Derry/Londonderry, as shown in Figure 1.1: Site Location.

FEI Request

1.13 CC & G BC requested Further Environmental Information by letter on 28th January 2019 (see Appendix 1), requiring clarification in relation to the following:

- Aviation;
- Transport;
- Habitat Management, and;
- Construction Environmental Management Plan (CEMP).

1.14 Whilst Habitat and Construction Management require more substantial revisions to provide the necessary level of detail, Aviation and Transport can be dealt with succinctly.

Aviation

1.15 City of Derry’s (CODA) initial consultation response of 2nd March 2018 advised that the Development would impact on CODA operations and that they were in discussions to determine suitable mitigation to minimise the impact. Following a

CONSENTED (LA01/2018/0200/F)

meeting on 26th April 2018 and further discussions with CODA regarding a suitable suite of planning conditions, CODA responded on 3rd August 2018 (see Appendix 1) to advise that subject to the inclusion of stated conditions that they have no objection.

Transport

1.16 Transport NI advised in their consultation response dated 22nd June 2018 (see Appendix 1) that they would require more detail of the site entrance so that the following was adequately shown:

- DfI Roads would advise that the submitted plans regarding the access on to Broad Road are unacceptable in relation to scale and detail.
- 1:500 scale plan based on an accurate ground survey indicating all roadside detail, fence lines, buildings etc. within the extent of the required visibility splays i.e. 215 metres on each side of the proposed access;
- the proposed access superimposed on the existing plan together with the visibility splays of 4.5m x 215m shown to the edge of the carriageway. The proposed access drainage and its outlet, radii, gradient etc;
- the position of any gates being erected at the access should be shown on the plan. It should be noted that the gates should be sited far enough from the edge of the carriageway to allow the largest vehicle likely to use the access to stop clear of the carriageway when the gates are closed;
- the width of the access to be 6m minimum for the first 20m from the edge of the carriageway.

1.17 Accordingly the Site Entrance Drawing – Figure 2.8 has been revised to reflect the above requirements and Figure 2.8 - Revision A is included in Volume 3 – Figures.

Replacement / Additional Assessments

1.18 The revised oHMP and Outline Construction Environmental Management Plan have been produced to enable the Development to meet the requirements of the DAERA consultation response (25 January 2019) and similar views expressed by Shared Environmental Services (27 February 2019), see Appendix 1.

1.19 Clarification was sought regarding the status of badgers on site and more detail regarding mitigation. A Confidential Badger Report is submitted separately as part of the FEI Request.

Revised Outline Habitat Restoration Management Plan

1.20 Appendix 6.9 of ES – Outline Habitat Management Plan has been revised and supercedes the previous version as submitted with the Environmental Statement (February 2019).

1.21 NIEA NED requested clarification regarding the temporary and long-term habitat loss as there was conflicting information between the Environmental Statement and

CONSENTED (LA01/2018/0200/F)

the original oHMP. The Revised oHMP clarifies the amount of habitat loss resulting from Development, which is the same as previously stated in the oHMP. Dunbeg South Wind Farm will result in permanent habitat loss of 6.9 hectares and temporary loss of 3.3 hectares.

1.22 NIEA NED also raised concerns with the previously proposed habitat management which involved turve translocation to and reinstatement of heather sward to restore 3.5 hectares of wet heath to compensate for the loss of 0.7 hectares of wet heath, which is a Northern Ireland Priority Habitat. In combination with 10.88 hectares of Purple Moor Grass & Rush Pasture to be restored, which was approximately twice the area lost to construction. NED considered that a much more straightforward and far more effective measure to improve the quality of the rush pasture on the site would be to simply implement a sympathetic grazing regime which substantially reduces the amount of sheep grazing on site.

1.23 These comments have been taken on board and the previously proposed habitat management area and measures contained therein have been discounted. The loss of NI Priority Habitats remains unchanged, but the revised proposal has refocussed the compensation measures on sensitive grazing management and the restriction of damaging agricultural activities in order to enhance 90 hectares of Purple Moor Grass & Rush Pasture, at least 14 times the area of NI Priority Habitats lost as a result of the Development. The aim is to improve the conservation status of said habitat so that at the end of the 30 year – lifetime of the project that it meets the criteria as an NI Priority Habitat.

Snipe

1.24 In terms of Ornithology, the ES highlighted that it is possible that displaced snipe will be able to utilise existing habitat however in the event that this did not occur, the loss of 2 pairs of breeding snipe would not be significant at the regional (Northern Ireland) level and no additional mitigation was proposed. NIEA NED considers that the loss of 50% of breeding population on this site would be significant at a local scale.

1.25 The grazing dates, prescriptions and overall regime within the proposed Habitat Management Area (HMA) has incorporated the requirements for snipe, however in addition an area has been identified for drain blocking (Figure 6.9 (Revised)). There is a total of 12.48 hectares within the HMA which lies over 400m from the proposed turbines. In view of details of the breeding ecology and territorial behaviour of snipe then this is considered to be more than sufficient lands for 2 pairs of snipe in the event that this number were displaced during construction.

Red Grouse

1.26 Red Grouse were only detected in the 2017 breeding seasons, with one pair breeding in a large territory (between 400m and 950m from the nearest turbine). However, taking cognisance of NIEA NED comments in relation to Red Grouse, pre-construction heather management is proposed within a Red Grouse Management Area (Figure 6.9 (Revised)), and the monitoring of habitat and Red Grouse including provision for contingency measures should the habitat condition deteriorate over the 30-year lifetime.

CONSENTED (LA01/2018/0200/F)

1.27 In conclusion, with the successful implementation of the OHMP there should be 'Net Gain' in biodiversity terms, which more than offsets for any habitat lost or damaged during the construction and operation of the wind farm.

Outline Construction Environmental Management

1.28 As requested by NIEA NED, an Outline CEMP has been produced to include: details of timings of works; all mitigation measures identified within the ES, which apply to the construction, operational and decommissioning phases.

1.29 The infrastructure of the Development remains unchanged barr additional detail provided in relation the Site Entrance and therefore construction drawings submitted as part of Environmental Statement (February 2018) remain unchanged. As part of the final CEMP it may be the case that more detailed drawings are provided following detailed site investigations should the project receive planning consent. For orientation purposes the relevant drawings to Outline CEMP are included in Annex 1 of the Outline CEMP and within other Annexes as relevant.

Water Framework Directive Assessment

1.30 The WFD Assessment included as part of Appendix 9.1 of the ES (February 2019) has been revised to take into comments raised in relation to the use of flocculent and to reflect amendments to the habitat management area and measures proposed within the outline Habitat Management Plan (oHMP). The revised WFD Assessment is included in Annex 3 of the outline CEMP.

1.31 In conclusion, following incorporation of site-wide general binding mitigation control measures, NIEA approved Guidance for pollution prevention (GPPs) and pollution prevention guidelines (PPGs), and site specific mitigation, no adverse effect is anticipated to Water Framework Directive classification of the affected waterbodies caused by Dunbeg South Wind Farm.

Peat Management Plan

1.32 The Peat Management Plan included as part of Appendix 9.5 remains unchanged as this details the likely volumes of spoil / peat and highlights areas for storing same.

1.33 The reproduced PMP is included in Annex 3 of the outline CEMP.

Mitigation

1.34 Annex 4 of the outline CEMP includes a table detailing the proposed mitigation measures as highlighted in the Environmental Statement in addition to those detailed as part of the main body of the outluine CEMP

The Need for the Proposed Wind Farm

1.35 A key policy driver for the development of renewable energy in Northern Ireland is the need to increase security of supply. There are also potential adverse impacts on local populations and the economy through high volatile fuel costs, contributing to fuel poverty and high energy costs for businesses and industry. In addition, increasing focus on renewable energy can deliver environmental and climate

CONSENTED (LA01/2018/0200/F)

change gains, reductions in carbon emissions, as well as investment and employment opportunities. With a lack of indigenous fossil fuel and no nuclear power stations, Northern Ireland is keen to develop the full range of its available renewable energy resources to optimise the contribution that renewables make to the overall energy mix.

1.36 Northern Ireland's current renewable energy target is that 40% of electricity consumption should be met from renewable sources by 2020 (DETI 2010). The 40% target is the equivalent of 1600 MW. Wind energy will be the main focus of renewable electricity development on the island of Ireland, and certainly in Northern Ireland.

Climate Change

1.37 The Paris Agreement (12 December 2015), which the UK signed up to, sets out the need to hold the increase in global average temperature to *"well below 2^{o}C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5^{O}C"*. To achieve this long-term temperature target, the text states *"parties aim to reach global peaking of greenhouse gas emissions as soon as possible"*. The document also includes a ratcheting mechanism on climate action, with countries having to communicate nationally determined contributions to reducing global emissions.

1.38 It is clear that moving to a low carbon economy is now a globally shared goal and will require absolute emission reduction targets. For the first time, some 195 countries, including the world's largest emitters have now committed to act together to address climate change and to be held equally accountable. Countries will also be legally obliged to make new post-2030 commitments to reduce emissions every five years.

1.39 In October 2018, the landmark Intergovernmental Panel on Climate Change (IPCC) Report highlighted the importance of the limiting temperature increases to 1.5 degrees C. The report concludes that human-induced warming reached approximately 1^{o}C above pre-industrial levels in 2017 and at the present rate, global temperatures would reach 1.5^{o}C around 2040. *The IPCC's report recognises that in order to meet our climate change targets, up to 85% of global power generation needs to come from renewables by 2050.*

ROI & UK Targets

1.40 The Republic of Ireland (ROI) will fall short of their 2020 renewable energy target of 16% of energy to come from renewables and whilst they are also aiming for 40% (currently at 30.1%) of electricity by 2020, the Irish Government have set 2030 targets of 70% of electricity from renewables as part of an overall European target of 32% of energy from renewables by 2030.

1.41 The UK has its own 2020 target to provide for 15% of its energy needs from renewable sources, including 30% in electricity. In 2017, the UK was only at 10.2%[1] of total energy from renewable energy. Although evidence suggests that the UK has

[1] https://www.gov.uk/government/statistics/renewable-sources-of-energy-chapter-6-digest-of-united-kingdom-energy-statistics-dukes

CONSENTED (LA01/2018/0200/F)

made substantial progress in the renewable electricity sector, due to slower progress in the heat and transport energy sectors, the UK is not on track to achieve the overall 15% target. In addition, there are clear renewable energy, electricity and carbon emission saving targets for 2020, but also stretching in the long term to 2050.

1.42 If approved, the proposed Dunbeg South Wind Farm could account for up to 29.7 MW, a material contribution to achieving the 40% renewable energy target for 2020 and will positively contribute towards the wider UK's Renewable Energy Strategy target. This is the equivalent of approximately 23,000 homes based on an output of 29.7 MW.[2]

1.43 It is also important to highlight that energy production is not static and additional renewable generation will be required to be connected to achieve and maintain the NI targets and subsequently achieve and maintain the UK renewable targets.

Summary

The main change made as part of FEI (2019) is the significant increase of habitat enhancement proposed as part of the development. An additional 75 hectares of habitat enhancement is now incorporated into the current proposal covering an area of approximately 90 hectares.

1.44 Habitat management is proposed within land under the applicants control and comprises a combination of measures with the aim of improving the conservation status of said habitat so that at the end of the 30 year – lifetime of the project that it meets the criteria as an NI Priority Habitat. With the successful implementation of the OHMP there should be 'Net Gain' in biodiversity terms, which more than offsets for any habitat lost or damaged during the construction and operation of the wind farm.

1.45 The outline CEMP identifies and co-ordinates all of the mitigation recommended in the various chapters of the Environmental Statement (2018) and details the implementation of the identified measures and how these will be monitored and reported during construction, operation decommissioning.

1.46 The potential effects of the proposed Dunbeg South Wind Farm have been assessed in accordance with regulatory requirements and good practice. The ES (2018) and FEI (2019) incorporate technical assessments of the proposed development based on requisite legislation and relevant planning policy framework and have demonstrated that significant environmental effects associated with the construction, operation and decommissioning of the proposed wind farm have been avoided or minimised through the use of the iterative design process and with the application of mitigation measures.

1.47 The Dunbeg South Wind Farm will provide a number of benefits. The scheme will result in a reduction in greenhouse gas emissions from the electricity generating

[2] The 23,000 homes equivalent has been calculated by taking the predicted annual electricity generation of the site (based on RES studies at Dunbeg South Wind Farm has a predicted capacity factor of 36% - based on the 3.3MW turbine) and dividing this by the annual average electricity consumption figures from the Department of Business, Energy and Industrial Strategy (3994 kWh).

CONSENTED (LA01/2018/0200/F)

industry by harnessing wind, as an alternative to the burning of fossil fuels, in line with the local government's energy goals and wider UK energy targets.

1.48 Paragraph 5.72 of SPPS states "Planning authorities should be guided by the principle that sustainable development should be permitted, having regard to the local development plan and all other material considerations, unless the proposed development will cause demonstrable harm to interests of acknowledged importance". RES are firmly of the opinion that the Dunbeg South Wind Farm is a suitable location for a wind farm development and that the ES (2018) and FEI (2019) demonstrate that to be the case.

1.49 Onshore wind is now the cheapest form of any new generation bar none and Dunbeg South, if approved, would play an important part in helping to make the important transition to a low cost, low carbon future for Northern Ireland.

CONSENTED (LA01/2018/0200/F)

Appendix 1 – FEI Request & relevant Consultation Responses

CONSENTED (LA01/2018/0200/F)

Causeway Coast & Glens Borough Council

Renewable Energy Systems Ltd
Willowbank Business Park
Willowbank Road
Larne
BT40 2SF

Causeway Coast and Glens
Local Planning Office
Cloonavin
66 Portstewart Road
Coleraine
BT52 1EY

Date:	28th January 2019
Our Ref:	LA01/2018/0200/F (Please quote at all times)
Contact:	Elaine Olphert
Contact Number:	028 7034 7100

Dear Sir/Madam,

Location: **Lands approx 6km N E of Limavady which are located immediately to the south of Broad Road (A37), in the Town land of Gortcorbies, Co Derry/Londonderry. Access is provided directly from the Broad Road where an unoccupied stone building is located. The Western site boundary is located approx 1.2km east of Keady Hill Quarry and the eastern boundary is located approx 400m S W of disused quarry on Broad Road, which is adjacent to Springfield Forest.**

Proposal: **Construction of a wind farm comprising 9 no wind turbines (maximum 149.9mto blade tip) and associated infrastructure including internal electricity transformers, crane hard standings, underground cabling, control building, substation compound, energy storage area, newly created site entrance, new and upgraded on site access tracks, turning heads and all other associated ancillary works. During construction and commissioning there will be a number of temporary works including a construction compound with car parking, temporary parts of crane hard standing and welfare facilities.**

I would take this opportunity to inform you that the Council require further environmental information concerning the above application in the form of an Addendum to the Environmental Statement. This information is sought, without prejudice, in accordance with Regulation 21 of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 to enable processing of the application to proceed.

CONSENTED (LA01/2018/0200/F)

5. Production of an outline Construction & Environmental Management Plan (OCEMP) to include: details of timing of works; all mitigation measures identified within the ES which apply to the construction, operational and decommissioning phases; identification of peat and spoil storage areas; roles and responsibilities of ECoW.

DFI Roads

DFI Roads require an amended plan as per their consultation response of 22nd june 2018.

City of Derry Airport

City of Derry Airport require mitigation measures to minimise the impact of the proposal on their aircraft operations.

The information noted above is requested under the Environmental Impact Assessment Regulations (Northern Ireland) 2017. This information should be submitted to the Council within 3 months of the date of this letter (or to an extended date as agreed in writing with the Council). If this information is not received by the Council within the specified time period the application is deemed as refused and there is no right of appeal.

I would remind you that the consultation process is not yet complete and that further environmental information may be required should Consultees require additional details.

If you require any further assistance regarding the above, please do not hesitate to contact the case officer at the above number.

Yours faithfully

For Head of Planning

CONSENTED (LA01/2018/0200/F)

Planning Response Team
Klondyke Building
Cromac Avenue
Gasworks Business Park
Lower Ormeau Road
Belfast
BT7 2JA
Tel: 028 9056 9604
Email:
planningresponse.team@daera-ni.gov.uk

Date: 25/01/2019

Dear Sir/Madam

Planning Application Ref:	LA01/2018/0200/F
Location:	Lands approx 6km N E of Limavady which are located immediately to the south of Broad Road (A37) in the Town land of Gortcorbies Co Derry/Londonderry. Access is provided directly from the Broad Road where an unoccupied stone building is located. The Western site boundary is located approx 1.2km east of Keady Hill Quarry and the eastern boundary is located approx 400m S W of disused quarry on Broad Road which is adjacent to Springfield Forest.
Proposal:	Construction of a wind farm comprising 9 no wind turbines (maximum 149.9mto blade tip) and associated infrastructure including internal electricity transformers, crane hard standings, underground cabling, control building, substation compound, energy storage area, newly created site entrance, new and upgraded on site access tracks, turning heads and all other associated ancillary works. During construction and commissioning there will be a number of temporary works including a construction compound with car parking, temporary parts of crane hard standing and welfare facilities.

Thank you for your consultation on the above which was received by DAERA on 28/02/2018.

We have reviewed the details of the application and would provide summary comments as follows:

Drainage and Water
Water Management Unit has no objection to this development subject to best practice and mitigation, as set out in the accompanying Environmental Statement being implemented. A Schedule of best practice and mitigation measures should be provided to the Planning Authority, by way of Condition, prior to construction commencing on site.

CONSENTED (LA01/2018/0200/F)

Land, Soil and Air
Regulation Unit (Land and Groundwater Team) has considered the impacts of the proposal on the aquatic environment (especially groundwater). On the basis of the information provided, the proposed development is considered to have minimal impact on local groundwater resources and/or quality.
Natural Heritage and Conservation Areas
Natural Environment Division has concerns with this proposal and considers that, in the absence of further information, the proposal would be contrary to the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017, Planning Policy Statement 2: Natural Heritage and the Strategic Planning Policy Statement for Northern Ireland in that the development would be likely to have significant adverse effects on internationally and nationally designated nature conservation sites, Northern Ireland priority habitats and species and legally protected species and insufficient information has been submitted to adequately assess these impacts and on appropriate mitigation and compensation measures. Protected Landscapes Team has no objection to this proposal on landscape grounds.

If you wish to discuss anything raised in our response, please do not hesitate to contact Planning Response Team (details above).

Kind Regards

Planning Response Team

On behalf of DAERA

CONSENTED (LA01/2018/0200/F)

Land, Soil & Air

Planning Reference No.: LA01/2018/0200/F

Section Reference: AE1/18/331375

Considerations

Regulation Unit (Land and Groundwater Team) has considered the impacts of the proposal on the aquatic environment (especially groundwater). On the basis of the information provided, the proposed development is considered to have minimal impact on local groundwater resources and/or quality.

Explanatory note

The comments below are not exhaustive but serve to capture key points in support of the Regulation Unit (RU) position outlined above. These comments are made on consideration of:

1. Renewable Energy Systems, Ltd: Dunbeg Wind Farm, Limavady – Environmental Statement, Volume 2, Chapter 2: Proposed Development – Published 19/02/2018
2. McCloy Consulting: Dunbeg Wind Farm, Limavady – Environmental Statement, Volume 2, Chapter 9: Geology and Water Environment – Published 19/02/2018, Prepared on behalf of Renewable Energy Systems, Ltd
3. McCloy Consulting: Dunbeg Wind Farm, Limavady – Water Framework Directive Assessment, Appendix 9.1, published 14/03/2018 – Prepared on behalf of Renewable Energy Systems, Ltd

Land and Groundwater Team (LGW) have considered the proposal for a wind farm consisting of nine turbines in Dunbeg, Limavady. The foundations of wind turbines have the potential to impact on groundwater flow paths, groundwater receptors (aquifers) or secondary receptors and hence on potential receptors that depend on groundwater flow.

A baseline survey has been conducted to identify any sensitive aquatic receptors within the following radii of the proposed turbine bases:

- Surface watercourse: 10 m;
- Private (or public) water supply used for drinking water: 250 m
- Any other spring, well or borehole that is not used as a drinking water supply: 50 m; and
- Designated wetland: 250 m.

One well for private water supply has been identified within 1 km of the site boundary, serving six properties. However, it has been established by the applicant that no boreholes fall within a 250 m radius of any of the nine proposed turbine bases.

The information supplied by the applicant indicates that the localised dewatering of shallow groundwater in excavations may be required in the vicinity of the most northerly turbine (T9).

CONSENTED (LA01/2018/0200/F)

Land, Soil & Air

If groundwater is in fact encountered in excavations, it is recommended that the mitigation measures detailed within the Geology and Water Environment Assessment (listed above as report number 2) be implemented.

Informatives

All relevant guidelines for pollution prevention should be followed. The guidelines can be downloaded from the NetRegs website:

http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

CONSENTED (LA01/2018/0200/F)

Section Reference: CB25671-1

Planning Reference: LA01/2018/0200/F

Date of NED response: 21 January 2019

Considerations

Please note that this proposal is subject to the Conservation (Natural Habitats, etc) Regulations (Northern Ireland) 1995 (as amended) (known as the Habitats Regulations).

The application site is hydrologically connected to the River Roe and Tributaries Special Area of Conservation (SAC) and Area of Special Scientific Interest (ASSI) and Lough Foyle Special Protection Area (SPA), ASSI and Ramsar site and within close proximity to Gortcorbies ASSI and Ballyrisk More ASSI (hereafter referred to as the designated sites) which are of international and national importance and are protected by the Habitats Regulations and The Environment (Northern Ireland) Order 2002 (as amended).

The site is situated within the Binevenagh Area of Outstanding Natural Beauty (AONB).

The site contains Northern Ireland priority habitats and priority species and species protected by the Habitats Regulations and the Wildlife (Northern Ireland) Order 1985 (as amended).

NIEA, Natural Environment Division (NED) has considered the Environmental Statement (ES) submitted with this application and uploaded to the planning portal in February and March 2018 and additional confidential annexes provided directly to the NED case officer in November 2018.

NED carried out a site visit on 6 December 2018 to verify the findings of the ES.

Summary of Position

NIEA, Natural Environment Division (NED) has concerns with this proposal and considers that, in the absence of further information, the proposal would be contrary to the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017, Planning Policy Statement 2: Natural Heritage and the Strategic Planning Policy Statement for Northern Ireland in that the development would be likely to have significant adverse effects on internationally and nationally designated nature conservation sites, Northern Ireland priority habitats and species and legally protected species and insufficient information has been submitted to adequately assess these impacts and on appropriate mitigation and compensation measures.

Explanatory note

<u>Designated Sites</u>

The Curly River constitutes part of the River Roe and Tributaries Area of Special Scientific Interest (ASSI) and Special Area of Conservation (SAC) and flows westwards approximately 750m to the north of the planning application boundary. Approximately five minor streams and their tributaries flow through the development site and enter the Curly River. The boundary of the SAC in relation to the proposed wind farm is illustrated in Figure 6.1 of the ES. The River Roe and Tributaries was designated as a SAC due to its internationally important population of Atlantic salmon, an Annex II

CONSENTED (LA01/2018/0200/F)

species of the Habitats Directive. The River Roe and Tributaries was declared an ASSI because of the physical features of the river and its associated riverine flora and fauna.

Gortcorbies and Ballyrisk More Areas of Special Scientific Interest (ASSIs) are adjacent to the site. These sites have been designated for their species-rich grassland (purple moor-grass and rush pasture). Gortcorbies is an area of purple moor-grass and rush pasture (lying between the A37 and the Curly River) and is an important site for both the lesser butterfly-orchid and the latticed heath moth. Ballyrisk More is situated on the lower western slope of Keady Mountain and its wet grassland supports species such as greater butterfly-orchid, common twayblade and lesser clubmoss. A map illustrating the location of the ASSIs can be found in Figure 6.1 of the ES.

From the information available to NED it is clear that the proposal is not connected with, or necessary for, the conservation management of the designated sites.

NED has considered the proposal and highlights the following as potential impacts on the designated sites:

Potential Impacts	**Designated site considerations**
Degradation of adjacent aquatic environment from contaminated runoff resulting during construction and operational works.	The proposed wind farm site located on Keady Mountain is hydrologically connected (within 1km) to the Curly River, a key tributary of the River Roe and Tributaries SAC/ASSI, via several small streams flowing through the site. Lough Foyle ASSI/SPA/Ramsar is approximately 12.5km downstream of the site, hydrologically connected via the River Roe. The Curly River has been classified by the Loughs Agency as an important nursery, holding and spawning habitat supporting the designated site feature. Salmon are susceptible to deteriorating water quality as a result of both direct point-source discharges and diffuse or non-point-source pollution arising from land-use practices or construction run-off. The site falls within the Loughs Agency consultation zone therefore their response should be taken into consideration when making a full and robust assessment of the application. Gortcorbies ASSI is located immediately to the north of the site and Ballyrisk More ASSI is approximately 360m to the west. Several small watercourses from the proposed site run through Gortcorbies ASSI and presents a potential risk to the Purple-Moor grass and rush pasture habitat feature of this site in the case of construction run off.
Sediment laden runoff entering watercourses could be detrimental to Salmon	The applicant has submitted a detailed Environmental Statement in which Volume 2 outlines robust mitigation measures that will be employed in the final Construction &

CONSENTED (LA01/2018/0200/F)

resulting in gills being smothered, or their passage upstream impeded indirectly. Sediment can smother gravels by infilling of interstitial spaces, leading to reduced oxygen flow across the spawning bed. Otter population structure may also be affected through interference with Salmon food source.	Environmental Management Plan for development and operation of the proposed wind farm to protect sensitive environmental receptors from polluted runoff. **Drainage** The Geology and Water Environment Report (Chapter 9) indicates the proposed use of run off attenuation measures to reduce flow rates from hard standing areas such as attenuating check dams within swales. This will also allow settlement and filtration of runoff from the site to reduce possible pollution risk to the River Roe and Tributaries SAC/ASSI. Environmental Statement (Volume 2 Section 2.97) details a SuDS system with mitigation measures to prevent watercourse pollution to include attenuation ponds, silt fences to restrict sediment run off, scour prevention and energy dissipation structures. Direct drainage to existing watercourses to be avoided. **Ground Water Pollution Prevention** Pollution prevention measures to be utilised as detailed in Environment Statement Section 2.94 include restricting excavations during intense rainfall, use of Sulphate-resistant concrete for turbine bases to limit alkaline leaching into groundwater, storage sites for fuels, lubricants and chemicals contained in area bunded to 110%, refuelling to be carried out in bunded area with secondary containment, concrete washout to occur in bunded area, solid and liquid waste to be disposed offsite, no use of askarels or Polychlorinated biphenols and emergency spill kits present in case of a pollution event. A Surface Water Monitoring Scheme is to be implemented at the site. **Foul Sewage** NED refer to NI Water report, dated 04th March 2018, in relation to foul sewage. Due to a lack of public foul sewers in the vicinity of the proposal NED are content that foul sewage will be collected via chemical facilities and removed by a licensed haulier with no resulting discharge from the site as detailed in Chapter 9 Section 8.7 (Geology and Water Environment Report).

CONSENTED (LA01/2018/0200/F)

	Water Course Crossings Construction of seven water crossing points are indicated by the applicant. Two of which cross Stream C that has been identified as significant in terms of fisheries (Environmental Statement Chapter 8). NED is satisfied with the installation of two bottomless culverts to assist the passage of fish as discussed is Chapter 9 Section 8.2.2 and also the installation of silt fences during construction on all water crossings and buffer zones to limit proximity of construction, chemical & fuel storage and spoil storage. **Decommissioning** Construction Decommissioning Management Plan to be finalised and submitted prior to construction and include mitigation measures for removal and restoration of the site subject to consent as detailed in Environmental Statement Section 2.87.
Risk of flocculant entering sensitive watercourses and acting as a toxic agent in Salmon habitat causing osmoregularity failure.	The applicant has indicated the use of flocculant in dirty water settlement lagoons (Chapter 9 Section 8.5.2). Aluminium based flocculants can have potential toxicity to gill breathing animals, such as Salmon. Due to the potential risk of toxicity NED require further information on the type of flocculant to be employed and method of use.
Peat failure/slide resulting in significant sediment mobilisation, resulting in sedimentation of downstream water bodies	The Peat Slide Risk Assessment (PSRA), Chapter 9 Appendix 9.4, indicates low risk of peat slide on the site overall, however, it does highlight the proposed location of T9 as being significant on the hazard rating due to its proximity to a watercourse. GSNI provided a consultation response to this application which was uploaded to the planning portal on 29 June 2018. They have stated that they have read the PSRA and are *satisfied that the survey, modelling and methods proposed are sufficient to mitigate any potential peat instabilities*. NED is content with the findings of the PSRA and the mitigation measures described should be included in an appropriate Construction & Environmental Management Plan

It is the view of NED that there is insufficient information for the planning authority to undertake a robust Habitats Regulations Assessment and for NIEA to undertake an assessment on any additional ASSI features likely to be impacted by the proposal.

NED therefore objects to the proposal as required by the precautionary approach set out in

CONSENTED (LA01/2018/0200/F)

Commission Guidance: Managing Natura 2000 Sites and as required by the European Court of Justice in C 127/02 (Waddenzee).

NED considers the proposal is contrary to the Planning Policy Statement 2: Natural Heritage, Policies NH1 and NH3, in that development would, if permitted, be likely to have a significant effect on the designated sites and insufficient information has been submitted to establish otherwise.

NED considers the following information is required to fully assess the application:

- Full details of the type of flocculant to be used in settlement ponds, i.e. if it will be aluminium based, and method of use.

If NED is to be re-consulted following the submission of this information, the assessment undertaken by the planning authority should be included.

Habitats

The site is dominated by rush pasture in a complex mosaic with semi-improved acid grassland, wet heath, poor fen and acid flushes. The site is crossed by a number of minor watercourses and streams, some of which have steep sided gullies and ravines. The habitats across the site have been degraded by sheep grazing and have probably been subject to extensive peat cutting in the past. Peat depths across the development area are largely shallow (<0.5m), however, blanket bog is extant above the line of agricultural enclosure just outside the development footprint of the wind farm to the south.

The rush pasture which dominates the site has been described as purple moor-grass and rush pasture (PMGRP) in the ES. However, it states that the habitat has been impacted by agricultural management such as sheep grazing and drainage and that the most of the PMGRP exists as the species poor M23a (*Juncus effusus/acutiflorus-Galium palustre* rush pasture; *Juncus acutiflorus* sub-community) variant and therefore does not qualify as the NI priority habitat of purple moor-grass and rush pasture. There are some more species rich areas of PMGRP on the site which may qualify as the priority habitat, however, the ES states that these areas have been avoided by the construction footprint. It is stated in Section 6.230 of the ES that approximately 5.44ha of species poor PMGRP (M23a) will be lost due to the development but that this does not qualify as the NI priority habitat type.

Across the site there are also numerous localised patches of upland flushes, fens and swamps (which are groundwater dependent terrestrial ecosystems (GWDTEs)) within the wider mosaic of M23a rush pasture with wet heath and blanket bog (on the plateau). The majority of these occur upslope of the infrastructure within the large expanse of blanket bog & heath towards the summit of Keady Mountain although a few do occur within 200m of the infrastructure below the fence line which separates the two halves of the site. Some of these would qualify as NI priority habitats.

The ES acknowledges that 0.7ha of wet heath (M15/M15d), which occurs near T3 and T6, will be lost due to the footprint of the development. The wet heath on the site falls under the NI priority habitat of upland heathland.

ES Section 6.218 states that the footprint of wind farm infrastructure will involve permanent land-take of approximately 4ha, due to the construction of 4.25km of access tracks and approximately

CONSENTED (LA01/2018/0200/F)

1.393 ha for the construction of 9 crane pads and turbine bases. Including land take for the substation and control building this amounts to a total land take of just over 4.5ha.

The Outline Habitat Management Plan states that the wind farm will result in permanent habitat loss of 6.9ha and temporary habitat loss of 3.3ha.

However, the figures provided in Table 6.13 for the temporary and long term habitat loss of various habitat types do not match the other figures previously quoted. Therefore, NED requires clarification on the figures for the total permanent (long term) and temporary habitat loss on the site.

The NED site visit on 6 December 2018 assessed the quality of the habitats on site and this largely agreed with the results presented in the ES. However, NED considers that it is likely that the rush pasture on the site has the potential to revert to purple moor-grass and rush pasture priority habitat given appropriate management. Additionally, while much of the rush pasture on the site may not be species rich enough to qualify as the Northern Ireland priority habitat it still constitutes a habitat of significant local biodiversity importance as evidenced by its use by a number of priority and protected species, such as various breeding birds, common lizard, smooth newt and badger. Therefore, NED considers appropriate compensation is required for its loss.

Outline Habitat Management Plan

It is proposed to compensate for the permanent loss of 0.7ha of wet heath and 5.44ha of species poor purple moor-grass and rush pasture by a process of habitat restoration and enhancement as described in the Outline Habitat Management Plan (OHMP). This will involve vegetated turve translocation from areas of proposed infrastructure to a compensation area beside the main road and adjacent to the proposed temporary construction compound and substation. The overall area which it is claimed will be enhanced is approximately 14.5ha, comprising 3.5ha of restored wet heath and 10.88ha of restored PMGRP. However, it is not clear if this figure has excluded the watercourse buffers which are located within the compensation area.

NED has a number of serious concerns with the proposed habitat management and restoration measures and does not consider that they represent the most appropriate or effective way to compensate for the loss of habitats on the site and the impact of the proposal on local biodiversity. The proposed measures to translocate wet heath and purple moor-grass and rush pasture habitats carry a high degree of uncertainty and insufficient evidence has been provided of the likelihood of their success. In fact NED considers these proposals have the potential to cause additional harm to natural heritage interests on and off the site, particularly in the short term, through increased disturbance from vehicle movements and the creation of significant additional areas of bare or disturbed ground which has the potential to substantially increase the risk of sediment release to sensitive watercourses.

NED’s concerns with the the proposed habitat management and restoration measures, as detailed in the OHMP, are outlined below.

It is acknowledged in the OHMP that it may take several years for the target habitat in the habitat compensation areas to be established. However, even then success in habitat restoration involving translocation of turves is not guaranteed and has a significant degree of uncertainty. It should be

CONSENTED (LA01/2018/0200/F)

highlighted that the reference provided in the OHMP to evidence the likely success of the proposed translocation measures (Pywell et al, 1995[1]) refers to the translocation of dry heath on a lowland site which is significantly different from the translocation of wet heath on an upland site. No evidence has been presented in the OHMP to support the likelihood of successful recreation of PMGRP.

The heavy flailing, harrowing and contour ploughing proposed in the compensation areas is likely to give rise to significant areas of bare ground and exposed peat/soil which could cause a risk of significant sediment release during periods of wet weather. The contour ploughing in the PMGRP area is also proposed to be continued for the lifetime of the development which will result in long term disturbance to this area and compromise its potential to be used by ground nesting birds and other species, such as lizards.

The proposed compensation area already contains a significant area of species poor purple moor-grass and rush pasture. It is not clear how a species rich sward equivalent to the priority habitat will be created when translocated turves will be from other areas of largely species poor rush pasture under the construction footprint.

A much more straightforward and far more effective measure to improve the quality of rush pasture on the site would be to simply implement a sympathetic grazing regime which substantially reduces the amount of sheep grazing on the site.

It is stated that heavy flailing and harrowing will be carried out on the wet heath restoration area to aid over-seeding after the translocation of vegetated turves. However, it is unclear how damage to the translocated turves in this area will be avoided and it seems highly unlikely that damage can be avoided.

The wet heath restoration area is bisected by infrastructure which will reduce the nature conservation value of any restored habitat through fragmentation and disturbance. It is also unclear whether the restoration measures will be carried out before or after the construction of the infrastructure in this area.

It is also not clear if the figures for the habitat management areas have taken into account the 50m and 10m watercourse buffers which are required in these areas and how the measures will be implemented while preserving these buffers. In particular the measures will involve a significant number of vehicle movements which is likely to include a significant number of watercourse crossings. The assessment of the OHMP and the proposed compensation measures within Chapter 9 of the ES - Water & Geology - is inadequate and does not explain how vehicle movement will be controlled.

The significant additional excavations, handling and transport of peat and vegetated turves and heavy vehicle movements required by the proposed habitat management measures will give rise to significant additional risks of harm to the water environment and habitats and species which have not been properly assessed within the ES and which are unlikely to be warranted by the likely success of the measures. This also contradicts the recommendations of the Peat Management

---

[1] Pywell R.F., Webb N.R. & Putwain P.D. (1995) A comparison of techniques for restoring heathland on abandoned farmland. *Journal of Applied Ecology*, 32, 400-411

CONSENTED (LA01/2018/0200/F)

Plan to minimise the handling and transport of peat within the site to minimise risks to the water environment from peat movements and suspended solids release.

The proposed compensation/restoration area is an area of relatively high badger activity within which there is an active badger sett which is likely to be a main sett. NED is concerned about the additional disturbance and harm which is likely to be caused to badgers through these proposals which will involve the use of heavy equipment and vehicles to flail and harrow the vegetation and carry excavated turves to the area. Furthermore the proposed drain/watercourse blocking is in close proximity to the main badger sett and the use of 'dropboard sluices' to raise the water table in this area by blocking the small stream which runs through this area has the potential to cause flooding to the badger sett which is present along this stream. The impact of the habitat management measures on badgers has not been assessed within the ES.

Finally, the additional fencing proposed to separate the habitat management areas from the rest of the site is likely to compromise and reduce its potential to support ground nesting birds as it will provide additional perching locations for predators such as Corvids. It will also present an additional collision risk for red grouse.

NED therefore requires a revised approach to habitat management on the site.

Ornithology

The developer has carried out a programme of ornithological surveys using approved methods during the period December 2015 to August 2017. The surveys covered both the development site and a buffer zone extending 500m beyond the site boundary. A zone of 800m radius was also searched for breeding curlew. The programme included five walk-over breeding bird surveys between March and July 2016 and six surveys during March to June 2017. Surveys of non-breeding birds were undertaken monthly between December and March in 2015/16 and between October and February in 2016/17.

Specific surveys for breeding raptors covering a radius of 2km from the windfarm site were also undertaken in 2016 and 2017.

Vantage point observations of flight activity, particularly by raptors, were carried out from three points in 21 consecutive months between December 2015 and August 2017. Observation effort from vantage points was satisfactory in all seasons. A proportion of vantage point watches was allocated to the detection of hen harrier roosts.

No hen harrier (EU Birds Directive: Annex 1) nests were found within 2km of the development site in 2016, though a pair was present in the area. Nesting, probably by the same pair, was recorded in the survey area, but not within 500m of the development, in 2017. Disturbance to nesting hen harriers during construction or operation of the windfarm is therefore very unlikely. Use of the wind farm site and buffer zone by hen harriers was found to be very infrequent in 2016 with only one observation from vantage points recorded in the breeding season and single records in each of the two winters covered. Confirmed nesting within 2km in 2017 resulted in an increase of breeding season flight records to 20. The observation rate indicates that the development site is not a particularly important foraging area for hen harriers. Even assuming avoidance of turbines resulting

CONSENTED (LA01/2018/0200/F)

in a reduction of flight activity of 53%, as estimated by Pearce-Higgins *et al* (2009)[2], within 500m of the site it is unlikely that hen harriers using the area would experience a significant adverse impact. Collision risk modelling estimated one collision by this species every 126 years. The impact of this is considered negligible. No evidence of roosting by hen harriers within or close to the survey area was found.

Surveys of suitable habitat extending to 2km from the site boundary failed to detect evidence of nesting by merlins (EU Birds Directive: Annex 1). Usage of the survey area was very low. During the 2016 breeding season there was only one observation of this species from vantage points. In the following breeding seasons two observations were obtained. Merlins were not recorded during vantage point watches in the 2015/16 winter and only twice in 2016/17. The frequency of observation suggests that the collision risk for this species would be negligible.

Peregrines (EU Birds Directive: Annex 1) did not breed within 2km of the windfarm site or buffer zone in either of the survey years. Occurrence within the survey area was infrequent. Peregrines were absent during both breeding seasons and observed only one and six times respectively during the 2015/16 and 2016/17 winters. This indicates that the collision risk for this agile species is unlikely to be significant.

Other raptor species detected during vantage point watches included buzzard (Schedule 1 of the Wildlife Order) and kestrel (Amber-listed species of conservation concern in Ireland). A single pair of buzzards held territory within 2km of the windfarm site in both 2016 and 2017. Although kestrels occurred regularly within the survey area no evidence of nesting was found within 2km. Habitat for these species, suitable for nesting and foraging, is widely available in the vicinity of the site and it is considered highly unlikely that the development would have a significant adverse impact through habitat loss. Collision risk for both the above species was estimated at approximately 1 fatality every eight years assuming 98% and 95% avoidance respectively.

No territorial curlew (Red-listed species of conservation concern in Ireland) were detected within the site boundary or within the 800m zone of potential sensitivity for this species (Pearce-Higgins *et al* 2009). A single bird was recorded on one date in May 2016. This may have been a late passage bird, non-breeder or an early failed breeder from elsewhere. Any significant adverse impact of the development upon curlew is therefore considered highly unlikely.

The breeding population of snipe (Amber-listed species of conservation concern in Ireland) within the development site and buffer zone was estimated at four pairs, though a maximum of only two individuals was recorded in the 2017 breeding season. This species has undergone a decline estimated at 78% in Northern Ireland since 1987 (Colhoun *et al* 2015[3]). It is therefore important that remaining breeding sites be maintained. Research by Pearce-Higgins *et al* (2009) indicates that there is a possibility of displacement of this species from up to 400m from turbines affecting, on average 47% of the population. Under such a scenario, the loss of two pairs on the site would

---

[2] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009) The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323-1331.

[3] Colhoun, K., Mahwhinney, K. & Peach, W. (2015) Population estimates and changes in abundance of breeding waders in Northern Ireland up to 2013. *Bird Study* 62: 394-403.

CONSENTED (LA01/2018/0200/F)

be anticipated. ES Section 7.83 states that it is possible that displaced snipe will be able to utilise existing habitat within the site, however, it is not certain that this would occur. The ES states that the loss of 2 pairs of snipe would not be significant at the regional (Northern Ireland) level and no additional mitigation is proposed.

However, best practice for Ecological Impact Assessments in the UK and Ireland (CIEEM, 2018[4]) makes clear that significant effects should be assessed on a range of geographical scales and NED considers that the loss of 50% of the breeding snipe population on this site would be significant at the local scale. Therefore we require mitigation for snipe to be detailed in the OHMP. This should include the retention or provision of sufficient wet areas on the site for snipe at least 400m from turbines and grazing management measures which are beneficial for this species.

The only other waders observed during the surveys were golden plover which were recorded within the site in small numbers (max.32) intermittently during the 2015/16 and 2016/17 winters. The species was not observed during the main migration periods. There is no evidence of the species breeding in the vicinity of the windfarm site. At this level of usage any displacement effect is unlikely to have a significant impact. Similarly, there is no indication that golden plovers are particularly susceptible to collision with turbines and a 98% avoidance rate is generally applied for this species. Such a level of risk would have a negligible effect on the Northern Ireland wintering population.

Red grouse (red-listed species of conservation concern in Ireland) is scarce in Northern Ireland and has an increasingly fragmented range (Allen & Mellon 2004). The species was detected only in the 2017 breeding seasons and it is estimated that only one pair bred in the vicinity of the survey area in. This pair appear to have a large territory and were encountered between 400m and 950m from the nearest turbine site during the breeding season. Droppings of this species were found 250m from a turbine location in winter. This species has been shown to be susceptible to relatively short-term displacement by windfarm construction, with rapid re-colonisation occurring during the operational phase (Pearce-Higgins *et al* 2012[5]). However, NED recommends that measures are taken, including pre-construction vegetation management and surveillance during construction work, to ensure that breeding grouse are not disturbed. Existing heather habitat within the site and buffer zone should retained and brought into good condition where currently degraded. Grouse have been shown to be susceptible to collision with fences. Any new fences associated with the development should therefore be fitted with markers to increase visibility to grouse.

The survey data indicate that this development would pose negligible risk to whooper swans or any other migratory waterfowl. There is no evidence to suggest that the site is located on a regularly used flyway for these species. Whooper swans (EU Birds Directive: Annex 1) were recorded in

---

[4] CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine.* Chartered Institute of Ecology and Environmental Management, Winchester. https://www.cieem.net/data/files/ECIA%20Guidelines.pdf

[5] Pearce-Higgins, J.W., Stephen, L., Douse, A. & Langston, R.H.W. (2012) Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. *Journal of Applied Ecology* 49: 386-394.

CONSENTED (LA01/2018/0200/F)

flight at the margins of the survey area on only three occasions (max. 18 birds) and no geese were observed.

Breeding bird surveys within the development site and buffer zone recorded a total of 25 additional species over both years. Of these, 22 were considered confirmed or probable breeders. In addition to those mentioned above, species of conservation concern amongst those breeding included two red-listed species (grey wagtail, meadow pipit) and six amber-listed species (skylark, swallow, robin, stonechat, mistle thrush, starling). Additional Northern Ireland priority and Schedule 1 species recorded as probable breeders included cuckoo, song thrush, grasshopper warbler and reed bunting. Despite recent declines, all of the above species that breed in or close to the site remain widespread and relatively abundant. NED is satisfied that this development is unlikely to have a significant adverse impact on any of the above species at the local population level.

Surveys outside the breeding season recorded 23 species over the two years. Numbers were generally low and no additional species of conservation concern were detected. No significant impact on local populations of wintering birds is anticipated.

Cumulative impact assessment has included wind energy developments within a 10km radius. Following SNH (2012) criteria[6], cumulative impact assessment has been restricted to three species: hen harrier, kestrel and snipe. The assessment appears to have taken the approach of considering only cumulative impact of multiple developments upon the populations of the above species nesting or occurring in the Dunbeg South survey area rather than addressing the in-combination effect of all the developments considered on regional or Northern Ireland populations. It is, however, apparent that the scale of any impact of the Dunbeg South development on any sensitive species is sufficiently small as to have no significant additional impact regionally. Therefore NED is satisfied with the conclusion that this development will not add significantly to any cumulative ornithological impact.

On the basis of the information contained in the Environmental Statement, NED would find no compelling reason to oppose this development on ornithological grounds, providing appropriate mitigation measures are implemented. NED will require an Ornithological Mitigation Strategy and a Bird Monitoring Programme to be conditioned as part of any planning approval.

Bats

Bat surveys were carried out on the site in 2017. The site was identified as having low bat potential because it is an exposed, open upland site. Therefore, survey effort followed Bat Conservation Trust guidance for a low risk site, with surveys in spring (May 2017), summer (July 2017) and autumn (Sep 2017). Both manual walked transects and automated (static) surveys were carried out. Static detectors were placed at all 9 turbines and associated habitat features for 5 consecutive nights during each season. NED is content with the level of bat survey effort carried out for the site.

---

[6] Scottish Natural Heritage (2012) Guidance: Assessing the cumulative impact of onshore wind energy developments. https://www.nature.scot/sites/default/files/2017-09/Guidance%20note%20%20-%20Assessing%20the%20cumulative%20impact%20of%20onshore%20wind%20energy%20developments.pdf

CONSENTED (LA01/2018/0200/F)

Bat activity, expressed as an index (bat passes per hour), was generally very low with very few static survey periods showing total bat activity greater than 1 pass per hour. However, some of the static results showed more significant activity with, in particular, the detectors at T4 and T4 habitat feature recording peaks of 10.5 and 8.9 bat passes per hour respectively on 1st September 2017 (autumn) for all bats.

The ES Section 6.254 states that, without mitigation, the proposal has the potential to have a moderate adverse impact of major significance on the local bat population during the operational phase. Mitigation includes the positioning of all turbines to maintain minimum buffer or stand-off distances of 50m between turbines and habitat features, such as watercourses and forestry edges.

However, this mitigation is not sufficient on its own as the survey results show that there were some significant periods of bat activity at turbine locations away from habitat features and over open ground. Leisler's bats in particular do not stick closely to habitat features and will usually forage over open ground. Also, the detector at the T4 habitat feature was placed on a post and wire fence between heathland and blanket bog habitat and therefore not at a specific habitat feature for bats. The average bat activity index (BAI) recorded for all bats at T4 and T4 habitat feature during the autumn period was 2.45 and 2.25 bat passes per hour respectively. This significant activity highlights that bats are using the open habitats on the site for foraging and/or commuting.

Additionally, when you consider that bat activity can change once turbines are operational and that research has shown that bats can be attracted to wind turbines, and applying the precautionary principle, this highlights that further mitigation is necessary to ensure no likely significant effects on the local bat population.

NED recommends that the turbine blades are 'feathered' below the cut-in speed of the selected turbines to reduce the blade rotation speeds below 2rpm while idling. This measure has been shown to significantly reduce bat fatalities at operational wind farms and does not result in any loss of output. It can be applied at any site with a blade pitch control system which can be automated using SCADA data.

Sections 6.290-6.291 of the ES also recommends that a Bat Monitoring Plan (BMP), to be agreed with NIEA and the Council, is implemented on the site. NED agrees that this is a necessary measure in light of the bat activity recorded and considers that this should be conditioned with any planning approval. This should require the appropriate monitoring of bat activity across the site post construction for a period of at least three years (subject to review) and the submission of yearly monitoring reports to the planning authority. The BMP should include provision for any contingency measures deemed necessary should monitoring reveal significant bat activity at operational turbines.

Badger

A badger survey was carried out on 17 May 2017. The results are provided in a confidential Annex to the ES - Appendix 6.6: Confidential Badger Survey Report - which was provided to NED via e-mail by the planning case officer.

Occasional evidence of signs of badger presence, including mammal trails and snuffle holes, were noted across the site and four separate excavations were recorded which were described as

CONSENTED (LA01/2018/0200/F)

badger setts or had the potential to be used by badgers. Table 1 of Appendix 6.6 describes these excavations. In addition to the above table, Figure 6.8 of the ES shows the location of badger setts on site with 25m buffers applied. However, this Figure does not label the setts/excavations to link them with Table 1 and NED would highlight that there is a cluster of four badger setts/excavations mapped to the northeast of Turbine 5 which are not described in the Badger Report. This area was visited during the NED site visit which confirmed the presence of badger setts at this location.

The report states that the status of badgers on the site is uncertain with some of the holes likely to be used by foxes. Excavations 1 and 4 are described as having three holes or sett entrances and as likely to be abandoned subsidiary setts or alternatively one of them may have been a main sett in the past. However, the NED site visit found five active badger sett entrances at the location of Excavation 1 along the eastern bank of a small stream and we consider that this is likely to be a main badger sett.

It is also possible that the cluster of badger setts identified to the north east of Turbine 5 (approximately 600m from Excavation 1) may be another main sett of a separate social group of badgers, however, insufficient information is provided in the ES to adequately classify this sett.

NED also notes that some of the grid references provided in Table 1 for the location of badger setts/excavations may be inaccurate. In particular Excavation 2 could not be found during the NED site visit using the grid reference provided.

All of the badger setts/excavations described in Table 1 of Appendix 6.6 and shown on Figure 6.8 are more than 25m from the development area with the exception of Excavation 3 which is adjacent to the red line boundary and within 25m of the access track to Turbine 1. The report recommends that a fixed camera could be used to establish the status of this sett prior to works commencing and that any necessary measures could then be agreed with NIEA. However, this approach would not comply with planning policy or the EIA Regulations and the status of this sett and any necessary mitigation measures would need to be confirmed and agreed prior to planning approval being granted.

NED is concerned that the findings from our site visit contradict some of the descriptions of badger setts/excavations provided in the ES and that some setts have not been described or classified at all. NED considers that the status of badgers on the site and the overall level of badger activity has been inadequately detailed in the ES and we therefore require further clarification on the status and classification of badger setts on the site. Accurate grid references for the location of all setts/excavations should also be provided.

NED considers that the proposal has the potential to have a significant impact on the local badger population and we are concerned that the only mitigation proposed for badgers is the 25m buffers to setts shown on Figure 6.8. However, ES Sections 6.238-6.240 describe potential impacts on badgers from construction activities, such as entrapment within excavations, accidental injuries, disturbance and displacement as well as loss of foraging habitat. Furthermore, it should be highlighted that recent research (Agnew et al, 2016[7]) has found that badgers living close to operational wind farms (within 1km) have significantly greater levels of stress than those living

---

[7] Agnew R.C.N., Smith V.J., Fowkes R.C. (2016) Wind Turbines cause chronic stress in badgers (*Meles meles*) in Great Britain. *Journal of Wildlife Disease, 52(3)*.

CONSENTED (LA01/2018/0200/F)

distant from wind farms (>10km). Therefore, as well as clarification on the status of badgers on the site, further information on mitigation for potential impacts to badgers is required, particularly during the construction phase. Measures should ensure that badger setts are fully protected and that they have safe access to foraging grounds during the construction phase and throughout the lifetime of the development.

A comprehensive badger mitigation plan should be produced and agreed prior to any planning approval being granted to demonstrate adequate protection to badgers during the construction phase and continued access to foraging grounds during the operational phase. The stream gullies and ravines on the site appear to be important for badgers and function as valuable wildlife corridors and these, in particular, should be protected and enhanced.

<u>Smooth Newt</u>

A newt survey was undertaken on 8 June 2016. Two smooth newts (*Lissotriton vulgaris*) were found in a large pond (the dam pond) to the east of the site. The pond has extensive coverage of dense vegetation cover floating on the surface and is considered suitable for smooth newt breeding. The site lacks the woodland cover favoured by newts for hibernation but it is assumed that they are using the conifer plantation to the southeast of the pond. The proposal has the potential to remove suitable terrestrial habitat for smooth newt and fragment their habitat. The construction of the access roads in proximity to the pond has the potential to interrupt their migration to hibernaculae and construction works may cause mortality of adult newts.

Proposed mitigation involves the erection of drift fencing along both sides of the access track to the southeast of the pond and the installation of pit traps to capture adult newts on their migration to and from the pond in the spring and summer. This would be supervised by the project Ecological Clerk of Works (ECoW) under licence from NIEA. Once construction was complete the fence would be removed. Any captured newts would be moved to the breeding pond. It is also proposed to create a newt hibernaculum to the southeast of the pond to avoid the need for them to cross the wind farm access track.

NED is content with the assessment of impacts to smooth newts in the ES and, in general, with the mitigation proposed. However, more detail would be required in a Protected Species Management Plan to be to be submitted and agreed prior to any works commencing and this would need conditioned in any planning approval.

<u>Common Lizard</u>

A lizard survey was undertaken from the end of April 2016 to the end of August 2016, firstly by placing 40 refugia (carpet tiles) across the site and then carrying out three walked transects in June, July and August. Six adult common lizards (*Zootoca vivipara*) were found using 5 refugia and the population on the site is assessed to be good. The ES considers that the habitat around T3 and adjacent to T5 & T6 are optimal for lizards while other areas are likely to be poor or sub-optimal due to the presence of more improved grassland and heavy grazing by sheep.

Mitigation is proposed in the ES for impacts to lizards and this mainly involves the mowing of tall vegetation within the construction corridor prior to works commencing and the removal, by hand, of stones, tree stumps, logs, brash, rocks or piles of similar debris. Appendix 6.7 of the ES also states

CONSENTED (LA01/2018/0200/F)

that the implementation of site specific enhancement measures as part of the OHMP will also help to offset potential significant effects on lizards through improvement to habitats increasing prey availability. However, as stated above NED has concerns with the submitted OHMP and requires a revision of proposed habitat management measures.

NED is content that, due to the availability of suitable lizard habitat in the wider area and with the mitigation proposed, the proposal is unlikely to have a significant impact on the local common lizard population. All proposed mitigation for common lizard would need incorporated into an enforceable Protected Species Management Plan to be conditioned in any planning approval.

Other Priority/Protected Species

No evidence of otter (*Lutra lutra*) was found on the site but the ES states there is potential for otters to commute along the small watercourses on site. Impacts on otters are predicted to be negligible to neutral. NED is content with the assessment with regard to otters.

Surveys for suitable habitat for the marsh fritillary butterfly (*Euphydryas aurinia*) and the argent & sable moth were carried out and the site was considered to have negligible potential for these species. NED is content with these assessments.

Grid Connection

Although connection to the electricity grid is an integral, requisite part of any wind farm project, NED acknowledges that it typically follows a completely separate consenting process through Northern Ireland Electricity (NIE). However, the Best Practice Guidance to Planning Policy Statement 18: Renewable Energy highlights that developers will generally be expected to provide details of indicative routes and method of connection to the electricity grid with a wind farm application. The EIA Regulations also require an assessment of the likely significant effects of all elements of a project.

NED acknowledges that although the exact means of grid connection was unknown at the time of writing the ES, Technical Appendix 2.1 contains an assessment of a potential grid connection route which is likely to be the option most favoured by NIE.

The proposed grid connection route assessed in the ES consists of 8km of underground cable which will follow public roads to the Cam cluster substation. The route is indicated on Figure 1 of Appendix 2.1.

NED is content with the ecological assessment which has been carried out on the likely grid connection route and with the mitigation measures described. These measures should form part of a final Construction and Environmental Management Plan for the project to be conditioned with any planning approval. Should the proposed grid connection route change at any time in the future NED would expect a revised assessment to be carried out and for it to be re-consulted on this.

CONSENTED (LA01/2018/0200/F)

Natural Heritage

Construction & Environmental Management Plan

No outline Construction & Environmental Management Plan (CEMP) or Construction Method Statement (CMS) has been submitted with the application. The production of an outline CEMP is best practice in wind farm developments. NIEA standard EIA scoping advice provided to the developer in July 2017 prior to the submission of the application highlighted the need for a CEMP.

An outline CEMP is required to identify, bring together and co-ordinate all of the mitigation recommended in the various chapters and reports of the ES. It should detail the proper implementation of all of the mitigation measures, monitoring and reporting which will be required during the construction, operation and decommissioning phases of the development. It should also identify any contingency measures which may be applied, if necessary, in the event of unforeseen circumstances or emergencies. The outline CEMP should include relevant drawings, diagrams and indicative photographs, showing the proposed construction method and include a drawing identifying any permanent and temporary peat and spoil storage areas. It should clearly highlight the timing and sequencing of works to minimise impacts on important natural heritage interests. It is also useful if the outline CEMP contains a table summarising all of the various mitigation measures to be implemented.

It is acknowledged that some finer details of construction methods and mitigation measures may not be available until more detailed ground investigations have been carried out post consent and a future principal contractor appointed. However, the outline CEMP should provide sufficient detail of how the development will be carried out in accordance with the recommendations reported in the ES to minimise its effects on the environment. Where any uncertainty remains regarding exact construction methods or mitigation measures the outline CEMP should detail any options being considered and identify minimum standards or parameters within which works will take place.

A final CEMP should then be produced from the outline CEMP once the finer details of construction methods are known. A final CEMP will be required to be submitted to the planning authority for agreement prior to works commencing. The final CEMP needs to be an unambiguous and enforceable document and all works on site must conform to the final CEMP. However, the document also needs to be a live, working document to be used by the appointed contractor and any deviations from or changes to the CEMP should be agreed in writing with the planning authority. Where a final CEMP differs significantly from the outline CEMP the measures proposed should not provide less protection than those previously described and should be in accordance with the recommendations contained within the ES to reduce environmental impacts to a minimum.

Further Environmental Information

1. Information to inform a Habitats Regulations Assessment:
   i. Full details of the type of flocculant to be used in settlement ponds, i.e. if it will be aluminium based, and method of use.

2. Clarification on the figures for permanent (long term) and temporary habitat loss on the site.

3. Revised approach to habitat management on the site. A revised Outline Habitat Management Plan (OHMP) should be produced to focus compensation measures on sensitive grazing

CONSENTED (LA01/2018/0200/F)

management and the restriction of damaging activities across all of the lands under the applicant's control. The OHMP should also make provisions for beneficial habitat management for snipe more than 400m from turbines and enhancement of degraded heather for red grouse. Some key measures which should be included and points to be addressed are:

i. Revised aims and objectives of OHMP;
ii. Grazing should be removed during the construction phase and for a period thereafter to allow areas of PMGRP to recover from historic overgrazing;
iii. Grazing should be removed during the bird breeding season (1 April to 30 July minimum);
iv. Future grazing to be at suitably low densities – preferably cattle;
v. No applications of fertiliser or lime;
vi. No application of herbicide, pesticide, sheep dip, poultry litter or any other material;
vii. No cultivation, reseeding, reclamation, rolling, infilling, or dumping of materials;
viii. No supplementary feeding;
ix. No peat cutting or installation of new drainage;
x. No burning, flailing or harrowing of vegetation;
xi. A monitoring programme involving fixed vegetation quadrats and photography;
xii. Contingency measures;
xiii. Confirmation of landowner agreement for all measures.

4. Clarification on the status of badgers on the site and more detail on badger mitigation measures. This must include:
    i. Appropriate classification of and detailed descriptions of all of the badger setts/excavations on the site.
    ii. Accurate grid references for all sett locations should also be provided
    iii. More detail on badger mitigation measures, particularly during the construction phase. Measures must ensure badgers have safe access to foraging grounds.

5. Production of an outline Construction & Environmental Management Plan (OCEMP) to include: details of timing of works; all mitigation measures identified within the ES which apply to the construction, operational and decommissioning phases; identification of peat and spoil storage areas; roles and responsibilities of ECoW.

CONSENTED (LA01/2018/0200/F)

Section Reference: CB25671-1

Planning Reference: LA01/2018/0200/F

Date of NIEA NED response from Protected Landscapes Team: 23rd March 2018

Considerations

The site lies within the Binevenagh AONB.

Our comments relate essentially to the potential strategic impact of the proposal on the AONB.

Given the existing and consented wind farms in relatively close proximity to this site and that our preference is always to look more favourably on extensions to existing wind farms as opposed to new schemes within the landscape we would have no particular objection to this proposal.

Explanatory Note

We have considered the Environmental Statement as a whole and the Non-Technical Summary and Chapter 4 on the ‘ Landscape and Visual ’ component. The Figures showing the proposal in relation to other existing and consented wind farms have been instrumental in our assessment of the overall impact on the landscape. We have taken cognisance of the fact that the proposal would extend the visual influence (and influence on the landscape character) in a south-westerly direction towards Limavady. In addition the proposal would be sited away from the iconic escarpment and highest points within the area.

We have also taken cognisance of the height of these turbines with an overall tip height of 149.9m which have the potential to visually discordant with existing turbines of 125m in height.

We have considered the impact of the proposal on the other 2 AONBs in proximity – The Causeway Coast AONB and The Sperrin AONB and would broadly concur with paras 4.92 – 4.94 in the ES in that additional impacts would be minimal.

Our overall conclusion is that any potential visual inconsistencies and additional adverse impacts would not be significant enough to sustain an argument against this proposal.

CONSENTED (LA01/2018/0200/F)

Shared Environmental Service
County Hall
182 Galgorm Road
Ballymena
Co. Antrim
BT42 1QF

Date: 27/02/2019

Planning Reference: LA01/2018/0200/F

Location: Lands approx. 6km N E of Limavady which are located immediately to the south of Broad Road (A37), in the Town land of Gortcorbies Co Derry/Londonderry. Access is provided directly from the Broad Road where an unoccupied stone building is located. The Western site boundary is located approx. 1.2km east of Keady Hill Quarry and the eastern boundary is located approx. 400m S W of disused quarry on Broad Road which is adjacent to Springfield Forest

Proposal: Construction of a wind farm comprising 9 no wind turbines (maximum 149.9mto blade tip) and associated infrastructure including internal electricity transformers, crane hard standings, underground cabling, control building, substation compound, energy storage area, newly created site entrance, new and upgraded on site access tracks, turning heads and all other associated ancillary works. During construction and commissioning there will be a number of temporary works including a construction compound with car parking, temporary parts of crane hard standing and welfare facilities.

This planning application was considered in light of the assessment requirements of Regulation 43 (1) of the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended) by Shared Environmental Service on behalf of Causeway Coast and Glens Council which is the competent authority responsible for authorising the project and any assessment of it required by the Regulations.

Shared Environmental Service (SES) notes that NIEA Natural Environment Division, in its response of 25TH January 2019, has requested further information as follows:

NED request:

1. Information to inform a Habitats Regulations Assessment:
    a. Full details of the type of flocculant to be used in settlement ponds, i.e. if it will be aluminium based, and method of use.

2. Clarification on the figures for permanent (long term) and temporary habitat loss on the site.

3. Revised approach to habitat management on the site. A revised Outline Habitat Management Plan (OHMP) should be produced to focus compensation measures on sensitive grazing management and the restriction of damaging activities across all of the lands under the applicant's control. The OHMP should also make provisions for beneficial habitat management for snipe more than 400m from turbines and enhancement of degraded heather for red grouse. Some key measures which should be included and points to be addressed are:
    a. Revised aims and objectives of OHMP;

CONSENTED (LA01/2018/0200/F)

b. Grazing should be removed during the construction phase and for a period thereafter to allow areas of PMGRP to recover from historic overgrazing;
c. Grazing should be removed during the bird breeding season (1 April to 30 July minimum);
d. Future grazing to be at suitably low densities – preferably cattle;
e. No applications of fertiliser or lime;
f. No application of herbicide, pesticide, sheep dip, poultry litter or any other material;
g. No cultivation, reseeding, reclamation, rolling, infilling, or dumping of materials;
h. No supplementary feeding;
i. No peat cutting or installation of new drainage;
j. No burning, flailing or harrowing of vegetation;
k. A monitoring programme involving fixed vegetation quadrats and photography;
l. Contingency measures;
m. Confirmation of landowner agreement for all measures.

4. Clarification on the status of badgers on the site and more detail on badger mitigation measures. This must include:
    a. Appropriate classification of and detailed descriptions of all of the badger setts/excavations on the site.
    b. Accurate grid references for all sett locations should also be provided iii. More detail on badger mitigation measures, particularly during the construction phase. Measures must ensure badgers have safe access to foraging grounds.

5. Production of an outline Construction & Environmental Management Plan (OCEMP) to include: details of timing of works; all mitigation measures identified within the ES which apply to the construction, operational and decommissioning phases; identification of peat and spoil storage areas; roles and responsibilities of ECoW.

<u>SES would request that the OCEMP should also include:</u>

a. Details of all proposed excavations and construction works as detailed in the ES, including <u>all</u> culverting works proposed and mitigation measures to be implemented.
b. Details of any construction compound to include areas for storage of oils, fuels and chemicals and illustrating a minimum 10m buffer to any watercourse.
c. A proposed storm drainage plan designed to the principles of Sustainable Drainage Systems (SuDS) in order to minimise the polluting effects of storm water on waterways. Construction of SuDS should comply with the design and construction standards as set out in The SuDS Manual - Construction Industry Research and Information Association (CIRIA) Report C697.
d. Detailed drawing plans, demonstrating buffer zones of at least 10m to all watercourses as well as the storm drainage proposed.
e. Details of all pollution prevention measures to be employed during the works. This must include details of the safe use of wet concrete on the site, the erection of a suitable barriers to prevent the egress of contaminated surface water runoff from the construction site, the refuelling of construction machinery and the storage of fuel/ spoil to be undertaken at least 10 metres from all watercourses.

CONSENTED (LA01/2018/0200/F)

Please re-consult SES once all relevant information has been submitted and all consultees have responded in order for the HRA to be completed.

sharedenvironmentalservice@midandeastantrim.gov.uk

CONSENTED (LA01/2018/0200/F)

DfI Roads

Department for Infrastructure
An Roinn Bonneagair
www.infrastructure-ni.gov.uk

Network Planning
Northern Division

County Hall
Castlerock Road
Coleraine
BT51 3HS

Tel: 028 7034 1300

Causeway Coast and Glens
Local Planning Office

Planning Authority Case Officer: Elaine Olphert
Planning Application Ref: LA01/2018/0200/F
Date consultation received: 28th February, 2018
Date of Reply: 22nd June, 2018
Location: Lands approx 6km N E of Limavady which are located immediately to the south of Broad Road (A37), in the Town land of Gortcorbies, Co Derry/Londonderry. Access is provided directly from the Broad Road where an unoccupied stone building is located. The Western site boundary is located approx 1.2km east of Keady Hill Quarry and the eastern boundary is located approx 400m S W of disused quarry on Broad Road, which is adjacent to Springfield Forest.
Proposal: Construction of a wind farm comprising 9 no wind turbines (maximum 149.9mto blade tip) and associated infrastructure including internal electricity transformers, crane hard standings, underground cabling, control building, substation compound, energy storage area, newly created site entrance, new and upgraded on site access tracks, turning heads and all other associated ancillary works. During construction and commissioning there will be a number of temporary works including a construction compound with car parking, temporary parts of crane hard standing and welfare facilities.

Comments:-

DfI Roads has noted that the Council considers this proposal to be an exemption to the Protected Routes Policy.

DfI Roads would advise that the submitted plans regarding the access on to Broad Road are unacceptable in relation to scale and detail.

DfI Roads will require a 1:500 scale plan based on an accurate ground survey indicating all roadside detail, fence lines, buildings etc. within the extent of the required visibility splays i.e. 215 metres on each side of the proposed access.

DfI Roads will require the proposed access superimposed on the existing plan together with the visibility splays of 4.5m x 215m shown to the edge of the carriageway. The proposed access drainage and its outlet, radii, gradient etc. should all be indicated.

Comments continued overleaf

INVESTORS IN PEOPLE

CONSENTED (LA01/2018/0200/F)

DfI Roads

Department for
Infrastructure
An Roinn
Bonneagair
www.infrastructure-ni.gov.uk

Comments continued:-

DfI Roads would advise that the position of any gates being erected at the access should be shown on the plan. It should be noted that the gates should be sited far enough from the edge of the carriageway to allow the largest vehicle likely to use the access to stop clear of the carriageway when the gates are closed.

DfI Roads will require the width of the access to be 6m minimum for the first 20m from the edge of the carriageway.

Note to local Planning office:- DfI Roads awaits the submission of a revised plan.

DfI Roads Case Officer: William Reid,
Network Planning

Issued on behalf of the Divisional Roads Manager

INVESTORS IN PEOPLE

CONSENTED (LA01/2018/0200/F)

City of Derry Airport

Consultation Response

Application Details

Application Reference:	LA01/2018/0200/F
Proposed Development:	Construction of a wind farm comprising 9 no wind turbines (maximum 149.9mto blade tip) and associated infrastructure including internal electricity transformers, crane hard standings, underground cabling, control building, substation compound, energy storage area, newly created site entrance, new and upgraded on site access tracks, turning heads and all other associated ancillary works. During construction and commissioning there will be a number of temporary works including a construction compound with car parking, temporary parts of crane hard standing and welfare facilities.
Location:	Lands approx 6km N E of Limavady which are located immediately to the south of Broad Road (A37)

Date of Response	03 Aug 2018
Response	City of Derry Airport will have no objection to the above planning application subject to the conditions below.
Reason	Draft Aviation Conditions – Without Prejudice **Revised Procedures** Prior to the erection of any turbines, the developer shall commission an aviation consultant (from a City of Derry Airport (CODA) approved supplier) to revise all associated Instrument Flight Procedures (IFP) to illustrate a revised Low Holding Altitude of 2,500 feet AOD (as applicable). The developer shall submit and agree in writing with CODA and the Council the draft revised IFPs for CAA submission, which will be updated in the UK AIP. Reason: In the interest of flight safety. **Radar** To ensure aviation safeguarding at the CODA, if turbines will demonstrably effect a specific contemporary radar system* and CODA are in receipt of written confirmation from Derry City &

CONSENTED (LA01/2018/0200/F)

	Strabane DC to evidence that full funding will be provided for the contemporary radar system (prior to grant of planning permission), no turbine erection or operation shall take place on site until a Radar Mitigation Scheme (RMS) for the development has been agreed in writing with CODA operations and the Council. This scheme shall: i. Set out the appropriate measures to mitigate the impact of the development upon the operation of the proposed CODA Air Traffic Control (ATC) radar and any ATC operations which are reliant on the radar. ii. Set out the appropriate performance criteria to be satisfied to mitigate the impact of the development on the radar. The wind turbines shall not become operational until all agreed measures and time scales in the RMS have been implemented and met. * A contemporary radar system should have wind farm tolerance included if such technology is market ready. Reason: In the interests of flight safety. **Aviation Scheme** Prior to the erection of any turbines, the developer shall submit and agree in writing with the Council a scheme for the installation of aviation lighting. Upon erection of the turbines, the agreed lighting scheme shall be installed and operational for the lifetime of the turbines. Reason: In the interest of flight safety.
Issued By	M Edwards
Department	ATS Manager

CONSENTED (LA01/2018/0200/F)

A

Outline Habitat Restoration Management Plan (OHRMP)

CONSENTED (LA01/2018/0200/F)

Outline Habitat Management Plan

Dunbeg South Windfarm, Co. Derry

For: res power for good

141/2019-02

April 2019

Ecological Assessment | Ecological Clerk of Works | Bat Surveys | Badger Surveys
Biodiversity Checklists | Ornithological Assessment | Preliminary Ecological Appraisal

Blackstaff Ecology

CONSENTED (LA01/2018/0200/F)

Document history

Author	Cormac Loughran	22/04/2019
Checked	Cormac Loughran	23/04/2019
Approved	Cormac Loughran	23/04/2019

Client Details	
Contact	Garth McGimpsey
Client Name	Res UK & Ireland. Ltd
Address	Willowbank Business Park, Willowbank Road, Millbrook, Larne, County Antrim, BT40 2SF

Issue	**Date**	**Revision Details**
A	23/04/2019	DRAFT issue
B	24/04/2019	Final issue

Blackstaff Ecology

Copyright © 2019 BLACKSTAFF ECOLOGY LTD.

CONSENTED (LA01/2018/0200/F)

Contents

CONSENTED (LA01/2018/0200/F)

Introduction

1. This outline Habitat Management Plan (oHMP) was produced by Blackstaff Ecology on behalf of the windfarm owner as part of the EIA for the proposal. The HMP sought to deliver ecological mitigation and enhancement measures associated with Dunbeg South Windfarm. It is intended to inform a broad audience including DAERA (NIEA), Ecologists and Local Authority Planning Officers. It is intended to be simple and effective.

2. It was envisaged that the HMP would represent an iterative and adaptive process which will continue to be informed by new guidance and best practice and will be guided by the Project Ecologist/ECoW. The Project Ecologist will liaise with appropriate specialists from the Council, NIEA and the windfarm owner. Subsequent document review will be informed by monitoring, to ensure the scope of the HMP remains appropriate and the objectives successfully achieved.

3. However, in their consultation response (25 January 2019) NIEA NED raised a number of concerns regarding the appropriateness, efficacy and likely success of the initial draft of the oHMP. Therefore, this revised draft of the OHMP seeks to address these concerns and bring the management prescriptions in line with NIEA's requirements.

Background Information

4. The project has been subject to Environmental Impact Assessment through which a range of impacts on ecological features have been identified and mitigation measures set out.

Consultations

5. This revised oHMP has been produced to enable the Development to meet the requirements of the DAERA consultation response (25 January 19), as detailed below;

> *A revised Outline Habitat Management Plan (OHMP) should be produced to focus compensation measures on sensitive grazing management and the restriction of damaging activities across all of the lands under the applicant's control. The oHMP should make provisions for snipe more than 400m from turbines and enhancement of degraded heather for red grouse. Some key measures which should be included and points to be addressed are:*
>
> *i. Revised aims and objectives of OHMP;*
>
> *ii. Grazing should be removed during the construction phase and for a period thereafter to allow areas of PMGRP to recover from historic overgrazing;*
>
> *iii. Grazing should be removed during the bird breeding season (1 April to 30 July minimum);*
>
> *iv. Future grazing to be at suitably low densities - preferably cattle;*
>
> *v. No applications of fertiliser or lime;*
>
> *vi. No application of herbicide, pesticide, sheep dip, poultry litter or any other material;*
>
> *vii. No cultivation, reseeding, reclamation, rolling, infilling, or dumping of materials;*
>
> *viii. No supplementary feeding;*
>
> *ix. No peat cutting or installation of new drainage;*
>
> *x. No burning, flailing or harrowing of vegetation;*
>
> *xi. A monitoring programme involving fixed vegetation quadrats and*

CONSENTED (LA01/2018/0200/F)

photography;

xii. Contingency measures;

xiii. Confirmation of landowner agreement for all measure.

6. This oHMP ensures the DAERA requirements described above are appropriately considered before, during and following construction works. This oHMP also considers the requirement for an appropriate Decommissioning and Restoration Plan.

Planning Policy Statement 2

7. Planning Policy Statement 2 (Natural Heritage) - Policy NH 5 Habitats, Species or Features of Natural Heritage Importance states that; *Planning permission will only be granted for a development proposal which is not likely to result in the unacceptable adverse impact on, or damage to known*:

- *priority habitats;*
- *priority species;*
- *active peatland;*
- *ancient and long-established woodland;*
- *features of earth science conservation importance;*
- *features of the landscape which are of major importance for wild flora and fauna;*
- *rare or threatened native species;*
- *wetlands (includes river corridors); or*
- *other natural heritage features worthy of protection.*

8. A development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

9. Priority habitats and species may fall within and beyond designated sites. They include both European (as identified under Annex I and II of the Habitats Directive and Annex I of the Birds Directive) and Northern Ireland priority habitats and species, identified through the Northern Ireland Biodiversity Strategy (NIBS) 27 (in pursuance of the statutory duties under the Wildlife and Natural Environment (NI) Act 2011).

10. To ensure international and domestic responsibilities and environmental commitments with respect to the management and conservation of biodiversity are met, the habitats, species and features mentioned above are material considerations in the determination of planning applications.

11. It is therefore expected that wind farm proposals will provide measures that enhance the site for biodiversity, and this expectation is reflected within the Causeway Coast & Glens Borough Council consultation responses from the Pre-Application Notice and in particular the response from DAERA NED. Accordingly, RES (supported by Blackstaff Ecology) have been exploring opportunities for habitat management at the site, which would operate throughout the wind farm's consented lifespan through a dedicated HMP.

Project Ecologist/ECoW

12. The role of the Project Ecologist/ECoW will be to measure the success of the HMP in line with objectives, ensure the frequency of monitoring is adhered to (and after year five), assess the requirement for any remedial measures or changes to the existing prescriptions in light of monitoring results and new emerging guidance and best practice. The ECoW will consult with

CONSENTED (LA01/2018/0200/F)

and take advice (as appropriate) from representatives from the following key stakeholders:

- *DAERA (NIEA NED)*
- *The Planning Authority*
- *The windfarm owner*

Habitat Losses

13. NIEA also requested clarification on the habitat loss figures presented in the ES and oHMP as these appeared to be inconsistent. For clarification, the figures presented in the text (and table) below are the correct figures and those which have been used during calculations on the requirements for lands to be included within the oHMP by way of compensation and to ensure a 'Net Gain' in biodiversity terms as a result of the Development.

14. The Dunbeg South Windfarm will result in permanent habitat loss of 6.9ha (or 68927.26m^2) and temporary habitat loss of 3.3ha (or 3.3182.9m^2), largely comprising purple moor-grass & rush pasture (PMGRP) and wet (dwarf shrub) heath, although small areas of other habitats will also be lost, such as acid grassland mosaic and poor semi-improved grassland. Habitat loss figures have been taken from Chapter 6 (of the ES) - Ecology[1].

15. A summary of the extent of loss of habitat types which represent Priority Habitats in the Northern Ireland Habitat Action Plan (HAP) are shown in Table 1 below. The habitat calculations provided in the ES distinguish between the 'permanent' and 'temporary' habitat loss. Also, the areas of 'permanent' represent real world calculations based on the experience of the author and best practice and are not 'idealised' calculations which can occasionally underestimate the 'permanent' while overestimating the 'temporary' habitat loss.

16. In summary, the loss of HAP habitats will comprise 0.7ha of 'wet heath'; in addition, the ES reported a loss of 5.44ha of purple moor-grass & rush pasture (PMGRP), which was likely to have been NI HAP habitat in the recent past (circa 15-20 years). The extent of habitat loss has been used to inform the prescriptions detailed in this HMP, including a commitment to enhance **<u>at least 14 times</u>** the area of NI Priority Habitat lost as result of the Development.

Table 1: Temporary and Long-Term Habitat Loss

Habitat	Temporary Loss (m^2)*	Long Term Loss (m^2)	Total Loss (m2)
M15/M15d	1785	7038	8823
M23a (turbines)	5355	21114	26469
M23a (new tracks)	21250	29750**	51000
M23a (upgraded track (existing track +3m)	2917.5	3500	6417.5
U4d (turbines)	892.5	3519	4411.5
Semi-improved grassland (Compound & substation)	982.9	4006.26	4989.16
Totals	33182.9	68927.26	102110.16

**Based on a continuous 2.5m buffer around all construction structures*
***Based on 7m wide track (5m for running surface and 1m either side for drainage.*

17. The ES chapter specified a range of mitigation measures to avoid, or where this was not possible, minimise detrimental effects on certain habitats and species. Enhancement

[1] The figures in Table 6.13 of Chapter 6 Dunbeg South ES for each habitat type were presented accurately, however, the totals were incorrect and have been amended as Table 1 in this oHMP.

CONSENTED (LA01/2018/0200/F)

measures were also specified to achieve benefits for biodiversity within the site as a whole, in accordance with planning policy requirements. It is these mitigation and enhancement measures that will be delivered via this outline HMP.

NIEA HAP – Minimum Habitat Targets

18. Several NI Habitat Action Plans (HAP's) have been produced by NIEA. Each HAP contains a series of action plans covering the nationally threatened or declining habitats in Northern Ireland. Each action plan includes actions aimed at safeguarding that particular habitat. As a result, the HAP's for wet heath and PMGRP was used to guide and develop the objectives set out in this HMP to maximise the contribution towards the aims of the NI HAP. Table 2 below demonstrates how the HMP objectives will contribute to the NI HAP targets.

19. NIEA has previously requested that habitat establishment should seek to provide approximately five times the habitat area lost for habitat types represented in the HAP. As a result, minimum target areas have been established for each habitat type and are also provided in Table 2 below.

Table 2 - Minimum establishment targets for NI HAP habitats

<table>
<tr><th>Relevant component habitats</th><th>Associated species of principal importance</th><th>Contributing HMP objectives</th><th>Area to be lost to the Development</th><th>Area proposed to mitigate for the loss</th></tr>
<tr><td rowspan="2">Purple moor-grass and rush pasture</td><td rowspan="2">- Irish hare
- Marsh fritillary
- Various invertebrates
- Various plants
- Curlew, lapwing</td><td>Establish and maintain species- rich grasslands</td><td rowspan="2">5.44 ha</td><td rowspan="3">90 ha</td></tr>
<tr><td>Retain, protect and maintain area of marshy grassland</td></tr>
<tr><td>Upland heath</td><td>- skylark, meadow pipit, cuckoo, grasshopper warbler, curlew, lapwing, golden plover, red grouse, hen harrier
- Irish hare
- Juniper, bog orchid, stags horn club moss, globeflower, wood bitter vetch</td><td>Establishment of heathland and acid/marshy grassland mosaic in semi-improved grassland

Establishment of heathland and acid/marshy grassland mosaic alongside new access tracks</td><td>0.7 ha</td></tr>
</table>

Other relevant Action Plan Targets

20. There are a number of NI HAP targets for Upland Heath which the actions within this oHMP could contribute towards meeting, including;

CONSENTED (LA01/2018/0200/F)

- Maintain the current extent and overall distribution of upland heathland which is currently in favourable condition.

- Improve by management at least 50% of upland heathland currently in unfavourable condition outside ASSIs by 2010.

- Seek to increase dwarf shrubs to at least 25% cover where they have been reduced or eliminated due to inappropriate management. A target of 2,000 ha is proposed for such restoration by 2010.

- Initiate management to re-create 100 ha of upland heathland by 2010 where heathland has been lost due to agricultural improvement or afforestation, with a particular emphasis on reducing fragmentation of existing heathland.

21. There are also similar HAP targets for PMGRP which the OHMP could potentially contribute towards, including;

- Maintain the total extent of PMGRP in Northern Ireland at 18,919 ha.

- Maintain condition, where favourable, of the existing resource.

- For stands outside ASSIs, achieve favourable condition over 75% of the resource by 2015.

Mitigation for NI Priority Habitats

Background

22. The objective of this mitigation is to enhance 90ha of PMGRP to compensation for the habitat loss resulting from the proposal. This will be achieved through the use of (NICMS based) grazing prescriptions for wet grassland (and breeding waders). The oHMP has been produced collaboratively and all proposed measures have been agreed with the landowners.

23. The overall aim of the oHMP is to bring the PMGRP habitat within the proposed habitat management area into favourable (conservation) condition via sensitive grazing management and the restriction of damaging activities (e.g. over-stocking, supplementary feeding and drainage).

Habitat Management (PMGRP)

24. Nearly all PMGRP (species-rich) swards require management if they are not to be taken over by coarser vegetation, scrub, and eventually by woodland. The nature and speed of this process; and hence the intensity and frequency of management required to counter it, vary greatly with the depth and fertility of the soil, and with topography and local climate.

25. Disturbed areas created following the construction of the proposed Development will require a few years to revegetate and the removal of grazing for 18-months (or 2 growing seasons) will be the main management measure with respect to revegetation. Once the grazing is restored across the site, the disturbed areas should be robust enough to cope with light grazing. The management of the habitat will be grazed in the traditional way as grazed swards usually support a greater diversity; however, the stocking rates will be much reduced over historic levels, which should further allow for the gradual recovery of the habitats post construction.

CONSENTED (LA01/2018/0200/F)

26. Grazing by cattle is the desired management for PMGRP sites (however, sheep are permitted as long as the overall stocking densities are not exceeded). Grazing will be to NICMS levels (i.e. 0.75 LU/Ha).

Prescriptions

Objective: Allow natural regeneration during construction

27. No livestock will be permitted on site during the 18-month construction period in order to allow the vegetation to recover. This will include two growing seasons. This also includes the entire LUAC within which infrastructure is located and is not restricted to the proposed Habitat Management Area.[2]

Objective: Re-establish the characteristic floristic diversity of the PMGRP via ongoing management

28. As described in Chapter 6 of the ES the main issue reducing the overall conservation status of the PMGRP habitat on site is reduced by the absence of the characteristic suite of wildflowers which signify the species-rich variant of this habitat type (i.e. the NI Priority Habitat).

29. The aim of this management prescription is therefore to increase the floristic diversity of the habitat. The grassland in the habitat management area will be managed in line with the following key measures:

- No grazing will be permitted between 1 January and 15 April.
- Grazing is permitted between 16 April and 31 December at a stocking density of 0.75 LU/ha (cattle should be included in the grazing regime).
- Excess grass can be cut for hay but must not be cut until after 15 August (but the area should be cut at least once every 3 years (to remove litter accumulation (if possible) with half mown in year one, half in year two and no cut in year 3)[3].
- Introduction of livestock (cattle only) aftermath grazing from mid-August onwards to create gaps in the sward and trample in the seed.
- No use of inorganic fertilisers, lime or animal slurry.
- Cultivation, reseeding, reclamation, infilling, dumping or application of herbicide, pesticide, sheep dip, poultry litter or any other material will not be permitted.
- Installation of new drainage systems will not be permitted.
- Supplementary feeding will not be permitted.
- Excess grass may be saved for hay or silage but must not be cut until after 15 July.
- No poaching of ground will be permitted.
- Noxious weeds may be controlled by cutting between 15 July and 15 March, or with herbicides applied using a spot sprayer only.
- Existing drainage systems can be maintained but not widened, deepened or

[2] Should the ECoW/Project Ornithologist deem grazing to be necessary in order to maintain the local conditions required for breeding snipe (during construction). Cattle will be permitted at 0.2 LU/Ha (n sheep will be permitted in order to allow further regeneration of the construction corridor and of the drier short sward semi-improved acid grassland/wet heath mosaic on parts of the site).

[3] Only during years that ground conditions permit (as the landowner maintains that much of the PMGRP is on land too wet to support a tractor and cutting attachment, during most years).

CONSENTED (LA01/2018/0200/F)

extended.

- No peat cutting.
- No burning, flailing or harrowing of vegetation.

Objective: Establish, extend and maintain area of habitat suitable for snipe[4]

30. The grazing dates, prescriptions and overall regime (above) have been designed to incorporate the requirements for snipe within the wider HMA. It should be noted that much of the area to the northwest of the HMA is currently in good condition for snipe ((D. Steele pers com) and as evidenced by the 2 existing pairs of snipe already in this area)). However, in addition to the prescriptions previously outlined, the following will also be required;

- Cattle must not be released directly on to breeding wader sites after being wintered indoors. Cattle must be outside for at least one week before being put on to breeding wader fields.
- Field operations, for example rolling and fertiliser application, are not permitted between 15 April and 30 June.
- Soft rush (*Juncus effusus)* control must be carried out where rushes cover more than one third of the area. Rushes must be controlled by cutting between 15 July and 15 March, retaining 30% uncut.
- The spread of scrub/trees will be controlled.
- The landowners will implement predator control (foxes, magpies and hooded/carrion crows) within the habitat management area; during the period 15 January to 15 August. (Larsson traps and shooting will be used).
- Water levels in sheughs and drains will be maintained as close as possible to bank height during the period 1 March to 30 June to create soft ground (within the area outlined in (revised) Figure 6.9).

Management for red grouse

31. The species was detected only in the 2017 breeding seasons, with one pair breeding in a large territory (between 400m and 950m from the nearest turbine). Although droppings of this species were found 250m from a turbine location in winter. This species has been shown to be susceptible to relatively short-term displacement by windfarm construction, with rapid re-colonisation occurring during the operational phase (Pearce-Higgins et al 2012[5]).

32. However, NED recommended that measures should be taken, including pre-construction vegetation management in order to enhance areas of degraded heather for red grouse and surveillance during construction work, to ensure that breeding grouse are not disturbed. This will be monitored as part of the vegetation and ornithological monitoring programmes, with contingencies in the event that the habitat condition deteriorates over the lifetime of the project.

33. Figure 6.9 (revised) outlines the area which will be monitored for red grouse habitat and within which construction year vegetation management will be undertaken. This area will also be included within the overall monitoring regime to allow for the possibility of further management, in the event that there is the loss of the breeding pair on site or any decline in

[4] There is a total of 12.48Ha of land within the proposed HMA which lies >400m from the proposed turbines. In view of details of the breeding ecology and territorial behaviour of snipe then this is considered to be more than sufficient lands for 2 pairs of snipe in the event that this number were displaced during construction.

[5] Pearce-Higgins, J.W., Stephen, L., Douse, A. & Langston, R.H.W. (2012) Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. *Journal of Applied Ecology* 49: 386-394.

CONSENTED (LA01/2018/0200/F)

heather condition.

34. Cutting heather may not produce results as good as burning, however there are other issues relating to burning which mean that it is not considered appropriate on Dunbeg South, therefore cutting is recommended[6]. Cutting is also considered to be particularly useful in areas where *Molinia caerulea* or purple moor-grass is mixed with the heather but has not formed tussocks. As is the case in parts of the site. Cutting heather requires the same degree of planning as controlled burning and it is important that cut blocks are as irregular as possible to produce a more natural appearance. Cutting of vegetation should not be permitted between the 01 March and the 31 August.

35. Red grouse have also been shown to be susceptible to collision with fences. Any new fences associated with the development will therefore be fitted with markers to increase visibility to grouse (in the event that these are necessary in the future). However, at the moment, no new fencing is currently proposed.

Monitoring and Maintenance

36. Monitoring targets have been devised to measure the success of the objectives described above. Maintenance requirements have been established to maximise the likelihood of success. In years 1-5 the priority is a gradual improvement in species diversity and sward structure. This has been reflected in the broad nature of the targets outlined below. At Year 5, new specific habitat targets and maintenance requirements will be devised as informed by the results of habitat monitoring and assessment of achievement/failure against the targets.

37. Monitoring of the access track restoration and the wider habitat management area will be undertaken using fixed $4m^2$ quadrats spaced, totalling approximately 100 quadrats (50 HMA, 25 along the infrastructure, and 25 within the red grouse habitat area). The location of quadrats will be recorded using GPS and marked using marker stakes. Quadrat locations will be re-surveyed in subsequent years. Quadrat surveys will be undertaken between May – July. Quadrats will record vegetation structure and species % cover, including bare ground. Monitoring will also record ground conditions including topography and surface wetness.

Table 3 – Management objectives & monitoring targets

Objective	Monitoring Targets
Establish, permanent quadrats – Construction Corridor	Record species diversity, habitat type, percentage cover, percentage bare ground, fixed point photograph, percentage cover, presence of animal dung, and wetness. Quadrat surveys undertaken in year 1 prior to construction to establish species diversity (minimum of 25 (2m x 2m) quadrats). Quadrats repeated in years 1 – 5 to assess species change.
Establish, permanent quadrats – Habitat Management Area	Record species diversity, habitat type, sward height, fixed point photograph, percentage cover, presence of animal dung, wetness - Increase in species diversity, sward height & structure. - No increase in % cover of non-target species. Quadrat surveys undertaken in year 1 prior to construction to establish species diversity (minimum of 50 (2m x 2m) quadrats). Quadrats repeated in years 1, 2, 3, 5, 10, 15, 20 & 25 to assess species change.

[6] Hudson and Newborn 1995

CONSENTED (LA01/2018/0200/F)

Drain blocking for snipe	Detailed records (including dates, photographs and locations) of all management measures designed to rewet/maintain water levels on site will be kept. The area of suitable snipe habitat will also be estimated (by the Project Ornithologist) based on ground conditions/number and location of breeding snipe.
Predator control	Detailed records will be kept of the dates, times and numbers of foxes, hooded crows and magpies controlled as part of the on-site management.
Vegetation management – Red grouse	Photographic evidence of construction year heather management over 15% of the lands within the area outlined on Figure 6.9. The results of the red grouse habitat surveys (below) will be used to determine if vegetation (heather) management should be repeated at any point during 30-year management period.
Establish, permanent W Walk – Red grouse habitat	Focus of survey will be condition of ling heather, abundance, cover, percentage of each of the 4 growth forms (pioneer, mature, building and degenerate). Evidence of grouse occupation. Record species diversity, habitat type, fixed point photograph, percentage cover, presence of animal dung, wetness etc. Surveys undertaken in year 1 prior to construction to establish baseline condition (minimum of 25 (2m x 2m) quadrats). Quadrats repeated in years 1, 5, 10, 15, 20 & 25 to assess species change. Red grouse surveys will also be incorporated into the post-construction ornithological monitoring for the site and the results considered in conjunction with the habitat quality monitoring.

Mitigation for GWDTE's

38. Where tracks cross a watercourse (or seepage) which feeds (or emanates) from a GWDTE (flush or seepage), flow across the watercourse will be preserved by installing flow-balancing cross drainage pipes laterally through the track structure, retaining the hydraulic gradient across the footprint of the track. Pipes will be installed at a high frequency (nominally 5m intervals), subject to observational design by the ECoW to suit particular water channels observed on site. No longitudinal drainage is to be installed parallel to and adjacent to the track, in order that no unnecessary flow path that would significantly alter flow routes is introduced. Drainage arrangements are shown on site layout drawings (SuDS technical appendix) appended to the Water Framework Directive Assessment prepared by McCloy Consulting and submitted in annex 3 of the Outline CEMP.

Timeframe

39. The timings required for management are detailed above. In summary, habitat creation and establishment will be undertaken as soon as possible after construction i.e. once the moratorium on grazing during the construction phase has been completed. Management operations will be undertaken as specified above and as informed by monitoring conclusions post-construction.

Implementation of HMP

CONSENTED (LA01/2018/0200/F)

Roles and Responsibilities

40. It will be the responsibility of the wind farm owner to ensure that the HMP is implemented in accordance with the specifications detailed herein for the 30-year lifetime of the wind farm. The windfarm owner will therefore assume the lead role and responsibility in ensuring tasks are undertaken in accordance with the necessary timings specified. Many of the on-site monitoring tasks and overseeing of method statements and ensuring adequate implementation by contractors during construction will be undertaken by the Ecological Clerk of Works, who will be appointed prior to commencement of construction works. Following construction, the windfarm owner will manage and oversee the operation of the wind farm including implementation of the requirements set out within this oHMP.

41. The role of DAERA NED will be primarily advisory in that they will provide support and advice as necessary to ensure that HMP prescriptions and objectives are appropriate, realistic, successfully implemented and in accordance with the requirements set out in any potential future Planning Conditions.

Reporting

42. Monitoring of specific features will be undertaken in line with the timeframes (in years 1- 5) which have been outlined previously. In line with these timings monitoring reports will be provided by end of December in each year.

Photographic Records

43. A baseline photographic record of the site will be completed prior to construction. Photographs will be mapped using 10 figure grid references and accompanied by comments as appropriate, including a compass orientation. A photographic record will be repeated every in line with the details provided in Table 3 (above). This will provide a valuable aide memoir and will include the specific habitat features including (but not limited to):

- All turbine locations;
- Access track verges;
- Habitat Management Area; and,
- Within the red grouse habitat area.

Sharing of Data

44. Monitoring data will be provided to DAERA and The Council in a suitable format (i.e. Microsoft Excel for data, and shape file format for mapping data).

Contingency

45. The following measures will be completed in order to ensure that there is a ‘Net Gain’ for biodiversity and to allow for the any failure in the management prescriptions due to unforeseen events.

Protection of restored areas

46. All restored areas will be protected against livestock grazing, for at least the first 18-months (2 growing seasons), as reviewed by the ECoW. Ideally protection should be by (electric) exclusion fencing (rather than permanent fencing).

CONSENTED (LA01/2018/0200/F)

Grazing management - PMGRP

47. The grazing management will be closely monitoring during the first 5-years post construction. The results of the vegetation surveys will be provided/discussed with NIEA and stocking density will be reduced/increased as required on an annual basis.

Red grouse

48. In the event that the condition monitoring of the area of blanket bog/heath shows a decline in the suitability for red grouse the windfarm owner will undertake to reduce the stocking density and if required, will also implement additional heather management measures (i.e. flailing/reseeding) (under the direction of the Project Ornithologist). All measures will be agreed with NIEA in advance.

Resourcing

49. Detailed prescriptions in terms of requirement for, and timing and frequency of tasks are detailed within specific topic sections above. This will be largely dependent on the monitoring findings. Most tasks specified will be undertaken by contracted specialists with appropriate expertise as specified below. Time and costs associated with the specified tasks will vary in line with market forces as part of the bidding and tendering process. Compliance of tasks will be monitored on site by the ECoW (during construction) and overseen by the windfarm owners environmental management team (during operation).

Table 4: Resourcing Breakdown

Task	Frequency years 1-5	Frequency year 6-30	Expertise Required
Heather management (red grouse)	Once (during construction)	As required	Project Ornithologist
Grazing management[7]	per DARD CMS prescriptions	per DARD CMS prescriptions	landowner
Drain blocking	Annually	Annually	Landowner
Predator control	Annually	Annually	Landowner
Quadrat monitoring (HMA/Construction Corridor)	annually, from years 1-5	years 10, 15, 20, 25	ECoW
Quadrat monitoring (red grouse habitat)	once	years 5, 10, 15, 20, 25	Project Ornithologist
Interpretation of monitoring results, reporting and planning	annually	years 10, 15, 20, 25	ECoW

Note – drain blocking/predator control will be undertaken by the landowner; but under the supervision of the ECoW/Project Ornithologist.

Decommissioning and Restoration

50. This element of the project works is included in the outline Construction Environmental Management Plan (oCEMP) which has been prepared for the Development.

[7] There will be no grazing for 18-months (or two growing seasons) unless the project ornithologist determines that cattle grazing only would be required to maintain the habitat for breeding snipe. No sheep will be permitted during this period.

CONSENTED (LA01/2018/0200/F)

Conclusions

51. The revised oHMP has refocussed the compensation measures on sensitive grazing management and the restriction of damaging activities in order to enhance 90ha of PMGRP, and aims to improve the conservation status of said habitat so that at the end of the 30-year lifetime of the project that it meets the criteria as an NI Priority Habitat.

52. Furthermore, the OHMP also makes provisions for beneficial habitat management for snipe (>400m from turbines), as well as providing heather management for red grouse. Other key issues as raised by NIEA have been address in the form of monitoring the success of the oHMP, allowing for contingency measure to be agreed in the event targets are not met.

53. Overall with the successful implementation of the oHMP there should be a ‘Net Gain’ in biodiversity terms, which more than offsets for any habitat lost or damaged during the construction and operation of the windfarm.

References

Countryside Council for Wales, Natural England, Environment and Heritage Service, Exmoor National Park, The National Trust, RSPB, Wildlife Trusts Wales, WWT (2009) *HMP Management Planning for Nature Conservation Sites – Core Principles.* HMP Consortium

Hill, H., Fasham, M., Tucker, G., Shewry, M. and Shaw, P. (2006) *Handbook of Biodiversity Methods: survey, evaluation and monitoring*

JNCC (2001) *National Vegetation Classification: Field guide to woodland.* JNCC, Peterborough

Red Grouse Species Action Plan 2013. National Red Grouse Steering Committee

CONSENTED (LA01/2018/0200/F)

B

Outline Construction Environmental Management Plan

CONSENTED (LA01/2018/0200/F)

Dunbeg South Outline Construction Environmental Management Plan (CEMP)

Author: Stephen McCarron

Date: 12 March 2019

Ref: 03219-001417

CONSENTED (LA01/2018/0200/F)

Revision History

Issue	Date	Author	Nature And Location Of Change
01	12 Mar 2019	Stephen McCarron	First Created

CONSENTED (LA01/2018/0200/F)

CONTENTS

CONSENTED (LA01/2018/0200/F)

CONSENTED (LA01/2018/0200/F)

1.0 INTRODUCTION

This outline Construction Environmental Management Plan (CEMP) is submitted by RES Ltd (RES). The principal objective of this document is to provide information on the methodologies to construct and decommission Dunbeg South Wind Farm.

As the outline CEMP is being prepared as part of the planning application, RES Ltd are yet to appoint a wind turbine manufacturer or contractors to undertake the electrical or civil engineering works. The contractor(s) appointed to construct the project will prepare detailed method statements to construct the works which will incorporate the details outlined in this outline CEMP.

This outline CEMP sets out the overarching construction management philosophy for the site and provides further details on specific activities that will be undertaken on the site.

1.1 Project Description

The proposed Dunbeg South Wind Farm includes the installation of nine wind turbines with a maximum height to blade tip of 149.9m and associated infrastructure associated external electricity transformers, underground cabling, a newly created site entrance, access tracks, turning heads, crane hardstandings, control building and substation compound and energy storage containers. During construction and commissioning there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and welfare facilities.

Relevant Drawings of the Site infrastructure are included as Annex 1.

Table 1.1: Outline Project Programme

TASK	CONSTRUCTION MONTH											
	1	2	3	4	5	6	7	8	9	10	11	12
Mobilisation & setup construction compound												
Site entrance and tracks												
Crane hardstandings												
Turbine foundations												
Control building & substation												
Cable installation												
Turbine deliveries												
Turbine erection												
Operational take over												

1.2 Conditions of Consent

Planning permission for the construction and operation of the Wind Farm is yet to be received. Upon receiving conditions, RES Ltd will provide an updated to illustrate how applicable conditions will be discharged, aligning current construction methods with relevant legislation and environmental protection practices.

CONSENTED (LA01/2018/0200/F)

1.3 *Community Liaison*

Throughout the construction period of the project, RES Ltd will maintain an open dialogue with local residents and all other interested parties. RES Ltd will ensure the local community is provided with regular updates on the progress of construction and upcoming activities through appropriate channels.

A member of staff will be appointed for responsibility of key contact between RES Ltd and the community. This person will be the nominated point of contact for local residents in connection any issues that may be raised during construction, operation and decommissioning of the wind farm.

Any change to the appointed person shall be communicated to the planning authority and the local community representatives as required.

2.0 GENERAL CONSTRUCTION MANAGEMENT PRINCIPLES

Dunbeg South Wind Farm will be constructed in accordance with the Environmental Statement (2018) and Further Environmental Information (2019) prepared during the development stage of the project.

Throughout the development of the project, the aim has been to ensure the design:

- Minimises the extent of infrastructure;
- Avoids sensitive habitats;
- Minimises environmental impacts; and
- Maximises health and safety.

Where appropriate and practicable, local plant and materials will be used in order to maximise the benefit of the wind farm project to the local economy.

2.1 *Environmental Management and Pollution Prevention*

Specific procedures to ensure that the local environment is protected during construction works are managed through our Environmental Management System Procedures and Policies which is certified to ISO 14001.

2.1.1 Contractors Requirements

Details of the environmental management and emergency procedures to be adopted by Contractors during the construction phase are contained within the RES management system procedure Safety and Environmental Requirements of Contractors – 01059R00038.

2.1.2 Surface and Ground Water Management

In accordance with, a sustainable drainage system (SuDS) will be implemented to provide a series of surface water management techniques to mitigate any adverse impact on the hydrology of the site.

The Dunbeg South Wind Farm – Water Framework Directive Assessment details the design criteria and philosophy for the SuDS system. This document is included as Annex 2.

The above document also makes reference to the design of watercourse crossing, and an inventory of identified watercourse locations.

2.1.3 Water Quality Monitoring

Any potential pollution incident on site that may impact water quality will be dealt with in accordance with the Water Framework Directive Assessment. This document is included as Annex 2.

.

CONSENTED (LA01/2018/0200/F)

Water quality monitoring will be undertaken on discharge waters during the construction phase to ensure that the development does not impact on local watercourses and rivers.

A bespoke water monitoring strategy will be prepared and implemented by a specialist consultant, detailing monitoring locations, sampling frequency and the methodology for chemical and biological analyses. Site sensitivity will be considered when deciding on the level and periodicity of sampling and the proposed monitoring plan discussed and agreed with Water Management Unit prior to implementation.

The exact location of each sampling point will be determined during a walkover survey, and will reflect the point on all relevant controlled waters closest to the proposed active construction areas. Sampling points up- and down-stream of the construction activity will be selected to provide a full profile of the controlled waters.

A baseline report will be prepared following initial pre-construction water quality monitoring. This report will provide details of any contamination concentrations recorded and will be used to depict "uncontaminated background pollution levels" for the site.

In the event of a potential pollution incident, all relevant monitoring points would be visited and re-sampled to determine any changes relative to the baseline data. A report detailing the findings would be prepared for each incident and recommendations provided for further monitoring and / or requisite mitigation measures.

Following completion of the construction of the wind farm, all sample points will be revisited, re-sampled and analysed for a full suite of analytical parameters and a further report prepared discussing any impacts upon water quality arising from the construction process.

2.1.4 Foul Water Management

Foul drainage will be provided in agreement with the relevant authorities and most likely involve Foul effluent disposal via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).

2.1.5 Noise Management

The sources of construction noise are temporary and vary in location, duration and level as the different elements of the wind farm are constructed. Construction noise arises primarily through the operation of large items of plant and equipment such as excavators, diesel generators, vibration plates, concrete mixer trucks, rollers etc. Noise also arises due to the temporary increase in construction traffic near the site.

BS 5228-1:2009 'Noise control on construction and open sites; Part 1 – Noise' is identified as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities.

For all activities, measures shall be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Section 72 of the Control of Pollution Act 1974.

It's proposed the following noise mitigation measures will be implemented where appropriate and in line with further guidance from BS 5228-1;

- Consideration will be given to noise emissions when selecting plant and equipment to be used on site. Where appropriate, quieter items of plant and equipment will be given preference.

CONSENTED (LA01/2018/0200/F)

- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;

- Stationary noise sources shall be sited as far as reasonably possible from residential properties and, where necessary and appropriate, acoustic barriers installed to further reduce the impact;

- The movement of vehicles to and from site will be controlled; and

- Employees will be instructed to ensure compliance with the noise control measures adopted.

Should it be considered necessary to further reduce noise levels, mitigation measures would be considered and appropriate measures will be undertaken.

There are many strategies that could be employed to reduce construction noise levels; BS 5228-1 also states that the 'attitude to the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local community should occur. Non-acoustic factors such as mud on roads and dust generation, which can also influence the overall level of complaints, will also be controlled as detailed elsewhere in this document.

In the event that noise complaints are received, the RES onsite staff member will contact the complainant and if required, visit the property to discuss the complaint and subjectively assess the noise levels. If the noise complaint is found to be merited, additional mitigation measures will be put in place.

In the event a resolution cannot be reached between RES and the complainant, the planning authority will be informed in order that they can carry out their own subjective assessment and if required agree any additional mitigation.

All noise complaints will be recorded along with actions taken to resolve the issue. These records will be available to the Council on request.

2.1.6 Dust Management

The potential issue of dust creation during the works will be weather and season dependant, therefore detailed dust management methods will be subject to the works programme and contractor working methods.

Dust management will be carried out at all times in accordance with industry best practice to ensure that any local sensitive receptors are not affected by nuisance levels of dust from the works.

The following methods of dust suppression will be considered during the construction phase of the wind farm as required:

- Site tracks to be damped down using bowser or other suitable system;

- Road sweeper to be used to remove loose material from adjacent public roads during construction;

- Cleaning of vehicles, including provision of waterless wheel washing facilities, prior to exiting site onto the public road;

- Soil erosion control measures;

- Speed limits to be put in place to ensure low vehicle speeds;

CONSENTED (LA01/2018/0200/F)

- Vehicle loads to be covered;
- Damping of dry excavations and cutting activities which generate dust; and
- Sequencing of works to minimise the time that soils are exposed.

2.1.7 Spoil Management Bunds

Excavated peat, topsoil and subsoil are expected to be reused within the works either as part of backfilling or reinstatement operations or used to form landscaping bunds. Materials will generally be stockpiled close to the location of reuse to limit vehicle movements on site. Details of peat and soil stripping at the site and the proposed use and placement of peat, topsoil and subsoil is detailed in Annex 3: Peat Management Plan.

2.1.8 On-Site Fuel and Chemical Storage

All fuel and chemicals will be stored within appropriately specified containers and within specifically designed stores / storage areas, and shall include appropriate measures to avoid spillages in accordance with Control of Pollution (Oil Storage) Regulations (NI) 2010.

2.2 *Temporary Lighting*

Temporary lighting will be required at the construction compounds for security purposes and to ensure that a safe working environment is provided to construction staff. In addition, temporary lighting may be required to ensure safe working conditions at tracks, control building and turbine locations during construction.

All temporary lighting installations will be downward facing and all lights will be switched off during daylight hours and in accordance with mitigation proposed to avoid disturbance to badgers.

2.3 *Peat Slide Risk and Slope Stability*

A Quantitative Slope Stability Assessment has been undertaken as part of the Environmental Statement (see Appendix 9.4 of ES) and the design of infrastructure has taken into account the findings of the assessment. The General Risk Management Recommendations highlighted in Annex 4 – Mitigation, will be followed.

Prior to commencement of construction, detailed method statements will be prepared to address the working methods to be used. Additionally, a "toolbox talk" will be provided by the site management team to highlight possible events causing slope instability and provide guidance on best practice when operating in areas identified as at risk.

2.4 *Post Construction Restoration and Reinstatement*

During construction of the infrastructure elements (detailed in Section 3), the vegetated layer will be stripped from the area of the excavation and stored locally with the growing side up. The remaining organic topsoil and subsoils will be excavated down to formation level, or a suitable stratum, and again will be stored local to the point of excavation, but shall remain segregated to avoid mixing of materials.

Temporary storage areas shall take consideration of all identified buffer areas and be stripped of vegetation prior to stockpiling in line with best working practices. As construction is progressed the effectiveness of the buffer zones will be reviewed and if necessary adjusted. Alternatively the construction procedure may be reviewed and altered or additional control measures put in place.

CONSENTED (LA01/2018/0200/F)

Post-construction reinstatement will be undertaken as work progresses to minimise the period any organic material is stockpiled. Subsoils shall be used in landscaping and backfilling around structures while the vegetated layer and/or topsoil will be used to reinstate storage and working areas, road verges, drainage swales and embankments. In addition, following the completion of the works, a final inspection of the wind farm site will be undertaken and in circumstances where reinstatement using vegetation and/or topsoil is unsuccessful alternative methods will be considered.

Upon completion of all construction works, the temporary construction compounds will be reinstated to their approximate pre-wind farm condition. All temporary structures and construction equipment will be removed and the granular material that forms the hardstandings will be moved to areas agreed with the landowner or removed from site. Following this, the areas will be backfilled with material stripped and stored during the construction of the wind farm and reseeded as required.

In line with construction best practice and to suit the ground conditions anticipated on site, the track and hardstanding design has endeavoured to minimise spoil generated during construction.

2.5 Traffic Management

Details of the proposed traffic management arrangements will be contained in a Traffic Management Plan (TMP). Any operations not covered by the TMP will be performed in accordance with local and national standards and specifications. All abnormal load movements associated with the project will be performed in accordance with the anticipated Article 78 Permit, using the delivery route shown on drawing 03219D2403, *Turbine Delivery Route*.

2.6 Health and Safety Management

The Principal Contractor will be responsible for ensuring that a construction phase health and safety plan is prepared and implemented on site. All work will be carried out in accordance with:

- The Health and Safety at Work etc. Act 1974;
- The Construction (Design and Management) Regulations (NI) 2016; and
- All applicable third party safety guidelines.

2.7 Environmental

An Ecological Clerk of Works (ECoW) will be appointed, and will be fully engaged in preparatory works that will be undertaken, with their terms of appointment extended throughout the construction period into the operational period. The agreed terms of appointment, to be agreed with Causeway Coast and Glens Borough Council, will be provided prior to construction.

The provision of an Archaeologist will be implemented during any excavation works, in agreement with Causeway Coast, and a Written Scheme of Investigation will be provided and agreed with Causeway Coast & Glens Borough Council and applied to all applicable areas of work.

3.0 DESIGN PHILOSOPHY AND CONSTRUCTION METHODS

3.1 Site Entrance

The traffic associated with construction of the wind farm will access the site from the A37 using the proposed site entrance. Wheel cleaning facilities will be set up at the site entrance to remove mud from the wheels of vehicles leaving the site. Public roads will be inspected daily and a road sweeper will be employed to remove any mud or debris transferred onto the roads from site activities.

3.1.1 General Construction Method

The site entrance will be constructed in accordance with the design drawings as follows:

CONSENTED (LA01/2018/0200/F)

- Traffic management to be installed;
- Topsoil shall be removed and carefully stockpiled;
- New drainage shall be installed taking care to ensure that existing drainage will not be compromised;
- Road pavement works to be completed to the design requirements; and
- Line marking, signage, fencing and vehicle restraint systems required as part of the design will be installed.

3.2 Temporary Construction Compounds, Site Tracks and Crane Hardstandings

3.2.1 Temporary Construction Compounds

Temporary construction compounds are required for the provision of site offices, welfare facilities and storage arrangements for materials, plant and equipment. There is one temporary construction compound required for the construction phase of the project.

The temporary construction compound will be constructed at the location indicated on Drawing 'Infrastructure Layout' 03219D1001, in Annex 1.

Initial welfare provision will be made for use during construction of the access tracks to the temporary construction compound. This will likely be a single unit for use by a small workforce tasked with the enabling works.

The temporary construction compound will be the main compound for the site with welfare facilities at this location.

An area will be assigned for the storage of fuels and chemicals, ensuring any spillage is captured and appropriately dealt with.

3.2.2 Site Tracks

The running width of the tracks will be typically 5 m on straight sections, increasing at corners and passing places to accommodate the swept path of turbine delivery vehicles. The track working area will be kept to the minimum required allowing for working area, safe access, drainage and electrical works.

Site tracks will consist of compacted crushed-stone. Where tracks cross over services such as gas pipelines or electricity cables, they will be designed in consultation with the relevant authority and accordance with their specific requirements.

A number of track designs may be utilised on site which will be determined during detailed design, dependent on the ground conditions encountered on site and include:

- Typical track founded on suitable load bearing strata;
- Floating Track, laying a suitable membrane on existing ground level and constructing off that layer;

Track drainage will be incorporated within the design in accordance with sustainable drainage design principles. Where the road alignment crosses existing drainage channels, crossings appropriate to the location will be designed in accordance with the relevant guidelines.

A buffer zone in accordance with the relevant guidance from NIEA will be maintained around watercourses shown on Drawing MCL115-77 Dwg_01 in Annex 2: WFD Assessment. The exceptions to these buffers will be where the existing tracks are located within the buffer zone and where

CONSENTED (LA01/2018/0200/F)

there are watercourse crossings. Site personnel will be made aware of the buffer zones through the site induction and specific tool box talks.

Typical Track

Typical track construction may be used in areas identified where the thickness of soft soils is low, and the underlying layer has adequate load bearing properties. This track system will likely consist of a suitable capping layer and then a suitable running layer.

Floating Track

Floating track construction may be adopted where the ground conditions require, and is typically a method used in areas of deep peat. This system involves installing geo-grid directly onto the organic or exposed soil layer and placing layers of suitable stone and additional geo-grid (as required) above until the track design level is achieved.

3.2.3 Crane Hardstandings

The main crane hardstanding area is anticipated to be 40m x 20m. There may be additional temporary hardstanding areas required for the erection of the main crane, lay down of materials and turbine components.

The main crane hardstanding area will be left uncovered for the operational lifetime of the wind farm in line with good practice outlined in the Scottish National Heritage guidance “Good Practice during Windfarm Construction” – 4th Edition 2019. Any temporary crane hardstanding elements will be reinstated post construction.

All crane hardstandings will consist of a compacted stone structure bearing directly on a suitable formation strata.

3.2.4 General Construction Method

Where competent soils exist close to the existing ground surface the following construction method will typically be followed:

- Track and crane hardstanding alignments will be established from the construction drawings and marked out with ranging rods, timber posts or steel pins;

- Track corridors and crane hardstanding locations shall be pegged out 500 - 1000m in advance of operations;

- Where possible, upgraded access tracks will re-use the structure of the existing track to reduce construction requirements;

- Drainage swales will be excavated adjacent to the tracks where required. Surface water runoff will not be allowed to discharge directly into existing watercourses but will be routed through a Sustainable Drainage System (SuDS);

- A surface water cut off ditch may be installed on the slope above the earthworks footprint where achievable given the topography;

- Material will be excavated and stored;

- Cut track construction will be used where soils are identified as being shallow. This cut track system will likely consist of a suitable layer of crushed aggregate, either spread by a dozer or placed by hydraulic excavator, prior to being compacted in layers by vibratory rollers. If ground conditions dictate a geotextile membrane will be applied;

CONSENTED (LA01/2018/0200/F)

- Crane hardstanding construction will follow the same construction method as cut track;

- Floating track construction may be adopted where the ground conditions dictate. This system involves installing a geogrid membrane directly onto the organic vegetated layer and placing layers of suitable stone and additional geogrid layers (if required by the design) above;

- Where the road alignment crosses existing drainage channels, crossings appropriate to the location will be designed in accordance with the relevant guidelines;

- Depending on depth and type of material, adjacent slopes are anticipated to be between 1:1 to 1:3.

- Post-construction reinstatement shall be in line with the details of Section 2.5.

Where the load bearing properties of the underlying soils are determined to be insufficient, ground stabilisation may be carried out to provide adequate bearing capacity of the formation level. Due to the variable nature of the ground at the site, specific construction methods shall be selected at detailed design stage in consultation with specialist contractors. Such methods may consist of:

- Compaction of the existing in situ soils;

- Lime/cement stabilisation of the existing in situ soils; or

- Installation of stone or concrete columns to provide adequate support.

3.3 Turbine Foundations

Foundations will be designed as a reinforced concrete slab, in accordance with the relevant design standards, specific turbine supplier load information and ground conditions. Due account will be taken of guidance provided in appropriate codes and standards such as Eurocodes, British Standards and other specialist design documents.

Due to the anticipated load bearing capacity of the near surface soils, gravity base turbine foundations are expected to be used to support the wind turbine.

3.3.1 General Gravity Base Construction Method

The gravity base foundation general construction method would generally be as follows:

- A surface water cut off ditch may be installed on the slope above the earthworks footprint where achievable given the topography;
- The topsoil will be excavated and stored to one side for reuse during the landscaping round the finished turbine;
- Excavation will be undertaken to competent material. Excavated subsoil material may be stockpiled temporarily adjacent to the excavation for later use as backfill or stored elsewhere on site. Temporary & permanent drainage shall be installed at the same time as the excavation works;
- In the case where competent material is lower than the required formation level the foundation will likely be over-excavated to competent material and compacted engineering fill placed to the required level;
- Where excavation is required to extend below the water table or in material which does not drain freely, temporary pumping will be employed to keep the excavation dry. Water pumped from an excavation shall be adequately treated in line with the SuDS philosophy, before being discharged directly to any watercourse;

CONSENTED (LA01/2018/0200/F)

- A layer of concrete blinding will be laid directly on top of the newly exposed formation, finished to ensure a flat and level working surface;
- Steel reinforcement, the turbine anchorage system and cable ducts will be fixed in place and formwork erected around the steel cage;
- Concrete will be placed using a pump, or other suitable device, and compacted using vibrating pokers;
- Following the setting process, the foundation will be backfilled with suitable material, and landscaped using the vegetated soil layer set aside during the initial excavation; and
- A gravel path will be built leading from the access track or crane hardstanding to the turbine door or access steps and around the turbine for maintenance.

3.4 Turbines and Turbine Transformers

3.4.1 Turbines

The turbine will typically be supplied with a light grey semi-matt finish (RAL colour 7035) and installed with a height not exceeding 149.9m measured from ground level to the blade tip in the vertical position.

The turbines shall not carry any symbols, logos or other lettering except where required under other legislation. However, RES proposes to add turbine numbers to the base of each tower to aid service engineers during the operational phase of the wind farm.

In line with Health and Safety best practice, turbine manufacturers have indicated a preference to locate a passive infra-red (PIR) detector and light above each turbine door. It should be noted that this lamp will not be permanently lit and would only be switched on by the PIR when personnel approach a particular turbine.

Specific locations for the turbines are as per 'Infrastructure Layout' 03219D1001-02 in Annex 1.

3.4.2 Turbine Transformers

Depending on the model of turbine finally chosen for the site, turbine transformers will either be placed internally, or externally in close proximity to the turbine.

Oil cooled transformers will be supplied full of oil and will not require topping up on site. The transformers will be sealed and will be inspected for any damage prior to offloading. Air cooled or cast resin transformers do not require cooling oil.

Exterior transformers will be located within enclosures which shall be locked, accessible by trained and authorised personnel only, and displaying appropriate warning signs.

3.4.3 General Turbine Erection Method

The following general steps will be undertaken to erect the turbines on site:

- Turbine components will be lifted by adequately sized cranes (one main crane and one smaller tail crane) and positioned on the foundations / other turbine sections until the entire turbine is erected;
- Upon completion of the erection all fasteners will be tightened and the internal fit out of the turbine undertaken;
- The turbines will then be connected to the wind farm substation; and finally
- Turbine testing and commissioning will be undertaken before the turbines will be handed over as complete.

CONSENTED (LA01/2018/0200/F)

3.5 *Control Building and Substation Compound*

Cables will transfer power from the wind turbines to the substation compound and control building before being transferred to the National Grid. The location of the Control Building and Substation Compound is shown on Drawing 03219D1001-02 in Annex 1.

The control building has been designed, sized and positioned to be sympathetic with the surroundings. The building typically contains the following rooms; control room, switch room, SCADA room, and equipment store and welfare facilities.

The detailed design of the foundations for the building will be based on the Site Investigation reports and building requirements, and will ensure loads associated with the building are transferred to the appropriate bearing layer in the sub-surface.

The building will likely consist of masonry/block cavity.

Foul drainage will be provided in agreement with the relevant authorities and most likely involve Foul effluent disposal via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).

Communications to the site is anticipated to be provided via direct cable connection with the service provider.

3.5.1 Sub Station Finishes

The superstructure will consist of cavity wall construction with external cladding in some sections and a traditional pitch roof construction spanning front to back. Final building finishes will be widely in keeping with the local area where possible.

3.5.2 General Construction Method

The control building and substation compound will generally be constructed in accordance with the following:

- A surface water cut off ditch may be installed on the slope above the earthworks footprint where achievable given the topography;
- The plan area of the substation control building and compound will be set out and the topsoil stripped and removed to a temporary stockpile;
- The building foundations will be excavated and concrete poured;
- The building structure will be constructed from the foundations, in accordance with current practice and specific design;
- The internal fit out of the building including installation of services will be completed.

3.6 *Cabling Works*

All electricity and other service cables between the turbines and the sub station will be placed underground.

The detailed construction and trenching specifications will depend on the ground conditions encountered but typically cables will be directly buried inside a trench, except at road crossings when cables will be ducted.

Specific cable layout plans will be provided prior to construction.

3.6.1 General Construction Method

The following construction method will typically be used:

- Trenches will be excavated and a suitable bedding material placed for which to lay the cables upon. The ground is trenched typically using a mechanical digging machine;

CONSENTED (LA01/2018/0200/F)

- The cables shall be laid directly onto the bedding material;
- The trench will then be backfilled and compacted with suitable material up to the required level and finished with a layer of topsoil to aid in the trench reinstatement;
- A suitable marking tape is installed between the cables and the surface; and
- The cables are terminated on the switchgear at each turbine and at the substation.

4.0 OUTLINE DECOMISSIONING PLAN

Prior to decommissioning, a detailed site restoration scheme will be provided to the Causeway Coast and Glens Borough Council for written approval.

Outlined in the following sections are the general procedures to be followed in the decommissioning of the wind farm based on current knowledge.

4.1 *Site Track & Hardstanding Areas*

New site tracks and hardstanding areas constructed during development of the wind farm will be reinstated to the approximate pre-wind farm condition, unless otherwise agreed with the Landowner and/or Local Planning Authority. Areas to be reinstated would be treated in the following way:

- The material used to construct the tracks will be taken up and removed to areas identified in the site restoration scheme;
- The areas will be backfilled with suitable fill material, covered with topsoil and reseeded as required; and
- Backfilling of access tracks will be carefully planned in advance to avoid having to unnecessarily move plant and equipment on freshly reinstated land.
- Any tracks which were upgraded during the development of the wind farm would be left unchanged from the conditions used during the operation phase of the wind farm.

4.2 *Wind Turbines*

The decommissioning of the wind turbines will be the reverse of the erection process involving similar lifting plant and equipment:

- Wind turbines will be disconnected from the cabling and internal components stripped and taken off site;
- It is anticipated that the turbine nacelle would then be taken down and loaded straight onto the back of transport vehicles and removed from site for reconditioning or scrap; and
- The turbine towers and blades would be taken down and either transported directly off site or broken down into smaller components if required.

4.3 *Turbine Foundations*

It is widely accepted that there is no appreciable effect on the local environment from buried reinforced concrete structures left in-situ due to the inert state of concrete. Therefore the foundations will be reinstated as follows:

- Following the removal of the wind turbine, topsoil and subsoil will be excavated to expose the top of the foundation and set aside for reuse;
- The reinforced concrete foundation will then be broken out to an agreed depth below existing the ground level and the material will be taken up and removed as identified in the site restoration scheme; and

CONSENTED (LA01/2018/0200/F)

- The excavation will be then backfilled with suitable fill material, covered with topsoil and reseeded as required.

4.4 *Control Building and Substation Compound*

The control building and substation compound will be decommissioned by disconnecting and dismantling all the surface plant. Solid structures such as the building and equipment plinths will be demolished and the foundation will be removed to an agreed depth below ground level. Ducting and cabling that is within the depth to be cleared will be removed.

The fence surrounding the compound will be removed and the area landscaped so it can revert to its original state.

4.5 *Electrical Equipment*

The electrical equipment will be decommissioned in the reverse of the installation method involving similar plant. The equipment will be dismantled, removed from site and disposed of in an appropriate manner.

4.5.1 Cabling

Cables will be removed if it is deemed that removal would not be detrimental to the local environment. If removed, trenches will be backfilled with material removed during the cable removal process, covered with topsoil and reseeded as required.

5.0 RECORDS

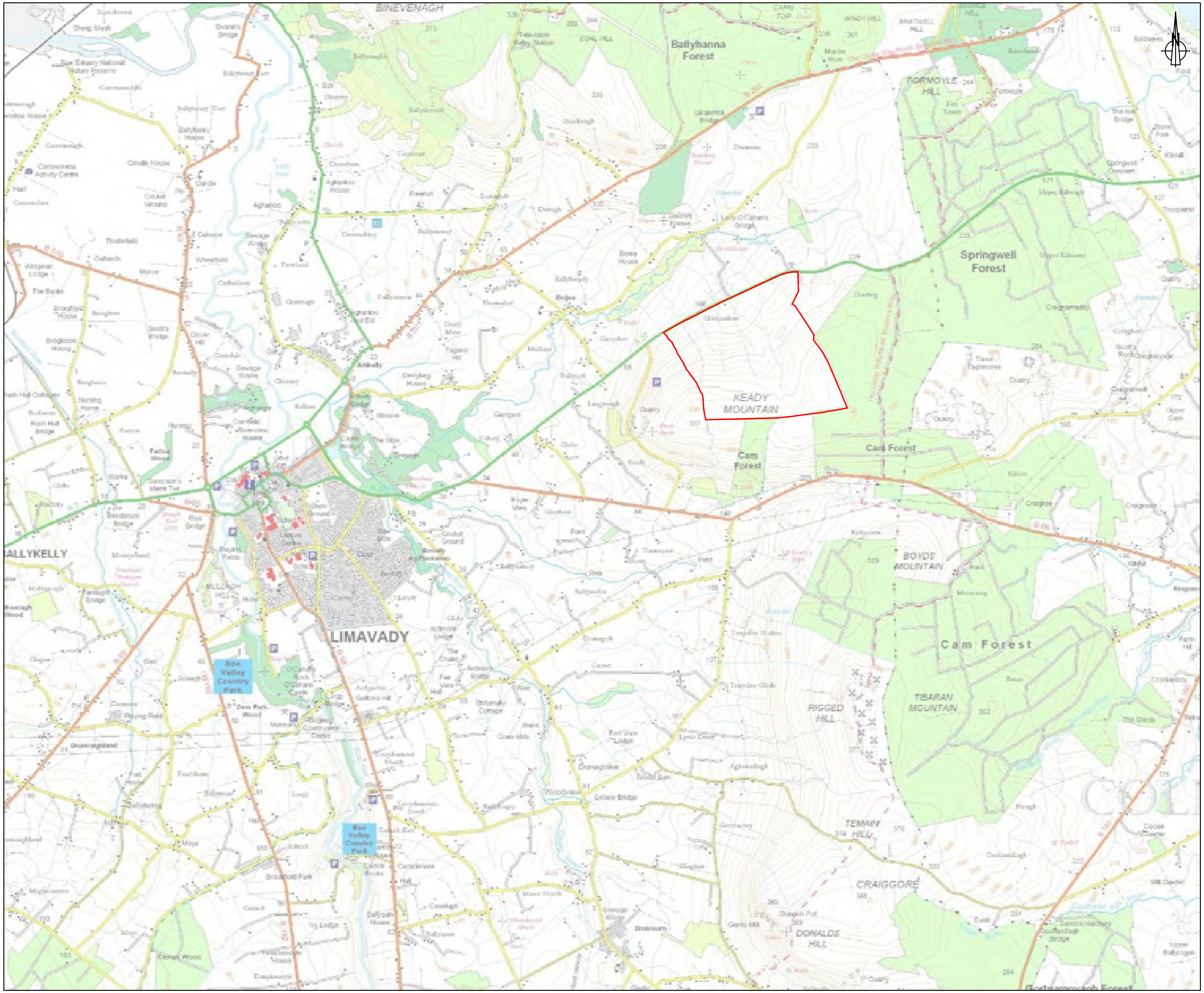
Records, as-built drawings, specifications, operational maintenance manuals and residual risks will be collated and filed in the Project Health & Safety file based upon the requirements of CDM Regulations (NI) 2016.

CONSENTED (LA01/2018/0200/F)

ANNEX 1: DRAWINGS

Drawing Name	Drawing Reference
Site Location Plan	03219D2202-03
Infrastructure Layout	03219D1001-02
Turbine Elevation	03219D2901-01
Track Construction	03219D2301-01
Construction Compound	03219D2212-01
Wind Turbine Foundation	03219D2302-02
Crane Hardstanding	03219D2303-02

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 1.1

SITE LOCATION MAP

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

SITE LOCATION

LAYOUT DWG N/A

T-LAYOUT NO. N/A

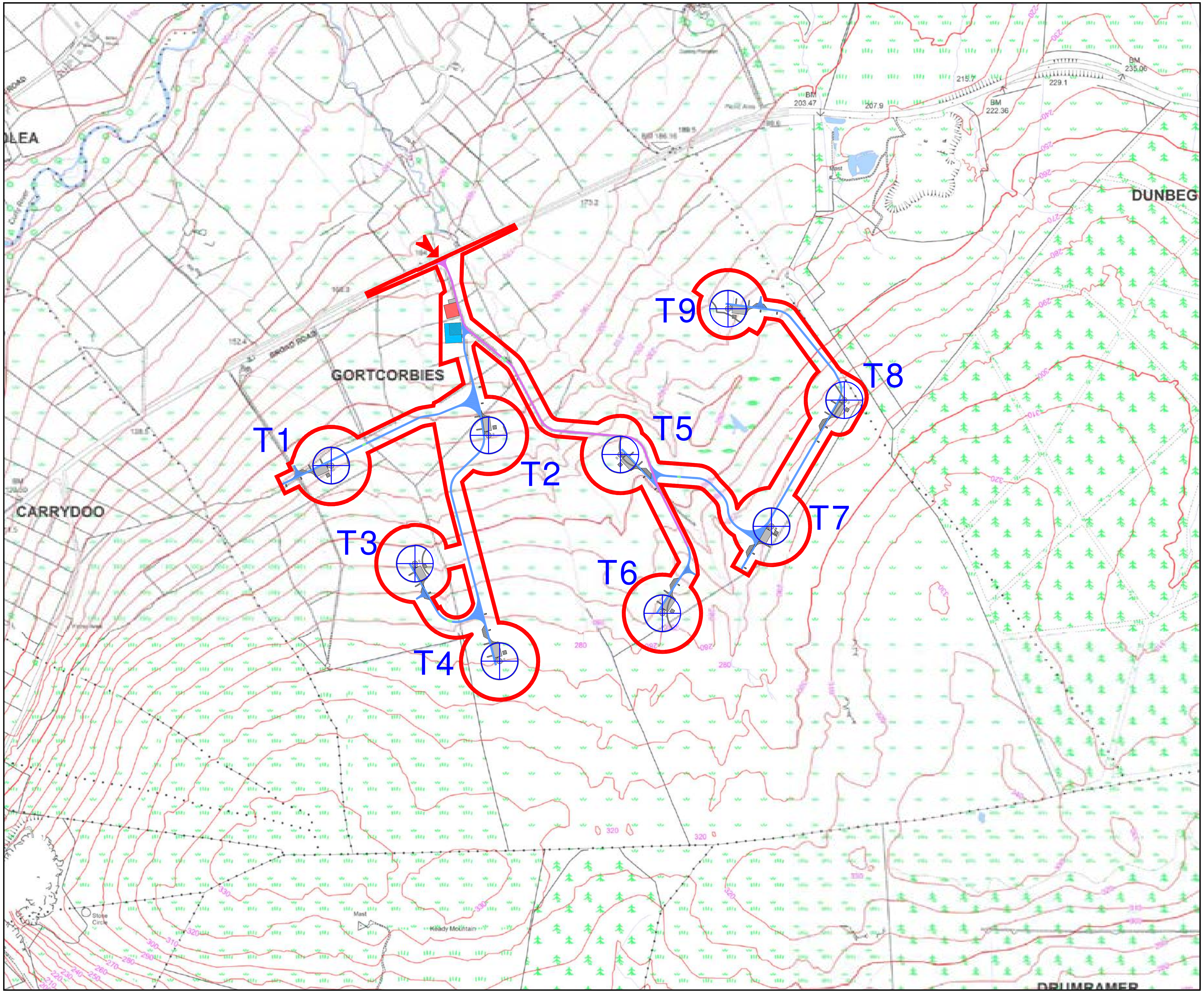
DRAWING NUMBER 03219D2202-03

SCALE - 1:50,000 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH WIND FARM

FIGURE 2.1

INFRASTRUCTURE LAYOUT

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG	03219D0001-06	T-LAYOUT NO.	PNIRdbx028

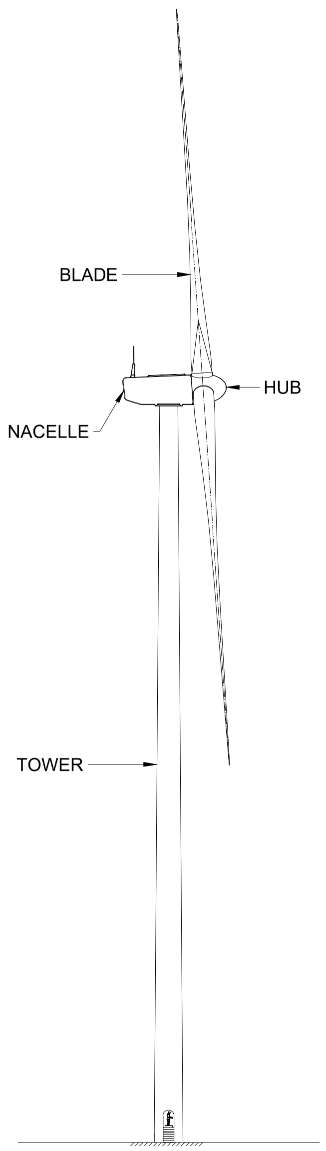
DRAWING NUMBER
03219D1001-02

SCALE - 1:10,000 @ A3

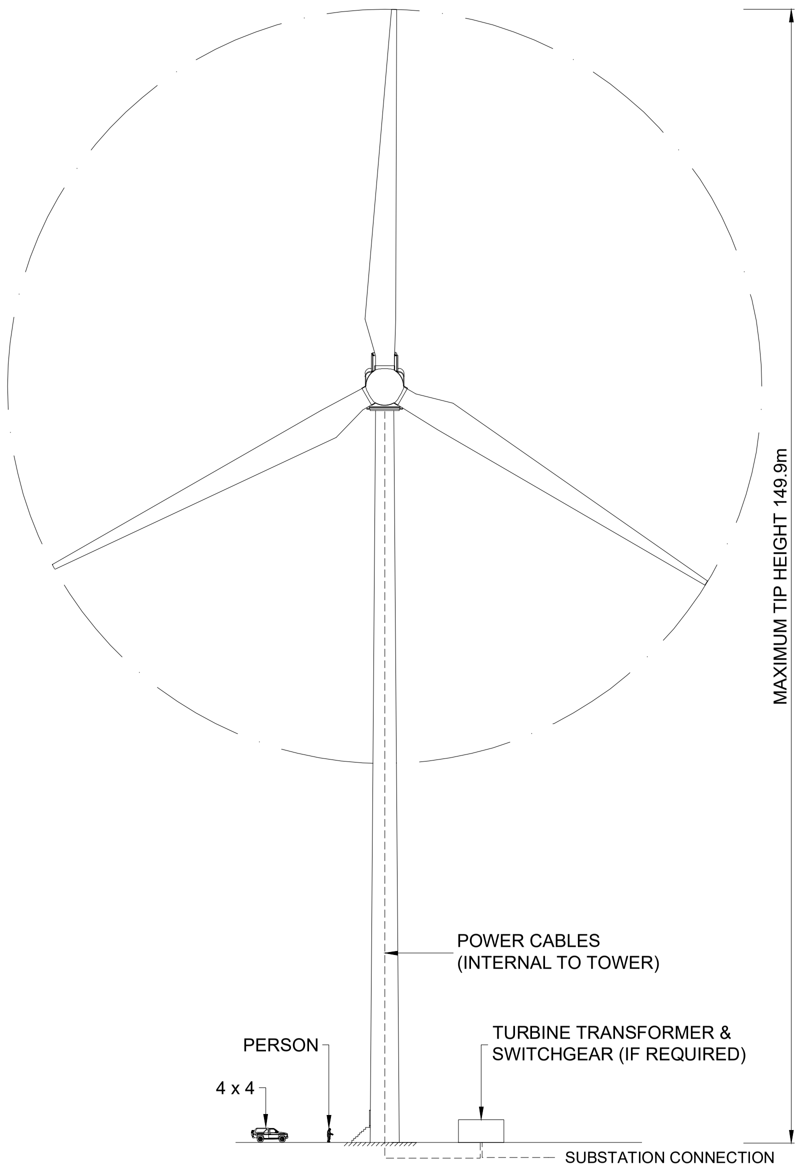
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SIDE VIEW



FRONT VIEW

PHOTOGRAPH OF TYPICAL TURBINE

DUNBEG SOUTH
WIND FARM

FIGURE 2.2

TURBINE ELEVATION

LAYOUT DWG N/A	T-LAYOUT NO. N/A

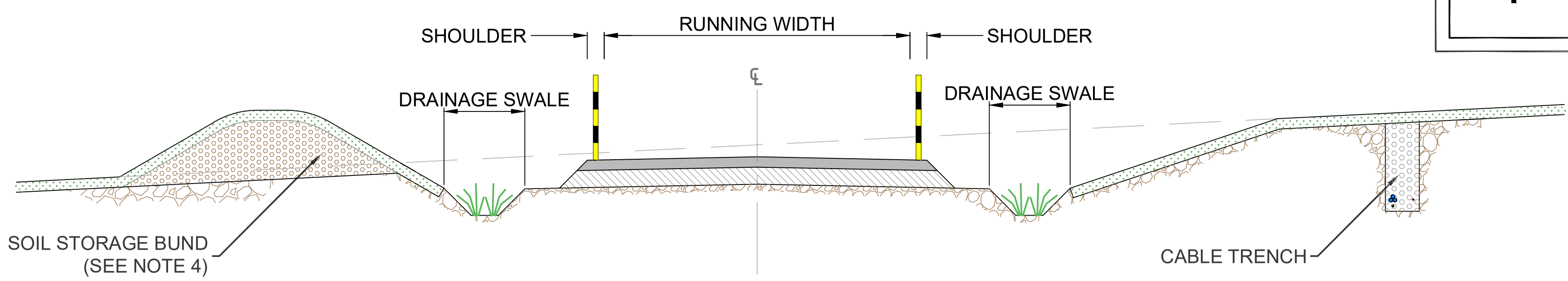
DRAWING NUMBER
03219D2901-01

SCALE - 1:1000 @ A3

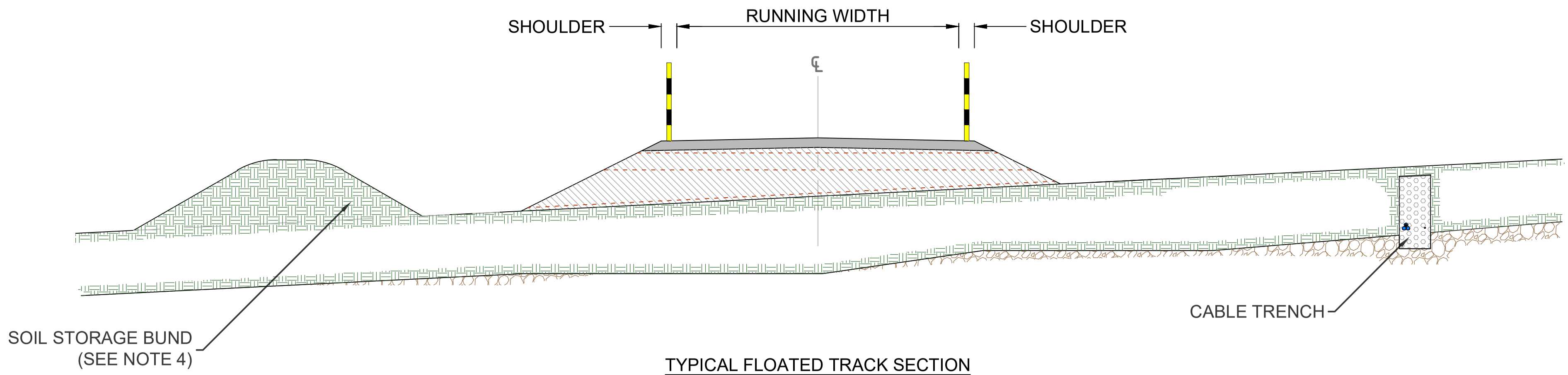
ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



TYPICAL TRACK SECTION



TYPICAL FLOATED TRACK SECTION

KEY:

- RUNNING SURFACE
- BASE/CAPPING LAYER
- TOPSOIL
- SUBGRADE
- PEAT LAYER/SOFT GROUND
- GEOGRID
- EXISTING GROUND LEVEL
- SNOW POLES (WHERE REQUIRED)

DUNBEG SOUTH WIND FARM

FIGURE 2.9

ACCESS TRACK TYPICAL DETAILS

NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. TRACK WIDTH TO INCREASE ON BENDS AND PASSING PLACES.
3. ALL EMBANKMENT SLOPES TO BE PROVIDED AT A STABLE ANGLE BASED ON THE PROPERTIES OF THE MATERIAL ENCOUNTERED ON SITE.
4. EXCAVATED MATERIAL WILL BE PLACED IN AGREED LOCATIONS. REINSTATEMENT AND/OR SPOIL MANAGEMENT PLANS WILL BE DEVELOPED IN LINE WITH CURRENT BEST PRACTICE.
5. TRACK CONSTRUCTION TYPE TO BE DETERMINED DURING DETAILED DESIGN. LAYOUT OF DRAINAGE, CABLE TRENCHES AND STORAGE BUNDS MAY VARY.
6. RUNNING SURFACE AND BASE/CAPPING LAYER TO BE FORMED FROM SUITABLE MATERIALS COMPACTED IN LAYERS.
7. GEOSYNTHETIC REINFORCEMENT OR SOIL STABILISATION MAY BE USED TO REDUCE THE DEPTH OF TRACK CONSTRUCTION. REQUIREMENT TO BE DETERMINED DURING DETAILED DESIGN.

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

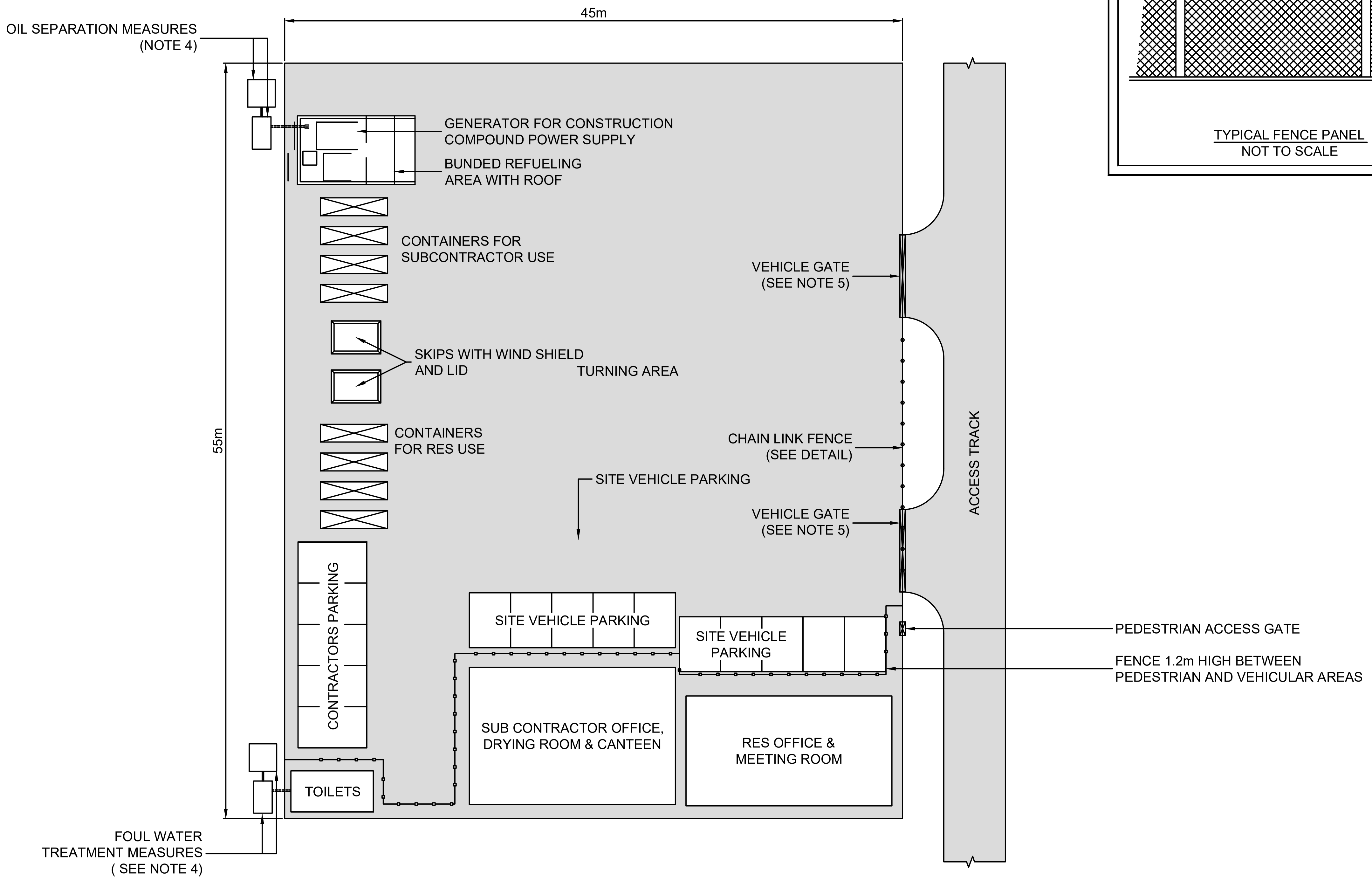
DRAWING NUMBER 03219D2301-01

SCALE - NOT TO SCALE

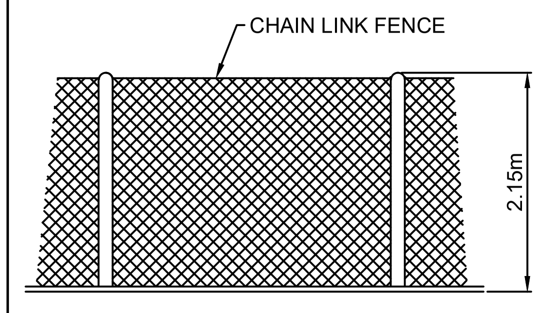
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



PLAN
SCALE - 1:350 @ A3



TYPICAL FENCE PANEL
NOT TO SCALE

DUNBEG SOUTH WIND FARM

FIGURE 2.10

TEMPORARY CONSTRUCTION COMPOUND LAYOUT PLAN

NOTES:

1. SIZE, NUMBER AND LOCATION OF COMPOUND EQUIPMENT AND FACILITIES ARE INDICATIVE ONLY
2. STRUCTURE TO BE TEMPORARY AND TO BE REMOVED AFTER CONSTRUCTION.
3. COMPOUND HARDSTANDING CONSISTING OF COMPACTED STONE OVER A LAYER OF GEOTEXTILE TO PROVIDE A CLEAN, FIRM, LEVEL AND FREE DRAINING SURFACE SUITABLE FOR CABINS AND HEAVY TRAFFIC.
4. APPROPRIATE MEASURES FOR SEPARATION OF OILS AND TREATMENT OF FOUL WATER TO BE AGREED WITH THE RELEVANT AUTHORITIES.
5. VEHICULAR GATES TO BE 6m WIDE CONSISTING OF 2 x 3m LEAVES

LAYOUT DWG N/A | T-LAYOUT NO. N/A

DRAWING NUMBER 03219D2212-01

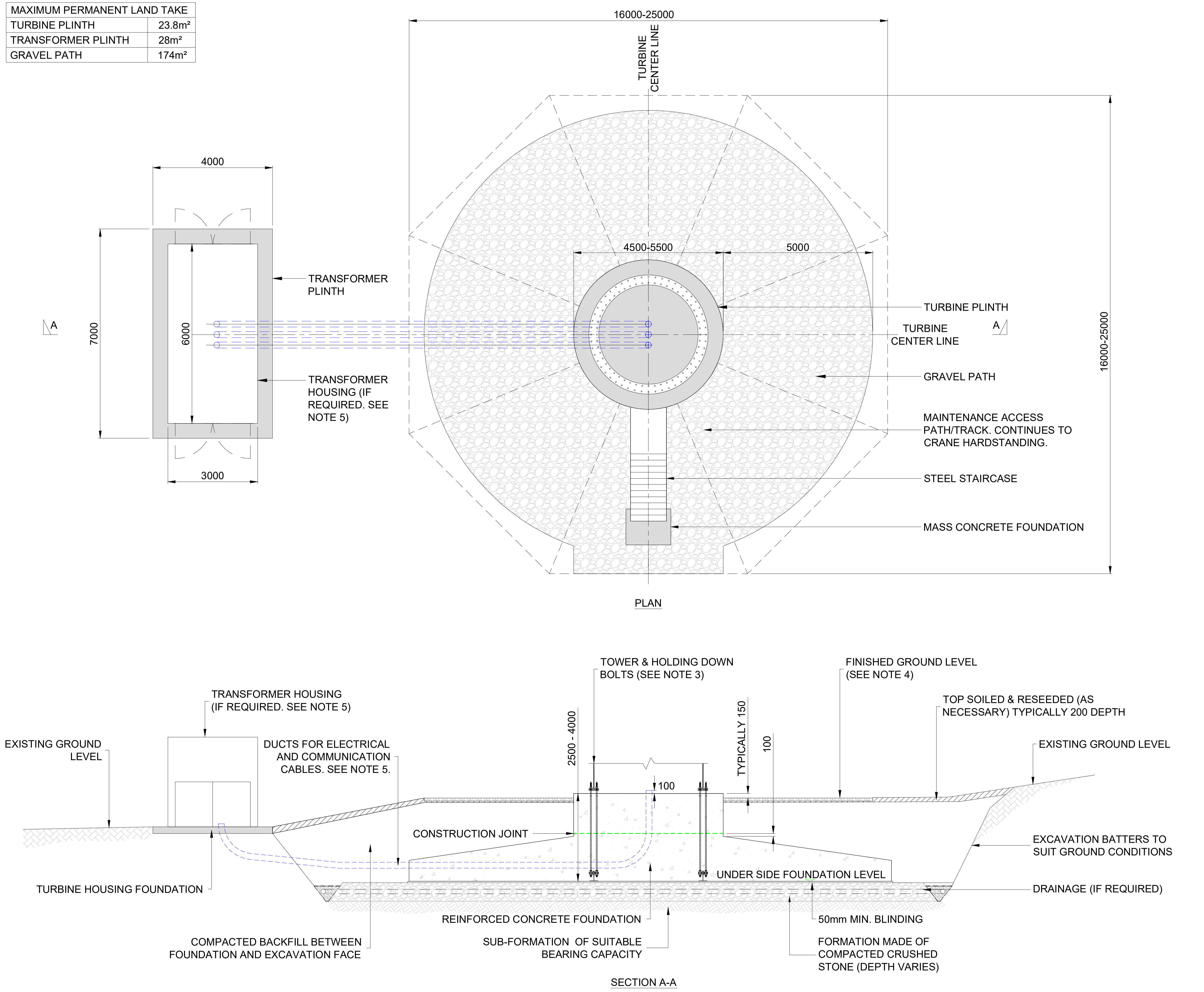
SCALE - AS SHOWN @ A3

ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

MAXIMUM PERMANENT LAND TAKE	
TURBINE PLINTH	23.8m²
TRANSFORMER PLINTH	28m²
GRAVEL PATH	174m²



DUNBEG SOUTH WIND FARM

FIGURE 2.12

WIND TURBINE FOUNDATION

NOTES:

1. DIMENSIONS AND DETAILS ARE INDICATIVE ONLY AND MAY VARY DUE TO SPECIFIC TURBINE OR GROUND CONDITIONS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED
3. THE HOLDING DOWN BOLT ARRANGEMENT SHOWN ON THIS DRAWING IS TYPICAL. HOWEVER ALTERNATIVE CAST IN ARRANGEMENTS ARE AVAILABLE AND MAY BE SUBSTITUTED DEPENDING ON ACTUAL TURBINE SELECTION.
4. GRADIENT OF FINISHED GROUND LEVEL OVER TURBINE BASE, MAX 1:12.
5. EXTERNAL TRANSFORMER NOT REQUIRED FOR ALL TURBINES AND NEED FOR TRANSFORMER HOUSING WILL DEPEND ON THE TURBINE SELECTED DURING DETAILED DESIGN.
6. MATERIALS ARISING FROM EXCAVATIONS TO BE SEGREGATED AND PLACED IN AGREED LOCATIONS ADJACENT TO THE WORKING AREA FOR RE-USE. REINSTATEMENT AND /OR PEAT MANAGEMENT PLANS WILL BE DEVELOPED DURING THE DETAILED DESIGN OF SITE INFRASTRUCTURE, IN LINE WITH CURRENT BEST PRACTICE.

LAYOUT DWG N/A	T-LAYOUT NO. N/A

DRAWING NUMBER 03219D2302-02

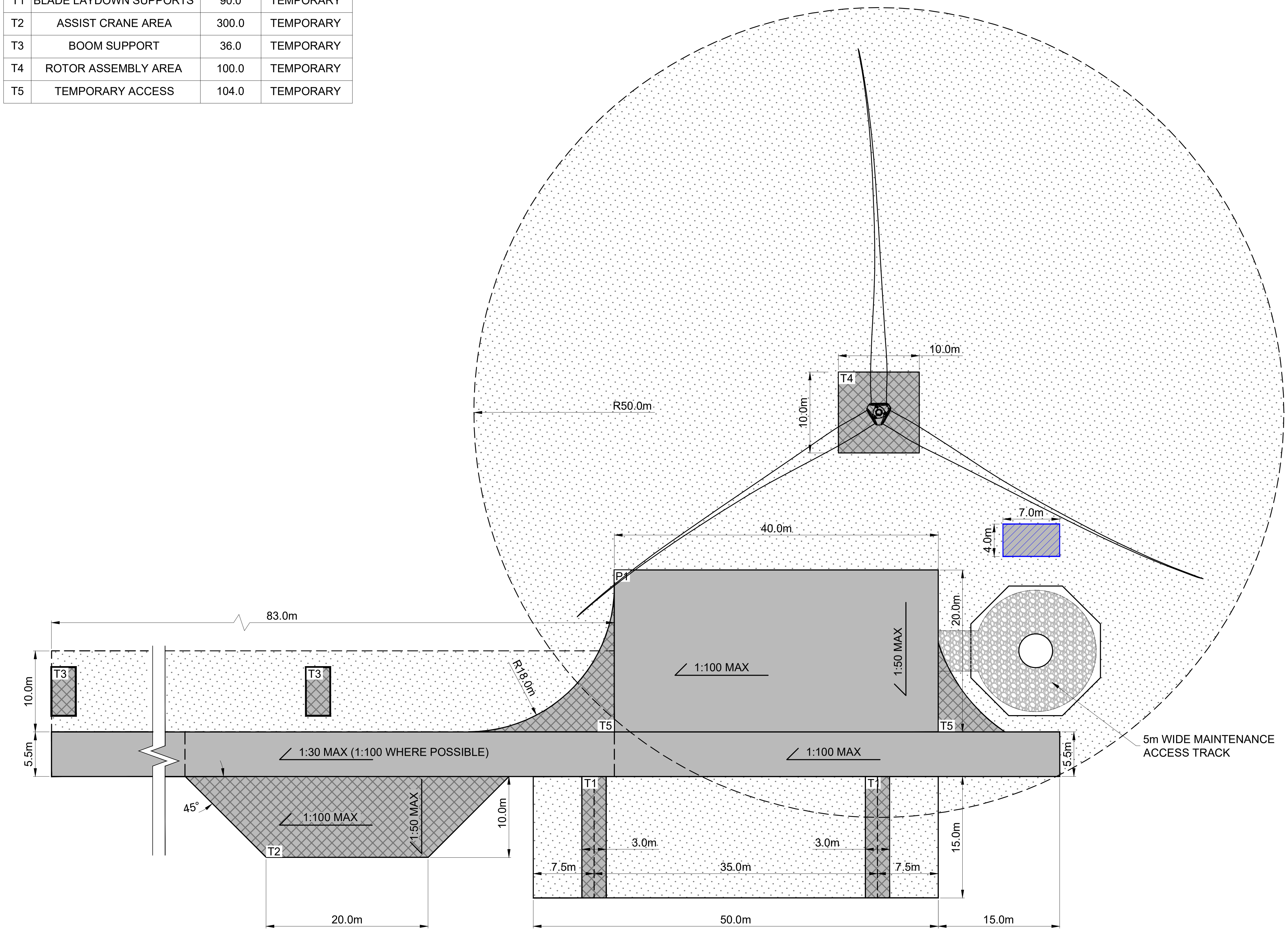
SCALE - 1:125 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

REF	DESCRIPTION	AREA (m^2)	MAINTENANCE
P1	MAIN HARDSTANDING	1200.0	PERMANENT
T1	BLADE LAYDOWN SUPPORTS	90.0	TEMPORARY
T2	ASSIST CRANE AREA	300.0	TEMPORARY
T3	BOOM SUPPORT	36.0	TEMPORARY
T4	ROTOR ASSEMBLY AREA	100.0	TEMPORARY
T5	TEMPORARY ACCESS	104.0	TEMPORARY



DUNBEG SOUTH WIND FARM

FIGURE 2.13

CRANE HARDSTANDING GENERAL ARRANGEMENT

KEY:

- PERMANENT WORKS
- TEMPORARY WORKS
- EXTERNAL TRANSFORMER AND SWITCHGEAR ENCLOSURE
- AREA TO BE FREE FROM TOPOGRAPHICAL CONSTRAINTS
- MAINTENANCE ACCESS TRACK

NOTES:

1. ALL DIMENSIONS IN METRES.
2. HARDSTANDING ARRANGEMENT SUBJECT TO CHANGE DEPENDENT ON SPECIFIC WIND TURBINE MODEL SELECTED FOR CONSTRUCTION.
3. ALL HARDSTANDINGS TO BE CONSTRUCTED ON SUITABLE FOUNDATION MATERIAL.
4. ALL HARDSTANDINGS TO BE FINISHED WITH CRUSHED ROCK, FORMING A FREE DRAINING SURFACE.
5. TRACK ADJACENT TO CRANE HARDSTANDING TO BE DESIGNED TO ACCEPT CRANE OUTRIGGER LOADING.
6. THE PRELIMINARY CRANE HARDSTANDING LAYOUT HAS BEEN DEVELOPED TO ACCOMMODATE EITHER A SINGLE BLADE LIFT OR FULL ROTOR LIFT.

LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 03219D2303-02	
SCALE - 1:500 @ A3	

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

CONSENTED (LA01/2018/0200/F)

Water Framework Directive Assessment

Dunbeg South Wind Farm

115-77_DG02 | April 2019

CONSENTED (LA01/2018/0200/F)

[PAGE INTENTIONALLY BLANK]

CONSENTED (LA01/2018/0200/F)

DOCUMENT CONTROL

DOCUMENT FILENAME	MCL115-77_DG02 Appendix 9.1 WFD Assessment Rev 3_FEI Submission April 2019 (002) - Gmcg Comments.Docx
DOCUMENT REFERENCE	115-77_DG02
TITLE	Water Framework Directive Assessment
CLIENT	RES Ltd
CLIENT CONTACT	Garth McGimpsey
PROJECT MANAGER	Kyle Somerville
AUTHOR(S)	Catherine McQuillan
BRANCH	BELFAST Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey BT36 5QA T: +44 (0) 28 9084 8694 | W: www.mccloyconsulting.com

REVISION HISTORY

Rev. Ref.	Date	Prep	Chk	App	Amendments	Reason for Issue
1	18/10/2017	CMQ	DKS	DKS	Original	For Review
2	30/10/2017	CMQ	DKS	DKS	Updated to RES comments	For Planning
3	25/04/2019	DKS	DKS	DKS	Revised to suit amended HMP proposals and address DAERA / NIEA comments	For FEI

DISTRIBUTION

Recipient	Revision					
	1	2	3	4	5	6
FILE	✓	✓	✓			
RES Ltd	✓	✓	✓			

CONSENTED (LA01/2018/0200/F)

DISCLAIMER

This document has been prepared solely as a Water Framework Directive Assessment for RES Ltd at the instruction of the party named in this document control sheet. McCloy Consulting Ltd accepts no responsibility or liability for any use that is made of this document other than for the purposes for which it was originally commissioned and prepared, including by any third party.

The contents and format of this report are subject to copyright owned by McCloy Consulting Ltd save to the extent that copyright has been legally assigned by us to another party or is used by McCloy Consulting Ltd under licence. McCloy Consulting Ltd own the copyright in this report and it may not be copied or used without our prior written agreement for any purpose other than the purpose indicated in this report.

CONSENTED (LA01/2018/0200/F)

CONTENTS

CONSENTED (LA01/2018/0200/F)

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Annex A Drainage Management - General Arrangement
Annex B Drainage Management – Typical Details
Annex C Flocculant Datasheet

CONSENTED (LA01/2018/0200/F)

1 INTRODUCTION

1.1 Terms of Reference

RES Ltd (RES) has appointed McCloy Consulting Ltd to undertake a Water Framework Directive (WFD) Assessment for a planning application for the proposed Dunbeg South Wind Farm. The purpose of this WFD assessment is to:

- Determine if specific components or activities related to the development of the proposed Development will compromise the attainment of a WFD objective or result in the deterioration in the ecological status of any waterbodies in the vicinity of the site.
- Provide details of proposed mitigation measures specifically in relation to management of surface water from the developed site if there is initially a perceived risk of deterioration in the ecological status of any affected waterbody.

The assessment is intended to supplement the Environmental Statement (and in particular Chapter 9, Geology and Water Environment) submitted in support of the planning application for the proposal.

1.2 Statement of Authority

McCloy Consulting is an independent environmental consultancy specialising in the water environment, with specialist knowledge of hydrological and hydrogeological assessments, sustainable drainage systems (SuDS), drainage, river modelling, and flood risk assessment.

McCloy Consulting has ongoing involvement in numerous geology and water environment studies and SuDS projects across the UK and has developed a particular expertise in surface water management for wind farms. The company has successfully designed a number of SuDS/silt management solutions for wind farms in accordance with current best practice guidance. The primary personnel responsible for undertaking this hydrology assessment are:

- Catherine McQuillan BSc(Hons) MSc FGS - Environmental Consultant with experience in environmental assessment and monitoring for onshore wind energy projects in the UK, groundwater screening and hydrogeological assessments.
- Kyle Somerville BEng (Hons) CEng MIEI - Chartered Engineer with experience in the fields of hydrology, surface water management, groundwater screening assessments and geology assessments for wind farm developments in the UK and Ireland, and has overseen outline and detailed design of surface water management for in excess of thirty onshore wind farm developments in the UK and Ireland.

1.3 Water Framework Directive

The EU Water Framework Directive (2000/60/EC, as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU) was established in law in Northern Ireland in December 2003.

The Directives is transposed in Northern Ireland through the Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017.

A fundamental requirement of the Water Framework Directive (WFD) is to attain good ecological water status and that deterioration in the status of water is prevented. Any new development must ensure that this fundamental requirement of the directive is not compromised.

1.3.1 River Basin Districts

The WFD is implemented through River Basin Planning which introduces a six-yearly cycle of planning, action and review. The plans will include identifying river basin districts, identifying water bodies and protected areas, identifying pressures and risks, monitoring and setting environmental objectives, classification systems and standards.

The WFD was initially implemented in Northern Ireland through three River Basin Management Plans (RBMPs) that were published in December 2009; as required by WFD the plans are reviewed and updated every six years.

CONSENTED (LA01/2018/0200/F)

A second set of Plans was published in 2015.

1.3.2 Local Management Areas

The RBMPs have been put into practice by a Local Management Area (LMA) Action Plans during the planning cycle from 2009 to 2015.

LMAs outline some of the measures carried out locally that will contribute to protecting or improving waterbody status, while others involve long-term projects and multiple partners.

1.3.2.1 Water Framework Directive Assessment

The aims, objectives and processes of a WFD Assessment are outlined by the Northern Ireland Environment Agency (NIEA) Water Management Unit within their report published in March 2012[1] which outlines how to carrying out a Water Framework Directive Assessment on EIA Developments.

A WFD Assessment should be used as a decision making tool; the proposer of the scheme should use the conclusions of the assessment to decide whether to proceed with the development or to amend proposed works and / or instigate mitigating measures prior to proceeding.

Each specific component of the proposed Development, that may interact with or pose a risk to a waterbody, is required to have its potential impact assessed. The cumulative effect of a number of such impacts should also be considered.

This report provides a description of the specific activity being undertaken (construction of compounds, hardstandings, tracks, trenches and turbine excavations, and electrical cabling etc.), identifies the potentially impacted waterbodies and provides baseline data for the waterbody.

The potential impact of the proposed works is then assessed in light of the relevant WFD classification and the following WFD key environmental objectives:

- To prevent deterioration in the ecological status of the waterbody.
- To prevent the introduction of impediments to the attainment of 'Good' WFD status of the waterbody.
- To ensure that the attainment of the WFD objectives for the waterbody are not compromised.
- To ensure the achievement of the WFD objectives in the other waterbodies within the same catchment are not permanently excluded or compromised.

1.3.3 Approach to the Assessment

This WFD Assessment will be carried out in line with the NIEA guidance / methodology outlined in Section 1.3.2.1 and will comprise of three stages:

- Stage I: Review of WFD Waterbody catchments, classifications and LMA Plans.
- Stage II: Assessment of proposals for the Proposed Dunbeg South Wind Farm.
- Stage III: Proposed mitigation measures where key WFD objectives are not met.

[1]NIEA (2012) Carrying Out A Water Framework Directive (WFD) Assessment on EIA Developments. Available: https://www.daera-ni.gov.uk/publications/guidance-note-carrying-out-water-framework-directive-assessment-environmental-impact [Accessed 12/10/2017]

CONSENTED (LA01/2018/0200/F)

2 STAGE I: WATERBODY IDENTIFICATION AND CLASSIFICATION

2.1 Approach

The first stage identifies those surface water and groundwater bodies with potential to be affected by the development and reviews any available WFD information to classify the waterbody including a review of the current WFD status, future status, identified environmental constraints and any existing / proposed 'mitigation approaches' for the waterbody.

Hydrological catchment boundaries established are as per online NIEA River Basin Plan Interactive Map and classification information was primarily sourced from RBMP documents for the relevant LMA.

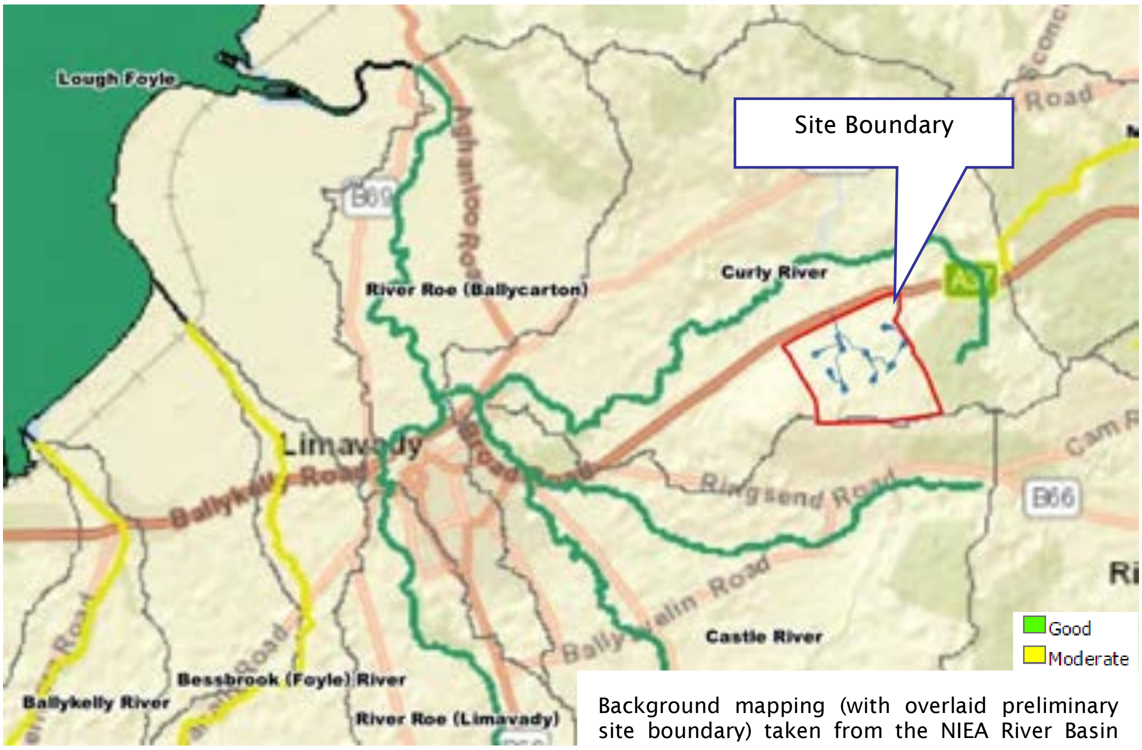
2.2 Surface Waterbody Identification

The site boundary considered as part of this assessment falls entirely with the Curly River.

From the end of 2015 the number of water bodies within the Roe LMA was reduced. This resulted in the two Curly River waterbodies (UKGBNI1NW02022013 & UKGBNI1NW02022049) being merged to form a single entity as Curly River (UKGBNI1NW020204060).

The Curly River flows into the River Roe (UKGBNI1NW20202024) 5.2 km west of the site.

Figure 2.1: WFD Surface Waterbody



Background mapping (with overlaid preliminary site boundary) taken from the NIEA River Basin

2.3 Surface Waterbody Classification

The following section is intended to provide a qualitative appraisal of existing surface water quality in the waterbody whose catchment the proposed development lies within.

CONSENTED (LA01/2018/0200/F)

As identified within Section 2.2; for purposes of classification under the WFD the Curly River which is located within the Roe Local Management Area[2, 3] and the Lower Foyle Catchment Stakeholder Group. The River Roe and its tributaries are located within the North Western River Basin District[4].

Following the publication of the Water Framework Directive waterbodies are given a WFD classification based on annual average / percentile results from several individual monitoring stations. WFD classification or status is a combination of chemical, biological and hydromorphological elements, whereby the overall status is the lowest of the combined constituents.

A number of biological and chemical water quality elements used in classification in the Roe Catchment can be affected by both diffuse and point source pollution. Within the LMA Plan the main impact has been assessed as affecting invertebrate communities. This element is associated with organic enrichment.

2.3.1 Surface Water Quality

The current Overall Current Status for the Curly River (UKGBNI1NW020204060[5]) is 'Good' with an objective to maintain 'Good' status through to 2021 and 2027. The Curly River is designated under the WFD as a Freshwater Fish Directive protected area due to the presence of economically significant species.

Prior to 2015 the Curly River comprised two separate bodies UKGBNI1NW020204049 and UKGBNI1NW020202013, both of which were subject to 2009 – 2014[6] classifications. The previous body directly downgradient of the site was UKGBNI1NW020204049 and as such the classifications for that body have been used to inform of the 2009 -2014 status.

The WFD results are detailed within Table 2.1.

[2] DAERA (2012) Roe Local Management Area Action Plan 2009 to 2015 https://www.daera-ni.gov.uk/publications/roe-local-management-area-action-plan-2009-2015
[3] Roe Local Management Areas Action Plan and Update (2013) https://www.daera-ni.gov.uk/sites/default/files/publications/doe/roe-swmi-joined.PDF
[4] DAERA (2015) North Western River Basin Management Plan 2015 to 2010 https://www.daera-ni.gov.uk/publications/north-western-river-basin-management-plan-2015-2021
[5] NIEA (2015) Reasons for status of the water bodies within the Roe LMA https://www.daera-ni.gov.uk/sites/default/files/publications/doe/roe-historical-status-historical-status.pdf [Accessed 14/06/2017]
[6] NIEA (2014) Reasons for status for the water bodies within the Roe LMA. https://www.daera-ni.gov.uk/sites/default/files/publications/doe/water-report-reasons-for-status-for-water-bodies-within-roe-lma-2014.pdf [Accessed 14/06/2017]

CONSENTED (LA01/2018/0200/F)

Table 2.1: Curly River LMA Waterbody Classification

River Classification Element		2010 Status	2011 Status	2012 Status	2013 Status	2014 Status	2015 Status
Overall Status		Good	Good	Good	Moderate	Moderate	Good
Confidence in Overall Status		High	High	Medium	Medium	Medium	Medium
Biological	Benthic Invertebrates	Good	Good	Good	Good	Good	Good
	Macrophytes	High	High	High	High	High	High
	Phytobenthos	-	-	-	Moderate	Moderate	Good
	Fish	Good	-	-	-	-	-
Chemical / Physio-chemical	Ammonia	High	High	High	High	High	Good/ High
	Dissolved Oxygen	High	High	High	High	High	High
	pH	High	High	High	High	High	High
	Soluble Reactive Phosphate	High	High	High	High	High	High
	Biological Oxygen Demand*	High	Good	High	High	High	High
	Temperature*	High	High	High	High	High	High
Specific Pollutants	Dissolved Copper	Pass	-	-	Pass	Pass	-
	Total Zinc	Pass	-	-	Pass	Pass	-
Hydro-morphology	Hydrological Regime	High	High	Moderate	Moderate	Good	High
	Morphological conditions#	-	-	-	-	-	-

No Morphological Conditions recorded for the Curly River. Rive Roe(Limavady) recorded as good (2015).

*Element does not contribute to overall classification.

2.3.2 Roe Local Management Area Action Plan and Update

The LMA Action Plan and Update states that many rivers (62 %) within the River Roe Catchment have been classified as less than 'Good' status. The main pressures being abstraction and flow regulation, diffuse and point source pollution, changes to morphology (physical habitat).

Catchment wide actions to be implemented to maintain and improve the water environment are outlined within the Action Plan and the plan also outlines surface water catchment specific actions to be undertaken to maintain and improve the Catchment as follows:

2.3.2.1 Catchment Wide Actions

- Carry out agricultural advisory site visits where identified as an issue through river walks and spot checks or as identified by stakeholders.
- Carry out fish habitat improvement works at identified areas within the LMA.
- Conduct a water resource assessment to inform an ongoing review of abstraction licences within Northern Ireland.
- Encourage riparian zone management with an aim to improve biodiversity and minimise sedimentation through practical management measures on farms.
- Raise awareness and promote the benefits of effective farm nutrient and waste management.

CONSENTED (LA01/2018/0200/F)

- Support local environmental initiatives such as river clean-up campaigns.
- Review of groundwater abstraction and planning applications where necessary.
- Provide advice on protected area designations to work towards improving the condition assessment of the 'River Roe & its tributaries' Special Area of Conservation (SAC).

2.3.2.2 Curly River Actions

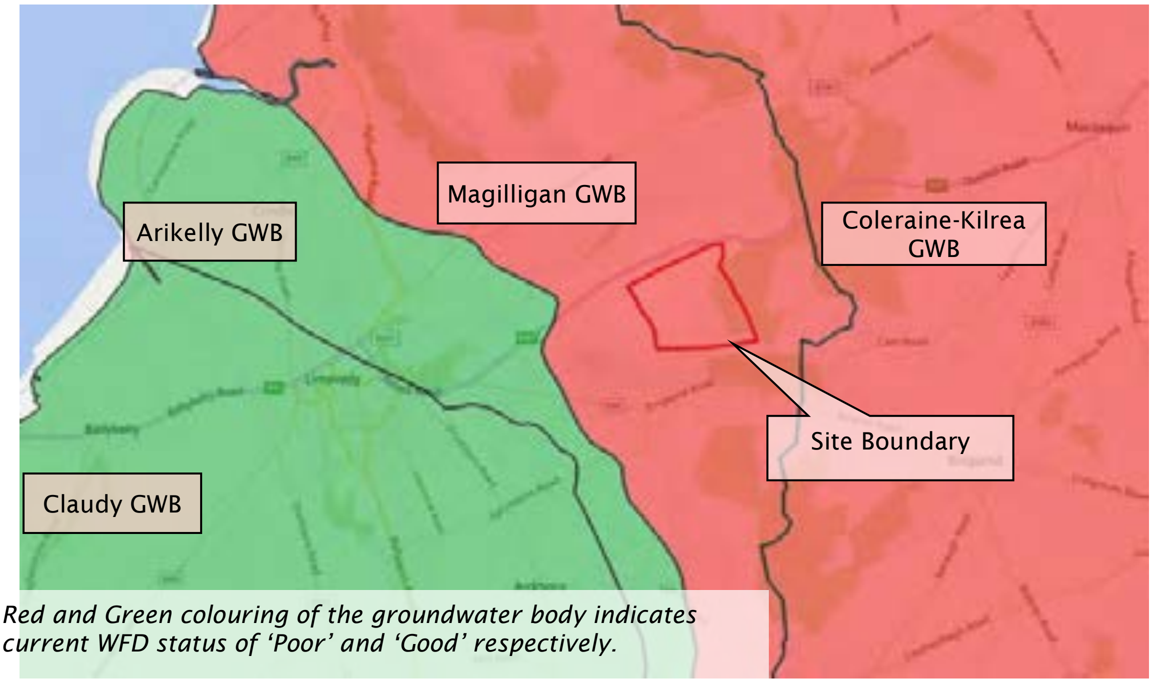
- Maintain current regulatory controls.
- Investigate identified water quality impacts by assessing sources of organic pollution.
- Carry out pollution prevention and enforcement measures if necessary at active quarries.

The actions within the plan applicable to the construction of the Dunbeg South Wind Farm are to be adhered to throughout the construction process to ensure maintenance and, where feasible, improvement of water quality classifications in the catchment.

2.4 Groundwater Body Identification

The proposed Development is situated within the catchment of the Magilligan Groundwater Body (UKGBNI4NW001), within the North-Western River Basin District as shown on Figure 2.2.

Figure 2.2: WFD Groundwater Body



Red and Green colouring of the groundwater body indicates current WFD status of 'Poor' and 'Good' respectively.

2.5 Groundwater Body Classification

The groundwater body is located on the east of Lough Foyle. The body includes the area between Castlerock and Magilligan on the north coast, extending southwards towards the Glenshane Pass. The body is associated with minor population centres and dominantly agricultural land use (58.9% improved grassland).

The groundwater body is defined to the west and south mostly by the geological contact between older Carboniferous and Triassic (Sherwood Sandstone Group) rocks of the adjacent body. Younger Triassic (Mercia Mudstone Group) and Palaeogene (basalts) rocks comprise the majority of the body. The eastern boundaries are defined by the surface water catchment with the northern boundary formed by the coastline.

CONSENTED (LA01/2018/0200/F)

The chemical composition of the natural waters is variable with geology[7]. For example the Mercia Mudstone Group which has limited groundwater may report elevated sulphates due to evaporitic minerals such as gypsum and halite.

Ulster White Limestone (chalk) and Hibernian Greensands is overlain eastwards by Palaeogene basalts which form the eastern part of the body. The resultant natural waters contain calcium bicarbonates, with a sodium signature also present in the basalt in places.

The bedrock aquifers may be locally confined where overlain by thicker deposits of clayey Till. Depth to water table is unknown but expected to be shallow (<10m).

Characterisation of the groundwater body in the vicinity of the site is summarised within Table 2.2.

Table 2.2: Characterisation of Magilligan Groundwater Body

Region	Geological Characteristics	Aquifer Type	
All Infrastructure	Palaeogene Basalt Bedrock	Bm (f)	Bedrock with moderate potential. Intergranular porosity negligible and fracture flow dominant. Flow mostly short (hundreds of metres) although some limited regional flow may also occur. Potentially some vertical hydraulic connection with the underlying Chalk (Ulster White Limestone).
North-western corner of Preliminary Boundary	Ulster White Limestone	Bh(f-k)	High productivity potential locally or where exploited with overlying basalts. Intergranular flow is negligible with fracture flow dominant. Karstic conditions may exist based upon evidence from where the chalk occurs elsewhere in NI but no specific evidence within this body.

2.5.1 Groundwater Body WFD Classifications

Following publication of the NIEA River Basin Management Plan in 2009 only an initial characterisation had been carried out for this groundwater body. The plan classified the quantitative, chemical, and overall status of the groundwater body as 'Poor'.

Second cycle results for the 2015-2021 cycle indicated water quality (quantitative, chemical, and overall) remained classified as 'Poor'.

2.5.2 Groundwater Body WFD Objectives

The updated RBMP document "What We Plan to Achieve by 2021 and Beyond"[8,9] produced in December 2014 following the second cycle; highlights changes to original 2009-2015 WFD objectives. The RBMP

[7] NIEA (2012) Characterisation of groundwater bodies within Northern Ireland. Available: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/water-report-characterisation-of-groundwater-bodies-within-Northern-Ireland-June-2012.pdf [Accessed 05/06/2017]
8 NIEA (2014) RBMP What we plan to achieve by 2021 and beyond https://www.daera-ni.gov.uk/sites/default/files/publications/doe/water-plan-what-we-plan-to-achieve-by-2021-beyond-2014.pdf [Accessed 14/06/2017]
9 NIEA (2015) Review of the Environmental Objects for the Second Cycle RBMP Available: https://www.daera-ni.gov.uk/publications/what-we-plan-achieve-by-2021-and-beyond-2015 [Accessed 15/06/2017]

CONSENTED (LA01/2018/0200/F)

now aims to achieve 'Good' status and ensure there is no deterioration in the water quality of these waters.

2.5.3 Local Management Area Action Plans

The Roe Action Plan and Update published in December 2013 highlighted any actions which had been implemented to date. Catchment wide actions to be implemented to maintain and improve the groundwater environment were outlined within the Action Plan as follows:

- Review of groundwater abstraction and planning applications where necessary; and
- Authorisation of discharges to groundwater.

CONSENTED (LA01/2018/0200/F)

3 STAGE II: ASSESSMENT OF PROPOSALS

3.1 Approach

The next stage undertaken will identify the nature of the development, the construction activities proposed and the potential specific detrimental effect to the water environment based on the key WFD objectives.

3.2 Development Description

The proposed Development comprises:

- Construction of an enabling works compound, construction of new access tracks and upgrade of an existing track;
- Construction of a construction compound throughout the construction period and a permanent substation;
- Excavation of nine turbine foundations and associated dewatering and concrete pouring activities and construction of nine crane pads and lay-down areas;
- Construction of two bottomless crossings watercourses five culvert crossings of other watercourses;
- Installation of underground power and telemetry cables;
- Temporary and permanent stockpiling of soils associated with all of the above.

3.3 Potential Effects

The proposed Development works include works over, in and in close proximity to waterbodies. There are a number of potential adverse effects to both surface and groundwater and these will be considered in the following sections. The risks will be considered on a case by case basis in the WFD Schedules presented later on this assessment. Potential effects of wind farm construction are outlined in greater detail in **Chapter 9: Geology and Water Environment**.

3.3.1 Surface Water

The primary risks of degradation of surface water bodies, i.e. streams and drains, are summarised as follows:

- Changes in runoff and flow patterns;
- Silt / suspended solid pollution of surface waters;
- Chemical pollution of surface waters e.g. Oil / fuels.

3.3.2 Groundwater

Groundwater is not at risk from as many sources of pollution as surface waters. However, potential risks are considered to be as listed below:

- Chemical pollution of groundwater e.g. Oil / fuels;
- Due to the nature of the works (deep excavations / importing of fill material) it is considered that there is potential for disturbance of aquifers and aquifer recharge.

3.4 Site Specific Proposals Assessment

The following sections (Table 3.1-Table 3.5) detail those areas where the proposed Development has potential to affect the water environment, detailing the nature and extent of work required and potential for adverse impact.

The format generally mirrors that required by the guidance provided by NIEA Northern Ireland Environment Agency Water Management Unit (NIEA WMU) in 'Carrying out a Water Framework Directive Assessment on EIA Developments'. It is noted that the "Current" status shown is taken from the most recent year a particular parameter was tested for and can vary between watercourses and parameters.

CONSENTED (LA01/2018/0200/F)

3.4.1 Potential Effect of Construction - Changes in Runoff and Flow Patterns

Table 3.1: Potential Impact of Changes in Runoff and Flow Patterns on site affecting the Curly River

WATERCOURSE		
	Waterbody Name	Curly River
	WFD Waterbody ID	(UKGBNI1NW020202060)
	Local Management Area	Roe
	Objective 2021- 2027	Good Status

UNMITIGATED IMPACT DISCUSSION

Proposed Works

Installation of new temporary or permanent impermeable surfaces.

New temporary or permanent excavations and structures acting as barriers to runoff.

Temporary Compaction of soils due to plant and site traffic.

Potential Impacts

Increased rate and volume of surface runoff, ponding and alterations to preferential flow routes, reduced surface permeability on site.

Consequences

Temporary or permanent redirection of surface water flows can result in potential adverse effects to down gradient dependant habitats either through starvation of areas where water currently flows, or flooding.

Temporary or permanent increases in surface water runoff rates and volumes can result in increased flood risk and increased effects of erosion and scour in down gradient watercourses.

Adopting a precautionary approach, flow changes in affected watercourses may affect benthic invertebrate communities, given that individual species are adapted to specific flow conditions.

Changes to flow patterns causing sediment movement may impact adversely on any macrophytes via smothering or changes to water depth.

Soluble reactive phosphate status concentrations may be expected to increase if sediment concentrations increase (as a result of changes to flow patterns and runoff characteristics).

A reduced water depth may also be associated with increased water temperatures; and consequently dissolved oxygen decreases.

Changes to flow patterns have the potential to affect the hydrological regime of the river.

WFD CLASSIFICATION

WFD Element	Current Status	Assessed Change
Benthic Invertebrates	Good	Moderate
Phytobenthos	Good	Moderate
Ammonia	Good /High	Good /High
Dissolved Oxygen	High	Good
pH	High	High
Soluble Reactive Phosphate	High	Good
Biological Oxygen Demand	High	Good
Temperature	High	Good
Hydrological Regime	High	Good
Morphological conditions	-	

CONSENTED (LA01/2018/0200/F)

ASSESSMENT	Does the component comply with WFD Objectives 1, 2, 3 and 4?		
	No		Do not proceed or complete Article 4.7 assessment.
	Yes (Justification provided)		Proceed after NIEA agreement.
	Yes, with mitigation	✓	Complete Schedule B.

CONSENTED (LA01/2018/0200/F)

3.4.2 Potential Effect of Construction - Silt / Suspended Solid Pollution of Surface Waters

Table 3.2: Potential Impact of Silt / suspended solid pollution on watercourses leading to the Curly River

WATERCOURSE		
	Waterbody Name	Curly River
	WFD Waterbody ID	(UKGBNI1NW020202060)
	Local Management Area	Roe
	Objective 2021-2027	Good Status

UNMITIGATED IMPACT DISCUSSION

Proposed Works

Excavations, ground disturbance, stripping of top soil and temporary soil deposition will be required during construction of the wind farm infrastructure.

Importing, handling and placement of aggregate for access tracks.

Plant and maintenance vehicle movement across disturbed soils and stone access tracks and washing down plant and machinery.

Potential Impacts

The proposed works have the potential to release fine sediments, fine soil, clay and aggregate particles into surface runoff or where construction is in the vicinity off watercourses.

Shallow groundwater gathering in excavations will come in contact with excavated surfaces and aggregate.

Traffic movements can transport silts and find grade aggregates.

Consequences

Polluted groundwater within excavations will have to be pumped and (without treatment) if discharged to nearby watercourses will result in the release of a potentially heavily polluted effluent.

Sediments and debris entering watercourses have the potential to adversely modify stream morphologies, smother habitats, harm aquatic flora / fauna and increase risk of blockage to culverts / drainage channels.

Increased suspended sediment concentrations may affect benthic invertebrate communities given that individual species are adapted to specific water quality conditions.

Changes to suspended sediment concentrations may impact adversely on macrophytes via smothering or changes to water depth and flow patterns for example.

WFD CLASSIFICATION

WFD Element	Current Status	Assessed Change
Benthic Invertebrates	Good	Poor
Phytobenthos	Good	Good
Ammonia	Good /High	Good /High
Dissolved Oxygen	High	Moderate
pH	High	High
Soluble Reactive Phosphate	High	Poor
Biological Oxygen Demand	High	Poor
Temperature	High	Good
Hydrological Regime	High	Good

CONSENTED (LA01/2018/0200/F)

Table 3.2: Potential Impact of Silt / suspended solid pollution on watercourses leading to the Curly River

	Soluble reactive phosphate status concentrations may be expected to increase given that phosphorus adheres strongly to some sediment particles. BOD concentrations may increase if it is presumed that some of the sediment fraction is organic. Some influence on water temperature may be exhibited due to changes to the turbidity. A reduced water depth (caused by sediment build up) may also be associated with increased water temperatures – in reality this is unlikely to increase the temperature to such a degree that the WFD status is affected; however a precautionary approach is adopted here. Some increased concentrations of metals may occur (given their association with sediments) but such increases are likely to be negligible.		Morphological conditions	-	

ASSESSMENT	Does the component comply with WFD Objectives 1, 2, 3 and 4?		
	No		Do not proceed or complete Article 4.7 assessment.
	Yes (Justification provided)		Proceed after NIEA agreement.
	Yes, with mitigation	✓	Complete Schedule B.

CONSENTED (LA01/2018/0200/F)

3.4.3 Potential Effect of Construction - Chemical Pollution of Surface Waters

Table 3.3: Potential Impact of Chemical pollution on the Curly River

WATERCOURSE	Waterbody Name	Curly River
	WFD Waterbody ID	(UKGBNI1NW0202020460)
	Local Management Area	Roe
	Objective 2021-2027	Good Status

UNMITIGATED IMPACT DISCUSSION

Proposed Works

The proposed works will require the temporary presence of chemicals, fuels and other oils and alum flocculants along with permanent presence of oils and lubricants associated with turbine maintenance.

Excavations, deforestation / replanting, soil stripping, concrete pouring and construction of temporary welfare facilities.

Potential Impacts

There is the potential for chemicals to enter a watercourse through accidental spillage, improper transport and refuelling or inappropriate storage and disposal procedures.

Earthworks in areas previously forested may cause the release of residual fertilisers and in areas of peat excavations may cause acidification of surface waters.

Unregulated use of flocculants can result in large doses entering surface waters.

Cementitious materials and discharge from temporary welfare activities have the potential to enter the watercourses.

Consequences

Oils and chemicals entering watercourses have the potential to adversely affect water quality, with associated effects to fish and aquatic ecology.

Release of forestry fertilisers and acidification from peat may adversely affect nitrate and pH levels and unregulated use of flocculants has the potential to cause locally significant fluctuations in pH, with adverse effects to fish.

Wastewater and associated coliforms discharged to subsoil irrigation or to the ground surface can percolate through to underlying aquifer and adversely affect water quality.

WFD CLASSIFICATION

WFD Element	Current Status	Assessed Change
Benthic Invertebrates	Good	Poor
Phytobenthos	Good	Good
Ammonia	Good /High	Good /High
Dissolved Oxygen	High	High
pH	High	Moderate
Soluble Reactive Phosphate	High	High
Biological Oxygen Demand	High	Moderate
Temperature	High	High
Hydrological Regime	High	High
Morphological conditions	-	

CONSENTED (LA01/2018/0200/F)

ASSESSMENT	Does the component comply with WFD Objectives 1, 2, 3 and 4?		
	No		No
	Yes (Justification provided)		Yes (Justification provided)
	Yes, with mitigation	✓	Yes, with mitigation

CONSENTED (LA01/2018/0200/F)

3.4.4 Potential Effect of Construction - Chemical Pollution of Groundwater Bodies

Table 3.4: Potential Impact of Chemical pollution to Magilligan Groundwater body

WATERCOURSE				UNMITIGATED IMPACT DISCUSSION	
	Groundwater Body	Magilligan			Proposed Works The proposed works will require the temporary presence of chemicals, fuels and other oils and alum flocculants along with permanent presence of oils and lubricants associated with turbine maintenance on the site. Excavations, deforestation / replanting, soil stripping, concrete pouring and construction of temporary welfare facilities. Potential Impacts There is the potential for chemicals to enter the groundwater through accidental spillage, improper transport and refuelling or inappropriate storage and disposal procedures. Earthworks in areas previously forested may cause the release of residual fertilisers into the groundwater and shallow groundwater can gather in significant excavations. Unregulated use of flocculants can result in large doses entering groundwater. Cementitious materials have the potential to enter the groundwater. Leakage from the discharge from temporary welfare activities (above ground storage and taken off-site by licensed waste disposal team) has the potential to enter shallow groundwater. Consequences Oils and chemicals entering groundwater have the potential to adversely affect water quality. Acidification from peat may adversely affect pH levels. Unregulated use of flocculants has the potential to cause locally significant fluctuations in pH. Wastewater and associated coliforms discharged to subsoil irrigation or to the ground surface can percolate through to underlying aquifer and adversely affect water quality.
	WFD Waterbody ID	(UKGBNI4NW001)			
	River Basin District	North Western			
	WFD Element	Current Status	Assessed Change		
	Chemical Status	Poor	Poor		

ASSESSMENT			
	Does the component comply with WFD Objectives 1, 2, 3 and 4?		
	No		Do not proceed or complete Article 4.7 assessment.
	Yes (Justification provided)		Proceed after NIEA agreement.
	Yes, with mitigation	✓	Complete Schedule B.

CONSENTED (LA01/2018/0200/F)

3.4.5 Potential Effect of Construction - Disturbance of Groundwater Bodies

Table 3.5: Potential Impact of Construction Disturbance of Aquifer / Aquifer Recharge to Magilligan GWB

<table>
<tr><td rowspan="6">WATERCOURSE</td><td>Groundwater Body</td><td colspan="2">Magilligan</td><td rowspan="6">UNMITIGATED IMPACT DISCUSSION</td><td rowspan="6"><u>Proposed Works</u>
Installation of new temporary or permanent impermeable surfaces.
<u>Potential Impacts</u>
Reduced surface permeability.
The detailed geology and hydrogeology assessment for the project has determined that works proposed are unlikely to encounter caustic features in limestone, and that potential for causing morphological change to fractured groundwater flow is not a significant consideration at the site.
<u>Consequences</u>
Reduction permeable areas on the site can reduced the potential for groundwater recharge.</td></tr>
<tr><td>WFD Waterbody ID</td><td colspan="2">(UKGBNI4NW001)</td></tr>
<tr><td>River Basin District</td><td colspan="2">North Western</td></tr>
<tr><td>WFD Element</td><td>Current Status</td><td>Assessed Change</td></tr>
<tr><td>Chemical Status</td><td>Poor</td><td>Poor</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td rowspan="4">ASSESSMENT</td><td colspan="3">Does the component comply with WFD Objectives 1, 2, 3 and 4?</td></tr>
<tr><td>No</td><td></td><td>Do not proceed or complete Article 4.7 assessment.</td></tr>
<tr><td>Yes (Justification provided)</td><td></td><td>Proceed after NIEA agreement.</td></tr>
<tr><td>Yes, with mitigation</td><td>✓</td><td>Complete Schedule B.</td></tr>
</table>

CONSENTED (LA01/2018/0200/F)

4 STAGE III: MITIGATING MEASURES

4.1 Approach

Sections 4 to 10 of this report detail the third stage of the assessment; the approach to implementation of specific mitigation measures to be applied at the site.

In order to mitigate the potential degradation of surface and groundwater quality and morphology, identified in Section 3 as a result of construction activities associated with the development, mitigation measures are to be implemented during all stages of the construction process.

4.2 Introduction

The construction phase of all projects is a period within which there is increased potential for pollution, in particular silt pollution to local watercourses due to unearthed clay surfaces. The focus of this document is to provide sufficient detail to ensure that water pollution will not occur as a result of construction activities at the site and to minimise the risk of any such occurrence.

Chapter 9: Geology and Water Environment has identified particular downstream receptors, of most significance from a drainage perspective being watercourses with fisheries potential and should be referred to for a detailed appraisal of the site hydrology and hydrogeology.

The main objectives of the following sections are to demonstrate that sufficient measures have been put in place so as to protect those identified receptors and to ensure that drainage is constructed to relevant guidance and standards, particularly as follows:

- To propose appropriate, robust and buildable SuDS techniques for the prevention of erosion and the removal of silts and pollutants from construction runoff;
- To ensure that permanent drainage at the development is designed to a sufficient hydraulic capacity to contain a pre-determined return period rainfall event;
- To give consideration of the control and monitoring proposals for the dewatering of excavations;
- To ensure that surrounding heath and agricultural lands are not negatively affected by surface water runoff from the site.

The drainage design adopts a SuDS approach, using temporary SuDS for the drainage of the temporary works during the construction phase.

Where construction activities near water courses and water bodies are essential, steps have been undertaken to identify sufficient mitigation measures for the protection of the watercourses against pollution and have been presented on drawings accompanying this report within Annex A and Annex B. Silt management and pollution prevention during all elements of construction has been given due consideration within the design statement and within the scope of the full SuDS design.

This report gives both specific and general details on the drainage method for temporary works, permanent site drainage and pollution prevention measures for silt management.

4.3 Additional References & Document Hierarchy

This document refers to and should be read in conjunction with the Dunbeg South Environmental Statement, in particular:

- Chapter 06: Ecology / Chapter 09: Fisheries;
- Technical Appendix 6: Outline Habitat Management Plan;
- Technical Appendix 9.4: Peat Slide Risk Assessment;

Chapters are contained within Volume 2 and Technical Appendices are included within Volume 4 of the ES.

This version of the WFD Assessment, submitted as Further Environmental Information in 2019, **should be read as superseding the previous Appendix 9.1 included in Volume 4 of the ES.**

CONSENTED (LA01/2018/0200/F)

Attention is drawn to the following accompanying drawings included within Annex A and Annex B of this Technical Appendix, which similarly supersede those previously supplied in **the previous Appendix 9.1 included in Volume 4 of the ES.:**

- DWG 01 Preliminary SuDS General Arrangement (Planning Stage Drainage Layout);
- DWG 02 – 08 Preliminary SuDS Typical Details (Planning Stage Drainage Details).

CONSENTED (LA01/2018/0200/F)

5 SITE DRAINAGE INFORMATION

5.1 Site Area

The proposed Development is located approximately 8 km to the east of Limavady, County Londonderry and lies on the north-eastern slopes of Keady Mountain.

The area within the preliminary site boundary (hereafter referred to as "the Site") considered within this assessment; occupies an area of approximately 31km^2 (31 Ha) and contains the proposed Wind Farm infrastructure consisting of nine Wind turbines and associated infrastructure.

5.2 Topography

Topography on the Site is dictated by Keady Mountain. The highest point of the site is in the south-west corner with land generally falling to the north, towards the Curly River Valley. Levels fall from approximately 341 m AOD(Above Ordnance Datum) to 137 m AOD.

5.3 Site Hydrology

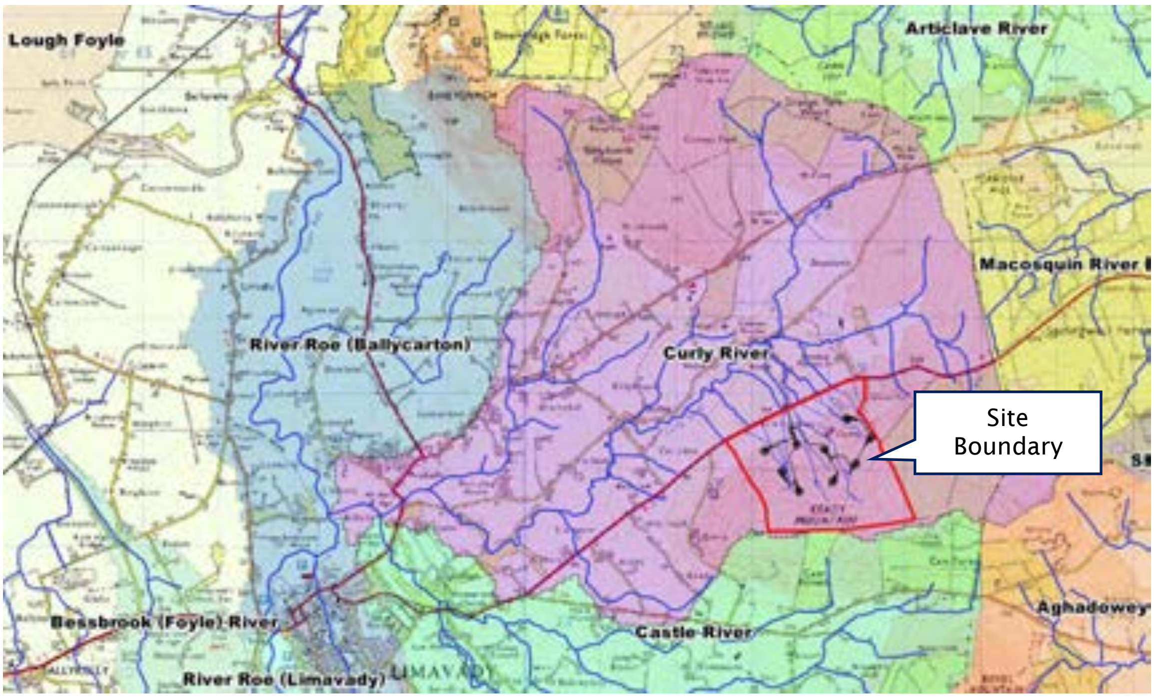
The following is based on a combination of desktop study and walkover survey observations. Main stream reach lengths identified are as per OSNI 1:2,500 scale mapping, validated or otherwise by means of visual survey on-site.

Several undesignated watercourses within on site drain to the north into the Curly River, as described in full within **Chapter 9: Geology and Water Environment** and shown on Figure 5.1 below.

The proposed Development is located entirely within the Curly River Catchment. The Curly River joins the main channel section of the River Roe 5.2 km to the west of the site. The Roe River discharges into Lough Foyle 8.2 km to the north-west of the site.

Based on NIEA River Basin Management Plan boundaries; the Site is situated within the Roe Local Management Area (LMA) which is within the Lower Foyle Catchment Stakeholder Group and falls under the control of the North Western Basin District.

Figure 5.1: Site Hydrology



CONSENTED (LA01/2018/0200/F)

6 RELEVANT GUIDANCE AND LEGISLATIVE REQUIREMENTS

6.1 Relevant Guidance and Legislative Requirements

It is proposed that all drainage relating to Dunbeg South Wind Farm will be constructed using best practice and in conformance with the requirements of the relevant regulatory authorities. The key legislation and guidance which will be adhered to are defined as follows:

6.1.1 National Planning Policy

- EU Water Framework Directive (2000/60/EC);
- Groundwater Daughter Directive to the Water Framework Directive (2006/118/EC);
- Priority Substance Daughter Directive to the Water Framework Directive (2008/105/EC);
- Freshwater Fish Directive (2006/44/EC);
- Environmental Liability Directive (2004/35/EC);
- Dangerous Substances Directive (2006/11/EC);
- UK Environmental Standards and Conditions Phase 1 and Phase 2 (UK TAG 2008);
- Control of Pollution (Oil Storage) (Amendment) Regulations (NI) 2011;
- Drainage (Environmental Impact Assessment) Regulations (NI) 2006;
- Environmental Liability (Prevention and Remediation) (Amendment) Regulations (NI) 2009;
- Groundwater Regulations (NI) 2009 and Groundwater (Amendment) Regulations (NI) 2014;
- Nature Conservation and Amenity Lands (NI) Order 1985;
- Private Water Supplies Regulations (NI) 2009 and Private Water Supplies (Amendment) Regulations (NI) 2010;
- Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998;
- The Drainage (NI) Order 1973 and The Drainage (Amendment) (NI) Order 2005;
- The Environment (NI) Order 2002;
- The Fisheries (NI) Act 1966;
- Water Act (NI) 1972 and The Water (NI) Order 1999;
- Water Supply (Water Quality) Regulations (NI) 2007
- Water Supply (Water Quality) (Amendment) Regulations (NI) 2010;
- Water Environment (Water Framework Directive) Regulations (NI) 2003;
- Water Framework Directive (Priority Substances and Classification) (Amendment) Regulations (NI) 2012;
- Water Framework Directive (Classification, Priority Substances and Shellfish Water Regulations (NI) 2015.

6.1.2 Regional and Local Planning Policy

- Revised Planning Policy Statement 15 - Planning and Flood Risk;
- Planning Policy Statement 18: Renewable Energy (and supplementary Planning Guidance: Wind Energy Development in Northern Ireland's Landscapes);
- Northern Area Plan (2015);
- Sustainable Development Strategy, "Everyone's Involved" (2010);

6.1.3 NIEA Guidance Notes and Selected Industry Guidance

- Good Practice during Wind Farm Construction - Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland (2010);
- SNIFFER - WFD111 Coarse Resolution Rapid - Assessment Methodology to Assess Obstacles to Fish Migration (2010);
- CIRIA C523 - Sustainable Urban Drainage Systems; Best Practice Manual (2001);

CONSENTED (LA01/2018/0200/F)

- CIRIA C532 - Control of Water Pollution from Construction-sites (2001);
- CIRIA C692 - Environmental Good Practice on-Site (2010);
- CIRIA C609 - Sustainable Drainage Systems, hydraulic, structural and water quality (2004);
- CIRIA C753 - The SuDS Manual (2015)
- CIRIA C689 - Culvert Design and Operation Guide (2010);
- Code of Practice for Earthworks (2009) - BS6031;
- Environment Agency - Policy Regarding Culverts: Technical Guidance on Culverting Proposals (1999);
- Scottish Executive - River Crossings and Migratory Fish: Design Guidance (2002);
- DEFRA - Good Practice Guide for Handling Soils (2000);
- DEFRA - Construction Code of Practice for the Sustainable Use of Soils on Construction-sites (2009);
- NIEA Guidance for Pollution Prevention (GGP)
  - GPP2 Above Ground Oil Storage Tanks;
  - GPP4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer
  - GPP5 Works and Maintenance in or near Water;
  - GPP 20: Dewatering underground ducts and chambers
  - GPP 21: Pollution incident response planning
  - GPP 26 Safe storage - drums and intermediate bulk containers
- Pollution Prevention Guidance Notes (PPGs);
  - PPG1 Understanding Your Environmental Responsibilities: Good Environmental Practice;
  - PPG3 Use and Design Of Oil Separators in Surface Water Drainage Systems;
  - PPG6 Working at Construction and Demolition-sites;
  - PPG7 The Safe Operation of Refuelling Facilities;
  - PPG18 Managing Fire, Water and Major Spillages;

CONSENTED (LA01/2018/0200/F)

7 SUDS DESIGN APPROACH

In order to meet the design criteria and objectives detailed previously in this report and regulatory authority requirements, the following design philosophy has been developed.

7.1 Controlling Runoff

- Track and hardstanding runoff will be handled by sheet flow to trackside ditches or swales.
- Tracks and hardstanding areas are to be constructed from unbound aggregate and are not surfaced, thus helping to reduce runoff volumes. This has been allowed for within the design philosophy through the utilisation of a reduced runoff coefficient of 70 %, and a heavy silt loading assumed as defined by D'Arcy et al (2000), for light industrial and engineering land uses.
- Piped under track drainage will be provided with associated sumps and check dams. The under track drainage will provide a means for flows to pass from a swale on the uphill side to the downhill side of the slope.
- In cases where the tracks must run significantly downhill, transverse drains ('grips') will be constructed where appropriate in the surface of the tracks to divert any runoff flowing down the track into the adjacent drainage ditch/across open ground.
- Rate and volume of runoff will be attenuated using check dams located in trackside swales and ponds located at significant new hardstanding areas. Attenuation features will also reduce flow velocities preventing scour, and allow settlement of silts prior to discharge.
- The use of large balancing ponds is to be avoided and there will be no merit in using other methods such as filter drains or hard permeable surfacing due to the lack of infiltration capacity and likely high groundwater levels.

7.2 Water Quality and Treatment

- Clean / dirty water separation will be maintained on site in all practicable instances. Clean water will be prevented from entering excavations and dirty water drainage swales through use of clean water diversion / cut-off ditches.
- A treatment train will be designed with a minimum of two stages of treatment for polluted runoff from the site during the construction phase.
- All treatment settlement features (check dam backwaters and ponds) are to be designed to offer sufficient retention time to settle out the silt grain sizes anticipated.
- Silt laden runoff within trackside swales will be treated through the provision of small check dams at specified centres along the swales (to be specified as part of detailed design). Note that steeper swale sections will require a greater frequency of check dams.
- Appropriate site management measures will be taken to ensure that runoff from the construction site is not contaminated by fuel or lubricant spillages. Earth spillages into any existing streams will also be avoided. There will be no discharge of trade effluent, sewage effluent or contaminated drainage into any watercourse system or ditch. Any dewatering from excavations will be via surface silt traps, check dams and settlement ponds to ensure sediment does not enter surrounding watercourses.
- Areas stripped of vegetation should be kept to a minimum. Stripped vegetation should be reinstated on slopes as early as possible. Further details on habitat management are included within **Technical Appendix 6.8: Outline Habitat Management Plan**.

7.3 Preserving Hydrology and Groundwater Recharge / Amenity & Biodiversity

- Drainage design will seek to aid in habitat enhancement and improvement measures (refer to **Revised Appendix 6.8: Outline Habitat Management Plan**) where improvement is sought by ditch blocking, by allowing for the following:
  - ensuring that water flows are maintained or increased to areas where re-wetting is proposed;
  - providing treatment to runoff to ensure re-wetted areas are not affected by siltation or nutrient enrichment;
  - routing drainage to maximise overland flows in areas where wet conditions are desirable for habitat creation and enhancement..

CONSENTED (LA01/2018/0200/F)

- Drainage design will ensure natural streams are piped directly through appropriately sized drainage pipes on their original alignment.
- Runoff from new hardstanding areas will be collected and attenuated before discharge to receiving drainage networks.
- Settlement ponds will be designed to cater for infilling and rehabilitation post construction phase of the project; however subject to requirements of habitat management or enhancement plans for the site, water features may be retained for the whole life of the project as a means of providing wetland habitat on the site.

7.4 Summary

The proposed SuDS design provides a surface water management train that will seek to mitigate potentially adverse impacts on the hydrology of the proposed Development

Application of the above design philosophy in the detailed design and construction of site specific elements is considered in the following sections of this report.

CONSENTED (LA01/2018/0200/F)

8 DRAINAGE DESIGN PHASE - DETAILED CONSIDERATIONS

8.1 Preamble

The following key considerations have been identified in the preliminary design of hydrology and drainage (including foul) for the site in order to preserve water quality, downstream hydrology and preserve stream morphology. These issues and development of suitable mitigating measures will be given further consideration during the detailed design stage of the project.

- Identification of watercourse crossings and drainage paths across the site;
- Sizing and definition of hydraulic capacity requirements for watercourse crossings;
- Requirement for fish passes / consideration of migratory fish;
- Detailed design of track and hardstanding drainage and silt management;
- Separation of 'clean' and 'dirty' water;
- Spoil storage;
- Management and discharge of runoff in areas of upland heath and in areas of improved grassland;
- Requirement for attenuation storage;
- Definition of Buffer Zones.

Note that the infrastructure layout and associated SUDS design prepared for purposes of Planning is preliminary only. Post consent, track layout design and associated SuDS design will be further developed to minimise and mitigate for the effects of pollution to all local watercourses.

Preliminary drainage layout is shown on accompanying drainage management drawings **DWG 01** within **Annex A.**

8.2 Watercourses and Watercourse Crossings

8.2.1 Identification of Watercourse Crossings

Watercourses significant for purposes of environmental design have been identified within the Hydrology Assessment undertaken for the Environmental Statement for the project. Sensitive water features on the site comprise natural watercourses and main flowing drains.

- Three crossings of significant watercourses are required to allow development (two of which are significant in terms of fisheries potential as outline within **Chapter 8: Fisheries,** Stream C).
- Four crossings of minor watercourses are proposed to allow development

Additional consideration will be given to design of drainage crossings at detailed (post-planning) design stage, including other drainage crossings where other drainage crossings may be ditches and drains as encountered alongside existing roads tracks and field boundaries or moorland / peatland drainage.

Works to watercourse crossings will be subject to authorisation by DfI Rivers under Schedule 6 of the Drainage (Northern Ireland) Order 1973. Works causing disturbance to the river bed shall similarly be subject to Loughs Agency Section 46/47 permit.

8.2.2 Design of Watercourse Crossings

Full design of watercourse crossings will be undertaken at detailed design stage, post planning consent. Outline designs sufficient to allow assessment of environmental effects have been prepared as part of this assessment.

The following guidance has been adhered to in the outline design and will be similarly applied in the detailed design of watercourse crossings:

- Hydrological assessments made using a number of methods including Flood Estimation Handbook to determine the design flow;
- SNIFFER WFD 111 documents;
- CIRIA Culvert design and operation guide (C689);

CONSENTED (LA01/2018/0200/F)

- Fisheries considerations shall incorporate guidance stated in Loughs Agency Guidelines for Fisheries Protection during Development Works (2011) and Scottish Executive (2002) River Crossings and Migratory Fish: Design Guidance (where appropriate).

Watercourse crossings on the site shall comprise two bottomless culvert crossings and eight conventional closed culverts, with the requirement for bottomless culverts driven by consideration of fish passage determined in conjunction with the site specific fisheries assessment included with the Environmental Statement.

Factors considered in the design and orientation of all watercourse crossings includes:

- Crossing direction to generally be perpendicular with access track direction, therefore minimising the length of stream affected;
- Consideration of the passage of out-of-bank flood flows;
- Crossings are generally located in an area where bank slopes are the shallowest available, thus reducing the potential for runoff to carry sediment into the watercourse.
- Additional mitigation will be designed to prevent pollution of the watercourse during the construction of the watercourse crossing to reduce residual risk; comprising the temporary installation of silt fences in the stream channel downstream or similarly effective measures.
- Typical in-channel silt Fence arrangements are shown on drawing **DWG03** included in **Annex B.**

8.2.2.1 Bottomless Culvert Crossings

Bottomless Culvert crossings will be utilised as directed by **Chapter 8: Fisheries**, to ensure that the stream bed and bank remains undisturbed / intact and negate the need for in-channel works in order to preserve fish habitat and will avoid introducing structures that would inhibit fish passage.

A bottomless culvert crossing detail representing an outline design is shown on drawing **DWG02** included in **Annex B.**

8.2.2.2 Culvert Crossings

Conventional piped or closed bottom culverts are proposed at minor water features (based on site observations and catchment size < 0.25 km^2), and at water features where the requirement to maintain fish habitat in the channel has been determined to be not applicable within **Chapter 8: Fisheries**. These crossings and other culverts for surface flood conveyance or similar, shall be piped culverts.

Design requirements will be imposed to ensure that culverts are installed at a level lower than existing bed levels in order to create a "stilling" effect and reduce potential for increased local flow velocities in the culvert in addition to promoting the formation of a natural substrate within the culvert. Mitigation of construction of the culvert within watercourses is discussed further in Section 9.2.2.

A typical culvert representing an outline design is shown on drawing **DWG04** included in **Annex B.**

8.2.3 Preservation of Overland Flow Routes

Where appropriate, on areas of heath on the relatively elevated areas of the Site, overland flow will be preserved by the provision of under-track cross drainage (cross drains) at regular intervals and at all natural depressions and flow collection points.

Conventional cross drains sizes will be confirmed at detailed design stage and increased locally at all points where water would tend to accumulate due to land drainage or natural drainage paths. Frequency and location of specific cross drains will be specified following inspection of topographical data, with cross drain frequency dictated by:

- Terrain gradients lateral to the proposed access track;
- Terrain gradients longitudinal to the proposed track;
- Location of natural depressions and points of flow collection.

CONSENTED (LA01/2018/0200/F)

8.2.4 Water Feature Buffer Zones

Buffer zones to water features have been established for the Site within **Chapter 9: Geology and Water Environment** for the project and are shown on accompanying drainage management drawings **DWG01** within **Annex A.**

Infrastructure designed to lie outwith stated hydrological buffer zones comprises those elements of the works associated with significant earthworks, and greatest potential for spillage or leakage of chemical pollutants, i.e.:

- All turbine bases, met mast foundations, crane pads, and associated working areas including spoil storage areas.
- Areas designated for temporary or permanent spoil management or storage.
- Substation buildings and compounds, temporary construction compounds, fuel and chemical storage areas, and any other platforms.

Buffers would be imposed during the construction phase in order to limit the types of construction activities permissible in proximity to water. Where the local site environment requires additional protection (e.g. steep slopes or lack of vegetation between construction corridor and watercourse) the buffer zone will be increased or stringent mitigation measures introduced. Buffer areas will act as riparian zones allowing filtration and settlement, minimising sediment transport, attenuating flows and maximising infiltration.

All turbines and infrastructure are outside the recommended buffers (other than unavoidable watercourse crossings) as described in **Chapter 3**: **Design Evolution & Alternatives**.

8.3 Temporary Drainage

8.3.1 Clean / Polluted Water Separation

Drainage management will ensure that clean water is not permitted to mix with contaminated water from sources such as excavation dewatering or track runoff, where "clean water" should be interpreted as natural surface runoff unaffected by construction / earthworks runoff.

Design will ensure that upslope cut off ditches are to be installed in order to intercept and divert clean upslope surface water runoff flowing overland or within forestry drainage prior to it coming in contact with areas of excavation. Design will ensure that clean water cut off ditches are installed ahead of main earthworks wherever practical. This is intended to reduce the flow of clean water onto any exposed areas of rock and soil, thereby reducing the amount of potential silt laden runoff requiring treatment.

Installed drainage will allow provision for clean water intercepted in cut-off ditches to pass through and under track structures separate to drainage provided for track runoff.

Temporary silt / pollution prevention and scour protection measures will be provided in artificial clean water drainage installed in order to mitigate potential for scouring and transport of sediment from newly excavated channels.

Diversion drainage is to discharge either to existing watercourse channels (via silt removal features) or be dispersed over vegetated ground. Diversions are to be designed to avoid collection and interception of large catchments creating significant point flows, with associated risks due to scour and hydraulic capacity.

8.4 Track Drainage

8.4.1 Trackside Drainage

The cross fall on the track will be aligned to divert "dirty" surface water (i.e. contaminated surface water from track surface or excavations) into trackside swales by overland sheet flow or via track surface grips.

The swale and track shoulder will be vegetated as soon as possible after construction, in order to reduce potential for runoff from exposed aggregates and clays, and promote removal of suspended solids within runoff by filtration in vegetation. Any vegetation used will be appropriate to the local area. Temporary erosion protection may be required until the vegetation becomes established (coir matting or similar).

CONSENTED (LA01/2018/0200/F)

All swales will be kept as shallow as possible so that they pose no health and safety risk to plant or personnel. Maximum depth of standing water will be limited to 0.5m within the ponds and 0.3m within the swales.

Drainage swales shall be designed to satisfy the following conveyance and water quality criteria:

- Hydraulic conveyance of runoff appropriate to the protection of the surrounding land use, with additional consideration of effect of a 100-yr (flood protection) event (i.e. exceedance event);
- Store treatment volume (T_v) (15 mm rainfall on drained area).

Under-track piped drainage crossings will be provided to allow up-slope swales to drain to the down slope side. Crossings will be provided at regular intervals (to be determined at detailed design stage) and at all localised low points. Outlets from crossing pipes shall generally coincide with swale breakouts.

Note that dirty water under track crossings and breakouts are to be maintained separate from clean water crossings (see Section 8.3.1).

Where appropriate on areas of upland heath, there will be regular outflow points ("breakouts") from the swales throughout the SuDS system to eliminate the potential for the generation of large flows at single outflow points. This will assist the drainage network in maintaining the natural hydrological response displayed by the natural catchment. Outflows will be directed away from watercourses and across open vegetation to increase the drainage path and buffer zone between the point of discharge and the watercourse.

Typical trackside swale arrangements are shown on **DWG01** within **Annex A** and track drainage details are shown on **DWG05** and **DWG07** in **Annex B.**

8.4.2 Drainage Grips

Drainage grips may be installed on the track surface where deemed a requirement in order to direct runoff into trackside drainage or to downslope settlement / filtration features. Positioning of grips will be determined at detailed design stage and on an observational basis during construction, however in general the need for grips will be greatest in areas on steep longitudinal track gradient.

Installation of grips will prevent extensive rutting of the track structure and aids drainage of the track surface, which in turn reduces potential for trafficking of the surface to cut the track and generate silt.

Drainage grips will generally comprise a steel channel section installed flush to the track surface, with concrete haunching as may be required in areas of heavy trafficking.

8.4.3 Runoff Attenuation

Runoff from large hardstanding areas such as the site compound, turbine hardstandings, and substation will be attenuated to mimic natural runoff patterns. Flow rates from tracks will be reduced through use of attenuating check dams within swales installed adjacent to all hardstanding areas, providing immediate attenuation "at source", with pass-forward flow rate reduced by filtration and temporary detention.

Frequent breakouts from swales to discharge accumulated runoff overland at regular frequencies will further encourage attenuation of runoff peaks by dispersing runoff over vegetation where losses would be expected by vegetative retention, transpiration, and infiltration.

Attenuation will utilise shallow ponds to aid removal of suspended solids. Calculations for the determination of storage requirements will be undertaken at detailed design stage.

Consideration will be given to the potential for further storage features across the site.

8.5 Management of Suspended Solids

Runoff from the site shall be required to ensure that water quality in the receiving watercourses, including those draining to areas of fisheries interest, is not adversely affected in terms of key water quality parameters. The primary means by which the development could cause adverse effect is by release of suspended solids.

CONSENTED (LA01/2018/0200/F)

Detailed drainage design shall ensure that settlement and filtration of runoff from the site is designed such that the water quality standard is preserved.

8.5.1 Check Dams

Initial treatment will be provided "at source" by check dams installed within trackside swales at regular frequencies, in order to reduce flow velocities and improve conditions for the settlement of solids in transit.

Check dams shall ideally be of stone formation however compacted clay check dams may be used should suitable stone be unavailable locally.

Where stone is used, the aggregate used to form check dams will be a small 'clean' graded stone. On steeper slopes the check dams will be anchored using larger stone placed on the downhill side of the check dam to prevent washing away of the smaller graded stone. The frequency of the check dams will be determined at detailed design stage.

The check dams will serve dual functions, by both removing and settling out silts and reducing flow velocities, therefore mitigating against the effects of erosion within the swale and improving the design life of end of line infiltration features.

Where feasible and where observed site conditions allow, the frequency of installed check dams may be reduced post-construction phase, due to reduced silt loading anticipated following completion of construction activities and reduced site traffic.

Typical swale check dam arrangements are shown on track drainage drawings **DWG05** and **DWG06** in **Annex B.**

8.5.2 Settlement Ponds

All locations where significant accumulations of dirty water discharge in the vicinity of watercourses will pass through one or a sequence of settlement lagoons in order that suspended solid concentrations released can demonstrably be shown to have no detrimental effect to downstream fish life.

Temporary and permanent settlement lagoons shall be sized to allow treatment of the levels of silt and suspended solids anticipated in construction phase and operational phase runoff respectively and shall be informed by intrusive site investigation post consent.

Where runoff contains solids unlikely to settle adequately in conventional settlement lagoons, it shall be subject to additional treatment by flocculent. In such a scenario, secondary lagoons or a containerised system would be used in which flocculent dosing and final settlement would occur. Particular requirements for flocculent dosing (in terms of type of dosing, concentration, flocculent type etc) would be determined on an observational basis to suit the nature of suspended solids within the runoff measured on site. Treated water from settlement ponds would be discharged over intact vegetation for further treatment.

Typical settlement lagoon arrangements are shown on drawing **DWG07** included in **Annex B.**

8.5.3 Vegetative Filtration

In areas not classified as improved agricultural grassland; all runoff from swales, ponds, or other pumped discharges will be dispersed over undisturbed intact vegetation, nominally over agreed riparian watercourse buffer zones, in order to allow vegetative filtration of runoff prior to water entering the receiving watercourse.

8.5.4 Dewatering and Washout Pits

Washout pits to be located local to significant excavations will be designed to accommodate the anticipated volume of contaminated water to be removed from the excavation, either through unavoidable surface water runoff or accumulation of shallow groundwater. Washout pits shall be sized to accommodate the volume for a period until such times as the water has been clarified, with the water subsequently pumped out and into the site drainage system.

CONSENTED (LA01/2018/0200/F)

8.6 Temporary Spoil Management

Management of spoil, including temporary and permanent spoil generated from excavations, will be considered as part of a Construction Method Statement to be approved by the planning authority prior to construction and is discussed further within **Annex 3 of Outline CEMP : Peat Management Plan**. Site and drainage design would ensure the following in terms of drainage for temporary spoil management areas:

- There will be no depositing of material within the watercourse buffer zones.
- Spoil shall be placed in such a manner so as to ensure no ponding of surface water on top of spoil heaps. Temporary spoil should be graded to ensure that all direct precipitation will run directly off the surface.
- Temporary spoil deposition areas will be designed to ensure that natural flow paths (drainage channels) are not be altered or blocked by deposited spoil.
- Spoil heaps in the vicinity of watercourses would be surrounded on the low side with silt fences in order to trap fine sediment in runoff.

8.7 Foul Drainage

In order to prevent the requirement for a discharge of treated effluent of poor quality to a watercourse or percolation to groundwater that may cause nutrient enrichment of habitats, foul water from temporary compounds and the permanent substation will drain to temporary or permanent chemical facilities.

There will be no treated foul water discharge from the facilities. Emptying of chemical facilities (by tanker or similar) will be undertaken by a licensed haulier and waste will be disposed of at a suitable licensed waste disposal facility.

Detailed foul design (to establish suitability of cesspool or septic tank etc.) will be determined at detailed design stage incorporating results from percolation tests.

CONSENTED (LA01/2018/0200/F)

9 CONSTRUCTION PHASE – DETAILED CONSIDERATIONS

Specific requirements to be imposed on any Contractor involved in the construction of the scheme will be further detailed in a Construction Method Statement to be approved by NIEA / the relevant local planning authority prior to construction.

All site personnel will be made aware of their environmental responsibilities at the site induction prior to being allowed to work on site, and through the production of a Method Statement, outlining Environmental Requirements for Sub-Contractors, which will include environmental emergency response procedures to deal with spillages, should they occur.

This section of the report outlines the steps which will be undertaken during the construction phase of the project to ensure compliance with the relevant guidance and legislation outlined in Section 6.1 of this report. Site visits by the SuDS Engineer will be agreed in advance and will be undertaken at various stages of the construction process to ensure that the proposed SuDS scheme is being constructed in line with the design.

Essential mitigation measures relevant to controlling erosion and runoff from construction of the SuDS are described in NIEA's Guidance for Pollution Prevention and Pollution Prevention Guidance notes.

9.1 Planning and Phasing of Drainage Works

9.1.1 Site-Wide Requirements

Temporary or permanent drainage and silt management features (SuDS) will be constructed prior to earthworks (including preliminary or enabling works) proceeding to construct any linear works (tracks / hardstanding areas / cable routes), turbine bases, and other infrastructure. Drainage will be provided to temporary works and reinstated to suit the final footprint of the completed development.

Temporary measures may include:

- Temporary silt fences erected in areas where risk of pollution to watercourses has been identified e.g. watercourse crossing locations and areas where tracks or other infrastructure lie within watercourse buffer zones.
- Upslope cut-off drainage channels approximately parallel to the proposed track alignment installed in advance of any excavated cuttings for the track or turbine hardstanding areas. This will prevent washout by surface flows of exposed clays in excavations and fine sediments in track makeup, and increase efficiency of silt removal in future trackside drainage swales.
- Watercourses, drains, natural flow paths and cut-off drain outlet locations should be identified and charted, in order to ensure that piped crossings can be installed in advance of or adjacent to the track construction.
- Settlement ponds should be constructed in advance of commencing excavations for foundations and at any other locations identified as required at detailed design stage.
- Trackside drainage swales should be installed in parallel with track construction. Note that this may require that drainage swales are reformed on an ongoing basis as temporary track alignments are modified to their eventual finished design level.

In addition, spoil management is to be planned in advance of earthworks and on an ongoing basis, in order to allow planning of drainage required in advance of spoil being deposited.

Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving watercourses.

9.1.2 Timing of Works

Works on the site likely to cause a high risk to surface water will be programmed so as to avoid unfavourable prevailing ground conditions and high volumes or extended periods of seasonal rainfall. Site clearance will take place in advance of construction works.

CONSENTED (LA01/2018/0200/F)

9.2 Specific Construction Phase Measures

9.2.1 Working in the Vicinity of Water / Buffer Zones

The following procedures apply to the general construction activities either within watercourses or in the vicinity of watercourses (i.e. within buffer zones):

- Due cognisance will be given to the prevailing ground conditions and season when programming the execution of the works, in order to seek to undertake the works in a period with low potential to cause introduction of silt laden runoff to the watercourse.
- Works will plan so that trackside drains do not discharge directly into watercourses, but rather through a buffer area of adequate width or via a constructed settlement feature such as pond or sequence of silt fences.
- Cement and concrete will be kept outwith buffer zone to avoid contamination of watercourses.
- Runoff from excavations will NOT be pumped directly to watercourses. Where dewatering of excavations is required, water shall be pumped to the head of a treatment train (swale, basin, or detention pond) in order to receive full treatment prior to re-entry to the natural drainage system.
- SuDS treatment techniques will be utilised to remove silts from runoff prior to the discharge of flows over open vegetated areas.

Construction buffer zones to drainage features will be set as stated within **Chapter 9: Geology and Water Environment** and are shown on the accompanying Drainage Management Drawings within **Annex A.**

In the event that a specific short term risk to water quality is identified on site, specific localised measures will be implemented including:

- Placing temporary filtration silt fences within drainage channels where siltation is observed.
- Installing temporary constructed settlement features such as sumps or settlement ponds / lagoons where required.

9.2.2 Watercourse Crossings

Residual risk to watercourses specific to the construction stage will be fully addressed in the Contractor's construction method statement and, in addition to those points outlined in Section 8.2.2, will include the following:

- Works to install all crossings shall be programmed to coincide with a period of anticipated low drain flow and firm ground conditions in order to minimise potential for silt laden runoff draining toward the stream.
- Geotextile or equivalent splash-guards shall be erected to the track embankment over the culvert or clear span crossing prior to trafficking.

Additional particular considerations (dependant on the crossing type) are stated subsequently.

9.2.2.1 Bottomless Culvert Crossings

Fisheries considerations shall be as per the guidance stated in Guidelines for Fisheries Protection during Development Works[10] as published by Loughs Agency in the absence of particular guidelines outside of Loughs Agency controlled catchments. Where bottomless culvert crossings are determined to be required:

- Works to construct bottomless culvert footings shall be constructed from the bank; civil works within the stream bed will be eliminated wherever practicable.
- Channel and banks will be retained intact within the bottomless culvert.

[10] Loughs Agency (2011) Guidelines for Fisheries Protection during Development Works. Available: http://www.loughs-agency.org/wp-content/uploads/2015/05/loughs-agency-guidelines-for-fisheries-protection-during-development-works.pdf [Accessed 17/06/201]

CONSENTED (LA01/2018/0200/F)

9.2.2.2 Culvert Crossings

The following shall apply to the construction of culvert crossings at the site:

- The channel will be dammed upstream of the proposed culvert location using sandbags or similar in order to provide a dry working environment at the culvert location. Dammed flows will be pumped out of channel and returning directly to the drain shortly downstream of the culvert location. Erosion protection shall be placed at the point of pump return. All pumping will be controlled on a contractor permit-to–pump scheme, such that pumping operations can be carefully planned, installed and monitored.
- Geotextile silt fences shall be installed adjacent to the drain bank upstream and downstream of the culvert location in order to filter contaminated runoff that may be caused by plant movement associated with the culvert installation. A sequence (minimum 2 no.) in-channel geotextile check dams will be installed within the drain channel downstream of the culvert location and downstream of the pump-return.
- The stream bed shall be excavated to permit the culvert to be installed at a suitable level to ensure a constant depth of water within the culvert in order to allow potential for fish passage.
- The culvert comprising pre-cast concrete or pre-formed plastic pipes shall be installed and backfilled with suitable aggregate. Headwalls and scour protection to the drain bed shall be formed at the culvert inlet and outlet using dry formed components (lean-mix concrete-filled sandbags or similar). Washed gravel or pebbles (including if feasible that material recovered from the natural substrate excavated to permit the culvert installation) shall be introduced to cover and protect the extent of the drain channel affected by excavations. No wet concrete or cementitious material shall be required to be used within the drain channel.
- Over pumping and upstream dams shall be removed and water permitted to pass through the culvert. Downstream in-channel filtration check dams shall be retained and renewed as necessary in order to trap sediment until any residual washout of sediment from the exposed excavation has stabilised to a normal (pre-construction) level.

9.2.3 Turbine Bases and Crane Pads

Excavated turbine foundations are likely to result in large volumes of displaced excavated material as spoil, as well as concrete operations. Specific measures are therefore required to manage potential for silt laden runoff from spoil, silt laden runoff from pumped dewatering, and cementitious contamination in pumped dewatering from turbine bases.

Concrete will not be allowed to enter watercourses under any circumstances, and drainage from excavations in which concrete is being poured will not be discharged directly into existing watercourses without appropriate treatment. Delivery trucks, tools and equipment will be cleaned at designated washout areas located conveniently and within a controlled area of the construction compound. Runoff from wash-out areas will be appropriately stored within bunded containers and removed off-site by an appropriate waste disposal company. In addition the following drainage measures will apply;

- Installation of cut-off drains around the working areas to intercept clean surface runoff and divert it around and away from the works.
- Minimising the stockpiling of materials and locating essential stockpiles outside any watercourse buffer zone.
- Polluted (silt laden) water collected in the base of any excavation would be gathered in a sump, and pumped at a low flow rate into either the mini-settlement pond or track swale for treatment. Dewatering of excavations direct to watercourses will not be permitted.
- The foundation working areas should be re-vegetated as soon as possible after construction.

9.2.4 Cable Trenches

It is noted that where feasible, the design of cable trench alignment will avoid the creation of preferential flow routes. The following shall apply to the construction of all cable trenches at the site:

- To minimise impacts from disturbance, cables will be laid in small trenches along the side of access tracks, as far as possible.
- Due cognisance will be given to the prevailing ground conditions and season when programming the execution of the works, in order to seek to undertake the works in a period with low potential to cause introduction of silt laden runoff from excavations.

CONSENTED (LA01/2018/0200/F)

- Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches, in order to minimise opportunity for the ingress of water into open trenches.
- Temporary silt traps will be provided in longer trench runs and on steeper slopes.
- Where constructed trackside swales are disturbed by cable installation, swale slopes will be correctly reinstated post infilling of the cable trench.

9.2.5 Dewatering

In order to control dewatering activities and to ensure that all dewatering allows for pollution prevention measures, a permit-to-work system will be imposed on the Contractor, particularly to ensure pumped dewatering from excavations is controlled. A permit will be required to be issued to a competent person prior to allowing any specific dewatering to commence.

9.2.6 Use of Flocculant

The use of flocculant is generally discouraged where possible in favour of using conventional settlement techniques to remove suspended solids, due to the preference to avoid introducing artificial chemicals to the surface water environment.

Where flocculant is ultimately required on a temporary basis, due to the presence of extremely fine particles within clays or aggregates that cannot be effectively removed using filtration or settlement ponds or where a particular pollution risk is observed due to weather conditions, then it will be installed at settlement lagoons per the detail shown on drawing **DWG07** in **Annex B.**

Flocculant would generally be installed in solid form in a culvert with water allowed to flow around the flocculant block. A datasheet for the flocculant type preferred, comprising a cationic polyacrylamide, is included in **Annex C**, confirming that the product is non-toxic – refer specifically to datasheet Section 12.

Use of flocculant, which will be on a temporary basis-only, will be strictly regulated with a permit scheme to be put in place and competent person installed to oversee installation, monitoring and removal of flocculant. The permit scheme will record the location, time and date of installation, date of removal, and the quantity of product used, and this schedule will be maintained for inspection by the interested regulatory body, nominally NIEA:WMU or Loughs Agency.

Flocculant would be required to be removed immediately upon reduction of the observed pollution risk that prompted its use.

9.2.7 Excavated Track Drainage

Where an excavated type track construction is specified, all track runoff (polluted water) would be directed to flow to track-side drainage channels as per Section 8.4, to be installed as tracks are constructed.

Due to anticipated low rates of infiltration and high ground water tables, as is common in predominately peat conditions, it is likely across the majority of the site that flows will not percolate through the base of the swale and will therefore be discharged from the swale via frequent spillways created through the embankments on the downhill sides of the access tracks.

Drainage swales and track shoulders will be re-vegetated as soon as feasible after completion of the track and drainage across the site. Full details on the re-establishment of vegetation are outlined within **Chapter 6: Habitat Assessment** and **Technical Appendix 6.8: Outline Habitat Management Plan**.

Typical drainage installation for excavated tracks is shown on drawing **DWG05** in **Annex B.**

9.2.8 Floated Track Drainage

Where a floating type track construction is specified, existing drainage paths are not to be unnecessarily re-routed or changed. Existing drainage paths and overland flow-routes should be maintained through the placement of drainage pipes at existing land drainage locations and/or at regular intervals.

Track runoff will be directed over the edge of the track structure to discharge across existing vegetation to allow filtration / settlement of suspended solids. Typical drainage installation for floated tracks is shown on drawing **DWG06** in **Annex B.**

CONSENTED (LA01/2018/0200/F)

9.3 Habitat Management Works

The **Revised Appendix 6.8: Habitat Management Plan** (submitted in April 2019 includes measures for re-wetting of an area for snipe habitat.

The measures are intended to include installation of small corrugated plastic sheet piles of a type that necessarily would be installed by hand or by mini excavator. The piles would be installed perpendicular to the channel and to be flush with outlying ground levels, with the intention of causing water to back up behind the pile to overtop at ground level.

Such works would have a wider beneficial effect to the hydrological environment, by causing:

- Increased natural attenuation of rainfall-fed surface water within the restored bog, leading to a reduced rate of runoff from the drained bog and a reduction in downstream peak river flood rates, which would have a beneficial effect in relation to flood risk from rivers and surface water.
- Reduced velocity in runoff from drains, causing reduced scour within the degraded peat channels, and an associated reduction in suspended solids and organic matter within runoff to watercourses.

A temporary and short-term effect during dam placement may cause release of disturbed sediment from the channel into downstream watercourses. Practical measures to mitigate this are as follows:

- Temporary measures (such as silt fences) are to be placed adjacent to protected watercourses downstream of the area of ditch blocking.
- Dam installation shall be sequenced from downstream to upstream, so that the downstream dams installed initially would cause a stilling effect allowing settlement of reduced quality runoff from upstream dams.
- Installation shall be manual or by mini-digger with low-bearing tracks to minimize cutting up of the vegetated ground cover.

The area where ditch blocking for habitat improvement is proposed is indicated on drawing **DWG01** in **Annex A.**

CONSENTED (LA01/2018/0200/F)

10 MAINTENANCE

10.1 Construction Phase

The following is intended to inform the detailed drainage / SuDS maintenance manual for the construction phase.

It is envisaged that an Engineer specialising in surface water management and SuDS would be required to undertake regular site inspections during the construction phase of the wind farm, in order to validate that any detailed SuDS design and associated requirements to ensure construction methods are adhered to on site, and in order to identify areas where additional or enhanced mitigation is required.

In addition to the regular site inspections carried out by the Engineer, the following construction inspections will be undertaken during the construction phase of the project. The list is not exhaustive and should be added to as per the requirements of the site.

10.1.1 Swales / Check Dams

- All check dams and settlement basins to be checked weekly in dry weather and daily during periods of heavy rainfall via a walkover survey during the construction phase. Excess trapped silt to be removed and disposed of/ re-used as may be agreed with relevant authorities.
- Where check dams have become fully blocked with silt, they should be replaced. Procedure for replacement of the check dam as follows:
  - silt deposits to be removed from the upstream side of check dams.
  - removed silt to be buried or re-used by spreading in an area of the site where surface runoff will not convey silt deposits back to a watercourse.
  - where there are regular incidents of check dam blockage further check dams to be installed (every 15-20 m intervals) within the swales.
- Monitor side slopes of swales and basins and reinstate any areas of slope slippage by battering back or otherwise as may be appropriate;
- Should there be noticeable effects of erosion along the swales or at discharge points, suitable erosion protection measures such as placement of large stones or erosion protection textiles should be installed at the area affected;
- Any temporarily stored or stockpiled material will be placed in a manner to ensure stability and set back sufficiently far such that in the case of unforeseen collapse, spoil would not cause infilling of swales.

10.1.2 Settlement / Detention Basins

- Basin inlets to be cleared of debris.
- Silt in aggregate forebays to be removed by excavator and disposed of. Any aggregate removed to be replaced with clean stone.
- Any flow control device (orifice, weir or similar) to be checked and cleared of any debris.

10.2 Operational Phase

A post construction phase maintenance manual will be produced upon production of as built drainage survey for the site. This maintenance manual will contain recommendations identified above, augmented with further drainage findings collected during the construction phase which are deemed to assist in provision of long term drainage management for the site.

CONSENTED (LA01/2018/0200/F)

11 ASSESSMENT OF MITIGATION

11.1 Assessment of Mitigation against WFD Objectives

Table 11.1: Schedule B – Assessment of Specific Mitigation Against WFD Objectives

<table>
<tr><td rowspan="3">Scheme Component / Effect</td><td>Objective 1</td><td>Objective 2</td><td>Objective 3</td><td>Objective 4</td></tr>
<tr><td>To prevent deterioration in the ecological status of the waterbody.</td><td>To prevent the introduction of impediments to the attainment of Good WFD status for the waterbody.</td><td>To ensure the attainment of the WFD objectives for the waterbody are not compromised.</td><td>To ensure the achievement of WFD objectives in other waterbodies within the same catchment are not permanently excluded or compromised.</td></tr>
<tr><td>Describe mitigation required to meet objective 1:</td><td>Describe mitigation required to meet objective 2:</td><td>Describe mitigation required to meet objective 3:</td><td>Describe mitigation required to meet objective 4:</td></tr>
<tr><td>Changes in Runoff and Flow Patterns
In relation to the surface water body.</td><td colspan="4">Detailed in Sections 3.3 to 3.4, and summarised as follows:
• Track and hardstanding runoff will be handled by sheet flow to trackside ditches or swales;
• Tracks and hardstanding areas are to be constructed from unbound aggregate and are not surfaced, thus helping to reduce runoff volumes;
• Piped under track drainage will be provided with associated sumps and check dams. The under track drainage will provide a means for flows to pass from a swale on the uphill side of the slope to the downhill side of the slope;
• In cases where the tracks must run significantly downhill, transverse drains (‘grips’) will be constructed where appropriate in the surface of the tracks to divert any runoff flowing down the track into the adjacent drainage ditch/across open ground;
• Rate and volume of runoff will be attenuated using check dams. Attenuation features will reduce flow velocities preventing scour, and allow settlement of silts prior to discharge;
• Drainage design will ensure natural streams are piped directly through appropriately sized drainage pipes on their original alignment;
• Settlement ponds will be designed to cater for infilling and rehabilitation post construction phase of the project; however subject to requirements of habitat management or enhancement plans for the site, water features may be retained for the whole life of the project as a means of providing wetland habitat on the site;
• Buffer zones to water features will be established.</td></tr>
</table>

CONSENTED (LA01/2018/0200/F)

Table 11.1: Schedule B – Assessment of Specific Mitigation Against WFD Objectives

<table>
<tr><td rowspan="3">Scheme Component / Effect</td><td>Objective 1</td><td>Objective 2</td><td>Objective 3</td><td>Objective 4</td></tr>
<tr><td>To prevent deterioration in the ecological status of the waterbody.</td><td>To prevent the introduction of impediments to the attainment of Good WFD status for the waterbody.</td><td>To ensure the attainment of the WFD objectives for the waterbody are not compromised.</td><td>To ensure the achievement of WFD objectives in other waterbodies within the same catchment are not permanently excluded or compromised.</td></tr>
<tr><td>Describe mitigation required to meet objective 1:</td><td>Describe mitigation required to meet objective 2:</td><td>Describe mitigation required to meet objective 3:</td><td>Describe mitigation required to meet objective 4:</td></tr>
<tr><td>Silt / Suspended Solid pollution of surface water
In relation to the surface water body.</td><td colspan="4">Detailed in Sections 3.3 to 3.4, and summarised as follows:
• Clean / dirty water separation will be maintained on site in all practicable instances;
• A treatment train will be designed with a minimum of two stages of treatment for polluted runoff from the site during the construction phase;
• All treatment settlement features (check dam backwaters and ponds) are to be designed to offer sufficient retention time to settle out the silt grain sizes anticipated;
• Silt laden runoff within trackside swales will be treated through the provision of small check dams at specified centres along the swales;
• Areas stripped of vegetation should be kept to a minimum and any stripped vegetation should be reinstated on slopes as early as possible.
• Earth spillages into any existing streams will also be avoided;
• Any dewatering from excavations will be via surface silt traps, check dams and settlement ponds to ensure sediment does not enter surrounding watercourses;
• Runoff from new hardstanding areas will be collected and attenuated before discharge to receiving drainage networks.</td></tr>
<tr><td>Chemical Pollution of surface water and groundwater
In relation to the surface water body and groundwater body.</td><td colspan="4">Detailed in Sections 3.3 to 3.4, and summarised as follows:
• Appropriate site management measures will be taken to ensure that runoff from the construction site is not contaminated by fuel or lubricant spillages;
• There will be no discharge of trade effluent, sewage effluent or contaminated drainage into any watercourse.</td></tr>
</table>

CONSENTED (LA01/2018/0200/F)

12 SUMMARY AND CONCLUSION

12.1 Assessment of Post-Construction WFD Status

In all instances, the mitigation described previously is sufficient to meet the WFD Objectives 1 to 4. The post-construction assessment of WFD elements for the on-site WFD waterbody is summarised in Table 12.1 below.

Table 12.1: Summary of post-construction WFD Status

WFD Element	Current Status	Assessed Post-Works Status - No Mitigation	Assessed Post-Works Status - With Mitigation
Curly River (2015)			
Benthic Invertebrates	Good	Poor	Good
Phytobenthos	Good	Good	Good
Ammonia	Good /High	High	Good /High
Dissolved Oxygen	High	Moderate	High
pH	High	Good	High
Soluble Reactive Phosphate	High	Poor	High
Biological Oxygen Demand	High	Poor	High
Temperature	High	Moderate	High
Hydrological Regime	High	Moderate	High
Morphological conditions	-		
Magilligan Groundwater Body			
Chemical Status	Poor	Poor	Poor

12.2 Summary

This Water Framework Assessment has been undertaken to determine the effects of Dunbeg South Wind Farm on the ecological quality status of waterbodies potentially affected by construction activities associated with the development.

In order to consider and assess potential impacts, the elements that constitute the current and predicted status for the waterbodies affected have been considered in the context of the proposed development initially assuming no mitigation measures are implemented. This approach allows the identification of the activities with the potential to cause an adverse impact on the current and / or predicted WFD status of the waterbody.

Consideration was then given to the design and mitigation measures incorporated into the scheme. Further mitigation measures were outlined where required and general pollution prevention measures were presented.

12.3 Conclusion

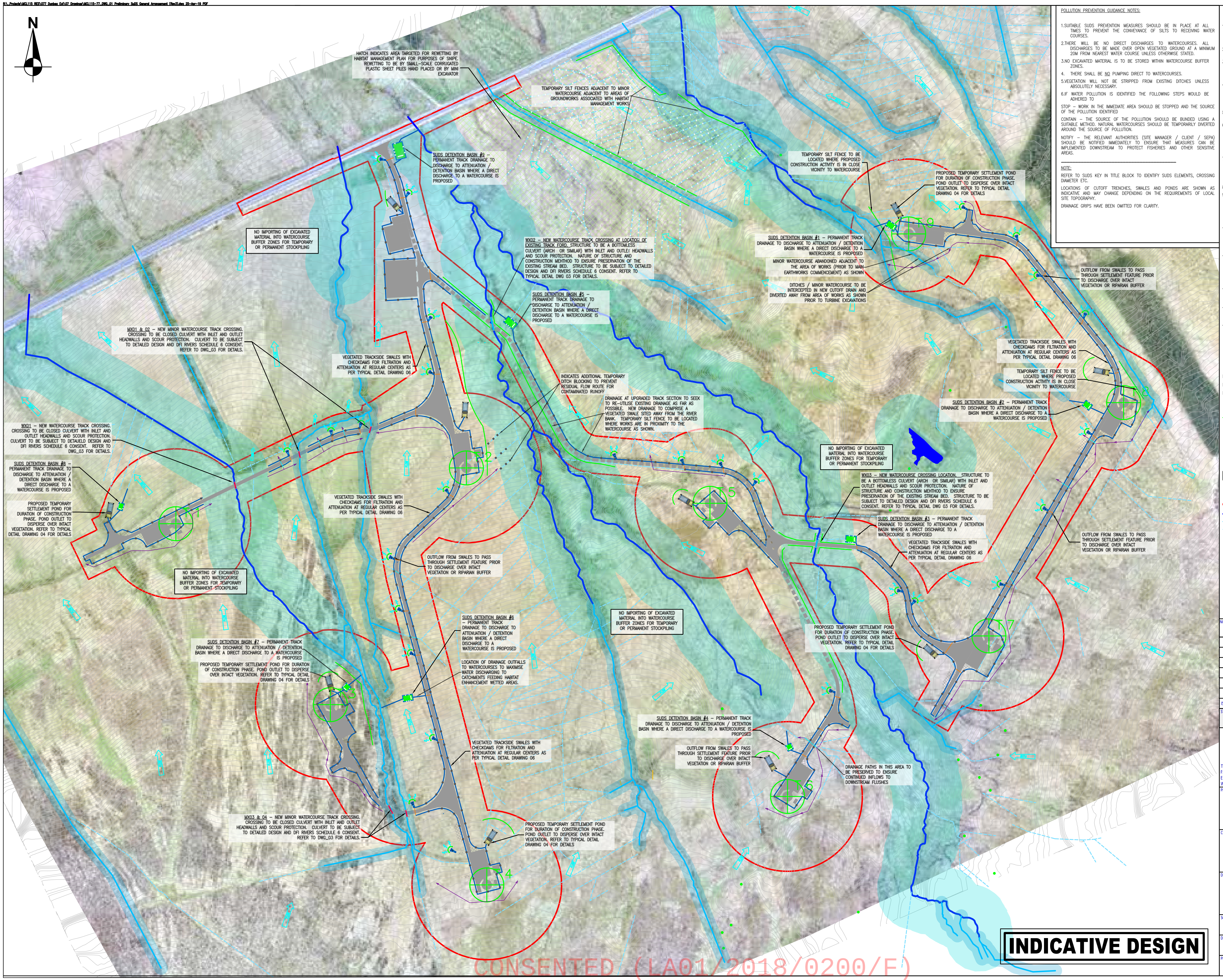
Following incorporation of site-wide general binding mitigation control measures, NIEA approved Guidance for pollution prevention (GPPs) and pollution prevention guidelines (PPGs), and site specific mitigation, no adverse effect is anticipated to the Water Framework Directive classification of the affected waterbodies caused by the Dunbeg South Wind Farm Development.

CONSENTED (LA01/2018/0200/F)

Annex A

Drainage Management - General Arrangement

CONSENTED (LA01/2018/0200/F)



POLLUTION PREVENTION GUIDANCE NOTES:

1.SUITABLE SUDS PREVENTION MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SILTS TO RECEIVING WATER COURSES.

2.THERE WILL BE NO DIRECT DISCHARGES TO WATERCOURSES. ALL DISCHARGES TO BE MADE OVER OPEN VEGETATED GROUND AT A MINIMUM 20M FROM NEAREST WATER COURSE UNLESS OTHERWISE STATED.

3.NO EXCAVATED MATERIAL IS TO BE STORED WITHIN WATERCOURSE BUFFER ZONES.

4. THERE SHALL BE NO PUMPING DIRECT TO WATERCOURSES.

5.VEGETATION WILL NOT BE STRIPPED FROM EXISTING DITCHES UNLESS ABSOLUTELY NECESSARY.

6.IF WATER POLLUTION IS IDENTIFIED THE FOLLOWING STEPS WOULD BE ADHERED TO

STOP – WORK IN THE IMMEDIATE AREA SHOULD BE STOPPED AND THE SOURCE OF THE POLLUTION IDENTIFIED

CONTAIN – THE SOURCE OF THE POLLUTION SHOULD BE BUNDED USING A SUITABLE METHOD. NATURAL WATERCOURSES SHOULD BE TEMPORARILY DIVERTED AROUND THE SOURCE OF POLLUTION.

NOTIFY – THE RELEVANT AUTHORITIES (SITE MANAGER / CLIENT / SEPA) SHOULD BE NOTIFIED IMMEDIATELY TO ENSURE THAT MEASURES CAN BE IMPLEMENTED DOWNSTREAM TO PROTECT FISHERIES AND OTHER SENSITIVE AREAS.

NOTE:

REFER TO SUDS KEY IN TITLE BLOCK TO IDENTIFY SUDS ELEMENTS, CROSSING DIAMETER ETC.

LOCATIONS OF CUTOFF TRENCHES, SWALES AND PONDS ARE SHOWN AS INDICATIVE AND MAY CHANGE DEPENDING ON THE REQUIREMENTS OF LOCAL SITE TOPOGRAPHY.

DRAINAGE GRIPS HAVE BEEN OMITTED FOR CLARITY.

NOTES

1.DRAINAGE LAYOUT SHOWN IS INDICATIVE AND IS INTENDED TO BE FURTHER DEVELOPED POST DETERMINATION OF THE ASSOCIATED PLANNING APPLICATION. DRAINAGE FEATURES SHOWN ARE SUBJECT TO CHANGE DEPENDANT ON DETAILED INFRASTRUCTURE DESIGN AND LOCAL TOPOGRAPHY.

2.LOCATION OF CROSSINGS, SWALES, BREAKOUTS, SETTLEMENT PONDS ETC. IS INDICATIVE ONLY FOR PURPOSES OF PRELIMINARY PLANNING DRAWING LAYOUT.

3.THE LEVEL OF SILT IN RUNOFF DURING CONSTRUCTION IS TO BE MONITORED VISUALLY AND EXCESSIVE SILT LEVELS IN ANY AREA TO BE TEMPORARILY MANAGED BY PLACING SILT FENCES & GEOTEXTILE BARRIERS AT THE PROBLEM AREAS.

4.SUDS SYSTEM TO BE CONSTRUCTED PRIOR TO, OR AT THE SAME TIME, AS THE ACCESS ROAD. INTERIM MEASURES SUCH AS THE PLACEMENT OF SILT FENCES TO BE EMPLOYED IN ALL INSTANCES WHERE WORK CARRIED OUT TO CONSTRUCT THE ACCESS ROAD IS LIKELY TO CAUSE ADVERSE ENVIRONMENTAL IMPACTS.

5.SUITABLE PREVENTION MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SILTS TO RECEIVING WATER COURSES.

6.DRAINAGE SWALES TO BE CONSTRUCTED ADJACENT TO THE ACCESS TRACK. REGULAR CROSS DRAINS TO BE LOCATED ALONG ACCESS TRACKS TO PREVENT EXCESSIVE VOLUMES OF WATER COLLECTING IN THE SWALES. SURFACE WATER WILL NOT BE ALLOWED TO DISCHARGE DIRECTLY INTO EXISTING WATER COURSES. SUMPS /PONDS TO BE CONSTRUCTED FOR PEAT AND SILT COLLECTION FROM EXCAVATIONS & SPOIL HEAPS.

7.ROADSIDE SWALES TO BE SHALLOW WITH MODERATE GRADIENTS TO PREVENT SCOURING. IN STEEP AREAS CHECK-DAMS HAVE BEEN DESIGNATED TO REDUCE FLOW RATE & PROVIDE SOURCE CONTROL SILT CONTAINMENT. WHERE NECESSARY THESE HAVE BEEN DESIGNATED IN CONJUNCTION WITH SETTLEMENT PONDS AND/OR CROSS-DRAINS.

8. AREAS STRIPPED OF VEGETATION SHOULD BE KEPT TO A MINIMUM.

9.CLEAN STONE FLOW CONTROL CHECK-DAMS TO BE LOCALLY WON WELL GRADED STONE. AGGREGATE SIZE FOR STONE CHECK DAMS TO BE TYPICALLY 20/40MM CLEAN STONE. ON SLOPING SECTIONS OF THE ACCESS ROAD, 20/40MM CHECK DAMS TO BE PROTECTED FROM WASHING AWAY THROUGH THE PLACEMENT OF 100MM STONE ON THE DOWNHILL FACE OF THE CHECK-DAM.

10.BUILD UP OF SILT LEVELS AT CHECK-DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING MAINTENANCE PROGRAM DURING THE CONSTRUCTION PHASE. WHERE CHECK-DAMS BECOME CLOGGED WITH SILT OR VEGETATION, STONE CHECK DAM TO BE REMOVE AND REPLACED.

11.SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDANT UPON LONGITUDINAL GRADIENT OF SWALE. LOCATION OF FILTRATION CHECK DAMS TO BE GENERALLY AS PER THE SITE LAYOUT PLAN. FLOW FILTRATION CHECK DAMS TO BE CONSTRUCTED FROM RECYCLED RAILWAY SLEEPERS OR SIMILAR APPROVED. MATERIALS USED TO CONSTRUCT FLOW FILTRATION CHECK DAM TO BE BOLTED TO SUPPORTS WHERE ACCESSIBLE.

12.OIL FUEL SHOULD BE STORED WITHIN CONTAINMENT AND CEMENT SHOULD BE MIXED WITHIN COMPOUND / CONTAINMENT, TOOLS WASHED IN THE SAME AREA AND WATER RECYCLED (IN THE CEMENT MIX).

13.WATERCOURSES SHOWN ARE AS PER CLIENT PROVIDED OS MAPPING AND DRAWINGS; LOCATIONS SHOWN ARE APPROXIMATE ONLY AND MAY REQUIRE FURTHER INVESTIGATION FOR DETAILED DESIGN.

14.NO DIRECT DISCHARGE TO WATERCOURSES – MAINTAIN APPROPRIATE VEGETATION BUFFER.

SuDS KEY

UNDERTRACK DRAINAGE (CONSTRUCTION RUNOFF)
UNDERTRACK DRAINAGE (NATURAL RUNOFF)
PROPOSED NEW TRACK
PROPOSED UPGRADE TO EXISTING TRACK
DRAINAGE SWALE / INDICATIVE BREAKOUT & CHECK DAM
NATURAL RUNOFF CUT-OFF DITCH
SILT FENCE
WATERCOURSE / SIGNIFICANT DRAIN CROSSING
SETTLEMENT POND TO BE INSTALLED PRIOR TO CONSTRUCTION OF TURBINE BASE
ATTENUATION / DETENTION LAGOON
50M BUFFER TO WATERCOURSE
10M BUFFER TO DRAIN / MINOR WATERCOURSE
HMP DITCH BLOCKING AREA / INDICATIVE DAM PLACEMENT

MAP KEY

PLANNING APPLICATION BOUNDARY
MAJOR WATER COURSE
MINOR WATERCOURSE / DRAIN / CHANNEL
EPHEMERAL / LAND DRAINAGE
NATURAL OVERLAND FLOW DIRECTIONS

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
03219D1001-01

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
3	DKS	DKS	18/04/2019	CONTOUR PLOUGHING OMITTED, REVISED HMP INCORPORATED (SNIPE DITCH BLOCKING)
2	CD	DKS	30/10/2017	FOR PLANNING
1	MR	DKS	05/10/2016	ORIGINAL DRAFT – FOR INFORMATION

STATUS
FOR FEI – APRIL 2019

McCloy Consulting
T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West),
Carnmoney Road North,
Newtownabbey,Co. Antrim
BT36 5QA

PROJECT
PROPOSED DUNBEG SOUTH WIND FARM

CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT DRAWINGS
SITE GENERAL ARRANGEMENT
SHEET 1

SCALE	ORIGINAL SIZE	
1: 5000 @ A3	A3	
DRAWN	CHECKED	DATE
MR	DKS	05/10/2017
PROJECT No.	DRAWING No.	ISSUE NO.
MCL115-77	DWG_01	3

CONSENTED (LA01/2018/0200/F)

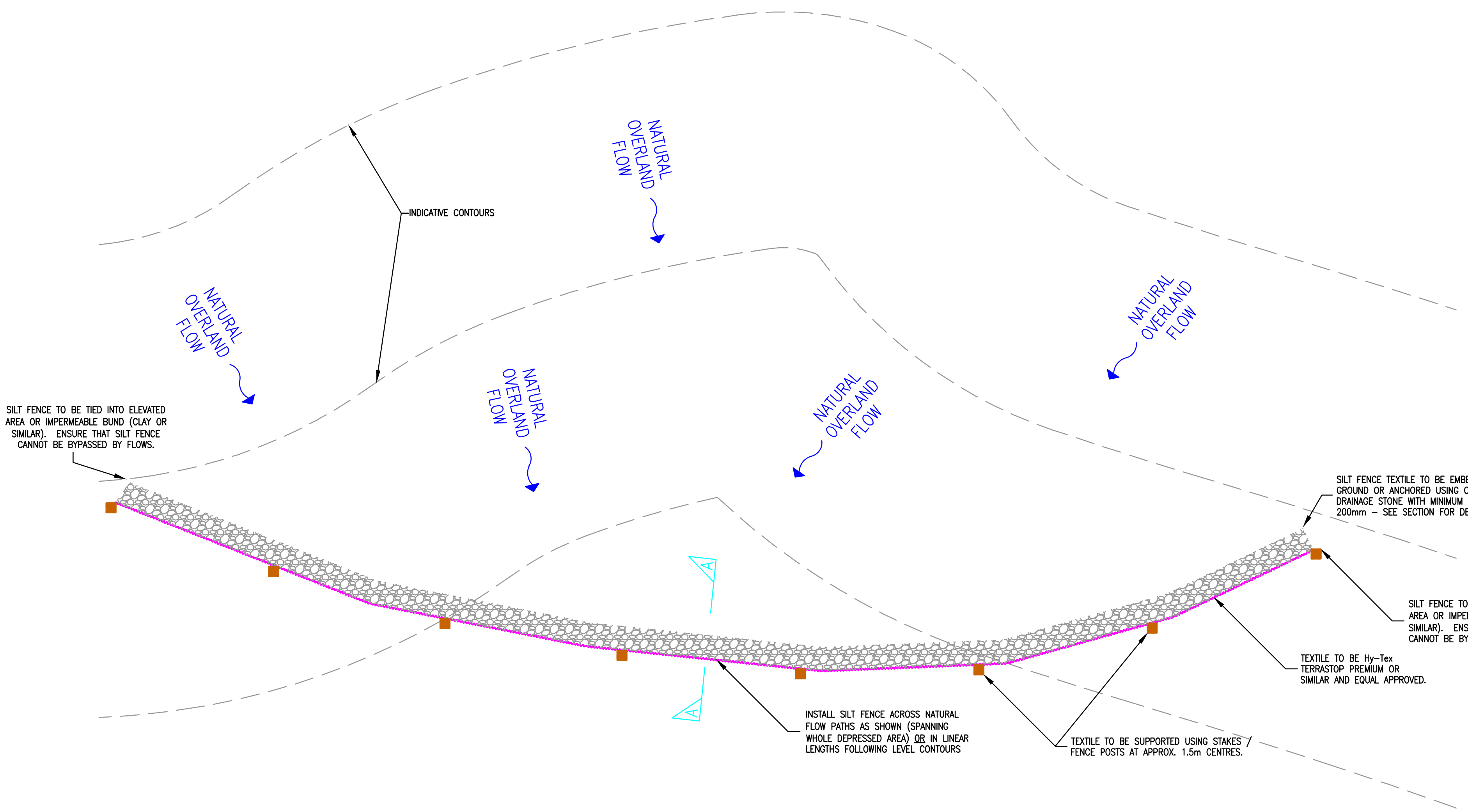
Annex B

Drainage Management – Typical Details

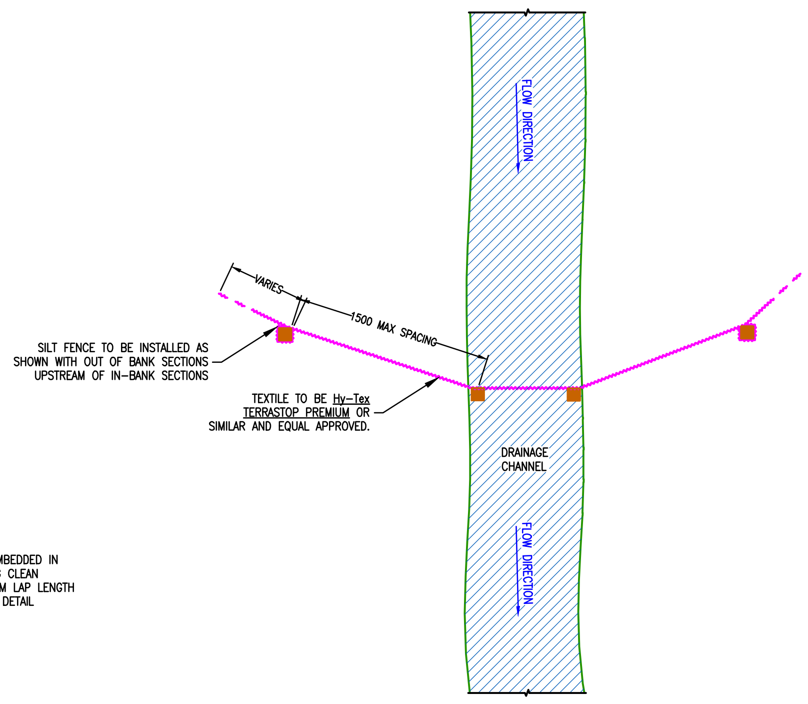
MCL115-77 DWG 02	Silt Fence
MCL115-77 DWG 03	Bottomless Culvert
MCL115-77 DWG 04	Piped Culverts
MCL115-77 DWG 05	Drainage at Excavated (Cut) Track
MCL115-77 DWG 06	Drainage at 'Floated' Track
MCL115-77 DWG 07	Settlement Lagoon Arrangement
MCL115-77 DWG 08	Attenuation Pond

CONSENTED (LA01/2018/0200/F)

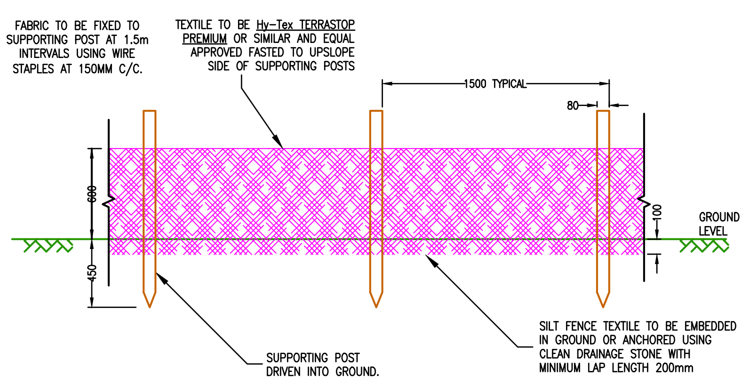
\\mccserver\shared_Projects\MCL115 RES\077 Dunbeg Ext\07 Drawings\MCL115-77_DWG_02-08 Preliminary SuDS Typical Details [ISSUE 2].dwg 2-Nov-17 None



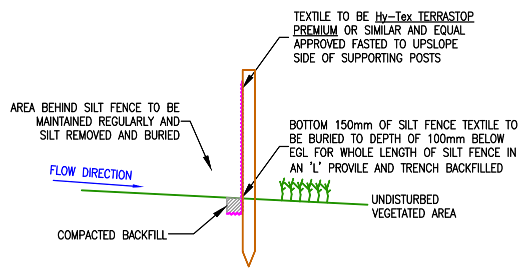
TYPICAL OVERLAND SILT FENCE PLAN
SCALE 1:25



TYPICAL CHANNEL SILT FENCE PLAN
SCALE 1:25

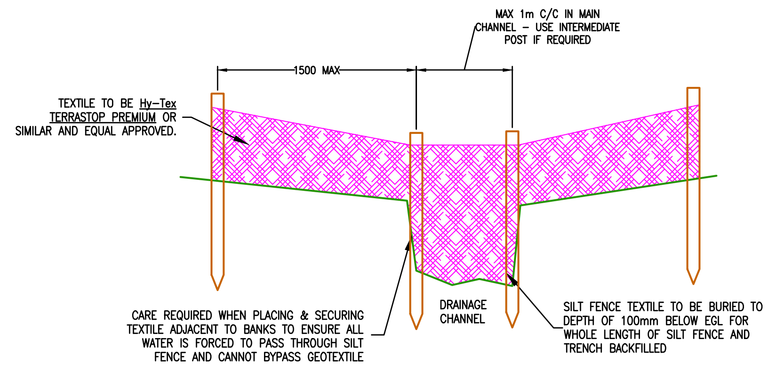


ELEVATION
SCALE 1:25



SECTION A-A
BURIED TYPE OPTION
SCALE 1:25

EXAMPLE OF CHANNEL SILT FENCE INSTALLATION
NTS



TYPICAL CHANNEL SILT FENCE ELEVATION
SCALE 1:25

INDICATIVE DESIGN

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	ORIGINAL - FOR INFORMATION

STATUS
FOR PLANNING

McCloy Consulting
T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey, Co. Antrim BT36 5QA

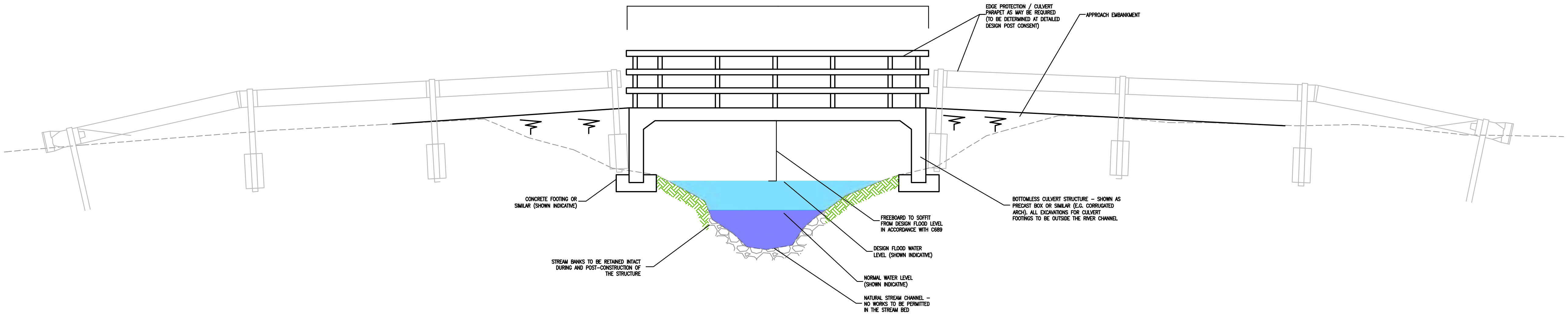
PROJECT
PROPOSED DUNBEG SOUTH WINDFARM

CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS SILT FENCE

SCALE	ORIGINAL SIZE	
AS SHOWN	A1	
DRAWN: DL	CHECKED: CMQ	DATE: 17/10/2017
PROJECT No.: MCL115-77	DRAWING No.: DWG_02	ISSUE NO.: 2

CONSENTED (LA01/2018/0200/F)



TYPICAL BOTTOMLESS CULVERT

WATERCROSSING

NTS

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:

N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	ORIGINAL – FOR INFORMATION

STATUS

FOR PLANNING

McCloy Consulting

T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

Mossley Mill, Lower Ground (West),
Carnmoney Road North,
Newtownabbey, Co. Antrim
BT36 5QA

PROJECT

PROPOSED DUNBEG SOUTH WINDFARM

CLIENT

res

DRAWING TITLE

DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS BOTTOMLESS CULVERT

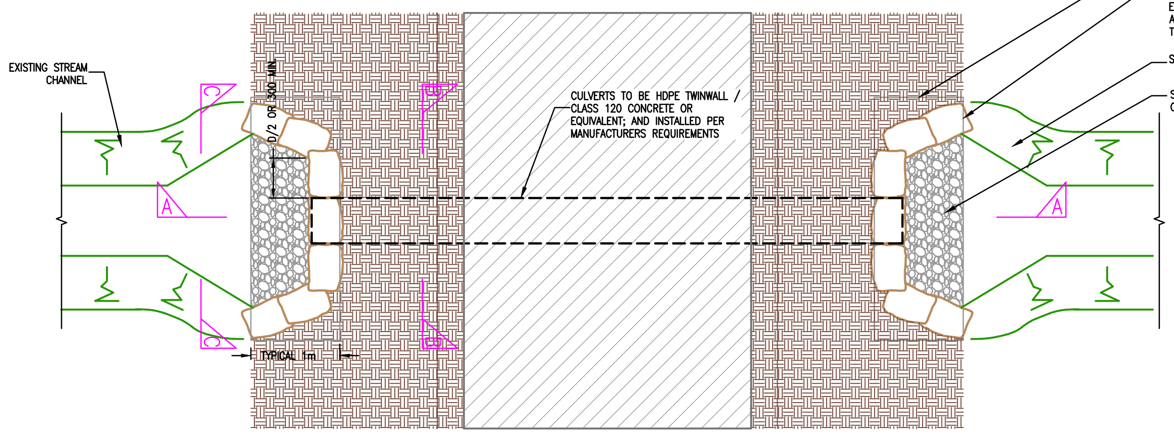
SCALE	ORIGINAL SIZE
AS SHOWN	A1

DRAWN	CHECKED	DATE
DL	CMQ	17/10/2017

PROJECT No.	DRAWING No.	ISSUE NO.
MCL115–77	DWG_03	2

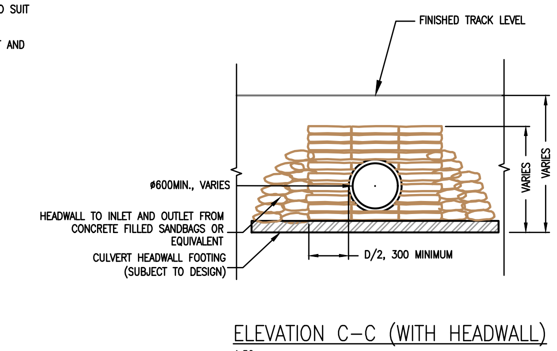
INDICATIVE DESIGN

CONSENTED (LA01/2018/0200/F)



PLAN

SCALE 1:50

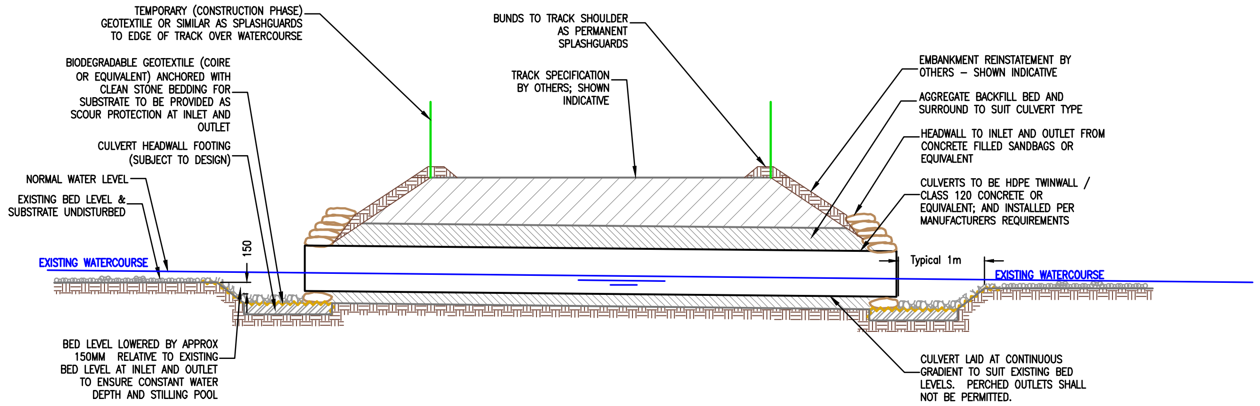


ELEVATION C–C (WITH HEADWALL)

1:50

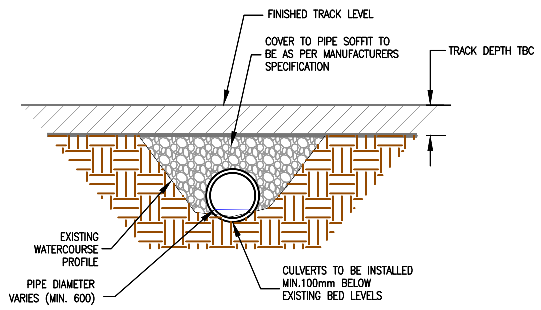
NOTES FOR CONSTRUCTION METHODS & ENVIRONMENTAL PROTECTION

1. WORKS TO BE PROGRAMMED TO SUIT PERIODS OF LOW RIVER FLOW AND RAINFALL. DUE COGNISANCE GIVEN TO THE PREVAILING GROUND CONDITIONS AND SEASONAL WEATHER CONDITIONS.
2. CULVERT LOCATION TO BE DAMMED UPSTREAM BY USE OF SANDBAGS OR EQUIVALENT AND OVERPUMPED IN ORDER TO PROVIDE A DRY WORKING ENVIRONMENT.
3. IN CHANNEL SILT FENCING TO BE INSTALLED DOWNSTREAM OF THE WORKS AND DOWNSTREAM OF OVERPUMPING FOR THE DURATION OF THE CULVERT INSTALLATION WORKS.



SECTION A–A

SCALE 1:50



SECTION B–B

SCALE 1:50

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:

N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	ORIGINAL – FOR INFORMATION

STATUS

FOR PLANNING

McCloy Consulting

T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com

Mossley Mill, Lower Ground (West),
Carnmoney Road North,
Newtownabbey, Co. Antrim
BT36 5QA

PROJECT

PROPOSED DUNBEG SOUTH WINDFARM

CLIENT

res

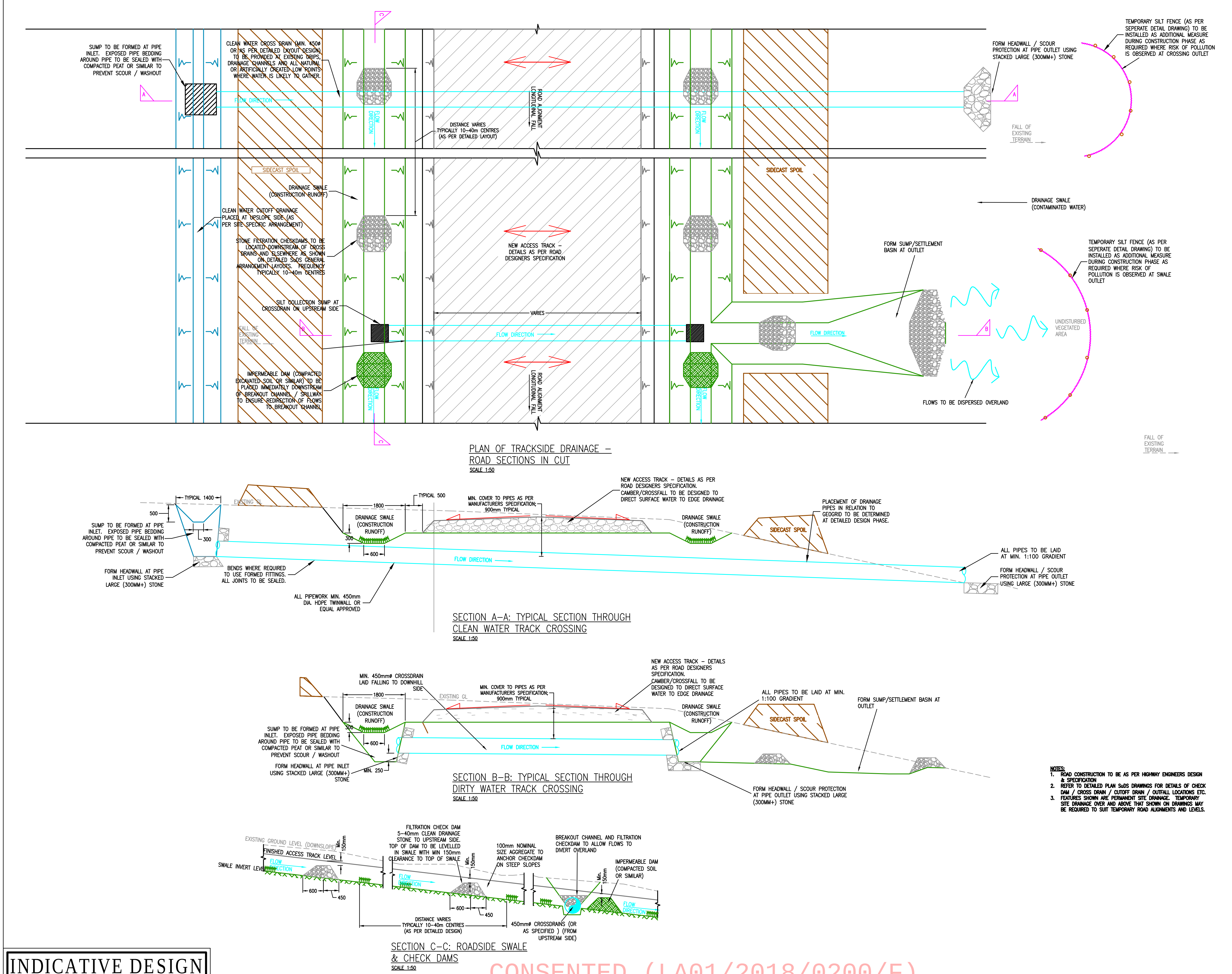
DRAWING TITLE

DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS PIPED CULVERTS

SCALE	ORIGINAL SIZE	
AS SHOWN	A1	
DRAWN: DL	CHECKED: CMQ	DATE: 17/10/2017
PROJECT No.: MCL115-77	DRAWING No.: DWG_04	ISSUE NO.: 2

INDICATIVE DESIGN

CONSENTED (LA01/2018/0200/F)



NOTES:
1. ROAD CONSTRUCTION TO BE AS PER HIGHWAY ENGINEERS DESIGN & SPECIFICATION
2. REFER TO DETAILED PLAN SuDS DRAWINGS FOR DETAILS OF CHECK DAM / CROSS DRAIN / CUTOFF DRAIN / OUTFALL LOCATIONS ETC.
3. FEATURES SHOWN ARE PERMANENT SITE DRAINAGE. TEMPORARY SITE DRAINAGE OVER AND ABOVE THAT SHOWN ON DRAWINGS MAY BE REQUIRED TO SUIT TEMPORARY ROAD ALIGNMENTS AND LEVELS.

INDICATIVE DESIGN

CONSENTED (LA01/2018/0200/F)

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	ORIGINAL - FOR INFORMATION

STATUS
FOR PLANNING

McCloy Consulting

T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey, Co. Antrim BT36 5QA

PROJECT
PROPOSED DUNBEG SOUTH WINDFARM

CLIENT
res

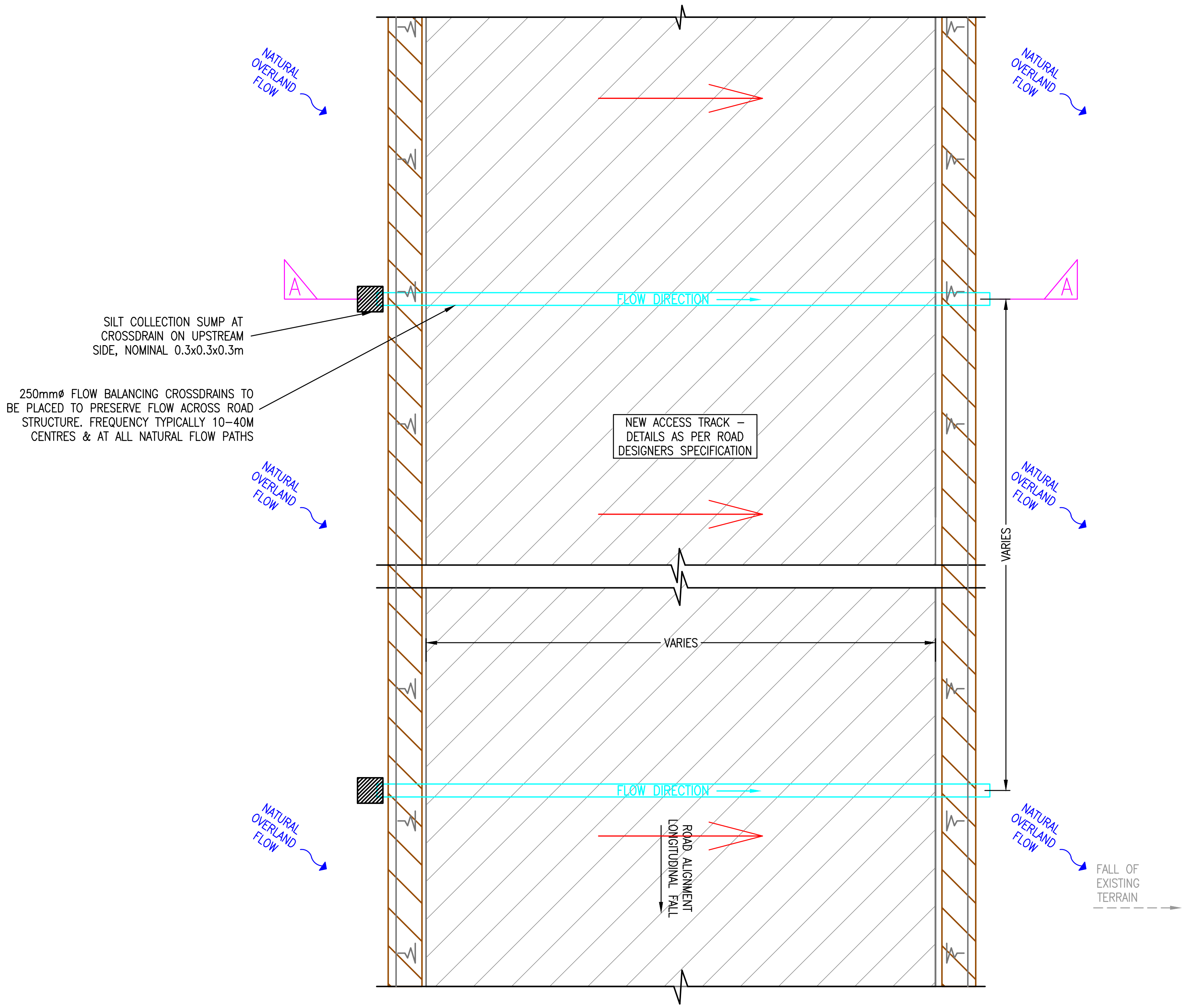
DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS DRAINAGE AT EXCAVATED (CUT) TRACK

SCALE	ORIGINAL SIZE
AS SHOWN	A1

DRAWN	CHECKED	DATE
DL	CMQ	17/10/2017

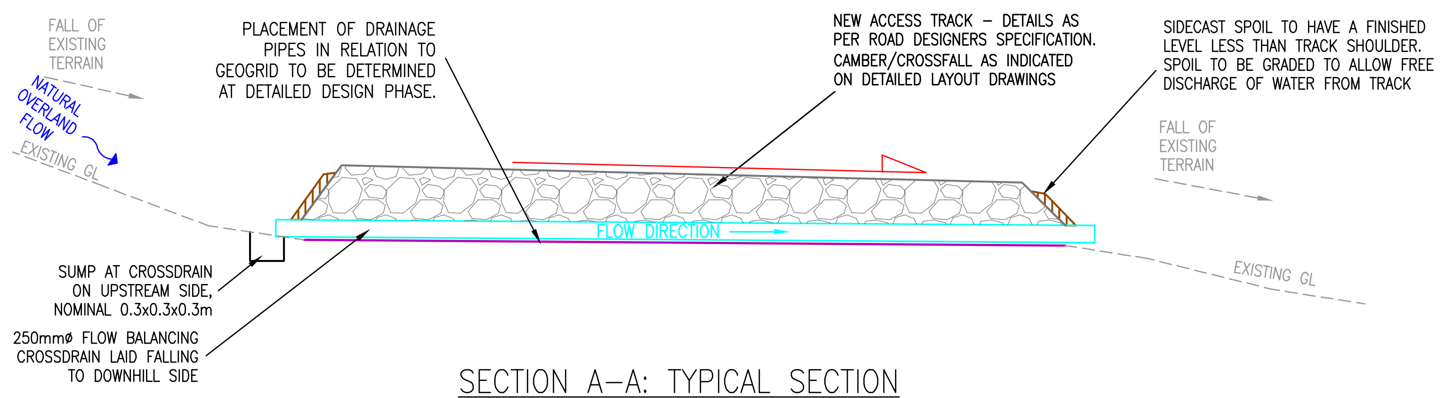
PROJECT No.	DRAWING No.	ISSUE NO.
MCL115-77	DWG_05	2

\\mccserver\shared_Projects\MCL115 RES\077 Dunbeg Ext\07 Drawings\MCL115-77_DWG_02-08 Preliminary SuDS Typical Details [ISSUE 2].dwg 2-Nov-17 None



PLAN OF ROADSIDE DRAINAGE – FLOATED ROAD SECTIONS

SCALE 1:50



SECTION A–A: TYPICAL SECTION

SCALE 1:50

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	ORIGINAL – FOR INFORMATION

STATUS
FOR PLANNING

McCloy Consulting
T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey, Co. Antrim BT36 5QA

PROJECT
PROPOSED DUNBEG SOUTH WINDFARM

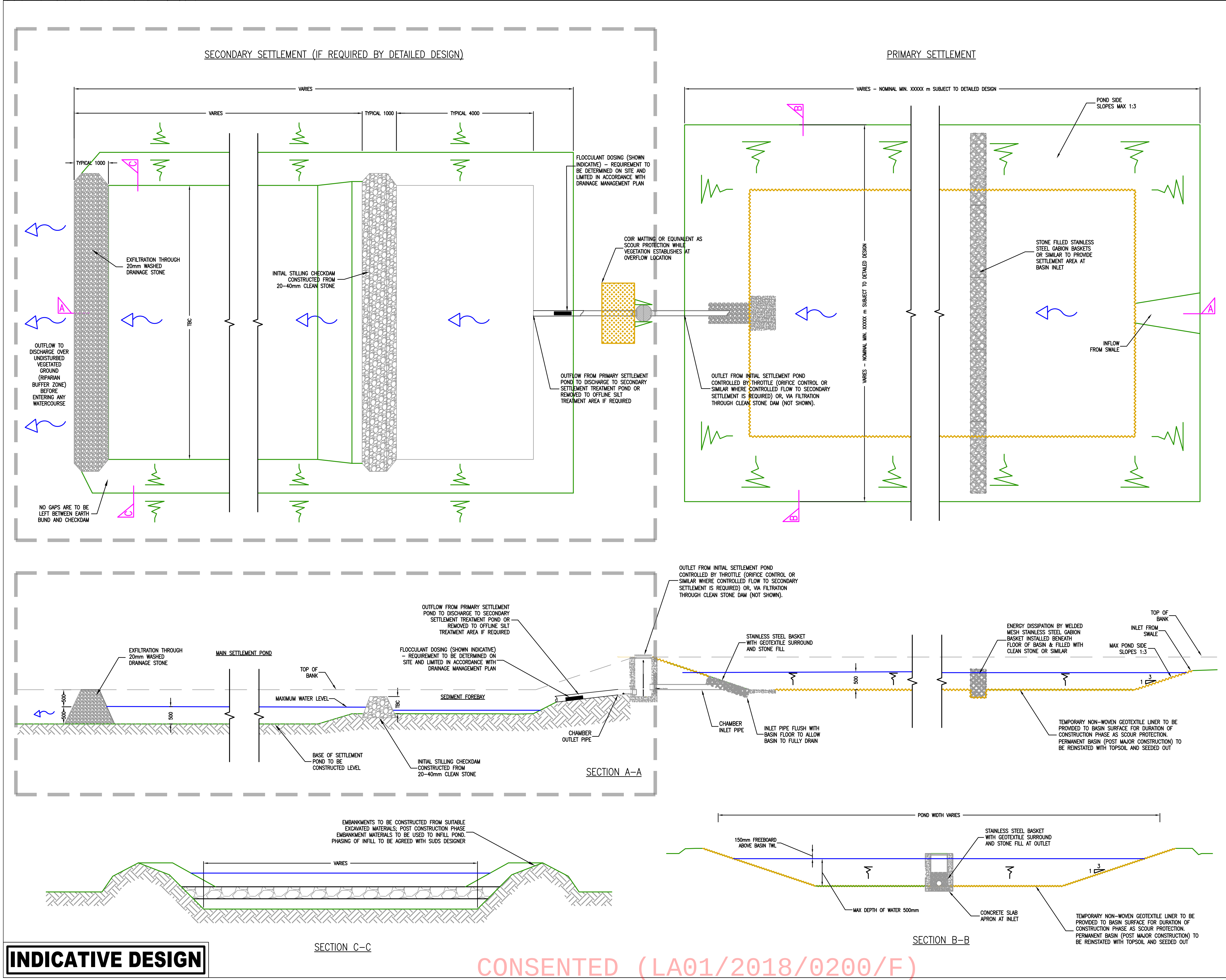
CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS DRAINAGE AT FLOATED TRACK

SCALE	ORIGINAL SIZE	
AS SHOWN	A1	
DRAWN	CHECKED	DATE
DL	CMQ	17/10/2017
PROJECT No.	DRAWING No.	ISSUE NO.
MCL115-77	DWG_06	2

INDICATIVE DESIGN

CONSENTED (LA01/2018/0200/F)



INDICATIVE DESIGN

CONSENTED (LA01/2018/0200/F)

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING: N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
3	DKS	DKS	25/04/2019	FLOCCULANT DOSING UPDATED TO FLOCC BLOCK TYPE INSTALLATION, FOR REVISED WTD FOR FD
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	ORIGINAL – FOR INFORMATION

STATUS: FOR PLANNING

McCloy Consulting

T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey, Co. Antrim BT36 5QA

PROJECT: PROPOSED DUNBEG SOUTH WINDFARM

CLIENT: res

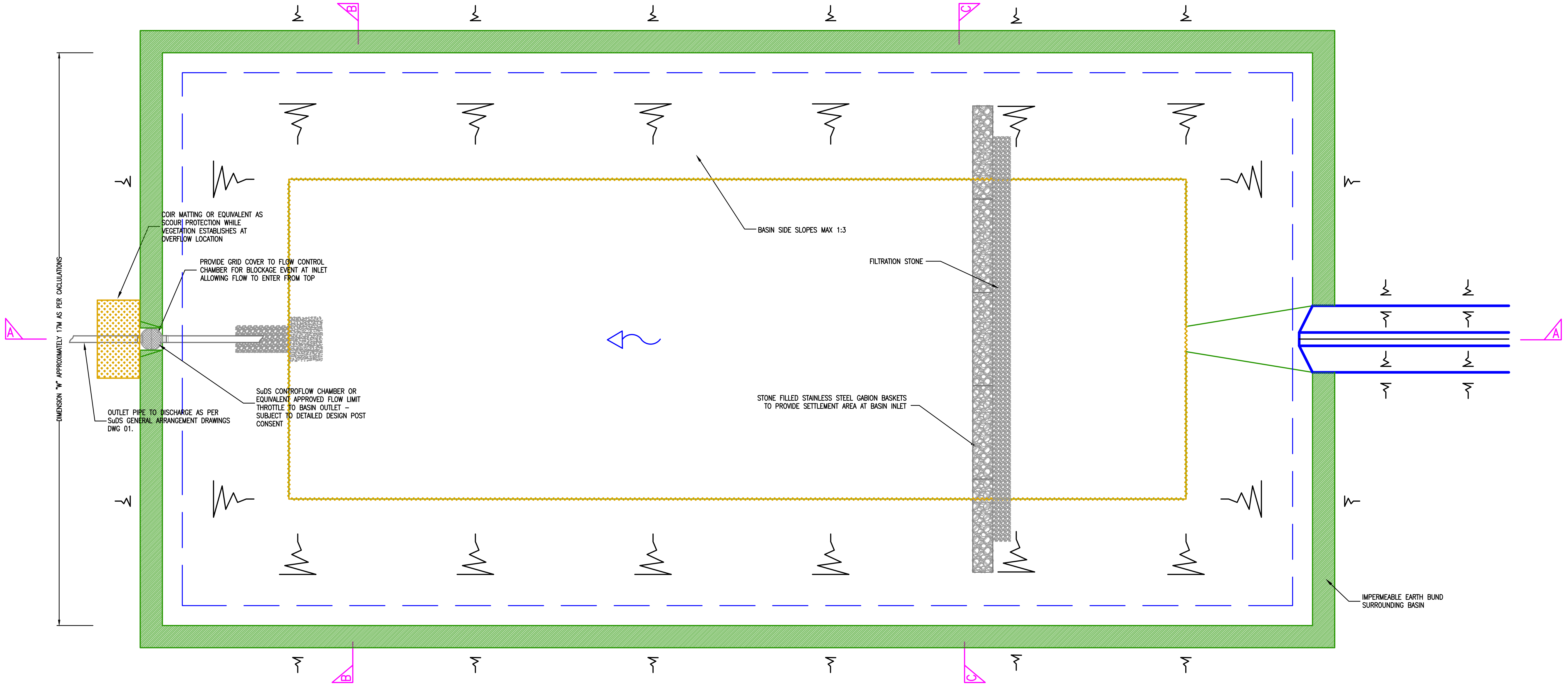
DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS SETTLEMENT LAGOON ARRANGEMENT

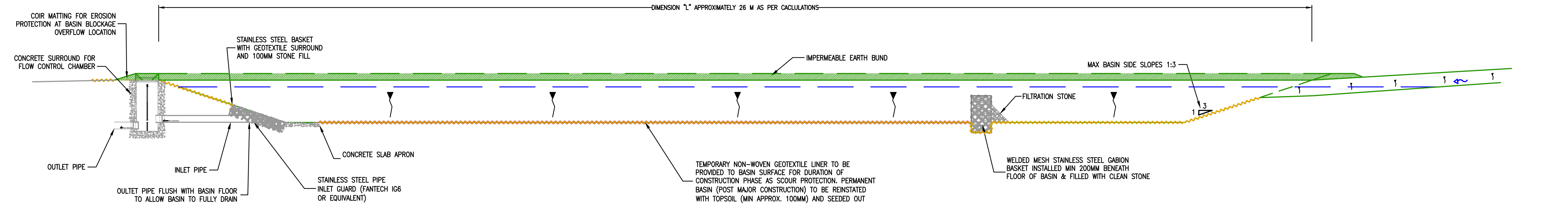
SCALE	ORIGINAL SIZE		
AS SHOWN	A1		
DRAWN	CHECKED	DATE	
DL	CMQ	17/10/2017	
PROJECT No.	DRAWING No.	ISSUE No.	
MCL115-77	DWG_07	3	

INDICATIVE DESIGN

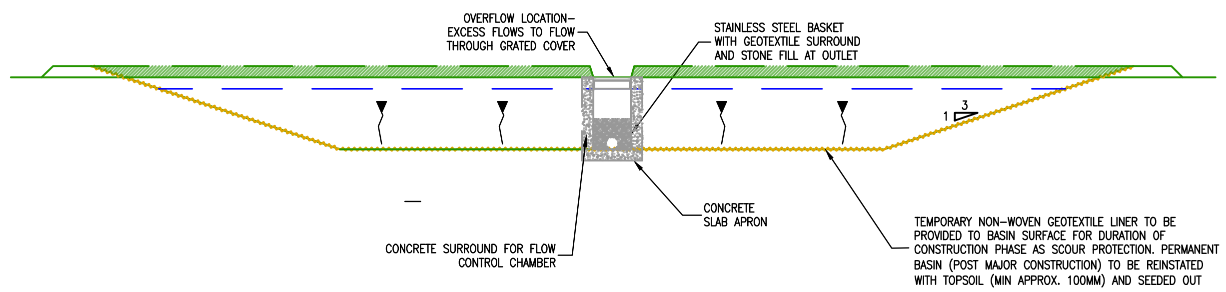
SuDS ATTENUATION / DETENTION BASIN PLAN

SCALE 1:50

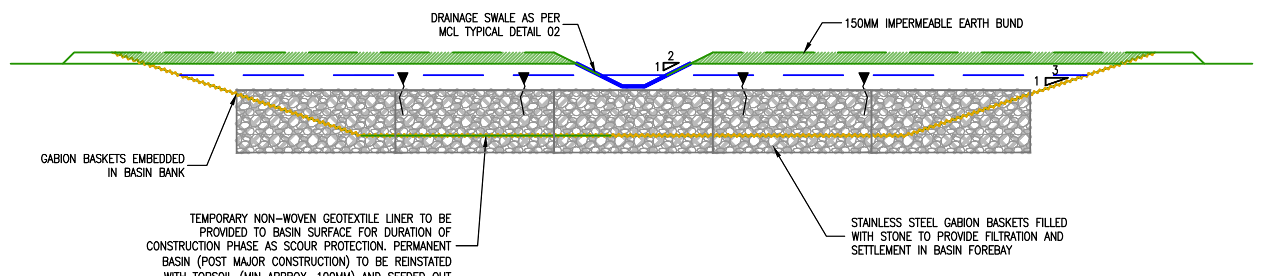




SECTION A–A



SECTION B–B



SECTION C–C

CONSENTED (LA01/2018/0200/F)

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	DKS	DKS	02/11/2017	FOR PLANNING
1	DL	CMQ	18/10/2017	FOR INFORMATION

STATUS
FOR PLANNING

McCloy Consulting
T: 028 9084 8694
F: 028 9084 1525
E: info@mccloyconsulting.com
W: www.mccloyconsulting.com
Mossley Mill, Lower Ground (West), Carnmoney Road North, Newtownabbey, Co. Antrim BT36 5QA

PROJECT
PROPOSED DUNBEG SOUTH WINDFARM

CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS) OUTLINE TYPICAL DETAILS DETENTION BASIN/ ATTENUATION POND

SCALE	ORIGINAL SIZE	
AS SHOWN	A1	
DRAWN	CHECKED	DATE
DL	CMQ	17/10/2017
PROJECT No.	DRAWING No.	ISSUE NO.
MCL115-77	DWG_08	2

Annex C

Flocculant Datasheet

CONSENTED (LA01/2018/0200/F)

Floc blocks (all AN grades)

Safety Data Sheet

according to Regulation (EC) No. 1907/2006 (REACH) with its amendment Regulation (EU) 2015/830

Date of issue: 8/4/2016 Version: 1.1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	:	Mixtures
Product name	:	Floc blocks (all AN grades)
Type of product	:	Construction materials,Construction materials additives

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.2.1. Relevant identified uses

Industrial/Professional use spec	:	Industrial use Professional use
Use of the substance/mixture	:	Flocculant

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Mudtech Ltd
Wyburn House
ST16 1SB Stafford - United Kingdom
T +44 (0)845 299 0790 - F +44 (0)1929 554361
sales@mudtech.co.uk

1.4. Emergency telephone number

Emergency number	:	CHEMTEL International: +1 813-248-0585; USA/Canada And Territories 800-255-3924, Chemtel - will accept call charge.

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Not classified

Adverse physicochemical, human health and environmental effects

To our knowledge, this product does not present any particular risk, provided it is handled in accordance with good occupational hygiene and safety practice.

2.2. Label elements

Labelling according to Regulation (EC) No. 1272/2008 [CLP]

EUH-statements	:	EUH210 - Safety data sheet available on request

2.3. Other hazards

Other hazards not contributing to the classification	:	Very slippery when wet.

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

3.2. Mixtures

Comments	:	An anionic polyacrylamide blend

This mixture does not contain any substances to be mentioned according to the criteria of section 3.2 of REACH annex II

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general	:	Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).
First-aid measures after inhalation	:	Not expected to present a significant inhalation hazard under anticipated conditions of normal use.

CONSENTED (LA01/2018/0200/F)

First-aid measures after skin contact	:	Take off contaminated clothing and wash it before reuse. Wash with plenty of soap and water. Get medical advice if skin irritation persists.
First-aid measures after eye contact	:	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
First-aid measures after ingestion	:	Rinse mouth. Give water to drink. Do NOT induce vomiting. Get immediate medical advice/attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation	:	Not expected to present a significant inhalation hazard under anticipated conditions of normal use.
Symptoms/injuries after skin contact	:	May cause slight irritation.
Symptoms/injuries after eye contact	:	May cause slight irritation.
Symptoms/injuries after ingestion	:	May cause irritation to the respiratory tract.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	:	Carbon dioxide. Dry powder. Foam. Use extinguishing media appropriate for surrounding fire.
Unsuitable extinguishing media	:	Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard	:	The product is not flammable.
Explosion hazard	:	Product is not explosive.
Reactivity in case of fire	:	Not known.
Hazardous decomposition products in case of fire	:	Toxic fumes may be released.

5.3. Advice for firefighters

Precautionary measures fire	:	No special measures required. Stop leak if safe to do so.
Firefighting instructions	:	Use extinguishing media appropriate for surrounding fire. Exercise caution when fighting any chemical fire. Prevent fire fighting water from entering the environment.
Protection during firefighting	:	Do not enter fire area without proper protective equipment, including respiratory protection. Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.
Other information	:	Very slippery when wet.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment	:	Wear suitable gloves and eye/face protection.
Emergency procedures	:	Ventilate spillage area. Avoid contact with skin and eyes.

6.1.2. For emergency responders

Protective equipment	:	Wear suitable protective clothing, gloves and eye or face protection. For further information refer to section 8: "Exposure controls/personal protection". Avoid contact with skin and eyes.
Emergency procedures	:	Ventilate area.

6.2. Environmental precautions

Avoid release to the environment. Prevent entry to sewers and public waters.

6.3. Methods and material for containment and cleaning up

For containment	:	No special measures required.
Methods for cleaning up	:	Sweep up the product. Shovel into suitable and closed container for disposal. This material and its container must be disposed of in a safe way, and as per local legislation. Do not use water for cleaning.
Other information	:	Dispose of in accordance with relevant local regulations.

6.4. Reference to other sections

For further information refer to section 8: "Exposure controls/personal protection". For disposal of solid materials or residues refer to section 13 : "Disposal considerations".

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed	:	Very slippery when wet.

CONSENTED (LA01/2018/0200/F)

Precautions for safe handling	: Wear personal protective equipment. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Avoid contact with skin and eyes.
Hygiene measures	: Always wash hands after handling the product. Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions	: Store in a well-ventilated place. Keep container closed when not in use. Keep away from water or moist air. Keep dry.
Incompatible products	: Strong bases. Strong acids.
Incompatible materials	: Direct sunlight.
Storage area	: Store in a well-ventilated place.
Packaging materials	: Keep only in original container.

7.3. Specific end use(s)

No special requirements.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls:

Ensure good ventilation of the work station.

Personal protective equipment:

Protective goggles. Gloves. Protective clothing.

Materials for protective clothing:

Wear suitable protective clothing

Hand protection:

protective gloves

Eye protection:

tightly fitting safety goggles

Skin and body protection:

Wear suitable protective clothing

Respiratory protection:

Not required for normal conditions of use

Environmental exposure controls:

Avoid release to the environment.

Other information:

Do not eat, drink or smoke when using this product. Provide readily accessible eye wash stations and safety showers.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Emulsion.
Colour	: white.
Odour	: odourless.
Odour threshold	: No data available
pH	: 6.5 Approx
Relative evaporation rate (butylacetate=1)	: No data available

CONSENTED (LA01/2018/0200/F)

Melting point	:	Not applicable
Freezing point	:	No data available
Boiling point	:	No data available
Flash point	:	≈ °C
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	Non flammable
Vapour pressure	:	No data available
Relative vapour density at 20 °C	:	No data available
Relative density	:	g/cm3
Solubility	:	Soluble.
Log Pow	:	No data available
Viscosity, kinematic	:	> mm²/s
Viscosity, dynamic	:	No data available
Explosive properties	:	Product is not explosive.
Oxidising properties	:	Oxidising solids Not applicable.
Explosive limits	:	No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

The product is non-reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

Moisture. Extremely high or low temperatures.

10.5. Incompatible materials

Strong acids. Strong bases. Strong oxidizing agents.

10.6. Hazardous decomposition products

fume. Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified (Based on available data, the classification criteria are not met)

Floc blocks (all AN grades)	
LD50 oral rat	> 2000 mg/kg

Skin corrosion/irritation	:	Not classified (Based on available data, the classification criteria are not met) pH: 6.5 Approx
Serious eye damage/irritation	:	Not classified (Based on available data, the classification criteria are not met) pH: 6.5 Approx
Respiratory or skin sensitisation	:	Not classified (Based on available data, the classification criteria are not met)
Germ cell mutagenicity	:	Not classified (Based on available data, the classification criteria are not met)
Carcinogenicity	:	Not classified (Based on available data, the classification criteria are not met)
Reproductive toxicity	:	Not classified (Based on available data, the classification criteria are not met)
STOT-single exposure	:	Not classified
STOT-repeated exposure	:	Not classified
Aspiration hazard	:	Not classified (Based on available data, the classification criteria are not met)
Potential adverse human health effects and symptoms	:	Based on available data, the classification criteria are not met.

CONSENTED (LA01/2018/0200/F)

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : The product is not considered harmful to aquatic organisms nor to cause long-term adverse effects in the environment.

Ecology - water : The product does not have any known adverse effect on the tested aquatic organisms.

Floc blocks (all AN grades)	
LC50 fish 1	> 100 mg/l
LC50 fish 2	≈ mg/l
LC50 other aquatic organisms 1	> mg/l
EC50 Daphnia 1	> 100 mg/l

12.2. Persistence and degradability

Floc blocks (all AN grades)	
Persistence and degradability	No data available.

12.3. Bioaccumulative potential

Floc blocks (all AN grades)	
Bioaccumulative potential	No data available.

12.4. Mobility in soil

Floc blocks (all AN grades)	
Ecology - soil	Soluble in water.

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Other adverse effects

Other adverse effects : None known.

Additional information : The product does not have any known adverse effect on the tested aquatic organisms

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Regional legislation (waste) : Disposal must be done according to official regulations.

Waste treatment methods : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

14.1. UN number

UN-No. (ADR) : Not applicable

UN-No. (IMDG) : Not applicable

UN-No. (IATA) : Not applicable

UN-No. (ADN) : Not applicable

UN-No. (RID) : Not applicable

14.2. UN proper shipping name

Proper Shipping Name (ADR) : Not applicable

Proper Shipping Name (IMDG) : Not applicable

Proper Shipping Name (IATA) : Not applicable

Proper Shipping Name (ADN) : Not applicable

Proper Shipping Name (RID) : Not applicable

14.3. Transport hazard class(es)

ADR

Transport hazard class(es) (ADR) : Not applicable

IMDG

Transport hazard class(es) (IMDG) : Not applicable

IATA

Transport hazard class(es) (IATA) : Not applicable

CONSENTED (LA01/2018/0200/F)

ADN

Transport hazard class(es) (ADN)	: Not applicable

RID

Transport hazard class(es) (RID)	: Not applicable

14.4. Packing group

Packing group (ADR)	: Not applicable
Packing group (IMDG)	: Not applicable
Packing group (IATA)	: Not applicable
Packing group (ADN)	: Not applicable
Packing group (RID)	: Not applicable

14.5. Environmental hazards

Dangerous for the environment	: No
Marine pollutant	: No
Other information	: No supplementary information available

14.6. Special precautions for user

- Overland transport

Not applicable

- Transport by sea

Not applicable

- Air transport

Not applicable

- Inland waterway transport

Not applicable

- Rail transport

Not applicable

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

15.1.1. EU-Regulations

Contains no REACH substances with Annex XVII restrictions
Contains no substance on the REACH candidate list
Contains no REACH Annex XIV substances

15.1.2. National regulations

Classified in line with 29 CFR

15.2. Chemical safety assessment

No chemical safety assessment has been carried out

SECTION 16: Other information

Other information	: None.

Full text of H- and EUH-statements:

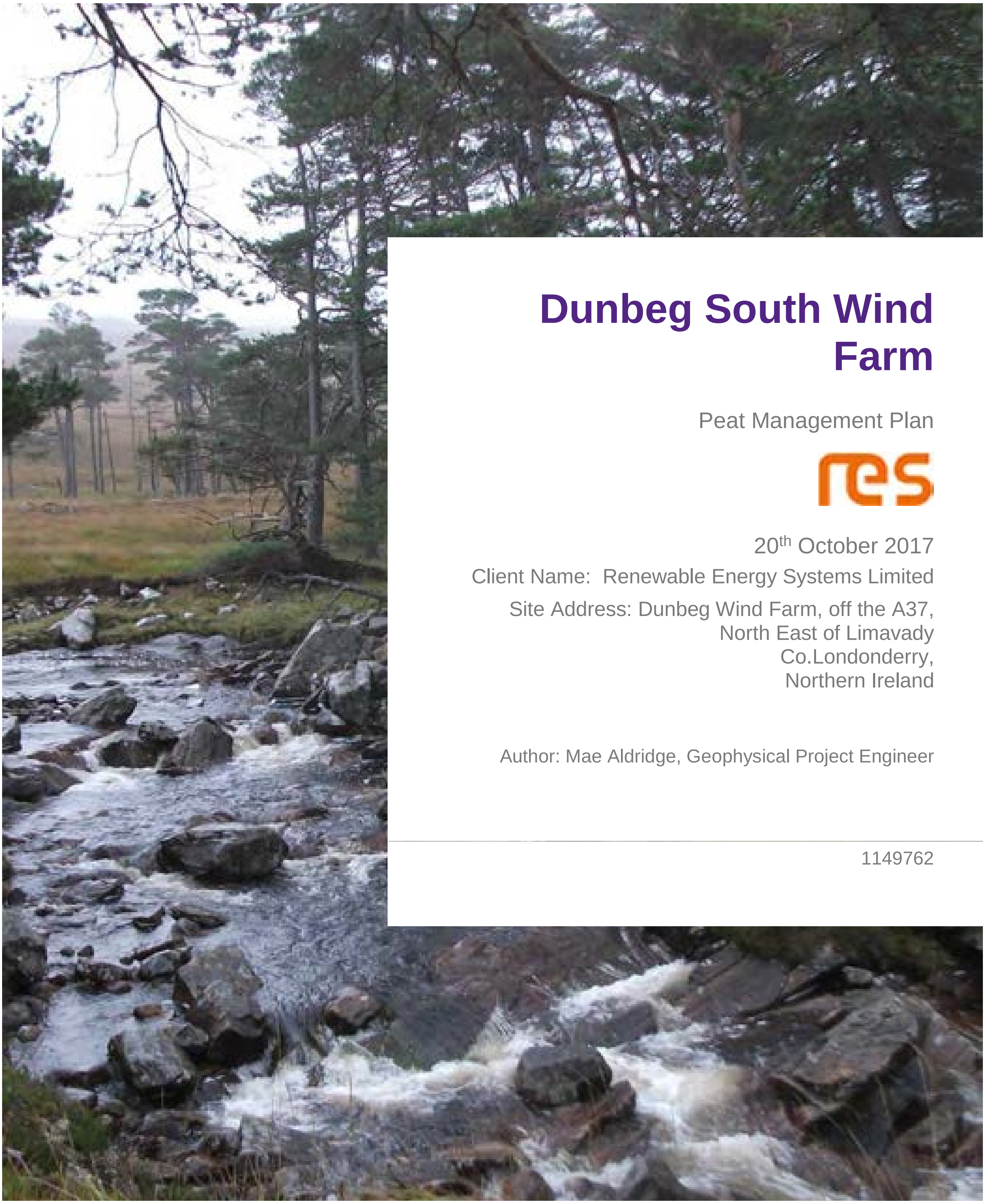
EUH210	Safety data sheet available on request

SDS EU (REACH Annex II)

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product

CONSENTED (LA01/2018/0200/F)

CONSENTED (LA01/2018/0200/F)



Dunbeg South Wind Farm

Peat Management Plan

20th October 2017

Client Name: Renewable Energy Systems Limited

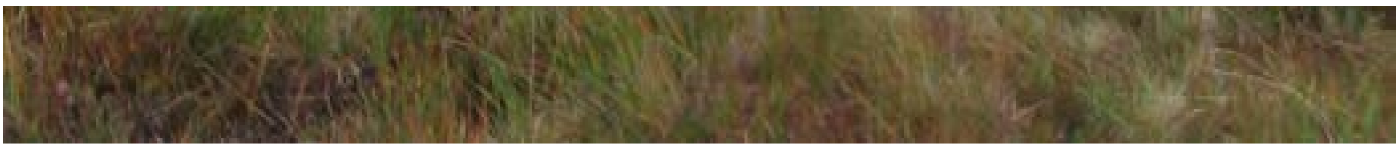
Site Address: Dunbeg Wind Farm, off the A37,
North East of Limavady
Co.Londonderry,
Northern Ireland

Author: Mae Aldridge, Geophysical Project Engineer

1149762

Planning & Development | Ecology & Hydrology | Technical
Construction & Geotechnical | Asset Management | Due Diligence

natural power



CONSENTED (LA01/2018/0200/F)

Document history

Author	Mae Aldridge	17/08/2017
Checked	Gavin Germaine	01/09/2017
Approved	Gavin Germaine	01/09/2017

Client Details	
Contact	Garth McGimpsey
Client Name	Renewable Energy Systems Limited
Address	Dunbeg Wind Farm, off the A37, North East of Limavady Co.Londonderry, Northern Ireland

Issue	Date	Revision Details
A	06/09/2017	First Issue
B	27/09/2017	Re-issue to include comments from RES
C	03/10/2017	Re-issue again for comments from RES
D	20/10/2017	Re-issue again for comments from RES

NATURAL POWER CONSULTANTS LIMITED, THE NATURAL POWER CONSULTANTS LIMITED, NATURAL POWER SARL, NATURAL POWER CONSULTANTS (IRELAND) LIMITED, NATURAL POWER LLC, NATURAL POWER S.A, NATURAL POWER SERVICES LIMITED AND NATURAL POWER OPERATIONS LIMITED (collectively referred to as "NATURAL POWER") accept no responsibility or liability for any use which is made of this document other than by the Client for the purpose for which it was originally commissioned and prepared. The Client shall treat all information in the document as confidential. No representation is made regarding the completeness, methodology or current status of any material referred to in this document. All facts and figures are correct at time of print. All rights reserved. VENTOS® is a registered trademark of NATURAL POWER. Melogale™, WindCentre™, ControlCentre™, ForeSite™, vuWind™, WindManager™ and OceanPod™ are trademarks of NATURAL POWER.

Copyright © 2017 NATURAL POWER.

Local Office:

The Green House, Forrest Estate
Dalry, Castle Douglas, DG7 3XS
SCOTLAND, UK
Tel: +44 (0) 1644 430 008

Registered Office:

The Natural Power Consultants Limited
The Green House
Forrest Estate, Dalry,
Castle Douglas, Kirkcudbrightshire,
DG7 3XS

Reg No: SC177881
VAT No: GB 243 6926 48

CONSENTED (LA01/2018/0200/F)

Contents

CONSENTED (LA01/2018/0200/F)

1. Introduction

The Peat Management Plan (PMP) for the development provides information and guidance on the environmentally compliant re-use and management of excavated peat across the proposed Dunbeg South Wind Farm.

The information presented in this plan should be used to inform the wider assessments carried out for Dunbeg South Wind Farm. The study has drawn on information collected as part of a two phase peat study including desk study, phase one peat probing exercise followed up by phase two site reconnaissance. The PMP as outlined in this document; **estimates** the total volumes of excavated peat likely to be produced by the development and proposes suitable reuse methods in line with regulatory requirements and best practice methods.

This strategy should be adopted to ensure peat is managed in a sustainable manner, minimising excavation via the adoption of appropriate construction methods. Targeted re-use of peat as part of the reinstatement works shall also be a primary consideration.

1.1. Regulatory Requirements

This document addresses the following requirements in line with the SEPA Regulatory Position Statement – Developments on Peatland:

- **Prevention** – The best management option for waste peat is to prevent its production; and
- **Re-use –** Developers should attempt to re-use as much of the peat produced on site as is possible.

The aspects of peat management outlined in this document are also based on the principles of the "*Development on Peatland: Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste"*, document published in 2012.

1.2. Limitations

The information presented in this report is based on the results of peat surveys carried out over several phases by Natural Power between August 2016 and July 2017. It is highlighted that whilst all attempts have been made to collect detailed peat depth and condition information, further investigations should be carried out as part of detailed site investigation (post consent). This process will provide further information across all infrastructure locations, which should be used to refine the peat excavation and reuse volumes provided in this report.

The PMP forms part of a site specific Construction Environmental Management Plan (CEMP) and should be considered as a live document throughout the planning and any future pre-construction phase of works. As such, additional information can be incorporated following the results of detailed site investigations carried out prior to construction as well as from any discussions with Northern Ireland Environment Agency (NIEA) or other engaged stakeholders throughout the development process.

CONSENTED (LA01/2018/0200/F)

2. Amended Infrastructure Layout

This Peat Management Plan was first issued to the client on 06/09/2017, following this an amended layout was provided to Natural Power on 04/09/2017 with the following amendments to infrastructure:

- Use of the upgraded track utilising an existing track present on the site. This is at locations close to the site entrance and between T5 and T6
- Some of the turning spaces have swapped sides.
- Construction Compound and substation have moved North West.
- Tracks have changed slightly

It is assumed where the upgraded track is used no new cut tracks are required. The use of the existing track will reduce the peat cut during the construction of the site access tracks. There are two sections where developer proposed to upgrade the existing track these are approximately 440m in length between T05 and T06 and 370m in length at the site entrance.

Assuming no peat cut along these lengths of access track the developer could expect to reduce excavated peat volumes by up to 913 m^3 in comparison to the original layout. Peat volumes quoted in this study are for the amended layout described above.

The other infrastructure amendments are not expected to impact the results of this peat management plan.

CONSENTED (LA01/2018/0200/F)

3. Excavated Peat Volume

In order to quantify the volume of peat that may be excavated and re-used across the development, the proposed wind farm layout has been analysed using a comprehensive peat depth dataset. The proposed 9 wind turbine layout has been appraised to obtain a preliminary estimate of the size and extent of the infrastructure footprint. The peat depth dataset comprises a total of 1101 individual peat probe points. The peat depth data was collected across a multi-phase survey with final peat probing carried during July 2017 to cover the final layout configuration:

The peat depth data has been processed into a peat depth contour map (Ref: GB200135_M_005_C, Appendix F of the Peat Slide Risk Assessment). The volumetric analysis of excavated peat volumes incorporates the mean peat depths recorded across each discrete infrastructure element. Therefore average peat depths have been assessed based on relevant data points as opposed to anomalous site wide averages.

The estimation of peat extraction and re-use volumes relies on a series of design assumptions that may vary on a small scale according to discrete changes in ground conditions. Therefore it should be highlighted that the peat volume estimates stated in this report are a preliminary indication only. Volumetric calculations should be re-evaluated if more detailed intrusive site investigation data becomes available. Design assumptions with regard to the likely access track construction methods have also been taken. Natural Power does not warrant these assumptions as a final engineering design for the wind farm. The design of the detailed site layout should be confirmed with a comprehensive site investigation.

3.1. Design Assumptions

3.1.1. Excavation & Replacement

Excavate and replacement ('cut') type construction of tracks, passing places, turning areas and crane pads are proposed where peat depths are consistently shallower than 1.0 m, along section of access track and/or where gradients are in excess of 1:10. This type of construction may also be adopted where there are cross slopes to be negotiated. The cut and fill construction method requires the removal of peat deposits down to a suitable sub-grade layer within the superficial or bedrock geology. Excavated peat is then reinstated carefully along access track landscaped verges on either side of the track or utilised in appropriate landscaping across the development infrastructure. Slope Angle Constraints (Ref: GB200135_M_003_D+, Appendix B of the Peat Slide Risk Assessment) depicts the slope angle changes and has been used to inform this part of the assessment.

Excavate and replacement track construction sequences shall be designed in accordance with local ground conditions and following a detailed site investigation. A general good practice construction sequence has been provided below and has been adapted and informed by Scottish Natural Heritage (SNH) Guidance, (2005):

1. The route of the cut / fill access track shall be marked out on the ground well ahead of the construction activity. This will allow for advanced checks of any newly developed or unforeseen constraints.

2. As part of this process, the most sensitive sections of the access track route shall be defined. This will include water crossings, peat hags, slopes and steep slopes. These defined zones shall become established management zones where specific mitigation measures and construction techniques shall be implemented to minimise impacts during the construction phase.

3. Where possible, the construction of the cut tracks shall avoid periods of wet weather (when peat deposits are particularly susceptible to deformation and when there is an increased risk of run-off carrying unacceptable levels of sediment. Similarly, the construction of access tracks shall, where possible, avoid periods of very dry weather; when there is a high risk of excavated and exposed peat soils drying out

CONSENTED (LA01/2018/0200/F)

4. The cut access track construction shall typically proceed in an uphill direction, thus allowing drainage to be managed with a greater degree of control. The access track side and cut-off ditches shall be generally constructed first. It shall be ensured that these discharge to a suitable buffered watercourse in line with hydrological assessment and relevant drainage controls. It shall be important to ensure that surface water run-off is directed away from the track formation layer. This will act to reduce disturbance by the prevention of water-logging and erosion.

5. A progressive construction method shall typically be adopted whereby the cut track is excavated to a suitable formation and up-filled to the track running surface. Following this, the newly constructed track verges will be restored with peat and vegetation from the next advancing section of track under construction. The sequence of excavation, up-fill and restoration will be managed to minimise the time between excavation and restoration as far as is practicable.

6. Plant machinery shall work where practicable from the section of access track most recently completed. The re-use of peat turves and peat from newly excavated sections onto the verges of the most recently completed section of track will act to reduce the overall disturbance of excavated peat. Excavators with long reach arms are also beneficial in reducing vehicle manoeuvres over peat deposits.

3.1.2. Floating Access Track

Floating type construction of access track may be proposed where peat depths are consistently deeper than 1m. Slope geometry also should been taken into account with floating track construction considered unsuitable across gradients in excess of 1:10 (~6^{o}) and along cross slopes. Reference is also made to the Peat Stability Risk Assessment in which peat slide risk and proposed construction methods have been discussed in detail.

The floating construction design leaves the peat deposit in place and utilises a construction of layered geo-grid, geo-textiles and aggregate fill, which is placed over the peat deposits. This system forms a ‘floating’ platform to spread the construction loads over the peat. A comprehensive description of this construction method is presented by Forestry Commission Engineering (FCE) & Scottish National Heritage (SNH), (2010). This sequence of construction may need to be adapted to localised ground conditions that may only become fully evident following a detailed site investigation:

1. Mark out the alignment of the road and install advance drainage ahead of construction where necessary.

2. Clear the intended floating road area of major protrusions such as rocks, trees, down to ground level leaving any residual stumps and roots in place.

3. Leave the local surface vegetation and soils in place if possible. In many cases the existing vegetation and root system may be the strongest layer in the system providing increased tensile strength at surface, and care shall be taken to preserve the integrity of this layer.

4. Any local hollows or depressions along the route alignment shall be in-filled with a suitable lightweight fill such as tree brash, logs or a combination of lightweight fill and suitable materials. Similarly a brash mat and fascines (bundles of brash material) may be adopted to form the initial surface across uneven ground surface.

CONSENTED (LA01/2018/0200/F)

5. Broken vegetation surfaces such as peat hags and very wet areas with high fines content, may need to be covered with a separator grade geo-membrane to prevent contamination of the aggregate layers. This geotextile may be covered with a thin regulating layer of aggregate prior to installing the main geo-grid.

6. Geo-grids shall be placed by hand along the alignment of the road, directly onto the prepared area. Each grid section shall overlap adjacent sections using a simple overlapping arrangement generally in accordance with the relevant manufacturer's specification. A minimum transverse overlap is normally set at 400mm. This overlap may be increased where necessary, depending on the amount of displacement and transverse tension caused by un-even terrain and taking the manufacturer's recommendations into account.

7. Place the first layer of aggregate material onto the geo-grid, this shall be a suitable 'well graded material' that will be able to achieve a sound interlock with the geo-grid. The final specification of the aggregate grading shall be dictated by the chosen geo-grid mesh size. Care shall be taken at all times to avoid damage to the geo-grids.

8. The degree of compaction required will be dictated by the local ground conditions along the route alignment. Across exceptionally soft areas of peat there may be a requirement not to apply mechanical vibratory compaction and instead rely on compaction of aggregate through trafficking of wheels and tracks of the construction plant alone.

3.1.3. Access Track Dimensions

Proposed access tracks have been assumed to accommodate a 5m running width. The peat volume calculations have assumed a 6m wide access track excavation with a batter angle of 45° to the excavation sides. This geometry includes the additional width of 0.5m along either side of the track to accommodate drainage and cabling. Figure 3.1 below depicts the indicative dimensions adopted in the assessment.

Source: Natural Power, Not to scale, do not use for design

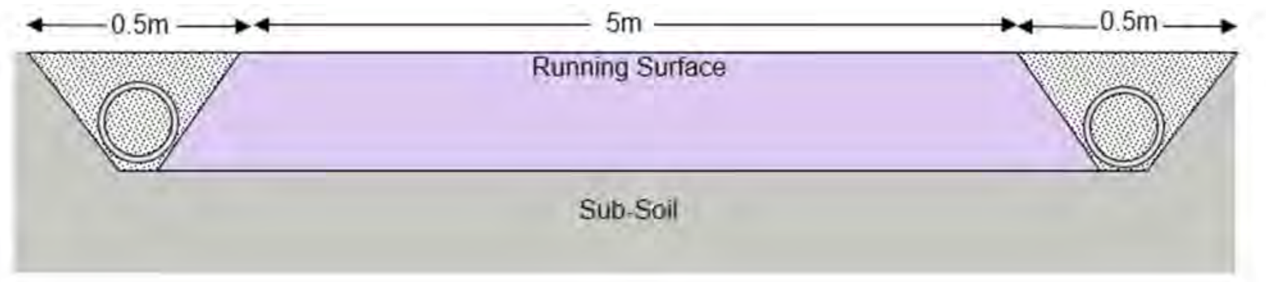


Figure 3.1: Indicative Cut Track Dimensions

Turning areas and passing places have been omitted from this analysis as it is assumed that any peat excavated as part of their construction would be accommodated along the periphery of these infrastructure elements, used to form landscaped verges.

3.1.4. Foundations and Hard-standing

The surface working area of the wind turbine foundation excavation has been assumed to be a 24x24m square excavation into which a reinforced concrete gravity base will be constructed. This dimension has been assumed based on a typical 18m diameter foundation founded at 3m below ground level. Assuming a batter angle to the excavation of 45° then a working area projected at the surface of 24x24m has been calculated. This is a

CONSENTED (LA01/2018/0200/F)

conservative assumption as a number of the foundations may be constructed using a different design. Detailed design may also allow for a smaller foundation footprint. The final formation level for the wind turbine foundation will be dictated by the local ground conditions. These shall be only defined following a detailed intrusive site investigation. Where suitable formation layers are identified at a shallower level, there may be scope to reduce the foundation working area. The geotechnical performance of the formation layer shall also input into the design dimensions of the gravity foundations.

The limit of disturbance in the peat deposits surrounding the foundation working areas should be controlled where appropriate with plastic sheet piling. This shall be particularly important in excavations of peat in excess of 1.5m where localised failures in the sides of the excavation need to be prevented from developing into retrogressive failures affecting larger areas outside of the foundation working area.

The final design chosen for the wind turbine foundations shall be informed by a detailed intrusive site investigation carried out during a post consent phase. Of particular importance shall be the underlying depth of superficial glacial deposits and the quality of the rock mass beneath each wind turbine location. The requirement for a detailed site investigation and design analysis out-with the scope of this peat management plan; dictates that the option of piling can only be fully considered during the pre-construction phase.

The client has provided information on the crane pad detailing the expected footprint to be 40x20m with a total working area of 800m^2. It should be noted if the selected turbine changes it could be necessary to alter the crane pad size which could increase the volume of peat extracted. A working area of 40x20m for the crane pad volume calculations has been assumed with a batter angle of 45^o to the excavation sides.

3.1.5. Ancillary Infrastructure

A temporary construction compound and control building has been modelled based on a concrete foundation of 100m x 50m with a 45^o batter angle to the excavation sides.

It is assumed that the substation and associated transformers will have a foundation requiring the removal of all peat beneath these structure. For the temporary construction compound buildings it is assumed these with be erected on a levelled surface overlain with hardcore. It was assumed that up to 0.5m would be cleared in order to level the area in preparation for laying the hardcore.

3.2. Excavated Peat Volumes

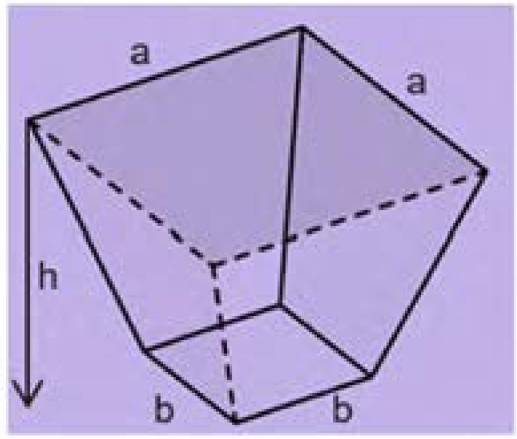
The estimate of excavated peat volume has been completed following a desk-based appraisal of the wind farm layout supplemented by digital terrain analysis. There has been further refined spatial analysis of the peat depth data set using GIS software.

The following sequence of tables provides a summary of the indicative peat extraction volume calculation for each infrastructure element. The relevant design assumptions are also confirmed within each table. The volumetric calculations are set out diagrammatically below.

For base volume calculations the volume of a truncated square pyramid has been used with the following expression as shown in Figure 3.2 below:

CONSENTED (LA01/2018/0200/F)

Source: Natural Power



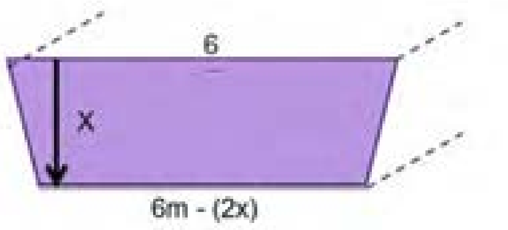
Volume = 1/3 (a^2 + ab + b^2) x h

Where: a = surface width of working area; b = (a – 2h) ; h = mean peat depth

Figure 3.2: Volume of a truncated square pyramid (foundation and crane hard standing calculations)

For excavation and replacement access track construction the volume of a trapezoid has been adopted as depicted in Figure 3.3 below

Source: Natural Power



Volume = (X * ((6 + (6-2X)) / 2)) * Length of access track

Figure 3.3: Volume of access track excavation based on a trapezoid

Table 3.1: Wind Turbines

Turbine ID	Average Peat Depth (m) Turbine	Average Peat Depth (m) Crane Pad	Crane Pad Peat Volume (m^3)	Foundation Peat Volume (m^3)	Total Peat Extraction Volume (m^3)
T1	0.23		184	130	314
T2	0.23		184	130	314
T3	0.42		336	234	570
T4	0.8		640	431	1071
T5	0.21		168	119	287
T6	0.69		552	375	927
T7	0.27		216	152	368

CONSENTED (LA01/2018/0200/F)

Turbine ID	Average Peat Depth (m)		Crane Pad Peat Volume (m^3)	Foundation Peat Volume (m^3)	Total Peat Extraction Volume (m^3)
	Turbine	Crane Pad			
T8	0.35		280	196	476
T9	0.43		344	239	583
				Total Peat Extraction (m^3)	**4,900**

Source: Natural Power

Table 3.2: Access Track

Access Track Section	Average Peat Depth (m)	Approximate Length (m)	Type of Track Construction	Total Peat Extraction Volume (m^3)
Track 1: Site Entrance to T1	0.14	858	Cut Track	704
Track 2: T2 to T4	0.39	814	Cut Track	1781
Track 3: Track to T3	0.42	312	Cut Track	731
Track 4: Track to T5	0.18	587	Cut Track	615
Track 5: Track to T6	0.26	516	Cut Track	770
Track 6: Track to T7	0.62	400	Cut Track	1334
Track 7: Track To T8	0.43	551	Cut Track	1320
Track 8	0.43	485	Cut Track	1162
			Total Peat Extraction (m^3)	**8,417**

*Source: * Site Wide Track Average Used due to Data Gap*

Table 3.3: Ancillary Infrastructure

Location ID	Average Peat Depth (m)	Indicative Working Area (m^2)	Total Peat Extraction Volume (m^3)
Temporary Construction Compound and Control Building	0.16	5,000	800
		Total Peat Extraction (m^3)	**800**

Source: Natural Power

An initial estimate of required rock volumes has been prepared to provide an indication of the scale of rock extraction required as part of the Development. These indicative required rock volumes are detailed below in Table 3.4.

Table 3.4: Indicative Rock Fill Requirements

Infrastructure Element	Total Volume of Rock Fill (m^3)
New ‘Cut’ Access Tracks	21,659
New Floating Access Tracks	-
Crane Hardstand Areas	16,290
Temporary Construction Compound and Control Building and other infrastructure	4,356

CONSENTED (LA01/2018/0200/F)

Infrastructure Element	Total Volume of Rock Fill (m^3)
Total Rock Fill Requirements	42,305

*Notes: *All rock is expected to be imported to Dunbeg wind farm, quarried off-site.*

3.2.1. Peat Extraction Volume Summary

Table 3.5 below provides a Development wide indicative value of the total volume of excavated peat required as part of the construction phase of development. Values have been rounded to the nearest 100m^3 so as not convey a false level of accuracy.

Table 3.5: Total Peat Extraction (Indicative) Site Wide

Construction Element	Peat Extraction Volume (m^3)
Wind Turbine Foundations & Hardstand	4,900
New Access Tracks	8,400
Ancilliary Infrastructure	800
TOTAL	**14,100**
TOTAL (including 25% bulking factor)*	**17,600**

*Notes: *after Trenter, (2001)*

A bulking factor of 25% has been added to the total volume of peat extraction. It is reported by Trenter, (2001) that a range of bulking factors between 25 and 45% can be expected for peat. The bulking or effective volume increase of the peat occurs over the process of excavation, transport and replacement. The magnitude of the bulking factor will depend upon site specific ground conditions and the physical properties of the excavated peat. A primary factor will be in the amount of handling which the excavated peat deposits experience.

4. Re-use Volumes of Excavated Peat

4.1. Access Infrastructure

In order to estimate the volume of peat that would potentially be re-used as part of construction and restoration, an indicative estimate has been calculated based on best practice and past project experience. Table 4.1 below provides an approximate total volume of peat that could be accommodated across the site. The following assumptions salient to the best practice re-use of excavated peat are highlighted below:

CONSENTED (LA01/2018/0200/F)

Floating tracks are not expected to be required on the Dunbeg South wind farm. The following information is given to inform the reader should any sections require floating track.

Source: FCE, SNH, (2010)

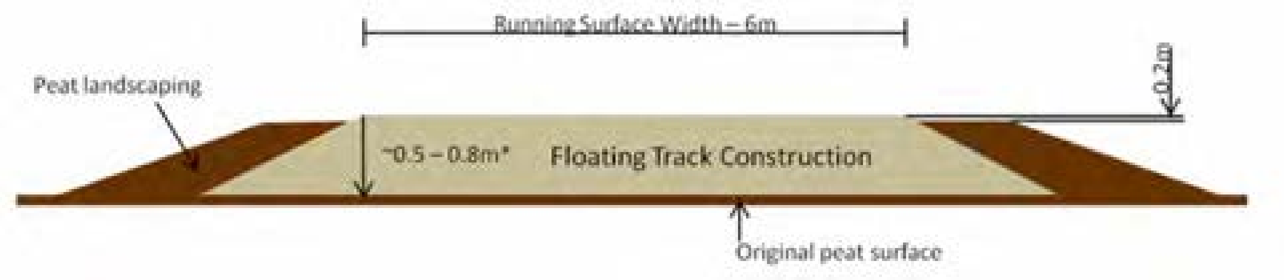


Figure 4.1: Typical Arrangement for Peat Verges on Floating Access Tracks

The final construction thickness of any floating track construction will be a function of the local ground conditions, including geotechnical properties of the peat, hydrology and design load requirements. An indicative range of 0.5 – 0.8m has been indicated as a typical thickness for upland wind farm floated access tracks, (FCE & SNH, 2010). The depth of peat on the landscaped verge would therefore be a function of the total depth of floating track. It would be a priority for the landscaped verge only to re-instate the track edge and any disturbed peat along the corridor of the access track. No undisturbed peat shall be smothered by the landscaping. Landscaped verges should be lowered by 0.2m below the running surface of the access track is to ensure any surface water can drain naturally, and diffusely where it arises. This shall aid in maintaining hydrology within the peat and prevent it oxidising and drying out. This approach is taken to provide visual continuity between the raised infrastructure and surrounding peat land while maintaining important hydrological and drainage conditions.

For ‘cut’ access track construction across the site, it is assumed that 1m^3 of peat per linear metre of track constructed may be accommodated as part of the reinstatement works. This is an indicative figure only and will vary according with the prevailing ground conditions.

4.2. Preserving Peat Structure

During the excavation and re-use of peat deposits the two layered structure of the ‘acrotelm’ and underlying ‘catotelm’ shall be preserved as far as is practicable (Figure 4.2). This approach will aid in the successful re-vegetation and prevent drying and desiccation of the peat. Where the catotelmic peat becomes separated appropriate measures shall be in place to ensure this material is stabilised prior to re-use. This will be verified by a suitably qualified geotechnical engineer.

CONSENTED (LA01/2018/0200/F)

Source: *Good Practice During Wind Farm Construction*

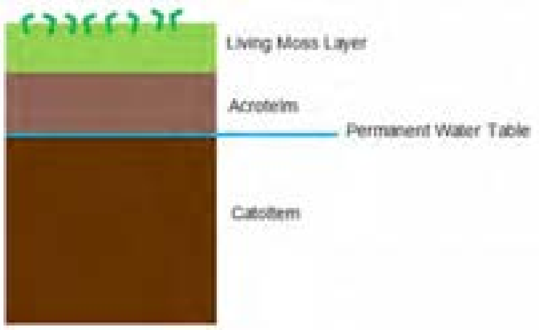


Figure 4.2: Diagram showing idealised Peat Structure

Re-use Volume Estimate

Table 4.1: Estimate of Peat Re-use Volumes

Construction Element	Peat Extraction Volume (m^3)	Peat Re-use Volume (m^3)	Surplus (+) or Deficit (-) (m^3)
Turbine Foundations & Hardstand	4,900	13,300	**4,700**
New Access Track	8,400	4,500	3,900
Ancillary Infrastructure	800	2,500	**1,700**
TOTAL*	14,100	20,300	**6,200**
TOTAL (including 25% bulking factor)*	**17,600**	20,300	**2,700**

It should be noted that this assessment has not accounted for excavation volumes of glacial sub-soils or weak bedrock material, which may be deemed unsuitable for incorporation into foundations and hardstand elements. The estimate is that there is approximately 20,300m^3 of capacity for excavated peat to be accommodated in the construction of the wind farm and utilised in the finishing and landscaping across all infrastructure elements when adopting the strategy set out above. This figure is based on re-use of peat in circumstances where there is an identified and suitable use.

Comparing the total volume of re-usable peat with total volumes of excavated peat, allowing a bulking factor of 25% it is indicated that all peat excavated during the construction of the proposed infrastructure can be reused on the Dunbeg South Wind Farm. Where factors which contribute to the bulking of the peat deposit are mitigated the total volume of excess excavated peat may be reduced to balance with re-use volumes through:

- Reduction of peat handling with re-use of peat undertaken as close as possible to the excavation site;
- Maintaining the integrity of the excavated peat mass including preservation of the surface acrotelm layer as far as is practicable;
- Prevent the drying and desiccation of excavated peat deposits through timely re-vegetation and preservation of the surface hydrology systems.

4.3. Temporary Peat Storage

Consideration for the storage of peat has been undertaken with input gathered from the Scottish Renewables Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste, (2012).

CONSENTED (LA01/2018/0200/F)

The temporary storage of excavated peat shall seek to minimise disturbance of deposits by minimising haul distance between temporary peat storage sites and re-use areas. In general it shall be a priority to avoid a single site dedicated temporary peat storage area. A progressive construction method which re-cycles peat through excavation and timely re-instatement in a continuous process shall be adopted for the construction of access tracks, hardstand areas and foundation elements. However temporary infrastructure elements shall require storage of peat prior to re-instatement at the end of the construction phase.

For the temporary construction compound, it is proposed that stripped peat and superficial deposits are temporarily stored in stockpiles / bunds adjacent and surrounding each infrastructure site. The exact areas identified for temporary storage shall only be defined following a detailed site investigation.

Surrounding these areas the peat stability, drainage and pollution prevention mitigations shall be appraised as part of the detailed construction method statement. In general areas of deep peat (>1.5m) shall be avoided for dedicated temporary storage areas. It would be a priority to ensure that a future detailed site investigation provides information on the suitability of these temporary peat storage areas including the topographic profile, groundwater regime, and geotechnical properties of deposits underlying the temporary storage sites. Furthermore it may be necessary to undertake further peat stability calculations based on finalised placement of temporary peat storage areas.

In temporary storage areas; peat shall be stored on geo-textile matting which acts as a protective barrier to the underlying soils and vegetation. The geo-textile shall be designed to prevent ingress of groundwater and erosion and de-stabilisation of the base of the stored peat. Peat shall be stored to a maximum depth of 1m with the peat turfs stored separately from underlying peat. The peat turfs or vegetation layer shall be stored in a single layer.

A system of watering the stored peat and turfs / vegetation shall be in place to ensure that the peat remains damp and prevents drying out and desiccation. The vegetation layer and seed bank shall therefore be sustained. This is an important element in the restoration of infrastructure, providing continuity with surrounding local vegetation upon reinstatement. For the duration of the temporary storage it shall be necessary to periodically monitor the condition of the stored peat and ensure the stability is maintained. This may need to be undertaken by a suitably qualified geotechnical engineer.

4.3.1. Temporary Peat Storage Suggested Locations

The following areas have been identified as potential peat storage locations based on their distance from water courses, low volume of peat, slope angle and proximity to infrastructure to limit transport of peat around the site.

CONSENTED (LA01/2018/0200/F)

Source: Natural Power

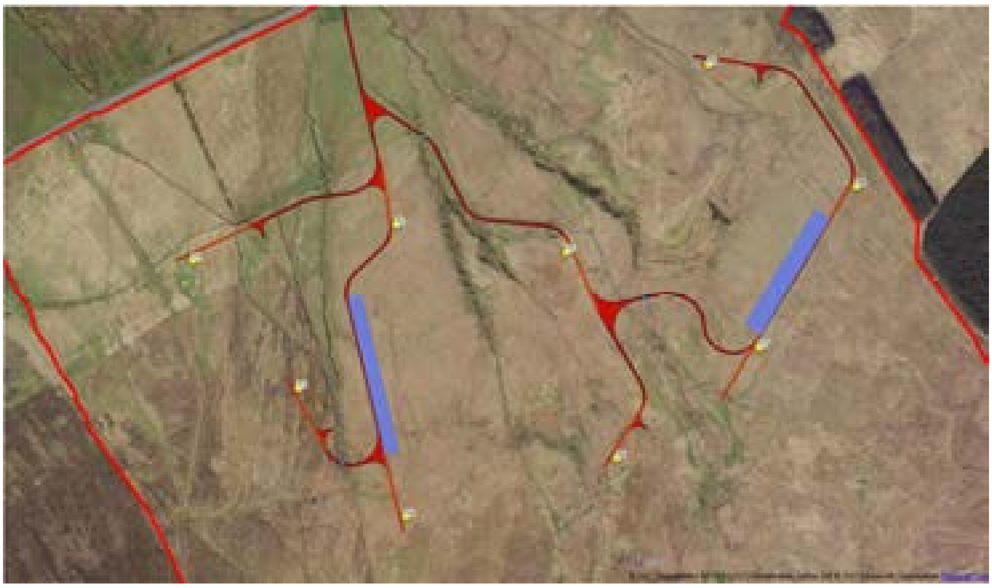


Figure 4.3: Potential Peat Storage locations shown in blue.

4.4. Limitation of Assessment

The peat extraction and re-use volumes are intended as a preliminary indication. The total peat volumes are based on a series of assumptions for the development layout and peat depth data averaged across discrete areas of the development. Such parameters can still vary over a small scale and therefore local topographic changes in the bedrock profile may impact the total accuracy of the volume calculation. Where total volumes have been stated these have been rounded to the nearest 100m^3 in order not to convey a false accuracy.

The accuracy of these predictions may be improved though detailed site investigation (post consent). It is therefore important that the Peat Management Plan remains a live document throughout pre-construction and construction phases and is encapsulated within the wider Environmental Management Plan. The peat management plan and volumetric assessments can be updated as more accurate information becomes available.

In general the following guidance has fed into the design assumptions and subsequent selection of appropriate construction methods based on the distribution of peat depths across the site:

- Developments on Peatland: Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste (A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, 2012);
- Floating Roads on Peat (Forestry Civil Engineering & Scottish Natural Heritage, 2010);
- Good practice during wind farm construction (A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environmental Protection Agency, Forestry Commission Scotland, 2010).

The Peat Depth Contour Map reference (GB200135_M_005_C) provided within the Peat Slide Risk Assessment; illustrates the peat depth across the site, thus giving an indicative assessment of the peat depths at various infrastructure locations. As will be discussed in the following sections, the excavated peat and peaty soils across the site can be used in a variety of scenarios including dressing side slopes on the roads; backfill over turbine bases; and infill of artificial drainage. These further details on the best practice measures to re-use the excavated peat and peaty soils at the development are discussed in the following section.

CONSENTED (LA01/2018/0200/F)

5. Reinstatement Methodologies

Prior to commencing the construction excavation works, consideration will be given to methods for handling and holding the excavated materials, particularly peat or peaty soils. Haulage distances for the excavated material will be kept to a minimum, in order to reduce the potential impact on the peat/soil structure. Peat has the potential to lose structural integrity upon excavation particularly when double handled or moved around the site. Peat handling can also increasing the bulking factor of the material which has the overall effect of increasing the volume of peat which will need to be re-used across the site (Table 4.1)

The following paragraphs discuss the reinstatement measures that can be adopted for the main infrastructure components associated with the development.

5.1. Access Tracks

During track excavation works, where possible the vegetated top layer of material, which holds the seedbank, will be stripped and carefully set to the side of the worked area for re-use in the re-profiling and track verge reinstatement works (Photograph 1a). The vegetative layer will be stripped as whole turves and will be set aside vegetation side up (Photograph 1b).

Photo 1a: Track verge reinstatement works

Source: Natural Power

Photo 1b: Effective turf management

Source: Natural Power

If cut and fill tracks are required in areas of peat or remnant peat habitat, then reinstatement will involve laying subsoil peat on the cut batters and then placing peat turves and clods on top of this. Reinstatement will be completed as soon as possible following construction to minimise the risk of turf drying. Restoration will be carried out as track construction progresses (Photo 2).

CONSENTED (LA01/2018/0200/F)

Photo 2: Example of floating track verge reinstatement whilst access track construction continues

Source: Natural Power

In order to obtain the best results the previously stripped soils, vegetated layers or turves will be brought back over the verges of constructed tracks within as short a time period as reasonably possible, to give the seed bank and vegetation the best chance of an early regeneration (Photograph 3). Where possible, turves and topsoil will be matched to the adjacent habitat.

Photo 3: Example of good track reinstatement with heather turves re-established

Source: Natural Power

Where practical, if storage is required, the layers will be correctly stored in their respective soil/peat horizons, i.e. in the layers that they were stripped in, so when reinstated they can be put back in the correct order. This also provides the seedbank and vegetation the best chance of early regeneration. If temporary storage of excavated materials is required, then such material will be stored safely and the method of storage will not lead to any areas

CONSENTED (LA01/2018/0200/F)

of additional disturbance. If materials are to be stored for any length of time, then these designated areas will be agreed prior to the storage of any material. Consideration will also be given to periodically wetting the vegetation layers in order to prevent drying out. If this method is implemented, any runoff will be dealt with appropriately and will not be allowed to discharge into any adjacent watercourses unless treated.

Materials used for the construction process will not be used on the track edges unless it is being used for re-profiling purposes, in order to tie in with the adjacent topography. Peat and peaty soils will only be used to re-profile or finish off the edges of the track or where construction has damaged the surface layer (Photograph 4). In order to re-establish vegetation in these areas as quickly as possible peat or peaty soil turves will be utilised wherever practical.

Photo 4: Example of excavate and replacement access track verge reinstatement with peat turves

Source: Natural Power

The soil and peat material that is utilised for the track edge reinstatement will not be spread too thinly. If the material is spread too thinly then there is a tendency for it to dry out and crack, particularly during prolonged dry periods. This subsequently means that the soil/peat material will be unstable because the root system has not had an opportunity to establish. This is very much dependent upon the time of year that the work is taking place and also the altitude. These factors affect the growing performance of the vegetated turf. Early reinstatement will be undertaken as this provides for the most beneficial results.

Care will also be taken to ensure that excessive material is not used during the re-profiling and reinstatement of the track verges. In addition, excess peat will also not be used for reinstatement of track edges as it can lead to the additional loss of habitat, by smothering the existing adjacent vegetation and preventing re-growth of the vegetation next to the tracks. The addition of excessive materials, may cause instability at the track edges and increase the risk of the creation of sediment laden runoff and lead to potential carbon losses.

During the construction works, in areas where the spreading of seed rich materials or natural re-growth are considered to be impractical, not plausible or ineffective, then consideration should be given to re-seeding methods (Photo 5). The seed type and mix will be agreed by SNH and the local planning authority (the seed bank mix will be of local native species). In the event that vegetation re-establishment is observed to be failing during the post-construction monitoring stage, the potential for using re-seeding methods will be considered and discussed in consultation with SNH and the local planning authority.

CONSENTED (LA01/2018/0200/F)

Photo 4: Example of re-seeded track verge following construction

Source: Natural Power

The fundamental aspects of track reinstatement are summarised as follows:

- Consider haulage methods and specified storage locations in relation to areas being worked. Haulage distances to storage locations will be minimal;
- Vegetated turves and topsoil will be stripped with care and stored correctly i.e. separated in horizons and vegetation stored vegetation side up;
- For track reinstatement peat/peaty soil will be placed back in the correct horizon order and topsoil containing the seed bank will be on the top. If vegetated turves have been previously stripped then these will be placed on top to maximise vegetation growth potential;
- Reinstatement of verges will be completed as soon as possible to minimise turf drying i.e. reinstatement can take place whilst track construction continues;
- Peat/peaty soil will not be spread too thinly during verge reinstatement in order to prevent cracking/drying out and excessive amounts of peat will also not be used as this can lead to unstable surfaces, effect drainage, loss of habitat via smothering of adjacent vegetation and create sediment laden runoff; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration, however, if required, following consultations with SNH re-seeding using a native species mix will be considered.

5.2. Cable Trenches

The reinstatement and storage of any excavated materials for the cable trenches will involve replacement of previously stripped soils, vegetated layers or turves (Photo 5). Timing of trench reinstatement works will also take into account adjacent construction activities which may disturb any reinstatement works already carried out.

CONSENTED (LA01/2018/0200/F)

Photo 5: Reinstatement of cable trench adjacent to access track with excavated materials

Source: Natural Power

The amount of time between the excavation of the trench and subsequent reinstatement following cable laying will be minimised as much as practically possible. The reason for this is that the longer the stripped turves are stored for the more they will degrade and become unsuitable for successful reinstatement. The optimum scenario for the cable trench works will be to ensure that no cable trenches are excavated until the electrical contractor has their cables ready for installation on site. Reinstatement will take place as soon as possible, trenches which are left open for a long period of time will have a tendency, to act as conduits for surface water runoff, thus potentially leading to increased sediment loading due to erosion. This could potentially affect the sites watercourses and lead to the occurrence of a pollution event.

The type of vegetation used for reinstatement will not differ from the adjacent area. The fundamental aspects of cable trench reinstatement are summarised as follows:

- Cable trenches will be constructed to the relevant detailed design specifications;
- The majority of cable trenches will be constructed adjacent to access tracks, i.e. reducing construction impacts on virgin ground;
- Scheduling of cable trenches will be considered in conjunction with access track construction, i.e. track verges will not be reinstated and then disturbed again for cable trench works;
- Stripping, storage and reinstatement of excavated materials will be as per the information presented in Section 4;
- Time between trench excavations and reinstatement will be as short as possible in order to reduce the potential for stored turf layers to dry out and decompose. In addition if excavations are left open for any length of time they have a tendency to act as conduits for surface water runoff; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration. However, if required, following consultations with SNH, re-seeding using a native species mix will be considered.

CONSENTED (LA01/2018/0200/F)

5.3. Wind Turbine Foundations

Where practical the peat turves and topsoil will be stored around the perimeter of the foundation excavation, as shown in Photo 6. A plan showing where the material is to be stored will be created prior to the works commencing. In areas where storage of the peat turves or excavated material adjacent to the works is not possible, then the material will be taken to the nearest agreed storage areas as soon as possible.

Photo 6: Excavated material stockpiled around the perimeter of the foundation excavation

Source: Natural Power

The turbine foundations will be backfilled with the excavated material. Not all excavated material will be suitable for backfilling or reinstatement. The material unsuitable for backfilling and reinstatement will be taken to its final agreed location as soon as possible in order to reduce the risk of a pollution event or contamination of adjacent land or stockpiles. The previously stripped and stored soils, and vegetated layers or turves will then be spread over the disturbed area, caused by turbine foundation construction (Photo 7). Where turbine bases are constructed in peat, reinstatement will involve laying subsoil peat on the backfilled area and then placing the vegetated peat turves on top. Reinstatement will be carried out as soon as practically possible following completion of foundation construction to minimise the risk of turves/vegetated layers drying out.

CONSENTED (LA01/2018/0200/F)

Photo 7: Reinstatement of turbine bases using excavated materials (in peat)

Source: Natural Power

Re-seeding will be considered for surfaces where natural re-growth and spreading of seed rich material is unlikely to be effective, or where re-establishment of vegetation is observed to be failing during monitoring. In the event that re-seeding is required, the seed type and mix will be agreed in consultation with SNH and local planning authority. The fundamental aspects of turbine foundation reinstatement are summarised as follows:

- Construction works will be carried out to the detailed specification of the turbine foundation design however excavations will be kept to a minimum to reduce the amount of peat excavated;
- Stripping, storage and reinstatement of excavated materials will be as per the information provided in Section 4;
- A detailed plan of where excavated material will be stored will be created;
- Subsoil/peat will be spread over the backfilled area during reinstatement. Peat turves will then be placed on top to encourage natural re-growth of the vegetation;
- Time between turbine foundation excavation and reinstatement will be as short as possible in order to reduce the potential for stored turf layers to dry out and decompose; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration. However, if required, following consultations with SNH, re-seeding using a native species mix will be considered.
-

5.4. Crane Hardstanding

As detailed within the “Good practice during wind farm construction” document (2010), reinstatement of the crane pads will not occur:

- Re-use of crane pads following construction is higher than previously estimated;
- In the past crane pads have been reinstated using a layer of peat following construction. On many sites this layer has been stripped back within 2-3 years of operation to allow maintenance works to take place; and
- When the peat is stripped back, it mixes with the stone from the hardstanding, thus contaminating the peat/peaty soil layer and making it unsuitable for re-use for reinstatement.

CONSENTED (LA01/2018/0200/F)

Due to the requirement for hardstandings to remain in place, and use of crane pad areas during maintenance activities, levels of vegetation re-growth are liable to be low if crane hardstandings are covered.

The area around the crane pad and any exposed batters will be reinstated with previously stripped soils, vegetated layers and turves, using the same methods to those described for track reinstatement in section 4 of this document.

The fundamental aspects of crane hardstanding reinstatement are summarised as follows:

- Crane pads will not be reinstated – in line with best practice; and
- Stripping, storage and reinstatement of excavated materials will be as per the information presented in Section 4, this will however, only be in relation to the area around the crane pad and any exposed batters.

5.5. Ancillary Infrastructure

All temporary construction areas will be removed and reinstated as quickly as possible following construction. Following removal of temporary site accommodation, storage, equipment and materials, all areas will then be reinstated. The hardstanding surface will be lifted prior to re-soiling to aid with drainage and re-generation. Installation of a geo-grid base/geotextile during construction of the compound would help to facilitate removal of the hardstanding if this is required.

The reinstatement will involve reprofiling/landscaping to ensure that the reinstated area blends in with the surrounding area. Suitable materials i.e. topsoil and peat will then be replaced over the area in appropriate horizons i.e. in the correct order (Photo 9). The material used for the reinstatement works (often that which was excavated for the temporary construction area), will be stored and managed adjacent to the temporary construction areas but away from watercourses and other sensitive receptors.

It is highly probable that the temporary construction areas, such as the site compound will only be required for the duration of the construction period. Therefore it is unlikely that any stripped turves would be suitable for reinstatement, as the vegetation would have decomposed if stored for any length of time. Vegetation will therefore be allowed to regenerate naturally. Natural regeneration could take several years and is dependent upon the type of adjacent vegetation and the altitude of the location. Re-seeding will be considered if required. In the event that re-seeding is required, the seed type and mix will be agreed in consultation with SNH and local planning authority. In addition, temporary fencing of the areas to prevent grazing by deer will also be considered in order to help accelerate the re-vegetation process (Photo 8).

The fundamental aspects of temporary construction reinstatement is summarised as follows:

- Areas will be re-profiled/landscaped to ensure they blend in with the surrounding area;
- Topsoil/peat will then be spread over the area in its appropriate horizons;
- Material used for the reinstatement will be stored appropriately where practical adjacent to the temporary construction area;
- Stripped turves may dry out due to the length of time they are stored (compound required for duration of construction period) therefore will not be suitable for reinstatement; and
- Natural regeneration of vegetation is the preferred option for reinstatement and restoration. However, if required, following consultations with SNH, re-seeding using a native species mix will be considered.

CONSENTED (LA01/2018/0200/F)

Photo 8: Example of temporary compound reinstatement

Source: Natural Power

6. Peat Restoration

The area within which the wind farm will be located has not been subject to extensive modification via the installation of widespread and deep artificial drainage or peat cuttings. However where suitable there may be further scope of restoration of artificial drainage if deemed to be of hydrological benefit and where this will not create any increased risk of peat instability.

It is reiterated that Table 4.1 has indicated that there is approximately 20,300 m^3 of capacity for excavated peat to be accommodated in the construction of the wind farm and utilised in the finishing and landscaping across all infrastructure elements. This figure is based on re-use of peat in circumstances where there is an identified and suitable use. The peat excavation volume calculations predict on the order of 17,600 m^3 of peat which will require excavation as part of the wind farm proposals. With the 25% bulking factor there will be deficit of 2,700 m^3 meaning the total volume of extracted peat should be able to be restored on site. It is important to follow the appropriate mitigations outlined in the reuse section in order to lower the bulking factor and reduce the volume of excess peat. Extraction and reuse volumes for each infrastructure element are outlined in Figure 6.1 below.

CONSENTED (LA01/2018/0200/F)

Source: Natural Power

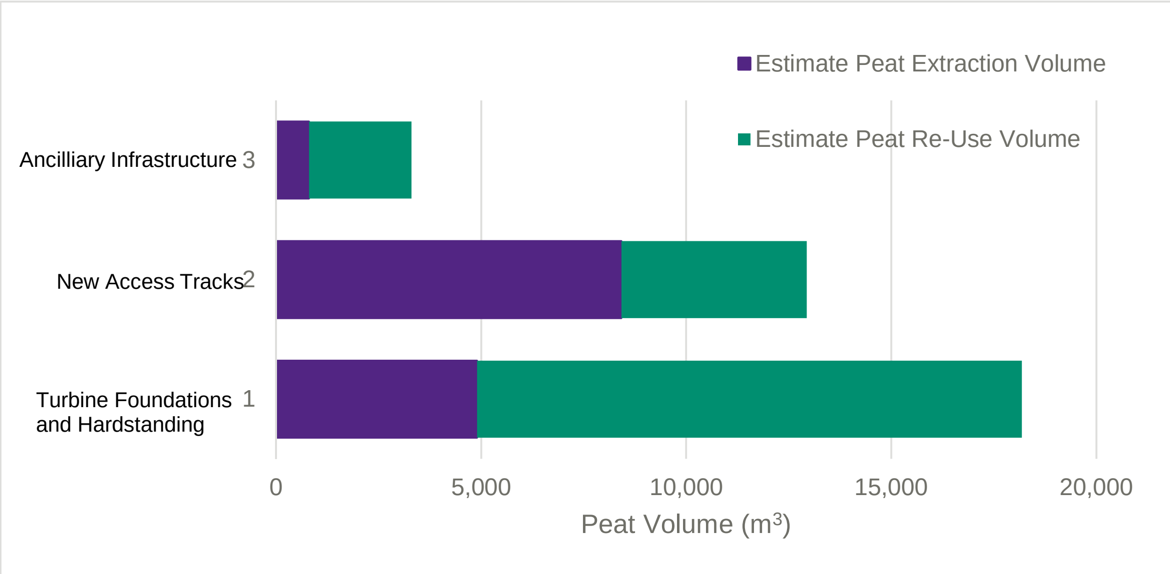


Figure 6.1: Graphical Representation of Estimated Peat Excavation and Re-use Volumes

7. Monitoring

The success of construction and the subsequent re-use of peat across the site can be monitored to ensure that effects on the peat land environment are appropriately understood and subsequently reduced via any remedial works that can be undertaken. The details of any required monitoring would be discussed and agreed with Northern Ireland Environment Agency (NIEA), National Heritage Ireland and Local Planning Authority prior to commencement. Appropriate monitoring is important to:

- Provide reassurance that established in-place mitigation and reinstatement measures are effective and that the site is not having an significant adverse impact upon the local and/or wider environment;
- Indicate whether further investigation is required and, where pollution is identified or unsuccessful reinstatement, the need for additional mitigation measures to prevent, reduce or remove any impacts on the environment; and
- Understand the long term effects of the site on the natural environment.

Due to the nature of the construction activities and the possibility that such works can increase the volume of dissolved and particulate matter from entering the natural drainage network a robust hydrological monitoring strategy will be implemented.

A reinstatement monitoring strategy can also be implemented, where surveys can be carried out to monitor the success of peat re-use and subsequent reinstatement. Complimentary to the hydrological monitoring highlighted above and best practise geotechnical monitoring, the success of vegetation reinstatement can provide an insight into the effects of the wind farm on the local environment. Full details of the environmental monitoring strategies will be finalised following consultation with SNH, NIEA and Local Planning Authority.

CONSENTED (LA01/2018/0200/F)

8. References

British Geological Survey (Scotland) Solid & Drift Geology, 1:50,000.

British Standards Institute (2009). BS6031:2009 Code of practice for Earthworks.

MacCulloch, F. (2005). Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume/Low Cost Roads over Peat. Road Ex 11 Northern Periphery.

Scottish Executive (2007). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. http://www.scotland.gov.uk/Publications/2006/12/21162303/0.

Trenter, N.A, 2001, Earthworks A Guide, Thomas Telford Ltd, ISBN 9780727729668

Developments on Peatland – Guidance on the assessment of peat volumes, re-use of excavated peat and the minimisation of waste – Scottish Natural Heritage (SNH), Scottish Renewables, SEPA, Forestry Commission Scotland (FCS), 2012;

Developments on Peatland – Site Survey, Scottish Government Guidance, Soil Survey of Scotland, 2012.

Floating Roads on Peat – Report into Good Practice in Design, Construction and Use of Floating Roads on Peat with particular reference to Wind Farm Developments in Scotland, FCS, SNG, 2010;

Good Practice During Windfarm Construction, A joint publication by; Scottish Renewables, SNH, SEPA, FCS, 2010;

Web Resources

http://www.bgs.ac.uk/

http://www.sepa.org.uk

https://www.daera-ni.gov.uk/

CONSENTED (LA01/2018/0200/F)

What We Do

Natural Power is a leading independent renewable energy consultancy and products provider. We offer proactive and integrated consultancy, management & due diligence services, backed by an innovative product range, across the onshore wind, offshore wind, wave, tidal, solar and bioenergy sectors, whilst maintaining a strong outlook on other new and emerging renewable energy sectors. Established in the mid-1990s, Natural Power has been at the heart of many ground-breaking projects, products and portfolios for close to two decades, assisting project developers, investors, manufacturers, finance houses and other consulting companies.

With its iconic Scottish headquarters, The Green House, Natural Power has expanded internationally employing 300 renewable energy experts across Europe and the Americas and operating globally. Providing Planning & Development, Ecology & Hydrology, Technical, Construction & Geotechnical, Asset Management and Due Diligence services, Natural Power is uniquely a full lifecycle consultancy – from feasibility to finance to repowering, and every project phase in between. We are a truly trailblazing consulting organisation; Natural Power has consistently invested in product development and technical research in order to progress certain key areas within the industry such as the operational management of wind farms, the design and assessment of wind farms in complex flow and the use of remote sensing for wind measurement. From award-winning consultancy and management services, through a string of technology world-firsts, Natural Power has a successful track record and the breadth of services and deep-rooted experience that provides a wealth of added value for our diverse client base.

Natural Power – delivering your local renewable energy projects, globally.

Our Global Expertise

Natural Power delivers services and operates assets globally for our clients, with twelve offices across Europe and North America and agencies active in South America and AsiaPac.

UK

Registered Office > Scotland
The Green House, Forrest Estate
Dalry, Castle Douglas, DG7 3XS
SCOTLAND, UK

Stirling > Scotland
Ochil House
Springkerse Business Park
Stirling, FK7 7XE
SCOTLAND, UK

Inverness > Scotland
Suite 3, Spey House, Dochfour
Business Centre, Dochgarroch
Inverness, IV3 8GY
SCOTLAND, UK

Dublin > Ireland
First Floor, Suite 6, The Mall,
Beacon Court, Sandyford,
Dublin 18
IRELAND

Aberystwyth > Wales
Harbour House, Y Lanfa
Aberystwyth, Ceredigion
SY23 1AS
WALES, UK

London > England
200 Aldersgate St
City of London, EC1A 4HD
ENGLAND, UK

Newcastle > England
Unit 5, Horsley Business Centre
Horsley
Northumberland, NE15 0NY
ENGLAND, UK

Warrington > England
Suite 26, Genesis Centre,
Birchwood, Warrington, WA3 7BH
ENGLAND, UK

EUROPE

Strasbourg > France
1, rue Goethe
67000 Strasbourg
FRANCE

Nantes > France
1 rue du Guesclin
BP61905, 44019 Nantes
FRANCE

Halmstad > Sweden
c/o The Green House,
Forrest Estate
Dalry, Castle Douglas, DG7 3XS
SCOTLAND, UK

Ankara > Turkey
re-consult
Bagi's Plaza
- Muhsin Yazıcıoğlu Cad. 43/14
TR / 06520 Balgat-Ankar
TURKEY

THE AMERICAS

New York > USA
63 Franklin St, Saratoga Springs,
NY 12866, USA

Valparaiso > Chile
Latwind Energías Renovables
Lautaro Rosas 366, Cerro
Alegre Valparaiso, CHILE

naturalpower.com
sayhello@naturalpower.com

No part of this document or translations of it may be reproduced or transmitted in any form or by any means, electronic or mechanical including photocopying, recording or any other information storage and retrieval system, without prior permission in writing from Natural Power. All facts and figures correct at time of print.
All rights reserved. © Copyright 2017

CONSENTED (LA01/2018/0200/F)

ANNEX 4: ES MITIGATION TABLE

CONSENTED (LA01/2018/0200/F)

Alongside each mitigation measure identified, the proposed mechanism by which it will be adopted, implemented or enforced has been provided as well as the period by and /or timing which the mitigation measure will be undertaken.

Schedule of Mitigation

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
4. LVIA	Landscape And Visual impact	The exterior surfaces of the turbines will be painted in a recessive, non-reflective light grey colour to minimise their visual prominence against the sky in most weather conditions.	By condition.
		The control room and substation compound will be designed in a manner that is sensitive to the immediate landscape character with regards to colour and choice of materials.	Through Construction & Decommissioning Method Statement (CDMS) to be agreed with CC & G BC prior to construction and implemented during construction.
		A landscape restoration plan will be implemented on decommissioning of the Proposed Wind Farm Development. This would include the reinstatement of appropriate vegetation, enhancement of the landscape with additional planting if appropriate, the treatment of remaining access tracks, etc. Such a restoration plan will be subject to discussion and approval by the relevant statutory authorities at the appropriate time.	By Condition. Decommissioning Method Statement to be agreed with CC & G BC prior to decommissioning and implemented during decommissioning.
5. Archaeology and Cultural Heritage	Potential direct effects on currently undiscovered archaeological remains and heritage assets on site	Prior to construction commencing, an archaeological programme of works should be presented to and approved by the DOE: HED. This approved programme should be incorporated into a pre-build Construction Method Statement, prepared by the Applicant. The written scheme should specify the methodology and timetable for a programme of work covering the investigation and evaluation of archaeological remains within the Planning Application Boundary, for mitigation of any impacts through excavation or recording and preservation of the remains *in situ*.	By Condition. Programme of Works to be agreed with CC & G BC prior to construction and implemented during construction
6. Ecology	General	Measures required to address ecological concerns described in this ES during the construction phase will be incorporated within a Construction and Decommissioning Method Statement (CDMS), which will be submitted to and agreed with the CC & G BC at the pre-construction stage.	By Condition. CDMS will be agreed with the CC & G BC prior to construction and implemented during construction.
	Land take (0.7ha), resulting in loss of wet heath which, despite being degraded is still considered to be an NI priority habitat	Habitat restoration and enhancement is described in the Revised Outline Habitat Management Plan (OHMP) as submitted as part of FEI 2019 to provide compensation for the loss of small areas of degraded M15 wet heath and a larger area of species-poor PMGRP The grassland in the habitat management area will be managed in line with the following key measures: • No grazing will be permitted between 1 January and 15 April. • Grazing is permitted between 16 April and 31 December at a stocking density of 0.75 LU/ha (cattle should be included in the grazing regime). • Excess grass can be cut for hay but must not be cut until after 15 August (but the area should be cut at least once every 3 years (to remove litter accumulation (if possible) with half mown in year one, half in year two and no cut in year 3)[1]. • Introduction of livestock (cattle only) aftermath grazing from mid-August onwards to create gaps in the sward and trample in the seed. • No use of inorganic fertilisers, lime or animal slurry.	By Condition HMP to be agreed with NIEA / CC & G BC prior to construction and implemented during construction and operation.

[1] Only during years that ground conditions permit (as the landowner maintains that much of the PMGRP is on land too wet to support a tractor and cutting attachment, during most years).

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		• Cultivation, reseeding, reclamation, infilling, dumping or application of herbicide, pesticide, sheep dip, poultry litter or any other material will not be permitted. • Installation of new drainage systems will not be permitted. • Supplementary feeding will not be permitted. • Excess grass may be saved for hay or silage but must not be cut until after 15 July. • No poaching of ground will be permitted. • Noxious weeds may be controlled by cutting between 15 July and 15 March, or with herbicides applied using a spot sprayer only. • Existing drainage systems can be maintained but not widened, deepened or extended. • No peat cutting. • No burning, flailing or harrowing of vegetation.	
	Loss of Wet Heath	Turves of heathland vegetation and associated topsoil from construction activity represent a valuable resource that can be used in the restoration of bare areas. Turves must be cut so that they capture the root systems of mineral soil as this will ensure any viable seeds are present. Turves can be laid in blocks or in a patchwork and over time heathland will develop within gaps and will provide a mosaic of structure. Prior to the commencement of the main works, the areas of wet heath (T3 & T6) will be translocated into the restoration area using large-scale turfing equipment, using a technique known as "macro-turfing", moving large, thick turves. This method has many advantages over traditional turfing, virtually eliminating problems of frost and drought damage, and because the turves are thick, most burrowing invertebrates and deep-rooted plants survive. At both locations (around T3 & T6) the vegetated turves will be lifted to a depth of approximately 25-40cm, (i.e. total depth of topsoil at each location).	By Condition CDMS will be agreed with the CC & G BC prior to construction and implemented during construction To be completed during autumn / winter if possible.
	GWDTEs	Where tracks cross a watercourse (spring or seepage) which feeds (or emanates) from a GWDTE (upland flush, fen or swamp), water flow under the track will be preserved by installing numerous flow-balancing cross drainage pipes laterally through the track structure, thus retaining the hydraulic gradient across the footprint of the track. Pipes will be installed at a high frequency (nominally 5-10m intervals), subject to observational design by the ECoW to suit particular water channels observed on site. No longitudinal drainage is to be installed parallel to and adjacent to the tracks (in proximity to these areas (immediately north of T6 and south of T7), in order that no unnecessary flow path that would significantly alter flow routes is introduced. Drainage arrangements are shown on site within the Water Framework Directive Assessment prepared by McCloy Consulting – Annex 2 of Outline CEMP.	By Condition CDMS will be agreed with the CC & G BC prior to construction and implemented during construction
	Bats (under precautionary principle).	The Bat Monitoring Plan (BMP) will be agreed with NIEA/The Council and monitoring will be undertaken in years 1, 2, 3 & 5 and will be reviewed after each survey period to determine whether remedial action is required to mitigate the effects of the Development on bats. At the end of year 5, the data will be reviewed to determine whether monitoring should continue.	By Condition BMP to be agreed with NIEA / CC & G BC prior to construction and implemented during construction and operation.
	Impact on Common Lizard	Depending on the commencement of construction on site, the works corridor will be mowed.	By Condition

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations. Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e. mid-October to mid-March). Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include: • Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or; • Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut; Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above. Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above. As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population. If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor.	CDMS and HMP, which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction.
	Smooth Newt – sections of track (illustrated on Figure 6.8) within 200m buffer which surrounds the smooth newt breeding pond	It is proposed that any newts migrating from adjacent coniferous plantation (Springwell Forest) towards the pond would be captured using a combination of drift fencing (during the construction phase), along with pitfall traps in order to prevent access by newts to the works area. The drift fencing would consist of UV-resistant plastic stretched between poles with wire to present a barrier 50-60cm high and would be dug into a depth of 10-20cm below ground level to prevent access underneath. This would be positioned for 200m along both sides of the proposed access track (southwest of the smooth newt breeding pond (as shown on Figure 6.8)). Twenty number plastic 10-litre buckets would be buried with the rim at ground level and placed firmly against the fence (ten either side of the track) in order to catch any newts migrating towards the pond. The traps would contain 10cm depth of water at all times and would be checked daily (between the first erection of the fence (prior to the 15 March) and the completion of construction. This mitigation program would be carried out during both the spring migration (mid-Feb to mid-Apr) towards the pond and the autumn migration (mid-June to mid-August) towards hibernation areas.	By Condition CDMS which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction.

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		This would be carried out under licence; and once construction is completed the newt fencing would be removed to allow the newt's access to the wider site again. The Project EcoW would also be present on the site immediately prior to and during clearance of site vegetation in order to comply with any likely Wildlife Licence relating to the proposed mitigation. The EcoW would also supervise the erection of the drift fence, the checking of the pitfall traps (and associated removal of any newts to the breeding pond). A newt hibernaculum would also be created (to the southeast side of the pond); so as to reduce the need for newts to have to cross the wind farm access track towards the conifer plantation (located on the opposite side of the new access track). An example of a suitable hibernaculum can be found in Appendix 6.7 of ES).	
	Badgers – Potential for disturbance	A detailed Protected Species Management Plan (PSMP) will be developed and agreed with NIEA prior to construction commencing. This will include details of the protection of badgers. The following will be included within the PSMP (as a minimum): A preconstruction badger survey will be carried out not more than 12 months prior to construction in order to identify any changes to setts on the ground in the period from 2019. The results of this will be provided to NIEA and will form the basis of the Wildlife Licence application to permanently close sett A2 as part of the construction works. A 25m buffer zone will be maintained around all setts. Although sett Cluster C maybe exempt from this condition (upon agreement with NIEA), given the distance to construction and (topographical protection). The fencing should consist of hazard protection mesh and substantial posts. Signage will also be erected on route to warn operatives of the location of badger setts. An Ecological Clerk of Works will oversee the implementation of all mitigation measures (including fencing); this will include a tool-box talk for all operatives of the location of badger setts. All excavations will be fenced off and/or ramps provided to prevent entrapment in the event that a badger was to fall into an excavation. No artificial lighting will be allowed to spill on to setts or nearby foraging grounds. This is particularly relevant to the area surrounding sett A1 and the site compound. No fencing that restricts access for badgers will to their foraging grounds will be permitted. An emergency procedure will be implemented by site workers if signs of badger (e.g. setts, latrines or animals) are encountered. All work within 25m to cease, and the Ecological Clerk of Works to inspect site and define mitigation (if required).	By Condition CDMS which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction.
7. Ornithology	Sensitive Bird Species	To reassess use of the proposed wind farm site and relevant buffer areas by sensitive bird species and to provide a revised ornithology baseline for input to the Ornithological Mitigation Strategy	By Condition CDMS which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction. Year prior to construction commencement
	Impacts during bird breeding season	To allow construction work to take place during the bird breeding season (1st March – 31st August) whilst avoiding any significant adverse effects on breeding birds	By Condition CDMS which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction.

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
			During Construction
	Snipe – potential displacement	The grazing dates, prescriptions and overall regime within the proposed Habitat Management Area (HMA) has incorporated the requirements for snipe, however in addition the following will also be required: • Cattle must not be released directly on to breeding wader sites after being wintered indoors. Cattle must be outside for at least one week before being put on to breeding wader fields. • Field operations, for example rolling and fertiliser application, are not permitted between 15 April and 30 June. • Soft rush (Juncus effusus) control must be carried out where rushes cover more than one third of the area. Rushes must be controlled by cutting between 15 July and 15 March, retaining 30% uncut. • The spread of scrub/trees will be controlled. • The landowners will implement predator control (foxes, magpies and hooded/carrion crows) within the habitat management area; during the period 15 January to 15 August. (Larsson traps and shooting will be used). • Water levels in sheughs and drains will be maintained as close as possible to bank height during the period 1 March to 30 June to create soft ground (within the area outlined in (revised) Figure 6.9).	By Condition CDMS and HMP which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction and operation.
	Red Grouse	Figure 6.9 (revised) outlines the area which will be monitored for red grouse habitat and within which construction year vegetation management will be undertaken. Photographic evidence of construction year heather management over 15% of the lands within the area outlined on Figure 6.9. The results of the red grouse habitat surveys (below) will be used to determine if vegetation (heather) management should be repeated at any point during 30-year management period.	By Condition CDMS and HMP which will be agreed with NIEA / CC & G BC prior to construction and implemented during construction and operation.
8. Fisheries	Sediment run-off	50m minimum width for significant watercourses (catchment area within site >0.25 km2 with the exception of essential watercourse crossings.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
	Obstruction of fish passage	Appropriate site management during all works near watercourses will ensure that the channel remains passable for migratory fish at all times as required at two locations on Stream C for the provision of access tracks to T5, T6, T7, T8 & T9 located in the eastern half of the site..	
	Loss of fish habitat and sediment run-off	Stream crossings at the two sensitive locations on Stream C will be achieved using bottomless culverts to minimise disturbance of the river channel and the release of sediments.	
	Loss of fish habitat and sediment run-off	All works at stream crossings will adhere to the measures outlined in the Good Practice Guidance notes PPG5: Works In, Near or Liable to Affect Watercourses (Environment Agency, 2014).	
	Sediment entrainment in surface water run-off	The site drainage system should only be constructed during periods of low rainfall and therefore low run-off rates.	
	Release of pollutants	All precautions will be taken to avoid spillages of diesel, oil or other polluting substances during the construction phase. This will be achieved through good site practices as described in the Good Practice Guidance notes proposed by EA/SEPA/NIEA (Environment Agency, 2014)	

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		A contingency plan will be prepared setting out the procedure to be followed in the event of a significant spillage occurring. Specific measures will be included in the Construction and Decommissioning Method Statement (CDMS), which will be agreed with DOE Planning prior to construction.	
	Sediment run-off, release of pollutants during decommissioning	Mitigation measures during decommissioning will be the same as during the construction phase with regard to addressing the potential for run-off of suspended solids and other polluting substances. However the level of mitigation will be determined by the level of reinstatement required. It is proposed that the surface water quality monitoring be extended into the decommissioning phase.	Through Decommissioning Method Statement, to be agreed with CC & G BC prior to decommissioning and implemented during decommissioning.
9. Geology and Water Environment	Changes in run-off and flow pattern, silt/suspended solid/chemical pollution of watercourses	The Site will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of on-site retention of flows and use of buffers and other silt removal techniques. All drainage-related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the Site.	CDMS and CEMP, which will be agreed with CC & G BC prior to construction and implemented during construction. Outline SUDS is provided in Revised Technical Appendix 9.1 – Water Framework Directive Assessment in Annex 2 of outline CEMP
		Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C689 "Culvert Design and Operation Guide" (or other standard as may be required by Rivers Agency in post-consent consultation), with primary parameters likely to include: ▪ Width of the culvert will be greater than the width of the active drainage channel; ▪ Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow; ▪ The slope of the culvert will not exceed the slope of the bed of the existing drainage channel. ▪ Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland. ▪	Statutory Approval, prior to construction
		Fisheries shall be protected by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency.	Through CDMS which will be agreed with CC & G BC prior to construction and implemented during construction.
		Consultation and approval will be sought from all relevant parties as required by the Department of the Environment Surface Waters Alteration Handbook (December 2013), including Rivers Agency in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments.	Statutory Approval, prior to construction
		A water quality monitoring program will be implemented to monitor effects on the hydrological and groundwater regime and water quality during the infrastructure construction, operation and decommissioning phases of the wind farm.in order to: ▪ Demonstrate that the mitigation measures and surface water management is performing as designed; ▪ Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment; ▪ Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short term flocculant dosing to suit observed Site conditions.	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction. Operational phase. Decommissioning Method Statement
		A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of a full Construction & Decommissioning Method Statement (CDMS) for the project	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction
		▪ Storage – all equipment, materials and chemicals on the Site will be stored away from any watercourse (i.e. outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with PPG2 and within a secured bund of 110% of the storage capacity, within the lay down area. ▪ Vehicles and refuelling – standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		areas, well away from any watercourse or drainage ditches (i.e. outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG7. ▪ Maintenance – on site maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Suitable measures in accordance with a pollution prevention plan will be put in place prior to commencement of maintenance in this instance. ▪ Cement and concrete batching – Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement are used, concrete batching will not be permitted on Site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed Pollution Prevention Plan for the Site to be approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water. ▪ Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on Site).	
		The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones: ▪ Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water. ▪ Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction
		Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months) and adhere to working period restrictions imposed. Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include: ▪ Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing; ▪ Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity; ▪ Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location; ▪ Use of over pumping where deemed appropriate.	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction
		▪ Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations. ▪ Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CDMS at the pre-construction stage. ▪ Cable crossings of watercourses shall use a raised cable tray to bridge the river channel, with supports and footings constructed out with the river channel. No plant shall be permitted within watercourse channels when undertaking such works.	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction
		Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat: ▪ will not be permitted within previously identified watercourse buffer zones; and ▪ will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided. Spoil drainage will be designed on a bespoke basis for spoil storage areas and ditch blocking areas contained in the HMP to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment.	CDMS, which will be agreed with CC& G BC prior to construction and implemented during construction. Outline SUDS is provided in Revised Technical Appendix 9.1 – Water Framework Directive Assessment in Annex 2 of outline CEMP

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		In dry weather dust suppression methods such as by dust suppression bowser will be employed.	CDMS, which will be agreed with DOE Planning prior to construction and implemented during construction.
		All swales, crossings and other hydraulic features will be engineered to ensure that dimensions etc. are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding. Shallow groundwater (e.g. in areas of glaciofluvial sand/gravel deposits) or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment. Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable.	CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction.
		Mitigation of the effects of the wind farm development will comprise the following: ▪ Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating NIEA Pollution Prevention Guidance notes into management policy. ▪ In the event that permanent welfare facilities are installed as part of control building / substation facilities, foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on the Site). ▪ Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in Technical Appendix 10.1: Water Framework Directive Assessment.	Operational management
App 9.4. Peat Slide Risk Assessment	General Risk Management Recommendations	The following recommendations, when incorporated into the design of the project will assist in the management of the risk from peat instability: ▪ The use of experienced and competent construction contractors; Detailed monitoring programme of geomorphology and hydrology across the critical areas as part of the construction management; this should be focussed across all infrastructure elements where a hazard ranking of 'Significant' or higher has been identified; map reference: GB200135_M_010_AError! Reference source not found., as well as areas with high Environmental Impact, in the case of Dunbeg generally located in close proximity to watercourses identified on map reference: GB200135_M_008_A; ▪ Refine the environmentally sensitive zones across the site and integrate these areas into the detailed Construction Method Statement (CMS); ▪ Implement appropriate peat mitigation measures at T09 to protect nearby watercourses, including diversion of minor water course away from construction works. ▪ Review micro-siting options if further detailed analysis reveals significant or substantial hazard rank areas. ▪ Apply conservative design parameters across the elevated hazard zones (i.e. where undrained shear strengths are low and there is shallow groundwater interaction); ▪ Produce a robust drainage design which preserves the natural hydrological regime across the development. The control of silt and suspended solids should be carefully planned to avoid detrimental environmental effects. All drainage discharges should be under consent from the relevant SEPA control unit and performed in an environmentally compliant manner; ▪ A documented procedure should be in place and rapid reaction strategy in place prior to the commencement of construction on peatland. This strategy should be easily enacted should signs of peat movement be recorded across the development. This approach requires periodic and continued monitoring of the construction process by a suitably qualified geotechnical engineer; ▪ A detailed Construction Method Statement (CMS) should incorporate the conclusions of the peat stability report and continuously update the assessment and develop appropriate mitigations to respond to the peat slide risk; ▪ A Geotechnical Risk Register should be maintained as a 'live' document and updated and amended as required throughout the pre-construction and construction phase of development.	CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction.

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
10. Noise	Potential construction noise at nearby properties Potential short term construction noise at nearby residential properties	The following noise mitigation options will be implemented where appropriate: ▪ Consideration will be given to noise emissions when selecting plant and equipment to be used on site; ▪ All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable; Stationary noise sources will be sited as far away as reasonably possible from residential properties and where necessary and appropriate, acoustic barriers will be used to screen them.	Through CDMS, which will be agreed with CC & G BC prior to construction and implemented during construction
		The movement of vehicles to and from the site will be controlled and employees will be instructed to ensure compliance with the noise control measures adopted.	TMP within CDMS, to be agreed with DfI Roads and CC & G BC prior to construction and implemented during construction.
		Site operations will be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or during periods of emergency work.	By Condition
		Action may be required to reduce construction noise levels at nearby properties for work scheduled to take place on Saturdays 1300-1900. The following may be considered: ▪ Reduce number of construction activities occurring simultaneously ▪ Restrict distance of construction activities from identified properties or ▪ Reduce construction traffic as required. ▪	TMP within CDMS, to be agreed with DfI Roads and CC & G BC prior to construction and implemented during construction.
11. Traffic and Transport	Impact on other road users	A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of Department of Infrastructure - Roads, CC & G BC, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include: ▪ Details of the access route, conformation of any points along the access route that require engineering works, details of traffic numbers, delivery timings, and signage and escort requirements; ▪ A delivery schedule for normal and abnormal loads so as to minimise disruption as far as reasonably practicable; ▪ Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods; ▪ Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy; and ▪ Information about marking of vehicles as long/abnormal loads. ▪ Information on how warning signs will be used ▪ The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, Transport NI, local residents, local business, local services and schools.	TMP within CDMS, to be agreed with DfI Roads and CC & G BC prior to construction and implemented during construction.
		A video survey of the pre-construction condition of all public roads will be recorded around the site entrances and access routes (but including the site entrance and immediate access roads), to provide a baseline record of the state of the roads prior to construction work commencing. This will enable any repairs and maintenance work required to the relevant road due to any damage caused by the passing of heavy vehicles associated with the wind farm construction to be identified following the construction phase. The roads will be returned, at minimum, to the baseline condition at the end of the construction phase. Any damage caused by wind farm traffic during the construction period, which would be hazardous to public traffic, will be repaired immediately. These works will be carried out under permits with DfI Roads, as appropriate.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
		The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and	TMP within CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
		pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible.	
	Impact on breeding birds	If cutting or removal of hedges and trees is required then this should be done outside the bird breeding season (1st March to 31st August). If work is to be done during the breeding season then there should be a survey to establish whether nesting birds are present.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
App 2.1. Grid Connection	Minimal Disturbance to Trees	The following measures are recommended: ▪ Consideration should be given to the protection of established trees and hedgerows during cable installation and where appropriate temporary fencing should be erected; ▪ Excavated materials arising from the excavations that cannot be reused in reinstatement works should not be dumped onto roadside verges but should be removed from site on an ongoing basis during the construction period; ▪ Construction works should be planned such that they occur within as short a time period as reasonably practicable in order to minimise the period during which visual and physical disturbance occurs; ▪ Where there is disturbance to grass verges it should be reinstated promptly on completion of the construction works subject to the appropriate ground and weather conditions. The ground should be regraded to a profile that matches adjacent verges and should be cultivated where necessary and re-seeded with grass seed of an appropriate species mix to that which is present elsewhere along the road corridor. Reseeded areas should be watered in periods of dry weather in order to ensure that the seed germinates and establishes successfully. Works to verges should be planned to give due consideration to weather conditions and, when necessary, avoided in excessively wet or cold conditions in order to avoid compacting or otherwise damaging soil structure.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
	Potential habitat loss and disturbance of habitats.	▪ Pre-construction mitigation measures that should be adopted by the construction contractor are proposed below: ▪ ▪ Pre-construction surveys to identify areas of sensitive habitat which should be avoided; ▪ Pre-construction protected species to identify species or features supporting species along the route and allow the preparation of appropriate mitigation; ▪ Preparation of a construction method statement for the grid connection stating how impacts on protected species and habitats would be avoided; and ▪ The use of an ECoW (Ecological Clerk of Works) during construction to ensure that all of the above measure is properly implemented. ▪ Tree roots will be protected by the implementation of BS5837:2005, where excavations will not be permitted inside the RPA (Root Protection Area). Which are; ▪ 12 times the diameter of the trunk measured at 1.5 m for a single stemmed tree or; ▪ 10 times the diameter of the tree measured immediately above the root flare for a multi-stemmed tree. ▪ No spoil, vehicles, fuel, materials, temporary buildings or ancillary equipment shall be stored inside the RPA. Existing ground levels within the RPA should not be raised or lowered. ▪ It is not possible at this stage to completely rule out the need to remove small sections of hedgerow or trees but if this was required, these should be replanted or replaced. ▪	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
	Disturbance to Breeding Birds	▪ The following mitigation measures are recommended: ▪ ▪ If cutting or removal of hedges and trees is required then this should be done outside the bird breeding season (1st March to 31st August). ▪ If work is to be done during the breeding season then there should be a pre-construction survey to establish whether nesting birds are present. During March and after mid-July the likelihood of active nests being present would be very low.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.

CONSENTED (LA01/2018/0200/F)

ES Chapter	Potential Effect	Mitigation Proposed	Means of Implementation and timing
	Deterioration of water quality	▪ Surface water management and pollution prevention measures stated in Chapter 9: Geology and Water Environment and accompanying Technical Appendix 9.1: Water Framework Directive Assessment.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
	Damage to aquatic habitats	▪ Construction processes should follow industry standard guidelines to ensure that no sediment or other polluting substances are released into the watercourses, in particular Pollution Prevention Guidance (PPG5): Works and maintenance in or near water.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
	Noise	▪ Noise levels due to the construction of the grid connection route will be mitigated by the short-term nature of the activity but further mitigation including the installation of acoustic barriers or the restriction of working hours per day could also be considered, if required.	CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.
	Traffic disruption	▪ All grid connection construction works should be undertaken in accordance with a Construction Method Statement and any associated road opening licences, agreements or permits. ▪ A Traffic Management Plan including details of any temporary road closures should be agreed with DfI Roads prior to the commencement of works. The Traffic Management Plan should be developed to ensure any disruption during the underground cable works will be kept to a minimum.	TMP & CDMS, to be agreed with CC & G BC prior to construction and implemented during construction.

CONSENTED (LA01/2018/0200/F)

DUNBEG SOUTH WIND FARM

Further Environmental Information (2019)

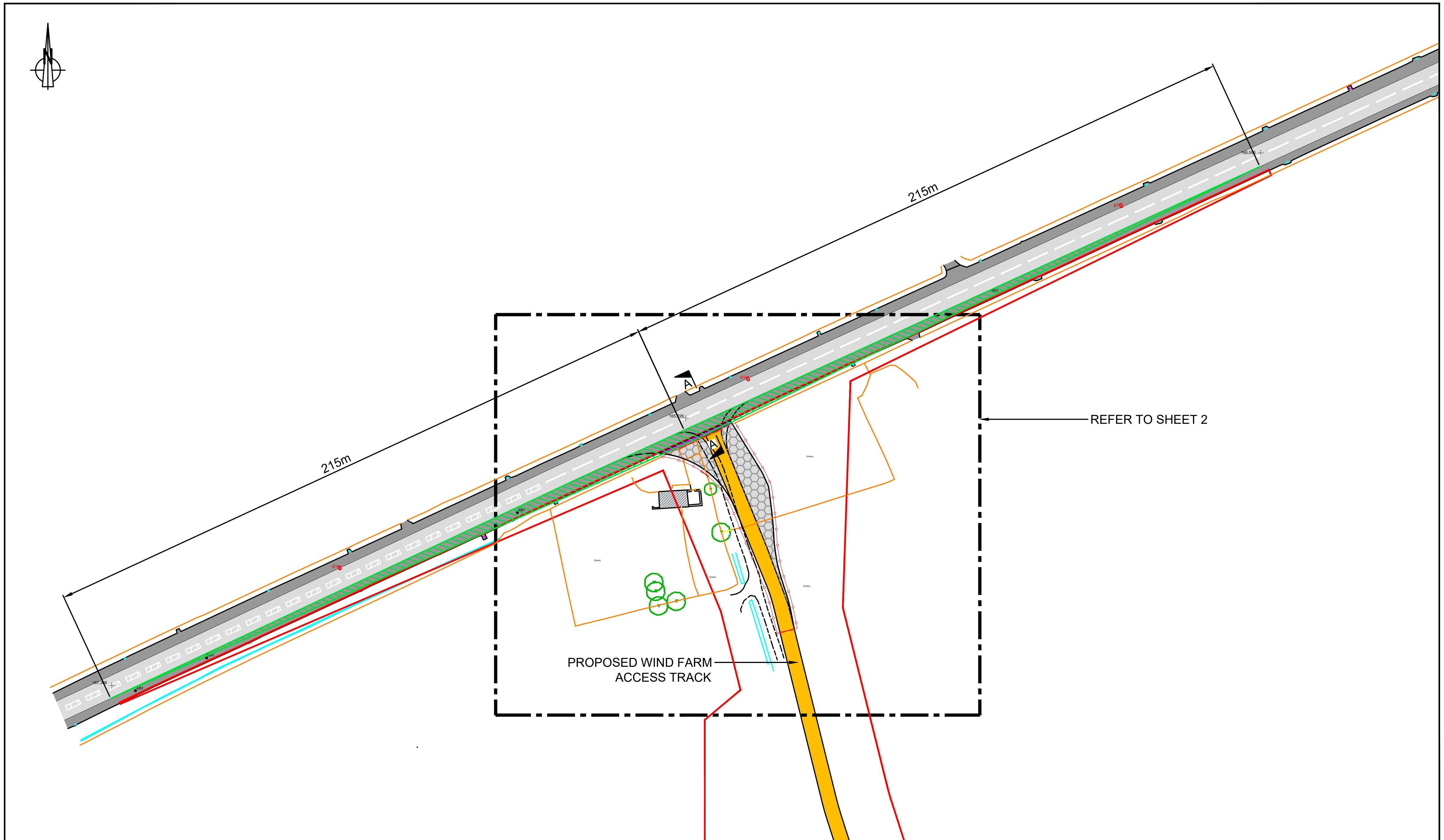
Volumes 3 - Figures

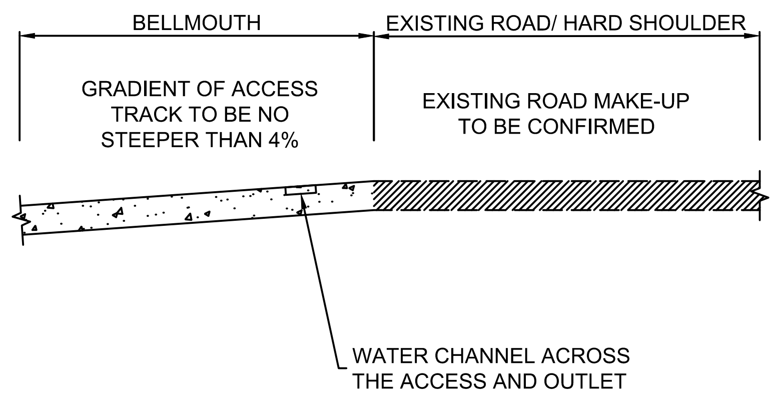
powering change

CONSENTED (LA01/2018/0200/F)

Figures

CONSENTED (LA01/2018/0200/F)





SECTION A-A
INDICATIVE CROSS SECTION AT SITE ENTRANCE
SCALE - N.T.S.

DUNBEG SOUTH WIND FARM

FIGURE 2.8 - REVISION A

SITE ENTRANCE SHEET 1 OF 2

KEY:

- EXISTING ROAD
- EXISTING HARD SHOULDER
- PROPOSED SITE TRACK
- PROPOSED ABNORMAL LOADS: AREA WILL BE REINSTATED ON COMPLETION OF WIND FARM CONSTRUCTION

  MINIMUM 150mm TYPE 1 SUB-BASE SOFT AREAS AND UNSUITABLE MATERIAL (PEAT, TOPSOIL, SILT) TO BE REMOVED:
- PERMANENT APRON
  - 150mm CONCRETE OR BLACK TOP
  - MINIMUM FALL FROM ENTRANCE TO PUBLIC ROAD 1:100
  - EXISTENCE OF SERVICES TO BE CHECKED WITH RELEVANT AUTHORITIES
- VISIBILITY SPLAY:
  - VEGETATION TO BE CUT BACK AS NECESSARY. AREA TO BE LEVELED TO BETWEEN 150 AND 250mm ABOVE THE LEVEL OF CARRIAGEWAY.
- PROPOSED TEMPORARY STOCK PROOF FENCE
- PROPOSED GATE
- EXISTING FENCE/ GATES TO BE REINSTATED POST CONSTRUCTION
- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)

NOTES:

1. DO NOT SCALE FROM DRAWING
2. DETAILS AND DIMENSIONS ARE INDICATIVE ONLY AND SUBJECT TO CHANGES AT DETAILED DESIGN STAGE.
3. APPROPRIATE SUDS DESIGN MEASURES WILL BE EMPLOYED AT DETAIL DESIGN STAGE.
4. ANY SURFACE WATER RUNOFF WILL BE TARGETED USING APPROPRIATE SUDS MEASURES TO BE DESIGN AT A LATER DATE.
5. ALL VISIBILITY SPLAYS SHOWN ARE WITHIN LANDS UNDER APPLICANTS CONTROL.

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

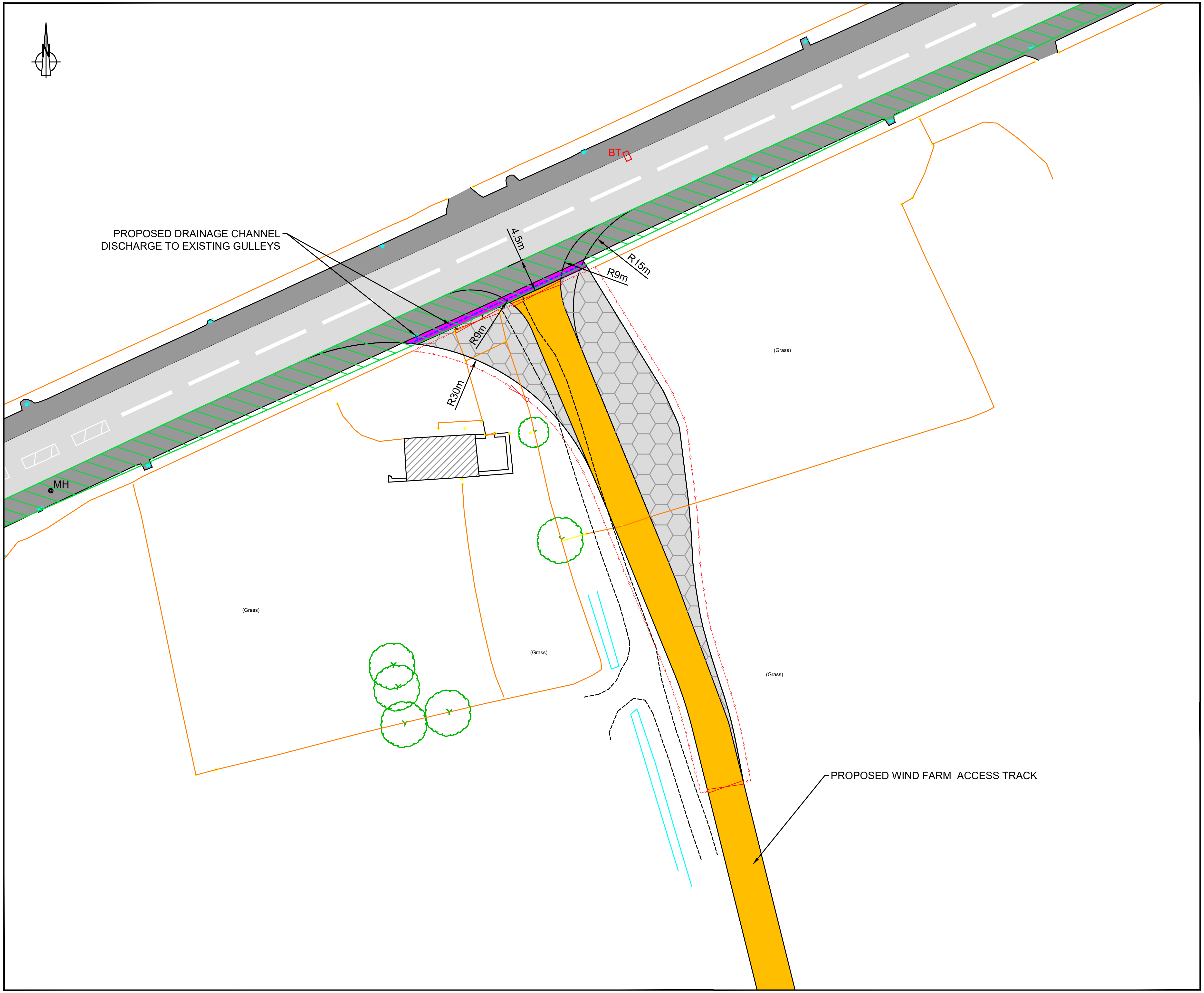
DRAWING NUMBER
03219D2402-03

SCALE - 1:1500 @ A3

FEI

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2.8 - REVISION A

SITE ENTRANCE SHEET 2 OF 2

KEY:

- EXISTING ROAD
- EXISTING HARD SHOULDER
- PROPOSED SITE TRACK
- PROPOSED ABNORMAL LOADS: AREA WILL BE REINSTATED ON COMPLETION OF WIND FARM CONSTRUCTION

  MINIMUM 150mm TYPE 1 SUB-BASE SOFT AREAS AND UNSUITABLE MATERIAL (PEAT, TOPSOIL, SILT) TO BE REMOVED:
- PERMANENT APRON
  - 150mm CONCRETE OR BLACK TOP
  - MINIMUM FALL FROM ENTRANCE TO PUBLIC ROAD 1:100
  - EXISTENCE OF SERVICES TO BE CHECKED WITH RELEVANT AUTHORITIES
- VISIBILITY SPLAY:
  - VEGETATION TO BE CUT BACK AS NECESSARY. AREA TO BE LEVELED TO BETWEEN 150 AND 250mm ABOVE THE LEVEL OF CARRIAGEWAY.
- PROPOSED TEMPORARY STOCK PROOF FENCE
- PROPOSED GATE
- EXISTING FENCE/ GATES TO BE REINSTATED POST CONSTRUCTION
- PROPOSED DRAINAGE CHANNEL (SHOWN INDICATIVE)

NOTES:

1. DO NOT SCALE FROM DRAWING
2. DETAILS AND DIMENSIONS ARE INDICATIVE ONLY AND SUBJECT TO CHANGES AT DETAILED DESIGN STAGE.
3. APPROPRIATE SUDS DESIGN MEASURES WILL BE EMPLOYED AT DETAIL DESIGN STAGE.
4. ANY SURFACE WATER RUNOFF WILL BE TARGETED USING APPROPRIATE SUDS MEASURES TO BE DESIGN AT A LATER DATE.
5. ALL VISIBILITY SPLAYS SHOWN ARE WITHIN LANDS UNDER APPLICANTS CONTROL.

LAYOUT DWG N/A	T-LAYOUT NO. N/A

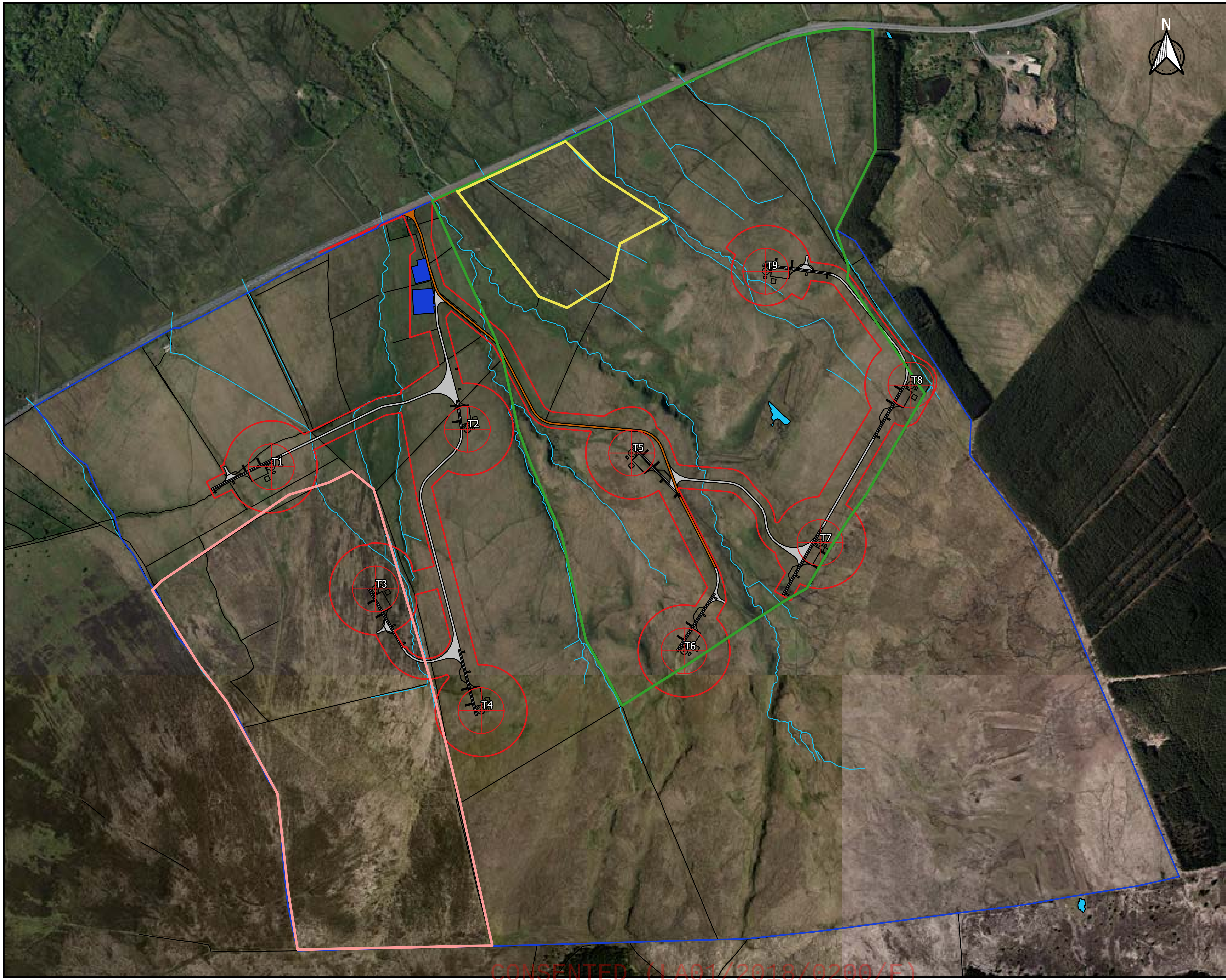
DRAWING NUMBER 03219D2402-03

SCALE - 1:500 @ A3

FEI

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH WIND FARM

FIGURE 6.9 (REVISED)

HABITAT MANAGEMENT

KEY

- HABITAT MANAGEMENT AREA (90ha)
- DRAIN BLOCKING (SNIPE)
- RED GROUSE MANAGEMENT AREA
- LAND UNDER APPLICANT CONTROL
- PLANNING APPLICATION BOUNDARY
- WATERCOURSE
- BOUNDARIES
- TURBINE LOCATION
- COMPOUND & SUBSTATION
- WATERCROSSING
- EXISTING TRACK (UPGRADED)
- SITE TRACK
- CRANE HARDSTANDING
- DAM POND

* COMPENSATION AREAS HAVE BEEN CALCULATED EXCLUDING THE INFRASTRUCTURE LAYOUT.

LAYOUT DWG	T-LAYOUT NO.
03219D1001-02	PNIRdbx028

DRAWING NUMBER

SCALE - 1: 5,000 @ A3

FURTHER ENVIRONMENTAL INFORMATION 2019

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LIMITED AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

Blackstaff Ecology

MANAGEMENT SYSTEM CERTIFICATION
ISO 9001 = ISO 14001 = OHSAS 18001
DNV

res
power for good

CONSENTED (LA01/2018/0200/F)

Table of Contents

Figures

CONSENTED (LA01/2018/0200/F)

Preface

This document is Volume 1 of the ES. The ES comprises:

- Volume 1: Non-Technical Summary (NTS)
- Volume 2: Main Report
- Volume 3: Figures (Maps & Illustrations)
- Volume 4: Technical Appendices

The aim of the NTS is to summarise the content and main findings of the ES in a clear and concise manner to assist the public in understanding what the environmental effects of the Dunbeg South Wind Farm are likely to be. The full ES provides a more detailed description of the Development and the findings of the Environmental Impact Assessment (EIA) process.

The ES has been prepared by RES in consultation with Causeway Coast & Glens BC, various consultees and in collaboration with the subject specialists outlined below.

Specialism	Author
Introduction & Planning Policy; Proposed Development (including Electromagnetic Interference and aviation); Design Evolution & Alternatives; Noise; Transport and Shadow Flicker;	RES
Landscape and Visual	Shanti McAllister Landscape Planning & Design
Archaeology and Cultural Heritage	Gahan and Long
Ecology	Blackstaff Ecology
Ornithology	David Steele
Fisheries	Paul Johnston Associates
Geology and Water Environment *Peat Slide Risk & Peat Management Plan*	McCloy Consulting *Natural Power*
Socioeconomics	Oxford Economics

CONSENTED (LA01/2018/0200/F)

Commenting on the ES

The full ES, together with supporting documents submitted as part of the planning application (Design and Access Statement and Pre-Application Community Consultation Report) will be available (and CD copies available free of charge) for viewing during normal opening hours at the address below:

Viewing Location	**Address**
Limavady Library	5 Connell Street Limavady County Londonderry BT49 0EA Phone: 028 7776 2540

An electronic version of the reports supporting the application, including the ES, will be available to download free of charge from http://www.dunbegsouth-windfarm.co.uk

Copies of the ES can be obtained at a cost of £50 from the address below:

RES Ltd
Willowbank Business Park
Willowbank Road
Millbrook
Larne
BT40 2SF
Email: garth.mcgimpsey@res-group.com
Phone: 028 2844 0580

CONSENTED (LA01/2018/0200/F)

1. Introduction

1. This Non-Technical Summary (NTS) has been prepared in support of a planning application by RES Ltd for the proposed Dunbeg South Wind Farm, hereinafter referred to as 'the Development', which is located approximately 6 km north east of Limavady, County Derry/Londonderry.

2. A planning application has been submitted to Causeway Coast & Glens BC in accordance with the Planning (Environmental Impact Assessment) Regulations, 2017. The regulations require an Environmental Impact Assessment (EIA) to be carried out and the results of the EIA to be included in an Environmental Statement (ES) to accompany the planning application. The application follows a detailed assessment of the environmental and technical aspects of the site's suitability for development.

3. The Development comprises 9 three-bladed, horizontal axis wind turbines, each up to a maximum of 149.9 m to tip height, with a total installed capacity of up to 29.7 MW. The Development would include a newly created site entrance, access tracks, crane hardstandings, control building and substation compound, electricity transformers, underground cabling, energy storage containers and drainage works. During construction there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and welfare facilities. The proposed layout is illustrated in **Figure 2: Infrastructure Layout**.

4. Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[1]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens District Council area.

The Applicant

5. RES is one of the world's leading independent renewable energy project developers with operations across Europe, the Americas and Asia-Pacific. At the forefront of renewable energy development for over 30 years, RES has developed and/or built almost 12,000 MW of renewable energy capacity worldwide. In the UK alone, RES currently has more than 1,000 MW of projects either constructed, under construction or consented. RES is active in a range of renewable energy technologies including onshore and offshore wind, solar, as well as enabling technologies such as energy storage.

6. RES has developed 16 onshore wind farms in Northern Ireland totalling 229 MW, which equates to 36% of Northern Ireland's onshore wind capacity. RES currently

[1] This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

CONSENTED (LA01/2018/0200/F)

operates over 83 MW of wind capacity across Northern Ireland, has secured planning permission for a further 112 MW awaiting construction and has 92 MW in the planning system.

The Application Site

7. There are a number of key technical and environmental factors that influence the suitability of a site for a wind farm. The following are key attributes that contribute to a viable site, which the application site possesses:
   - Good wind speeds
   - A site which complies with planning policy and in particular, avoids unacceptable effects on areas designated by statutory agencies; maintains appropriate distances from dwellings to avoid unduly impacting local amenity and; avoids impeding or interfering with major electromagnetic transmission and airport communication systems
   - Sufficient area to accommodate the number of wind turbines required for economic viability
   - Adequate vehicular access for wind turbine components (abnormal loads)
   - Suitable terrain and topography, which affect wind flow across a site and need to be considered in relation to turbine performance, specification and life-span
   - Suitable ground conditions for the construction of wind turbine foundations, erection of the machines and the provision of access tracks and cables.

8. The Site is positioned on a north facing slope below Keady Mountain in the south eastern part of the Binevenagh Area of Outstanding Natural Beauty (AONB). The Site is bounded by Broad Road (A37) to the north which is part of the primary road network linking the towns of Limavady and Coleraine.

9. The Site is currently used for rough sheep and cattle grazing and primarily comprises improved agricultural land, wet marshy grassland with areas of wet heath and blanket bog on the upper slopes. The lands are dissected by several deeply incised water channels. The Site is open and exposed to the west but is bounded to the east by Springwell Forest with further areas of coniferous forestry to the south.

The Need for the Development

10. A key policy driver for the development of renewable energy in Northern Ireland is the need to increase security of supply. There are also potential adverse impacts on local populations and the economy through high volatile fuel costs, contributing to fuel poverty and high energy costs for businesses and industry. In addition, increasing focus on renewable energy can deliver environmental and climate change gains, reductions in carbon emissions, as well as investment and employment opportunities. With a lack of indigenous fossil fuels and no nuclear power stations, Northern Ireland is keen to develop the full range of its available renewable energy resources to optimise the contribution that renewables make to the overall energy mix.

CONSENTED (LA01/2018/0200/F)

11. Northern Ireland's current renewable energy target is that 40% of electricity consumption should be met from renewable sources by 2020 (DETI 2010). The 40% target is the equivalent of 1600 MW. Wind energy will be the main focus of renewable electricity development on the island of Ireland, and certainly in Northern Ireland, through to 2020.

12. If approved, the Development could account for up to 29.7 MW, a material contribution to achieving the 40% renewable energy target for 2020. This is the equivalent of approximately 23,000 homes.

CONSENTED (LA01/2018/0200/F)

2. Description of the Development

13. The main elements of the Development are as follows:

- 9 three-bladed horizontal axis wind turbines of up to 149.9 m tip-height
- Turbine foundations
- Hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbines
- Electricity transformers
- Approximately 3.5 km of new access track and 1.1 km of upgraded access track
- Wind farm substation compound containing a control building
- Energy Storage Containers
- On-site electrical and control network of underground (buried) cables
- Connection from the substation to the local grid network
- Temporary construction compound
- Permanent and temporary drainage works
- Associated ancillary works
- New site entrance from the public road.

14. The wind farm layout is shown in **Figure 2: Infrastructure Layout**.

15. The actual area of permanent land take is limited to the control room and substation compound, energy storage area, wind turbine towers, permanent crane hardstandings and on-site access tracks, which collectively account for approximately 4.4 ha, which is approximately 10.3% of the area within the planning application boundary. In addition there will be an estimated 0.7 ha of hardstanding required on a temporary basis during construction.

16. Prior to construction the locations of the proposed wind turbines would be subject to micrositing, which allows for a small degree of flexibility in the exact locations of turbines and routes of tracks and associated infrastructure (50 m deviation in plan from the indicative design). Any repositioning would not encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine positioning would help mitigate any potential environmental effects: e.g. avoidance of unfavourable ground conditions or archaeological features not apparent from current records. The micrositing allowance has been taken into account in the EIA.

Wind Turbines

17. The wind turbine industry is evolving at a remarkable rate. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine

CONSENTED (LA01/2018/0200/F)

for the Development has not yet been made. The most suitable machine will be selected before construction, with a maximum tip height of 149.9 m.

18. For visual and acoustic assessment purposes, the most suitable candidate turbine available in the market place (currently of 3.3 MW nominal capacity and with an overall tip height of 149.9 m) has been assumed. Exact tower and blade dimensions vary marginally between manufacturers. A diagram of a typical 149.9 m tip height turbine is given in **Figure 3: Typical Wind Turbine Elevation**.

19. It is proposed to install infrared lighting on the turbines in a pattern that is acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capability to detect and avoid wind farms. Infrared lighting cannot be detected with the naked eye, thereby reducing visual impact.

20. Each turbine would have a transformer and switchgear. Depending on the turbine supplier, the transformer and switchgear may be located inside or outside each turbine.

21. The wind turbines would be erected on steel re-enforced concrete foundations. During the erection of the turbines, crane hardstanding areas would be required at each turbine base consisting of both permanent and temporary elements. After construction is complete, the temporary crane pad areas will be reinstated.

Site Tracks

22. A new site entrance is proposed in the central portion of the site on the northern boundary with access off the Broad Road.

23. Approximately 3.5 km of new access tracks and 1.1km of upgraded access tracks are required within the site to enable the turbine components and construction materials to be transported to their locations, and to enable ongoing access during the operational period for maintenance visits.

24. The on-site access track layout has been designed to minimise environmental disturbance by utilising existing track locations and avoiding sensitive habitats where possible whilst keeping the length of track commensurate with the minimum required for operational safety. The track route takes cognisance of the various identified environmental constraints.

25. Seven watercourse crossings will be required as part of the track layout. These crossings would be designed to ensure that fish and mammal movements are not restricted, in addition to ensuring the crossing size is adequate for potential flood flows. Indicative locations are shown on **Figure 2: Infrastructure Layout**.

Electrical Connection, Control Building & Substation and Energy Storage

26. Assuming the use of the currently available models, each wind turbine would generate electricity at 690 V and would have an ancillary transformer located either within or outside the base of the tower to step up the voltage to the

CONSENTED (LA01/2018/0200/F)

required on-site distribution voltage. Each turbine would be connected to any adjacent turbines by underground cables.

27. The wind farm control building and substation is proposed to be located on the eastern part of the site as shown in **Figure 2: Infrastructure Layout**. All power and control cabling on the wind farm will be buried underground in trenches located, where possible, along the route of site access tracks.

28. The control building will be designed and constructed to the standard required by NIE for the accommodation of substation equipment. Where possible, local building materials and finishes will be used to ensure that the appearance is in keeping with other buildings in the area. The building will be staffed by maintenance personnel on a regular basis.

29. Four permanent containers housing an energy storage device, inverters and other ancillary equipment will be positioned adjacent to the control building and substation compound on hardstanding used originally for the temporary construction compound. These units are a means of storing electrical energy just like a rechargeable battery, cell phone or electric car. These are means by which power can be stored and released. The application is of course of a larger scale but the basic principle is the same.

Construction Management

30. A Construction and Decommissioning Method Statement (CDMS) will be prepared once planning consent has been gained. This will be submitted to Causeway Coast & Glens BC prior to any construction works taking place. This will describe the detailed methods of construction and working practices, work to reinstate the site following completion of construction activities and methods to reinstate the site post operation. The CDMS will:

- provide a mechanism for ensuring that measures to prevent, reduce and where possible offset potentially adverse environmental impacts identified in the ES are implemented;
- ensure that good construction practices are adopted and maintained throughout the construction;
- provide a framework for mitigating unexpected impacts during construction;
- provide a mechanism for ensuring compliance with environmental legislation and statutory consents;
- provide a framework against which to monitor and audit environmental performance.

31. The wind farm drainage system will be designed to mimic natural conditions to mitigate against increased flashiness in water courses and reduced groundwater recharge. The drainage system will protect the status of water courses and ground waters.

CONSENTED (LA01/2018/0200/F)

32. Construction will be carried out according to Department of Agriculture, Environment & Rural Affairs (DAERA) and Construction Industry Research and Information Association (CIRIA) guidance for site works. Pollution control measures during the construction phase will be included in the CDMS.

33. It is anticipated that the construction would take 18 months. Construction work will take place between the hours of 0700-1900 Monday to Friday and 0700 – 1300 on Saturdays. Outside these hours, work at the site shall be limited to turbine erection, testing/commissioning works and emergency works. Deliveries may occur outside these times to minimise disruption to local residents.

34. A programme of reinstatement would be implemented upon completion of construction. This would relate to the construction compound, temporary areas of the crane hardstandings, cable trenches and track shoulders where appropriate. There remains a potential to use cranes during the operational phase of the Development, therefore the main crane hardstanding will remain uncovered.

Operation

35. The expected operational life of the Development is 30 years from the date of commissioning. Wind turbines and wind farms are designed to operate largely unattended. Each turbine would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

36. The Development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines. This is monitored 24 hours a day, 7 days a week.

37. An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the Development and would be on-site intermittently.

38. Routine maintenance of the turbines would be undertaken approximately twice yearly to ensure the turbines are maintained to Industry Standard. This would not involve any large vehicles or machinery.

CONSENTED (LA01/2018/0200/F)

39. A Habitat Management Plan will be implemented during the construction and operational phases of the Development, working with the site landowners, which will provide for the restoration and enhancement of currently degraded blanket bog and wet heath habitats on site.

Decommissioning

40. One of the main advantages of wind power generation over other forms of energy production is the ease of decommissioning and the simple removal of components from the site. The residual impact on the site is limited to the continued presence of the foundations and access tracks. All above ground structures can be removed from the site.

41. If the Development obtains planning approval it is expected that a planning condition would be set to provide for the decommissioning of the site in accordance with a scheme agreed in writing with Causeway Coast & Glens BC.

42. The Development will be decommissioned in accordance with best practice and/or in compliance with any planning conditions. Current best practice includes the removal of all above ground structures; the removal of all underground structures where required; and reinstatement of disturbed areas all of which will be subject to any necessary consents. Consideration will be given to the retention of wind farm access tracks if they utilise pre-existing farm infrastructure or are not located on sensitive habitats if such continued use could lead to the long term degradation of these habitats.

CONSENTED (LA01/2018/0200/F)

3. The Environmental Impact Assessment (EIA) Process

43. The purpose of EIA is to provide adequate environmental information to enable stakeholders to understand the potential environmental effects of a project. The EIA identifies and assesses the potential environmental effects associated with the construction, operational and decommissioning of the Development. The assessment and potential effects are recorded in the ES.

Consultation

Public Consultation

44. RES is committed to finding effective and appropriate ways of consulting with all its stakeholders, including local residents and community organisations, and believes that the views of local people are an integral part of the development process. RES began the engagement process with the local community eight months prior to the submission of the planning application, to facilitate a constructive consultation process which helped RES to understand and address any concerns as the project developed.

45. A public exhibition was held in August 2017 which included detailed information about the proposals, including: a map of the proposed layout; photomontages representing how the proposed layout would appear from a range of viewpoints; Zone of Theoretical Visibility (ZTV) drawings. (A ZTV is a map-based diagram of where and how many wind turbines, or wind farms, would theoretically be visible from all parts of a given area.) RES staff were available to answer questions and feedback was encouraged.

46. A Pre-Application Community Consultation (PACC) Report has been produced and is available for viewing at the location listed in Section 1 of this NTS.

EIA Consultation

47. RES and the various chapter authors have undertaken pre-application consultation with relevant consultees, which has informed the EIA process and is detailed in each of the technical chapters within the Volume 2 (Main Report) of the ES.

Wind Farm Design Evolution & Alternatives

48. In accordance with EIA process and best practice the project team employed an iterative approach to the design of the Development. The design evolved throughout the EIA process as different constraints and adverse/ beneficial effects were identified and evaluated. This approach allowed mitigation measures to be integrated into the design in order to alleviate or remove significant effects of the proposed development. It also allowed measures to enhance beneficial effects of the proposed development to be incorporated into the design.

CONSENTED (LA01/2018/0200/F)

49. Following consultation and baseline characterisation of the Site, the following key topics were identified:

- Landscape and visual
- Archaeology and cultural heritage
- Ecology
- Ornithology
- Fisheries
- Geology and water environment
- Noise
- Shadow flicker
- Traffic and transport.

50. The topics listed above were considered through the design with the aim of designing out significant effects. Where it was not possible to mitigate by design, the issues were considered further as part of the EIA.

51. A key tool in this process was the combined constraints drawing, which identifies constraints to development and sensitive features on the site. This drawing was iteratively updated as new information from surveys, site visits and consultation was received.

Turbine Layout Evolution

Landscape & Visual

52. A landscape consultant was involved throughout the design process to provide advice regarding the scale of the development and turbine height.

53. RES began the development process by identifying 21 potentially suitable turbine locations on this site. These locations were chosen by correlating on-site constraints such as hydrology, ecology and ground conditions with off-site constraints such as aviation. Next, a feasibility appraisal was carried out to identify the key landscape and visual issues that would need to be considered if a wind farm were to be proposed on this site. This included a preliminary analysis of the site in its wider landscape context, including its location within the Binevenagh AONB and its proximity to other wind farms, particularly the adjacent cluster of existing, consented and proposed wind farms at Dunbeg and Dunmore.

54. Following the feasibility appraisal a number of potential turbine layouts and dimensions were considered in order to further refine the layout and its potential landscape and visual effects on the Study Area. This included the consideration of variable turbine heights (125 – 149.9m), the relocation of turbines to minimise visibility on the summit of Keady Mountain and to create a good visual relationship between the Development, the adjacent Dunbeg cluster, and other cumulative wind farms in the wider Study Area.

CONSENTED (LA01/2018/0200/F)

55. The 9-turbine option that is presented in the EIA is the result of this iterative design process. A series of comparative diagrams have been presented as part of this LVIA to illustrate the relocation and reduction in the number of proposed turbines in order to present a Development that is deemed to be acceptable in EIA and LVIA terms.

56. Comparative wirelines illustrate that the discernible difference in visual effects between turbines with 149.9 m and 125 m tip heights would be negligible but the reduction in the overall number of turbines and the wider spacing between the final turbines that are proposed has resulted in a number of benefits, namely:

- There are few instances where 'stacking' of turbines occurs. Stacking is where two or more turbines will appear directly in front of each other in a view and will therefore result in a 'heavier' or more solid, and hence more prominent appearance;
- The turbines can be more evenly spaced in relation to each other and to the site topography which has resulted in a simpler layout with fewer variations in tip heights in relation to contour AOD levels;
- A reduction in the proposed number of turbines means that the Development can remain clear of the summit of Keady whilst also remaining contained in the saddle of land between Keady and Binevenagh, thus minimising visual effects on the AONB and the sequence of views along the Binevenagh range of uplands, particularly when viewed from the west;
- A greater amount of space could be created between the Development and the Dunbeg cluster of wind farms so that differences in turbine heights are less noticeable and are not visually jarring.

57. The comparative ZTV (Figure 4.11) indicates no areas of theoretical visibility of the final 9-turbine layout (149.9 m tip height) beyond any theoretical visibility that would have occurred with the 21 potential turbine locations that were initially considered with 125 m blade tips or with the refined 14-turbine layout using turbines with tip heights of 134.9 m - 149 .9 m. This layout would have resulted in theoretical visibility across 61.1 % of the Study Area whereas the final layout results in theoretical visibility across 58.18 % of the Study Area.

Environmental Constraints & Assessments

58. Following baseline surveys, the combined constraints drawing incorporated the following, which are shown in **Figure 4: Combined Constraints and Infrastructure**:

- The hydrology consultant recommended watercourse buffers of 50 m and 10 m depending on the sensitivity of the watercourse, which were agreed as appropriate by the fisheries consultant. Upstream abstraction constraints were added to identified private water supplies;
- A 50m buffer was applied to Ground Water Dependent Terrestrial Ecosystems, which were identified through the baseline survey;

CONSENTED (LA01/2018/0200/F)

- A 25 m buffer was applied to badger setts, which was identified through the baseline survey;
- Bat buffers of 36 m and 65 m were added to major watercourses and forestry edge respectively, as advised by the ecological consultant. The 36 m and 65 m distances are in plan, and achieves a 50 m buffer between the blade tip and the habitat feature, in line with Bat Conservation Trust guidance.
- 165 m buffers were applied to nearby public roads in line with the Best Practice Guidance to PPS18 which recommends a set-back distance of at least tip height plus 10% between turbines and roads.

59. In addition, the lower slopes are enclosed by a fence line that runs broadly west to east and contains extensive linear drainage, overgrazing by sheep and cattle, and historic peat harvesting. To the south of this fenceline there are areas of upland blanket bog present with the best examples of this habitat located on the plateau of the site. As this habitat is of greatest conservation value on site, it was considered that these that these areas should be avoided in their entirety as recommended by the ecology consultant.

60. Baseline peat probing indicated that peat depths were predominantly shallow (>80% probes were between 0.0 – 0.5m deep) and areas of peat depth greater than 2 m were avoided to limit excavation and spoil generation.

61. Before the turbine layout could be confirmed, noise and shadow flicker assessments were carried out. Both assessments conclude that there would be no significant effects on any surrounding residential properties.

62. The final turbine layout consists of 9 turbines of 149.9 m tip height.

Infrastructure Design Evolution

63. The infrastructure design evolved through the EIA process. The following principles were taken into consideration when designing the supporting infrastructure:

- Avoidance of environmental and technical constraints;
- Design of the track layout to utilise existing track locations and follow natural contours as far as possible, in order to avoid unnecessary amounts of excavation;
- Minimisation of the overall length of access track;
- Minimisation of the number of watercourse crossings, as far as possible;
- Avoidance of steep slope areas to minimise earthworks;
- Incorporation of measures to improve the visual appearance of the scheme, including reinstatement of temporary infrastructure following the construction period;
- Use of bottomless culverts at two watercourse crossing locations following the advice of the fisheries and water environment consultants.

CONSENTED (LA01/2018/0200/F)

Environmental Effects

64. The following sections summarise the technical chapters of the ES. The term 'Site' refers to the Preliminary Site Boundary of the wind farm, which is shown in **Figure 1: Site Location**, which is a larger area than the final planning application boundary, which is shown in **Figure 2: Infrastructure Layout**.

Landscape and Visual

65. The Landscape and Visual Impact Assessment (LVIA) methodology was specifically developed for wind farm development in Northern Ireland in accordance with best practice guidance. The LVIA considered a 30 km radius Study Area and involved a combination of existing desktop information (maps, planning policy and existing landscape character assessment documents), detailed site surveys of the Study Area and computer modelling.

66. Potential landscape and visual effects were assessed as separate but linked issues. The magnitude of landscape effects was derived from the extent to which physical changes cause changes in landscape character and value. Visual effects relate to changes in the composition of views and people's perception of/responses to these physical changes. Viewers / visual receptors include local residents, tourists, walkers, farmers, general road users etc.

67. For both landscape and visual effects the Significance of effect was derived from the assessment of Landscape Value, Sensitivity and Magnitude of change and also by using objective professional judgement in relation to site circumstances.

68. An assessment was carried out of the potential cumulative effect arising from the Development in combination with other wind farm developments, including operational, consented and proposed projects. In accordance with GLVIA[2] best practice guidelines existing and consented wind farms are considered to be part of baseline landscape and visual character as well as in the cumulative assessment. The assessment of effects of the Development takes consideration of their presence, or anticipated presence.

69. The Development is located in the south eastern part of the Binevenagh AONB and within the Binevenagh Landscape Character Area (LCA) and a detailed description is included within Chapter 4.

70. Although the Development is not located within the core of the Binevenagh AONB it is recognised that the proposal is within the AONB and that the site has merit in terms of its contribution to the landscape and visual character of the wider AONB. The layout and position of the Development has, therefore been designed to minimise its effect on the AONB as a whole. This has been achieved by locating it

[2] The Landscape Institute and Institute of Environmental Management and Assessment (April 2013) 'Guidelines for Landscape and Visual Impact Assessment 3rd Edition'

CONSENTED (LA01/2018/0200/F)

away from the core area containing the majority of visitor attractions and iconic landscape features. It is also in a location that is closely related to existing wind turbines, and that is neither highly visible from the rest of the AONB nor from other parts of the Study Area with good views to the core part of the AONB. These are considered to be the summit / escarpment of Binevenagh and the lowlands to the north of this escarpment.

71. The Development reinforces the existing character of the site and immediately adjacent landscape and is less detrimental to the overall landscape character of the AONB than forestry or quarrying because it will not have permanent presence. Whilst forestry and quarry both leave permanent marks on the landscape, wind farms are considered to be long term temporary rather than permanent developments which will ultimately be removed and the sites reinstated back to their previous uses.

72. The site of the Development does not contribute significantly to the iconic value attributed to the summits and escarpments in the Binevenagh AONB. Neither does it contain significant visitor amenity facilities that are likely to attract the most sensitive receptors – the main tourist attractions and scenic routes are generally located to the north overlooking the coast.

73. The overall conclusion of the LVIA is that the landscape effects on the Binevenagh LCA, in which the Development is located are Not Significant due to the Development's location within the same part of the landscape as the Dunbeg cluster of wind farms, and the presence of other human factors that strongly influence the landscape character.

74. The ZTV diagrams indicate that, within a 30 km radius, theoretical visibility of the Development would cover less than 59% of the Study Area. This percentage does not take into account the screening effects of trees and buildings etc. Therefore actual visibility would be lower.

75. The effect of the drumlin topography in farmland in the eastern part of the Study Area is indicated by patchy areas of visibility. The largest and most uninterrupted areas of theoretical visibility occur around the flat coastal areas to the west of the Development – Magilligan and the Roe Valley, and in the sea and Lough Foyle estuary to the north and north-west. However, detailed site assessment indicates that built development and vegetation cover in these parts of the Study Area are likely to screen many low-lying views. The Development is also likely to be difficult to discern with the naked eye in long distance views particular from low level viewpoints where its scale will be diminished by the scale of wider views. There will be very few visual receptors present on the sea and their distance from the Development, combined with their low elevation in relation to the land, is likely to mean that the Development will not be a clearly discernible feature in their views.

76. The ZTV diagrams indicate that there are very few parts of the Causeway Coast and Sperrin AONBs that are likely to have view of the Development and the northern

CONSENTED (LA01/2018/0200/F)

half of the Binevenagh AONB, including the summit of Binevenagh, will either have no views or views of the Development that are limited in their extent.

77. Of a total of 27 viewpoints representing typical levels of visibility throughout the study area, three viewpoints, which are all close range viewpoints, were assessed as being significantly affected. The remaining 24 viewpoints were assessed as experiencing No Significant visual effects.

78. In terms of cumulative landscape effects the Development was not deemed to have a significant effect on the receiving landscape. Clusters of wind farms located on these upland areas are a relatively common landscape characteristic but there are sufficient separation distances between these clusters to ensure they are not the dominant characteristic. This is in accordance with general advice provided in the SPG that elevated upland landscapes can accommodate larger turbines and the broader the upland the greater the capacity. Larger horizons tend to diminish the perception of height. In this Study Area the fact that many viewpoints are elevated in nature means that very broad panoramic views occur frequently and, from certain directions / in certain viewpoints, often incorporate both simultaneous and sequential views of several clusters of wind farms. The Development would increase the size of the Dunbeg cluster of wind farms but would not decrease its separation distances with other clusters of wind farms in the Study Area. Neither would it encroach onto elements of the landscape that are not already characterised by wind farm development or other man-made features.

79. Of the 27 viewpoints only one is judged to experience significant cumulative visual effects on views. This is a close range view on a tertiary road where the primary visual receptors would be residents of properties and where views towards the existing Dunbeg cluster are screened by woodland along the Curly River corridor. The remaining 26 viewpoints are deemed to experience no significant cumulative visual effects.

80. All policy documents (the SPPS, PPS 18 and its best practice and supplementary guidance) recognise that wind farms may be prominent elements in close range views but that this does not necessarily equate to unacceptable development. Taking into account that only three of the 27 viewpoints assessed as part of the LVIA are deemed to experience significant visual effects, and that no significant landscape effects have been identified, the LVIA concludes that the Development is acceptable in landscape and visual terms.

Archaeology and Cultural Heritage

81. An Archaeological & Cultural Heritage impact assessment was conducted for the Development. The purpose of this was to identify the archaeological potential of the Site, assess the impact of the Development upon this and to assess the impact on known archaeological monuments in the wider landscape.

CONSENTED (LA01/2018/0200/F)

82. Following consultation with the Department for Communities: Historic Environment Division (DfC: HED), it was agreed that a 5 km search radius for the desktop survey would be adequate to provide a comprehensive assessment of the Development.

83. Further to this, it was agreed to consider all state care/scheduled monuments and historic gardens within 10 km for potential visual analysis. Preliminary analysis of potential inter-visibility between regionally important monuments and the Development identified a number of monuments which may require further in-depth analysis. Further discussions with DFC:HED established the scope of this analysis.

84. The desk top survey and site inspection identified 6 known monuments within the area of land ownership and an additional 80 known archaeological monuments within the 5 km search radius. Of the monuments located within the Site, only LDY 10:21 will be directly affected by the Development. This monument consists of a number of early field systems and hut circles which extend over a relatively large area in the north western section of the Site. The full extent of this monument is not known but it is believed to cover approximately 900m x 800m. It is likely that the infrastructure for turbines T1, T2 and T3 and possibly the turbine bases themselves will come into some contact with elements of this monument. Should this occur, the construction of the proposed development would result in a partial or minor loss of some elements of the baseline conditions of the monument. Any effect this would have on the monument would be significantly reduced through the implementation of the recommended mitigation strategy.

85. A site inspection of the wind farm Site was also conducted. This identified no evidence of any previously unknown archaeological monuments within the Site.

Visual Impact Analysis

86. For visual impact analysis, a 10 km search radius was used to identify monuments of regional importance and listed buildings. A total of 40 regionally important monuments, 4 historic gardens and 15 historic buildings were identified. Through the use of ZTV mapping, wireframe production and site inspections it was established that only twelve monuments and one historic garden would be potentially inter-visible with the Development.

87. Consultation with DFC:HED was conducted to establish which of these would require further analysis. The assessment found that the introduction of the Development into the local landscape will have a negligible-slight effect upon their setting.

88. Given the presence of the known monuments within the proposed application boundary and the extent of archaeological sites within the wider area, a mitigation strategy was recommended for the construction phase. The aim of this is to identify any potential archaeological deposits uncovered during the construction phase of the project.

CONSENTED (LA01/2018/0200/F)

89. An assessment of cumulative impacts on the archaeology and cultural heritage of the area was undertaken, and it was concluded that there will be no significant effects.

Ecology

90. The study methodology for the Ecological Impact Assessment included both desktop and field survey methods in order to assess the potential impact on local ecological and nature conservation interest. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are valued in some way for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken during 2016/2017 on the site including suitable buffer zones:

- Habitats
- Bat survey
- Otter survey
- Badger survey
- Common Lizard survey
- Smooth Newt habitat survey
- Marsh Fritillary butterfly habitat survey
- Argent & Sable moth habitat survey

91. Features of conservation interest and importance were recorded and their locations were one of the key criteria that affected the wind farm layout. The location of the wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this was not possible, mitigation and/or enhancement measures have been incorporated into the design to balance any detrimental impact.

92. The principal habitats on the site are extensive areas of purple moor-grass and rush pasture within a mosaic of semi-improved grassland, wet heath and poor fen. Upland blanket bog is also present within the (preliminary) site boundary (on the southern plateau) but none lies within the Planning Application Boundary. Overall, the habitat of greatest conservation value, the blanket bog, has been avoided.

93. Ecological constraints determined from extensive site surveys have been used to evolve the layout and design of the Development. The impact assessment is therefore based on a wind farm design that already includes a number of important mitigation measures.

94. A series of generic and specific mitigation measures including a Peat Management Plan and a Habitat Management Plan have been proposed to mitigate effects on wet heath vegetation.

95. The Development will result in permanent habitat loss of 6.9 hectares (ha) and temporary habitat loss of 3.3ha, largely comprising purple moor-grass & rush pasture (PMGRP) and wet (dwarf shrub) heath, although small areas of other

CONSENTED (LA01/2018/0200/F)

habitats will also be lost, such as acid grassland mosaic and poor semi-improved grassland.

96. The extent of habitat loss has been used to inform the prescriptions detailed in the Habitat Management Plan, including a commitment to establish at least twice the area lost for PMGRP and five times for wet heath (an NI Priority Habitat).

97. After implementation of the mitigation measures proposed in this chapter it is assessed that there would be no significant residual adverse effects on Northern Ireland priority habitats (wet heathland) as a result of the Development. Indeed, it is assessed that the Habitat Management Plan would deliver a net beneficial effect during operation by enhancing currently degraded wet heath habitats.

98. There is no recorded usage of the area by otter, marsh fritillary or argent & sable moth, therefore no impacts to these species is likely. Mitigation for the herpetofauna found on site (smooth newt and common lizard) is proposed. This involves the provision of artificial refugia and habitat management, as well as drift fencing and mowing/hand clearance during the construction phase. Badger setts found during survey have all been buffered by 25m. Ground Water Dependent Terrestrial Ecosystems (GWDTEs) have all been buffered by 50m.

99. The layout of the Development, in terms of the separation distance between the wind turbines and relevant features, and the maintenance of this throughout the lifetime of the wind farm, will ensure that any potential impacts to bats will be neutral. In conclusion, and based on current knowledge, this would appear to be a Site posing little risk to bats or bat populations, however a BMP has been recommended as a precaution.

100. Therefore, the potential effects of the Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a minor adverse or neutral effect that would not adversely affect the ecological integrity of the site and the wider area.

101. An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that there will be no significant effects.

Ornithology

102. The ornithology impact assessment considered the potential effects of construction, operation and decommissioning of the Development on the following key bird communities:

- Breeding birds
- Wintering and migrating birds
- Raptors (birds of prey).

CONSENTED (LA01/2018/0200/F)

Vantage point surveys, breeding bird surveys and wintering bird surveys were carried out in the period 2015-2017.

103. The assessment was carried out with reference to published Scottish Natural Heritage (SNH) guidance on assessing the effects of on-shore wind farms on birds out-with conservation designated areas. All wild birds are subject to a general level of protection through the Wildlife and Countryside Act (Wildlife Order in Northern Ireland) and the EU Birds Directive but only some species should normally be of concern in relation to wind farms:

- Birds listed under Annex 1 of the EU Birds Directive
- Regularly occurring migratory species
- Birds listed under Schedule 1 of the Wildlife and Countryside Act (Wildlife Order)
- Birds listed under non-statutory lists of high conservation concern (red-listed birds).

104. Wind farms can potentially affect birds in two main ways: (1) by direct mortality of individual birds due to collisions, or (2) by indirect habitat loss due to displacement of birds from a zone around the turbines and other related infrastructure. Direct habitat loss from wind farms is usually relatively small scale compared to other types of developments and in most cases is unlikely to be significant.

105. For red grouse and for all passerine species it is extremely unlikely that any adverse effects would occur. For snipe, displacement of two breeding pairs is probable but the effect falls well short of being significant at the regional (Northern Ireland) level.

106. Collision risk for all raptor species which use the site on a regular basis has been estimated using the SNH Collision Risk Model. For hen harrier collision risk is predicted to be negligible. For kestrel and buzzard a small number of collisions is predicted to occur during the expected 30 year operational life of the wind farm, however when placed in the context of the very widespread distributions of both these species and also other relevant factors (discussed in the assessment) then it is extremely unlikely that the predicted collisions would have a significant adverse effect on the distribution and abundance of these species at the regional (Northern Ireland) level.

107. Current evidence also suggests that adverse effects of wind farms on birds are likely to be greatest during construction and that wind farm operation may have no significant effects on local bird populations. It is proposed that pre-construction bird surveys and an Ornithological Mitigation Strategy would be implemented by the Developer in order to avoid or mitigate any possible adverse effects due to construction.

108. In view of these key points, and assuming implementation of the proposed mitigation measures, it is concluded that the Development would not have any significant adverse effects on local bird populations or on the distribution and abundance of sensitive species at the regional (Northern Ireland) level.

CONSENTED (LA01/2018/0200/F)

Fisheries

109. The fisheries impact assessment outlines the potential effects of the Development on the fish stocks and fish habitats of the receiving watercourses in the Curly River and wider Roe catchment. It provides relevant baseline information on fisheries, gathered through desktop and field survey, enabling the potential effects to be identified and evaluated.

110. The survey has shown that the principal drainage stream (Stream C) is populated by brown trout throughout its course within the Site Boundary and downstream of the site to the Curly River. In addition, the connected section of the Curly River, approximately 1km downstream of the Site, is an important spawning and nursery area for Atlantic salmon and is also included as part of the Special Area of Conservation (SAC).

111. It has been determined that potential effects are primarily related to the sediment run-off to the receiving watercourses with related effects on fish stocks and their habitats. Although these impacts have the potential to be significant, a series of specific mitigation measures have been designed to avoid adverse effects on fisheries with regard to both the construction and operational phases of the project, including buffer zones around watercourses; good construction practice; the implementation of a Sustainable Drainage System (SuDS) and the use of bottomless culverts at the two most sensitive watercourse crossings.

112. It is concluded that, provided the mitigation measures are implemented as specified, construction and operation of the Development will have a neutral impact on the fish stocks and aquatic biology of the Curly River and the wider River Roe catchment. It follows that the Development will have no effect on the Atlantic salmon as the primary feature of the River Roe and Tributaries ASSI/SAC.

113. An assessment of cumulative impacts on fisheries interests of the area was also undertaken, and it was concluded that there will be no significant effects.

Geology and Water Environment

114. The impact assessment involved a combination of desk study, site visits and consultation with various bodies including Causeway Coast & Glens BC, Departments of Agriculture, Environment & Rural Affairs (DAERA), the Department of Cultural Arts and Learning (DCAL), Department of Infrastructure (DOI) and the Department for Economy (DOE). The impact assessment identifies the potential impacts on geology, hydrology and hydrogeology, including surface water, groundwater, abstractions, the potential for pollution of watercourses and flooding. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

CONSENTED (LA01/2018/0200/F)

115. All on site water features drain into the Curly River. The Curly River is a sub-catchment of the designated River Roe and Tributaries SAC[3] and ASSI[4]. The Curly River joins the main branch of the River Roe 5.2 km to the west of the Site. The Roe River discharges into Lough Foyle 8.2 km to the north-west of the Site.

116. Aspects of the design, construction and operation of the proposed Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for effects assessed. It has been determined that without mitigation the Development would be likely to cause adverse impacts of moderate significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the baseline assessment and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

117. Monitoring of the effect of the Development on the water environment and fisheries habitat will be provided through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance of effects to all receptors to “not significant”.

118. There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.

Peat

119. A Peat Slide Risk Assessment (PSRA) was undertaken for the Development. The peat depths across the site are predominantly shallow (<1m) with areas of deeper peat avoided. Limited cover of superficial deposits highlights a low risk of mass movement. This is supported by British Geological Survey which does not highlight any mass movement across the site.

[3] Joint Nature Conservation Committee. (2015). Natura 2000 Standard Data Form - River Roe and Tributaries. Available from: http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030360.pdf. [Accessed: 14/8/2017].

[4] Department of the Environment. (2005). Declaration of Area of Special Scientific interest at River Roe and Tributaries, County Londonderry. Article 28 of the Environment (Northern Ireland) Order 2002. Available from: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/River-Roe-and-Tributaries-ASSI-citation-documents-and-map.pdf. [Accessed: 14/8/2017].

CONSENTED (LA01/2018/0200/F)

Noise

120. An assessment of the acoustic impact from both the construction and operation of the Development, was undertaken taking into account the identified nearest residential properties.

121. The operational noise impact was assessed according to the guidance described in the 'The Assessment and Rating of Noise from Wind Farms', referred to as 'ETSU-R-97', as recommended for use in relevant planning policy. The methodology described in this document was developed by a working group comprised of a cross section of interested persons including environmental health officers, wind farm operators and independent acoustic experts. It provides a robust basis for assessing the noise impact of a wind farm and has been applied at the vast majority of wind farms currently operating in the UK.

122. ETSU-R-97 makes clear that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that would arise through the development of renewable energy sources. The assessment also adopts the latest recommendations of the Institute of Acoustics 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.

123. Representative baseline conditions (the "background noise level") at nearby residential properties were established by undertaking noise surveys. These measured levels were then used to infer the background noise levels at other nearby residential properties as the ETSU-R-97 document recommends. As background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, the measurement of background noise levels at the survey locations were made concurrent with measurements of the wind speed and wind direction. These wind measurements are made at the wind turbine site rather than at the survey locations, since it is this wind speed that will subsequently govern the wind farm's noise generation.

124. A sound propagation model was used to predict the noise levels due to the Development at nearby residential properties over a range of wind speeds, taking into account the position of the proposed wind turbines, the nearest residential properties, and the candidate wind turbine type. The model employed (which considered downwind conditions at all times) took account of attenuation due to geometric spreading, atmospheric absorption, ground effects and barriers. It has been shown by measurement based verification studies that this model tends to slightly overestimate noise levels at nearby residential properties.

125. The relevant noise limits were then determined through analysis of baseline conditions and the criteria specified by the ETSU-R-97 guidelines. The general principle regarding the setting of noise criteria is that limits should be based relative to existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. This approach has the advantage

CONSENTED (LA01/2018/0200/F)

that the limits can directly reflect the existing noise environment at the nearest residential properties and the impact that the wind farm may have on this environment. Different limits are applicable depending upon the time of day. The daytime limits are intended to preserve outdoor amenity, whilst the night-time limits are intended to prevent sleep disturbance.

126. The predicted operational noise levels are within noise limits at nearby residential properties at all considered wind speeds. The Development therefore complies with the relevant guidance on wind farm noise and the impact on the amenity of all nearby properties would be regarded as acceptable.

127. A cumulative operational noise assessment has also been undertaken. Considering the mitigation measures identified the predicted cumulative noise levels are within noise limits at nearby residential properties. Compliance with relevant guidance implies that the cumulative impact on the amenity of nearby properties would be regarded as acceptable.

128. A construction noise assessment, incorporating the impact due to increased traffic noise and considering the mitigation measures identified, indicates that predicted noise levels likely to be experienced at the nearest residential properties are below relevant construction noise criteria at all residential properties.

129. An acoustic assessment of the proposed energy storage facility in accordance with BS 4142: 2014 shows that the impact would be low and the levels insignificant in comparison to the cumulative wind farm noise, which as mentioned above, is in compliance with relevant guidance.

Traffic & Transport

130. An assessment of the potential impact of the Development on traffic and transport was undertaken, involving consultation with Department of Infrastructure (DfI) Roads.

131. The proposed access route for abnormal loads (turbine components) is from Lisahally Port, which has been used previously for wind farm construction accessing from the Broad Road (A37). From Lisahally, the route will travel onto the Maydown Road and turn east onto the Clooney Road and travel east for approximately 28km via both Greysteel and Ballykelly before bypassing Limavady town on the Ballykelly Road travelling south east onto the Broad Road. The site entrance is located on the Broad Road where an existing access is provided to an unoccupied building and associated agricultural enclosures.

132. DfI Roads have a proposal for a climbing lane at this location (NAP 2016 – Proposal TRA 1). DfI Roads - Strategic Routes Improvement Team advised that whilst there is currently no allocated budget for the climbing lane scheme, the proposed site entrance is unlikely to effect the climbing lane proposal. The site entrance's

CONSENTED (LA01/2018/0200/F)

position does not conflict with the proposed location of the climbing lane or associated earthworks.

133. It is proposed that Normal HGV load delivery routes (including stone and concrete) will travel to the site entrance on the Broad Road (A37). Consideration was given to the effect of increased HGV traffic flow on Severance, Driver Delay, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation, Accidents and Safety and Cumulative Impacts.

134. The abnormal load route and the HGV routes have been assessed as acceptable in the ES. Taking into account the existing vehicle movements on the affected roads, and the proposed type and frequency of vehicle numbers, it is considered that with the appropriate mitigation measures, there will be no significant effects.

Shadow Flicker

135. A shadow flicker analysis of the Development was performed. Under certain combinations of geographical position, time of day, time of year and meteorological conditions, the sun may pass behind the turbine rotor and cast a shadow over neighbouring buildings’ openings (i.e. windows and doors) where the contrast between light and shade is most noticeable. To a person within that room the shadow, depending on its intensity, may appear to flick on and off, giving rise to an effect referred to as shadow flicker.

136. The Best Practice Guidance to Planning Policy Statement 18 (PPS18) states that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

137. An analysis of shadow flicker throughout the year from Development was carried out, taking into account the behaviour of the sun, the local topography and the turbine layout and dimensions[5]. The analysis was performed using a turbine layout consisting of 9 turbines, each with maximum tip heights of 149.9 m and maximum rotor diameters of 99.8 m.

138. There are no inhabited houses within ten rotor diameters of any of the proposed turbines.

139. Due to both the distance of the nearest residential properties to the Development, and the recommendations pertaining to ten rotor diameter proximity, and proposed mitigation if required, it is concluded that the Development should not cause a material reduction to residential amenity owing to shadow flicker.

Socioeconomics

140. A socioeconomic assessment of the Development was carried out. It concluded that should the Development go ahead, it will deliver substantial benefits to the

[5] Turbine ref 03219D0001-06, house ref 03219D0201-01

CONSENTED (LA01/2018/0200/F)

economies of Northern Ireland and the Causeway Coast & Glens BC area, in economic and environmental terms. It will provide significant job creation and activity in the construction sector (with a commitment to use local labour where possible); increase tax and rates revenue for local and central government; contribute to renewable energy targets; and has the potential to transfer the knowledge, expertise and skills gained and developed to other wind farms, possibly acting as a catalyst for further investment in the area.

141. The Development is estimated to involve a capital spend of £26.02 million. Of this total, £7.87 million (nominal prices) will be realised within the Northern Ireland economy. The projected 18-month construction phase is estimated to create or sustain 128-167 total (direct, indirect and induced) job years[6] of employment, £3.51-£4.54 million of wages and £4.72-£6.12 million (£2013 prices) of GVA[7] to the Northern Ireland economy.

142. The estimated total (direct, indirect and induced) benefits from the operational phase of the proposed Development includes 71 job years within Northern Ireland, with associated wages of £2.4 million and £7.3 million (£2013 prices) in GVA over the 30-year operating period.

143. Over the Development's construction phase the UK Exchequer is estimated to benefit from increased tax revenue and benefits saving of £1.59-£2.55 million. In addition to this, each year of operation is likely to yield a further £0.03-£0.04 million of increased tax revenue and benefit savings (in constant prices). Over the 30-year project life, we estimate that £2.6-£3.8 million would be realised in raised revenue and benefits savings[8].

144. Based on rateable values of £27,500 per MW we calculate that the Development will increase rateable value by £816,750 each year, or by £24.5m over the project horizon. From these values business rates are calculated and collected for local Councils and the Northern Ireland Assembly. By applying Causeway Coast and Glens BC non-domestic poundage rates, we estimate additional business rates of £468,795 each year and £14.0m over the 30-year lifetime of the project.

145. Over the lifetime of the project, rates, taxes and land rental will collectively amount to approximately £30.5 million.

[6] **Job years**: For the construction phase 'job years' refers to the amount of activity that is required. E.g. two people could be employed for six months – this would equate to two jobs, but would actually only mean activity would take one job year of work to complete. Alternatively one person could be employed for two years - this would only equate to one job, but is actually two job years of employment.

[7] **Gross value added** (GVA) measures the value of goods & services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

[8] This analysis relates to results from Method 1 – see Chapter 13 of ES for full details.

CONSENTED (LA01/2018/0200/F)

4. Conclusion

146. The potential effects of the Development have been assessed in accordance with regulatory requirements and good practice. The ES incorporates technical assessments of the Development based on the requisite legislation and the relevant planning policy framework. The ES has demonstrated that significant environmental effects associated with the construction, operation and decommissioning of the Development have been avoided or minimised through the use of the iterative design process and with the application of mitigation measures.

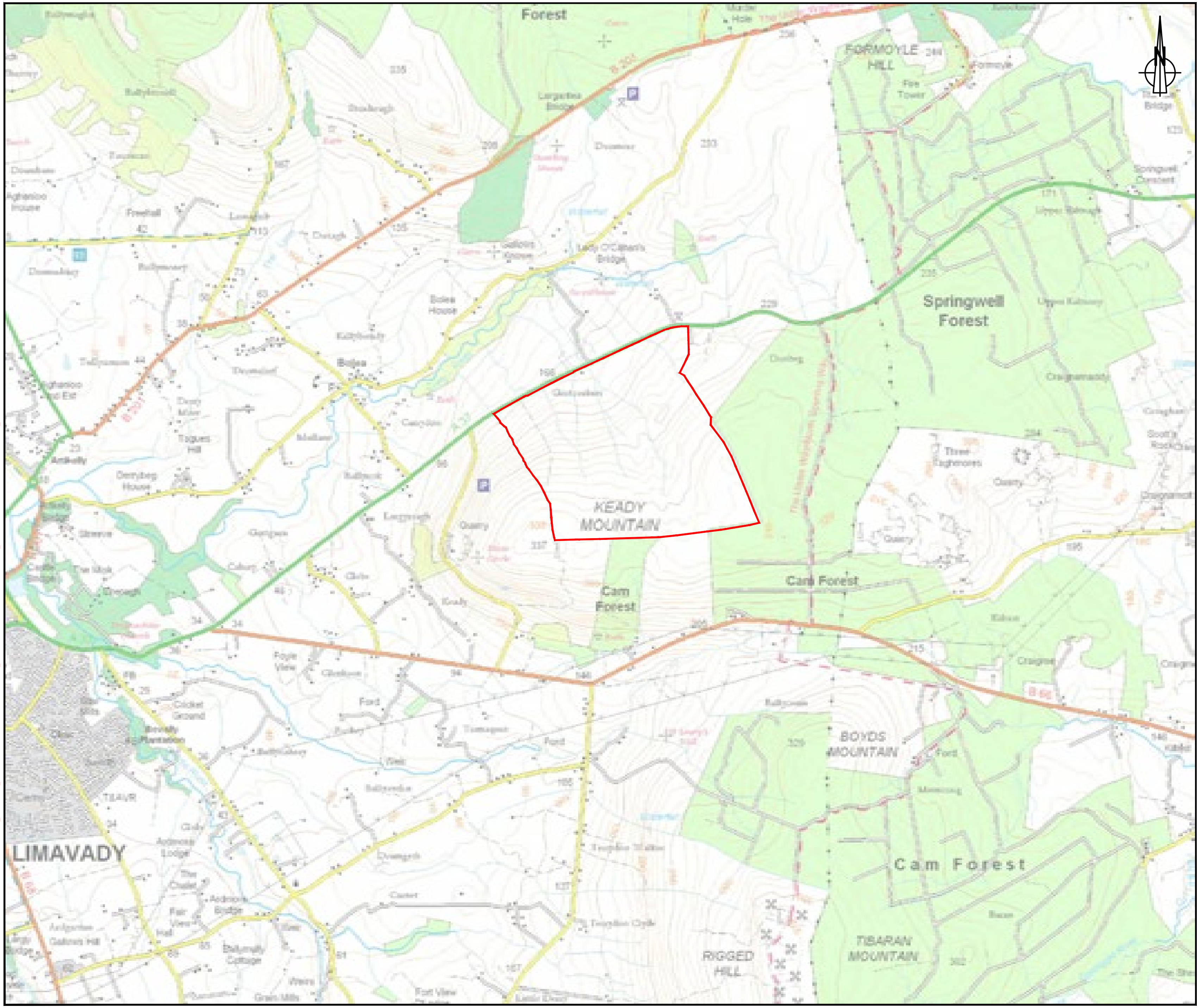
147. Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[9]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens Borough area. In addition, the Development is also estimated to reduce CO_2 emissions by 40,800 tonnes each year. This equivalent to 30,100 newly registered cars.[10]

148. The Development will result in a reduction in greenhouse gas emissions from the electricity generating industry by harnessing wind as an alternative to the burning of fossil fuels, in line with the government's energy goals. It will also make a significant contribution to the Northern Ireland government target that 40% of electricity consumed should be sourced from renewable energy by 2020 (DETI).

[9] This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

[10] https://www.gov.uk/government/publications/new-car-carbon-dioxide-emissions

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH
WIND FARM

FIGURE 1

SITE LOCATION MAP

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

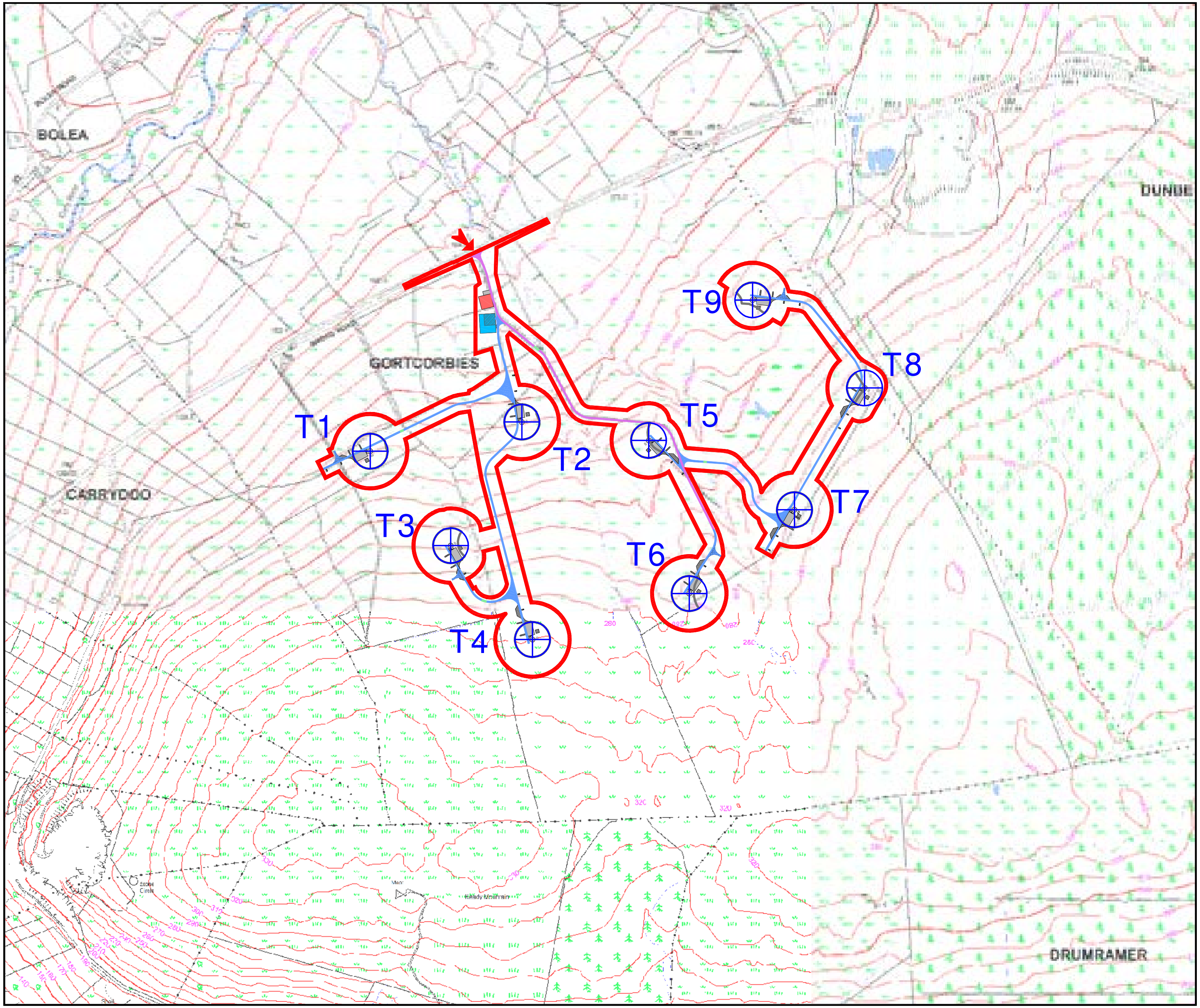
KEY:

SITE LOCATION

LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 03219D1001-02	
SCALE - 1:50,000 @ A4	
NON-TECHNICAL SUMMARY 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2

INFRASTRUCTURE LAYOUT

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG	03219D0001-06	T-LAYOUT NO.	PNIRdbx028

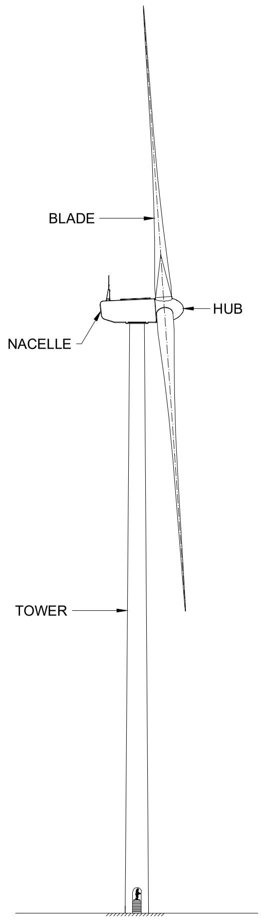
DRAWING NUMBER **03219D1001-02**

SCALE - 1:15,000 @ A4

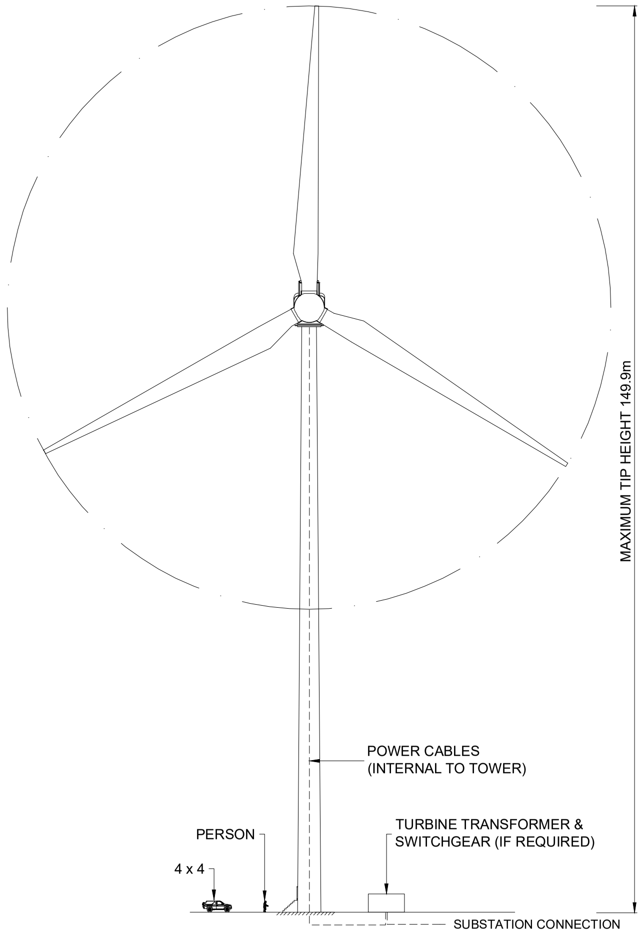
NON-TECHNICAL SUMMARY 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SIDE VIEW



FRONT VIEW

PHOTOGRAPH OF TYPICAL TURBINE

DUNBEG SOUTH
WIND FARM

FIGURE 3

TURBINE ELEVATION

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

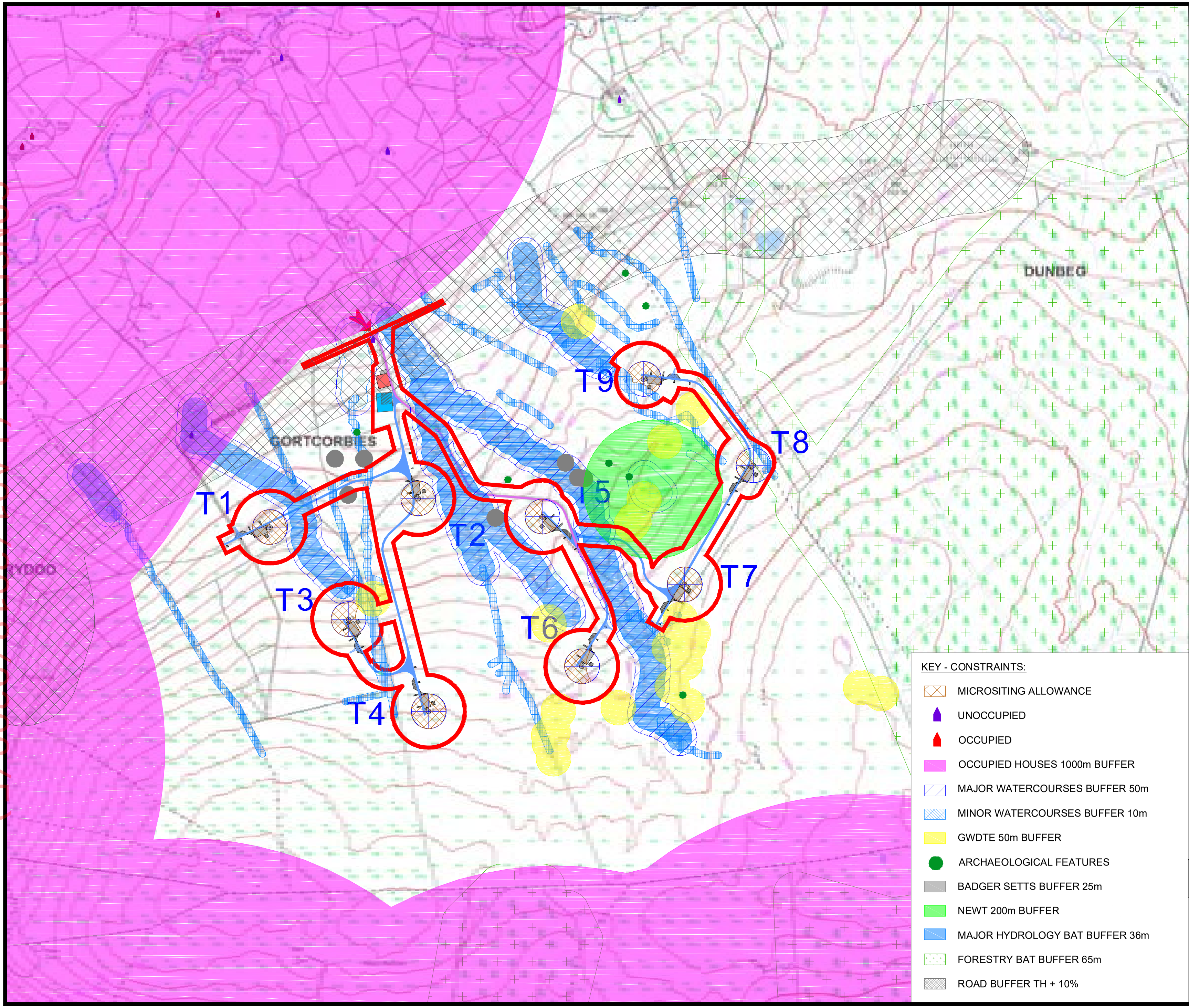
DRAWING NUMBER
03219D2901-01

SCALE - 1:1250 @ A4

NON TECHNICAL SUMMARY
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH
WIND FARM

FIGURE 4

COMBINED CONSTRAINTS
& INFRASTRUCUTRE

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY - INFRASTRUCTURE:
- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028
DRAWING NUMBER 03219D2237-01	
SCALE - 1:15,000 @ A4	
NON TECHNICAL SUMMARY 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

SECTION 3

ORIGINAL ES CHAPTERS

OF CONSENTED

LA01/2018/0200/F

APPLICATION

DUNBEG SOUTH WIND FARM

Environmental Statement

power for good

CONSENTED (LA01/2018/0200/F)

Table of Contents

Figures

CONSENTED (LA01/2018/0200/F)

Preface

This document is Volume 1 of the ES. The ES comprises:

- Volume 1: Non-Technical Summary (NTS)
- Volume 2: Main Report
- Volume 3: Figures (Maps & Illustrations)
- Volume 4: Technical Appendices

The aim of the NTS is to summarise the content and main findings of the ES in a clear and concise manner to assist the public in understanding what the environmental effects of the Dunbeg South Wind Farm are likely to be. The full ES provides a more detailed description of the Development and the findings of the Environmental Impact Assessment (EIA) process.

The ES has been prepared by RES in consultation with Causeway Coast & Glens BC, various consultees and in collaboration with the subject specialists outlined below.

Specialism	Author
Introduction & Planning Policy; Proposed Development (including Electromagnetic Interference and aviation); Design Evolution & Alternatives; Noise; Transport and Shadow Flicker;	RES
Landscape and Visual	Shanti McAllister Landscape Planning & Design
Archaeology and Cultural Heritage	Gahan and Long
Ecology	Blackstaff Ecology
Ornithology	David Steele
Fisheries	Paul Johnston Associates
Geology and Water Environment *Peat Slide Risk & Peat Management Plan*	McCloy Consulting *Natural Power*
Socioeconomics	Oxford Economics

CONSENTED (LA01/2018/0200/F)

Commenting on the ES

The full ES, together with supporting documents submitted as part of the planning application (Design and Access Statement and Pre-Application Community Consultation Report) will be available (and CD copies available free of charge) for viewing during normal opening hours at the address below:

Viewing Location	Address
Limavady Library	5 Connell Street Limavady County Londonderry BT49 0EA Phone: 028 7776 2540

An electronic version of the reports supporting the application, including the ES, will be available to download free of charge from http://www.dunbegsouth-windfarm.co.uk

Copies of the ES can be obtained at a cost of £50 from the address below:

RES Ltd
Willowbank Business Park
Willowbank Road
Millbrook
Larne
BT40 2SF
Email: garth.mcgimpsey@res-group.com
Phone: 028 2844 0580

CONSENTED (LA01/2018/0200/F)

1. Introduction

1. This Non-Technical Summary (NTS) has been prepared in support of a planning application by RES Ltd for the proposed Dunbeg South Wind Farm, hereinafter referred to as 'the Development', which is located approximately 6 km north east of Limavady, County Derry/Londonderry.

2. A planning application has been submitted to Causeway Coast & Glens BC in accordance with the Planning (Environmental Impact Assessment) Regulations, 2017. The regulations require an Environmental Impact Assessment (EIA) to be carried out and the results of the EIA to be included in an Environmental Statement (ES) to accompany the planning application. The application follows a detailed assessment of the environmental and technical aspects of the site's suitability for development.

3. The Development comprises 9 three-bladed, horizontal axis wind turbines, each up to a maximum of 149.9 m to tip height, with a total installed capacity of up to 29.7 MW. The Development would include a newly created site entrance, access tracks, crane hardstandings, control building and substation compound, electricity transformers, underground cabling, energy storage containers and drainage works. During construction there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and welfare facilities. The proposed layout is illustrated in **Figure 2: Infrastructure Layout**.

4. Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[1]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens District Council area.

The Applicant

5. RES is one of the world's leading independent renewable energy project developers with operations across Europe, the Americas and Asia-Pacific. At the forefront of renewable energy development for over 30 years, RES has developed and/or built almost 12,000 MW of renewable energy capacity worldwide. In the UK alone, RES currently has more than 1,000 MW of projects either constructed, under construction or consented. RES is active in a range of renewable energy technologies including onshore and offshore wind, solar, as well as enabling technologies such as energy storage.

6. RES has developed 16 onshore wind farms in Northern Ireland totalling 229 MW, which equates to 36% of Northern Ireland's onshore wind capacity. RES currently

[1] This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

CONSENTED (LA01/2018/0200/F)

operates over 83 MW of wind capacity across Northern Ireland, has secured planning permission for a further 112 MW awaiting construction and has 92 MW in the planning system.

The Application Site

7. There are a number of key technical and environmental factors that influence the suitability of a site for a wind farm. The following are key attributes that contribute to a viable site, which the application site possesses:

- Good wind speeds
- A site which complies with planning policy and in particular, avoids unacceptable effects on areas designated by statutory agencies; maintains appropriate distances from dwellings to avoid unduly impacting local amenity and; avoids impeding or interfering with major electromagnetic transmission and airport communication systems
- Sufficient area to accommodate the number of wind turbines required for economic viability
- Adequate vehicular access for wind turbine components (abnormal loads)
- Suitable terrain and topography, which affect wind flow across a site and need to be considered in relation to turbine performance, specification and life-span
- Suitable ground conditions for the construction of wind turbine foundations, erection of the machines and the provision of access tracks and cables.

8. The Site is positioned on a north facing slope below Keady Mountain in the south eastern part of the Binevenagh Area of Outstanding Natural Beauty (AONB). The Site is bounded by Broad Road (A37) to the north which is part of the primary road network linking the towns of Limavady and Coleraine.

9. The Site is currently used for rough sheep and cattle grazing and primarily comprises improved agricultural land, wet marshy grassland with areas of wet heath and blanket bog on the upper slopes. The lands are dissected by several deeply incised water channels. The Site is open and exposed to the west but is bounded to the east by Springwell Forest with further areas of coniferous forestry to the south.

The Need for the Development

10. A key policy driver for the development of renewable energy in Northern Ireland is the need to increase security of supply. There are also potential adverse impacts on local populations and the economy through high volatile fuel costs, contributing to fuel poverty and high energy costs for businesses and industry. In addition, increasing focus on renewable energy can deliver environmental and climate change gains, reductions in carbon emissions, as well as investment and employment opportunities. With a lack of indigenous fossil fuels and no nuclear power stations, Northern Ireland is keen to develop the full range of its available renewable energy resources to optimise the contribution that renewables make to the overall energy mix.

CONSENTED (LA01/2018/0200/F)

11. Northern Ireland's current renewable energy target is that 40% of electricity consumption should be met from renewable sources by 2020 (DETI 2010). The 40% target is the equivalent of 1600 MW. Wind energy will be the main focus of renewable electricity development on the island of Ireland, and certainly in Northern Ireland, through to 2020.

12. If approved, the Development could account for up to 29.7 MW, a material contribution to achieving the 40% renewable energy target for 2020. This is the equivalent of approximately 23,000 homes.

CONSENTED (LA01/2018/0200/F)

2. Description of the Development

13. The main elements of the Development are as follows:

- 9 three-bladed horizontal axis wind turbines of up to 149.9 m tip-height
- Turbine foundations
- Hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbines
- Electricity transformers
- Approximately 3.5 km of new access track and 1.1 km of upgraded access track
- Wind farm substation compound containing a control building
- Energy Storage Containers
- On-site electrical and control network of underground (buried) cables
- Connection from the substation to the local grid network
- Temporary construction compound
- Permanent and temporary drainage works
- Associated ancillary works
- New site entrance from the public road.

14. The wind farm layout is shown in **Figure 2: Infrastructure Layout**.

15. The actual area of permanent land take is limited to the control room and substation compound, energy storage area, wind turbine towers, permanent crane hardstandings and on-site access tracks, which collectively account for approximately 4.4 ha, which is approximately 10.3% of the area within the planning application boundary. In addition there will be an estimated 0.7 ha of hardstanding required on a temporary basis during construction.

16. Prior to construction the locations of the proposed wind turbines would be subject to micrositing, which allows for a small degree of flexibility in the exact locations of turbines and routes of tracks and associated infrastructure (50 m deviation in plan from the indicative design). Any repositioning would not encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine positioning would help mitigate any potential environmental effects: e.g. avoidance of unfavourable ground conditions or archaeological features not apparent from current records. The micrositing allowance has been taken into account in the EIA.

Wind Turbines

17. The wind turbine industry is evolving at a remarkable rate. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine

CONSENTED (LA01/2018/0200/F)

for the Development has not yet been made. The most suitable machine will be selected before construction, with a maximum tip height of 149.9 m.

18. For visual and acoustic assessment purposes, the most suitable candidate turbine available in the market place (currently of 3.3 MW nominal capacity and with an overall tip height of 149.9 m) has been assumed. Exact tower and blade dimensions vary marginally between manufacturers. A diagram of a typical 149.9 m tip height turbine is given in **Figure 3: Typical Wind Turbine Elevation**.

19. It is proposed to install infrared lighting on the turbines in a pattern that is acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capability to detect and avoid wind farms. Infrared lighting cannot be detected with the naked eye, thereby reducing visual impact.

20. Each turbine would have a transformer and switchgear. Depending on the turbine supplier, the transformer and switchgear may be located inside or outside each turbine.

21. The wind turbines would be erected on steel re-enforced concrete foundations. During the erection of the turbines, crane hardstanding areas would be required at each turbine base consisting of both permanent and temporary elements. After construction is complete, the temporary crane pad areas will be reinstated.

Site Tracks

22. A new site entrance is proposed in the central portion of the site on the northern boundary with access off the Broad Road.

23. Approximately 3.5 km of new access tracks and 1.1km of upgraded access tracks are required within the site to enable the turbine components and construction materials to be transported to their locations, and to enable ongoing access during the operational period for maintenance visits.

24. The on-site access track layout has been designed to minimise environmental disturbance by utilising existing track locations and avoiding sensitive habitats where possible whilst keeping the length of track commensurate with the minimum required for operational safety. The track route takes cognisance of the various identified environmental constraints.

25. Seven watercourse crossings will be required as part of the track layout. These crossings would be designed to ensure that fish and mammal movements are not restricted, in addition to ensuring the crossing size is adequate for potential flood flows. Indicative locations are shown on **Figure 2: Infrastructure Layout**.

Electrical Connection, Control Building & Substation and Energy Storage

26. Assuming the use of the currently available models, each wind turbine would generate electricity at 690 V and would have an ancillary transformer located either within or outside the base of the tower to step up the voltage to the

CONSENTED (LA01/2018/0200/F)

required on-site distribution voltage. Each turbine would be connected to any adjacent turbines by underground cables.

27. The wind farm control building and substation is proposed to be located on the eastern part of the site as shown in **Figure 2: Infrastructure Layout**. All power and control cabling on the wind farm will be buried underground in trenches located, where possible, along the route of site access tracks.

28. The control building will be designed and constructed to the standard required by NIE for the accommodation of substation equipment. Where possible, local building materials and finishes will be used to ensure that the appearance is in keeping with other buildings in the area. The building will be staffed by maintenance personnel on a regular basis.

29. Four permanent containers housing an energy storage device, inverters and other ancillary equipment will be positioned adjacent to the control building and substation compound on hardstanding used originally for the temporary construction compound. These units are a means of storing electrical energy just like a rechargeable battery, cell phone or electric car. These are means by which power can be stored and released. The application is of course of a larger scale but the basic principle is the same.

Construction Management

30. A Construction and Decommissioning Method Statement (CDMS) will be prepared once planning consent has been gained. This will be submitted to Causeway Coast & Glens BC prior to any construction works taking place. This will describe the detailed methods of construction and working practices, work to reinstate the site following completion of construction activities and methods to reinstate the site post operation. The CDMS will:

- provide a mechanism for ensuring that measures to prevent, reduce and where possible offset potentially adverse environmental impacts identified in the ES are implemented;
- ensure that good construction practices are adopted and maintained throughout the construction;
- provide a framework for mitigating unexpected impacts during construction;
- provide a mechanism for ensuring compliance with environmental legislation and statutory consents;
- provide a framework against which to monitor and audit environmental performance.

31. The wind farm drainage system will be designed to mimic natural conditions to mitigate against increased flashiness in water courses and reduced groundwater recharge. The drainage system will protect the status of water courses and ground waters.

CONSENTED (LA01/2018/0200/F)

32. Construction will be carried out according to Department of Agriculture, Environment & Rural Affairs (DAERA) and Construction Industry Research and Information Association (CIRIA) guidance for site works. Pollution control measures during the construction phase will be included in the CDMS.

33. It is anticipated that the construction would take 18 months. Construction work will take place between the hours of 0700-1900 Monday to Friday and 0700 – 1300 on Saturdays. Outside these hours, work at the site shall be limited to turbine erection, testing/commissioning works and emergency works. Deliveries may occur outside these times to minimise disruption to local residents.

34. A programme of reinstatement would be implemented upon completion of construction. This would relate to the construction compound, temporary areas of the crane hardstandings, cable trenches and track shoulders where appropriate. There remains a potential to use cranes during the operational phase of the Development, therefore the main crane hardstanding will remain uncovered.

Operation

35. The expected operational life of the Development is 30 years from the date of commissioning. Wind turbines and wind farms are designed to operate largely unattended. Each turbine would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

36. The Development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines. This is monitored 24 hours a day, 7 days a week.

37. An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the Development and would be on-site intermittently.

38. Routine maintenance of the turbines would be undertaken approximately twice yearly to ensure the turbines are maintained to Industry Standard. This would not involve any large vehicles or machinery.

CONSENTED (LA01/2018/0200/F)

39. A Habitat Management Plan will be implemented during the construction and operational phases of the Development, working with the site landowners, which will provide for the restoration and enhancement of currently degraded blanket bog and wet heath habitats on site.

Decommissioning

40. One of the main advantages of wind power generation over other forms of energy production is the ease of decommissioning and the simple removal of components from the site. The residual impact on the site is limited to the continued presence of the foundations and access tracks. All above ground structures can be removed from the site.

41. If the Development obtains planning approval it is expected that a planning condition would be set to provide for the decommissioning of the site in accordance with a scheme agreed in writing with Causeway Coast & Glens BC.

42. The Development will be decommissioned in accordance with best practice and/or in compliance with any planning conditions. Current best practice includes the removal of all above ground structures; the removal of all underground structures where required; and reinstatement of disturbed areas all of which will be subject to any necessary consents. Consideration will be given to the retention of wind farm access tracks if they utilise pre-existing farm infrastructure or are not located on sensitive habitats if such continued use could lead to the long term degradation of these habitats.

CONSENTED (LA01/2018/0200/F)

3. The Environmental Impact Assessment (EIA) Process

43. The purpose of EIA is to provide adequate environmental information to enable stakeholders to understand the potential environmental effects of a project. The EIA identifies and assesses the potential environmental effects associated with the construction, operational and decommissioning of the Development. The assessment and potential effects are recorded in the ES.

Consultation

Public Consultation

44. RES is committed to finding effective and appropriate ways of consulting with all its stakeholders, including local residents and community organisations, and believes that the views of local people are an integral part of the development process. RES began the engagement process with the local community eight months prior to the submission of the planning application, to facilitate a constructive consultation process which helped RES to understand and address any concerns as the project developed.

45. A public exhibition was held in August 2017 which included detailed information about the proposals, including: a map of the proposed layout; photomontages representing how the proposed layout would appear from a range of viewpoints; Zone of Theoretical Visibility (ZTV) drawings. (A ZTV is a map-based diagram of where and how many wind turbines, or wind farms, would theoretically be visible from all parts of a given area.) RES staff were available to answer questions and feedback was encouraged.

46. A Pre-Application Community Consultation (PACC) Report has been produced and is available for viewing at the location listed in Section 1 of this NTS.

EIA Consultation

47. RES and the various chapter authors have undertaken pre-application consultation with relevant consultees, which has informed the EIA process and is detailed in each of the technical chapters within the Volume 2 (Main Report) of the ES.

Wind Farm Design Evolution & Alternatives

48. In accordance with EIA process and best practice the project team employed an iterative approach to the design of the Development. The design evolved throughout the EIA process as different constraints and adverse/ beneficial effects were identified and evaluated. This approach allowed mitigation measures to be integrated into the design in order to alleviate or remove significant effects of the proposed development. It also allowed measures to enhance beneficial effects of the proposed development to be incorporated into the design.

CONSENTED (LA01/2018/0200/F)

49. Following consultation and baseline characterisation of the Site, the following key topics were identified:

- Landscape and visual
- Archaeology and cultural heritage
- Ecology
- Ornithology
- Fisheries
- Geology and water environment
- Noise
- Shadow flicker
- Traffic and transport.

50. The topics listed above were considered through the design with the aim of designing out significant effects. Where it was not possible to mitigate by design, the issues were considered further as part of the EIA.

51. A key tool in this process was the combined constraints drawing, which identifies constraints to development and sensitive features on the site. This drawing was iteratively updated as new information from surveys, site visits and consultation was received.

Turbine Layout Evolution

Landscape & Visual

52. A landscape consultant was involved throughout the design process to provide advice regarding the scale of the development and turbine height.

53. RES began the development process by identifying 21 potentially suitable turbine locations on this site. These locations were chosen by correlating on-site constraints such as hydrology, ecology and ground conditions with off-site constraints such as aviation. Next, a feasibility appraisal was carried out to identify the key landscape and visual issues that would need to be considered if a wind farm were to be proposed on this site. This included a preliminary analysis of the site in its wider landscape context, including its location within the Binevenagh AONB and its proximity to other wind farms, particularly the adjacent cluster of existing, consented and proposed wind farms at Dunbeg and Dunmore.

54. Following the feasibility appraisal a number of potential turbine layouts and dimensions were considered in order to further refine the layout and its potential landscape and visual effects on the Study Area. This included the consideration of variable turbine heights (125 – 149.9m), the relocation of turbines to minimise visibility on the summit of Keady Mountain and to create a good visual relationship between the Development, the adjacent Dunbeg cluster, and other cumulative wind farms in the wider Study Area.

CONSENTED (LA01/2018/0200/F)

55. The 9-turbine option that is presented in the EIA is the result of this iterative design process. A series of comparative diagrams have been presented as part of this LVIA to illustrate the relocation and reduction in the number of proposed turbines in order to present a Development that is deemed to be acceptable in EIA and LVIA terms.

56. Comparative wirelines illustrate that the discernible difference in visual effects between turbines with 149.9 m and 125 m tip heights would be negligible but the reduction in the overall number of turbines and the wider spacing between the final turbines that are proposed has resulted in a number of benefits, namely:

- There are few instances where 'stacking' of turbines occurs. Stacking is where two or more turbines will appear directly in front of each other in a view and will therefore result in a 'heavier' or more solid, and hence more prominent appearance;
- The turbines can be more evenly spaced in relation to each other and to the site topography which has resulted in a simpler layout with fewer variations in tip heights in relation to contour AOD levels;
- A reduction in the proposed number of turbines means that the Development can remain clear of the summit of Keady whilst also remaining contained in the saddle of land between Keady and Binevenagh, thus minimising visual effects on the AONB and the sequence of views along the Binevenagh range of uplands, particularly when viewed from the west;
- A greater amount of space could be created between the Development and the Dunbeg cluster of wind farms so that differences in turbine heights are less noticeable and are not visually jarring.

57. The comparative ZTV (Figure 4.11) indicates no areas of theoretical visibility of the final 9-turbine layout (149.9 m tip height) beyond any theoretical visibility that would have occurred with the 21 potential turbine locations that were initially considered with 125 m blade tips or with the refined 14-turbine layout using turbines with tip heights of 134.9 m - 149 .9 m. This layout would have resulted in theoretical visibility across 61.1 % of the Study Area whereas the final layout results in theoretical visibility across 58.18 % of the Study Area.

Environmental Constraints & Assessments

58. Following baseline surveys, the combined constraints drawing incorporated the following, which are shown in **Figure 4: Combined Constraints and Infrastructure**:

- The hydrology consultant recommended watercourse buffers of 50 m and 10 m depending on the sensitivity of the watercourse, which were agreed as appropriate by the fisheries consultant. Upstream abstraction constraints were added to identified private water supplies;
- A 50m buffer was applied to Ground Water Dependent Terrestrial Ecosystems, which were identified through the baseline survey;

CONSENTED (LA01/2018/0200/F)

- A 25 m buffer was applied to badger setts, which was identified through the baseline survey;
- Bat buffers of 36 m and 65 m were added to major watercourses and forestry edge respectively, as advised by the ecological consultant. The 36 m and 65 m distances are in plan, and achieves a 50 m buffer between the blade tip and the habitat feature, in line with Bat Conservation Trust guidance.
- 165 m buffers were applied to nearby public roads in line with the Best Practice Guidance to PPS18 which recommends a set-back distance of at least tip height plus 10% between turbines and roads.

59. In addition, the lower slopes are enclosed by a fence line that runs broadly west to east and contains extensive linear drainage, overgrazing by sheep and cattle, and historic peat harvesting. To the south of this fenceline there are areas of upland blanket bog present with the best examples of this habitat located on the plateau of the site. As this habitat is of greatest conservation value on site, it was considered that these that these areas should be avoided in their entirety as recommended by the ecology consultant.

60. Baseline peat probing indicated that peat depths were predominantly shallow (>80% probes were between 0.0 – 0.5m deep) and areas of peat depth greater than 2 m were avoided to limit excavation and spoil generation.

61. Before the turbine layout could be confirmed, noise and shadow flicker assessments were carried out. Both assessments conclude that there would be no significant effects on any surrounding residential properties.

62. The final turbine layout consists of 9 turbines of 149.9 m tip height.

Infrastructure Design Evolution

63. The infrastructure design evolved through the EIA process. The following principles were taken into consideration when designing the supporting infrastructure:
    - Avoidance of environmental and technical constraints;
    - Design of the track layout to utilise existing track locations and follow natural contours as far as possible, in order to avoid unnecessary amounts of excavation;
    - Minimisation of the overall length of access track;
    - Minimisation of the number of watercourse crossings, as far as possible;
    - Avoidance of steep slope areas to minimise earthworks;
    - Incorporation of measures to improve the visual appearance of the scheme, including reinstatement of temporary infrastructure following the construction period;
    - Use of bottomless culverts at two watercourse crossing locations following the advice of the fisheries and water environment consultants.

CONSENTED (LA01/2018/0200/F)

Environmental Effects

64. The following sections summarise the technical chapters of the ES. The term 'Site' refers to the Preliminary Site Boundary of the wind farm, which is shown in **Figure 1: Site Location**, which is a larger area than the final planning application boundary, which is shown in **Figure 2: Infrastructure Layout**.

Landscape and Visual

65. The Landscape and Visual Impact Assessment (LVIA) methodology was specifically developed for wind farm development in Northern Ireland in accordance with best practice guidance. The LVIA considered a 30 km radius Study Area and involved a combination of existing desktop information (maps, planning policy and existing landscape character assessment documents), detailed site surveys of the Study Area and computer modelling.

66. Potential landscape and visual effects were assessed as separate but linked issues. The magnitude of landscape effects was derived from the extent to which physical changes cause changes in landscape character and value. Visual effects relate to changes in the composition of views and people's perception of/responses to these physical changes. Viewers / visual receptors include local residents, tourists, walkers, farmers, general road users etc.

67. For both landscape and visual effects the Significance of effect was derived from the assessment of Landscape Value, Sensitivity and Magnitude of change and also by using objective professional judgement in relation to site circumstances.

68. An assessment was carried out of the potential cumulative effect arising from the Development in combination with other wind farm developments, including operational, consented and proposed projects. In accordance with GLVIA[2] best practice guidelines existing and consented wind farms are considered to be part of baseline landscape and visual character as well as in the cumulative assessment. The assessment of effects of the Development takes consideration of their presence, or anticipated presence.

69. The Development is located in the south eastern part of the Binevenagh AONB and within the Binevenagh Landscape Character Area (LCA) and a detailed description is included within Chapter 4.

70. Although the Development is not located within the core of the Binevenagh AONB it is recognised that the proposal is within the AONB and that the site has merit in terms of its contribution to the landscape and visual character of the wider AONB. The layout and position of the Development has, therefore been designed to minimise its effect on the AONB as a whole. This has been achieved by locating it

[2] The Landscape Institute and Institute of Environmental Management and Assessment (April 2013) 'Guidelines for Landscape and Visual Impact Assessment 3rd Edition'

CONSENTED (LA01/2018/0200/F)

away from the core area containing the majority of visitor attractions and iconic landscape features. It is also in a location that is closely related to existing wind turbines, and that is neither highly visible from the rest of the AONB nor from other parts of the Study Area with good views to the core part of the AONB. These are considered to be the summit / escarpment of Binevenagh and the lowlands to the north of this escarpment.

71. The Development reinforces the existing character of the site and immediately adjacent landscape and is less detrimental to the overall landscape character of the AONB than forestry or quarrying because it will not have permanent presence. Whilst forestry and quarry both leave permanent marks on the landscape, wind farms are considered to be long term temporary rather than permanent developments which will ultimately be removed and the sites reinstated back to their previous uses.

72. The site of the Development does not contribute significantly to the iconic value attributed to the summits and escarpments in the Binevenagh AONB. Neither does it contain significant visitor amenity facilities that are likely to attract the most sensitive receptors – the main tourist attractions and scenic routes are generally located to the north overlooking the coast.

73. The overall conclusion of the LVIA is that the landscape effects on the Binevenagh LCA, in which the Development is located are Not Significant due to the Development's location within the same part of the landscape as the Dunbeg cluster of wind farms, and the presence of other human factors that strongly influence the landscape character.

74. The ZTV diagrams indicate that, within a 30 km radius, theoretical visibility of the Development would cover less than 59% of the Study Area. This percentage does not take into account the screening effects of trees and buildings etc. Therefore actual visibility would be lower.

75. The effect of the drumlin topography in farmland in the eastern part of the Study Area is indicated by patchy areas of visibility. The largest and most uninterrupted areas of theoretical visibility occur around the flat coastal areas to the west of the Development – Magilligan and the Roe Valley, and in the sea and Lough Foyle estuary to the north and north-west. However, detailed site assessment indicates that built development and vegetation cover in these parts of the Study Area are likely to screen many low-lying views. The Development is also likely to be difficult to discern with the naked eye in long distance views particular from low level viewpoints where its scale will be diminished by the scale of wider views. There will be very few visual receptors present on the sea and their distance from the Development, combined with their low elevation in relation to the land, is likely to mean that the Development will not be a clearly discernible feature in their views.

76. The ZTV diagrams indicate that there are very few parts of the Causeway Coast and Sperrin AONBs that are likely to have view of the Development and the northern

CONSENTED (LA01/2018/0200/F)

half of the Binevenagh AONB, including the summit of Binevenagh, will either have no views or views of the Development that are limited in their extent.

77. Of a total of 27 viewpoints representing typical levels of visibility throughout the study area, three viewpoints, which are all close range viewpoints, were assessed as being significantly affected. The remaining 24 viewpoints were assessed as experiencing No Significant visual effects.

78. In terms of cumulative landscape effects the Development was not deemed to have a significant effect on the receiving landscape. Clusters of wind farms located on these upland areas are a relatively common landscape characteristic but there are sufficient separation distances between these clusters to ensure they are not the dominant characteristic. This is in accordance with general advice provided in the SPG that elevated upland landscapes can accommodate larger turbines and the broader the upland the greater the capacity. Larger horizons tend to diminish the perception of height. In this Study Area the fact that many viewpoints are elevated in nature means that very broad panoramic views occur frequently and, from certain directions / in certain viewpoints, often incorporate both simultaneous and sequential views of several clusters of wind farms. The Development would increase the size of the Dunbeg cluster of wind farms but would not decrease its separation distances with other clusters of wind farms in the Study Area. Neither would it encroach onto elements of the landscape that are not already characterised by wind farm development or other man-made features.

79. Of the 27 viewpoints only one is judged to experience significant cumulative visual effects on views. This is a close range view on a tertiary road where the primary visual receptors would be residents of properties and where views towards the existing Dunbeg cluster are screened by woodland along the Curly River corridor. The remaining 26 viewpoints are deemed to experience no significant cumulative visual effects.

80. All policy documents (the SPPS, PPS 18 and its best practice and supplementary guidance) recognise that wind farms may be prominent elements in close range views but that this does not necessarily equate to unacceptable development. Taking into account that only three of the 27 viewpoints assessed as part of the LVIA are deemed to experience significant visual effects, and that no significant landscape effects have been identified, the LVIA concludes that the Development is acceptable in landscape and visual terms.

Archaeology and Cultural Heritage

81. An Archaeological & Cultural Heritage impact assessment was conducted for the Development. The purpose of this was to identify the archaeological potential of the Site, assess the impact of the Development upon this and to assess the impact on known archaeological monuments in the wider landscape.

CONSENTED (LA01/2018/0200/F)

82. Following consultation with the Department for Communities: Historic Environment Division (DfC: HED), it was agreed that a 5 km search radius for the desktop survey would be adequate to provide a comprehensive assessment of the Development.

83. Further to this, it was agreed to consider all state care/scheduled monuments and historic gardens within 10 km for potential visual analysis. Preliminary analysis of potential inter-visibility between regionally important monuments and the Development identified a number of monuments which may require further in-depth analysis. Further discussions with DFC:HED established the scope of this analysis.

84. The desk top survey and site inspection identified 6 known monuments within the area of land ownership and an additional 80 known archaeological monuments within the 5 km search radius. Of the monuments located within the Site, only LDY 10:21 will be directly affected by the Development. This monument consists of a number of early field systems and hut circles which extend over a relatively large area in the north western section of the Site. The full extent of this monument is not known but it is believed to cover approximately 900m x 800m. It is likely that the infrastructure for turbines T1, T2 and T3 and possibly the turbine bases themselves will come into some contact with elements of this monument. Should this occur, the construction of the proposed development would result in a partial or minor loss of some elements of the baseline conditions of the monument. Any effect this would have on the monument would be significantly reduced through the implementation of the recommended mitigation strategy.

85. A site inspection of the wind farm Site was also conducted. This identified no evidence of any previously unknown archaeological monuments within the Site.

Visual Impact Analysis

86. For visual impact analysis, a 10 km search radius was used to identify monuments of regional importance and listed buildings. A total of 40 regionally important monuments, 4 historic gardens and 15 historic buildings were identified. Through the use of ZTV mapping, wireframe production and site inspections it was established that only twelve monuments and one historic garden would be potentially inter-visible with the Development.

87. Consultation with DFC:HED was conducted to establish which of these would require further analysis. The assessment found that the introduction of the Development into the local landscape will have a negligible-slight effect upon their setting.

88. Given the presence of the known monuments within the proposed application boundary and the extent of archaeological sites within the wider area, a mitigation strategy was recommended for the construction phase. The aim of this is to identify any potential archaeological deposits uncovered during the construction phase of the project.

CONSENTED (LA01/2018/0200/F)

89. An assessment of cumulative impacts on the archaeology and cultural heritage of the area was undertaken, and it was concluded that there will be no significant effects.

Ecology

90. The study methodology for the Ecological Impact Assessment included both desktop and field survey methods in order to assess the potential impact on local ecological and nature conservation interest. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are valued in some way for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken during 2016/2017 on the site including suitable buffer zones:

- Habitats
- Bat survey
- Otter survey
- Badger survey
- Common Lizard survey
- Smooth Newt habitat survey
- Marsh Fritillary butterfly habitat survey
- Argent & Sable moth habitat survey

91. Features of conservation interest and importance were recorded and their locations were one of the key criteria that affected the wind farm layout. The location of the wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this was not possible, mitigation and/or enhancement measures have been incorporated into the design to balance any detrimental impact.

92. The principal habitats on the site are extensive areas of purple moor-grass and rush pasture within a mosaic of semi-improved grassland, wet heath and poor fen. Upland blanket bog is also present within the (preliminary) site boundary (on the southern plateau) but none lies within the Planning Application Boundary. Overall, the habitat of greatest conservation value, the blanket bog, has been avoided.

93. Ecological constraints determined from extensive site surveys have been used to evolve the layout and design of the Development. The impact assessment is therefore based on a wind farm design that already includes a number of important mitigation measures.

94. A series of generic and specific mitigation measures including a Peat Management Plan and a Habitat Management Plan have been proposed to mitigate effects on wet heath vegetation.

95. The Development will result in permanent habitat loss of 6.9 hectares (ha) and temporary habitat loss of 3.3ha, largely comprising purple moor-grass & rush pasture (PMGRP) and wet (dwarf shrub) heath, although small areas of other

CONSENTED (LA01/2018/0200/F)

habitats will also be lost, such as acid grassland mosaic and poor semi-improved grassland.

96. The extent of habitat loss has been used to inform the prescriptions detailed in the Habitat Management Plan, including a commitment to establish at least twice the area lost for PMGRP and five times for wet heath (an NI Priority Habitat).

97. After implementation of the mitigation measures proposed in this chapter it is assessed that there would be no significant residual adverse effects on Northern Ireland priority habitats (wet heathland) as a result of the Development. Indeed, it is assessed that the Habitat Management Plan would deliver a net beneficial effect during operation by enhancing currently degraded wet heath habitats.

98. There is no recorded usage of the area by otter, marsh fritillary or argent & sable moth, therefore no impacts to these species is likely. Mitigation for the herpetofauna found on site (smooth newt and common lizard) is proposed. This involves the provision of artificial refugia and habitat management, as well as drift fencing and mowing/hand clearance during the construction phase. Badger setts found during survey have all been buffered by 25m. Ground Water Dependent Terrestrial Ecosystems (GWDTEs) have all been buffered by 50m.

99. The layout of the Development, in terms of the separation distance between the wind turbines and relevant features, and the maintenance of this throughout the lifetime of the wind farm, will ensure that any potential impacts to bats will be neutral. In conclusion, and based on current knowledge, this would appear to be a Site posing little risk to bats or bat populations, however a BMP has been recommended as a precaution.

100. Therefore, the potential effects of the Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a minor adverse or neutral effect that would not adversely affect the ecological integrity of the site and the wider area.

101. An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that there will be no significant effects.

Ornithology

102. The ornithology impact assessment considered the potential effects of construction, operation and decommissioning of the Development on the following key bird communities:

- Breeding birds
- Wintering and migrating birds
- Raptors (birds of prey).

CONSENTED (LA01/2018/0200/F)

Vantage point surveys, breeding bird surveys and wintering bird surveys were carried out in the period 2015-2017.

103. The assessment was carried out with reference to published Scottish Natural Heritage (SNH) guidance on assessing the effects of on-shore wind farms on birds out-with conservation designated areas. All wild birds are subject to a general level of protection through the Wildlife and Countryside Act (Wildlife Order in Northern Ireland) and the EU Birds Directive but only some species should normally be of concern in relation to wind farms:

- Birds listed under Annex 1 of the EU Birds Directive
- Regularly occurring migratory species
- Birds listed under Schedule 1 of the Wildlife and Countryside Act (Wildlife Order)
- Birds listed under non-statutory lists of high conservation concern (red-listed birds).

104. Wind farms can potentially affect birds in two main ways: (1) by direct mortality of individual birds due to collisions, or (2) by indirect habitat loss due to displacement of birds from a zone around the turbines and other related infrastructure. Direct habitat loss from wind farms is usually relatively small scale compared to other types of developments and in most cases is unlikely to be significant.

105. For red grouse and for all passerine species it is extremely unlikely that any adverse effects would occur. For snipe, displacement of two breeding pairs is probable but the effect falls well short of being significant at the regional (Northern Ireland) level.

106. Collision risk for all raptor species which use the site on a regular basis has been estimated using the SNH Collision Risk Model. For hen harrier collision risk is predicted to be negligible. For kestrel and buzzard a small number of collisions is predicted to occur during the expected 30 year operational life of the wind farm, however when placed in the context of the very widespread distributions of both these species and also other relevant factors (discussed in the assessment) then it is extremely unlikely that the predicted collisions would have a significant adverse effect on the distribution and abundance of these species at the regional (Northern Ireland) level.

107. Current evidence also suggests that adverse effects of wind farms on birds are likely to be greatest during construction and that wind farm operation may have no significant effects on local bird populations. It is proposed that pre-construction bird surveys and an Ornithological Mitigation Strategy would be implemented by the Developer in order to avoid or mitigate any possible adverse effects due to construction.

108. In view of these key points, and assuming implementation of the proposed mitigation measures, it is concluded that the Development would not have any significant adverse effects on local bird populations or on the distribution and abundance of sensitive species at the regional (Northern Ireland) level.

CONSENTED (LA01/2018/0200/F)

Fisheries

109. The fisheries impact assessment outlines the potential effects of the Development on the fish stocks and fish habitats of the receiving watercourses in the Curly River and wider Roe catchment. It provides relevant baseline information on fisheries, gathered through desktop and field survey, enabling the potential effects to be identified and evaluated.

110. The survey has shown that the principal drainage stream (Stream C) is populated by brown trout throughout its course within the Site Boundary and downstream of the site to the Curly River. In addition, the connected section of the Curly River, approximately 1km downstream of the Site, is an important spawning and nursery area for Atlantic salmon and is also included as part of the Special Area of Conservation (SAC).

111. It has been determined that potential effects are primarily related to the sediment run-off to the receiving watercourses with related effects on fish stocks and their habitats. Although these impacts have the potential to be significant, a series of specific mitigation measures have been designed to avoid adverse effects on fisheries with regard to both the construction and operational phases of the project, including buffer zones around watercourses; good construction practice; the implementation of a Sustainable Drainage System (SuDS) and the use of bottomless culverts at the two most sensitive watercourse crossings.

112. It is concluded that, provided the mitigation measures are implemented as specified, construction and operation of the Development will have a neutral impact on the fish stocks and aquatic biology of the Curly River and the wider River Roe catchment. It follows that the Development will have no effect on the Atlantic salmon as the primary feature of the River Roe and Tributaries ASSI/SAC.

113. An assessment of cumulative impacts on fisheries interests of the area was also undertaken, and it was concluded that there will be no significant effects.

Geology and Water Environment

114. The impact assessment involved a combination of desk study, site visits and consultation with various bodies including Causeway Coast & Glens BC, Departments of Agriculture, Environment & Rural Affairs (DAERA), the Department of Cultural Arts and Learning (DCAL), Department of Infrastructure (DOI) and the Department for Economy (DOE). The impact assessment identifies the potential impacts on geology, hydrology and hydrogeology, including surface water, groundwater, abstractions, the potential for pollution of watercourses and flooding. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

CONSENTED (LA01/2018/0200/F)

115. All on site water features drain into the Curly River. The Curly River is a sub-catchment of the designated River Roe and Tributaries SAC[3] and ASSI[4]. The Curly River joins the main branch of the River Roe 5.2 km to the west of the Site. The Roe River discharges into Lough Foyle 8.2 km to the north-west of the Site.

116. Aspects of the design, construction and operation of the proposed Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for effects assessed. It has been determined that without mitigation the Development would be likely to cause adverse impacts of moderate significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the baseline assessment and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

117. Monitoring of the effect of the Development on the water environment and fisheries habitat will be provided through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance of effects to all receptors to “not significant”.

118. There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.

Peat

119. A Peat Slide Risk Assessment (PSRA) was undertaken for the Development. The peat depths across the site are predominantly shallow (<1m) with areas of deeper peat avoided. Limited cover of superficial deposits highlights a low risk of mass movement. This is supported by British Geological Survey which does not highlight any mass movement across the site.

[3] Joint Nature Conservation Committee. (2015). Natura 2000 Standard Data Form - River Roe and Tributaries. Available from: http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030360.pdf. [Accessed: 14/8/2017].

[4] Department of the Environment. (2005). Declaration of Area of Special Scientific interest at River Roe and Tributaries, County Londonderry. Article 28 of the Environment (Northern Ireland) Order 2002. Available from: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/River-Roe-and-Tributaries-ASSI-citation-documents-and-map.pdf. [Accessed: 14/8/2017].

CONSENTED (LA01/2018/0200/F)

Noise

120. An assessment of the acoustic impact from both the construction and operation of the Development, was undertaken taking into account the identified nearest residential properties.

121. The operational noise impact was assessed according to the guidance described in the 'The Assessment and Rating of Noise from Wind Farms', referred to as 'ETSU-R-97', as recommended for use in relevant planning policy. The methodology described in this document was developed by a working group comprised of a cross section of interested persons including environmental health officers, wind farm operators and independent acoustic experts. It provides a robust basis for assessing the noise impact of a wind farm and has been applied at the vast majority of wind farms currently operating in the UK.

122. ETSU-R-97 makes clear that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that would arise through the development of renewable energy sources. The assessment also adopts the latest recommendations of the Institute of Acoustics 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'.

123. Representative baseline conditions (the "background noise level") at nearby residential properties were established by undertaking noise surveys. These measured levels were then used to infer the background noise levels at other nearby residential properties as the ETSU-R-97 document recommends. As background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, the measurement of background noise levels at the survey locations were made concurrent with measurements of the wind speed and wind direction. These wind measurements are made at the wind turbine site rather than at the survey locations, since it is this wind speed that will subsequently govern the wind farm's noise generation.

124. A sound propagation model was used to predict the noise levels due to the Development at nearby residential properties over a range of wind speeds, taking into account the position of the proposed wind turbines, the nearest residential properties, and the candidate wind turbine type. The model employed (which considered downwind conditions at all times) took account of attenuation due to geometric spreading, atmospheric absorption, ground effects and barriers. It has been shown by measurement based verification studies that this model tends to slightly overestimate noise levels at nearby residential properties.

125. The relevant noise limits were then determined through analysis of baseline conditions and the criteria specified by the ETSU-R-97 guidelines. The general principle regarding the setting of noise criteria is that limits should be based relative to existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. This approach has the advantage

CONSENTED (LA01/2018/0200/F)

that the limits can directly reflect the existing noise environment at the nearest residential properties and the impact that the wind farm may have on this environment. Different limits are applicable depending upon the time of day. The daytime limits are intended to preserve outdoor amenity, whilst the night-time limits are intended to prevent sleep disturbance.

126. The predicted operational noise levels are within noise limits at nearby residential properties at all considered wind speeds. The Development therefore complies with the relevant guidance on wind farm noise and the impact on the amenity of all nearby properties would be regarded as acceptable.

127. A cumulative operational noise assessment has also been undertaken. Considering the mitigation measures identified the predicted cumulative noise levels are within noise limits at nearby residential properties. Compliance with relevant guidance implies that the cumulative impact on the amenity of nearby properties would be regarded as acceptable.

128. A construction noise assessment, incorporating the impact due to increased traffic noise and considering the mitigation measures identified, indicates that predicted noise levels likely to be experienced at the nearest residential properties are below relevant construction noise criteria at all residential properties.

129. An acoustic assessment of the proposed energy storage facility in accordance with BS 4142: 2014 shows that the impact would be low and the levels insignificant in comparison to the cumulative wind farm noise, which as mentioned above, is in compliance with relevant guidance.

Traffic & Transport

130. An assessment of the potential impact of the Development on traffic and transport was undertaken, involving consultation with Department of Infrastructure (DfI) Roads.

131. The proposed access route for abnormal loads (turbine components) is from Lisahally Port, which has been used previously for wind farm construction accessing from the Broad Road (A37). From Lisahally, the route will travel onto the Maydown Road and turn east onto the Clooney Road and travel east for approximately 28km via both Greysteel and Ballykelly before bypassing Limavady town on the Ballykelly Road travelling south east onto the Broad Road. The site entrance is located on the Broad Road where an existing access is provided to an unoccupied building and associated agricultural enclosures.

132. DfI Roads have a proposal for a climbing lane at this location (NAP 2016 – Proposal TRA 1). DfI Roads - Strategic Routes Improvement Team advised that whilst there is currently no allocated budget for the climbing lane scheme, the proposed site entrance is unlikely to effect the climbing lane proposal. The site entrance's

CONSENTED (LA01/2018/0200/F)

position does not conflict with the proposed location of the climbing lane or associated earthworks.

133. It is proposed that Normal HGV load delivery routes (including stone and concrete) will travel to the site entrance on the Broad Road (A37). Consideration was given to the effect of increased HGV traffic flow on Severance, Driver Delay, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation, Accidents and Safety and Cumulative Impacts.

134. The abnormal load route and the HGV routes have been assessed as acceptable in the ES. Taking into account the existing vehicle movements on the affected roads, and the proposed type and frequency of vehicle numbers, it is considered that with the appropriate mitigation measures, there will be no significant effects.

Shadow Flicker

135. A shadow flicker analysis of the Development was performed. Under certain combinations of geographical position, time of day, time of year and meteorological conditions, the sun may pass behind the turbine rotor and cast a shadow over neighbouring buildings' openings (i.e. windows and doors) where the contrast between light and shade is most noticeable. To a person within that room the shadow, depending on its intensity, may appear to flick on and off, giving rise to an effect referred to as shadow flicker.

136. The Best Practice Guidance to Planning Policy Statement 18 (PPS18) states that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

137. An analysis of shadow flicker throughout the year from Development was carried out, taking into account the behaviour of the sun, the local topography and the turbine layout and dimensions[5]. The analysis was performed using a turbine layout consisting of 9 turbines, each with maximum tip heights of 149.9 m and maximum rotor diameters of 99.8 m.

138. There are no inhabited houses within ten rotor diameters of any of the proposed turbines.

139. Due to both the distance of the nearest residential properties to the Development, and the recommendations pertaining to ten rotor diameter proximity, and proposed mitigation if required, it is concluded that the Development should not cause a material reduction to residential amenity owing to shadow flicker.

Socioeconomics

140. A socioeconomic assessment of the Development was carried out. It concluded that should the Development go ahead, it will deliver substantial benefits to the

[5] Turbine ref 03219D0001-06, house ref 03219D0201-01

CONSENTED (LA01/2018/0200/F)

economies of Northern Ireland and the Causeway Coast & Glens BC area, in economic and environmental terms. It will provide significant job creation and activity in the construction sector (with a commitment to use local labour where possible); increase tax and rates revenue for local and central government; contribute to renewable energy targets; and has the potential to transfer the knowledge, expertise and skills gained and developed to other wind farms, possibly acting as a catalyst for further investment in the area.

141. The Development is estimated to involve a capital spend of £26.02 million. Of this total, £7.87 million (nominal prices) will be realised within the Northern Ireland economy. The projected 18-month construction phase is estimated to create or sustain 128-167 total (direct, indirect and induced) job years[6] of employment, £3.51-£4.54 million of wages and £4.72-£6.12 million (£2013 prices) of GVA[7] to the Northern Ireland economy.

142. The estimated total (direct, indirect and induced) benefits from the operational phase of the proposed Development includes 71 job years within Northern Ireland, with associated wages of £2.4 million and £7.3 million (£2013 prices) in GVA over the 30-year operating period.

143. Over the Development's construction phase the UK Exchequer is estimated to benefit from increased tax revenue and benefits saving of £1.59-£2.55 million. In addition to this, each year of operation is likely to yield a further £0.03-£0.04 million of increased tax revenue and benefit savings (in constant prices). Over the 30-year project life, we estimate that £2.6-£3.8 million would be realised in raised revenue and benefits savings[8].

144. Based on rateable values of £27,500 per MW we calculate that the Development will increase rateable value by £816,750 each year, or by £24.5m over the project horizon. From these values business rates are calculated and collected for local Councils and the Northern Ireland Assembly. By applying Causeway Coast and Glens BC non-domestic poundage rates, we estimate additional business rates of £468,795 each year and £14.0m over the 30-year lifetime of the project.

145. Over the lifetime of the project, rates, taxes and land rental will collectively amount to approximately £30.5 million.

[6] **Job years**: For the construction phase 'job years' refers to the amount of activity that is required. E.g. two people could be employed for six months – this would equate to two jobs, but would actually only mean activity would take one job year of work to complete. Alternatively one person could be employed for two years - this would only equate to one job, but is actually two job years of employment.

[7] **Gross value added** (GVA) measures the value of goods & services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

[8] This analysis relates to results from Method 1 – see Chapter 13 of ES for full details.

CONSENTED (LA01/2018/0200/F)

4. Conclusion

146. The potential effects of the Development have been assessed in accordance with regulatory requirements and good practice. The ES incorporates technical assessments of the Development based on the requisite legislation and the relevant planning policy framework. The ES has demonstrated that significant environmental effects associated with the construction, operation and decommissioning of the Development have been avoided or minimised through the use of the iterative design process and with the application of mitigation measures.

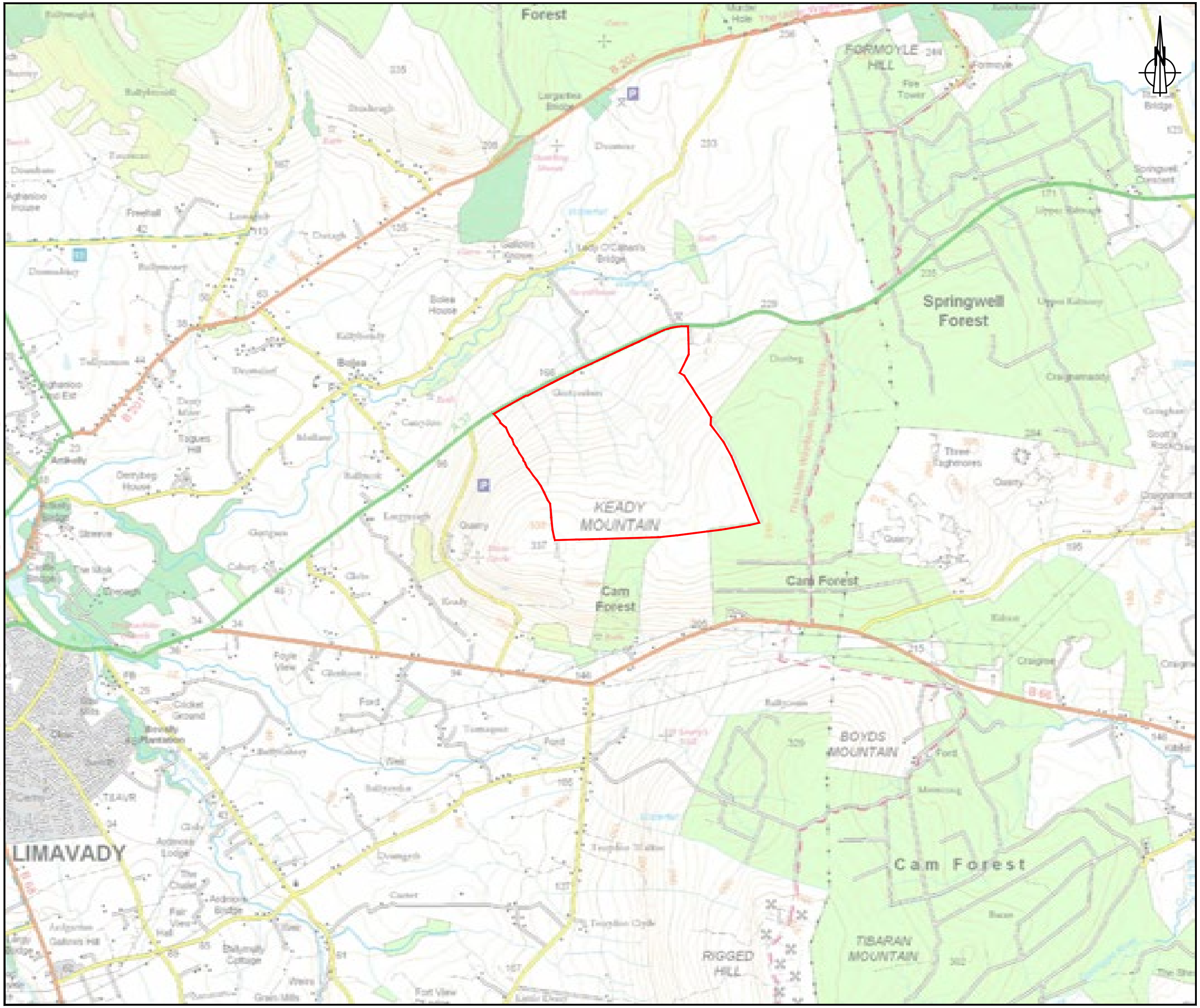
147. Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[9]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens Borough area. In addition, the Development is also estimated to reduce CO_2 emissions by 40,800 tonnes each year. This equivalent to 30,100 newly registered cars.[10]

148. The Development will result in a reduction in greenhouse gas emissions from the electricity generating industry by harnessing wind as an alternative to the burning of fossil fuels, in line with the government's energy goals. It will also make a significant contribution to the Northern Ireland government target that 40% of electricity consumed should be sourced from renewable energy by 2020 (DETI).

[9] This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

[10] https://www.gov.uk/government/publications/new-car-carbon-dioxide-emissions

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 1

SITE LOCATION MAP

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

SITE LOCATION

LAYOUT DWG N/A

T-LAYOUT NO. N/A

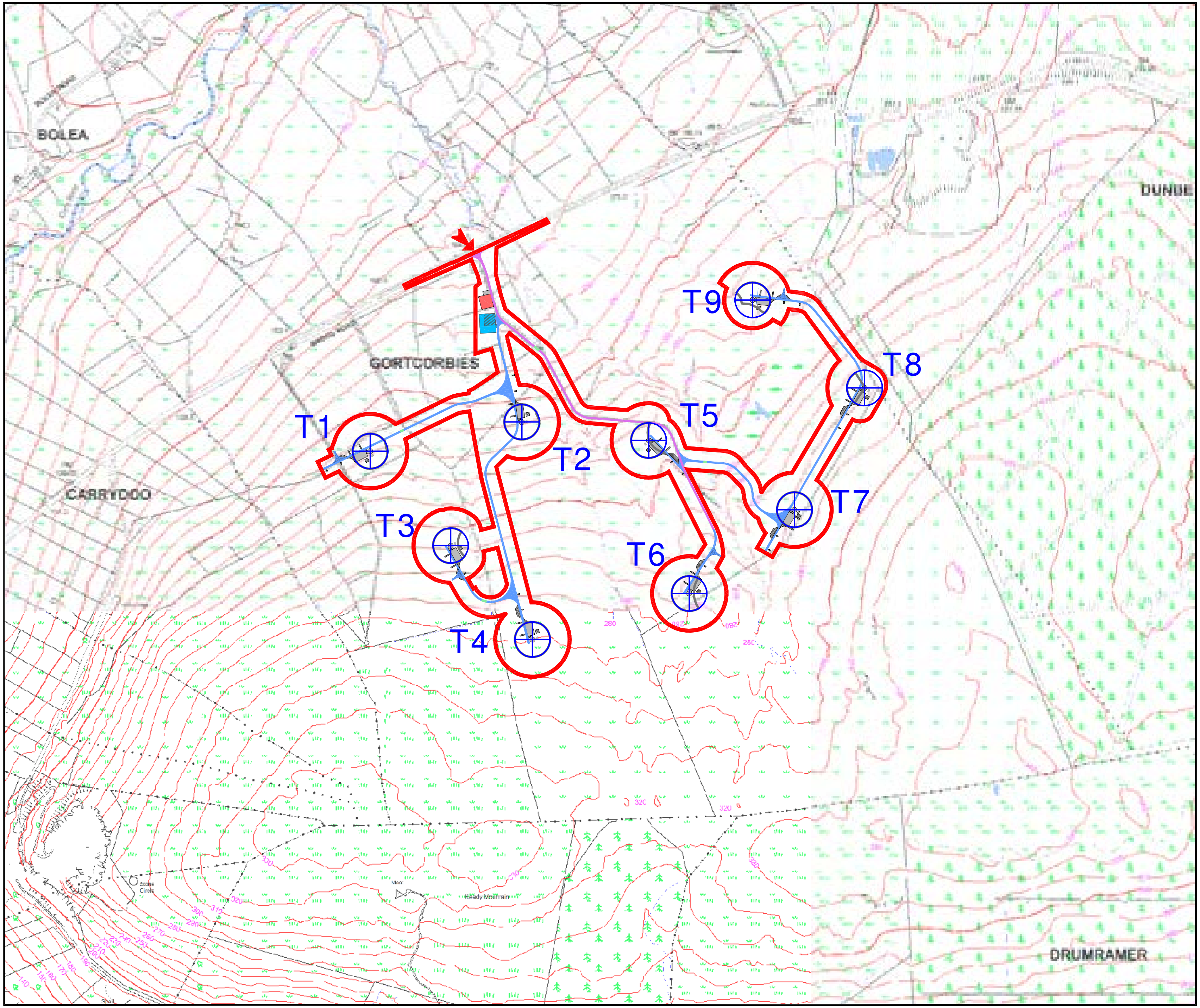
DRAWING NUMBER 03219D1001-02

SCALE - 1:50,000 @ A4

NON-TECHNICAL SUMMARY

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2

INFRASTRUCTURE LAYOUT

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

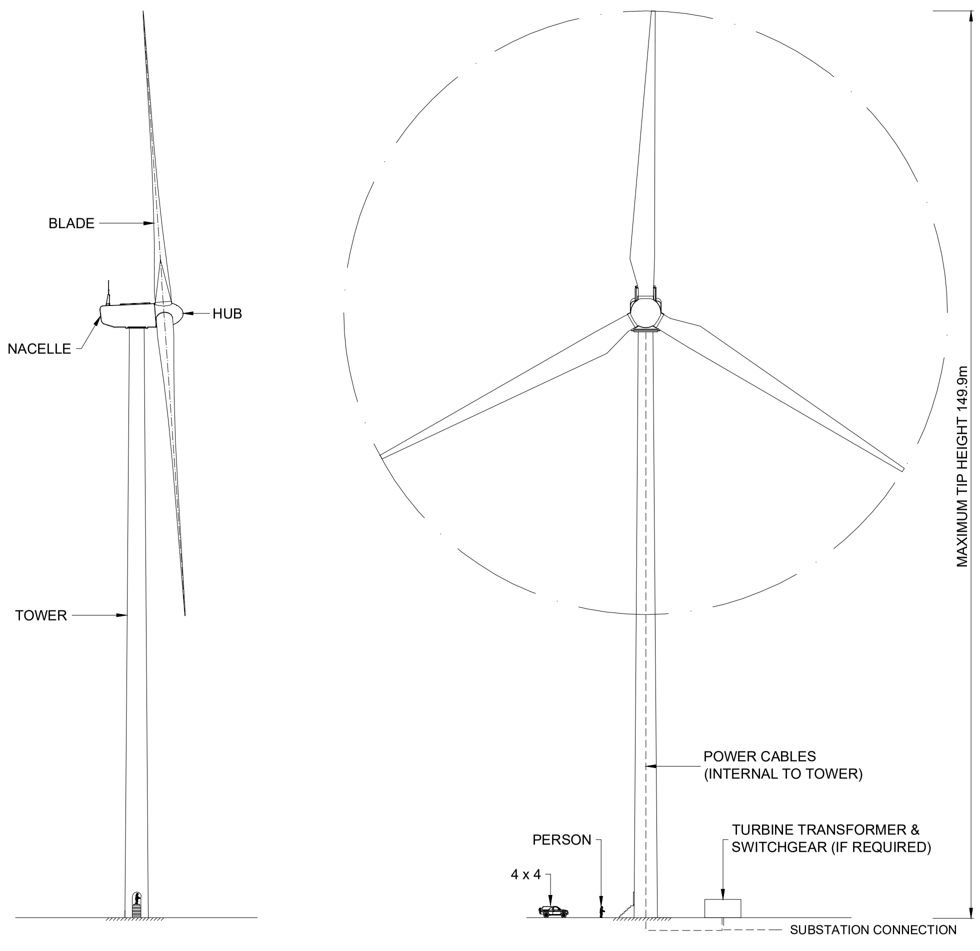
KEY

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028
DRAWING NUMBER 03219D1001-02	
SCALE - 1:15,000 @ A4	
NON-TECHNICAL SUMMARY	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SIDE VIEW

FRONT VIEW

PHOTOGRAPH OF TYPICAL TURBINE

DUNBEG SOUTH
WIND FARM

FIGURE 3

TURBINE ELEVATION

LAYOUT DWG N/A	T-LAYOUT NO. N/A

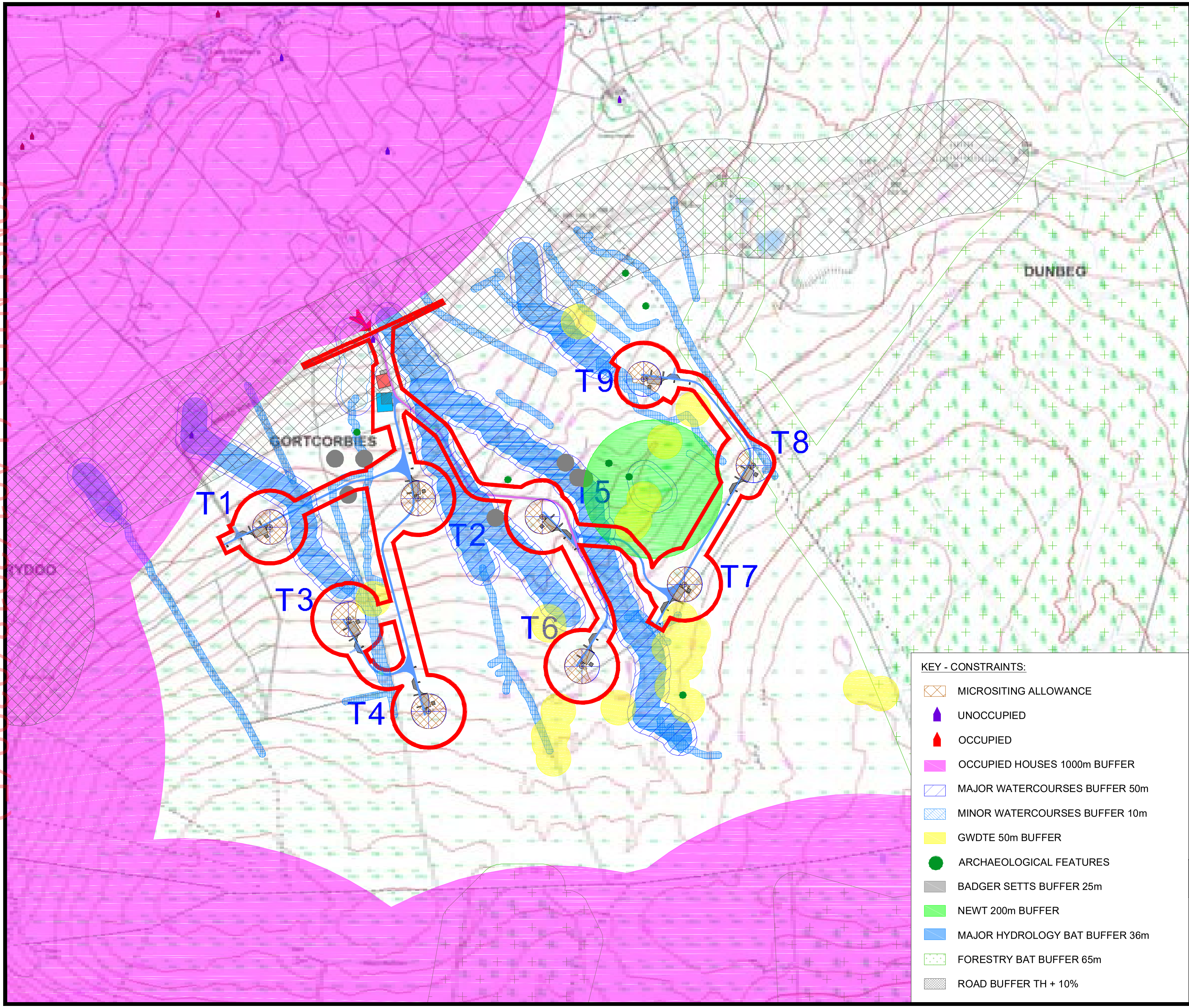
DRAWING NUMBER 03219D2901-01

SCALE - 1:1250 @ A4

NON TECHNICAL SUMMARY

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



CONSENTED (LA01/2018/0200/F)

DUNBEG SOUTH
WIND FARM

FIGURE 4

COMBINED CONSTRAINTS
& INFRASTRUCUTRE

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY - INFRASTRUCTURE:

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

KEY - CONSTRAINTS:

- MICROSITING ALLOWANCE
- UNOCCUPIED
- OCCUPIED
- OCCUPIED HOUSES 1000m BUFFER
- MAJOR WATERCOURSES BUFFER 50m
- MINOR WATERCOURSES BUFFER 10m
- GWDTE 50m BUFFER
- ARCHAEOLOGICAL FEATURES
- BADGER SETTS BUFFER 25m
- NEWT 200m BUFFER
- MAJOR HYDROLOGY BAT BUFFER 36m
- FORESTRY BAT BUFFER 65m
- ROAD BUFFER TH + 10%

LAYOUT DWG. 03219D0001-06 | T-LAYOUT NO. PNIRdbx028

DRAWING NUMBER 03219D2237-01

SCALE - 1:15,000 @ A4

NON TECHNICAL SUMMARY

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

power for good

CONSENTED (LA01/2018/0200/F)

Table of Contents

CONSENTED (LA01/2018/0200/F)

1

Introduction & Policy Context

CONSENTED (LA01/2018/0200/F)

1 Introduction & Policy Context

Background

1.1 This Environmental Statement (ES) has been prepared by RES Limited (RES) to accompany a planning application that has been made to the Northern Ireland Causeway Coast & Glens BC for permission to construct, operate and decommission a wind farm known as Dunbeg South Wind Farm, hereinafter referred to as 'the Development'. The purpose of the ES is to aid Causeway Coast & Glens BC in the assessment of the likely significant environmental effects resulting from the Development and to establish the need for mitigation measures to reduce such effects.

1.2 The application site is located approximately 6 km northeast of Limavady, Co. Derry/Londonderry, as shown in Figure 1.1: Site Location and Figure 1.2: Planning Application Boundary.

1.3 This chapter is supported by:

- Technical Appendix 1.1: Letter of Intention to Submit an Environmental Statement;
- Technical Appendix 1.2: Causeway Coast & Glens BC response to Intention to Submit an Environmental Statement.

The Applicant

1.4 The application for planning permission is made by RES ('the Applicant').

1.5 RES is one of the world's leading independent renewable energy project developers with operations across Europe, the Americas and Asia-Pacific. At the forefront of renewable energy development for over 30 years, RES has developed and/or built almost 12,000 MW of renewable energy capacity worldwide. In the UK alone, RES currently has more than 1,000 MW of projects either constructed, under construction or consented. RES is active in a range of renewable energy technologies including onshore and offshore wind, solar, as well as enabling technologies such as energy storage.

1.6 RES has developed 16 onshore wind farms in Northern Ireland totalling 229 MW, which equates to 36% of Northern Ireland's onshore wind capacity. RES currently operates over 83 MW of wind capacity across Northern Ireland, has secured planning permission for a further 112 MW awaiting construction and has 92 MW in the planning system.

CONSENTED (LA01/2018/0200/F)

EIA Process

Scope of Environmental Statement

1.7 The Environmental Impact Assessment (EIA) has assessed the environmental impacts associated with the construction, operation and decommissioning the Development, which comprises 9 three-bladed, horizontal axis wind turbines, each up to a maximum of 149.9 m to tip height, with a total installed capacity of up to 29.7 MW. The Development would include associated external electricity transformers, underground cabling, a newly created site entrance, access tracks, turning heads, crane hardstandings, control building and substation compound and energy storage containers. During construction and commissioning there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and welfare facilities.

1.8 A full description of the Development is provided in Chapter 2: Proposed Development.

1.9 RES has undertaken informal scoping with Causeway Coast & Glens BC regarding the Development and a letter of Intention to Submit an ES was lodged, which is included in Appendix 1.1. An Intention to Submit response from Causeway Coast & Glens BC is included in Appendix 1.2. Consultation responses from consultees have been considered in the individual chapters of this ES.

1.10 An EIA has been undertaken in accordance with the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017, (the “EIA Regulations”), to identify and assess the likely environmental effects of the Development and establish an appropriate range of mitigation measures in order to reduce adverse impacts where possible. This ES contains the findings of the EIA.

1.11 The Development will represent a ‘Schedule 2’ development, as defined under the “EIA Regulations”. Development that is listed in Schedule 2 requires an EIA if it is likely to have an impact on the environment by virtue of factors such as its size, nature or location. Therefore, any potential effects of the construction, operation and decommissioning of the Development deemed to have significant environmental effects are subject to an EIA.

1.12 The scale of the Development means that there is the potential for significant environmental effects to arise. Consequently it was deemed appropriate to undertake an EIA.

1.13 EIA is a process by which information about the environmental impacts of a project is collected, evaluated and taken into account in its design and the decision as to whether it should be granted planning permission. The applicant presents the information on the project and its likely environmental impacts in an ES. This enables decision-makers to consider these impacts when determining the related planning application. The EIA process has a number of key characteristics:

- It is systematic, comprising a sequence of tasks defined both by regulation and by practice;

CONSENTED (LA01/2018/0200/F)

- It is analytical, requiring the application of specialist skills from the environmental sciences;
- It is impartial, its objective being to inform the decision-maker rather than to promote the project;
- It is consultative, with provision being made for obtaining information and feedback from statutory agencies and key stakeholders; and
- It is iterative, allowing opportunities for environmental concerns to be addressed during the planning and design of a project.

1.14 This final point is particularly important with respect to the design of the Development where a number of design iterations have taken place in response to environmental factors identified during the EIA process (Chapter 3: Design Evolution and Alternatives).

1.15 The EIA for the Development has been carried out in accordance with the latest regulations, guidance and advice on good practice, comprising:

- Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017;
- Environmental Impact Assessment: A guide to procedures (Department for Communities and Local Government, amended reprint 2001); and
- Guidelines for Environmental Impact Assessment (Institute of Environmental Management and Assessment, 2004).

1.16 Individual technical assessments have been undertaken in accordance with a variety of legislation, guidance and best practice. Relevant details are contained within the Legislation and Policy Framework section where applicable to each technical chapter.

The Assessment Method

1.17 Appropriate methodologies have been used to assess the effects relating to each of the environmental topics that have been investigated as part of the EIA. These methodologies are based on recognised good practice and guidelines specific to each subject area, details of which are provided within each individual technical section.

1.18 The design team employed an iterative approach to the design of the Development where the design evolved throughout the EIA process as different constraints and potentially adverse impacts were identified and evaluated. This method is considered best practice as mitigation measures can concurrently be integrated into the design throughout the EIA process. This approach allowed the design team to alleviate or remove potentially adverse impacts and incorporate measures into the design to enhance positive impacts. The final evaluation of significance assesses the residual impacts assuming all mitigation measures are applied.

1.19 Each technical chapter assesses the impacts that could arise as a result of the Development. Impacts are assessed as being either adverse, beneficial,

CONSENTED (LA01/2018/0200/F)

permanent, temporary or reversible. Significance is determined by assessing the magnitude and sensitivity of each likely impact.

1.20 The ES complies with current planning policy and will be submitted in conjunction with a planning application. This report is a formal ES as required by Causeway Coast & Glens BC under the Planning (EIA) Regulations (Northern Ireland) 2017. The ES is designed to provide information for the purpose of assessing the likely impact upon the environment.

Structure of the Environmental Statement

1.21 Schedule 4 of the “EIA Regulations” states that the following must be included within the ES:

- A description of the development (description of the physical characteristics (site, design and size of the development), land-use requirements, production processes) and an estimate of expected residues and emissions resulting from the operation of the proposed development.
- An outline of the alternatives studied by the applicant and explanation of why the particular option was chosen.
- A description of the aspects of the environment likely to be significantly affected by the development (including population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage and landscape) and the inter-relationship between the above aspects.
- A description of the likely significant effects of the development on the environment (to include direct, indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, beneficial and adverse effects of the development).
- A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.
- The data required to identify and assess the main effects that the development is likely to have on the environment.
- An indication of any difficulties (technical deficiencies or lack of know-how) encountered.
- A non-technical summary of the information contained within the ES.

1.22 This ES has been prepared in accordance with the “EIA Regulations” described above. The ES comprises the following volumes:

- Volume 1: Non-technical Summary (NTS) of the ES
- Volume 2: Main Text
- Volume 3: Figures (the illustrations that accompany the ES)
- Volume 4: Technical Appendices (technical information relating to the environmental topics such as detailed methodologies, baseline data information and data analysis).

CONSENTED (LA01/2018/0200/F)

1.23 Volume 2 is organised as follows:

- Chapter 1: Introduction & Policy Context
- Chapter 2: Proposed Development
- Chapter 3: Design Evolution and Alternatives
- Chapter 4: Landscape and Visual
- Chapter 5: Archaeology and Cultural Heritage
- Chapter 6: Ecology
- Chapter 7: Ornithology
- Chapter 8: Fisheries
- Chapter 9: Geology and Water Environment
- Chapter 10: Acoustic
- Chapter 11: Traffic and Transport
- Chapter 12: Shadow Flicker
- Chapter 13: Socioeconomics
- Chapter 14: Summary of Effects.

1.24 Biodiversity is covered under Chapters 6, 7, 8 & 9; Human Health is covered under Chapters 10 & 12 and Climate Change is covered within Chapter 13. A summary of effects is described in Chapter 14.

1.25 Chapters 1, 2, 3, 10, 11, 12 & 14 have been authored by RES using their in-house professionally qualified expertise in respect of these topics. The Environmental Statement has been compiled by RES, primarily by Garth McGimpsey (Senior Development Project Manager) who is a Practitioner of the Institute of Environmental Management & Assessment (PIEMA) with over 13 years' experience of assessing, planning and developing renewable energy projects.

1.26 In general, for each environmental topic, the following format has been adopted with regard to the presentation of information:

- Introduction
- Scope of Assessment
- Legislation and Policy Framework
- Consultation
- Assessment Methodology
- Baseline Assessment
- Assessment of residual impacts
- Design Evolution and Mitigation Measures
- Residual Impacts
- Cumulative Impacts
- Summary and Conclusions
- References.

1.27 A number of individual disciplines have adopted variations from this format as a result of specific assessment methodologies and appropriate reporting structure.

CONSENTED (LA01/2018/0200/F)

Planning Application

1.28 In May 2016, Causeway Coast & Glens BC confirmed that the planning application should be submitted to the Council, in accordance with Section 26 of the Planning Act (Northern Ireland) 2011, regarding the Department's jurisdiction in relation to developments of regional significance.

Policy Context

1.29 This section provides a summary of the European Union (EU), National, Regional and local energy and planning policies that are relevant to the Development and highlights how the development fits with such policies. The policies relating to individual disciplines are examined in detail in the relevant technical chapters contained in this ES.

Renewable Energy Policy

European Policy

1.30 The EU is responsible for about 14% of the world's greenhouse gas emissions, but has only 5% of its population (EU, 2009). The EU recognises that it must take a lead in reducing emissions and has responded to the threat of climate change. The European targets for greenhouse gas reductions under the Kyoto Protocol are set at an 8% decrease in greenhouse gas emissions by 2012 compared to 1990 levels of 14%. Furthermore, all countries will need to make an additional effort, including cuts of 80-95% by 2050 by developed countries. An EU target of 20% by 2020 is just the first step to put emissions onto this path (EU, 2010).

1.31 In the last decade, the EU has introduced several Directives aimed at addressing energy issues within Europe. Directives have imposed obligations to introduce and facilitate competition, both within and between Member States (Internal Market in Electricity (Directive 2003/54/EC)) whilst the Renewables Directive (2001/77/EC) required the active promotion and maximisation of renewable energy sources. In addition, the Energy Trading Directive (2003/87/EC) has introduced mechanisms to incentivise reductions in greenhouse gas emissions.

1.32 The Emissions Trading System Directive (2009/29/EC) amended Directive 2003/87/EC to improve and extend the greenhouse gas emission allowance trading scheme of the Community and aims to reduce overall emissions by 20% below 1990 levels by 2020 (or 30% if an international agreement can be reached).

1.33 The need to promote electricity produced from renewable energy sources within the internal electricity market of the EU was established in September 2001 within Directive 2001/77/EC. Article 3 of this Directive required Member States to "take appropriate steps to encourage greater consumption of electricity produced from renewable energy sources in conformity with…national indicative targets".

CONSENTED (LA01/2018/0200/F)

1.34 The 2009 EU Renewable Energy Directive (Directive 2009/28/EC) furthers the common framework for the promotion of energy from renewable sources and sets mandatory national targets for the overall share of energy between each member state.

1.35 In order to achieve the targets laid down in the Directive more easily, each Member State must promote and encourage energy efficiency and energy saving.

1.36 Member States were required to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 5 December 2010, except for Article 4 on the adoption of national renewable energy action plans which takes immediate effect. In June 2010, each Member State presented a national renewable energy action plan which it will adopt, setting out national targets for the share of energy from renewable sources consumed in transport, electricity and heating and cooling in 2020, and taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy. The UK and Northern Ireland targets, which implement this Directive, are discussed below.

UK Policy

1.37 The UK Government has undertaken in recent years a number of studies designed to inform its renewable energy policies. Key policies to emerge from these studies include:

Meeting the Energy Challenge: UK White Paper on Energy 2007

1.38 The UK Government's Energy White Paper, 'Meeting the Energy Challenge' sets out a framework for action to address the energy challenges facing the UK. It sets out four key energy policy goals:

1.39 to put the UK on a path to cutting CO_2 emissions by 60% by 2050, with real progress by 2020;

- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond; and
- to ensure that every home is adequately and affordably heated.

1.40 This Paper states that renewables are key to the UK strategy to tackle climate change and deploy cleaner sources of energy. It also highlights the importance of lowering practical barriers to renewables investment, such as improved planning inquiry rules.

National Renewable Energy Action Plan for the United Kingdom

1.41 This plan sets out the key energy objectives and subsequent targets for 2009-2020 and beyond. It acts as an over-arching referral document containing a summary of all energy strategies from each of the four countries of the UK.

1.42 The plan outlines three main objectives:

- Financial support for renewables;

CONSENTED (LA01/2018/0200/F)

- Unblocking barriers to delivery;
- Developing emerging technologies

UK Renewable Energy Strategy (Action Plan) 2009

1.43 The UK Renewable Energy Strategy provides an action plan to ensure 15% of energy comes from renewable sources by 2020, in implementation of Directive 2009/28/EC.

1.44 This strategy aims to tackle climate change, reducing the UK's emissions of CO_2 by over 750 million tonnes between now and 2030. It also promotes increasing the security of energy supplies, reducing overall fossil fuel demand by around 10% and gas imports by 20–30%, against what they would have been in 2020.

1.45 The strategy recognises that acceleration of the uptake of renewable energy will help meet the goal of decarbonising energy production in the UK, while ensuring secure and safe energy supplies and exploiting the significant economic opportunities of the move to a low-carbon economy. The strategy will enable the UK to meet its EU renewable energy target to source 15% of energy from renewables by 2020. Renewable energy is therefore a key part of the overall UK Low Carbon Transition Plan, which outlines how the UK will meet the 34% cut in emissions on 1990 levels by 2020.

1.46 The strategy identifies Northern Ireland's potential to make significant progress in increasing the amount of energy from renewable sources in order to contribute to policy goals on security of supply, reduction of greenhouse gases, as well as contributing to business competitiveness, increasing competition in power generation and presenting opportunities for enterprise activity.

UK Energy Act 2013

1.47 The UK Energy Act 2013 was passed in December 2013. It establishes a legistive framework for delivering secure, affordable and low carbon energy and includes provisions on decarbonisation, electricity market reform, nuclear regulation and consumer protection.

1.48 The act discusses the UK's obligation to increase the use of renewable sources and reduce carbon emissions.

1.49 The Energy Act amalgamates the individual energy regulations of England, Scotland, Wales and Northern Ireland.

Northern Ireland Policy

Strategic Energy Framework 2010

1.50 In September 2010, the Department for Enterprise, Trade and Investment (DETI) published a new Strategic Energy Framework (SEF) 2010 which details Northern Ireland's energy future over the next ten years and illustrates the key energy goals in terms of building competitive markets, ensuring security of supply, enhancing sustainability and developing energy infrastructure. It also sets out a

CONSENTED (LA01/2018/0200/F)

new and ambitious renewable electricity target for 2020, 40% of electrical energy needs to be sourced from renewables by 2020.

1.51 The 2010 SEF notes that electricity generated by onshore wind farms is the most established, large-scale source of renewable energy in Northern Ireland. It also states that onshore wind farms will play a vital role in meeting the new renewable electricity target.

1.52 The SEF also highlights that there will continue to be concerns around planning and the infrastructure required to deal with increased wind generation and argues that it must be recognised that the integration of renewable technologies will incur additional costs in terms of new grid network management requirements.

1.53 The Development will play a key role in meeting the 40% target for 2020.

1.54 It is noted that in the Planning Appeals Commission (PAC) Decision (Appeal Ref 2009/A0363) Gaelectric, Commissioner T A Rue acknowledged *"that wind farms will play a vital role in meeting the new target"* and that *"it is noteworthy that the 40% is a minimum target and not a cap"*.

Northern Ireland Programme for Government 2011-2015

1.55 The Northern Ireland Programme for Government sets both the Budget and the Investment Strategy for Northern Ireland. It provides an over-arching set of priorities. These are:

- Growing a sustainable economy and investing in the future;
- Creating opportunities, tackling disadvantage and improving health and well-being;
- Protecting our people, the environment and creating safer communities;
- Building a strong and shared community;
- Delivering high quality and efficient public services.

Investment Strategy Northern Ireland 2011-2021

1.56 The Investment Strategy highlights the importance of renewable sources in electricity generation. The long-term targets are emphasised, underlining that the UK Climate Change Act 2008 legislated for an 80% mandatory cut in the UK's carbon emissions by 2050 (compared to 1990 levels), with a target of 35% by 2025.

1.57 It is stated in the Strategy that Northern Ireland needs to become less reliant upon fossil fuels.

1.58 " In energy generation, we will work with the utility companies to migrate from a reliance on imported fossil fuels to clean renewable generation in the future. If we act decisively, we can create new jobs and develop local expertise in this growing sector, building on our natural resources for wind and wave power and also on the engineering prowess of local companies and our universities and FE colleges".

CONSENTED (LA01/2018/0200/F)

Onshore Renewable Energy Action Plan 2013-2020

1.59 This plan considers the contribution of onshore renewable technologies to the 40% renewable energy target by 2020. It realises the implications that onshore wind has on the electricity network in Northern Ireland. The significance of onshore is emphasised with the plan stating;

1.60 "Large scale onshore wind is the most mature and cost effective of renewable technologies and as such helps the transition to a low carbon future with less pressure on fuel bills. It will continue to play a key role in renewable generation in Northern Ireland in the medium term".

Planning Policy

1.61 Key relevant planning policy documents for Northern Ireland were reviewed in respect of the proposed development. This included the Strategic Planning Policy Statement (SPPS), Planning Policy Statements (PPSs), Local Development Plans, Development Control Advice Notes (DCANs) and other publications.

1.62 The relevant policies and guidance in each of the planning policy documents are set out below, together with an analysis of how the proposed development complies with these policies.

Regional Policy

- The Regional Development Strategy: Shaping our Future 2025;
- The Regional Development Strategy: Shaping our Future 2025 (Adjustments);
- The Regional Development Strategy: Building a Better Future 2035;
- The Sustainable Development Strategy: Everyone's Involved 2010
- PPS 1: General Principles;
- PPS 2: Natural Heritage:
- PPS 3: Access, Movement and Parking;
- PPS 6: Planning, Archaeology and the Built Heritage;
- PPS 13: Transportation and Land Use
- PPS 15: Planning and Flood Risk;
- PPS 18: Renewable Energy;
- Best Practice Guidance to Planning Policy Statement 18: Renewable Energy;
- Wind Energy Development in Northern Ireland's Landscapes - Supplementary Planning Guidance to PPS 18;
- PPS 21: Sustainable Development in the Countryside;
- 'Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development';
- A Planning Strategy for Rural Northern Ireland;
- DCAN 10: Environmental Impact Assessment; and
- DCAN 15: Vehicular Access Standards

CONSENTED (LA01/2018/0200/F)

The Regional Development Strategy – Shaping our Future

1.63 The Regional Development Strategy: Shaping Our Future 2025 (RDS) was finalised in September of 2001 and offers a strategic and long-term perspective on the future development of Northern Ireland up to the year 2025. The RDS addresses a range of economic, social, environmental and community issues and provides the spatial planning context for:

- Strengthening the competitiveness of the regional economy and tackling social and economic disadvantage.
- Protecting and enhancing the physical, natural and man-made assets of the region.
- Housing, transport, air and water quality, energy and waste strategies, and for infrastructure providers and public service promoters.
- Development plans and for guiding public and private investment decisions relating to land use.

1.64 The recurring theme of sustainability is dominant throughout the RDS. It is recognised that:

"The effects of climate change will have implications for lifestyles and the form of development in the future. Strategic planning will be more cost effective than reacting to climate change impacts such as global warming and taking retrospective action."

1.65 This is reinforced in Policy SPG-ENV 5 which states that it wishes:

"To respond to the implications of climate change and promote more prudent and efficient use of energy and resources, and effective waste management".

1.66 This policy is split into a further four parts of which ENV 5.1 considers the implications of climate change and ENV 5.3 relates to the restraint of emissions of greenhouse gases by "the exploitation of renewable sources of energy and alternative energy technology".

1.67 Policy SPG-ENV 6 aims to "create healthier living environments and to support healthy lifestyles". Part 3 of ENV 6.1 ensures that "industrial emissions are minimised and effectively controlled and promotes more sustainable energy sources and a diversification of fuel supplies".

1.68 The main themes in the RDS with regard to the environment are:

- Protection of the environment (SPG-ENV 1).
- Protection of the natural environment including the coast (SPG-ENV 2).
- Conservation of the built environment (SPG-ENV 3).
- Wise use of the environment (SPG-ENV 5).
- Healthier living environment (SPG-ENV 6).
- Access to recreational and cultural amenities (SPG-ENV 7).

CONSENTED (LA01/2018/0200/F)

- Maintenance of a working countryside with a strong mixed use rural economy (SPG-RNI 1).

Shaping Our Future – Adjustments to the Regional Development Strategy – 2025

- The purpose of this document is to set out the adjustments to the Regional Development Strategy (RDS) 2025 as a result of the first 5-year Review of the Strategy, which reflects the Executive's Programme for Government and re-emphasises the key objective to ensure that all parts of Northern Ireland share in sustainable, economic and social development which is equitable across the region. Adjustments were made to some of the Objectives, Strategic Planning Guidelines (SPGs), and the Supporting Actions of the SPGs as detailed below.
- A number of SPGs were adjusted to reflect up-to-date policy and research on climate change and waste management and to meet obligations under the Habitats Regulations, (as described in Shaping Our Future – Adjustments to the RDS):
  - SPG ENV 1 (1.1, 1.2) was adjusted to meet obligations under the Habitats Regulations and includes two new Supporting Actions (1.5 and 1.6);
  - SPG ENV 2 (2.2) was adjusted to refer to the Water Framework Directive;
  - SPG ENV 5 (5.1, 5.2, 5.3 and 5.4) was adjusted to reflect up to date policy and research on climate change and waste management by taking actions to reduce emissions of greenhouse gases by promoting the use of cleaner and more efficient fossil fuels and through the exploitation of renewable resources of energy;
  - SPG ENV 6 (6.1) was updated to include reference to the Environment (NI) Order 2002; and
  - SPG ENV 6 (6.2) was reallocated to SPG ENV 1 (1.5) and ENV 6 (new 6.5).

The Regional Development Strategy - Building a Better Future– 2035

1.69 The Regional Development Strategy – Building a Better Future 2035 is the spatial strategy of the Executive, which recognises the importance of Belfast and Londonderry in generating regional prosperity. The plan aims to deal with climate change as a key environmental and economic driver and complements the Sustainable Development Strategy.

1.70 Regional Guidance (RG) focuses on the 3 sustainable development themes of Economy, Society and Environment throughout the region and the main themes in relation to the environment;

- Deliver a secure and sustainable energy supply (RG5);
- Reduce our carbon footprint and facilitate mitigation and adaption to climate change whilst improving air quality (RG9);

1.71 The RDS considers Renewable Energy to be Regionally Significant Infrastructure Projects and highlights strengthening electricity grid and interconnection as key

CONSENTED (LA01/2018/0200/F)

issues to facilitate increased renewable energy in line with the SEF ambitious 40% target.

Everyone's Involved: Sustainable Development Strategy - 2010

1.72 The Sustainable Development Strategy for Northern Ireland (2010) is intended to reinforce commitment to ensure that the principles of sustainability reach into all activities of Government. It aims to build a future characterised by economic prosperity, equality and social cohesion; strong confident communities and a high quality environment.

1.73 The Executive has set out a number of guiding principles that express the ambitions of the strategy. Two of these principles cover the overarching ambitions of the strategy:

- living within environmental limits; and
- ensuring a strong, healthy, just and equal society.

1.74 There are four further principles which describe the necessary conditions for the achievement of sustainable development:

- Achieving a sustainable economy.
- Promoting good governance.
- Using sound science responsibly.
- Promoting opportunity and innovation.

1.75 These six principles continue to echo those adopted by the previous Sustainable Development Strategy for Northern Ireland - First Steps towards Sustainability (2006).

1.76 The strategy focuses on six 'priority areas of action':

1. building a dynamic, innovative economy that delivers the prosperity required to tackle disadvantage and lift communities out of poverty;
2. strengthening society such that it is more tolerant, inclusive and stable and permits positive progress in quality of life for everyone;
3. driving sustainable, long term investment in key infrastructure to support economic and social development;
4. striking an appropriate balance between the responsible use and protection of natural resources in support of a better quality of life and a better quality of environment;
5. ensuring reliable, affordable and sustainable energy provisions and reducing our carbon footprint; and
6. ensuring the existence of a policy environment which supports the overall advancement of sustainable development in and beyond government.

1.77 Priority three is addressed by the Development. The proposed scheme is a driver for sustainable, long term investment which can support social and economic development. Further details are provided in Chapter 13. The Development also

CONSENTED (LA01/2018/0200/F)

addresses priority five. There is a requirement to reduce the amount of fossil fuels needed and the proposed scheme addresses this.

A Planning Strategy for Rural Northern Ireland (PSRNI)

1.78 A Planning Strategy for Rural Northern Ireland, produced in 1993, sets out the factors that the Department takes into account when considering development proposals outside the Belfast urban area, and the adjacent towns of Carrickfergus, Bangor, and Londonderry.

1.79 The Strategy, "establishes the objectives and the policies for land use and development appropriate to the particular circumstances of Northern Ireland and which need to be considered on a scale wider than the individual District Council Area".

1.80 The Strategy has been reviewed and significantly updated with the introduction of various Planning Policy Statements (PPSs). However, the Strategy remains in force with respect to those topics not covered by PPSs for those areas outside of settlement development limits.

1.81 The strategic objectives of the PSRNI, set out as part of the planning strategy, include:

- To protect and enhance the natural and man-made environment.
- To meet the future development needs of the rural community.
- To facilitate regeneration of the rural economy.
- To accommodate change, while maintaining the character of the countryside.
- To revitalise rural towns and villages in order to make them more attractive places in which to live and work.
- To promote a high quality of design in new development.

1.82 Specific relevant policies contained within the PSRNI are discussed in Chapter 13, Socio-Economic and Tourism Assessment.

'Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development'

1.83 Strategic Planning Policy Statement for Northern Ireland was introduced in September 2015.

1.84 It consolidates the twenty previous policy publications and sets out strategic subject polices on a wide range of planning matters including renewable energy in accordance with the Regional Development Strategy 2025.

1.85 The aim of the SPSS to plan for sustainable development is based on three overarching principles:

- Meeting the needs and aspirations of our society including supporting rural regeneration and progressing policies, plans and proposals that can improve the health and well-being of local communities;

CONSENTED (LA01/2018/0200/F)

- Economic sustainability including the promotion of recovery and balancing growth;
- Environmental sustainability including the protection and enhancement of heritage assets landscape and seascape character, ensuring that the planning system contributes to a reduction in energy usage and greenhouse gas emissions by continuing to support growth in renewable energy sources and promoting high quality development and good design.

1.86 In the renewable energy section it is stated that Northern Ireland has significant renewable energy resources and a vibrant renewable energy industry that makes an important contribution towards achieving sustainable development, and is a significant provider of jobs and investment across the region.

1.87 The main aim of the SPPS in relation to renewable energy is to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy without compromising other environmental assets of acknowledged importance.

1.88 The regional strategic objectives for renewable energy are to:

- ensure that the environmental, landscape, visual and amenity impacts associated with or arising from renewable energy development are adequately addressed;
- ensure adequate protection of the region's built, natural, and cultural heritage features; and
- facilitate the integration of renewable energy technology into the design, siting and layout of new development and promote greater application of the principles of Passive Solar Design.

1.89 The Regional Strategy Policy sets out the guidelines for how Local Councils should deal with renewable energy planning applications.

Planning Policy Statements

1.90 Planning Policy Statements (PPS) set out the policies of the DOE on particular aspects of land use planning. Their contents are taken into account in preparing Development Plans and they are also material to decisions on individual planning applications and appeals. PPSs specific to assessments undertaken in this EIA addressed in those chapters.

PPS 1: General Principles

1.91 PPS 1 sets out the principal functions of DOE, namely, formulating planning policies, making development plans, and exercising control of development. It also highlights the key themes of sustainable development, mixed use, quality development and design that underlie DOE's approach to planning.

CONSENTED (LA01/2018/0200/F)

PPS 2: Natural Heritage

1.92 PPS 2 sets out the Departments planning policies for the conservation, protection and enhancement of our natural heritage. Natural heritage is defined as *"the diversity of our habitats, species, landscapes and earth science features"*. Table 1.1 contains policies NH 1 to N H5 contained within PPS 2 and the relevant environmental topic of the ES.

Table 1.1: Policies NH 1 to NH 5 of PPS 2

Policy RE 1: Renewable Energy Developments *Applications for wind energy development will also be required to demonstrate all of the following:*	Environmental/Technical Topic
NH 1: European and Ramsar sites - International	Chapter 6: Ecology Appendix 6.8: Information to inform a Habitat Regulations Assessment
NH 2: Species protected by law	Chapter 6: Ecology Chapter 7: Ornithology Chapter 8: Fisheries
NH 3: Sites of nature conservation importance - National	Chapter 6: Ecology
NH 4: Sites of nature conservation importance - Local	Chapter 6: Ecology
NH 5: Habitats, species or features of natural heritage importance:	Chapter 6: Ecology Chapter 9: Geology and the Water Environment
NH 6: Areas of Outstanding Natural Beauty	Chapter 4: Landscape and visual

PPS 3: Access, Movement and Parking

1.93 PPS 3 (Revised) Access, Movement and Parking sets out the Department's planning policies for vehicular and pedestrian access, transport assessment, the protection of transport routes and parking. It forms an important element in the integration of transport and land use planning. It embodies the Government's commitments to the provision of a modern, safe, sustainable transport system, the improvement of mobility for those who are socially excluded or whose mobility is impaired, the promotion of healthier living and improved road safety. PPS 3 and PPS 13 should be read in conjunction with one another and both have been addressed in Chapter 11, Transport Assessment which has addressed this policy.

PPS 6: Planning Archaeology and the Built Heritage

1.94 PPS 6 Planning, Archaeology and the Built Heritage sets out the policies relating to the protection and conservation of archaeological remains and features of the built heritage.

1.95 Of particular relevance are Policies BH1, BH2, BH4 and BH11, which deal with the Preservation of Archaeological Remains of Regional Importance and their Settings,

CONSENTED (LA01/2018/0200/F)

the Protection of Archaeological Remains of Local Importance and their Settings, Archaeological Mitigation and Development Affecting the Setting of a Listed Building respectively. Chapter 5, Archaeology and Cultural Heritage Assessment has addressed this policy.

PPS 13: Transportation and Land use

1.96 Planning Policy Statement, PPS 13 "Transportation and Land Use" has been prepared to assist in the implementation of the RDS. It will guide the integration of transportation and land use, particularly through the preparation of development plans and transport plans, prepared respectively by Causeway Coast & Glens BC and DfI Roads. It will also be a material consideration in dealing with individual planning applications and appeals. The main objective of PPS13 is to integrate planning and transport at the national, regional, strategic and local level and to promote "a modern, sustainable, safe transportation system which benefits society, the economy and the environment and which actively contributes to social inclusion and everyone's quality of life." Chapter 11, Traffic and Transport has addressed this policy.

PPS 15: Planning and Flood Risk

1.97 PPS 15 sets out policies to "minimise flood risk to people, property and the environment", emphasising on sustainable development and the conservation of biodiversity. Chapter 9, Geology and the Water Environment, has addressed these policies.

PPS 18: Renewable Energy

1.98 PPS 18 sets out policies for development that generates energy from renewable resources and that requires the submission of a planning application with the aim of *"facilitating the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy."*

1.99 Of particular relevance is Policy RE 1 - Renewable Energy Development:

"Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

- public safety, human health, or residential amenity;
- visual amenity and landscape character;
- biodiversity, nature conservation or built heritage interests;
- local natural resources, such as air quality or water quality; and
- public access to the countryside.

1.100 Table 1.2 indicates the details of Policy RE1 and the relevant ES chapter where these have been addressed.

CONSENTED (LA01/2018/0200/F)

Table 1.2: Policy RE1 of PPS 18

Policy RE 1: Renewable Energy Developments *Applications for wind energy development will also be required to demonstrate all of the following:*	Environmental/Technical Topic
(i) that the development will not have an unacceptable impact on visual amenity or landscape character through the number, scale, size and sitting of turbines.	Chapter 4: Landscape and Visual
(ii) that the development has taken into consideration the cumulative impact of existing wind turbines, those which have permissions and those that are currently the subject of valid but undetermined applications.	Cumulative impacts have been considered in the assessments contained in this ES.
(iii) that the development will not create a significant risk of landslide or bog burst.	Chapter 9: Geology and Water Environment
(iv) that no part of the development will give rise to unacceptable electromagnetic interference to communications installations; radar or air traffic control systems; emergency services communications; or other telecommunication systems.	Chapter 3: Design Evolution and Alternatives
(v) that no part of the development will have an unacceptable impact on roads, rail or aviation safety.	Chapter 3: Design Evolution and Alternatives Chapter 11: Traffic and Transport
(vi) that the development will not cause significant harm to the safety or amenity of any sensitive receptors (including future occupants of committed developments) arising from noise; shadow flicker; ice throw; and reflected light.	Chapter 2: Proposed Development Chapter 10: Noise Chapter 12: Shadow Flicker
vii) that above-ground redundant plant (including turbines), buildings and associated infrastructure shall be removed and the site restored to an agreed standard appropriate to its location.	Details on decommissioning are contained in Chapter 2: Proposed Development. The effects of decommissioning have been assessed in each ES topic.
viii) Any development on active peatland will not be permitted unless there are imperative reasons of overriding public interest.	Chapter 6: Ecology
For wind farm development a separation distance of 10 times rotor diameter to occupied property is recommended, with a minimum distance not less than 500 m, will generally apply.	Chapter 3: Design Evolution and Alternatives
The supplementary planning guidance 'Wind Energy Development in Northern Ireland's	Chapter 4: Landscape and Visual

CONSENTED (LA01/2018/0200/F)

Policy RE 1: Renewable Energy Developments *Applications for wind energy development will also be required to demonstrate all of the following:*	Environmental/Technical Topic
Landscapes' will be taken into account in assessing all wind turbine proposals.	

1.101 Policy RE1 of PPS 18 also states that "The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted." It is noted that in the High Court of Justice in Northern Ireland Judicial Review decision (Ref: 2013, NIQB 24), Mr Justice Treacy quashed the Planning Appeals Commission (PAC) decision to refuse planning permission for the proposed Mullaghturk wind farm near Draperstown, Co. Londonderry after identifying mistakes in the assessment of the socio-economic benefits of the proposed wind farm. Mr Justice Treacy stated *"I am persuaded that the Commissioners assessment of the socio-economic benefit is legally flawed"*. He continued to say that *"On any showing in the context of this case such a figure (£350,000 on local rates and £3.5 million on local spend) would be not an insignificant contribution to the local economy and it is not apparent that this figure was fully grasped"*.

1.102 The socioeconomic impacts (including beneficial impacts) of the Development are addressed in Chapter 13.

Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy' (2009)

1.103 Best Practice Guidance to Planning Policy Statement 18 'provides advice and guidance on wind farms'. Guidance is provided on:

- technology of wind turbines;
- spacing of turbines;
- required infrastructure of a wind farm;
- operation and maintenance;
- wind resource;
- planning and specific issues;
- safety;
- proximity to roads and railways; and
- decommissioning and reinstatement.

Wind Energy Development in Northern Ireland's Landscapes - Supplementary Planning Guidance to PPS 18 (2010)

1.104 This Supplementary Planning Guidance accompanies Planning Policy Statement 18: Renewable Energy, and is based on the sensitivity of Northern Ireland's

CONSENTED (LA01/2018/0200/F)

landscapes to wind energy development and contains an assessment of each of the 130 Landscape Character Areas (LCAs) in Northern Ireland by referencing the characteristics and values associated with each LCA.

1.105 Full details on the SPG to PPS18 are addressed in Chapter 4, Landscape and Visual.

PPS 21 Sustainable Development in the Countryside (2010)

1.106 PPS 21 aims to, "Manage development in the countryside in a manner consistent with achieving the strategic objectives of the Regional Development Strategy for Northern Ireland 2025".

1.107 The policy provisions of PPS 21 will take precedence over many of the provisions of 'A Planning Strategy for Rural Northern Ireland'.

Objectives of PPS 21 include:

- Manage growth in the countryside to achieve appropriate and sustainable patterns of development that meet the essential needs of a vibrant rural community.
- Conserve the landscape and natural resources of the rural area and to protect it from excessive, inappropriate or obtrusive development and from the actual or potential effects of pollution.
- Facilitate development necessary to achieve a sustainable rural economy; including appropriate farm diversification and other economic activity.
- Promote high standards in the design, siting and landscaping of development in the countryside.

1.108 Of particular relevance is Policy CTY1 which relates to development in the countryside and states that there are a range of types of development which in principle are considered to be acceptable in the countryside and that will contribute to the aims of sustainable development. Other types of development will only be permitted where there are overriding reasons why that development is essential and could not be located in a settlement, or is otherwise allocated for development in a development plan. These exceptions include renewable energy developments in accordance with PPS 18.

1.109 Policy CTY 1 -Development in the Countryside:

"There are a range of types of development which in principle are considered to be acceptable in the countryside and that will contribute to the aims of sustainable development… Other types of development will only be permitted where there are overriding reasons why that development is essential and could not be located in a settlement, or it is otherwise allocated for development in a development plan…Planning permission will be granted for non-residential development in the countryside in the following cases…renewable energy projects in accordance with PPS18".

CONSENTED (LA01/2018/0200/F)

Local Policy

Northern Area Plan 2016

1.110 The Northern Area Plan 2016 was adopted by the Department in accordance with the provisions of Part II of the Planning (NI) Order 1991 in 22nd September 2015. The Plan was formulated in the context of the strategic and regional planning policy framework provided by Planning Policy Statements and the Department's document "A Planning Strategy for Rural Northern Ireland".

1.111 Planning powers were transferred from the Department to Council in April 2015, however, the legislative powers to allow the Department to adopt the Northern Area Plan 2016 were retained by the Department. The Northern Area Plan 2016 becomes the local development plan for the Council area until the Council adopts its own Local Development Plan, which is at the Preferred Options Paper stage.

1.112 The key objectives of the Plan include:

- To facilitate and promote sustainable development throughout the Northern Plan area in accordance with the Regional Development Strategy;
- To promote the continued development of Coleraine and Limavady as main hubs, and Ballymoney and Ballycastle as local hubs, consistent with their identified roles in the Regional Development Strategy;
- To consolidate and sustain small towns and villages as important rural service centres, in accordance with the Regional Development Strategy;
- To provide opportunities for single houses or small groups of houses and small scale economic and community development that act as a focal points for the local rural community;
- To allocate land for housing development within settlements consistent with the Regional Development Strategy;
- To identify land for housing development, including social housing, at locations that will create compact and more sustainable settlements, with preference for sites within the urban areas;
- To promote development that enhances the character and identify of existing settlements, avoids urban sprawl and protects the countryside;
- To facilitate economic development and the creation and maintenance of employment, consistent with the Anti-Poverty and Social Inclusion Strategy;
- To promote the vitality and viability of town centres;
- To improve access to, and the range of employment, commercial, health, education and community services;
- To promote the integration of public transport, cycle and footpath networks and new development, in order to ease congestion, reduce

CONSENTED (LA01/2018/0200/F)

dependence on the private car, and encourage the use of more sustainable forms of travel, particularly walking and cycling;

- To protect and enhance the coastline, river corridors, mountains and other natural and man-made environs in terms of their character, quality and biodiversity;
- To promote equality of opportunity between persons and groups identified under Section 75 of the Northern Ireland Act 1998 and good relations between persons of different religious beliefs, political opinion or racial groups.

1.113 In addition:

- The Plan proposals constitute considerations that will be taken into account in determining planning applications within the Plan Area. The contents of the contents of the Plan must be read as a whole as often several designations, policies and proposals may be relevant to a particular development proposal.
- Section 6(4) of the Planning Act (Northern Ireland) 2011 provides, 'Where in making any determination under this Act regard is to be had to the local development plan, the determination must be made in accordance with the plan unless material considerations indicate otherwise'.
- The contents of the Plan must therefore be read in conjunction with the relevant contents of regional planning policy publications, supplementary planning guidance documents and with policy publications of other Government Departments.

The Need for the Development

1.114 A key policy driver for the development of renewable energy in Northern Ireland is the need to increase security of supply. There are also potential adverse impacts on local populations and the economy through high volatile fuel costs, contributing to fuel poverty and high energy costs for businesses and industry. In addition, increasing focus on renewable energy can deliver environmental and climate change gains, reductions in carbon emissions, as well as investment and employment opportunities. With a lack of indigenous fossil fuel and no nuclear power stations, Northern Ireland is keen to develop the full range of its available renewable energy resources to optimise the contribution that renewables make to the overall energy mix.

1.115 Northern Ireland's current renewable energy target is that 40% of electricity consumption should be met from renewable sources by 2020 (DETI 2010). The 40% target is the equivalent of 1600 MW. Wind energy will be the main focus of renewable electricity development on the island of Ireland, and certainly in Northern Ireland, through to 2020.

CONSENTED (LA01/2018/0200/F)

1.116 If approved, the proposed Dunbeg South Wind Farm could account for up to 29.7 MW, a material contribution to achieving the 40% renewable energy target for 2020. This is the equivalent of approximately 23,000 homes based on an output of 29.7 MW.[1]

Summary

1.117 The identified documents are considered relevant and form material considerations to this application for planning consent for the Development. The relevant policies have been assessed in the various chapters of this EIA to determine that the proposed development is in compliance with the relevant policies and their objectives. Where the assessment has found that there may be any likely significant environmental effects mitigation measures to reduce or remove such impacts have been suggested.

1.118 The theme of sustainable development is recurrent in the above mentioned documents and it is recognised that differing interests must be reconciled so that conservation and development is integrated through a mix of coordinated economic, environmental and social measures. The documents outline that there is clear government policy support for the Development, as outlined in the Strategic Energy Framework (2010) and the recent Directive 2009/28/EC.

1.119 The Development, which will generate electricity from renewable resources, is the result of an extensive EIA process. This process has sought to minimise environmental impacts and will not result in an unacceptable adverse impact, in accordance with Policy RE1 – Renewable Energy Development.

[1] The 23,000 homes equivalent has been calculated by taking the predicted annual electricity generation of the site (based on RES studies at Dunbeg South Wind Farm has a predicted capacity factor of 36% - based on the 3.3MW turbine) and dividing this by the annual average electricity consumption figures from the Department of Business, Energy and Industrial Strategy (3994 kWh).

CONSENTED (LA01/2018/0200/F)

Commenting on the ES

1.120 An electronic version of the reports supporting the application, including the ES, will be available to download free of charge from http://www.dunbegsouth-windfarm.co.uk

1.121 Copies of the ES can be obtained at a cost of £50 from the address below:

RES Ltd
Willowbank Business Park
Willowbank Road
Millbrook
Larne
BT40 2SF
Email: garth.mcgimpsey@res-group.com
Phone: 028 2844 0580

1.122 The application documentation is also available for public inspection (and CD copies available free of charge) at the following address during normal opening hours:

Limavady Library
5 Connell Street
Limavady
County Londonderry
BT49 0EA
Phone: 028 7776 2540

CONSENTED (LA01/2018/0200/F)

List of References and Figures

References

Department of the Environment (2006) First Steps towards Sustainability – A Sustainable Development Strategy for Northern Ireland 2006, Department of the Environment for Northern Ireland

Department of Enterprise, Trade and Investment (2010) Strategic Energy Framework, Belfast, Department of Enterprise, Trade and Investment

Department of Enterprise, Trade and Investment (2009) Northern Ireland Renewables Obligation, Department of Enterprise, Trade and Investment

Department of Regional Development (2001) Regional Development Strategy for Northern Ireland 2025: Shaping Our Future, Belfast, Department of Regional Development

Department of Regional Development (2008) Shaping Our Future – Adjustments to the Regional Development Strategy – 2025, Belfast, Department of Regional Development

Department of Regional Development (2010) Building a Better Future – Regional Development Strategy – 2035, Belfast, Department of Regional Development

Directive 2001/77/EC (Renewables Directive)

Directive 2003/87/EC (Energy Trading Directive)

Directive 2003/54/EC (Internal Market in Electricity)

Directive 2009/28/EC (National Renewable Energy Action Plans)

Directive 2009/29/EC (The Emissions Trading System Directive)

EU (2009) The EU and Climate Change (http://ec.europa.eu/ireland/about_the_eu/eu_and_climate_change/index_en.htm)

EU (2010) Communication from the Commissioners to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions.

HM Government (2007) Meeting the Energy Challenge: UK White Paper on Energy, UK, Department of Trade and Industry

HM Government (2009) UK Renewable Energy Strategy 2009, UK, Department of Energy and Climate Change

Northern Irelands Executive (2010) Everyone's Involved, Sustainable Development Strategy

Northern Ireland Environment Agency (2010) Wind Energy Development in Northern Ireland's Landscapes, Department of the Environment

Northern Ireland Planning Service (1993) A Planning Strategy for Rural Northern Ireland, Belfast Department of the Environment

Northern Ireland Planning Service (1998) Planning Policy Statement 1 (PPS1) – General Principles, Belfast, Department of the Environment for Northern Ireland

Northern Ireland Planning Service (1999) Planning Policy Statement 6: Planning Archaeology and the Built Heritage, Department of the Environment

Northern Ireland Planning Service (2005) Planning Policy Statement 3: Access, Movement and Parking, Department of the Environment

Northern Ireland Planning Service (2005) Planning Policy Statement 13: Transportation and Land Use, Department of Environment/Department for Regional Development

CONSENTED (LA01/2018/0200/F)

Northern Ireland Planning Service (2006) Planning Policy 15: Planning and Flood Risk, Department of the Environment

Northern Ireland Planning Service (2009) Planning Policy Statement 18 (PPS 18) – Renewable Energy, Belfast, Department of the Environment for Northern Ireland

Northern Ireland Planning Service (2009) Best Practice Guidance to Planning Policy Statement 18– Renewable Energy, Belfast, Department of the Environment for Northern Ireland

Northern Ireland Planning Service (2010) Planning Policy Statement 21: Sustainable Development in the Countryside, Department of the Environment

Northern Ireland Planning Service (2013) Planning Policy Statement 2: Natural Heritage, Department of the Environment

Northern Ireland Planning Service (2015) Strategic Planning Policy Statement (SPPS), Department of the Environment

Department of the Environment (2015) Northern Area Plan 2016

SONI (July 2013) Generator Connection Process Allocation of Transmission FAQ in N Ireland & ITC Methodology to determine FAQs Decision Paper

UNFCC (1997) Kyoto Protocol

Figures

Figure 1.1: Site Location

Figure 1.2: Planning Application Boundary

CONSENTED (LA01/2018/0200/F)

2

Proposed Development

CONSENTED (LA01/2018/0200/F)

2 Proposed Development

Introduction

Site Description

2.1 The Proposed Dunbeg South Wind Farm, hereafter referred to as 'the Development' is located on privately owned agricultural lands. The main wind farm site is located approximately 6 km northeast of Limavady, Co. Derry/Londonderry.

Proposed Development

2.2 The Development comprises 9 three-bladed, horizontal axis wind turbines, each up to a maximum of 149.9 m to tip height, with a total installed capacity of up to 29.7 MW. The Development would include a newly created site entrance, access tracks, crane hardstandings, control building and substation compound, electricity transformers, underground cabling, energy storage containers and drainage works. During construction there would be a number of temporary works including a construction compound with car parking, temporary parts of crane hardstandings and welfare facilities.

2.3 The Planning Application Boundary (red line boundary) is shown on Figure 1.2. This boundary contains the main wind farm site, including positions of the turbines and associated infrastructure, with 50 m micrositing. The Planning Application Boundary lies fully within Land under the Applicant's Control (blue line boundary), as shown in Figure 1.2. The measures contained in the Outline Habitat Management Plan (Appendix 6.8) are contained within the blue line boundary.

2.4 A detailed plan of the Development showing the position of the turbines and other infrastructure is shown on Figure 2.1: Infrastructure Layout.

2.5 This chapter provides a description of the physical characteristics of the Development for the purpose of identifying and assessing the main environmental impacts of the proposal.

2.6 In this chapter in order to differentiate between land take and infrastructure that will be present for the wind farm life time, and land take and infrastructure which is only required for short term works during the construction period, the term 'permanent' is used to describe the former and 'temporary' used to describe the latter. However it should be noted that the Development would have a temporary operational lifetime of approximately 30 years from the date of commissioning, after which the above ground infrastructure would be removed and the land remediated. Therefore the effects are largely long-term temporary as opposed to permanent.

CONSENTED (LA01/2018/0200/F)

2.7 Planning permission is being sought for the Development comprising the following:

- 9 three-bladed horizontal axis wind turbines of up to 149.9 m tip-height
- Turbine foundations
- Hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbines
- Electricity transformers
- Approximately 3.5 km of new access track and 1.1 km of upgraded access track
- Wind farm substation compound containing a control building
- Energy Storage Containers
- On-site electrical and control network of underground (buried) cables
- Connection from the substation to the local grid network
- Temporary construction compound
- Permanent and temporary drainage works
- Associated ancillary works
- New site entrance from the public road.

Site Layout and Flexibility

2.8 Although the design process and evolution seeks to combine environmental and economic requirements, the Applicant would nevertheless wish some flexibility, where necessary, in micrositing the exact positions of the turbines and routes of on-site access tracks and associated infrastructure (50 m deviation in plan from the indicative design). Any repositioning would not encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine positioning would help mitigate any potential environmental effects: e.g. avoidance of unfavourable ground conditions or archaeological features not apparent from current records. See Figure 2.1: Infrastructure Layout for details.

Land Take

2.9 The turbines need to be spaced a suitable distance apart (taking into account the prevailing wind direction), so as not to interfere aerodynamically with one another (creating array losses). The actual land developed is limited to the substation, wind turbine towers, transformers, permanent crane hardstandings, energy storage hardstanding and the access tracks, which account collectively for about 10.3 % of the total area within the Planning Application Boundary.

CONSENTED (LA01/2018/0200/F)

2.10 The area of infrastructure created following construction of each turbine (including temporary areas) will be approximately 1647 m². Of this, approximately 630 m^2 would be temporary hardstanding (see Table 2.1 under crane pads and laydown areas). The turbine foundation formation level is approximately 25 m diameter in area and 3.5 m below ground level. The walls of the excavation will be battered to approximately 1:1, yielding a ground level excavation area of approximately 32 m diameter.

2.11 The excavation area around each turbine is significant in terms of both its scale and duration of the works and as such requires consideration. Ancillary excavation works and material storage around other parts of development, such as those for cable trenching, would have a negligible impact on environmental receptors due to the very minor scale of the excavation, or duration of the works and are not considered further in the ES.

2.12 Following completion of the turbine installation, the permanent hardstanding would be approximately 189 m^2 at each turbine site, which includes the concrete plinth to which the steel tower is attached, and a 5 m wide maintenance track/path around the base of the turbine (Figure 2.12). The external transformer (if required) would take an additional 28 m^2 of land at each turbine. The completed foundation is covered with soil approximately 1.5 m deep, leaving only the concrete plinth exposed at ground level, to which the steel tower is attached. Movement of livestock around the tower would be unrestricted.

2.13 Additionally, crane hardstanding areas would be constructed adjacent to each wind turbine. Figure 2.13 shows the general hardstanding arrangement at each turbine. The permanent hardstanding of each turbine for the life of the Development is 800 m^2, with a temporary hardstanding of 630 m^2 during construction, if required by the final choice of turbine supplier. If constructed, the temporary hardstanding areas would be reinstated following construction.

2.14 The Development would result in the construction of approximately 3.5 km of new track and 1.1 km of upgraded access track. The running width of the track would be 4.5 m on straight sections, with 0.25 m wide shoulders on each side, totalling 5 m. The permanent hardstanding area for the new track would be approximately 23,351 m^2, plus 5,850 m^2 of upgraded access track, totalling 29,201 m^2.

2.15 The total area taken up by the control building and associated infrastructure is expected to be 1,436 m². This is to include the building, rear compound, all associated welfare, access and parking (Figure 2.3).

2.16 A temporary construction compound (Figure 2.10) measuring 2430 m^2 will be constructed. On completion of the wind farm construction, 1,056m2 of temporary construction compound will be utilised permanently for Energy Storage and the remaining 1,374m2 will be reinstated to their original form following construction.

CONSENTED (LA01/2018/0200/F)

Table 2.1 - Summary of Temporary and Permanent Hardstanding

Wind Farm Element	Temporary hardstanding[1] in m^2	Permanent Hardstanding[2] in m^2
Turbines and transformer pads	N/A	226 per turbine = 2,486
Crane pads and laydown areas	630 per turbine = 5,670	800 per turbine = 7,200
On-site access tracks (new)	N/A	23,386
On-site access tracks (upgraded)	N/A	5,850
Control building & substation compound	N/A	1,436
Energy storage hardstanding	N/A	1,056
Construction compound	1,436	N/A
Total hardstanding in m^2	7,106	41,414
Total Hardstanding in ha	0.71ha	4.14 ha
Total Hardstanding as % of total area within the Planning Application Boundary (40.36ha).	1.75%	10.26%

2.17 Thus, in summary, the Development would require approximately 4.14 ha of hardstanding lasting throughout the life of the project. An estimated further 0.71 ha would be occupied by hardstanding on a temporary basis.

Habitat Management

2.18 An Outline Habitat Management Plan (HMP) has been developed to enhance habitats on site. Please see Chapter 6: Ecology, for further details.

Project Description

Wind Turbines

2.19 The wind turbine industry is evolving at a remarkable rate. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine for the Development has not yet been made. The most suitable machine will be selected before construction, with a maximum tip height of 149.9 m.

2.20 For visual and acoustic assessment purposes, the most suitable candidate turbine available in the market place (currently of 3.3 MW nominal capacity and with an overall tip height of 149.9 m) has been assumed. Most of the dominant

[1] Temporary hardstanding: this refers to ground which will be occupied by hardstanding / built structures during the construction of the Development. However, once the Development has been constructed this land will be reinstated and available for grazing.

[2] Permanent hardstanding: this refers to ground which will be occupied by hardstanding / built structures throughout the lifetime of the Development.

CONSENTED (LA01/2018/0200/F)

wind turbine manufacturers are now producing turbines that are classed as suitable for the wind regimes typical of Northern Ireland and many are also producing turbines that meet the up to 149.9 m tip height specification being suggested for the Development. Exact tower and blade dimensions vary marginally between manufacturers. A diagram of a typical 149.9 m tip height turbine is given in Figure 2.2.

2.21 Turbines begin generating automatically at a wind speed of around 3 to 4 metres per second (m/s) and have a shut-down wind speed of about 25 m/s. It is proposed to install infrared lighting on a turbine(s) in a pattern that is acceptable to the Ministry of Defence (MoD) for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capability to detect and avoid wind farms. Infrared lighting cannot be detected with the naked eye, thereby reducing visual impact.

2.22 We would seek to protect commercial aircraft safety and protect amenity by agreeing a scheme for the installation of aviation lighting with City of Derry Airport (CODA). Upon erection of the turbines, the agreed lighting scheme shall be installed and operational for the lifetime of the turbines.

2.23 Each turbine would have a transformer and switchgear. The transformer's function is to raise the generation voltage from approximately 690 volts to the higher transmission level that is required to transport the electricity into the grid. Depending on the turbine supplier, the transformer and switchgear may be located inside or outside each turbine.

Foundations and Hard Standing

2.24 The wind turbines would be erected on steel re-enforced concrete foundations. It is anticipated that the foundations would be of gravity base design, but there may be the requirement to use piled foundations where ground conditions dictate. Final base designs will be determined after a full geotechnical evaluation of each turbine location. Figure 2.12 provides an illustration of a typical gravity base wind turbine foundation design.

2.25 During the erection of the turbines, crane hardstanding areas would be required at each turbine base (Figure 2.13). Typically, these consist of one main permanent area of 800 m^2 adjacent to the turbine position, where the main turbine erection crane will be located. The other areas, totalling 630 m^2, will be temporary and used during the assembly of the main crane jib. The hardstanding will be constructed using the same method as the excavated access tracks. This involves the topsoil being replaced with suitable structural fill to finished level.

2.26 After construction operations are complete, the temporary crane pad areas, shown on Figure 2.14, will be reinstated. There will be a requirement to use cranes on occasion during the operational phase of the Development, so the main crane hardstanding (800 m^2) will be retained to ease maintenance

CONSENTED (LA01/2018/0200/F)

activities. This approach complies with current best practice guidance[3] which recommends crane hardstandings are left uncovered for the lifetime of the Development.

Site Tracks

2.27 The on-site access track layout has been designed to minimise environmental disturbance by maximising the use of upgraded site track and avoiding sensitive habitats where possible and keeping the length of track commensurate with the minimum required for operational safety. The track route also takes cognisance of the various identified environmental constraints. Approximately 3.5 km of new access tracks and 1.1 km of upgraded access tracks are proposed to access the various turbine locations totalling approximately 4.6 km in length. Typical access track designs are shown in Figure 2.10.

2.28 7 new watercourse crossings will be required as part of the track layout. These crossings would be designed to ensure that fish movements are not restricted (where applicable) in addition to ensuring the crossing size is adequate for potential flood flows. An example of the watercourse crossing design is shown in Figure 2.16. In line with recommendations in Chapter 8: Fisheries and Chapter 9: Geology and the Water Environment, it is proposed that two of the crossings will use bottomless culverts. An example is shown in Figure 2.17.

Electrical Connection

2.29 Assuming the use of the currently available models, each wind turbine would generate electricity at 690 V and would have an ancillary transformer located either within or outside the base of the tower to step up the voltage to the required on-site distribution voltage. Each turbine would be connected to any adjacent turbines by underground cables.

2.30 The wind farm substation is proposed to be located on the central part of the site as shown in Figure 2.1: Infrastructure Layout. All power and control cabling on the wind farm will be buried underground in trenches located, where possible, along the route of site access tracks. These trenches will be partially backfilled with topsoil. The vegetation soil tuft will be stripped and laid beside the trench and used to reinstate the trench to the original ground level immediately after the cables have been installed.

2.31 The connection of wind farms to the electrical grid typically follows a separate consenting process and it is normally the responsibility of the network operator to progress the relevant consent, where required. The Best Practice Guidance to PPS 18 states that whilst the routing of such lines by Northern Ireland Electricity (NIE) is usually dealt with separately to the application for the wind farm, developers will generally be expected to provide details of indicative routes and method of connection. RES has submitted an application for a grid

[3] SNH, Scottish Renewables, SEPA and the Forestry Commission Scotland (2010) "*Good Practice during Wind Farm Construction*"

CONSENTED (LA01/2018/0200/F)

connection for the Development to NIE and is currently awaiting a project specific response, which we understand has been delayed due to ongoing energy policy discussions between the Department of Economy (DfE), the Utility Regulator and NIE. Therefore the exact means of grid connection is unknown at the time of writing. Based on RES's knowledge of the grid connection system and NIE's published plans for future grid upgrades, RES has been able undertake an assessment to determine the grid connection option most likely favoured by NIE.

2.32 RES considers connection to the grid system via underground cables following the public road to the proposed Cam Cluster Substation as the most likely option. Although not a part of the planning application for the Development, proposed grid connection route is illustrated and the environmental effects have been assessed and these are presented in Appendix 2.1.

RES Control Building & Substation Compound and Energy Storage

2.33 The control building will be designed and constructed to the standard required by NIE for the accommodation of substation equipment. Where possible, local building materials and finishes will be used to ensure that the appearance is in keeping with other buildings in the area.

2.34 The control building and substation compound will contain power quality improvement equipment, including up to two auxiliary transformers. The control building will accommodate metering equipment, switchgear, the central computer system and electrical control panels. A spare parts store room, and welfare facilities will also be located in the control building. The building will be attended by maintenance personnel on a regular basis.

2.35 Following an assessment of foul treatment options through a review of Pollution Prevention Guidelines 4, it was determined that both the toilet, wash hand basin and sink should drain to a small package treatment plant located adjacent to the control building, which would follow the Controlled Activities Regulations (CAR) guidelines and be constructed and located in accordance with the relevant Building Standards and agreed with the Council.

2.36 A permanent external environmental waste storage area will be provided with a minimum of 6 m clearance from the buildings. The area will consist of a concrete plinth surrounded with a palisade fence and double gate.

2.37 Four permanent containers housing energy storage devices, inverters and other ancillary equipment will be positioned adjacent to the control building and substation compound on hardstanding used originally for the temporary construction compound. These units are a means of storing electrical energy just like a rechargeable battery, cell phone or electric car. These are means by which power can be stored and released. The application is of course of a larger scale but the basic principle is the same.

CONSENTED (LA01/2018/0200/F)

2.38 One of the basic roles of energy storage is to act as a power reserve, when electricity generation drops below demand. This reserve capacity can be called on at a moments notice to enable the necessary balancing of the emerging low carbon electrical system.

2.39 Another example of the flexibility services that energy storage could provide includes distribution, reinforcement and deferral services. These enable existing electrical network assests such as substations and overhead lines to have their capacity increased without the need for building new grid infrastructure.

2.40 All of these uses of energy storage involve charging a battery system with electricity, storing electricity for a period, or discharging electricity. Ultimately the proposed development will make a valuable contribution to a secure, low carbon and affordable electrical system.

Description of Access

2.41 The proposed access route for the delivery of large turbine components, known as abnormal indivisible loads (AILs), is shown in Figure 11.1 – Turbine Delivery Route. The site entrance is located directly off the Broad Road (A37). Depending on the port of delivery vehicles could potentially access the site from the west (Lisahally Port) via Limavady or from the east (Belfast Port) via Coleraine.

2.42 Appendix 11.1 shows a swept path analysis of all points along the turbine delivery route that require either overrun or oversail beyond the road edge.

2.43 At the end of the construction period and in consultation with DfI Roads, any reinstatement required to any street furniture which may be removed on a temporary basis will be undertaken. In the unlikely event that a replacement blade is required during the operational phase of the wind farm, any works will be undertaken following consultation with DfI Roads.

2.44 Further details are in Chapter 11: Traffic and Transport.

Typical Construction Activities

2.45 Prior to commencement of construction, detailed method statements will be prepared to address best practice working methods. As a minimum, the following best practice construction methods will be adhered to:

- Where possible and in order to minimise impacts of earthworks, excavations will be kept to a minimum with granular material being reused where appropriate
- Consideration will be given to weather conditions when stripping soil. For example, during periods of heavy rain (>25 mm in 24 hours), significant snow event (>75 mm lying) or an extended period of freezing conditions (ground penetration >100 mm), soil stripping works will be reviewed to

CONSENTED (LA01/2018/0200/F)

take in account any adverse weather conditions and where deemed applicable, works will cease until site conditions prevail that are compatible with this activity

- Vegetated turves shall be stripped and stockpiled separately prior to excavation of topsoil/peat in all work areas
- Vegetated turves will be reused as quickly as possible
- Excavations will be monitored for changing soils types to prevent cross mixing of soils in stockpiles
- Topsoil shall be stripped and stored carefully for use in reinstatement works, which shall be carried out as soon as possible after sections of work are complete. Topsoil will be stripped prior to excavation of subsoil in all work areas
- Any remaining subsoil will be excavated down to a suitable bearing stratum and set-aside for later use in landscaping, backfilling around structures and verge reinstatement
- Reinstatement will be ongoing as the works are constructed to minimise the amount of time in which any material will be stockpiled
- Where required, all stockpiled material will be sited in areas with shallow peat depths, negligible peatslide risk and avoiding all 50 m watercourse buffer zones, ecological and cultural heritage constraints
- All stockpiles shall be shaped to promote run-off. Detailed SUDS drainage and silt control methods shall be designed for each stockpile
- Additionally, a “toolbox talk” will be provided by the site management team to highlight possible events causing slope instability and provide guidance on best practice when operating in areas of peat and/or increased slopes. In addition, a workforce engagement event shall be performed at least once for the project and shall be organised by the project team and be attended by RES and project contractor’s workforce. The event will set and communicate the required safety culture and working practices for the project.

Access Tracks

2.46 As described in section 2.41 in areas of peat with a depth greater than 1.0 m consideration has been given to the use of floating tracks. The feasibility of a floating road construction is dependent upon a number of factors, namely: the geomorphology of the peat; topography; length of road section; wind farm layout; number of vehicle movements for each option; restoration requirements; peat re-use considerations. All parameters noted above will be assessed at detailed design stage post consent and the best practice road construction type will be inferred from the various design constraints.

CONSENTED (LA01/2018/0200/F)

2.47 The access track itself will be constructed of inert material of suitable grade to withstand the expected traffic loading. Road construction techniques and roadside ditches will be designed to minimise the effect on natural hydrology as much as possible.

2.48 The depths of the ditches will be kept to the minimum required for free drainage of the road. Individual drain lengths will be minimised to avoid significant disruption of natural drainage patterns and avoid accumulation of large volumes of water within an individual drain.

2.49 Drains will not directly flow into watercourses, but into a buffer zone. Buffer zones are used to allow filtration of suspended solids in the water and reduction of runoff velocities. This reduces the flashiness of response, encourages deposition of sediments and allows pollutants to be filtered out.

Construction of Temporary Compound and Energy Storage

2.50 A temporary construction compound will be located on the site, as illustrated in Figure 2.1: Infrastructure Layout. Details of the temporary compound layout are included in Figure 2.10. The compound will include the following:

- Temporary portable cabins for office accommodation, monitoring of incoming vehicles and welfare facilities
- - Self-contained toilets with provision for waste storage and removal
- - Containerised storage areas for tools, small plant and parts
- - An area for site vehicle parking and storage of larger material items
- - A standing and turning area for vehicles making deliveries to the site
- - A bunded area for storing fuels, oils and greases.

2.51 On completion of the construction work these facilities will be removed and the areas not being used for energy storage will be reinstated.

2.52 The location of the temporary compound has been selected to avoid environmental constraints and for reasons of security, practicality and to obtain suitable ground conditions. The proposed temporary compound area will be constructed by top soil excavation in a similar manner to the access tracks, laying stone over a geotextile membrane.

2.53 During construction, temporary fencing will be erected as required, around the construction compound. This is illustrated in Figure 2.11.

2.54 On completion of the construction phase work on the wind farm, 1,436m2 of the temporary construction compound will be removed and reinstated to agriculture with the remaining 1,056m2 utilised for Energy Storage devices.

2.55 The Energy Storage will comprise four permanent containers housing energy storage devices, associated inverters and ancillary equipment. Permanent fencing will enclose the containers. These are illustrated in Figure 2.6: Energy Storage Layout Plan and Figure 2.7: Energy Storage Elevation.

CONSENTED (LA01/2018/0200/F)

Sustainable Drainage System

2.56 The drainage measures and Sustainable Drainage System (SuDS) designs have been directed by recommendations in Chapter 9: Geology and Water Environment

2.57 The runoff drainage system will be designed to mimic natural conditions to mitigate against increased flashiness in water courses and reduced groundwater recharge. The SuDS will protect the status of water courses and ground waters. A proposed SuDS Design Statement is included within the Water Framework Directive Assessment in Appendix 9.1.

2.58 Construction will be carried out according to Department of Agriculture, Environment & Rural Affairs (DAERA) and Construction Industry Research and Information Association (CIRIA) guidance for site works. Pollution control measures during the construction phase will be included in the Construction & Decommissioning Method Statement (CDMS), which will be agreed with Causeway Coast & Glens BC before starting construction work on site.

2.59 Mitigation measures to minimise the hydrological effect of constructing the access tracks have been proposed in Chapter 9: Geology and Water Environment of this ES.

Crane Hardstanding Construction

2.60 Figure 2.13 shows the crane hardstanding layout configuration in plan. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil and subsoil being replaced with imported stone, ensuring an adequate bearing capacity has been achieved to carry the anticipated loads. The final position of the hardstanding would be decided at detailed design stage and prior to construction and shall be based on a number of considerations, including; size of crane required, depth of excavation required, hydrological/ecological features in the vicinity, local topography (it is preferable to position the crane hardstanding on the same level, or higher level to the turbine foundation level since this eases lifting operations).

Turbine Foundation Construction

2.61 The turbine towers are fixed to a concrete foundation. The foundation proposed in Figure 2.12 comprises a gravity base design. Each foundation typically consists of a tapered octagonal block of concrete, and formation will be approximately 3.5 m below ground level. The volume of concrete used to make each foundation is approximately 500 m^3, which is reinforced by approximately 50 tonnes of steel bar. The depth of the foundation varies for each turbine location according to the depth to suitable formation level. The excavation area for each foundation will be approximately 650 m^2. The foundation is typically poured in two parts, with a suitable construction joint between them.

CONSENTED (LA01/2018/0200/F)

This will be detailed in the CDMS. Following the pouring and curing of the concrete, the foundation is backfilled with material which is initially excavated and meeting the density requirements, leaving only the tower plinth, typically 4.5 m – 5.5 m diameter, sitting at ground level. Surplus excavated material will be stored in appropriate areas identified in the Peat Management Plan (PMP), produced as part of CDMS prior to construction. The proposed plan will calculate generated excavated material and identify space for the excess volume of material. An Outline Peat Management Plan is provided in Appendix 9.5.

2.62 The exact quantities of concrete, reinforcement, depth and dimensions will vary on the final choice of turbine model. In the detailed pre-construction design of each foundation, geotechnical tests are carried out to determine the strength of the subsoil layers beneath the turbines and the soil behaviour under loading over time. This information is used to confirm a final design and incorporates factors for safety.

2.63 An earthing mat or electrode consisting of up to three interconnected concentric rings of bare stranded copper conductor is laid around the foundation of each tower and transformer, approximately 0.5 m below the finished ground level. In addition, earthing rods padded by bentonite (a water retaining clay mineral) are required at set locations around the foundation, and are positioned vertically below the earth mat. The number of rods and length is dependent upon the electrical resistivity of the soil which is confirmed during the site investigation, prior to construction.

2.64 Sulphate resistant cement, or higher cement content, within the concrete will be used if the site is identified to have waters with potentially low pH. This is so that they do not have a corrosive effect on turbine bases.

Wind Turbine Erection

2.65 Wind turbine towers, nacelles and turbine blades will be transported to the site as abnormal loads as described in Section 2.41. The tower sections and other turbine components will be stored at each turbine hardstanding until lifted into position.

2.66 The components would be lifted by adequately sized cranes and constructed in a modular fashion. Assembly, in general requires only fixing of bolts, torquing of nuts and electrical and hydraulic connections.

Cabling, Substation and Control Building

2.67 The location of the substation and control building is shown in Figure 2.1: Infrastructure Layout. Layout and elevation drawings for these buildings are presented in Figures 2.3, 2.4 and 2.5. All cabling between the turbines and the substation on the site will be connected using underground trenched cables. Where excavated, the top layer of soil will be removed and used to reinstate the excavation following the installation of the cables. Where cables are being

CONSENTED (LA01/2018/0200/F)

laid in areas of peat, the various different layers will be separated and replaced appropriately. Cabling would generally run parallel to the adjacent site tracks. Figure 2.14 presents a typical underground cable cross-section. In addition and in an effort to ensure that the cable trench does not act as a preferential drain, impermeable bunds will be installed perpendicular to the cable direction at suitable intervals (taking into account local ground conditions and topography).

Re-instatement

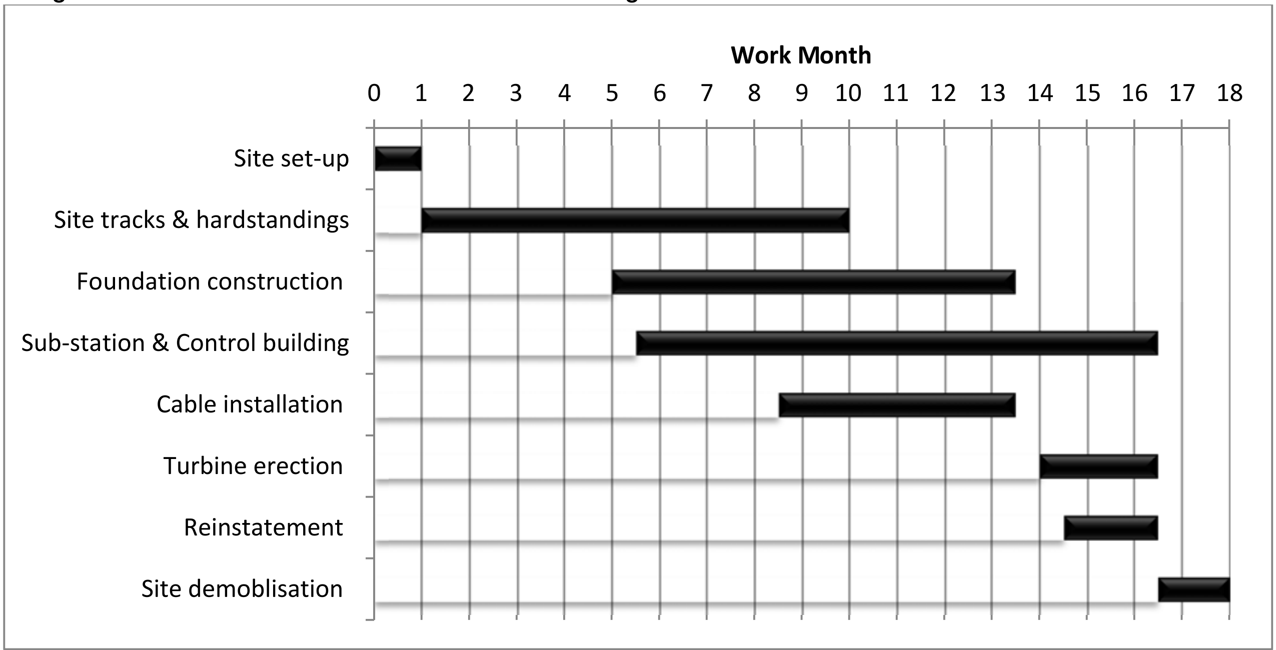
2.68 A programme of reinstatement would be implemented upon completion of construction. This would relate to the construction compound, temporary areas of the crane hardstandings, cable trenches and track shoulders where appropriate. There remains a potential to use cranes during the operational phase of the Development, therefore the main crane hardstanding will remain uncovered.

2.69 It is essential that the access track width is retained during the operation of the Development to allow occasional access if required. Therefore no works to reduce the track width, post turbine erection, are proposed.

Construction Programme

2.70 It is anticipated that the construction would take 18 months. The indicative construction programme shown in Diagram 2.1 shows the anticipated scheduling of construction activities.

Diagram 2.1 – Indicative Construction Programme



CONSENTED (LA01/2018/0200/F)

Hours of Work

2.71 Construction work will take place between the hours of 0700-1900 Monday to Friday and 0700 – 1300 on Saturdays. Outside these hours, work at the Site shall be limited to turbine erection, testing/commissioning works and emergency works. Deliveries may occur outside these times to minimise disruption to local residents.

Construction Traffic and Plant

2.72 In addition to staff transport movements, construction traffic will consist of heavy goods vehicles (HGVs) and abnormal load deliveries.

2.73 As outlined in Chapter 11: Traffic and Transport, taking into account forecast vehicle numbers from construction activities (5,908 trips) and forecast staff vehicle numbers (7,540 private car, mini bus or land rover trips), the total number of two-way vehicle movements generated during the construction period would therefore be 13,448 journeys. Approximately 90 abnormal load deliveries would be generated for the turbine erection stage which would typically result in three deliveries per day. However, the actual number will be determined in the development of the Traffic Management Plan (TMP) which will be written in consultation with Department for Infrastructure (DfI) and Causeway Coast & Glens BC, post-consent.

2.74 Turbine components will be supervised during their transportation using appropriate steerable hydraulic and modular trailer equipment where required. Axle loads would be appropriate to the roads and access tracks to be used. The transportation of turbine components would be conducted in agreement with the relevant roads authorities and local police. RES will notify the police of the movement of abnormal length (e.g. turbine blade delivery) and any abnormal weight (e.g. crane) vehicles and obtain authorisation from DfI prior to any abnormal vehicle movements.

2.75 Vehicle escorts will be used where necessary and the appropriate permits obtained for the transportation of abnormal loads, to ensure that other traffic is aware of the presence of large, slow moving vehicles. Where long vehicles have to use the wrong side of the carriageway, or have potential to block the movement of any vehicles travelling in the opposite direction, a lead warning vehicle will be used and escort vehicles will drive ahead to hold oncoming traffic. Vehicles will also be marked as long/abnormal loads. For return journeys, the extendible trailers used for wind turbine component delivery will be retracted to ensure they are no longer than that of a normal HGV.

Construction and Decommissioning Method Statement

2.76 A Construction and Decommissioning Method Statement (CDMS) will be prepared once planning consent has been gained. This will be submitted to Causeway Coast & Glens BC prior to any construction works taking place. This will

CONSENTED (LA01/2018/0200/F)

describe the detailed methods of construction and working practices, work to reinstate the site following completion of construction activities and methods to reinstate the site post operation.

Operation and Management

Life of the project

2.77 The expected operational life of the wind farm is 30 years from the date of commissioning. At the end of this period, a decision is made whether to refurbish, remove or replace turbines. If refurbishment or replacement were to be chosen, relevant planning applications will be made. Alternatively, if a decision is taken to decommission the Development, this would entail the removal of all of the turbine components, transformers, the substation and associated buildings. Specific sections of the access tracks may remain on-site to ensure the continued benefit of improved access for the landowners. The concrete foundations will normally remain in place to avoid the unnecessary intrusion to the ground. The exposed concrete plinth may be removed to a specified depth, but the entire foundation will be graded over with topsoil and replanted appropriately to restore the land to its original conditions.

Maintenance Programme

2.78 Wind turbines and wind farms are designed to operate largely unattended. Each turbine at the Development would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

2.79 The Development itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines. This is monitored 24 hours a day, 7 days a week.

2.80 An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would

CONSENTED (LA01/2018/0200/F)

also look after the day-to-day logistical supervision of the Development and would be on-site intermittently.

2.81 Routine maintenance of the turbines would be undertaken approximately twice yearly to ensure the turbines are maintained to Industry Standard. This would not involve any large vehicles or machinery.

2.82 If a fault should occur, the operator would diagnose the cause. If the repair warranted the Development being disconnected from the grid then the operator would make contact with NIE. However, this is a highly unlikely occurrence as most fault repairs can be rectified without reference to the network utility. If the fault was in the electrical system then the faulty part or the entire Development would be automatically disconnected until the fault is rectified.

2.83 Signs would be placed on the Development giving details of emergency contacts. This information would also be made available to the local emergency services and NIE.

Decommissioning

2.84 One of the main advantages of wind power generation over other forms of energy production is the ease of decommissioning and the simple removal of components from the site. The residual impact on the site is limited to the continued presence of the foundations and access tracks. All above ground structures can be removed from the site.

2.85 If the Development obtains planning approval it is expected that a planning condition would be set to provide for the decommissioning and restoration of the site in accordance with a scheme agreed in writing with Causeway Coast & Glens BC, which would consider the long term restoration of the site at the end of the lifetime of the Development.

2.86 The Development will be decommissioned in accordance with best practice at that time and/or in compliance with any planning conditions. Current best practice includes the removal of all above ground structures (e.g. turbines, substation etc); the removal of certain underground structures where required (e.g. cables); and reinstatement of disturbed areas all of which will be subject to any necessary consents. Consideration will be given to the retention of wind farm access tracks if they utilise pre-existing farm infrastructure or are not located on sensitive habitats if such continued use could lead to the long term degradation of these habitats.

Construction and Decommissioning Management

2.87 This section details the environmental management controls that would be implemented by RES and its contractors during the construction of the Development to ensure that potential significant adverse effects on the

CONSENTED (LA01/2018/0200/F)

environment are, wherever practicable, prevented, reduced and where possible offset.

2.88 A CDMS will be agreed with the relevant statutory consultees prior to construction commencing. The purpose of the CDMS is to:

- Provide a mechanism for ensuring that measures to prevent, reduce and where possible offset potentially adverse environmental impacts identified in the ES are implemented;
- Ensure that good construction practices are adopted and maintained throughout the construction of the Development;
- Provide a framework for mitigating unexpected impacts during construction;
- Provide a mechanism for ensuring compliance with environmental legislation and statutory consents;
- Provide a framework against which to monitor and audit environmental performance.

2.89 The CDMS will, as a minimum, include details of the following:

- Pollution prevention measures
- Peat slide, erosion and compaction management
- Control of contamination/pollution prevention
- Drainage management
- Control of noise and vibration
- Control of dust and other emissions to air.

Site Induction

2.90 The principal contractor would ensure that all employees, sub-contractors, suppliers and other visitors to the site are made aware of the content of the CDMS and its applicability to them. Accordingly, environmental specific induction training would be prepared and presented to all categories of personnel working on and visiting the site.

2.91 As a minimum, the following information would be provided to all inductees:

- Identification of specific environmental risks associated with the work to be undertaken on site by the inductee
- Summary of the main environmental aspects of concern at the site as identified in the CDMS
- Environmental Incident and Emergency Response Procedures (including specific Environmental Communication Plan requirements).

2.92 A conveniently sized copy of an Environmental Risk Map or equivalent would be provided to all inductees showing all of the sensitive areas, exclusion zones and designated washout areas. The map would be updated and reissued as required. Any updates to the map would be communicated to all inductees through a tool box talk given by specialist environmental personnel. Regular

CONSENTED (LA01/2018/0200/F)

tool box talks would be provided during construction to provide ongoing reinforcement and awareness of environmental issues.

Pollution Prevention, Water Quality Monitoring and Emergency Response Plan

2.93 The CDMS will detail a number of measures to deal with pollution prevention, including RES' policies and procedures such as 'Environmental Requirements of Contractors', 'Water Quality Monitoring Procedure' and 'Procedure in the Event of a Contaminant Spill'.

2.94 Contractors and sub-contractors would be required to follow all pertinent Pollution Prevention Guidance. The following pollution control measures will be incorporated into the CDMS:

- Equipment shall be provided to contain and clean up any spills in order to minimise the risk of pollutants entering watercourses, waterbodies or flush areas
- Trenching or excavation activities in open land shall be restricted during periods of intense rainfall and temporary landscaping shall be provided as required to reduce the risk of oil or chemical spills to the natural drainage system
- Sulphate-resistant concrete[4] shall be used for the construction of turbine bases to withstand sulphate attack and limit the resultant alkaline leaching into groundwater
- All refuelling will be undertaken at designated refuelling points. There will be no refuelling within catchments contributing to water supply points
- Equipment, materials and chemicals shall not be stored within or near a watercourse. At storage sites, fuels, lubricants and chemicals shall be contained within an area bunded to 110%. All filling points shall be within the bund or have secondary containment. Associated pipework shall be located above ground and protected from accidental damage
- Any on-site concrete wash-out shall occur in allocated bunded areas
- Drip trays shall be placed under machinery left standing for prolonged periods
- All solid and liquid waste materials shall be properly disposed of at appropriate off site facilities
- Routine maintenance of vehicles shall be undertaken outwith the site
- There shall be no unapproved discharge of foul or contaminated drainage from the Development either to groundwater or any surface waters, whether direct or via soakaway

[4] BS EN206:1 : 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1 : 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1

CONSENTED (LA01/2018/0200/F)

- Sanitary facilities shall be provided and methods of disposal of all waste shall be approved by regulatory bodies
- A programme of surface water quality monitoring would be undertaken during the construction phase to provide assurances as to the absence of water quality impacts
- RES has a policy that no wind turbines, auxiliary and electrical equipment would contain askarels or Polychlorinated biphenyls (PCBs).

2.95 In the unlikely event of an environmental pollution incident, there will be an emergency response procedure to address any accidental pollution incident. For example, a procedure requiring the use of spill kits to contain the material and procedures to ensure that NIEA is notified on their Pollution Hotline number (0800 807060) within 30 minutes of an incident (unless unsafe to do so), will be applied.

General Drainage Design

2.96 As set out in Chapter 9: Geology and the Water Environment, buffers to watercourses have taken account of and infrastructure designed in accordance with best practice guidance.

2.97 The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated through the following measures which would be incorporated into the SuDS Design:

- Site track construction materials would be free draining, strong, durable and well graded
- Attenuation ponds and silt fences would be provided adjacent to the drains to prevent pollution and sedimentation of watercourses
- Direct drainage into existing watercourses would also be avoided to ensure that sediment and runoff from disturbed ground is not routed directly to the watercourses
- Larger drains would be piped directly under the track through appropriately sized drainage pipes or culverts. Appropriate scour prevention and energy dissipation structures would be constructed at each culvert outlet. Where appropriate, a shallow, lateral drainage swale would be installed at the toe of site track cuttings to intercept the natural runoff. This lateral drain would be piped under the track at regular intervals through correctly sized cross drains away from watercourses. Again appropriate scour prevention and energy dissipation structures would be constructed at each culvert outlet
- Flow and sediment transport in any track drainage swales would be minimised by reducing concentrated flows, installing regular cross culverts

CONSENTED (LA01/2018/0200/F)

and the use of check dams placed at regular intervals within the trackside drainage swales

- Track drainage swales, where required, would discharge into attenuation ponds excavated on the downslope side, or silt fences. A shallow drainage swale would be cut directly downhill as a fan and at minimum slope until the bottom of the swale reaches the natural surface level. The discharge point of track drains would be constructed to minimise concentrated flows and ensure flows are dispersed over a large area with appropriate surface protection
- The depth of individual drainage swales would be kept to the minimum necessary to allow free drainage of the tracks and swale lengths would be minimised to avoid disruption of natural drainage paths. Direct drainage into existing watercourses would be avoided to ensure that sediment and runoff from disturbed ground is not routed directly to the watercourses.

Runoff and Sediment Control Measures

2.98 The following measures would be used to mitigate any potential impacts on the water quality of the sub-catchments through peat erosion, stream acidification and metals leaching during construction. These are incorporated into the CDMS:

- Appropriate sediment control measures (silt fences, attenuation ponds, etc.) would be used in the vicinity of watercourses, springs or drains where natural features (e.g. hollows) do not provide adequate protection
- Sediment control measures (e.g. check dams, silt fences etc.) would be employed within the existing artificial drainage network during construction. These would be regularly checked and maintained during construction and for an appropriate period following completion
- Watercourses would be monitored throughout the construction period by the ECoW to identify any enhanced scouring of the catchment surface. If sediment from disturbed peat is excessively mobilised through the minor channels network these would be mitigated by temporary sediment control measures (e.g. geotextiles/straw/bales/brash)
- The extent of all excavations would be kept to a minimum and during construction activities surface water flows shall be captured through a series of cut-off drains to prevent water entering excavations or eroding exposed surfaces. If dewatering of excavations is required, pumped discharges would be passed through attenuation ponds and silt fences to capture sediments before release to the surrounding land
- Where there is a permanent relocation of peat, the ground would be reinstated with vegetation as soon as practicable

CONSENTED (LA01/2018/0200/F)

- Where practicable, vegetation over the width of the cable trenches would be lifted as turfs and replaced after trenching operations to reduce disturbance
- The movement of construction traffic would be controlled to minimise soil compaction and disturbance. Vehicle movements outside the defined tracks and hardstandings would be avoided
- Trenching or excavation activities in open land would be restricted during periods of intense rainfall and temporary landscaping would be provided, as required, to reduce the risk of sediment transport to the natural drainage system
- Construction of the track and cable crossings will cease during periods of heavy rain (>25mm in 24 hours), significant snow event (>75mm lying) or extended period of freezing conditions (ground penetration>100mm). If necessary, upstream of the crossing would be dammed and water pumped around the construction zone. The construction period would be minimised as far as practicable.

Peat Slide, Erosion and Compaction Management

2.99 Management of the risk of peat slides is now recognised in literature, and a range of measures have now become standard engineering practice for construction of roads over peat. These measures would be adopted, as appropriate, on site, ensuring that:

- Concentrated loads, such as those arising from stockpiling of material from turbine foundation excavations, would not be placed on marginally or potentially marginally stable ground
- Concentrated water flows arising from any aspect of construction or operation of the Development would not be directed onto peat slopes and unstable excavations
- Construction would be supervised on a full time basis by engineers fully qualified and experienced in geotechnical matters
- Robust drainage plans would be developed
- Work practices would be reviewed, modified as necessary and adopted to ensure that existing stability is not compromised
- Appropriate ground investigation and movement monitoring practices would be adopted.

2.100 The major contributory factor resulting in peat slide is heavy rain. Almost invariably, peat-slide events are preceded by unusual weather conditions typically characterised by a long dry summer that leads to desiccation cracking of the peat profile followed by a prolonged continuous rainfall including exceptionally heavy rainstorms.

CONSENTED (LA01/2018/0200/F)

2.101 A separate Peat Slide Risk Assessment is provided as Appendix 9.4. This document would be updated during the detailed design stage and agreed with Causeway Coast & Glens BC prior to construction.

Peat Management Plan

2.102 A separate Draft Peat Management Plan is provided as Appendix 9.5. This provides details of the predicted volumes of peat that would be excavated for the Development, the characteristics of the peat that would be excavated, and how the excavated peat would be reused and managed. This document would be updated during the detailed design stage and agreed with Causeway Coast & Glens BC prior to construction.

Traffic Management Plan

2.103 As detailed in Chapter 11: Transport and Traffic, a Traffic Management Plan (TMP) would be developed to ensure road safety for all users during transit of development loads. The TMP would outline measures for managing the convoy and would set out procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. The TMP would be developed in consultation with DfI, the police and the local community and agreed before deliveries to the Development commence.

Construction Environmental Management Plan

2.104 A Construction Environmental Management Plan (CEMP) would be prepared and implemented through the CDMS to set out the measures required to protect and enhance ecology and hydrology at the Development during the construction phase, including pre-construction surveys, habitat management and biodiversity enhancement. The detail of the CEMP would be prepared and agreed with Department for Environment Agriculture & Rural Affairs (DEARA) and Causeway Coast & Glens BC prior to commencement of construction.

Potential Construction and Decommissioning Phase Environmental Impacts

2.105 Construction is predominantly a civil engineering operation and would be phased over an approximate 18 month period. Construction of tracks and foundations would be progressive, minimising the number of simultaneously active locations and ensuring that traffic density is kept low. Erection would span approximately nine weeks toward the end of the work programme.

2.106 A programme of site reinstatement and enhancement would be put in place to minimise the visual and ecological impacts on the land, in accordance with the Outline Habitat Management Plan (Appendix 6.8).

2.107 The Development would operate for approximately 30 years and would require only limited maintenance and inspection visits.

CONSENTED (LA01/2018/0200/F)

2.108 A detailed restoration plan / Decommissioning Method Statement would be prepared and agreed with the relevant authorities towards the end of the Development's operational life.

List of Figures and Appendices

Figures

CONSENTED (LA01/2018/0200/F)

Appendices

2.1 Potential Grid Connection

CONSENTED (LA01/2018/0200/F)

3

Design Evolution & Alternatives

CONSENTED (LA01/2018/0200/F)

3 Design Evolution & Alternatives

Introduction

3.1 In this chapter a description is given of the site selection process and design strategies that have been adopted in order to arrive at the Development described in Chapter 2: Proposed Development. Firstly, the general design principles adopted by RES are outlined and potential key issues which have affected the design are identified. Thereafter, a description is given of how the turbine layout and infrastructure design has evolved in response to constraints identified through the EIA process.

3.2 Figures 3.1 – 3.3 are referenced in the text where relevant.

Current land use and site context

3.3 The location of the Development is shown in Figure 1.1: Site Location. The 'Planning Application Boundary' (red line) and 'Land Under Applicant Control' (blue line) are shown on Figure 1.2: Planning Application Boundary. The 'Land Under Applicant Control' formed the Preliminary Site Boundary, hereinafter referred to as 'the Site'.

3.4 The Site is located approximately 6 km to the northeast of Limavady in County Derry/Londonderry. The Site is positioned on a north facing slope below Keady Mountain in the south eastern part of the Binevenagh Area of Outstanding Natural Beauty (AONB). The Site is bounded by Broad Road (A37) to the north which is part of the primary road network linking the towns of Limavady and Coleraine.

3.5 The Site is currently used for rough sheep and cattle grazing and primarily comprises improved agricultural land, wet marshy grassland with areas of wet heath and blanket bog on the upper slopes. The lands are dissected by several deeply incised water channels. The Site is open and exposed to the west but is bounded to the east by Springwell Forest with further areas of coniferous forestry to the south.

Key Issues and Constraints

3.6 The design of a wind farm is optimised in order to produce a layout that maximises the use of the land available for wind power generation balanced against the overall environmental impact of the development. The optimal layout of a wind farm depends on a range of technical, economic and environmental criteria. There following are site specific factors determining the viability of a wind farm:

- Wind Speeds/Energy Yields: Sufficiently high wind speeds to ensure energy production from the wind turbines that would yield an adequate return on investment;

CONSENTED (LA01/2018/0200/F)

- Planning: A site which complies with planning policy and in particular, avoids unacceptable effects on areas that have been designated by statutory agencies; maintains appropriate distances from dwellings to avoid unduly impacting local amenity and; avoids impeding or interfering with major electromagnetic transmission and airport communication systems;
- Area of Site: A site must have sufficient area to accommodate the number of wind turbines required for economic viability;
- Access: Adequate vehicular access to a site using existing roads wherever possible to minimise the amount of civil works, particularly during the construction phase;
- Local Terrain and Topography: Terrain and topography affect wind flow across a site and need to be considered in relation to turbine performance, specification and life-span;
- Ground Conditions: A site must have suitable ground conditions for the construction of wind turbine foundations, erection of the machines and the provision of access tracks and cables.

3.7 There are additional factors which also influence the scale and viability of a wind farm including:

- Turbines must be separated by specific distances both perpendicular to, and in line with, the prevailing wind direction to minimise turbulent interaction between the wind turbines (i.e. wake effect). This needs to be considered to balance turbine performance with energy extraction, and to protect the life-span of the turbines. Spacing requirements vary between turbine manufacturers and are also subject to wind conditions;
- Wind turbines have to be located at a distance sufficiently far from occupied residential property to ensure adherence to relevant noise criteria and to ensure that shadow flicker impacts are minimised;
- The implications of locating turbines near environmentally sensitive features and areas (ecology, archaeology, hydrology etc.) need to be carefully considered; and
- Landscape and visual design considerations need to be taken into account.

3.8 The apportioning of weight to each element is a site-dependent consideration and results in bespoke design approaches and strategies for each site.

3.9 For this Development, the upland nature of the Site creates a number of sensitivities that need to be carefully addressed through appropriate design of the wind farm. The following sections identify potential issues and outline how these have been addressed through appropriate design.

3.10 The basis of the design process is the evaluation of the various constraints that have been identified through the environmental surveying that was undertaken between 2015 and 2017. The constraints identified through these surveys, along with other

CONSENTED (LA01/2018/0200/F)

technical constraints and appropriate buffers are presented in Figure 3.3: Combined Constraints and Infrastructure and are discussed in sections 3.31 – 3.49.

Potentially significant effects

3.11 Following consultation and baseline characterisation of the Site, the following key environmental issues have been identified:

- Landscape and visual
- Archaeology and cultural heritage
- Ecology
- Ornithology
- Fisheries
- Geology and the water environment
- Noise and shadow flicker
- Traffic and transport.

3.12 The issues listed above have been considered during the iterative design process with the aim of designing out significant effects. Where it is not possible to mitigate these effects through design, the issues are considered further as part of the Environmental Impact Assessment process (EIA) which is described in this Environmental Statement (ES).

Consultation

3.13 Prior to and during the production of this ES, RES and the Consultant project team consulted with various stakeholders and, where appropriate, incorporated the outcome of this into the various chapters of this ES.

3.14 Throughout the EIA process, continual scoping has occurred to ensure that the ES fully, but concisely, addresses all potentially significant issues.

3.15 A summary of the telecommunications and aviation consultations are provided in Table 3.1. Details of consultation undertaken in the preparation of each of the technical chapters of this ES (chapters 4 to 13) are presented in the relevant chapter.

CONSENTED (LA01/2018/0200/F)

Table 3.1 – Summary of Consultation

Consultee	Date of Consultation	Nature and Purpose of Consultation
OFCOM	05/12/2015	OFCOM were consulted to establish the identity of telecom infrastructure owners in the vicinity of the Development.
Atkins Global	07/12/2015 22/06/2016	Atkins Global were consulted to establish the location of any radio links they manage.
Everything Everywhere	07/12/2015 04/08/2017	EE were consulted to establish the location of any radio links they manage.
JRC	07/12/2015 24/07/17	JRC were consulted to establish the location of any radio links they manage.
Northern Ireland Water	09/02/2016 10/08/2017	Arqiva Ltd and Magdalene Ltd were consulted to establish the location of any NIW radio links they control.
Defence Infrastructure Organisation	05/12/2016	Consultation regarding any issues the DIO may have with the Development. See paragraphs 3.75 – 3.76 for further detail.
City of Derry Airport	08/06/2016	Initial Consultation regarding any issues airport may have with the Development.
City of Derry Airport	19/09/2016	Consultation regarding specific turbine layout.
City of Derry Airport	18/05/2017	Consultation regarding any issues airport may have with the Development.
City of Derry Airport	04/07/2017	CAAi Safeguarding Report received
City of Derry Airport	13/09/2017	Clarification request in relation to CAAi Safeguarding / Instrument Flight Procedure Assessment
City of Derry Airport	26/09/2017	Consultation regarding any outstanding issues airport may have with Development.

Public Consultation

3.16 RES is committed to finding effective and appropriate ways of consulting with all its stakeholders, including local residents and community organisations, and believes that the views of local people are an integral part of the development process. RES began the engagement process eight months prior to the submission of the planning

CONSENTED (LA01/2018/0200/F)

application, to facilitate a constructive consultation process which helped RES to understand and address any concerns as the project developed.

3.17 A public exhibition was held on 8th August 2017 which included detailed maps and information about the proposals, including: a map of the proposed layout; photomontages representing how the proposed layout would appear from a range of viewpoints, and; Zone of Theoretical Visibility (ZTV) diagrams. (A ZTV is a map-based diagram illustrating where and how many wind turbines, or wind farms, would theoretically be visible from all parts of a given area. The methods for preparing ZTVs and their uses within the EIA process are described in Chapter 4: Landscape and Visual Impact Assessment. RES staff where available to answer questions and feedback was encouraged.

3.18 A Pre-Application Community Consultation (PACC) Report has been produced and is available for viewing at the locations listed in Chapter 1: Introduction & Policy Context.

Alternatives

3.19 RES considers a range of potential options when selecting and designing wind farm sites. The following sections outline the broad design alternatives that have been considered in terms of the EIA Regulations.

Do-Nothing Alternative

3.20 The “do-nothing” scenario is a hypothetical alternative considered as a basis for comparing the potential significant effects of a development proposal. In the case of the Development the “do-nothing” scenario would be to have the Site continue to be managed for sheep and cattle grazing by the landowners. It is likely that current land management activities, including agricultural improvements would continue.

Alternative Sites

3.21 RES has a robust site selection methodology, using a Geographical Information System (GIS) to aid identification of potential wind farm sites.

3.22 The Development site meets the criteria listed in section 3.28 of this chapter. The GIS model was used to identify potential constraints which could restrict development, or would need to be addressed in the design process.

Alternative Layout Designs

3.23 There have been several iterations of the turbine and infrastructure layouts. From the outset the following design principles have been employed when making design decisions:

- Mitigation by design should be the principle method of reducing potential environmental impacts

CONSENTED (LA01/2018/0200/F)

- Utilisation of existing infrastructure should be implemented whenever possible to avoid unnecessary development
- All site infrastructure should be designed as efficiently as possible to reduce the overall extent of development whilst maximising the renewable energy generation potential.

3.24 A key tool in the design process is the combined constraints drawing which integrates all potential constraints that need to be considered in the design process. The finalised combined constraints map is shown as Figure 3.3.

3.25 The combined constraints drawing is iteratively updated as new information from surveys, site visits and consultation is received. The following surveys informed the combined constraints drawing:

- Breeding and wintering bird survey
- Ornithological vantage point survey
- National Vegetation Classification (NVC) Phase 2 survey
- Terrestrial fauna surveys
- Fisheries survey
- Peat probing
- Hydrology assessment
- Archaeology and cultural heritage surveys
- Landscape field survey
- Aviation
- Transport and traffic reconnaissance trip
- Technical and engineering site walkovers.

3.26 The final site layout for the Development (Figure 2.1: Infrastructure Layout) balances the need to optimise the energy yield whilst paying due regard to environmental and technical sensitivities. Wind farm design is an iterative process and is influenced by potential environmental effects identified throughout the EIA process: policy recommendations; environmental, technical, engineering and landscape design considerations; and as a result of feedback from consultees.

3.27 The following sections describe the evolution of the turbine and infrastructure layouts.

Design Evolution

Turbine Layout

3.28 There were four principle iterations of the turbine layout, shown in Figure 3.1: Turbine Layout Evolution, which were developed at the following three stages in the project process:

- Initial feasibility stage, when turbines were located based on preliminary constraints only;
- Revised Turbine Layout, prior to baseline environmental surveys being completed;

CONSENTED (LA01/2018/0200/F)

- EIA baseline data stage, when baseline surveys were complete and constraint information gathered;
- Further environmental assessment and refinement, when more detailed assessment was carried out on specific issues highlighted and final refinements were made to the layout.

Initial Feasibility Stage

3.29 At the beginning of the development process an initial layout was produced to show the maximum potential extent of the development within the space available and in accordance with the design principles, prior to baseline surveys had been completed. The layouts were informed by the following constraints:

- Preliminary watercourse buffers
- Slope
- Known private water supply locations
- 10 x rotor diameter separation from housing (900m)
- 137.5 m buffer (tip height + 10%) to public roads, in accordance with the Best Practice Guidance to PPS 18[1].

3.30 This identified that the Site could potentially accommodate 21 turbines with a 90 m rotor diameter. This initial feasibility layout was reviewed by the Landscape Consultant who advised that whilst the turbine geometry matched that of the adjacent wind farm developments the position of turbines in the south and west of the site could potentially significantly increase the visibility of the Development in these directions.

Primary Turbine Layout

3.31 At this time turbine manufacturers were starting to develop larger turbines because small increases in turbine geometry resulted in significant increases in energy production e.g. a 20% increase in tip height could increase output by 90% due to taller turbines with longer blades capturing more wind.

3.32 Using a larger turbine would require constraints to be revised to take into account the increased turbine geometry, which would reduce the developable area of the site. In addition, increased inter-turbine spacing would result in a reduction in turbine numbers.

3.33 Discussions with the Landscape Consultant suggested that a smaller number of larger turbines may in fact be beneficial but would have to be balanced against the fact that the turbine geometry would be different to that of adjacent developments.

3.34 The revised layout was informed by the original constraints with the following amendments:

- 10 x rotor diameter separation from housing (998m)

[1] Best Practice Guidance to Planning Policy Statement 18: Renewable Energy, DOE Planning & Environmental Policy Group, August 2009.

CONSENTED (LA01/2018/0200/F)

- 164.9 m buffer (tip height 149.9m + 10%) to public roads, in accordance with the Best Practice Guidance to PPS 18.

3.35 Based on the revised turbine geometry and constraints, a 14 turbine layout with 99.8 m rotor diameter could be accommodated as shown in Layout 2 of Figure 3.1.

3.36 A ZTV diagrams were prepared in order to indicate where all, or parts of, the Development were likely to be visible from. These were used primarily to assist the identification of areas with theoretical visibility and the location of Preliminary Viewpoints as part of the baseline Landscape and Visual Impact Assessment (LVIA), and later to assist in the detailed analysis of the potential visibility of the Development throughout the 30km Study Area that was used for the LVIA.

3.37 The Landscape Consultant produced comparative ZTV diagrams to compare the relative visibility of the 21 turbines with 125 m blade tip height versus 14 turbines with a 149.9 m blade tip height. This showed that smaller number of taller turbines would result in a theoretical visibility of 58.18% across the study area, whereas the original 21 turbine layout would result in theoretical visibility of 58.8% a percentage which would not be discernible in practice (See Figure 4.11 – 4.14)

3.38 Provisional wirelines were also prepared for turbines with 125 m initially and subsequently at 149.9 m tip heights and it was established by the Landscape Consultant that the landscape and visual effects of using the taller turbines rather than the shorter ones would be negligible and in fact using fewer taller turbines would be preferable to a greater number of smaller turbines. From all the identified viewpoints the increase in turbine height did not equate to a significant or discernible increase in the levels of visibility of the Development although it was recognised that refinements had the potential to create a more balanced layout from key views.

Revised Turbine Layout

Combined Constraints

3.39 Based on the previous stage it was determined that a smaller number of larger turbines could be accommodated but amendments would be required to create a balanced layout.

3.40 To ensure that all requirements were captured a combination of desktop and site based surveys were undertaken to refine constraints. Detailed environmental and technical surveys were carried out to characterise the baseline environmental conditions on the Site and associated study areas, as described in more detail in chapters 4 to 13 of this ES. Any constraints to development resulting from the baseline surveys were used to build up the combined constraints drawing.

Landscape & Visual

3.41 As mentioned above a Landscape Consultant was involved throughout the design process to provide advice regarding the scale of the Development and turbine heights.

CONSENTED (LA01/2018/0200/F)

3.42 Provisional Viewpoints were analysed as part of the LVIA and the cultural heritage assessment (Chapter 5) to identify potentially significant effects that might result from the turbine layout, as well as from the effects of the wind farm as a whole. The Provisional Viewpoint locations were discussed with the Planning Department of Causeway Coast & Glens BC and Department of Communities: Historic Environment Division, (DfC:HED) respectively prior to the selection of a final list of Viewpoints that are presented and analysed in detail in Chapters 4: Landscape & Visual and Chapter 5: Archaeology & Cultural Heritage.

Aviation

3.43 Wind turbines can potentially interfere with aviation operators by either physically affecting the safeguarding of an aerodrome by the close proximity of the turbines or through interference with the Air Traffic Control (ATC) radars that direct aircraft in flight. RES consulted with all relevant organisations which could be affected by the Development.

3.44 NATS En Route (NERL) supplies air traffic service to all En Route aircraft navigating UK airspace. RES has consulted the published NATS safe-assessment maps which have been produced to indicate if a wind farm development will impact NERL infrastructure. The Development lies outside the safeguarding areas which identify need for further consultation with NERL and therefore the Development will have no impact on NERL infrastructure.

3.45 The Defence Infrastructure Organisation (DIO) consultation response stated that in the interests of air safety, the Ministry of Defence (MOD) requests that the structure is fitted with aviation warning lighting. The mast should be fitted with a minimum intensity 25 candela omni-directional, flashing, red light or equivalent infra-red light fitted at the highest practicable point of the structure. The Development will incorporate infrared lighting on the turbines in a pattern that is acceptable to the MOD for aviation visibility purposes. Infrared lighting allows military aircraft with night vision capability to detect and avoid wind farms. Infrared lighting cannot be detected with the naked eye, thereby reducing visual impact.

3.46 DIO Safeguarding further requested that, as a condition of any planning permission granted, the Applicant must notify UK DVOF & Powerlines at the Defence Geographic Centre with the following information prior to development commencing: Precise location of development; Date of commencement of construction; Date of completion of construction; The height above ground level of the tallest structure; The maximum extension height of any construction equipment; Details of aviation warning lighting fitted to the structure(s).

3.47 As detailed above in Table 3.1, pre-submission consultation was undertaken with airports located within 50 km of the Development. The only airport is the City of Derry Airport (CODA).

CONSENTED (LA01/2018/0200/F)

3.48 CODA is located over 10 nautical miles to the southwest of the Development. Initial assessments based on published aviation charts revealed approach procedures commenced at 2500ft within 5 nautical miles of the airport. In addition a 1000ft of vertical separation would be required from the highest point of the turbines (blade tip in vertical position) resulting in a 1500ft limit above ordnance datum (AOD) which turbines would breach CODA's safeguarding distances.

Vegetation

3.49 The principal habitat types found on the site are extensive areas of purple moor-grass and rush pasture within a mosaic with semi-improved grassland, wet heath and poor fen.

3.50 The lower slopes are enclosed by a fence line that runs broadly west to east and contains extensive linear drainage, overgrazing by sheep and cattle, and historic peat harvesting. To the south of this fenceline there areas of upland blanket bog was present with best examples of this habitat located on the plateau of the site. As this habitat is of greatest conservation value on site, it was considered that these that these areas should be avoided in their entirety as recommended by the ecology consultant.

3.51 A 50 m buffer was applied to Ground Water Dependent Terrestrial Ecosystems (GWDTEs) identified through the baseline survey.

3.52 Baseline peat probing indicated that peat depths were predominantly shallow (>80% probes were between 0.0 – 0.5m deep) and areas of peat depth greater than 2 m were avoided to limit excavation and spoil generation.

Terrestrial Fauna

3.53 A 25 m buffer was applied to badger setts identified through the baseline survey.

3.54 Bat buffers of 36 m and 65 m were added to major watercourses forestry edge respectively, as advised by the ecological consultant. The 36 m and 65 m distances are in plan, and achieves a 50 m buffer between the blade tip and the habitat feature, in line with Bat Conservation Trust guidance. This is based on a blade length of 49.9 m and a hub height of 100 m.

3.55 Locations of devils bit scabious, the main food plant of the marsh fritillary butterfly were mapped and avoided.

Water Environment and Fisheries

3.56 The hydrology consultant recommended watercourse buffers of 50 m and 10 m depending on the catchment size of the watercourse, which were agreed as appropriate by the fisheries consultant.

Public Roads and Walking routes

3.57 165 m buffers were applied to nearby public roads in line with the Best Practice Guidance to PPS18 which recommends a setback distance of at least tip height plus 10% between turbines and roads.

CONSENTED (LA01/2018/0200/F)

Revised Turbine Layout

3.58 As a result of the aviation, ecology and landscape assessments mentioned above the following changes were proposed for the turbine layout:

- T1,T2,T3,T4 & T7 to be omitted;
- T5, T6, T8, T9 & T10 to be moved north and downslope

3.59 Figure 3.1: Turbine Layout Evolution illustrates Layout 3 which consists of 9 turbines of 149.9 m tip height. In discussions with the various consultants it was determined that further detailed site surveys would be required to determine if any further refinements were required to the Turbine Layout.

Finalising Turbine Layout – EIA Baseline Stage

3.60 Prior to detailed site assessments being undertaken by external consultants, RES technical analysts undertook site visits to check that there were no physical characteristics on site that may impact upon the turbine performance such as topography and the proximity and height of forestry in relation to the turbines. It was considered that moving T11 west would increase the buffer distance from forestry which would be beneficial to turbine performance.

3.61 RES engineering and construction undertook site visits with ecological and geology/hydrology consultants to review the turbine locations and to agree principles for the design of the onsite infrastructure based on the constraints determined to date. It was considered that T12 would benefit from moving further east onto a rocky knoll that was easily accessed from existing farm track to the east. Co-ordinates of the optimum location for T12 from an engineering and construction perspective were recorded.

Final Turbine Layout

3.62 Technical analysts reviewed the proposed changes to both T11 and T12. To maximise efficiency of turbines it is critical that they are positioned appropriate distances relative to each other and necessitated the following changes:

- T12 moved south east (engineering);
- T11 moved west (forestry);
- T14 moved southwest (separation distance between T12 & T14)
- T13 moved northwest (separation distance between T11 & T13).

3.63 Using design principles agreed with environmental, engineering and technical disciplines, the infrastructure layout was developed and used to undertake baseline assessments. The revised turbine layout is illustrated in Layout 4 – Figure 3.1 with turbines renumbered to reflect how turbines would be reached when travelling along the infrastructure. The turbine numbers were revised as follows:

- T5 – T1

CONSENTED (LA01/2018/0200/F)

- T6 – T2
- T8 – T3
- T9 – T4
- T10- T5
- T12- T6
- T14- T7
- T11- T8
- T13- T9

3.64 A 50 m micrositing radius was applied to each of the turbines. The extent of this was then reduced such that the micrositing avoids any of the combined constraints. The final micrositing areas are included in Figure 2.1: Infrastructure Layout.

Infrastructure Design Evolution

3.65 The infrastructure design has evolved through the EIA process as illustrated in Figure 3.2: Infrastructure Design Evolution, Designs 1 to 2.

Engineering considerations

3.66 The following general principles were taken into consideration when designing the supporting infrastructure:

- Avoidance of environmental and technical constraints (as shown in Figure 3.3)
- Design of the track layout to follow natural contours as far as possible, in order to avoid unnecessary amounts of excavation and reduce adverse hydrological impacts using the following methods:
  - Maximise the use of existing track locations via upgrades;
  - Minimisation of the overall length of access track;
- Minimisation of the number of watercourse crossings, as far as possible
- Avoidance of steep slope areas to minimise earthworks
- Incorporation of measures to improve the visual appearance of the scheme, including reinstatement of temporary infrastructure following the construction period;
- Located the control room building / energy storage facility in close proximity to existing buildings on site.

3.67 Key adjustments in response to constraints made through the design evolution are summarised in the following sections.

Vegetation

3.68 Following the advice of the ecologist a number of refinements were made to the track layout in order to minimise impacts to wet heath habitats, including the following:

CONSENTED (LA01/2018/0200/F)

- Realignment of access track from site entrance to maximize use of existing farm track locations;
- Realignment of the track to T5 (final T5 position) to maximize the use of existing tracks;
- Realignment of the T5 crane pad and associated to minimize the extent of access track adjacent 50m watercourse buffer;
- Repositioning and alignment of track between T5 and T6 to maximize use of existing farm track locations;
- Reduction of crane pads from 40m x 30m to 40m to 20m to reduce the extent of infrastructure;
- Moving turning head at T6 to increase distance from Ground Water Dependents Terrestrial Ecosystems (GWDTEs) located upslope;
- Combining turning heads with areas of temporary crane hardstanding to reduce the extent of infrastructure.

Water Environment

3.69 The location and nature of watercourse crossings were reviewed with the hydrology and fisheries consultants. Following the mitigation detailed in Chapter 8: Fisheries and Chapter 9: Geology & Water Environment, bottomless culverts will be installed at two locations.

3.70 A number of refinements were made between Designs 1 and 2 to avoid and reduce potential effects as far as possible, including the following:

- T1 Crane pad flipped laterally to minimize the avoid watercourse buffer;
- Realignment of the T5 crane pad to minimize the extent of access track adjacent to watercourse buffer;
- Reduction of crane pads from 40m x 30m to 40m to 20m increased distance from adjacent watercourses.

Site Entrance Location

3.71 Is located at an existing farm access onto the A37, which is closely associated with an unoccupied building and associated agricultural enclosures. The existing access will be upgraded to provide suitable access. DfI Roads advised that 215m splays would be required, which are readily achievable in both directions.

CONSENTED (LA01/2018/0200/F)

Control Building and Substation

3.72 The buildings will be centrally located on the lower elevations of the site below all turbine locations, which will allow ease of access from both the public road network and turbine locations. The building will be orientated to be accessed from the north.

3.73 The control building and substation compound was moved further north to be more closely related to the existing farm building and associated enclosures to avoid being prominent in key long range views, as identified by of the viewpoints in the LVIA. Moving the substation further north utilises shallower gradient to minimise excavation and respects existing field boundaries. The substation is located out with the identified environmental constraints.

3.74 The buildings will be traditional in nature with rendered walls and tiled roofs, common characteristics of many rural buildings. The appearance of the buildings has been selected to reflect the rural character of the area to maximise the integration of the buildings within the wider landscape.

Temporary Construction Compound / Energy Storage

3.75 The temporary construction compound is required to be located close to the site entrance and turbine locations for logistical reasons. Through the course of the design evolution the location of the temporary construction compound was moved north to a flatter area of ground in order to reduce excavation and spoil generation, whilst remaining outside environmental constraints.

3.76 Energy storage containers will utilise the northern portion of the temporary construction compound on a permanent basis with the remainder of the temporary construction compound being removed and returned to farmland.

Final Infrastructure Layout

3.77 The final infrastructure layout is shown in Design 2 of Figure 3.2: Infrastructure Design Evolution. Once finalised, the Planning Application Boundary was redrawn, ensuring sufficient space within the boundary for all features including SUDS.

3.78 The final infrastructure layout and combined constraints is shown in Figure 3.3: Combined Constraints & Infrastructure.

Residual Design Considerations

Electromagnetic Interference / TV

3.79 Wind turbines can potentially interfere with communication systems that use electromagnetic waves as the transmission medium (e.g. television, radio or microwave links). Wind turbines therefore may cause interference to television reception in the proximity of a wind farm, primarily for receptors in the ‘shadow’ of the turbines with aerials pointing through the wind farm, causing loss of

CONSENTED (LA01/2018/0200/F)

picture detail, loss of colour or loss of audio. Microwave links can also be affected by the reflection, scattering, diffracting and blocking of the electromagnetic signal caused by wind turbines.

3.80 If the Development is consented, RES would agree a scheme of assessment and mitigation with Causeway Coast & Glens BC to be implemented in the case of complaints associated with television reception. Should interference to reception occur as a result of the Development, a range of viable mitigation measures can be considered, with the most suitable method chosen on a case by case basis. Any necessary work would be undertaken in a timely manner following receipt of a valid complaint, and would be funded by the wind farm operator.

3.81 RES has consulted with all organisations operating microwave links which could be affected by the Development and these are listed in Table 3.1 above. No existing links cross the Site and as such there will be no interference experienced.

Aviation

3.82 Based on published aviation procedures the revised 9 turbine layout does not breach airport safeguarding distances. Following further consultation with CODA it became apparent that there is a Low Holding Area (2300ft) that is used on occasion and RES are continuing to liaise with CODA to determine what if any measures may be required to ensure that the airport's operations are not negatively affected.

Ice Throw

3.83 Under certain climatic conditions, ice can build up on turbine blades which may be thrown from the blades during blade rotation or fall when blades are stationary.

3.84 The International Energy Association (IEA) has recommended an empirical formula to calculate the maximum distance that ice may be thrown from an operating turbine based on turbine geometry. For the proposed turbine envelope this ice throw risk distance has been calculated and used in the wind farm design to locate turbines away from public roads and therefore the potential for ice throw to affect members of the public is considered to be low.

Summary

3.85 The final layout of the Development reflects the need to optimise the energy yield whilst minimising potential effects on environmental sensitivities. Wind farm design is an iterative process and the design has been influenced by potential environmental effects identified through the EIA process. The proposed layout has evolved in response to policy recommendations, environmental, technical, engineering and landscape and visual design considerations and as a result of feedback from key consultees.

CONSENTED (LA01/2018/0200/F)

List of Figures

CONSENTED (LA01/2018/0200/F)

4

Landscape & Visual

CONSENTED (LA01/2018/0200/F)

4 Landscape and Visual Impact Assessment

Executive Summary

The Purpose of this Chapter

4.1 This chapter is a Landscape and Visual Impact Assessment (LVIA) of the proposed Dunbeg South Wind Farm (hereinafter referred to as the Development). An LVIA is a formal part of the Environmental Impact Assessment (EIA) process and the methodology used to prepare this chapter is defined by the requirements of the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 (hereinafter referred to as the EIA Regulations.) and best practice guidance publications relating both to the LVIA process in general and in specific relation to wind farm developments (refer to Technical Appendix 4.1 for further details).

4.2 The Development comprises 9 turbines with rotor diameters of 99.8 m, hub heights of 100 m and overall heights to blade tip of 149.9 m. It is located on the north-facing side of Keady Mountain approximately 6 km to the north east of Limavady, County Derry. The Study Area for this LVIA covers an area that extends to a 30 km radius from the Development and is further described in paragraph 4.74).

4.3 The objectives of an LVIA are to:

- Present an objective analysis of the landscape and visual character of a defined area (i.e. the '*baseline conditions*' within the '*Study Area*' for this LVIA) in so far as they relate to the Development;
- Identify the potential effects of the Development on these baseline conditions including direct, indirect, permanent, temporary and cumulative effects;
- Clearly distinguish between *landscape effects* – the effects on the physical landscape as a resource in its own right – and *visual effects* – the effects on specific views and general visual amenity as experienced by people;
- Propose appropriate mitigation measures to address likely significant effects, where possible, and to assess any residual effects that remain following the implementation of these measures;
- Present all information clearly and objectively with a well-reasoned methodology that is in accordance with best practice guidance and in a manner that will inform the decision making process.

Statement of Authority

4.4 This LVIA has been prepared by Shanti McAllister Landscape Planning & Design on behalf of the applicant, RES Ltd (hereinafter referred to as RES). Shanti McAllister is an independent consultant and Chartered Landscape Architect with over 16 years'

CONSENTED (LA01/2018/0200/F)

experience of preparing LVIAs for major development proposals including a large number of wind farms in Northern Ireland. She is familiar with the site and Study Area from her work on a number of other wind farms in the Study Area, including the existing Dunbeg Wind Farm and the consented Dunbeg Extension Wind Farm.

4.5 All information presented in this LVIA has been prepared in accordance with a methodology that is derived from a suite of best practice guidance (see Technical Appendix 4.1). A summary of the LVIA process and the key elements of this methodology are provided at paragraph 4.14 and are described in full detail in Technical Appendix 4.2. The identification and objective analysis of the landscape and visual effects of the Development is made using professional expertise and impartial judgement. The conclusions of the LVIA are based on whether or not the Development is likely to result in significant effects on landscape and visual elements of the Study Area.

Feasibility Appraisal and Design Iterations

4.6 The Development that is being assessed in this LVIA has evolved through an iterative design process that has been informed by a careful analysis of the constraints and opportunities presented by the site location and the characteristics of the Development itself. A number of potential turbine layouts and dimensions were considered in order to refine the layout and its potential landscape and visual effects on the Study Area. This included the consideration of variable turbine heights, number of turbines, and their locations on site in order to minimise visibility on the summit of Keady Mountain and to create a good visual relationship between the Development and existing and consented wind farms in the adjacent Dunbeg cluster and cumulative wind farms in the wider Study Area. The 9-turbine option that is presented in the EIA is the result of this iterative design process which is described in detail from paragraph 4.42. A series of comparative diagrams have been prepared to accompany the LVIA (Figures 4.11 – 14).

Establishing Baseline Conditions and Analysing Effects

4.7 The Baseline Assessment has considered statutory landscape designations that are contained within current planning policy in Northern Ireland and which cover the Study Area. The primary policy guidance on the assessment of landscape and visual effects of wind farm development is the Strategic Planning Policy Statement for Northern Ireland (SPPS) which should be read in conjunction with PPS 18 and its Supplementary Planning Guidance (SPG) (refer to paragraph 4.64). In addition there are a number of guidance documents and Development Plans, which contain relevant statutory planning designations for the Study Area. These documents are analysed in the Baseline Assessment where applicable. It is noted that Northern Ireland's planning system was recently re-structured. Further changes in planning policy and updates to development plans are expected to take place over the next few months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by the SPPS and emerging Local

CONSENTED (LA01/2018/0200/F)

Development Plans. For the time being, Causeway Coast and Glens Borough Council have published a number of topic papers to guide their emerging Development Plan and these have been taken into account in this LVIA as an indication of the likely priorities for future planning policy in this Study Area.

Viewpoint Selection Process and Consultation with the Local Planning Authority

4.8 A desk-based analysis identified potential parts of the Study Area and visual receptors that should be considered in the search for Provisional Viewpoint locations (PVPs). This included:

- PVPs at the Giant's Causeway World Heritage site and the three Areas of Outstanding Natural Beauty (AONBs) within the Study Area because these are the primary statutory designated landscapes;
- Locations where the Development would be seen in the wider context of the Binevenagh range of uplands were also deemed to be important because the Development is located within the Binevenagh AONB;
- PVPs along routes that are used by tourists and visitors to appreciate the landscape such as scenic driving routes, footpaths and cycle routes;
- Rural residential properties and settlements;
- Viewpoint locations that have previously been used for the assessment of landscape and visual effects of the Dunbeg cluster of wind farms which are located in proximity to the Development. Inclusion of such viewpoints allows the additional effects of the Development on this cluster of existing, consented and proposed wind farms to be compared with previous LVIAs.

4.9 Using this search criteria, 51 PVPs were identified and analysed through the production of a preliminary Zone of Theoretical Visibility diagram (ZTV – refer to Technical Appendix 4.2, starting at paragraph 4.20), preliminary wirelines and map-based research. Twenty eight of these PVPs were used in the previous Dunbeg, Dunbeg Extension or Dunmore Wind Farm LVIAs. A proposed shortlist of 22 viewpoints was provided to the Council's planning department for their comment and approval. For ease of analysis, and to ensure that they would also represent the characteristics of the wider Study Area, these shortlisted viewpoints were categorised as follows:

A. Views from primary and secondary routes, including tourist areas within approximately 5 km;
B. Views representing residential properties within approximately 5 km;
C. Viewpoint locations within 5 - 15 km including the urban areas and environs of Coleraine and Limavady, rural properties, tourist routes and primary and secondary roads;
D. Views illustrating landscape context and setting from the outer parts of the Study Area including the Giant's Causeway and Inishowen.

CONSENTED (LA01/2018/0200/F)

4.10 The Council responded with broad agreement to the proposed shortlist but requested a further 7 locations that they felt were pertinent to the LVIA and which would address their increased emphasis on the need to assess the visual effects on close-range viewpoints and/ or visual effects beyond those identified in previous LVIA submissions for neighbouring wind farms. The Council also requested the omission of two long range viewpoints located at the Giant's Causeway World Heritage Site and the A6 road corridor near Dungiven and the Sperrins AONB which they felt to be unnecessary in making an assessment of significant landscape and visual effects.

4.11 Thus a total of 27 final viewpoints have been selected for consideration in this LVIA as a result of the viewpoint selection process. A detailed description of this process and a full list of PVPs are provided in Technical Appendix 4.4. The locations of PVPs and final viewpoints are shown on Figure 4.4. Detailed descriptions of the final viewpoints are an integral part of the Visual Impact Assessment section of the LVIA (starting at paragraph 4.127). The locations of final viewpoints are indicated on all map-based Figures (Figures 4.1 – 4.11) and visualisations to accompany the detailed written analysis of these Viewpoints are provided in Figures 4.15 – 4.41.

Overall Significance of Landscape and Visual Effects

4.12 The overall conclusion is that the Development's location within the same part of the landscape as the Dunbeg cluster, and the other strong human factors that currently influence this landscape mean that there would be No Significant landscape effects resulting from the Development.

4.13 The Development is generally deemed to have No Significant effects on visual character for similar reasons. Wind energy development is a prominent visual element in all parts of the Study Area and the Development would have a negligible incremental effect on the manner in which wind energy development is perceived generally across the Study Area. Of the 27 viewpoints that have been analysed, only three were deemed to experience a significant visual effect resulting from the Development (Viewpoints 3, 10 and 14), and only Viewpoint 14 is also deemed to experience significant cumulative effects. In respect of Viewpoint 14 cumulative visual effects would occur in relation to a tertiary road in close proximity to the Development where the primary visual receptors would be residents of properties on this road and where views of the existing Dunbeg cluster are screened from view by woodland along the Curly River corridor. This level of effect would be limited to the area in immediate proximity to this Viewpoint and would not be experienced from other roads in the area. All policy documents (the SPPS, PPS 18 and its best practice and supplementary guidance) recognise that wind farms may be prominent elements in close range views but that this does not necessarily equate to unacceptable development. Taking into account that only three of the 27 viewpoints assessed as part of the LVIA are deemed to experience significant effects, and that no significant landscape effects have been identified, the LVIA concludes that the Development is acceptable in landscape and visual terms.

CONSENTED (LA01/2018/0200/F)

Summary of the Methodology for this Landscape and Visual Impact Assessment

Best Practice Guidance

4.14 An LVIA is a formal assessment, which is carried out as part of the EIA, a process defined by the EIA Regulations. In accordance with these Regulations the LVIA takes an objective approach to the identification of the baseline conditions within an appropriate 'Study Area'. In this instance the Study Area extends to a 30 km radius from the Development.

4.15 The LVIA methodology used for this Development has been developed by the author in accordance with the Regulations and the suite of available best practice guidance on the preparation of LVIAs in both general terms and specifically in relation to wind energy development. The latter is published by Scottish Natural Heritage and has been adapted by the author to suit the Northern Ireland context. A full list of this best practice guidance is provided in Technical Appendix 4.1 and a detailed description of the Methodology is provided in Technical Appendix 4.2.

4.16 This LVIA must be read in conjunction with these Technical Appendices in order to be properly understood. The criteria used to identify and analyse both the nature of landscape and visual receptors (their 'Sensitivity'), the nature of landscape and visual effects ('Magnitude') and the Signficance of these effects are all key LVIA terms which are defined in the Methodology.

The LVIA Process

4.17 The LVIA begins with an assessment of baseline conditions combining existing desktop information, such as maps and documents, with site surveys of the Study Area by an experienced Landscape Architect. A review of relevant planning policies is carried out in order to identify any elements or parts of the Study Area which are recognised for their landscape or visual qualities and any locations that may have been identified by the SPG as being more or less suitable for wind energy development. It also evaluates likely levels of acceptable change for various parts of the Study Area in accordance with current definitions of landscape and visual sensitivity which are contained within planning policy documents (see paragraph 4.51).

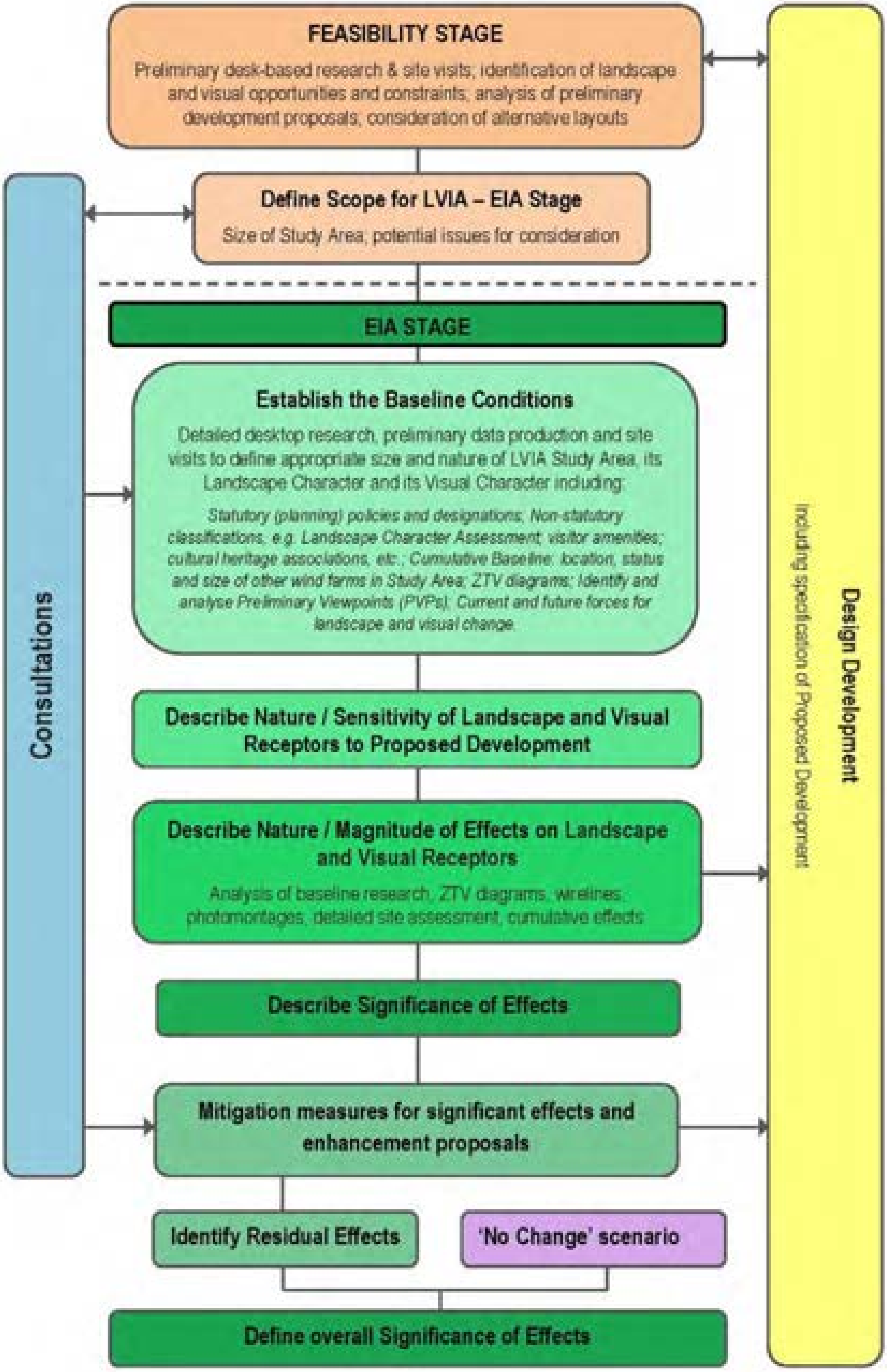
4.18 Potential landscape and visual effects on the baseline conditions are then assessed as separate but linked issues. Both require a combination of quantitative and qualitative evaluation. The magnitude of landscape effects is derived from the extent to which physical changes resulting from the Development would cause changes in landscape character and value. Visual effects relate to changes in the composition of views and people's perception of/responses to these physical changes.

CONSENTED (LA01/2018/0200/F)

4.19 For both landscape and visual effects the Significance of effect is derived from the assessment of Landscape Value, Sensitivity and Magnitude of change and also by using objective professional judgement in relation to site circumstances. It is important to recognise that the landscape is constantly evolving and that opinions on the beneficial or adverse effects of wind farms are highly subjective. Therefore, in order to ensure the that the LVIA presents information objectively, whilst a judgement is made on the significance of effects, no judgement is made on whether these effects are beneficial or adverse.

CONSENTED (LA01/2018/0200/F)

Plate 4.1: The LVIA Process



CONSENTED (LA01/2018/0200/F)

Key LVIA Terminology and Assessment Criteria

4.20 The following terms and assessment criteria form the basis for the LVIA. They are fully described in Technical Appendix 4.2 and summarised below.

The Nature of Landscape and Visual Receptors

4.21 The baseline assessment element of the LVIA gathers information on the 'nature' of landscape and visual receptors which is then correlated with the nature of the Development and its anticipated 'effects' on these receptors in order to draw conclusions on the 'significance' of these effects.

4.22 This LVIA uses the term 'Landscape Sensitivity' to refer to the overall nature of landscape receptors (refer to the landscape attributes described in Technical Appendix 4.2, paragraph 4.18) and their susceptibility to the changes caused specifically by the Development.

4.23 The consideration of key landscape attributes enables a considered judgement to be made on the level of Sensitivity to be apportioned to each defined LCA within the Study Area specifically related to the Development. The following criteria outline the general principles that are used to inform and guide the assessment of Landscape Sensitivity:

- *High Landscape Sensitivity:* A landscape where the majority of attributes are unlikely to withstand change without causing a change to overall landscape character to the extent that it would be difficult or impossible to restore. The frequency and sensitivity of receptors may be high but not exclusively so;
- *Medium Landscape Sensitivity:* A landscape with a combination of attributes that is capable of absorbing some degree of change without affecting overall landscape character. There are unlikely to be large numbers of sensitive receptors;
- *Low Landscape Sensitivity:* A landscape where the majority of attributes are robust and/ or tolerant of change to the extent that change or development would have little or no effect on overall landscape character. It is likely to be easily restored and the frequency and sensitivity of receptors may be Low but not exclusively so.

4.24 Visual effects relate to changes in the composition of views and people's responses to these changes. The nature of visual receptors is determined through the analysis of ZTV diagrams, site assessment and viewpoints representing both typically occurring views within the Study Area and views from specific locations or those likely to be experienced by specific visual receptors (for example, visitors to a specific site such as the Giant's Causeway). 'Visual Sensitivity' refers to the overall nature of views and viewers (visual receptors) and their likely sensitivity to the changes in views that would be caused specifically by the Development. The

CONSENTED (LA01/2018/0200/F)

following criteria outline the general principles that are used to inform and guide the assessment of Visual Sensitivity:

- *High Visual Sensitivity*: may typically include residents of properties where the main view is orientated towards the Development, or people undertaking recreation where the landscape within which the Development is seen is the primary reason for attraction (e.g. walkers, cyclist and drivers on scenic routes). Receptors are more likely to be within a designated landscape and could be attracted to visit more frequently, or stay for longer, by virtue of the view;
- *Medium Visual Sensitivity*: may typically involve people undertaking active recreational pursuits where the wider landscape within which the Development is not seen as the primary reason for attraction (e.g. golf, water sports, theme and adventure parks, historic sites, parks and gardens). Receptors are less likely to be within a designated landscape and could be attracted to visit more frequently or stay for longer by virtue of the facilities and features of the particular attraction rather than by the value of the view;
- *Low Visual Sensitivity*: may typically include vehicular travellers; outdoor workers (e.g. farm and forestry workers); people in indoor workplaces and community facilities; and residents within larger settlements. Receptors are unlikely to be within a designated landscape and are most likely to be present at a given viewpoint by virtue of some other need or necessity unrelated to the appreciation of the landscape or visual value.

The Nature of Landscape and Visual Effects

4.25 This LVIA uses the term 'Magnitude' to cover assessment of the degree of change that would result from the introduction of the Development into the baseline landscape and visual context.

4.26 The nature of landscape effects is dependent on the degree of change that would result from the introduction of the Development in terms of size or scale, geographical extent, duration and reversibility of the proposed change and whether the effects would be experienced directly or indirectly (refer to Technical Appendix 4.2 paragraph 4.28 for further detail). The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of landscape effects:

- *High Landscape Magnitude*: The Development would be immediately apparent and would result in substantial loss or major alteration to key elements of landscape character to the extent that there is a fundamental and permanent, or long-term, change to landscape character. The change may occur over an extensive area;

CONSENTED (LA01/2018/0200/F)

- *Medium Landscape Magnitude*: The Development would be apparent in the view and would result in loss or alteration to key elements of landscape character to the extent that there is a partial long-term change to landscape character. The change may occur over a limited area;
- *Low Landscape Magnitude*: The Development would result in minor loss or alteration to key elements of landscape character to the extent that there may be some slight perception of change to landscape character. The change may be temporary and occur over a limited area;
- *Negligible Landscape Magnitude*: The Development would result in such a minor loss or alteration to key elements of landscape character that there would be no fundamental change.

4.27 The nature of visual effects is dependent on factors including, for example, the prominence of the Development with the view in question; the number of turbines that would be visible and the geographical extent of turbines across the whole view; the angle and relative elevation of the viewpoint in relation to the Development; and the context within which the Development will be seen (refer to Technical Appendix 4.2 paragraph 4.36 for further detail). The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of visual effects:

- *High Visual Magnitude*: The Development would be a dominant and immediately apparent feature that would affect and change the overall character of the view and to which other features would become subordinate;
- *Medium Visual Magnitude*: The Development would form a visible and recognisable new element within the overall view and would be readily noticed without changing the overall nature of the view;
- *Low Visual Magnitude*: The Development would form a component of the wider view that might be missed by the casual observer. Awareness of the Development would not have a marked effect on the overall quality of the view;
- *Negligible Visual Magnitude*: The Development would be barely perceptible, or imperceptible, and would have no marked effect on the overall quality of the view.

The Significance of Landscape and Visual Effects

4.28 The EIA Regulations require the LVIA to identify and assess the acceptability of significant effects. Best practice guidance recognises that the significance of effects is not absolute and is related specifically to the Development. It is also dependent on the relationship between sensitivity and magnitude.

4.29 This LVIA uses the following criteria to inform and guide the assessment of the Significance of Landscape Effects:

CONSENTED (LA01/2018/0200/F)

- *Significant Landscape Effects:* Effects that would occur when the majority of landscape attributes are deemed to be highly sensitive and the magnitude of change would alter landscape character to the extent that it would become defined, or considerably influenced, by the presence of the Development;
- *No Significant Landscape Effects*: Effects would not be significant when the majority of landscape attributes are not deemed to be highly sensitive and where the Development would have little, or no, effect on existing landscape character. This would also occur where the Development can be integrated into the existing Study Area without the loss of key landscape attributes landscape effects. Where the Development is easily noticeable but the number and sensitivity of landscape attributes decreases, so landscape character will become less defined by the Development and more so by other landscape attributes.

4.30 This LVIA uses the following criteria to inform and guide the assessment of the Significance of Visual Effects:

- *Significant Visual Effects*: Effects that would occur when the majority of visual receptors are deemed to be highly sensitive and the magnitude of change would alter visual character to the extent that it would become defined, or considerably influenced, by the presence of the Development;
- *No Significant Visual Effects*: Such effects would occur when the majority of visual receptors are not deemed to be highly sensitive and where the Development would have little or no effect on existing views. The Development would be likely to constitute a minor component of the wider view, which might be missed by the casual observer, and awareness of the Development would not have a marked effect on the overall quality of the view. Where the Development is easily noticeable but the number and sensitivity of visual receptors decreases, so overall visual character will remain less defined by the Development and more so by other elements of the existing view.

Cumulative Landscape and Visual Effects

4.31 The purpose of the cumulative impact assessment is to measure the incremental effect of the Development on the Cumulative Baseline rather than to assess the combined effects of all, or some, of the Cumulative Baseline with the Development[1]. The magnitude of cumulative change is dependent on a number of factors, including the presence of other wind farms and the degree to which these already influence landscape and visual character and the distance between the Development and other wind farms (see Technical Appendix 4.2, paragraphs 4.60 and 4.65 for further detail).

[1] Scottish Natural Heritage (March 2012), 'Assessing the Cumulative Impacts of Onshore Wind Energy Development s' paragraphs 7 and 55, paraphrased from the GLVIA para 7.12

CONSENTED (LA01/2018/0200/F)

4.32 The Development is closely related to a cluster of existing, consented and proposed wind farms at Dunbeg and Dunmore and these are considered as an integral part of the assessment of landscape and visual effects, particularly the analysis of effects on viewpoints for this LVIA. The cumulative effects of the Development when considered with other wind farms and wind farm clusters in the cumulative baseline, are assessed from paragraph 4.203.

4.33 Cumulative landscape effects relate to the incremental degree of change to the existing landscape character or physical fabric of the Study Area that would result from the introduction of the Development over and above that of the Cumulative Baseline. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of Cumulative Landscape Effects:

- *High Cumulative Landscape Magnitude*: The introduction of the Development to the Cumulative Baseline would be immediately apparent and would result in substantial incremental loss of, or major alteration to, key elements of landscape character to the extent that there would be a fundamental and permanent, or long-term, change to landscape character. The change may occur over an extensive area;
- *Medium Cumulative Landscape Magnitude*: The introduction of the Development to the Cumulative Baseline would be immediately apparent and would result in the incremental loss of, or alteration to, key elements of landscape character to the extent that there would be a partial long-term change to landscape character. The change may occur over a limited area;
- *Low Cumulative Landscape Magnitude*: The introduction of the Development to the Cumulative Baseline would result in minor incremental loss of, or alteration to, key elements of landscape character to the extent that there may be some slight perception of change to landscape character. The change may be temporary and occur over a limited area;
- *Negligible Cumulative Landscape Magnitude*: The introduction of the Development to the Cumulative Baseline would result in such a minor incremental loss of, or alteration to, key elements of landscape character that there would be no fundamental change to landscape character.

4.34 The significance of cumulative landscape effects is dependent on landscape sensitivity, the magnitude of cumulative change, and the relationship between these two factors. The following criteria outline the general principles that are used to inform and guide the assessment of the Significance of cumulative landscape effects:

- *Significant Cumulative Landscape Effects*: Effects that would occur when the majority of landscape attributes are deemed to be highly sensitive and the incremental effects of the Development would alter landscape character to the extent that it would become defined or

CONSENTED (LA01/2018/0200/F)

considerably influenced by the presence of wind farms, taking account of Cumulative Baseline conditions;

- *No Significant Cumulative Landscape Effects:* Such effects would occur when the majority of landscape attributes are not deemed to be highly sensitive and where the Development would have little or no incremental effect on the existing landscape character. Where the Development can be integrated into the existing Cumulative Baseline, without the loss of key landscape attributes, cumulative landscape effects would also be deemed as Not Significant. This level of significance would also occur where the Development is easily noticeable but its incremental effects would not cause the landscape character to become more defined by wind farms than it currently is, or to become more defined by wind farms than by other landscape attributes

4.35 Cumulative visual effects relate to the degree to which wind energy developments feature in particular views or sequences of views, and the resulting effects of this upon visual receptors. This LVIA considers simultaneous and sequential cumulative visual effects that may arise within the Study Area and in relation to the selected viewpoints. The LVIA principally considers the degree to which the Development would contribute to wind energy development becoming a significant or defining characteristic of visual character. The following criteria outline the general principles that are used to inform and guide the assessment of the Magnitude of cumulative visual effects:

- *High Cumulative Visual Magnitude*: The Development would increase the scale of wind turbines in the landscape to a level at which the view would become dominated by wind farms;
- *Medium Cumulative Visual Magnitude*: The Development would result in a noticeable increase in turbines but this increase would not result in wind farms being the dominant feature of the view;
- *Low Cumulative Visual Magnitude*: The Development would be visible but would constitute a component of the view that might be easily missed by the casual observer and would not contribute to the overall prominence of wind farms within the view;
- *Negligible Cumulative Visual Magnitude*: The Development would be barely perceptible, or imperceptible, and would have no effect on the perception of wind turbines within the view.

4.36 The following general principles are used to inform and guide the assessment of the Significance of Cumulative Visual Effects:

- *Significant Cumulative Visual Effects*: Effects that would occur when the majority of visual receptors are deemed to be highly sensitive and the addition of the Development to the Cumulative Baseline would result in the view becoming defined, or considerably influenced, by wind turbines;

CONSENTED (LA01/2018/0200/F)

- *No Significant Cumulative Visual Effects*: Such effects would occur when the majority of visual receptors are not deemed to be highly sensitive and where the Development would have little or no incremental effect on existing views. The Development is likely to constitute a barely perceptible, or imperceptible, component of the wider view, which might be missed by the casual observer. Awareness of the Development would not have a marked effect on the overall quality of the view. Where the Development may still be a noticeable addition to views containing wind farms in the cumulative baseline but it would not cause the overall visual character of the view to become defined by wind turbines rather than by other elements of the existing view the overall effects would also be deemed to be Not Significant.

Description of the Development

4.37 The Development is located on agricultural land on the north-facing slope of Keady Mountain. It comprises 9 wind turbines with a maximum blade tip height of 149.9 m. A detailed description of the Development is provided in Chapter 2 of the ES, including the turbines, infrastructure, sub-station, energy storage compound, site access arrangements, site layout, construction methods and anticipated programme of construction work.

4.38 The construction period will be approximately 18 months and the visual effects of construction traffic and work on site will be short term and experienced only in close range views.

4.39 During the operational phase of the Development, anticipated to be 30 years, the landscape and visual effects would primarily relate to the presence of the turbines themselves as described and analysed in the following section of this LVIA. Day-to-day site activity would be minimal and there would be no further discernible changes to the landscape or visual character of the site resulting from site maintenance activities.

4.40 In addition to the turbines, there will be a sub-station building located near the site entrance on the A37 and an energy storage compound located behind the sub-station which will comprise of four metal storage containers surrounded by mesh fencing. They will not be prominent or incongruous features in views because they will be aligned with the A37 road corridor in order to reflect the local vernacular and the general alignment of buildings within this landscape including that of the existing agricultural building that currently marks the site entrance (and which will remain in place). The sub-station and compound will also reflect the vernacular style of agricultural buildings within this landscape in their simple form, layout and scale. The narrower ‘gable’ ends of the building and storage units will face the direction of views obtained by motorists travelling along the A37 in both directions, thus ensuring that the scale / mass of built form at the site entrance is minimised.

CONSENTED (LA01/2018/0200/F)

4.41 Following the cessation of the sites function as a wind farm, all above-ground structures would be dismantled and removed from site (unless further consent has been given to extend the operational life of the wind farm or replace the turbines) in accordance with an agreed decommissioning and restoration plan which will be agreed with the local planning authority prior to decommissioning of the wind farm.

Feasibility Appraisal, Design Evolution and Iteration

4.42 The Development that is being assessed in this LVIA has evolved through an iterative design process that has been informed by a careful analysis of the constraints and opportunities presented by the site location and the characteristics of the Development itself.

4.43 RES began the development process by identifying 21 potentially suitable turbine locations on this site. These locations were chosen by correlating on-site constraints such as hydrology, ecology and ground conditions with off-site constraints such as aviation. Next, a feasibility appraisal was carried out to identify the key landscape and visual issues that would need to be considered if a wind farm were to be proposed on this site. This included a preliminary analysis of the site in its wider landscape context, including its location within the Binevenagh AONB and its proximity to other wind farms, particularly the adjacent cluster of existing, consented and proposed wind farms at Dunbeg and Dunmore.

4.44 The feasibility appraisal identified eight potential turbine locations which were likely to meet the criteria for acceptable development as set out in planning policy and supplementary guidance and further locations which were likely to be acceptable in landscape and visual terms with refinement to the proposed layout. Following the feasibility appraisal a number of potential turbine layouts and dimensions were considered in order to further refine the layout and its potential landscape and visual effects on the Study Area. This included the consideration of variable turbine heights, the relocation of turbines to minimise visibility on the summit of Keady Mountain and to create a good visual relationship between the Development, the adjacent Dunbeg cluster, and other cumulative wind farms in the wider Study Area.

4.45 The 9-turbine option that is presented in the EIA is the result of this iterative design process. A series of comparative diagrams have been presented as part of this LVIA to illustrate the relocation and reduction in the number of proposed turbines in order to present a Development that is deemed to be acceptable in EIA and LVIA terms (refer to Figures 4.11 – 14 for further detail).

4.46 The comparative ZTV (Figure 4.11) indicates no areas of theoretical visibility of the final 9-turbine layout (149.9 m tip height) beyond any theoretical visibility that would have occurred with the 21 potential turbine locations that were initially considered with 125 m blade tips or with the refined 14-turbine layout using turbines with tip heights of 134.9 m - 149 .9 m. This layout would have resulted in

CONSENTED (LA01/2018/0200/F)

theoretical visibility across 61.1 % of the Study Area whereas the final layout results in theoretical visibility across 58.18 % of the Study Area.

4.47 Comparative wirelines have been prepared for Viewpoints 3, 10 and 13 to illustrate that the discernible difference in visual effects between turbines with 149.9 m and 125 m tip heights would be negligible but the reduction in the overall number of turbines and the wider spacing between the final turbines that are proposed has resulted in a number of benefits, namely:

- There are few instances where 'stacking' of turbines occurs. Stacking is where two or more turbines will appear directly in front of each other in a view and will therefore result in a 'heavier' or more solid, and hence more prominent appearance;
- The turbines can be more evenly spaced in relation to each other and to the site topography which has resulted in a simpler layout with fewer variations in tip heights in relation to contour AOD levels;
- A reduction in the proposed number of turbines means that the Development can remain clear of the summit of Keady whilst also remaining contained in the saddle of land between Keady and Binevenagh, thus minimising visual effects on the AONB and the sequence of views along the Binevenagh range of uplands, particularly when viewed from the west;
- A greater amount of space could be created between the Development and the Dunbeg cluster of wind farms so that differences in turbine heights are less noticeable and are not visually jarring.

Consultation

4.48 Consultation and discussion has been ongoing with the Council throughout the EIA process in relation to the iterative development of turbine layouts, turbine dimensions and the selection of final viewpoints. This is described in the Executive Summary section of this chapter (paragraph 4.11 and in Technical Appendix 4.4). The viewpoints that are analysed in this LVIA are the result of agreement with the Council.

4.49 A public exhibition was held in August 2017 to present and discuss the Development with interested parties from the local and wider community. A cumulative ZTV diagram was presented to illustrate the incremental theoretical visibility of the Development beyond that of the existing and consented wind farms at Dunbeg and Dunmore. This diagram included the location of the Development and the ZTV in relation to the Binevenagh AONB. Wirelines and photomontages of eight PVPs were also presented to illustrate how the Development would appear from some of the key viewpoints in the surrounding area (PVPs 2, 3, 7, 23, 36, 48, 51 and 55).

4.50 Every effort has been made to address the comments that were received during the public exhibition in relation to landscape and visual effects in this LVIA.

CONSENTED (LA01/2018/0200/F)

Baseline Assessment

Legislation and Planning Policy

4.51 The primary policy guidance on the assessment of landscape and visual effects of wind farm development is the Strategic Planning Policy Statement for Northern Ireland (SPPS) which should be read in conjunction with Planning Policy Statement 2 (PPS 2), Planning Policy Statement 18 (PPS 18) it's Supplementary Planning Guidance (SPG) and Best Practice Guidance (BPG)[2]. Further changes in planning policy and updates to development plans are expected to take place over the next few months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become entirely superseded by the SPPS and emerging Local Development Plans. For the time being, Causeway Coast and Glens Borough Council have published a number of topic papers to guide their emerging Development Plan and these have been taken into account in this LVIA as an indication of the likely priorities for future planning policy in this Study Area.

Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development

4.52 The SPPS sets out strategic subject policies, including renewable energy, and is intended to provide core principles to underpin the delivery of the new two-tier planning system where the new local councils have primary responsibility for the implementation of development control. However, for the transitional period whilst Local Development Plans are being prepared, the existing suite of Planning Policy Statements, supplementary and best practice guidance and relevant provisions within the *'Planning Strategy for Rural Northern Ireland'* will remain in place.

4.53 The aim of the SPPS is to facilitate for sustainable development based on three overarching principles of supporting rural regeneration; promoting economic growth and environmental sustainability. The latter principle includes for the protection of landscape character as well as a reduction in greenhouse gas emissions, and the mitigation and adaptation to the effects of climate change is a key principle in the SPPS and the promotion of renewable energy systems is one of the means by which the planning system will achieve this principle.

4.54 'Subject Polices' for Renewable Energy are covered in paragraphs 6.214 - 6.234 of the SPPS and the SPG remains in place. The SPPS retains the European Landscape Convention's definition of 'landscape' to mean "*an area, as perceived by people, whose character is the result of the action and interaction of natural and / or*

[2] Department of the Environment Northern Ireland (September 2015) 'Strategic Planning Policy Statement for Northern Ireland (SPPS): Planning for Sustainable Development' , (2013) 'Planning Policy Statement 2: Natural Heritage); (2009) 'Planning Policy Statement 18: Renewable Energy' and (August 2010) 'Wind Energy Development in Northern Ireland's Landscapes, Supplementary Planning Guidance to Accompany Planning Policy Statement 18 'Renewable Energy'; (2009) 'Best Practice Guidance to Planning Policy Statement 18: Renewable Energy'

CONSENTED (LA01/2018/0200/F)

human factors"[3]. The SPPS also recognises that Northern Ireland has significant renewable energy resources and that the renewable energy industry makes an important contribution to sustainable development and investment in the region. Renewable energy also reduces our dependence on imported fossil fuels and benefits our overall health, well-being and quality of life. "*The aim of the SPPS in relation to renewable energy is to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and to realise the benefits of renewable energy without compromising other environmental assets of acknowledged importance.*" (SPPS paragraph 6.218).

4.55 The strategic regional objectives are to ensure that environmental, landscape and visual amenity impacts are adequately addressed, and that natural and cultural heritage features are adequately protected. However, the SPPS also expects that the emerging Local Development Plans will support a diverse range of renewable energy developments whilst taking account of both local circumstances and the wider recognised benefits of renewable energy. Whilst the SPPS advises that a cautious approach should be applied to proposals within designated landscapes which are of significant value, and their wider settings where it may be difficult to accommodate renewable energy developments without detriment to the regions cultural and natural heritage assets it also notes that *"It will not necessarily be the case that the extent of visual impact or visibility of wind farm development will give rise to negative effects; wind farm developments are by their nature highly visible yet this in itself should not preclude them as acceptable features in the landscape. The ability of the landscape to absorb development depends on careful siting, the skill of the designer, and the inherent characteristics of the landscape such as landform, ridges, hills, valleys, and vegetation*." (SPPS paragraphs 6.230 - 231).

Planning Policy Statement 2: Natural Heritage

4.56 Policy NH 6 of PPS 2 states that permission will only be granted for new development in AONBs where it is of an appropriate design, size and scale for the locality and meets three criteria including; siting that is sympathetic to the special character of the AONB in general and also the particular locality; it respects or conserves features of importance to this character and; it respects vernacular styles and materials.

4.57 PPS 2 notes that "*the quality, character and heritage value of the landscape of an AONB lies in their tranquillity, cultural associations, distinctiveness, conservation interest, visual appeal and amenity value*" (PPS 2, paragraph 5.15). It refers to LCAs and AONB Management Plans for further information.

[3] Definition of landscape used in the European Landscape Convention (2000, Article 1.a) Council of Europe and 'Northern Ireland's Landscape Charter' (January 2014) NIEA

CONSENTED (LA01/2018/0200/F)

Planning Policy Statement 18: Renewable Energy

4.58 The aim of PPS 18, which is broadly aligned with that of the SPPS, is "*to facilitate the siting of renewable energy generating facilities in appropriate locations within the built and natural environment in order to achieve Northern Ireland's renewable energy targets and realise the benefits of renewable energy*" (PPS 18, section 3.1). Policy RE1 states that proposals must demonstrate that they "*would not have an unacceptable impact on visual amenity or landscape character through: the number, scale, size and siting of turbines; that the development has taken into consideration the cumulative impact of existing turbines, those which have permissions and those that are currently the subject of valid but undetermined applications*".

Best Practice Guidance to accompany PPS 18

4.59 This document provides technical information and potential considerations in relation to planning applications for wind energy projects. It refers to the SPG for guidance on the landscape and visual analysis process and advice on the indicative type of development that may be appropriate but is not prescriptive. The BPG notes that "*There are no landscapes into which a wind farm will not introduce a new and distinctive feature. Given the Government's commitment to addressing the important issue of climate change and the contribution expected from renewable energy developments, particularly wind farms, it is important for society at large to accept them as a feature of the Region for the foreseeable future.*" However, it also notes that the locations of developments should be carefully considered in order to reduce their impact and aid integration into the local landscape even though they may be highly visible. (BPG section 1.3.18 - 19).

4.60 The BPG reiterates the SPPS in its recognition that visibility doesn't necessarily equate with levels of acceptability and notes that there are three considerations when considering the capacity of a landscape to accommodate wind farm development (BPG 1.3.21):

- The degree of impact the development will have on the existing character of the landscape;
- The sensitivity of the character of the landscape; and
- The extent to which this impact can be modified and reduced by design.

4.61 The BPG also refers to the inherent characteristics of a landscape, such as land form and vegetation, the careful siting and skilful design of developments all playing an important role in the ability of a landscape to absorb development. Turbine layouts must also be appropriate to the local landform and landscape characteristics; groups of turbines can normally appear acceptable as single isolated features in open, undeveloped landscapes whereas rows of turbines may be more appropriate where there are formal field boundaries within flatter agricultural landscapes. Wind farms should not appear visually confusing in relation

CONSENTED (LA01/2018/0200/F)

to the character of the landscape and should ideally be separate from surrounding features to create a simple image (sections 1.3.22 & 1.3.26).

4.62 In relation to visual impact the BPG notes that wind farms in an open landscape setting are likely to be prominent features at distances below 2 km, and relatively prominent at up to 5 km. Between 5 – 15 km they are more likely to be seen as part of the wider landscape and prominent only in clear visibility. Beyond 15 km they are only likely to be seen in clear visibility and as a minor element in the landscape (section 1.3.25).

4.63 It is noted that Scottish Natural Heritage's best practice guidance in relation to the siting and design of wind farms has been updated since the BPG was published and no longer refers to specific distances in relation to visual prominence (see Technical Appendix 4.1, paragraph 4.3). Their research has found that other factors such as weather conditions, time of day/year, angle of view, and composition of other elements in the view, all contribute to the assessment of visual effects and visual prominence.

Supplementary Planning Guidance to accompany PPS 18

4.64 The SPG is intended to provide broad strategic guidance on appropriate locations for wind energy development based on the definition of LCAs within the Northern Ireland Landscape Character Assessment (NILCA). It advises that the detailed assessment of the nature of a wind farm's effects on landscape character should be dealt with on a case-by-case basis via an LVIA. The SPG itself is non-prescriptive with regards to turbine heights and groupings. Its assessment of landscape sensitivity is intended to provide broad guidance but not to exclude development. Rather it places an onus on developers to demonstrate, via the EIA process, that wind farms can be developed without unacceptable effects on LCAs as a whole.

4.65 The SPG recommends a 20-30 km radius Study Area for medium or large commercial height turbines, which has informed the selection of a 30 km Study Area for this Development. The SPG includes recommendations that are specific to the potential effects of wind energy developments on the character of individual LCAs. The SPG as it relates to the Development is analysed starting at paragraph 4.101.

4.66 The assessment of Landscape Value and Sensitivity for some LCAs has been altered from the SPG where detailed site survey in relation to Development has revealed variations in particular areas. This is in accordance with the SPG, which states that, "*It should be noted that within many LCAs there is considerable variation in sensitivity level across the area, reflecting the fact that the LCAs are broad character or identity areas. The overall sensitivity level is therefore the level that prevails over most of the LCAs geographic area. Localised areas of higher or lower sensitivity may also exist and these are generally identified in the sensitivity descriptions within each LCAs assessment sheet. The overall sensitivity level of a LCA is indicative of the relative overall sensitivity level of each LCA. A high sensitivity level does not necessarily mean that there is likely to be no capacity for*

CONSENTED (LA01/2018/0200/F)

wind energy development within the LCA and conversely a low sensitivity level does not mean that there are no constraints to development" (SPG section 2.3).

Emerging Council Policy

4.67 Changes in planning policy and updates to development plans are expected to take place over the next few months and years as Planning Policy Statements, supplementary guidance and existing Development Plans become superseded by emerging Local Development Plans, which will be primarily informed by the SPPS. For the time being, Causeway Coast and Glens Borough Council have published a number of topic papers to guide their emerging Development Plan and these have been taken into account in this LVIA as an indication of the likely priorities for future planning policy in this Study Area. The Borough Council published '*Discussion Paper 4: Landscape Character*' in November 2015 in which they note key points in relation to planning for future development within the Council area.

4.68 The Council define their approach to landscape planning as being a strong forward-looking action to enhance, restore or create new landscapes (section of 2.6 of Discussion Paper 4). Their emphasis will reflect that of the SPPS which is to protect special landscapes from inappropriate development and will take account of landscape character. They also note that the SPPS recommends that the principle of clustering, consolidating and grouping new and established developments together is a means to achieve sustainable development and mitigate potential adverse cumulative effects on scenic landscapes which can result from a sporadic approach to siting new developments.

Analysis of the Developments Effects on Planning Policy

4.69 Although the Development is located within the Binevenagh AONB, which is an environmental asset of acknowledged importance (the Developments effects on the AONB are analysed starting at paragraph 4.85) the Development is in an appropriate location within the AONB and is located in accordance with the main stipulations of relevant planning policies and guidance.

4.70 The SPPS, which is the overarching policy document, recognises that renewable energy is a beneficial type of development provided it is appropriately located. The SPPS also reiterates the European Landscape Convention's definition of landscape as being a result of both natural and human factors. This site conforms to these policy stipulations because it is largely characterised by human-influences including quarrying and agricultural activities on site and in adjacent areas, and it is bounded by large areas of coniferous forestry, a primary road corridor and an existing and consented cluster of wind farms.

4.71 The Council define their approach to landscape planning as forward-looking and reflective of the SPPS principle of clustering and consolidating existing developments in order to realise the benefits of renewable energy projects whilst also minimising the extent of cumulative effects on sensitive features within the Study Area, such as the Binevenagh AONB's key characteristics that are described

CONSENTED (LA01/2018/0200/F)

later in this section, and sensitive visual receptors that are described from paragraph 4.119.

4.72 PPS 2, Policy NH6 notes that the special qualities of AONB's include tranquillity but this is not a characteristic of this specific location with the Binevenagh AONB due to the human factors described above. It also lists cultural associations, distinctiveness, conservation interest, visual appeal and amenity value as other special qualities. The evidence of long-standing use of the site and surrounding landscape for activities such as farming, quarrying and forestry have lessened its landscape quality and condition, and hence its cultural and conservation interests and visual appeal (notwithstanding any factors that may be considered in Chapter 5: Archaeology and Cultural Heritage and Chapter 6: Ecology) and it has no specific amenity value because it is private land without public access. The site is located within the AONB as, as such, has visual appeal as part of the AONB. However, it does occupy a small part of the overall AONB and will not be visible from many other parts of the AONB, and will rarely appear as a separate entity to the Dunbeg cluster of wind farms on adjacent land.

4.73 PPS 18 and its Best Practice Guidance are generally promotive of wind energy development, again in appropriate locations, and note that the capacity of a landscape to accommodate such development is dependent on the existing character of the landscape, which in this case is already influenced by farms and also by a number of other dominant human factors which reduce the sensitivity of the receiving landscape character. Furthermore, through a process of iterative design, the Development has been refined to minimise its effects on key landscape and visual features such as the summit of Keady Mountain. It has minimal visibility from many parts of the three AONBs which are located within the Study Area. The SPGs guidance on landscape character considerations for wind energy development in LCA 36 Binevenagh Uplands is considered in further detail starting at paragraph 4.103.

Baseline Landscape Character Assessment and Analysis of Effects

The Site and the Study Area

4.74 The Study Area for this LVIA extends to a radius of 30 km from the centre of the Development (indicated on all map based figures in Section 4, Volume 3 of the ES). It encompasses coastal parts of Counties Antrim and Derry and a small part of northern County Tyrone in Northern Ireland and also includes the Inishowen Peninsula in County Donegal.

4.75 The proposed site is a rising undulating upland area of rough grazing land located on the northern slope of Keady Mountain. It forms one side of a broad saddle of land which sits around the Curly River corridor between Keady and Binevenagh mountains. There is much evidence of human influence on the site which is scattered with indentations highlighting historic quarrying activities and a number

CONSENTED (LA01/2018/0200/F)

of steep-sided drainage ditches and streams which run from the summit of Keady under the A37 road corridor and then into the Curly River which is located to the north.

4.76 The proposed site is flanked on the northern side by the A37 road. It is a busy road corridor linking the towns of Coleraine and Limavady in Co. Derry, approximately 6 km to the north east of the site. The edge of the road corridor is largely defined by a wide hard shoulder area and post and wire fencing. The most elevated section of the road is located slightly to the north east of the Site, near the edge of Springfield Forest and adjacent to the existing Dunbeg and Dunmore wind farms which are located on the opposite side of the road corridor to the Development. Elevated and panoramic views of the flat lowlands around the Foyle Estuary and Roe Valley can be obtained when travelling in a south-western direction along the A37 towards Limavady. These views are framed by the Inishowen peninsula in Co. Donegal. When travelling in the opposite direction towards Coleraine there are views of the side slopes of Binevenagh and Keady Mountains with the Curly River valley in between but these views quickly become dominated by forestry until the road corridor starts to descend towards the village of Macosquin on the outskirts of Coleraine.

4.77 There are two existing wind farms at Dunbeg and Dunmore which comprise 21 turbines and which are located on the opposite side of the A37 within the saddle of land around the Curly River. This cluster has a further consented 3-turbine extension to Dunbeg Wind Farm and a proposed 8-turbine extension to Dunmore Wind Farm (currently subject to a planning appeal).

4.78 Coniferous forestry covers an extensive part of the foreground landscape to the north, south and east. Springwell Forest has a hard angular form along the southern and eastern boundaries of the site and also borders the A37 road corridor to the east and south, beyond which the forestry extends as Cam Forest around Rigged Hill in the south. Ballyhanna, Binevenagh and Grange Park Wood clad much of the uplands to the north. There is also a Christmas tree farm on the upper part of Bolea Road directly to the north of existing Dunbeg wind farm.

4.79 There are a number of quarry sites located on the Binevenagh range of uplands, mostly on the east-facing slopes overlooking Coleraine around Macosquin, Croaghan and Cam Forest. There are also quarries on the west and south-west facing slopes around Craiggore mountain, Donald’s Hill, Smulgedon near Drumsurn village and Gortnamoyagh Forest. Some sites are active and some are no longer in use but remain noticeable features in the landscape. The nearest site is located on the west-facing side of Keady Mountain, approximately 1 km from the Development. It is prominent in views when travelling along the A37, B66 and from the countryside around Limavady.

4.80 The site is located in the south eastern part of the Binevenagh AONB and within the Binevenagh LCA as defined in the NILCA, both of which are described in detail below. There are no statutory designations of relevance to the LVIA within or

CONSENTED (LA01/2018/0200/F)

immediately adjacent to the site other than the AONB. The Ulster Way runs through Springwell Forest and continues to the north and south of the site through the AONB. There are likely to be views of the Development from this section of the Ulster Way in places where the track emerges from coniferous forest. The Causeway Coastal Route is a defined scenic route which stretches along the Antrim and Derry coastline and there are also likely to be views towards the Development from some parts of this route. There are picnic sites and parking areas located along the A37 and the B201 from where the Development may also be visible.

4.81 The summit of Keady Mountain is 337 m above sea level and the more prominent summit of Binevenagh rises to 385 m. It is marked by a television relay antenna near its peak. The proposed turbines would be located of between 207 m (proposed turbine T2) to 289.5 m (proposed turbine T4) above sea level. Through the iterative design process efforts have been made to avoid locating turbines on the higher slopes in order to minimise its effects on the summit of Keady Mountain, it's visibility from other parts of the AONB and its prominence within views that also include the wider expanse of the Binevenagh range of hills which continue southwards to form the Sperrins and Sperrin foothills. Both the Sperrins and Binevenagh are designated as Areas of Outstanding Natural Beauty. Turbine 4 is located at the highest point above sea level and is approximately 775 m from the summit of Keady. The ground falls towards Coleraine and Limavady to the east and west respectively and it is likely that the site will be most visible from these directions.

4.82 The nearest settlements are the medium-sized towns of Limavady and Coleraine and the small village of Macosquin to the west of Coleraine. There are no settlements or residential dwellings adjacent to the Development but there are a number of individual houses scattered along the lower parts of the A37 and the adjacent tertiary road network, particularly at the base of the Curly River valley and on the lower slopes of Binevenagh. There are more rural dwellings and farmsteads throughout the lowland slopes to the west of the proposed site which give this part of the Study Area a more managed pastoral character.

Landscape Designations

4.83 The European Landscape Convention (2000) requires member states to recognise that all landscapes can have value, and this value may vary from person-to-person. Statutory designations are one of the criteria used to assess the Significance of effects on landscape character and visual amenity in an objective manner. Whilst it is recognised that all landscapes have some subjective importance, particularly for those who live and work in them, or use them for leisure, designation gives an indication of a landscape's 'value to society'. Landscapes are designated by statute, and policies for their protection, use, and management are included in Development Plans, usually following a consultation process (which seeks to reach a consensus opinion, thereby reducing subjectivity). The national, regional and local designations that have been identified as being relevant to the landscape and visual

CONSENTED (LA01/2018/0200/F)

character of this Study Area are described in the following paragraphs and illustrated in Figures 4.1 and 4.2.

4.84 Statutory landscape designations are contained within the current planning policy and guidance which cover the Study Area. The primary designated landscape within the Study Area is the Binevenagh AONB and policy guidance in relation to this designation is contained within the SPPS, PPS 2, PPS 18 and SPG which are described in the preceding paragraphs. The nature of the Binevenagh AONB and the effects of the Development on this landscape are analysed starting at paragraph 4.85. Other AONBs and statutorily designated landscapes within the Study Area are analysed in subsequent paragraphs.

Binevenagh Area of Outstanding Natural Beauty

4.85 AONBs are the principal landscape conservation designation in Northern Ireland. The designation gives statutory recognition to the high scenic quality and distinctive landscape character of an area and the need to ensure that sensitive conservation measures take place to preserve these qualities alongside measures to allow public access and enjoyment of the area. The needs of local communities, including their social and economic well-being, is a key management objective, although development deemed to be detrimental to environmental quality is not permitted within AONBs. The landscape around AONBs performs an important function by providing context, particularly in view to and from the AONB and from key approach routes.

4.86 There are three AONBs within the Study Area for the Development. The Sperrin and Causeway Coast AONBs are located between 12 km and 20 km to the north east and south respectively and the potential effects of the Development on these areas is described in subsequent paragraphs. The Binevenagh AONB is regarded as the primary designation to be considered in this LVIA because the Development and a large proportion of representative viewpoints are located within it. Its landscape characteristics, including their potential sensitivity to the proposed Development, and the potential nature, or Magnitude of effects on this AONB are described below. The sensitivity, magnitude and significance of visual effects on receptors located within the AONB are described and analysed in the assessment of Visual Effects.

4.87 There are several documents which provide descriptions of the key characteristics of the Binevenagh AONB and which have been referred to when writing this LVIA[4]. The descriptions of the six LCAs that are located within the AONB boundary provide the most detailed information on landscape and visual characteristics of each part of the AONB. LCA 35 Magilligan Lowlands and LCA 36 Binevenagh cover the majority

[4] Causeway Coast and Glen Heritage Trust (June 2010) 'Binevenagh AONB Management Plan 2010 – 2020' and (June 2010) 'Binevenagh AONB Action Plan 2010 – 2015'; Council Coast and Glens Borough Council (25th November 2015) 'Discussion Paper 4: Landscape Character'; NIEA (August 2010) 'Supplementary Planning Guidance to Accompany Planning Policy Statement 18, Renewable Energy'; Northern Ireland Landscape Character Assessment Series

CONSENTED (LA01/2018/0200/F)

of the AONB but there are also peripheral parts of the LCA 33 Lough Foyle Alluvial Plains and LCA 37 Roe Basin which form the south western fringes of the AONB, and LCA 38 Eastern Binevenagh Slopes and LCA 34 Coleraine Farmland, which form the eastern fringes.

4.88 LCA 36 comprises a long finger of uplands which terminates the northern end of the AONB at the summit of Binevenagh Mountain and which also stretches as far as the fringes of the Sperrin AONB at its southern tip. Binevenagh Mountain has dramatic cliffs overlooking the north Antrim coast which the Council's Discussion Paper 4 specifically highlights as a dramatic feature within the AONB which is visible from miles around. This is also described as being one of the primary features of the AONB: the "*severe skyline of the cliffs at Binevenagh make a breath-taking contrast with the outstanding expanse of Magilligan Strand and Binevenagh cliffs*"[5]. The Development is located approximately 7 km from the summit of Binevenagh Mountain near the south western edge of the AONB and in the central part of LCA 36. It is not visible from this location (see Viewpoint 11, paragraph 4.148 and Figure 4.25). Nor does it have a close physical or visual relationship with the summit or in views where the strong contrast between the summit and the adjacent low-lying agricultural landscape within the Lough Foyle Alluvial Plains (LCA 35) can be appreciated. This is evident in the series of viewpoints which have been selected to represent the Development within the context of the wider AONB and Binevenagh uplands (see Category D viewpoints described from paragraph 4.187).

4.89 This is a relatively accessible AONB which can be experienced by tourists and visitors, travelling on the scenic coastal railway between Coleraine and Derry, driving along the Causeway Coast Scenic Route, using the National Cycle Network on the secondary and tertiary road network and walking on the Ulster Way which covers upland and coastal areas and the River Bann corridor. There is also a gliding club at Bellarena, one of only two such clubs in Ireland. The visibility of the Development from visitor attractions within the AONB is considered as part of the viewpoint selection process and the assessment of effects in this LVIA. The Baseline Assessment, including the assessment of PVPs and initial site assessment, found very little visibility from visitor attractions within the AONB including, for example the Lough Foyle mud flats which are a designated RAMSAR site and which are accessible as a visitor amenity site via Ballykelly (see Viewpoint 23 starting at paragraph 4.187 and Figure 4.37) or from important heritage sites within this AONB, namely Hezlett House, Castlerock town, and Downhill Estate.

4.90 Although the Development is not located within the core of the Binevenagh AONB it is recognised that the proposal is within the AONB and that the site has merit in terms of its contribution to the landscape and visual character of the wider AONB. The layout and position of the Development has, therefore been designed to minimise its effect on the AONB as a whole. This has been achieved by locating it away from the core area containing the majority of visitor attractions and iconic

[5] ttps://www.daera-ni.gov.uk/articles/binevenagh-aonb

CONSENTED (LA01/2018/0200/F)

landscape features. It is also in a location that is closely related to existing wind turbines, and that is neither highly visible from the rest of the AONB nor from other parts of the Study Area with good views to the core part of the AONB. These are considered to be the summit / escarpment of Binevenagh and the lowlands below this escarpment.

4.91 The proposed site is used as rough grazing land and is not a publicly accessible amenity. Adjacent areas are frequently dominated by large coniferous plantations with degraded field boundaries and are suffering from increasing amounts of coniferous forestry, which the NILCA identifies as the most detrimental force of landscape change in this LCA. There is also a history of quarrying in this part of the AONB with active and former quarry sites located to the north-east, east and south-east around Macosquin, Croaghan and Cam Forest, the west-facing side of Keady Mountain, and to the south around Craiggore, Donald's Hill, Smulgedon and Gortnamoyagh. The Development reinforces the existing character of the site and immediately adjacent landscape and is less detrimental to the overall landscape character of the AONB than forestry or quarrying because it will not have permanent presence. Whilst forestry and quarry both leave permanent marks on the landscape, wind farms are considered to be long term temporary rather than permanent developments which will ultimately be removed and the sites reinstated back to their previous uses. The site of the Development does not contribute significantly to the iconic value attributed to the summits and escarpments in the Binevenagh AONB. Neither does it contain significant visitor amenity facilities that are likely to attract the most sensitive receptors – the main tourist attractions and scenic routes are generally located to the north overlooking the coast.

Other Area of Outstanding Natural Beauty

4.92 There are two other AONBs within the 30 km Study Area:

The Causeway Coast AONB,

4.93 This AONB is located at some distance - approximately 18 km to the north east – from the Development but it contains a number of nationally important coastal landscape features and tourist attractions, and the internationally recognised Giant's Causeway World Heritage Site. Therefore, it was considered during the PVP selection process and the Council was presented with a shortlisted viewpoint located near the Giant's Causeway to represent the potential nature of views from this part of the Study Area. However, the preliminary wireline that was produced as part of the viewpoint selection process demonstrates that there will be no significant effects either in landscape or visual terms because it is substantially remote from it. The Council, having reviewed the preliminary wireline that was produced (see Technical Appendix 4.4, Plate 4.4.1), were in agreement that there were unlikely to be significant landscape or visual effects on this part of the Study Area and that it was not necessary to include a viewpoint that represented this in the LVIA.

CONSENTED (LA01/2018/0200/F)

The Sperrin AONB

4.94 This AONB is located approximately 15 km to the south of the Development. Significant adverse visual effects on the Sperrin AONB were one of Northern Ireland Environment Agency's (NIEA) recommended reasons for refusal of the 14-turbine Dunbeg Wind Farm. However, a viewpoint within the Sperrin AONB was assessed for this development which demonstrated that Altahullion and Rigged Hill wind farms were already visible from this location and the cumulative effect of Dunbeg, which would be a more distant feature, would in fact be largely obscured from view by Keady Mountain and would have no significant landscape or visual effects. The ZTV diagrams that have been prepared for this LVIA demonstrate very little visibility from within the Sperrin AONB with the exception of some parts of its northern edge. Viewpoint 24 has been shortlisted for assessment and illustrates very limited intervisibility between the Development and the Sperrin AONB. A further PVP 32 located on the A6 corridor near Dungiven was proposed as a shortlisted viewpoint but was deemed unnecessary by the Council (Technical Appendix 4.4, Plate 4.4.1).

Other Statutorily Designated Landscapes in the Study Area

Giant's Causeway World Heritage Site

4.95 The Giant's Causeway is the primary tourist attraction in Northern Ireland and there are other visitor amenities along the coastline which benefit from their proximity to this site. It is designated as a World Heritage Site (WHS) by UNESCO (United Nations Education, Scientific and Cultural Organisation) because it is deemed to be a site of outstanding universal value. Whilst the designation affords no additional statutory planning controls, planning policies do place great weight on the need to protect them for future generations. These are the areas of 'distinctive', 'supportive' and 'connective' settings defined in the Causeway Coast Management Plan The Development is located some distance from the WHS and its setting and there will be no significant effects on its landscape character. Viewpoint 25 has been shortlisted to represent potential effects on visual receptors, primarily tourists, on the north coast because the WHS is such an internationally important part of the landscape (refer to paragraph 4.193) but the analysis of this viewpoint has also concluded that there would be no significant visual effects.

Register of Historic Parks, Gardens and Demesnes

4.96 The Register identifies sites that are considered to be of exceptional importance within Northern Ireland, which have historic significance, and which may also contribute to local landscape character. It is maintained by NIEA Built Heritage. Inclusion on the Register affords sites protection through the SPPS and Planning Policy Statement 6 (PPS6)[6] which requires NIEA to make comment on the protection of such sites as part of the planning consultation process. The SPPS states that permission would not be granted for development that would harm the overall

[6] Department of the Environment (March 1999) 'Planning Policy Statement 6: Planning, Archaeology and the Built Environment'

CONSENTED (LA01/2018/0200/F)

character of site's integrity, overall quality or setting and its contribution to local landscape character should be maintained where possible.

4.97 There are a large number of registered sites located within the Study Area particularly around the urban areas of Derry, Limavady, Coleraine, Ballymoney and the Causeway coastline. However, few are likely to have views of the Development due to screening factors such as surrounding built development, high levels of tree cover and flat topography in low lying areas, the fact that the Development is often screened in wider views by the summits of Keady and Binevenagh, surrounding forestry and because it is closely related to a larger group of existing turbines. Therefore, no registered sites have been identified for detailed landscape and visual assessment because there are none which are likely to experience significant effects resulting from the Development. One site at Drenagh near Limavady has been included in Chapter 5, Archaeology and Cultural Heritage Assessment.

Statutory designations in County Donegal

4.98 Parts of the uplands on the Inishowen peninsula are designated as Areas of Especially High Scenic Amenity in the County Donegal Development Plan because they are deemed to be some of the highest quality landscapes in the County, characterised by wilderness and few man-made structures, which should receive the highest degree of protection. The Development Plan states that very limited development will be permitted within these areas. The Development would be located approximately 25 km from this designated landscape and is unlikely to interfere with its integrity. The County Development Plan also identifies a number of outstanding views and prospects which are located in the AEHSA's mentioned above where there are views across Lough Foyle towards the Development. Donegal County Council deems outstanding views to be a valuable asset requiring protection, as they are an important resource for the development of tourism in the county. However, the Development is located over 25km from County Donegal and as such any effects will be negligible. Viewpoint 27 (paragraph 4.195) has been included to demonstrate that there will be limited visibility of the Development in elevated views from Inishowen, no significant visual effects and also to illustrate that effects on landscape character will be indiscernible due to the distance between these designated areas and the Development.

Non-Statutory Landscape Classifications

The Northern Ireland Landscape Character Assessment

4.99 The NILCA classifies the landscape into six broad regions and 130 smaller areas of distinct and separate character called Landscape Character Areas (LCAs). The SPG accompanying PPS 18 provides further broad guidance on these regions and LCAs including the overall sensitivity of LCAs specifically in relation to wind energy developments. The descriptions of landscape character in this LVIA are based on the NILCA and the SPG. They are also inextricably linked to the description of the

CONSENTED (LA01/2018/0200/F)

key characteristics of the Binevenagh AONB and some elements of the subsequent LCAs have already been analysed in the preceding sections.

4.100 There are 20 LCAs within the Study Area of which 6 are located within the Binevenagh AONB. The Development is located within LCA 36 Binevenagh and would therefore have a direct physical effect on small part of this area, which is described in detail below. The Development may also have a potential indirect effect on the setting of parts of a further 5 LCAs which are in close proximity to it, or which contain viewpoints used in this LVIA. These LCAs are listed in Appendix 4.3. There are a further 14 LCAs which have not been assessed in detail because, following the Baseline Assessment and site surveys, they are unlikely to be significantly affected by the Development. In particular, LCAs on the periphery of the Study Area and the ZTV, and those which do not contain viewpoints have not been subject to a detailed assessment. These LCAs are also listed in Appendix 4.3. The ZTVs are illustrated in Figures 4.6 – 4.8.

4.101 The SPG accompanying PPS 18 provides further broad guidance on the LCAs that are defined in the NILCA, including their overall sensitivity, specifically in relation to wind energy developments. Broad landscape character issues to be considered in relation to wind farm development in the North West are provided in section 3.3.2 of the SPG:

- Effects on skylines along the Foyle valley: the Development is unlikely to be visible from this area;
- Effects on the wild character of some landscapes, and effects on the landscape character, scenic value and setting of the Sperrins of any development in the Sperrin Foothills LCA; the Development is not located within the Sperrin Foothills and the ZTV indicates that there is minimal potentially visibility within the Sperrins AONB with the exception of small areas of visibility on higher summits. However, these would be located in excess of 25 km from the Development, are relatively inaccessible and the Development would be indiscernible from the existing Dunbeg cluster of wind farms from such distance;
- Effects on transport corridors and important tourist routes: A series of viewpoints (Category A Viewpoints) have been selected to illustrate sequential views along the A37 and B201 road corridors between Limavady and Coleraine and from the Binevenagh Scenic Drive to the north west of the Development and the Roe Valley and Causeway Coast scenic routes further to the north west and south west. These effects are described in detail from paragraph 4.130;
- Cumulative effects with trans-boundary development in Co. Donegal: There is a cluster of existing and consented wind farms on the Inishowen Uplands which may be sequentially visible from some parts of the Study Area which are unlikely to result in significant visual effects. They are

CONSENTED (LA01/2018/0200/F)

further considered in the cumulative impact assessment starting at paragraph 4.203.

4.102 General principles for the spacing between wind farms, the layout, siting and design of wind farms are given. Of particular relevance to the Development are:

- Large-scale landscapes, where the turbines are likely to be in proportion with the landscape, are likely to be of lower sensitivity than small-scale landscapes. The Development would be located on the side slope of Keady Mountain which forms part of a saddle of land within the large expanse of the Binevenagh range of hills. It would not be a dominant additional feature;
- Elevated upland landscapes can accommodate larger turbines and the broader the upland the greater the capacity. Larger horizons tend to diminish the perception of height. The Binevenagh range stretches in a long broad arc from the north Antrim Coast to the Sperrin range in the southwest and its escarpments are visible in its full extent mostly from western parts of the surrounding landscape;
- Landscapes that do not form distinctive backdrops tend to be less sensitive. The Development's position within a lower-lying saddle of land and on the side slope of a secondary hill within the Binevenagh range means that it does not make as prominent a contribution to the overall Binevenagh range as Binevenagh itself or summits and uplands within the range, such as Benbradagh and Rigged Hill which have very distinctive profiles. The comparative ZTV and wirelines included in Figures 4.11 – 14 illustrate how a reduction in the number of proposed turbines and careful location of the final 9 proposed turbines has minimised the physical encroachment of the proposed wind farm on the summit of Keady Mountain, and hence ensured that its visual effects are minimised, particularly in relation to the Binevenagh AONB and its incremental effects on the cluster of existing and consented wind farms at Dunbeg;
- Development that is well set back from upland edges will be less prominent in the landscape than development that is close to edges and convex landform may also provide partial screening for turbine structures. The Development is located on a side slope, away from the summit of Keady Mountain and is surrounded on three sides by higher ground and forestry so it is screened in close to medium range views to the east, and in many views to the north and south. It is also well set-back from adjacent road corridors;
- Commercial forestry also introduces a man-made influence to landscapes that may otherwise seem natural, thereby reducing sensitivity. There are large expanses of coniferous forestry across the Binevenagh range, including Springwell Forest to the south and east and Ballyhanna Forest with Grange Park Wood to north and west of Dunmore Hill. The landscape

CONSENTED (LA01/2018/0200/F)

surrounding the Development is also influenced by other man-made elements including several quarries, television aerials, roads, two existing and one consented wind farm. Its relationship to the latter is in accordance with the Councils aim to cluster and consolidate developments in single locations in order to minimise cumulative effects as highlighted in their Discussion Paper 4: Landscape Character (see footnote to paragraph 4.87).

Landscape Character Area 36: Binevenagh

4.103 The SPG's assessment of the Binevenagh LCA, within which the Development is located, briefly summaries its landscape characteristics, defines its overall sensitivity to wind energy and its capacity to accommodate certain turbines groups and heights.

The SPG's description of Key Landscape and Visual Characteristics and Values

4.104 The SPG describes the Binevenagh LCA as a dramatic cliff-like escarpment stretching between the north coast and the Sperrin Mountains but it is more accurate to describe it as a series of escarpments, summits, plateaux and valleys. The AONB's core areas, as described on the NIEA website, are Binevenagh Mountain and the coast between Portstewart and Magilligan Strand[7]. It is the visual contrast between Binevenagh and the lowland areas that is one of the key characteristics of this AONB. This contrast is best appreciated from the Magilligan area directly below Binevenagh where the escarpment at the northern end of Binevenagh is fully visible. The Development is not visible from this part of the Study Area. The contrast can also be appreciated in medium to long range views from the north-west where one can appreciate how the full profile of the Binevenagh range stretches into the Sperrin mountain range to the south west. From these latter views the Development would often be visible on the skyline. However, it would form a small part of extensive, often 360^{o} views and would be located within a lower saddle of land between taller summits and in close proximity to the Dunbeg cluster of wind farms. Rigged Hill wind farm is also already more visible on a taller and more prominent plateau to the south. This wind farm is a well-established element of the landscape character in this area and precedes the Binevenagh AONB designation.

4.105 The SPG identifies Binevenagh Mountain as one of the most dominant physical and visual features of the AONB alongside the summits of Keady Mountain, Donald's Hill and Benbradagh. Through the iterative design process the proposed layout has been refined to ensure that turbines are not located on the summit of Keady Mountain so that it will not significantly affect the overall legibility or visual continuity of the Binevenagh profile.

4.106 Within proximity to the Development the physical landscape is in poorer condition and is less sensitive than the core parts of the AONB which are noted in the various

[7] ttps://www.daera-ni.gov.uk/articles/binevenagh-aonb

CONSENTED (LA01/2018/0200/F)

designation documents. The SPG describes the area as wild and tranquil. However, very little of this LCA is untouched by human influence. There are extensive conifer plantations within this part of the AONB, which the SPG recognises as detractive to landscape and visual quality. Whilst forestry may be regarded as a temporary land use the reality is that it is often a longstanding feature with impacts on the physical landscape that remain evident long after its removal. The Forest Service has confirmed that forestry policy as set out in the '*Northern Ireland Forest Strategy for Sustainability and Growth*' (March 2006) requires areas of forestry to be maintained and expanded where possible. In accordance with this policy Springwell Forest, Cam Forest and Grange Park Wood will continue to be managed and replanted by the Forest Service on a cyclical basis. Non-intensive management of rough grazing areas has created a sense of degradation rather than wildness. There is a proliferation of individual dwellings throughout the countryside in this part of the AONB with a mix of styles and buildings materials which are not in keeping with the historic vernacular. This part of the AONB is also dissected by the busy A37 road which runs directly past the site taking large volumes of traffic between Coleraine and Derry.

The SPG's description of Landscape Value of LCA 36: Very High

4.107 In broad terms this LCA is of very high value because it is a distinctive and extensive upland landscape containing lowlands to east and west. However, conifer plantations are a detractive man-made feature on many upper slopes and it is not in optimum condition. A more detailed consideration of the proposed site and adjacent areas has concluded that it is of lesser physical value than the overall LCA. It is characterised by large coniferous plantations, degraded field boundaries, quarry workings and areas of open moorland. It does not contribute significantly to the iconic value attributed to the summits and escarpments in the Binevenagh AONB. Neither does it contain significant visitor amenity facilities to attract the most sensitive visual receptors.

The SPG's description of Landscape Sensitivity to the Development

4.108 The SPG states that overall sensitivity to wind energy development in the Binevenagh LCA is high to medium. "*Much of this landscape is of extreme sensitivity due to its iconic, landmark character and very wide visibility*". Commercial development at the northern or southern ends is deemed by the SPG to be unacceptable. "*However, lower and less prominent sections of the escarpment and areas where there is extensive forestry may be somewhat less sensitive to commercial wind development*" (page 134). The Development is located in accordance with the recommendations of the SPG. Whilst it is within an AONB, which it is accepted is overall a highly sensitive landscape, it is not located on one of the prominent west-facing summits (Binevenagh, Keady, Donald's Hill and Benbradagh) which form a key part of the wider landscape setting and which the SPG infers should be avoided. Rather, it is located on the side slope of Keady

CONSENTED (LA01/2018/0200/F)

Mountain and will form a cluster with the existing and consented wind farms at Dunbeg and Dunmore which are located on the other side of the A37 road corridor. These have already deemed to be in an acceptable location within the AONB, and accepted to be of lower sensitivity than the core parts of Binevenagh or its extremities. Furthermore, the proposed site is also surrounded by a large amount of coniferous forestry which serves to reduce the sensitivity of this part of the AONB.

The SPG's description of Key Location, Siting, Layout and Design Considerations

4.109 The Development meets the locational criteria of the SPG, specifically:

- Turbines may be accommodated in appropriate locations because of large-scale strong horizontal form of escarpment;
- The lower central section of the LCA is better suited than the northern or southern ends;
- Siting within forestry in these locations may also be appropriate;
- Impacts on distinctive skylines of Binevenagh, Keady, Donald's Hill or Benbradagh should be avoided as well as impacts on features of natural and cultural heritage interest and recreational resources. The proposed turbines have purposefully been located away from the summit of Keady. In some views the turbines would be visible beyond / behind the summit of Keady Mountain but this does not prevent it from being clearly separate and distinguishable (see Viewpoints 15 and 18 as examples – Figures 4.29 and 4.32).

Other Non-Statutory Landscape Classifications

4.110 A review of other relevant non-statutory landscape classifications has also been carried out as part of this LVIA. These classifications identify landscapes or elements within the landscape that are recognised as being important by virtue of being marketed as attractions or identified in non-statutory documentation in the public realm, but which have no protection in law. These classifications are illustrated on Figures 4.1 - 4.3. Information on them in drawn from a number of websites[8] providing relevant descriptive information which is used in conjunction with Ordnance Survey maps to plot the locations of visitor attractions and including the Ulster Way, National Cycle Network, and scenic drives in the Study Area (Figures 4.1 and 4.2), and to aid the selection of viewpoints (Figure 4.4).

Rights of Way, Cycle Routes, and Scenic Drives

4.111 The Ulster Way is a 1000 km long circular walking route which covers the most scenic parts of Ulster. It is divided into 'Quality Sections', which provide largely off-road way-marked access for walkers in highly scenic areas, and 'Link Sections', which are mainly along roads and are not generally way-marked. A section of the

[8] http://www.walkni.com, www.cycleni.com, www.sustrans.org.uk

CONSENTED (LA01/2018/0200/F)

Ulster Way long distance footpath runs from the south of the Study Area, through the Sperrin AONB before continuing towards the north Derry coast via the Binevenagh AONB. The route then continues northeast, generally following the coastline to the edge of the Study Area. The Development is located approximately 1km due west of the Ulster Way.

4.112 The National Cycle Network provides cyclists with marked scenic routes across the province. Within this Study Area there are routes linking Binevenagh to the Roe Valley, the Loughermore Hills, and the Glenelly Valley in the Sperrins; Loughermore to Dungiven; the northern and central parts of the Sperrins; and a route along the Northern edge of the Sperrins, Faughan River Valley, Derry and the banks of the River Foyle. At its closest point the route comes within approximately 3km of the Development.

4.113 Several scenic routes are signposted on roads within the Study Area:

- The Causeway Coastal Route is the closest route to the Development and is one of the most popular scenic routes in Northern Ireland. It stretches along the coast, from Belfast Lough to Lough Foyle and covers over 80 miles of coastline includes a number of heritage sites, AONBs and the Giant's Causeway WHS. It also includes the Roe Valley way marked route and Binevenagh Scenic Drive in the central part of the Study Area. The ZTV indicates that there is potential visibility from many parts of this route (Figure 4.1) and Viewpoints 1 – 6, 12, 13, 19, 21 and 25 represent views from scenic driving routes;
- The Inishowen 100 route around the Inishowen Peninsula, part of which runs along the north western edge of the Study Area. However, preliminary site assessment indicated that the existing Dunbeg cluster of wind farms was not easily discernible features in views from sea level at such a distance. Therefore, no viewpoints were selected to analyse similar viewpoints for the Development. However, Viewpoint 27 was selected to illustrate the nature of elevated views from Inishowen;
- The North Sperrins Route is an 80 km circular route including the B40 and B64 in the south eastern part of the Study Area. However, the ZTV indicates very little visibility and it is therefore not considered further in this LVIA.

Blue Flag Beaches

4.114 Blue Flags are awarded to European beaches and marinas across Europe that have particularly high environmental standards and facilities. There are several Blue Flag beaches within Co. Derry and Co. Donegal which are popular tourist destinations. However, receptors on these beaches are usually located at sea level and the focus of their views is not inland. It is unlikely that the Development would have any significant impacts on these beaches and they are not considered further in this LVIA.

CONSENTED (LA01/2018/0200/F)

National Trust Properties

4.115 Whilst these are not statutorily designated, the National Trust manages landscapes and buildings which have significant cultural value and which are often prominent landscape features. There are a number of such properties and landscapes within the Study Area but preliminary ZTVs and site assessment work indicated no visibility from many of these sites and the following are not further considered in this LVIA for this reason: Giant's Causeway WHS; Hezlett House; Downhill Estate; Castlerock; Martello tower at Magilligan; C18th private residences: at Bellarena and Fruithill. The effects of the Development on Drenagh Estate near Limavady is considered as part of the Archaeology and Cultural Heritage Assessment (Chapter 5) but this is not a publicly accessible landscape and both Figure 5.15 and site assessment demonstrated that visibility of the Development would be limited so in LVIA terms it is not considered to be significantly affected.

Baseline Visual Character Assessment and Analysis of Effects

Visual Character of the Study Area

4.116 The Study Area comprises several ranges of hills with broadly north-west to south-east alignments. Each range of hill has its own distinctive profile and they markedly divide the areas of broad rolling lowlands between them. Most of these ranges of hills contain clusters of existing, consented and proposed wind farms, which are indicated on Figure 4.5 and the cumulative ZTVs (Figures 4.9 and 4.10) and described in paragraph 4.203. Working from left to right across the Study Area these hill ranges are as follows:

- Inishowen: this is a long range of hills on the north west boundary of the Study Area which physically contains the lowland area of Co. Donegal adjacent to Lough Foyle and which frame long range views to the north west;
- The Binevenagh escarpment is a basalt plateau with a distinctive profile of vertical cliff faces, which are a significant landmark particularly from surrounding lowland areas of Magilligan, the Foyle Estuary and Co. Donegal. From the proposed sites exposed location lying in a saddle of land between the Binevenagh escarpment and the summit of Keady Mountain long distance views can be obtained of Inishowen to the north west;
- Loughermore Hills: a small - medium sized range of hills located between the River Faughan and River Roe corridors in the west of the Study Area. There is a large coniferous plantation on this range called Loughermore Forest. It also contains a large and longstanding cluster of existing wind farms at Altahullion and Glenconway;
- Sperrin Mountains and outlying hills: This is the largest upland mass which covers the south western quarter of the Study Area and which forms the Sperrin AONB. The Sperrins are the highest peaks at its centre and there

CONSENTED (LA01/2018/0200/F)

are a large number of secondary hills surrounding these which are contiguous with the Slievekirk and Binevenagh ranges of hills;

- Long Mountain is a single long thin-profiled hill to the east of the River Bann corridor. It provides a setting for the main road between the south of the province and the north Antrim coast. Garves wind farm is a prominent feature on Long Mountain and there are two other consented wind farms in proximity to it.

4.117 The highest quality views from the Binevenagh AONB are usually wide angle views and views orientated towards the coast and to the north and west over the Foyle Estuary and Inishowen. In views of the AONB from surrounding lowland areas to the west and north-west it is often the sheer extent of these views, rather than the quality of the foreground landscape, that affords them high scenic value. Individual elements of these views are subordinate features. These include several large existing wind farms. In medium to long range views the Development is unlikely to be perceived as a dominant visual element adjacent to the Dunbeg cluster of wind farms (comprising 21 existing and 3 consented turbines) and it is not likely to detract from the overall quality of the physical landscape character or visual amenity.

4.118 The Binevenagh escarpment frames views from the lowlands to the north and west but there are very few instances from these lowlands where the entire profile of the Binevenagh range is visible and it is never visible in this manner for long periods of time. Vegetation, topography, built development and changes in the direction of views as the road corridor changes direction all serve to break up views of the profile. On the approach to settlements and within settlements along this route views are nearly always focused within the settlements themselves.

4.119 The Causeway Coast train journey between Coleraine and Derry is a popular tourist route. This journey takes approximately 45 minutes each way and the train travels in the general direction of the Development when travelling towards Coleraine from Derry. In both directions of travel views vary according to the position of passengers in relation to windows and the side of the train on which they are sitting. However, in general the sea-side is the most popular side of the train to sit on because the main points of interest on the journey are the sea and coastline framed at different points of the journey by the Inishowen peninsula in Co. Donegal, the Magilligan lowlands in Co. Derry, and the escarpment on the northern face of Binevenagh. Views in the direction of the Development are less likely to feature although the presence of the existing Dunbeg and Dunmore wind farms does provide a point of interest between Binevenagh and Keady mountains. Overall the visual experience of journeys in both directions is characterised by a series of transitory views. The Binevenagh escarpment is only visible for a very short period of time and not simultaneously with the Dunbeg cluster of wind farms. There are very few views of the entire profile of Binevenagh and there is only a period of a few minutes when views from the land-side of the train are focused towards these

CONSENTED (LA01/2018/0200/F)

wind farms. During this short period uninterrupted views are obtained intermittently for a matter of seconds. Foreground vegetation and buildings filter views and distract the eye. Based on these findings it is surmised that the Development will not be a prominent visual feature on views from trains.

The Zone of Theoretical Visibility

4.120 ZTV diagrams have been produced at a radius of 15 km and 30 km from the Development based on the proposed turbine dimensions and illustrating blade-tip visibility (Figures 4.6 and 4.7). A Reverse ZTV (Figure 4.8) has been produced to clearly illustrate areas where there would be no theoretical visibility of the Development. These diagrams are the starting point for the baseline visual assessment and were also used to assist the selection of PVPs. They illustrate the <u>theoretical</u> visibility and non-visibility of the Development as a standalone development, unrelated to any other wind farms in the Study Area. They indicate that, within a 15 km radius from the Development, 67.66% the Study Area is likely to have some theoretical visibility of the Development but this would reduce to 58.18% in the 30 km Study Area.

4.121 The reverse ZTV illustrates the screening effect of the higher ground directly to the north and south of the Development – i.e. the rising slopes and summit of Binevenagh and the summit of Keady Mountain - by showing (in blue shading) the large parts of the Study Area to the north and south which would have no visibility of the Development.

4.122 The effect of the drumlin topography in farmland in the eastern part of the Study Area is indicated by patchy areas of visibility. The largest and most uninterrupted areas of theoretical visibility occur around the flat coastal areas to the west of the Development – Magilligan and the Roe Valley, and in the sea and Lough Foyle estuary to the north and north-west. However, detailed site assessment indicates that built development and vegetation cover in these parts of the Study Area are likely to screen many low-lying views. The Development is also likely to be difficult to discern with the naked eye in long distance views particular from low level viewpoints where its scale will be diminished by the scale of wider views. There will be very few visual receptors present on the sea and their distance from the Development, combined with their low elevation in relation to the land, is likely to mean that the Development will not be a clearly discernible feature in their views.

4.123 The ZTV diagrams indicate that there are very few parts of the Causeway Coast and Sperrin AONBs that are likely to have view of the Development and the northern half of the Binevenagh AONB, including the summit of Binevenagh, will either have no views or views of the Development that are limited in their extent.

CONSENTED (LA01/2018/0200/F)

Table 4.1 - Zone of Theoretical Visibility of the Development

ZTV Diagram	No. of turbines theoretically visible (blade tip)	% of Study Area with visibility	
15 km ZTV	1 – 3 turbines visible	8.42 %	
Figure 4.6	4 – 6 turbines	14.19 %	Total % of 15 km Study Area where the proposed wind farm is theoretically visible = 67.66 %
	7 – 9 turbines	45.05 %	
	0 turbines	32.34 %	
30 km ZTVs	1 – 3 turbines visible	4.85 %	
Figures 4.7	4 – 6 turbines	7.14 %	Total % of 30 km Study Area where the proposed wind farm is theoretically visible = 58.18 %
	7 – 9 turbines	46.19 %	
Reverse ZTV Figure 4.8	0 turbines	41.82 %	

Desk-based selection of Provisional Viewpoint Locations

4.124 The Baseline Assessment identified a number of parts of the Study Area most likely to experience visibility of the Development and contain key receptors due the theoretical levels of visibility indicated by the ZTV diagrams and the potential sensitivity of either the location and / or the visual receptors likely to be present at these locations. These locations guided the selection of PVPs and this initial desk-based selection of PVPs, including the selection criteria, is described in Technical Appendix 4.4 and illustrated on Figures 4.1 and 4.4. Fifty one PVP locations were selected and draft wireline diagrams for all these locations were prepared and checked by site visits to confirm the nature of receptors and potential visibility of the Development. These draft wirelines were used as working documents and are not reproduced in this LVIA. Twenty eight of the PVPs selected were used in the LVIAs that were prepared by other developers for the Dunbeg cluster of wind farms because it was felt this would provide a useful means of assessing cumulative visual effects of the Development in particular.

Initial site assessment and viewpoint ‘shortlisting’

4.125 Following an initial site assessment a proposed shortlist of 22 PVPs was discussed with the Council. This included a proportionate number of locations which represented typical views of the Development, key visual receptors and key locations within the Study Area. PVPs were not shortlisted if they were found to provide no actual view of the Development. The reasons for this usually arose from

CONSENTED (LA01/2018/0200/F)

differences between theoretical and actual visibility which is explained in Technical Appendix 4.2. Other viewpoints were not shortlisted if a more typical view was demonstrated elsewhere, where no safe stopping place was possible to take a photograph or where the viewpoint location would not be easily accessible to the public. A summary analysis of all PVP locations and the rationale regarding shortlisting is provided in Technical Appendix 4.4, Table 4.4.1. For ease of analysis these shortlisted viewpoints were categorised as follows:

A. Views from primary and secondary routes, including tourist routes;
B. Views representing residential properties and rural settlement within 5 km of the Development;
C. Residential properties and settlements within 5 - 15 km of the Development;
D. Views illustrating the wider landscape setting and visibility of the Development in the context of the adjacent Dunbeg cluster of wind farms.

4.126 The Council were in broad agreement with the proposed shortlist but requested the omission of two long range viewpoints, and the inclusion of three PVPs along the A37. They also suggested five additional locations, of which it was agreed that four would be added to the final list of viewpoints. The discussion with the Council regarding additional shortlisted viewpoints is detailed in Technical Appendix 4.4, paragraph 4.79.

Final Viewpoint Selection

4.127 A total of 27 final viewpoints have been selected as a result of the provisional viewpoint selection process described above. They are intended to be representative of typically occurring views within the Study Area, views experienced by sensitive visual receptors, and also views from specific locations that merit inclusion in the LVIA by virtue of their contribution to the landscape and visual qualities of the Study Area. A detailed description of the methodology for viewpoint selection is included in Technical Appendix 4.2 starting at paragraph 4.23. The locations of final viewpoints are indicated on all map-based figures which accompany this LVIA chapter (Figures 4.1 – 4.11). Wirelines and photomontages of each viewpoint have also have been presented in Figures 4.15 – 4.41. These are intended to assist in the understanding of, but not to replace, the detailed written descriptions of effects on viewpoints which are contained in the subsequent paragraphs of this chapter. It is important to recognise the limitations of visualisations and this is further described in Technical Appendix 4.2, paragraphs 4.41 – 4.48. They should not be relied upon as the primary means to determine visual effects and it is expected that all locations will be visited in order to be fully understood.

4.128 Whilst it is noted that the Council's primary concern is the visual effect of the Development on close-range viewpoints cognisance is also taken of the SPPS and PPS 18: BPG. These policy and guidance documents note that whilst wind farms are, by their nature, highly visible and are likely to be relatively prominent at

CONSENTED (LA01/2018/0200/F)

distances of up to 5 km, this does not necessarily preclude them from being acceptable features (refer to paragraphs 4.55 and 4.60). The choice of viewpoints is intended to represent the manner in which the Development is experienced when travelling around the Study Area and not just from locations in close proximity where it can often be expected to be clearly visible.

4.129 The viewpoints have been grouped into four categories (Categories A – D as listed in paragraph 4.125 above) so that the different types of views, receptors, and specific areas they represent can be accurately described and understood without unnecessary repetition. These categories have been further subdivided for the purposes of the detailed viewpoint descriptions below, in particular to provide detailed descriptions on the manner in which views are experienced when travelling through various parts of the Study Area that are located within 0 – 15 km of the Development.

Category A: Views from primary and secondary transport routes, including tourist routes

A1: Views from the A37 road corridor between Coleraine and Limavady

Description of Existing and Predicted Views

4.130 Category A1 includes Viewpoints 1, 2, 3, 4, 5 and 6 which are illustrated in Figures 4.15 – 4.20. Viewpoints 1 and 2 represent views along the approach from Coleraine town. Viewpoint 1 is located in the hard shoulder of the road near the village of Macosquin approximately 7.56 km to the north east of the Development. It illustrates that whilst the existing cluster of wind farms at Dunbeg is sometimes clearly visible to the right hand side of the road corridor, it is frequently screened by roadside vegetation and its prominence is reduced by the relatively narrow proportion of the overall view which it occupies. The road corridor and agricultural land in the foreground and middle distance of the view are dominant and the large expanse of forestry across the centre of this view is also a strong visual feature. Overall, this view is characterised by manmade influences, including fast and frequently busy traffic movement on the road corridor. Views are generally transient in nature. It is not located within the AONB boundary.

4.131 The Development would not be visible from this location. The wireline indicates that the blade tips of turbine 7 and 8 would be visible but the photograph shows that the forestry would screen all parts of the proposed turbines. Taking account of the cumulative baseline that is visible in Viewpoint 1, i.e. clear visibility of the Dunbeg cluster and the increasing prominence of this cluster of wind farms as one travels along the A37 to other viewpoints in this category the Development, where it does become visible would not be incongruous and, would be seen as a coherent element in this context.

4.132 As one moves towards Viewpoint 2 from Viewpoint 1 the forestry in the foreground becomes a more dominant feature on the southern side of the view and screens views towards the Development. The northern side of the A37 becomes less

CONSENTED (LA01/2018/0200/F)

agricultural and is characterised by rough grazing land on which the existing Dunbeg cluster of wind farms are located adjacent to the road corridor and in front of Binevenagh. Beyond these turbines there are views of the 'back' side of Binevenagh Mountain to the north (i.e. there are no views of the iconic cliffs of Binevenagh that are one of the key AONB characteristics) and westwards across the Foyle estuary to Inishowen. Views from this location are more remote but the A37 is still a dominant feature both physically and visually. Field boundaries and roadside verges are not well managed and the landscape is not in optimum condition despite wider views being scenic in nature.

4.133 Viewpoints 3 – 6 represent the changing nature of visibility when travelling towards the proposed site from Limavady. Viewpoint 3 is located in closest proximity to the Development, in the A37 hard shoulder approximately 0.46 km to the north-west. This view would become apparent when travelling westwards from Viewpoint 2 where the Development is not visible. All turbines would become visible in their entirety for this short section of the road corridor. The bases of most turbines would be visible against a rising backdrop of the rough grazing land on the site and the edge of the adjacent Springwell Forest. This section of this viewpoint is almost entirely characterised by man-made factors and human-influences on landscape character. The existing and consented Dunbeg cluster of wind farms is located in the north and north-eastern section of this view (beyond the angle of view that is illustrated in Figure 4.17) on the opposite side of the A37. There is also a consented single turbine located in the quarry within Springwell Forest to the left hand side of T9. The majority of this turbine would be screened from view by the preceding belt of forestry and it would appear to be visually separate from the Development. The summit of Keady Mountain would not be visible and there are no views further west than the immediate foreground which is occupied by the Development. Therefore, the Development does not affect any appreciation of the Sperrin AONB or the southern section of the Binevenagh uplands which are not perceptible from this viewpoint. The Development would become a dominant feature in this viewpoint because of its close proximity. However, the existing Dunbeg cluster is already a dominant feature on the other side of the road corridor and it appears in front of Binevenagh Mountain, and adjacent to wider views towards Inishowen. Lough Foyle and the Roe Valley. The Development does not impinge on these parts of the wider view and occupies a small and visually quite contained element of the overall view from this location.

4.134 There are no safe opportunities to stop and appreciate static views towards any wind farms until in proximity of Viewpoint 3. Viewpoints 4 and 5 are therefore not located on the A37 but on side roads from where views towards the Development can be partially obtained through gaps in this vegetation and/ or from safer but arbitrary, stopping points. The screening effect of Keady Mountain and the location of turbines away from its summit can be appreciated from these viewpoints. The separation between the Development and the existing Dunbeg cluster which is formed by the base of Keady Mountain makes the proposed turbines seem closer

CONSENTED (LA01/2018/0200/F)

than the existing turbines rather than purely larger in dimensions. Viewpoint 4 is located approximately 0.79 km to the west of the Development also on a side slope of Keady Mountain and the angle of view and screening effects of vegetation on the slopes at this close proximity means that the majority of the turbines are screened from view

4.135 Viewpoint 6 is located in a layby at the side of the road near the junction with the B66 Ringsend Road from where Keady Summit is prominent but where forestry screens most of the existing cluster of Dunbeg turbines. The Development would be partially visible behind the side slope of Keady Mountain and to the right hand side of the road corridor approximate 3.67 km from the Development. They would be closer and larger in size that the existing Dunbeg cluster but the vegetation either side of the road corridor would provide a degree of separation between the two developments and, as one travels further along this section of the A37, this vegetation would become a screening element to any views of turbines.

4.136 In addition to the Dunbeg cluster of wind farms, there is a further proposed wind farm at Croaghan that would, if consented become a prominent feature to the left of the road corridor in Viewpoint 1 and which would further increase the level of manmade influences visible and influential on this viewpoint without altering the overall nature of the view which is already strongly defined by such influences. From Viewpoints 3 – 6, when travelling towards Limavady, there are existing clusters of wind farms present in one part of the Inishowen skyline and a large cluster of existing wind farms at Loughermore. Neither are prominent features from these viewpoints. They would not be simultaneously visible with the Development without needing to alter one's direction of view because there are large separation distances between these various wind farms.

Sensitivity of Visual Receptors: Medium to Low

4.137 The A37 is a busy part of the primary road network between two large towns and the majority of visual receptors will be travelling in fast-moving vehicles. These types of viewers are generally considered to be of low sensitivity (refer to the Methodology criteria in Appendix 4.2). However, with the exception of Viewpoint 1, these viewpoints are located within the AONB so many travellers are likely to be using this road to experience scenic views and may utilise the frequent laybys and hard shoulder areas to stop and appreciate such views. Taking account of the presence of existing wind farms in the Dunbeg cluster, which in all instances have an influence on the nature of views from these locations, the sensitivity of receptors in Viewpoints 2 – 6 is therefore deemed to be Medium.

Magnitude of Visual Effect: High to Negligible

4.138 The most attractive views from this part of the Study Area are north-westwards towards Inishowen. There is no visibility in this direction nor would there be visibility of the Development from Viewpoint 1. Such views are obtained from Viewpoint 2 where the Development would not be visible, and then continuously on

CONSENTED (LA01/2018/0200/F)

approach to Viewpoint 3 and from Viewpoints 3 to 6 when travelling away from the Development. Therefore, whilst the Development may influence parts of foreground views, it would not impinge or encroach upon views into the wider landscape. If travelling eastwards from Limavady towards Coleraine the Development would be a prominent feature adjacent to the Dunbeg cluster. However, it would be located behind viewers as they travel towards Limavady beyond the location of Viewpoint 3.

4.139 The magnitude of visual effects on Viewpoints 1 and 2 is deemed to be Negligible and there would be a Low magnitude of visual effects on Viewpoint 4 because the Development would be only partially visible and / or form a peripheral element in the overall views form these locations. This would increase to a Medium magnitude of effect from Viewpoints 5 and 6 where the turbines would appear to be larger in relation to the Dunbeg cluster which becomes less prominent in these views.

4.140 From Viewpoint 3 the Development would have a High magnitude of visual effect because it would be clearly visible as a new element in close proximity to this location. However, this magnitude of effect would depend somewhat on the direction of travel. In static views and westward-facing views it would have a lesser (Medium) magnitude of effect because a greater proportion of the wider view would also be experienced. Only if travelling eastwards, and for a relatively short time period, would the Development become a major feature of the view. It would also be located within the section of this viewpoint that is most heavily characterised by human factors, including close proximity to the Dunbeg cluster of wind farms, and it would not impinge on the most scenic parts of the view, which are directed to the wider landscape in the north-west. The Development would occupy a relatively small part of the overall view which, from this location, is extensive. The Development would not alter the overall nature of views from this location.

Significance of Visual Effect: Significant (Viewpoint 3), Not Significant (Viewpoints 1, 2, 5, 5 and 6)

4.141 Only if travelling towards the Development from the west would the effects on Viewpoint 3 be Significant. In all other instances the visual effects on Category A1 viewpoints are not deemed to be Significant because, despite being prominent in some close range views, the Development would either form a relatively small element of a wider view or not be visible at all from other sections of the road corridor.

A2: Views from the secondary B201 road corridor between Coleraine and Limavady

Description of Existing View and Predicted Views

4.142 Category A2 includes Viewpoints 7, 8 and 9 which are illustrated in Figures 4.21 – 4.23. Similarly to the A37, the B201 connects Coleraine to Limavady and, although a secondary route, it is still quite a busy road with fast-moving traffic and far fewer stopping places than the A37. Hence, the majority of views, and particularly views

CONSENTED (LA01/2018/0200/F)

to features located in the foreground, are transitory in nature because they are obtained primarily from vehicles. The B201 runs parallel with the A37 but at a greater distance from the Development.

4.143 Viewpoint 7 is located approximately 2.65 km to the north of the Development at the base of Binevenagh Mountain but all views northwards towards Binevenagh are screened by the adjacent mass of coniferous trees (Ballyhanna Forest). There are clear views in a southerly direction across an open expanse of poor quality rough grazing land in the foreground, which is dominated by part of the existing Dunbeg cluster of wind farms on the left hand (eastern) side of the view. This cluster of wind farms is not visible in its entirety from this location but becomes closer and more visible if travelling eastwards for a short section of this road. It becomes less of a feature of views when travelling westwards where views face away from the cluster. There are some views into the wider landscape around the Loughermore Hills and the existing cluster of wind farms here but these are not a prominent feature due to their distance from this viewpoint. The A37 road corridor is not a prominent feature either - it can be identified by some linear sections of vegetation running across the centre of the viewpoint photograph but this would not be discerned when experiencing views whilst in transit.

4.144 The Development would be visible on the side slope of Keady Mountain against a rising backdrop of rough grazing land and adjacent to the geometric outline of Springfield Forest. The consented turbines of Dunbeg Extension and a consented single turbine in the quarry within Springwell Forest would both be located within the current gap between the existing Dunbeg cluster of wind farms and the Development. Together they would appear to form a contiguous development with all the turbines appearing to be of broadly similar proportions when viewed from this distance. The single turbine between the two wind farm developments would be slightly incongruous because it would be smaller than the other turbines. However, it would also be located behind the other turbines and therefore be a secondary vertical element with less of a visual relationship with the other turbines than it would have to the quarry and stark outline of the forestry that surrounds the quarry which are already visually detractive elements in this part of the view.

4.145 Whilst the Development would become a dominant element in this view it would not alter the overall composition or character of the view which currently comprises of broad upland areas with rough grazing land and large clusters of wind turbines. The existing and consented elements of the Dunbeg cluster already create this character in the foreground, and the Loughermore cluster repeats this character in the wider landscape to the west. The Development would increase the geographical extent of wind turbines that would be visible in the foreground but not to the extent that these would encroach on, or influence the character of views into the wider landscape to the west.

4.146 Viewpoints 8 and 9 are located further away from the Development on more inhabited parts of the road corridor. The foreground landscape in these viewpoints

CONSENTED (LA01/2018/0200/F)

is more complex and the topography more undulating. In both viewpoints the Development would be located beyond the existing Dunbeg cluster and would not laterally extend the number of turbines that would be visible along the skyline. From these distances, from 6.44 km to 10.89 km, the Development would not be an easily discernible feature.

Sensitivity of Visual Receptors: Low

4.147 Viewers present at Viewpoint 7 will primarily comprise travellers in fast-moving vehicles or workers tending the adjacent rough grazing land. Both receptor groups are deemed to be of low sensitivity. The types of viewers present at Viewpoints 8 and 9 may, in addition, include residents who are generally deemed to be of High sensitivity. However, the Development is unlikely to be a discernible feature from these viewpoints and therefore, in this instance, they are also deemed to be of Low Sensitivity.

Magnitude of Visual Effect: Negligible to Medium

4.148 The Development would be readily noticeable but contiguous with, and of a similar scale and form as, the existing Dunbeg cluster of wind farms when seen from Viewpoint 7. It would not change the overall nature of the view which is already characterised by a large cluster of wind farms in the foreground landscape. The nature of effects would therefore be of Medium magnitude. From Viewpoint 8 the Development would be partially visible and occupy an existing gap or space between some turbines in the Dunbeg cluster so it would not increase the overall extent of this cluster. The increased density of turbines would be confirmed to one part of the cluster and is unlikely to be noticeable to the general observer, particularly in transitory views. Therefore the magnitude of visual effect is therefore deemed to be Low. From Viewpoint 9 the magnitude of effect is Negligible because the Development is even less discernible given the distance of this viewpoint from the Development, the complexity of other features in the foreground, and the general absence of points from which static views may be obtained.

Significance of Visual Effect: Not Significant

4.149 In all Category A2 viewpoints the sensitivity of visual receptors is Low and the magnitude of effects ranges from Negligible to Medium. In two of the Viewpoints the Development would not be clearly visible and from Viewpoint 7, although it would be prominent, it would not affect the overall quality of the view or impinge on the most scenic parts of the view which are located in the wider landscape to the west.

A3: Views from the Binevenagh Scenic Drive

Description of Existing View and Predicted Views

4.150 Category A3 includes Viewpoints 10 and 11 which are illustrated in Figures 4.24 and 4.25. Both are located on the Binevenagh scenic driving route which is a partially-

CONSENTED (LA01/2018/0200/F)

marked tourist route from which visitors to the AONB experience changing views from various parts of Binevenagh Mountain. The ultimate destination for this route are a number of viewing areas around the summit and escarpment from where panoramic views can be obtained over the Magilligan floodplains and Foyle estuary towards Inishowen and across the north Antrim coastline towards Scotland.

4.151 Viewpoint 10 is located on the lower part of the scenic drive on Bishop's Road approximately 3.6 km to the north west of the Development. There are no views of the summit or sea from this location but there are very attractive and panoramic south-westward facing views encompassing the rest of the Binevenagh range of hills, the northern-facing edge of the Sperrin Mountains, the Loughermore Hills and the Roe Valley. There are a number of rural properties located along this road, and elsewhere in the foreground landscape, which are generally orientated to take advantage of these aforementioned views. The foreground comprises of pastoral fields defined by clumps of trees and hedgerows. It is reasonably attractive despite not being in optimum condition - many of the hedgerows are in decline and field are often rush-infested. The lower slopes of Binevenagh and Keady Mountain to the north and north east are covered by large swathes of coniferous forestry and rougher grazing land, as are most other uplands visible from this viewpoint. There is also a prominent quarry site on the west-facing side of Keady Mountain, which is visible in profile from this viewpoint. There is a smaller quarry with a consented single turbine within Springwell Forest located between the Development and Dunbeg cluster of wind farms.

4.152 There are also clusters of turbines in several parts of this view which are all of a similar size in terms of the amount of turbines. Approximately 14 of the 24 existing and consented Dunbeg cluster of turbines are visible in the eastern (left-hand) section of Viewpoint 10. It is located above a ribbon of houses on the Stradreagh Road and is partially screened by this and by the lower slopes of Binevenagh. The Development would be located at a similar distance from this viewpoint as the Dunbeg cluster, and would be within the same broad basin of land formed by the A37 road corridor and Curly River valley that are positioned between the summits of Keady and Binevenagh.

4.153 The existing cluster of wind farms on the Loughermore Hills is visible at a distance of approximately 16 km. A consented wind farm at Ballyhanedin would be located to the left of this cluster at a distance of approximately 21.7 km but would appear to be contiguous from this direction and distance. Together these wind farms would form a cluster of 57 turbines. A consented wind farm at Evishagaran (14 turbines) would be visible at a distance of approximately 14 km on the east side of Benbradagh Mountain which forms one of the several distinctive ridgelines in the Binevenagh range of uplands.

4.154 The Development would be located equidistant between this cluster and the western side of Keady Mountain where the quarry is prominent. The Dunbeg cluster of wind farms quickly becomes less visible when travelling north on Bishops Road

CONSENTED (LA01/2018/0200/F)

towards the summit of Binevenagh but becomes more visible when descending this road towards Limavady. The Development would remain visible for a longer period of time, although if travelling in a northerly direction away from this viewpoint it would become located behind the direction of travel, and therefore would not be a feature of views in this direction. It would be a more prominent feature adjacent to the existing Dunbeg cluster but would not impinge upon the most attractive parts of this viewpoint which are the wider views along the rest of the Binevenagh uplands and to the south west.

4.155 The Development would become entirely screened by the slopes of Binevenagh and forestry plantations a little further north along Bishops Road and would remain entirely screened from all areas around the summit, including Viewpoint 11 which is located approximately 7 km from the Development. The summit is the destination for most people visiting Binevenagh because it is from here that the iconic juxtaposition between the escarpments, Magilligan lowlands, seascape and more distant hills can be appreciated.

Sensitivity of Visual Receptors: High to Low

4.156 The key visual receptors in and around Viewpoint 10 will be tourists on the scenic driving route and residents of rural properties. Both are regarded as highly sensitive and will experience clear views of the Development. Visitors may well stop to appreciate the panoramic south-westerly views from this section of the scenic drive and residents will experience static views in the same direction.

4.157 Receptors at Viewpoint 11 are likely to comprise almost exclusively of tourists who would usually be regarded as highly sensitive. However, because the Development would not be visible from this viewpoint or other parts of the summit they are, in this case, deemed to be of Low Sensitivity.

Magnitude of Visual Effect: Medium to Negligible

4.158 The Development would be a prominent feature located in relatively close proximity to Viewpoint 10. It would increase the duration for which wind farms would be visible when travelling along Bishops Road to and from the summit of Binevenagh and would also increase the lateral extent of turbines in this section of the Binevenagh range of hills. However, it would not introduce a completely new element to the view nor would it change the overall character of this section of the foreground which already contains a large cluster of existing and consented wind farms at Dunbeg. The wider landscape is highly attractive due to the panoramic nature of views and the crescent-shaped arc of Binevenagh uplands that frame more distant views towards the Sperrins, and across the pastoral Roe Valley landscape towards the Loughermore Hills. Large clusters of wind farms are already characteristic features in parts of this view and do not detract from its overall scenic qualities.

4.159 The Development would have a similar simple turbine layout to the adjacent Dunbeg cluster and would remain detached from the west-facing edge of Keady

CONSENTED (LA01/2018/0200/F)

Mountain which forms the setting and frame for the extensive panoramic views that are available across the rest of the view. For these reasons there is deemed to be a Medium magnitude of effect on Viewpoint 10. This decreases to a negligible magnitude of effect as one travels further northwards along Bishops Road and to the summit of Binevenagh including at Viewpoint 11.

Significance of Visual Effect: Significant – Not Significant

4.160 The Development would not be visible from Viewpoint 11 which represents the nature of views from the higher sections or summit of Binevenagh and which is the primary destination for tourists using this scenic route. Residents along the lower sections of Bishops Road, represented by Viewpoint 10, are also considered to be highly sensitive and there would be a significant effect on one part of static views obtained by these receptors. However, effects on the whole view obtained from this viewpoint are not deemed to be significant. Although it would be located relatively close to Viewpoint 10, the Development would occupy a site near the left-hand (southern) edge of this viewpoint. The magnitude of effect on Viewpoint 10 is deemed to be medium. The Development would be more prominent than the existing Dunbeg cluster but would not change the overall nature of views from Viewpoint 10. Nor would it impinge upon the main focus of views, which is in a south-westerly direction where large clusters of wind farms are already characteristic features of the wider landscape. However, visual receptors are deemed to be of High sensitivity in this part of the Study Area and overall visual effects are therefore deemed to be Significant.

A4: Views from the Roe Valley and Causeway Coast Scenic Routes to the west

Description of Existing View and Predicted Views

4.161 Category A4 includes Viewpoints 12 and 13 which are illustrated in Figures 4.26 and 4.27. They represent views and visual receptors located on scenic driving routes and near visitor amenities in the lowlands to the west of the Development. Views from this part of the Study Area also show the Development in relation to the summit of Binevenagh and the spine of uplands that run through the AONB.

4.162 Viewpoint 12 is located approximately 8 km from the Development on a tertiary road junction. It would not be a usual place to stop and appreciate a static view but it does provide an indication of the types of views that would be obtained when travelling to and from the Roe Valley Country Park and along the National Cycle Network. The foreground comprises of a richly vegetated flat pastoral landscape with rural dwellings throughout. It is relatively extensive in scale and is framed to the east and west by long ranges of uplands. East-facing views from the valley are framed by a long crescent-shaped arc of hills stretching from north to south and including Binevenagh, Keady, Rigged Hill, Donald’s Hill and Benbradagh which merge with the Glenshane slopes and the Sperrins in the south west. Views in a westerly direction are framed by the Inishowen uplands in Co. Donegal. Views are frequently screened or filtered by the low-lying nature of the topography in the

CONSENTED (LA01/2018/0200/F)

foreground combined with high levels of trees and hedgerows particularly along the tertiary road network. The framing of views by upland areas is a key characteristic of the Roe Valley but individual features on these uplands have less prominence that the overall extent and profile of these hills.

4.163 The existing Dunbeg cluster of wind farms is located between the summits of Binevenagh and Keady. From Viewpoint 12 the Development would be partially visible beyond the summit of Keady which serves to screen most of the proposed turbines (there would only be visibility of the rotors and upper towers of 3 turbines and the blade tips of a further 4 turbines). A group of 2 single turbines are visible on the lower slopes of Rigged Hill to the far right hand side of the view, and the existing Rigged Hill wind farm is a prominent and longstanding skyline feature located slightly to the south of these (beyond the angle of view illustrated in Figure 4.26).

4.164 Viewpoint 13 is located on the primary road network – the A2 – which forms part of the Causeway Coast scenic driving route between Limavady and Magilligan approximately 6.9 km to the east of the Development. The foreground is similar to that of Viewpoint 12 but it has a more open and geometric character than the Roe Valley and there are denser clusters of houses along the primary road network and the outskirts of Limavady. Traffic on this road tends to be fast-moving and there are few formal stopping places. Viewpoint 13 represents the types of glimpsed views that may be obtained when looking from the side windows of cars travelling along the A2 and also the views of residents in dwellings located along the road corridor. The Development would be a prominent addition to the existing Dunbeg cluster of wind farms. It would extend the spread of turbines beyond the lower lying saddle of land between Binevenagh and Keady mountains and onto the northern side slope of Keady. The turbines would be slightly taller than the existing Dunbeg cluster but a section of undeveloped land would be retained in between. The Development would also be located further from the summit of Binevenagh than the Dunbeg cluster, and no turbines would be located on the summit of Keady so the identity of these summits as part of the AONB and Binevenagh LCA would be maintained. From Viewpoint 13, as with Viewpoint 12, there are also extensive views to the Inishowen uplands which the Development would have no effect on.

Sensitivity of Visual Receptors: High - Medium

4.165 In both viewpoints there would be a range of visual receptors including general road users and agricultural workers who are considered to be of low sensitivity, but also road users of higher sensitivity due to their presence on scenic driving routes. Residents of rural properties present in and around Viewpoint 12 would be of high sensitivity. Residents in and around Viewpoint 13 would be of medium sensitivity where they are in closer proximity to an urban settlement and busy road corridor.

Magnitude of Visual Effect: Low - Medium

4.166 From Viewpoint 12 the Development would be seen behind the summit of Keady Mountain but only partially visible and to a much lesser extent than the adjacent

CONSENTED (LA01/2018/0200/F)

Dunbeg cluster. From this location, and surrounding parts of the Study Area views towards the Development, and the uplands on which it is located form an important part of the setting but they are often filtered or screened from view by foreground vegetation and thus individual features, unless they are prominently located, are subordinate to the overall extent of these uplands. The Development is not prominently located and the overall magnitude of effect is Low. From Viewpoint 13 the Development would be a prominent feature and would have a closer and more discernible relationship with the summit of Keady Mountain than in most other viewpoints. However, it would also be seen within the context of the existing Dunbeg cluster of wind farms and a foreground landscape that is more heavily influenced by suburban housing development and the primary road network. It does not interfere with the appreciation of Binevenagh, and in particular the north-facing escarpment overlooking the Magilligan lowlands which are the core feature of the AONB. The overall magnitude of effect on Viewpoint 13 is Medium.

Significance of Visual Effect: Not Significant

4.167 There are a range of visual receptors present in these viewpoints and most are not highly sensitive. Those of the highest sensitivity are also likely to experience transitory views from parts of the tertiary road network where there are few natural stopping places, or from a lowland pastoral landscape where views are often filtered be high levels of vegetation cover. From both viewpoints the Development would form a small part of much wider reaching views in several directions. Its close proximity to the existing Dunbeg cluster of wind farms would mean that it would not change the overall character of the parts of both viewpoints that are already characterised by this cluster of wind farms, and nor would it be visible in other parts of these views.

Category B: Views from residential properties and rural settlement within 5 km of the Development

Description of Existing View and Predicted Views

4.168 Category B includes Viewpoints 14, 15, 16 and 17 which are illustrated in Figures 4.28 – 4.31 and which have been selected to represent views from roads with residential properties and settlement clusters in the rural landscape around the Development. With the exception of Viewpoint 14, the Dunbeg cluster of wind farms is already a characteristic feature of these views but they are also typically wider in their extent, encompassing views towards the southern side slopes of Binevenagh, pastoral lowlands in the Roe Valley (Viewpoint 17 is located in this area), and also longer range views in a north-westerly direction towards Inishowen and Lough Foyle. Many properties are orientated to take advantage of these more extensive scenic parts of the view rather than being orientated towards the Development or the existing Dunbeg cluster which are located on higher ground in the opposite direction to the most scenic parts of the view.

CONSENTED (LA01/2018/0200/F)

4.169 The foreground landscape in all these viewpoints has an agricultural character with medium sized fields divided by hedgerows and fences. Viewpoint 14 on the section on Bolea Road close to the site (it is located approximately 1.6 km to the west) has small-scale fields, a high level of tree cover and a narrow road corridor from which views are often constrained. Adjacent properties along this part of the Bolea Road often have more elevated and open aspects but are also usually orientated to take advantage of views to the north-west. Views from properties further along the Bolea Road to the north east of Viewpoint 14 are likely to gain clearer views of the Dunbeg cluster whilst properties located at the bottom of Bolea Road are unlikely to obtain clear views in this direction.

4.170 In Viewpoints 15 and 16 tree cover tends to be concentrated around properties and farmsteads rather than between fields and often serves to screen or filter views from these properties. Viewpoint 17, which is located near the edge of Limavady town approximately 4.6 km to the south west of the Development, is in a flatter valley landscape with higher levels of tree cover generally which provides only glimpsed views in the direction of the Development.

4.171 In addition to clear views of the Dunbeg cluster of wind farms, Viewpoints 15 and 16 would also have views of the Loughermore cluster of wind farms to the south west and distant views to wind farms on Inishowen in clear weather conditions. However, neither cluster are prominent features of views from this location. The quarry on the west-facing slope of Keady is a close range and prominent feature in both of these views as is traffic moving along the A37 road corridor at the base of the mountain. Therefore, whilst these are rural locations within the AONB, neither are particularly remote nor free of visually detractive features.

4.172 The Dunbeg cluster is not easily discernible from Viewpoint 14 – all but some blade tips are screened from view by woodland surrounding the Curly River which is located at the end of the road corridor illustrated in Figure 4.28. In this viewpoint the Development would become the most dominant feature in this direction because the slope of Keady Mountain on which it is located is the main feature in east-facing views from this location.

4.173 In Viewpoints 15 and 16 the Development would become a prominent feature but would also be closely related to the existing Dunbeg cluster and would remain within the landscape between the summits of Keady and Binevenagh rather than extending the influence of turbines into the wider landscape. The lateral extent of turbines on the side slope of Keady would be smaller than the proportion of Keady that would remain free of turbines and they would not encroach on the summit or western-facing profile which is prominent in wider views of the Binevenagh uplands from elsewhere in the Study Area.

4.174 In Viewpoint 17 the Development would be only partially visible beyond the side slope of Keady. Turbine 1 would be prominent but the other turbines would be less so. Furthermore, there are few locations in this part of the Study Area that offer similar views in safe stopping places along the road network and views tend to be

CONSENTED (LA01/2018/0200/F)

focussed towards the north and west rather than in the direction of the Development.

Sensitivity of Visual Receptors: High to Medium

4.175 Receptors from all these viewpoints are likely to include residents of rural properties, associated road users and agricultural workers. Whilst the latter are considered to be of low sensitivity, residents are considered to be of high sensitivity. In proximity to Viewpoint 17, which is located at a cricket club, but which also represents the other receptor groups mentioned above, sensitivity would be lower because views towards the Development are more constrained and do not tend to be the main point of focus. Overall, receptors around Viewpoint 17 are deemed to be of Medium sensitivity.

Magnitude of Visual Effect: High – Medium - Low

4.176 There would be a high magnitude of effect from Viewpoint 14 where the Development would become the most dominant feature in this direction with limited views beyond the immediate foreground. From Viewpoints 15 and 16 there are more extensive views in other directions and the Development would occupy a smaller proportion of the overall view. It would also be seen in conjunction with the Dunbeg cluster of wind farms which is already a characteristic feature of both views. Therefore the Development would not alter the overall nature of these views although it would prominent in one direction of these views. There is only partial visibility of the Development from Viewpoint 17 which also features much wider and clearer views in several other directions. Therefore the magnitude of visual effect on Viewpoint 17 is Low.

Significance of Visual Effect: Significant in Viewpoint 14 but Not Significant in Viewpoints 15 - 17

4.177 Visual receptors are considered to be highly sensitive in Viewpoints 14, 15 and 16 and the Magnitude of effect on Viewpoint 14 is also considered to be high. Therefore there would be a significant effect on this latter viewpoint where the Development would become the dominant feature in a view that will be appreciated largely by sensitive receptors. In Viewpoints 15 and 16, although receptor sensitivity is high, the overall magnitude of effect is less – medium- and receptors would experience views of the Development in close proximity to an existing and consented cluster of wind farms and as part of a more extensive view which, in other parts, does not include and is not influenced by close range views of the Development. The effects on Viewpoint 17 are also considered to be Not Significant because the Development would only be partially visible by receptors that are generally of lesser sensitivity (medium) and in the context of more extensive and far-reaching views in most other directions. The Development would occupy a very small section of views in and around this location.

CONSENTED (LA01/2018/0200/F)

Category C: Views from residential properties and settlements within 5 - 15 km of the Development

C1: Views from rural residential properties and settlements between 5 – 15 km from the Development

Description of Existing View and Predicted Views

4.178 Category C1 includes Viewpoints 18 and 19 which are illustrated in Figures 4.32 and 4.33. They represent views from rural properties and areas of settlement within the countryside at a greater distance from the Development than Category B viewpoints. Viewpoint 18 is located approximately 6 km to the south-west of the Development on the hillside above Drumsurn village and represents a series of rural properties within the agricultural landscape on the edge of this village. This tertiary road corridor runs across the hillside and has elevated and panoramic views across the lowlands between Derry, Limavady and Dungiven. The northern most extent of this view is framed by the summit of Binevenagh (visible on the left-hand side of Figure 4.32) and there are also attractive views further to the left that include Lough Foyle and Inishowen. This viewpoint is overlooked and framed by Rigged Hill and the existing wind farm on its skyline which is partially visible at the right-hand edge of the view illustrated in Figure 4.32. Keady Mountain is located in the centre of the view illustrated in the figure but, in the field, this is part of the view becomes the far edge of a view that would naturally be orientated in a north-westerly direction.

4.179 The Development would be partially visible beyond the broad rounded profile of Keady Mountain which, from this direction, does not form the same landmark summit along the profile of the Binevenagh uplands that it does when viewed from lowlands to the west (for example in Viewpoint 19). There are two single turbines located on the horizon to the right hand side of Keady which would be more noticeable due to their prominent location and faster blade rotation which will be discernible at this range. The Dunbeg cluster of wind farms is not visible from this location.

4.180 Viewpoint 19 is located at a tertiary road junction with the A2 which is part of the Causeway Coast scenic drive approximately 7.1 km to the south west of the Development. There are a number of rural properties orientated in the general direction of the Development in order to take advantage of the attractive panoramic views formed by the Binevenagh uplands although views from most parts of the road corridor are limited by roadside vegetation and the lack of any hard shoulder or laybys where one may stop to appreciate views into the wider landscape. The uplands frame views across the flatter lowlands in the foreground which feature extensive pastoral land, high levels of tree cover but also industrial buildings at the edge of Limavady. The latter is a prominent feature in the middle portion of the view which is illustrated in Figure 4.33 and which appears directly below the Development. The existing cluster of Dunbeg wind farms is clearly visible almost in its entirety to the left of the Development. The northern end of

CONSENTED (LA01/2018/0200/F)

this cluster extends beyond / behind the side slopes of Binevenagh whilst the Development extends along the side slope of Keady Mountain. Both are contained by higher ground to the north and south which limits their effects on the wider landscape and in particular the profile of the Binevenagh uplands. There are other wind farms visible on higher sections of these uplands including the existing Rigged Hill wind farm and some consented turbines in the Garvagh cluster.

Sensitivity of Visual Receptors: Medium

4.181 Receptors at Viewpoint 18 comprise of road users on the tertiary road network and residents of properties along this road. They are deemed to be of Medium sensitivity to the Development in question because the Development would only be partially visible and would not be located within the main portion of the view. Receptors at Viewpoint 19 are also deemed to be of Medium sensitivity because, although residential properties are more likely to be orientated in the general direction of the Development, their views are already characterised by other wind farms, including the adjacent Dunbeg cluster, and by industrial development which will be viewed in the foreground of any views towards the Development. Road users will be on a scenic driving route, road views users will experience transitory views whilst moving at speed in a different direction to the Development and views from many other parts of the road corridor will be screened by roadside vegetation.

Magnitude of Visual Effect including Cumulative Effects: Low to Medium

4.182 Viewpoint 18 is deemed to experience a Low magnitude of visual effect because views are naturally orientated in a different direction and the Development would only be partially visible but not prominent. Nor would it introduce a completely new landscape characteristic into the view, which is already overlooked by Rigged Hill wind farm, two single turbines located closer to this viewpoint, and more distant views towards cumulative wind farms on Inishowen. The Loughermore cluster of wind farms would also be visible from this location in clear weather conditions and in a south westerly direction.

4.183 Viewpoint 19 is deemed to experience a Medium magnitude of visual effect because the Development would be prominent but would not change the overall nature of the view, which already features several wind farms, industrial development and a busy road corridor. Furthermore, many views along this section of road are effectively screened by roadside vegetation, thereby preventing the type of clear views that are represented by this viewpoint.

Significance of Visual Effect including Cumulative Effects: Not Significant

C2: Views from settlements between 5 – 15 km from the Development

Description of Existing View and Predicted Views

4.184 Category C2 includes Viewpoints 20 and 21 which are illustrated in Figures 4.34 and 4.35. They represent views from towns and villages with middle distance views of the Development. Viewpoint 20 is located at the edge of Drumsurn village

CONSENTED (LA01/2018/0200/F)

approximately 7.7 km to the south-west of the Development. Drumsurn is a small village which backs onto part of the Binevenagh range of uplands below Rigged Hill and Donald's Hill and the wider north- south part of this view is framed by other sections of the same uplands. The foreground and middle distance of most other parts of views from Drumsurn are occupied by extensive lowland farmland, as shown in Figure 4.34. There are also distant views towards Inishowen which are beyond the angle of view illustrated by this Figure but lowland landscape features such as field, hedgerows and belts of broadleaved woodland are the most prominent features in this part of the Study Area. This viewpoint is overlooked by Rigged Hill wind farm which is a longstanding and distinctive landscape characteristic. There are no other wind farms prominent in this view nut there are two single turbines on the horizon equidistant between Rigged Hill and the Development. They may be more noticeable due to their faster blade rotation but will be partially screened by woodland in the foreground. The Dunbeg cluster of wind farms is not visible from this location.

4.185 The Development would be partially visible beyond the broad rounded profile of Keady Mountain to the right had side of the summit, which is not as discernible as landmark feature as it is in views from a more westerly direction. Keady Mountain is located in the centre of the view illustrated in Figure 4.34 but, in the field, this is part of the view becomes the far edge of a view that would naturally be orientated in a north-westerly direction. The Development is unlikely to be a discernible feature to most visual receptors in and around this viewpoint.

4.186 Viewpoint 21 is located on the A2 primary road corridor at the urban fringes of Ballykelly town approximately 11.7 km to the west of the Development. It is a busy road with fast-moving vehicles but also pedestrians and adjacent residents in urban housing development. However, the majority of this housing is not orientated in the direction of the Development – only road users and pedestrians travelling into Ballykelly would have views specifically orientated towards the Development for a short period of time only and the latter views are likely to be constrained by roadside vegetation and buildings. The primary focus of static views from this location, and also the most visually attractive feature is the Binevenagh escarpment which is visible in the left-hand side of Figure 4.35. The existing Dunbeg cluster of wind farms and the Development would be located in a lower-lying saddle of land between the base of Binevenagh and Keady Mountain. From this viewpoint it is partially screened from view by foreground development around the road corridor and neither the Dunbeg cluster nor the Development are prominent features. They also occupy a very small part of a much wider view which includes a significant seaward facing portion to the north that is beyond the angle of view included in Figure 4.35.

Sensitivity of Visual Receptors: Medium to Low

4.187 Receptors at Viewpoint 20 comprise of road users on the tertiary road network and residents of the village. They are deemed to be of Medium sensitivity to the

CONSENTED (LA01/2018/0200/F)

Development in question because the Development would only be partially visible and would not be located within the main portion of the view. Receptors at Viewpoint 21 are deemed to be of Low sensitivity because they are located within an urban area with a more complex mix of land uses, including significant human influences, and their views towards the Development are constrained by these foreground elements. The focus of most views from this location is likely to be towards the Binevenagh escarpment and the coastal areas to the north which are located some distance from the Development. Road users in particular will experience transitory views whilst moving at speed and views from many other parts of the road corridor will be screened by roadside vegetation.

Magnitude of Visual Effect: Low

4.188 Viewpoint 20 is deemed to experience a Low magnitude of visual effect because views are orientated in a different direction and the Development would only be partially visible but not prominent. Nor would it introduce a completely new landscape characteristic into the view, which is already overlooked by Rigged Hill wind farm and two single turbines located closer to this viewpoint. Viewpoint 21 will also experience effects of a Low magnitude due to the complexity of the foreground landscape and the screening effects this has on views towards the Development.

Significance of Visual Effect: Not significant

Category D: Views illustrating the wider landscape setting and visibility of the Development in the context of the adjacent Dunbeg cluster of wind farms

Description of Existing View and Predicted Views

4.189 Category D includes Viewpoints 22 - 27 which are illustrated in Figures 4.36 – 4.41. Viewpoint 22 is located adjacent to Dunmore Wind Farm approximately 2.8 km from the Development. It has been selected to represent the appearance of the Development from an elevated viewpoint within the saddle of land between Keady and Binevenagh mountains where there are outward views from the AONB into the wider landscape and including the foreground character that is created by the existing Dunbeg cluster. The other viewpoints that are included in this category have been selected to illustrate views towards this same area where the Developments relationship with the Dunbeg cluster, the summits of Keady and Binevenagh and the fuller range of Binevenagh uplands within the context of the wider Study Area can be appreciated.

4.190 Viewpoint 22 is dominated by the existing Dunmore and Dunbeg wind farms which are located on rough grazing land in the foreground and against the backdrop of rising land formed by Keady Mountain and Springwell Forest. The consented Dunbeg Extension Wind Farm would be visible at the back of this cluster. From this elevated location there are also extensive panoramic views across the western part of the Study Area stretching from the southern edge of the Binevenagh uplands

CONSENTED (LA01/2018/0200/F)

(which can be seen to the right-hand side of Keady Mountain) across the Roe valley towards the Loughermore hills (which are located to the right of centre in the angle of view illustrate in Figure 4.36) and across to Derry and Donegal in the north west (not included within the angle of view illustrated by Figure 4.36). The existing cluster of wind farms at Loughermore is clearly visible on the summit of Loughermore and the consented Ballyhanedin wind farm would be visible to the left-hand side of this. There may also be visibility of other wind farms in Co. Donegal in clear weather conditions. Views in other directions from this location are contained to the foreground by rising land and forestry immediately behind Viewpoint 22.

4.191 The Development would be visible behind the Dunbeg cluster of wind farms on the side slope of Keady Mountain which currently forms the backdrop for this cluster. It would increase the lateral spread of turbines that would be visible along this profile of uplands by 3 turbines - T1 - 3 would be located further along the slope towards the western side of Keady Mountain. However, it would not extend the visibility of turbines beyond the confines of the foreground landscape that is formed by the slopes of Keady Mountain and would therefore not impinge upon views into the wider Study Area which includes parts of the Roe Valley and Loughermore Hills. The existing Dunmore turbines would remain the most dominant visual feature in this viewpoint.

4.192 Viewpoint 23 is located in the Magilligan floodplain which is located to the north of the summit of Binevenagh summit. The contrast between these two areas is one of the key features of the AONB. The foreground is characterised by very flat, exposed and intensively managed farmland interspersed with rural dwellings, farmsteads and shelterbelts of trees. The Binevenagh range of uplands forms a broad profile of hills that stretches from north to south across the view and which frame the lowlands. In the opposite direction, there is a similarly flat foreground created by the sea in Lough Foyle framed in a similar manner by the mountains in Inishowen. Because of the expansive nature of the foreground and the distance to both sets of uplands the latter appear low on the horizon and are visually subordinate to the foreground landscape.

4.193 The skyline of Binevenagh Mountain including its summit and side slope is generally clear of vertical man-made elements with the exception of large forestry plantations. The rest of the uplands are punctuated by existing and consented wind farm developments separated by areas of undeveloped skyline and other large areas of forestry. The Dunbeg cluster of wind farms is located in the saddle of land between Keady and Binevenagh, some distance from the escarpment at its northern end. The Development would be located to the right-hand side of this cluster on the rising side slope of Keady Mountain but would not encroach on its summit. At the southern base of Keady there are two single turbines, and beyond this there is a prominently located wind farm on the Rigged Hill plateau (right-hand side of the view illustrated in Figure 4.37). There will also be partial views of other existing and consented wind farms in the Garvagh cluster to the far right of Rigged Hill.

CONSENTED (LA01/2018/0200/F)

4.194 Viewpoint 24 is located near the summit of Benbradagh Mountain which is a prominent feature at the southern end of the Binevenagh range. It represents the nature of views looking northwards towards the Development from a remote and elevated viewpoint on the Ulster Way. From this location there are 360 degree views including wide views across the Sperrins in the south, the farmland around Coleraine stretching as far as the north Antrim coastline, and eastwards towards the Antrim Coast and Glens AONB well beyond this Study Area, and westwards across the Roe Valley, Loughermore Hills towards the Slievekirk uplands around Derry and beyond this to Co. Donegal. The views from this location are very scenic because of their extent and overall composition. However, wind farm development and other man-made features heavily influence the existing landscape character in all directions including abandoned military buildings and tracks amidst the rough grazing land on Benbradagh itself, towns and villages in lowland areas, forestry, single turbines and masts. The upper parts of the proposed turbines would be visible approximately 14.2 km to the north east of this viewpoint. It would be located to the left-hand side of the Dunbeg cluster, the blade tips of which are currently visible above an area of preceding forestry. Rigged Hill wind farm is more prominently located on the skyline to the other side of this cluster but still at some distance.

4.195 Viewpoint 25 is located within the seaside resort town of Portstewart in a carpark overlooking the town and the coast. It is approximately 14.7 km to the north east of the Development. Views are influenced by the urban area on one side and the open sea to the other. The latter are framed by the coastline to which the adjacent uplands form a backdrop. From this side of the Study Area the Binevenagh range of uplands appears as a long broad continuation of the coastal cliffs. It does not have the same distinctive profile as it does when views from the west where it's series of summits are identifiable. The Dunbeg cluster of wind farms is clearly visible but not prominent from this viewpoint.

4.196 Viewpoint 26 is located in a layby on the A36 road between Coleraine and Ballymoney approximately 15.3 km to the north east of the Development. Traffic is fast-moving and the focus of views is on the agricultural landscape of the foreground and middle distance. The Binevenagh range of hills provides a setting for the foreground but has a similar appearance to that described in Viewpoint 25 above - it is not a distinctive feature. The Dunbeg cluster is visible but prominent from this distance. The blade tips of some of the proposed turbines would appear above the coniferous forestry to the left-hand side of the Dunbeg cluster but would be easily missed by the casual observer.

4.197 Viewpoint 27 is located within a church car park in a small rural settlement on the Inishowen uplands approximately 27.36 km from the Development. It is situated below a designated Area of Especially High Scenic Amenity covering Eskaheen and Scalp mountains where Donegal County Council's policy is to preserve the amenity value and integrity of views. It has been chosen to represent views from both

CONSENTED (LA01/2018/0200/F)

elevated rural properties along the road network as well as from this designated landscape in the uplands at the western edge of the Study Area. The panoramic nature of views from this location is highly scenic and includes views across the Foyle estuary towards the Binevenagh and Sperrin uplands. The Inishowen cluster of wind farms would be visible at relatively close range to the north and west of this viewpoint and some of the turbine in this cluster will be clearly visible. The existing Dunbeg cluster of wind farms is visible in a lower saddle of land between the base of Binevenagh and Keady Mountains and there are a number of other wind farms located at similar distances including Rigged Hill, and wind farms in the Carntogher and Loughermore clusters. None are easily noticeable features from this distance, even in clear weather conditions. The Development would be located to the right hand side of the existing Dunbeg cluster, beyond/ behind the summit of Keady Mountain and is likely to appear of a similar scale to the existing turbines in this part of the view.

Sensitivity of Visual Receptors: Low - High

4.198 Receptors at Viewpoint 22 are deemed to be of Low sensitivity because they are likely to comprise mostly of general road users, farmers and wind farm personnel in close proximity to existing wind farms in the Dunbeg cluster and their views are already dominated by these turbines. Receptors at Viewpoint 25 are also deemed to be Low because of their distance from the Development, their location in an urban area and the focus of views towards the coastline rather than in land. Receptors at Viewpoint 26 are deemed to be Low because of their distance from the Development and their location in and adjacent to a busy road. Receptors at Viewpoint 27 are deemed to be of Low sensitivity due to their distance from the Development combined with the wide extent of views and the visual dominance of seaward views.

4.199 Receptors at Viewpoint 23 and 24 are deemed to be of High Sensitivity because they are likely to be present at this location for outdoor recreation or appreciation of the scenery.

Magnitude of Visual Effect: Low - Medium

4.200 The magnitude of effect on Viewpoint 22 is deemed to be Medium because although it is already dominated by the existing turbines and it would have very little marked effect on the character or quality of this view, the Development would increase the physical depth of the Dunbeg cluster and would become a recognisable additional element.

4.201 The magnitude of effect on Viewpoint 23 is deemed to be Medium because there are already wind farms located along the profile of these hills and, whilst the Development will reinforce this characteristic by increasing the size of the existing and consented Dunbeg cluster, it will not extend it beyond the saddle of land defined by the side slopes of Keady. From Viewpoint 27 the configuration of the Development, and its relationship with the Dunbeg cluster would be similar to that in Viewpoint 23 but from a much greater distance where neither would be clearly

CONSENTED (LA01/2018/0200/F)

visible features even in good weather conditions. Therefore, the magnitude of effect on Viewpoint 27 is deemed to be Negligible.

4.202 The magnitude of visual effect on Viewpoint 24 is deemed to be Low. None of the existing wind farms in this part of the view, including the Dunbeg cluster and Rigged Hill are discernible features because their scale is dwarfed by the overall extent of views from this location and also because there are more prominently located wind farms in other directions and in closer proximity to this viewpoint that will be more noticeable. These include consented and recently constructed elements of the Carntogher and Garvagh clusters of wind farms (the latter are located in the right-hand side of the view illustrated in Figure 4.38 and Evishagaran the recently constructed Brockaghboy wind farm is located beyond the illustrated angle of view approximately 2.5 – 8 km from this viewpoint). The same will apply to the Development.

4.203 The magnitude of effects on Viewpoint 25 is deemed to be Low because it would be indistinguishable from the Dunbeg cluster. The same is the case for Viewpoint 26.

Significance of Visual Effect: Not Significant

4.204 There would be no significant effects on any of these viewpoints because in all instances the Development would not alter the existing character of these views. In respect of Viewpoint 22 visual receptors are of Low sensitivity, the foreground is already dominated by an existing and consented cluster of wind farms, and the wider landscape also features clusters of wind farms on upland areas. The latter is also the case for the other viewpoints. In Viewpoints 24 – 27 the Development would only be partially visible and located at distances where views are typically spread across wide areas. In these instances the Development, as an individual element, would not be an easily discernible feature.

Table 4.2: Summary of Visual Effects on Viewpoints

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
A: Visibility from primary and secondary transport routes, including tourist routes:						
A1: Views from the A37 road corridor between Coleraine and Limavady:						
1	A37 near Macosquin Figure 4.15	7.56 km	Not visible	Low	None	Not Significant
2	A37 parking layby near Dunbeg wind farm Figure 4.16	1.39 km	Not visible	Medium	None	Not Significant
3	A37 near Dunbeg, Broad Road upper Figure 4.17	0.46 km	Prominent	Medium	High	Significant

CONSENTED (LA01/2018/0200/F)

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
4	Keady Mountain near A37 Figure 4.18	0.79 km	Visible	Medium	Low	Not Significant
5	Gortgarn Road near junction with A37, Broad Road middle Figure 4.19	2.63 km	Visible	Medium	Medium	Not Significant
6	Parking layby on A37, Broad Road lower near B66 junction Figure 4.20	3.67 km	Visible	Medium	Medium	Not Significant
A2: Views from the secondary B201 road corridor between Coleraine and Limavady						
7	Windyhill Rd West Figure 4.21	2.65 km	Prominent	Low	Medium	Not Significant
8	Ballinarees Orange Hall, Windy Hill Road Figure 4.22	6.44 km	Visible	Low	Low	Not Significant
9	B201 Windyhill Road near Coleraine Figure 4.23	10.89 km	Visible	Low	Negligible	Not Significant
A3: Views from the Binevenagh Scenic Drive						
10	Binevenagh Scenic Drive near Lisnagrib Figure 4.24	3.59 km	Prominent	High	Medium	Significant
11	Binevenagh Lake viewpoint Figure 4.25	7.02 km	Not visible	Low	Negligible	Not Significant
A4: Views from the Roe Valley and Causeway Coast Scenic Routes to the west						
12	Dogleap Road, Roe Valley Country Park environs Figure 4.26	8.09 km	Visible	High	Low	Not Significant
13	A2 Scenic Route near Seacoast Road Garden Centre Figure 4.27	6.90 km	Prominent	Medium	Medium	Not Significant
B: Views from residential properties and rural settlement within 5 km of the Development						
14	Bolea Road middle Figure 4.28	1.64 km	Prominent	High	High	Significant

CONSENTED (LA01/2018/0200/F)

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
15	Drumalief Road off B201 Figure 4.29	2.43 km	Prominent	High	Medium	Not Significant
16	Bolea Road near Deramore Presbyterian Church Figure 4.30	2.51 km	Prominent	High	Medium	Not Significant
17	Drummond Cricket Club, Drumsurn Road Figure 4.31	4.65 km	Visible	Medium	Low	Not Significant
C: Views from residential properties and settlements within 5 km - 15 km of the Development						
C1: Views from rural residential properties and settlements between 5 – 15 km from the Development						
18	Gortnarney Road near Drumsurn Figure 4.32	6.08 km	Visible	Medium	Low	Not Significant
19	Seacoast Rd near Ballykelly Figure 4.33	7.10 km	Prominent	Medium	Medium	Not Significant
C2: Views from settlements between 5 – 15 km from the Development						
20	Drumsurn Village at Fir Road Figure 4.34	7.70 km	Visible	Medium	Low	Not Significant
21	Foyle Way near Riverview housing development, A2, Ballykelly town Figure 4.35	11.74 km	Visible	Low	Low	Not Significant
D: Views illustrating the Development within the wider landscape setting and in the context of the Dunbeg cluster of existing, consented and proposed wind farms						
22	Bolea Road upper near Dunmore site entrance Figure 4.36	2.84 km	Visible	Low	Medium	Not Significant
23	Bank bird hide and railway crossing near Ballykelly Figure 4.37	11.99 km	Visible	High	Medium	Not Significant
24	Benbradagh Mountain, Ulster Way Figure 4.38	14.23 km	Visible	High	Low	Not Significant
25	Portstewart town at Portstewart Point car	14.70 km	Visible	Low	Low	Not Significant

CONSENTED (LA01/2018/0200/F)

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of visual effect	Significance of visual effect
	park Figure 4.39					
26	Parking Layby on A26 near Damhead (Belfast-bound side) Figure 4.40	15.36 km	Visible	Low	Low	Not Significant
27	Eskaheen, Inishowen, Co. Donegal Figure 4.41	27.36 km	Visible	Low	Negligible	Not Significant

The Cumulative Baseline and Analysis of Effects

4.205 The Cumulative Baseline refers to all existing, consented and proposed wind farms within the 30 km Study Area and any existing and consented wind farms beyond this distance that are visible within the final viewpoint selection. There are a total of 36 wind farms considered to be part of the Cumulative Baseline for this LVIA, of which 20 are existing, 12 are consented and 4 are proposed. It also includes single turbines where they are existing elements within the final viewpoints and three existing or consented single turbines which are located within 5 km of the Development and which are of a comparable size to commercial wind turbines (with an overall minimum blade tip height of 50 m). These three turbines are indicated on the wirelines for the final viewpoints (Figures 4.15 – 4.41). Full details of all wind farms and single turbines included in the Cumulative Baseline are provided in Technical Appendix 4.5.

4.206 In many instances other wind farms in the cumulative baseline are located in visually and / or physically distinct clusters. This often reflects landscapes, ground conditions and wind speeds that are favourable for wind energy development and also a general principle that is implemented by planning authorities to consolidate and group new and established developments together as a means to achieve sustainable development and mitigate potential adverse cumulative effects on scenic landscapes which can result from a sporadic approach to siting new developments (see the Council's Discussion Paper 4: Landscape Character referenced in footnote to paragraph 4.87). This LVIA has grouped and named clusters of wind farms within the Study Area for ease of reference and because it allows for a better understanding of their interrelationships. These clusters are referred to in Table 4.3 and illustrated in Figure 4.5.

Table 4.3: Clusters of Cumulative Wind Farms

CONSENTED (LA01/2018/0200/F)

Name of Cluster	Included wind farms	No. of Turbines in cluster
Dunbeg Cluster	Dunbeg, Dunmore, Dunbeg Extension, Dunmore Extension NOTE: the Development would be located in this cluster which would create a cluster of 41 turbines	32
Inishowen Cluster	Aught, Crockahenny, Flaughland, Glackmore I & II, Three Trees	33
Slievekirk Cluster	Carrickatane, Curryfree, Eglish, Slievekirk and Slievekirk Extension	37
Loughermore Cluster	Altahullion I, II & III, Glenconway	49
Garvagh Cluster	Craiggore, Smulgedon, Upper Ballyrogan	22
Carntogher Cluster	Brockaghboy, Brockaghboy Extension, Evishagaran, Corlacky Hill	44
Long Mountain Cluster	Garves, Glenbuck I & II, Long Mountain	21
Wind Farms not in a cluster	Ballyhanedin, Cloonty, Croaghan, Cam Burn, Rigged Hill, Single turbines 1, 2 & 3	36

Cumulative Landscape Effects

4.207 The primary cumulative landscape effects of the Development would occur in LCA 36, Binevenagh, which is also located within the Binevenagh AONB. The key characteristics of the AONB, which have already been analysed in detail, are the juxtaposition between the prominent escarpment at the northern end of Binevenagh Mountain overlooking the flat Magilligan lowlands. The Development is physically detached from this part of the AONB and is positioned in a lower-lying saddle of land between the southern side of the base of Binevenagh Mountain and Keady Mountain. The landscape character of this part of the Binevenagh AONB is already dominated by manmade influences in terms of land uses such as forestry, quarrying, wind energy, telecommunications masts and extensive rough grazing land. Given its location within this type of landscape and its close relationship with the adjacent wind farms in the Dunbeg cluster the Development is not judged to cause a significant change to the condition or quality of the physical landscape character either within the AONB or LCA 36.

4.208 The Study Area comprises of a series of broad upland ranges of hills which are separated from each other by lowland landscapes which are often pastoral in character and well-vegetated. Clusters of wind farms located on these upland areas are a relatively common landscape characteristic of the whole Study Area (Figure 4.5) but there are sufficient separation distances between these clusters to ensure they are not the dominant characteristic. This is in accordance with general advice provided in the SPG that elevated upland landscapes can accommodate

CONSENTED (LA01/2018/0200/F)

larger turbines and the broader the upland the greater the capacity. Larger horizons tend to diminish the perception of height. In this Study Area the fact that many viewpoints are elevated in nature means that very broad panoramic views occur frequently and, from certain directions / in certain viewpoints, often incorporate both simultaneous and sequential views of several clusters of wind farms. The Development would increase the size of the Dunbeg cluster of wind farms but would not decrease its separation distances with other clusters of wind farms in the Study Area. Neither would it encroach onto elements of the landscape that are not already characterised by wind farm development or other man-made features.

Cumulative Visual Effects

4.209 ZTV diagrams for the Cumulative Baseline are illustrated by the following figures. All ZTVs are calculated using theoretical blade tip visibility in order to consider the highest possible levels of visibility and cover a radius of 30 km from the centre of the Development unless otherwise stated. Refer to the LVIA methodology in Technical Appendix 4.2 for further details.

4.210 Figure 4.9 shows the cumulative ZTV with the Dunbeg Cluster of wind farms. The Development would be adjacent to this cluster of wind farms which is why it is considered in addition to being considered as part of the wider cumulative baseline. It includes the existing Dunbeg and Dunmore wind farms, a consented extension to Dunbeg, and a proposed extension to Dunmore wind farm. This ZTV diagram indicates that the location of the Development on the side slope of Keady would create additional visibility of this cluster of wind farms on the uplands between Keady and Benbradagh which would in theory extend partly into the edge of the Sperrin AONB. However, these views are represented by Viewpoints 18, 20 and 24 which demonstrate that there would only be partial visibility of the Development from such locations and that the effects would not be significant (refer to descriptions of these viewpoints starting at paragraphs 4.176, 4. 182 and 4.187, Figures 4.32, 4.34 and 4.38). The ZTV also suggests that there may be additional visibility of the Development across a greater area of Lough Foyle and Inishowen but at these distances effects would not be significant. Such views are represented by Viewpoints 23 and 27 which are located in similar landscapes and at similar distances where views are also deemed to be Not Significant. In most other parts of the Study Area where theoretical visibility occurs the Development would be visible in conjunction with the Dunbeg cluster. In the north eastern part of the Study Area the ZTV shows areas (indicated by red shading on Figure 4.9) where the existing Dunbeg cluster is theoretically visible but where the Development would not be visible and this is due to the screening effects of rising topography to the east of the Dunbeg cluster. It would be further screened by parts of Springwell Forest to the north east.

4.211 Figure 4.10 shows the cumulative ZTV for the Development in conjunction with all existing and consented wind farms in the Cumulative Baseline (see Technical

CONSENTED (LA01/2018/0200/F)

Appendix 4.5). It clearly illustrates the conclusion that has already been made in relation to cumulative landscape effects – that clusters of wind farms are a characteristic feature on uplands in all parts of the Study Area. There are no discernible parts of the Study Area (0.05%) where the Development would increase overall theoretical visibility. Existing and consented wind farms are already theoretically visible across 86.79% of the Study Area.

Table 4.4: The Development's Cumulative Zone of Theoretical Visibility

<table>
<tr><th>ZTV Diagram</th><th>No. of turbines theoretically visible (blade tip)</th><th colspan="3">% of Study Area with visibility</th></tr>
<tr><td rowspan="4">Cumulative ZTV: Dunbeg Cluster (30 km radius)

Figure 4.9</td><td>0 turbines visible</td><td>38.56 %</td><td></td><td></td></tr>
<tr><td>Visibility of Dunbeg cluster where there is no visibility of the Development</td><td>3.26 %</td><td rowspan="2">Total % of Study Area where other wind farms in the Dunbeg Cluster are theoretically visible = 52.79 %</td><td></td></tr>
<tr><td>Visibility of the Development together with the Dunbeg Cluster</td><td>49.53 %</td><td rowspan="2">Total % of Study Area where the Development is theoretically visible = 58.18 %</td></tr>
<tr><td>Additional visibility of the Development</td><td>8.65 %</td><td></td></tr>
<tr><td rowspan="4">Cumulative ZTV: Existing and Consented Wind Farms (40 km radius)

Figures 4.10</td><td>0 turbines visible</td><td>13.16 %</td><td></td><td></td></tr>
<tr><td>Visibility of other wind farms where there is no visibility of the Development</td><td>38.69 %</td><td rowspan="2">Total % of 40 km area where other wind farms are theoretically visible = 86.79 %</td><td></td></tr>
<tr><td>Visibility of the Development together with other wind farms</td><td>48.10%</td><td rowspan="2">Total % of 40 km area where the Development is theoretically visible = 48.14 %</td></tr>
<tr><td>Additional visibility of the Development</td><td>0.05 %</td><td></td></tr>
</table>

4.212 The presence of existing and consented wind farms, particularly those in the Dunbeg cluster, are described as an integral part of the baseline views from the final viewpoints. Of the 27 Viewpoints that have been analysed in detail (and these have been selected to represent typical views across the Study Area) only one – Viewpoint 14 - would experience significant cumulative effect resulting from the Development. This is a close range viewpoint located on the tertiary road network

CONSENTED (LA01/2018/0200/F)

where visual receptors will comprise of residents of several properties and where views into the wider landscape are more constrained by roadside trees and hedgerows that is typical in other parts of the road network in the vicinity. In this instance the Dunbeg cluster of wind farms is not simultaneously visible but would become more visible further along the Bolea Road. At Viewpoint 14 the Development would be visually prominent and the magnitude of cumulative effect would be High because the Development would significantly increase the visibility of turbines beyond that which is already visible. However, Viewpoint 14 must also be considered in sequence with Viewpoint 22 which is located further along the Bolea Road from where the existing Dunbeg cluster of wind farms is the most prominent and significant feature in the view, and where the Development would have a low magnitude of cumulative effect which is not deemed to be Significant.

4.213 In most instances, and in particular within the wider landscape context, the Development is not deemed to have significant cumulative visual effects on the because it will maintain a close physical relationship with the other wind farms in the Dunbeg cluster, the turbines will in most cases appear to be of a similar scale, and will not extend the spread of turbines beyond the saddle of land between Binevenagh and Keady mountain summits.

4.214 There are some viewpoints where the Development would have a significant visual effect on one part of the view and would become more visible that the adjacent Dunbeg cluster but it would not have a significant visual effect on the overall views which is much more extensive in its scale or extent. This occurs, for example, in Viewpoint 3 which is located adjacent to the boundary of the Development, where the Development would have a significant cumulative effect on one part of the foreground in the view but it would not impinge upon views into the wider landscape and nor would it alter the overall character of the foreground which is already considerably influenced by the Dunbeg cluster. It also occurs in a similar way in Viewpoints 10, 15 and 16.

4.215 There are very few views where the Development would be directly compared to wind farms in the cumulative baseline other than the Dunbeg cluster. Most of these are located some distance from the Development, are often not intervisible or closely related in physical terms and therefore will also appear in different parts of viewpoints. Overall, the cumulative effects of the Development, both in terms of landscape and visual effects is deemed to be Not Significant.

CONSENTED (LA01/2018/0200/F)

Table 4.5: Summary of Cumulative Visual Effects on Viewpoints

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of cumulative visual effect	Significance of cumulative visual effect
A: Visibility from primary and secondary transport routes, including tourist routes:						
A1: Views from the A37 road corridor between Coleraine and Limavady:						
1	A37 near Macosquin Figure 4.15	7.56 km	Not visible	Low	Negligible	Not Significant
2	A37 parking layby near Dunbeg wind farm Figure 4.16	1.39 km	Not visible	Medium	Negligible	Not Significant
3	A37 near Dunbeg, Broad Road upper Figure 4.17	0.46 km	Prominent	Medium	Medium	Not Significant
4	Keady Mountain near A37 Figure 4.18	0.79 km	Visible	Medium	Low	Not Significant
5	Gortgarn Road near junction with A37, Broad Road middle Figure 4.19	2.63 km	Visible	Medium	Low	Not Significant
6	Parking layby on A37, Broad Road lower near B66 junction Figure 4.20	3.67 km	Visible	Medium	Low	Not Significant
A2: Views from the secondary B201 road corridor between Coleraine and Limavady						
7	Windyhill Rd West Figure 4.21	2.65 km	Prominent	Low	Medium	Not Significant
8	Ballinarees Orange Hall, Windy Hill Road Figure 4.22	6.44 km	Visible	Low	Low	Not Significant
9	B201 Windyhill Road near Coleraine Figure 4.23	10.89 km	Visible	Low	Low	Not Significant
A3: Views from the Binevenagh Scenic Drive						
10	Binevenagh Scenic Drive near Lisnagrib Figure 4.24	3.59 km	Prominent	High	Medium	Not Significant
11	Binevenagh Lake viewpoint Figure 4.25	7.02 km	Not visible	Low	Negligible	Not Significant
A4: Views from the Roe Valley and Causeway Coast Scenic Routes to the west						

CONSENTED (LA01/2018/0200/F)

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of cumulative visual effect	Significance of cumulative visual effect
12	Dogleap Road, Roe Valley Country Park environs Figure 4.26	8.09 km	Visible	High	Low	Not Significant
13	A2 Scenic Route near Seacoast Road Garden Centre Figure 4.27	6.90 km	Prominent	High	Medium	Not Significant
B: Views from residential properties and rural settlement within 5 km of the Development						
14	Bolea Road middle Figure 4.28	1.64 km	Prominent	High	High	Significant
15	Drumalief Road off B201 Figure 4.29	2.43 km	Prominent	High	Medium	Not Significant
16	Bolea Road near Deramore Presbyterian Church Figure 4.30	2.51 km	Prominent	High	Medium	Not Significant
17	Drummond Cricket Club, Drumsurn Road Figure 4.31	4.65 km	Visible	Medium	Low	Not Significant
C: Views from residential properties and settlements within 5 km - 15 km of the Development						
C1: Views from rural residential properties and settlements between 5 – 15 km from the Development						
18	Gortnarney Road near Drumsurn Figure 4.32	6.08 km	Visible	Medium	Low	Not Significant
19	Seacoast Rd near Ballykelly Figure 4.33	7.10 km	Prominent	Medium	Medium	Not Significant
C2: Views from settlements between 5 – 15 km from the Development						
20	Drumsurn Village at Fir Road Figure 4.34	7.70 km	Visible	Medium	Low	Not Significant
21	Foyle Way near Riverview housing development, A2, Ballykelly town Figure 4.35	11.74 km	Visible	Low	Low	Not Significant
D: Views illustrating the Development within the wider landscape setting and in the context of the Dunbeg cluster of existing, consented and proposed wind farms						

CONSENTED (LA01/2018/0200/F)

Viewpoint		Approx. distance to nearest turbine (km)	Visual Prominence	Sensitivity of key visual receptors	Magnitude of cumulative visual effect	Significance of cumulative visual effect
22	Bolea Road upper near Dunmore site entrance Figure 4.36	2.84 km	Visible	Low	Low	Not Significant
23	Bank bird hide and railway crossing near Ballykelly Figure 4.37	11.99 km	Visible	High	Medium	Not Significant
24	Benbradagh Mountain, Ulster Way Figure 4.38	14.23 km	Visible	High	Low	Not Significant
25	Portstewart town at Portstewart Point car park Figure 4.39	14.70 km	Visible	Low	Low	Not Significant
26	Parking Layby on A26 near Damhead (Belfast-bound side) Figure 4.40	15.36 km	Visible	Low	Low	Not Significant
27	Eskaheen, Inishowen, Co. Donegal Figure 4.41	27.36 km	Visible	Low	Low	Not Significant

Information Gaps

4.216 Cumulative data on Donegal wind farms has not been recently verified and efforts to contact Donegal County Council in this regard have been unsuccessful. The data used has been taken from information held for previous LVIA submissions, including most recently Dunbeg Extension.

4.217 There are minor anomalies between the turbine coordinates held for Dunbeg and Dunmore wind farms and the appearance of these turbines in some viewpoint photographs. This is thought to be due to micrositing of turbines as part wind farm construction. It does not affect the outcome of this LVIA.

Future Baseline – The ‘No Change’ Scenario

4.218 Under the “no change” scenario, were the Development not to be constructed, it is anticipated that the site would be continued to be used in much the same manner as it currently is. However, the existing landscape and visual character of the site

CONSENTED (LA01/2018/0200/F)

and the wider Study Area will continue to be influenced by human activity which is constantly changing the landscape and it is important that the implications of these changes are considered and understood so that the intrinsic qualities of the landscape are retained and enhanced rather than destroyed or compromised. The key trends are identified in the NILCA and are also implied by the existing character of the Study Area:

- There are existing wind farms within the Study Area, including two on the adjacent Dunbeg and Dunmore sites, and more wind farms are likely to be developed across Counties Antrim, Derry and Donegal based particularly on the number of consented wind farms in the baseline. Some of these are likely to be intervisible with the Development. It is likely that the current trend of developing cleaner renewable energy sources will continue and become more environmentally acceptable given the predicted effects of climate change;
- Climate change is likely to have the biggest implications on the landscape and its users in the future. Broadly, it is characterised by a general increase in unpredictable weather conditions which will inevitably impact upon all areas of life. River levels are likely to rise and there will be an associated loss of buildings in the flood plain. There will be a loss of habitats associated with the erosion of river banks and lough shores which support unique combinations of plants and animals. Migrant species, in particular birds, may also be affected and warmth-loving species will gradually replace those currently adapted to colder climates. Flooding will become more frequent and cause damage to the interiors and structures of buildings. Land that is particularly prone to flooding will become undevelopable;
- Demographic change is creating the need for a large number of additional dwellings in the countryside which creates pressures on infrastructure. In particular the rural landscape at the edge of existing settlements, such as those around Limavady and Coleraine will continue to experience pressure for built development and ribbon development along road corridors such as the B201 may increase. In the open countryside the presence of derelict buildings signifies a loss of traditional built vernacular and a loss of biodiversity and vegetation associated with a decline in the management of rural field boundaries and farmland;
- Continued expansion of the road network in the study area is likely to occur alongside built development. Improvements to existing secondary roads are also likely (e.g. straightening, widening and increased signage) will have cumulative negative impacts on local landscape character by eroding local patterns and causing the loss of roadside trees, hedgerows, stonewalls and bridges;

CONSENTED (LA01/2018/0200/F)

- There is an ongoing trend towards the amalgamation of small farms with the associated loss of traditional buildings and vernacular features, loss of hedgerows and trees to create larger fields. This is having a detrimental impact on the general quality and condition of the rural landscape character. There is also a trend, however, for farmers to diversify into more traditional farming techniques, husbandry of traditional breeds, and the provision of tourist attractions and accommodation. This often has positive landscape impacts. Current forestry grant schemes encourage farmers to plant more broadleaved trees for amenity and wildlife benefits and in the future this should strengthen the character of farmed landscapes. However, converting fields to coniferous plantations or selling it for housing development will continue to be a detrimental force, particularly if wetter weather renders areas of rough grazing land unviable for livestock;
- Commercial forestry on a large scale is detrimental to landscape character as it conceals the intricate pattern of the landscape and often occupies visually prominent positions in upland areas. Peat cutting alters the undulating topography and creates abrupt and artificial changes in level. This activity, particularly as it has become mechanised, also destroys natural vegetation and habitats. Where land becomes too wet to farm forestry is likely to become an attractive alternative. This may provide the opportunity to continue the current shift from coniferous plantations to broadleaved forestry which will in turn have a potentially positive impact on landscape character, visual amenity and ecological function;
- Agriculture is one of Northern Ireland's major industries. Pasture is likely to remain the dominant agricultural land-use but warmer temperatures will also enable spring cereal crops to be grown as well as an increase in the use of pesticides.

Mitigation and Enhancement Proposals

Mitigation Proposals

4.219 Mitigation proposals in response to landscape and visual effects include:

- The exterior surfaces of the turbines will be painted in a recessive, non-reflective light grey colour to minimise their visual prominence against the sky in most weather conditions;
- Ancillary facilities, such as the control building, substation and energy storage compounds, have been designed in a manner that is sensitive to the immediate landscape character with regards to location, scale, colour, and choice of materials. These facilities have also been sited in close proximity to existing farm buildings to avoid being prominent in key long range views, as identified by of the viewpoints in this LVIA;

CONSENTED (LA01/2018/0200/F)

- The site entrance is located directly off the A37 (Broad Road) and utilises an existing farm access point adjacent to a derelict farm building and associated agricultural enclosures. The site entrance will be widened to accommodate both construction traffic and abnormal indivisible loads (AILs) during construction. Once operational the site entrance will closely resemble the existing frontage with strengthened field boundaries. Due to the physical and visual relationship with existing built structures the amendments to the site entrance will improve the frontage adjacent to the site entrance.

Residual Effects

4.220 Potential landscape and visual effects were addressed through a comprehensive feasibility study and through iterative design development. This resulted in the Development as it is now proposed and therefore potentially significant effects have been avoided prior to the LVIA being carried out as part of the EIA. A summary of the manner in which potential landscape and visual effects have been reduced is illustrated by the comparative ZTV diagram and wirelines shown in Figures 4.11 – 14.

4.221 Beyond this, the proposed mitigation measures will help to minimise the effect of certain aspects of the Development. The physical condition of the site boundary will be enhanced through more regular maintenance, and this will also have an effect on visual quality and experience when travelling past the site on the A37. However, there would be no resulting change in the overall significance of effects. Therefore the residual effects are the same as those already identified.

Overall Significance of Landscape and Visual Effects

4.222 The LVIA process has thoroughly analysed the nature of landscape and visual receptors present within the Study Area including those occurring at close, medium and long range in accordance with best practice guidance on LVIA, wind energy development in Northern Ireland, and emerging Council policies and objectives in relation to the Study Area. The Binevenagh AONB designation was considered to be the key designation within the Study Area. Landscape and visual receptors within the AONB were also regarded as being of greater sensitivity by virtue of their location in addition to any other characteristics that might otherwise make them sensitive to changes in their views (for example, statically located views from residential properties or scenic attractions). The presence of the Dunbeg cluster of existing and consented wind farms on an adjacent site was a key consideration in the assessment of cumulative landscape and visual effects.

4.223 The overall conclusion is that the Development's location within the same part of the landscape as the Dunbeg cluster, and the other strong human factors that currently influence this landscape mean that there would be No Significant landscape effects resulting from the Development.

CONSENTED (LA01/2018/0200/F)

4.224 The Development is generally deemed to have No Significant effects on visual character for similar reasons. Wind energy development is a prominent visual element in all parts of the Study Area and the Development would have a negligible incremental effect on the manner in which wind energy development is perceived generally across the Study Area. Of the 27 viewpoints that have been analysed, only three were deemed to experience a significant visual effect resulting from the Development (Viewpoints 3, 10 and 14), and only Viewpoint 14 is also deemed to experience significant cumulative effects. In respect of Viewpoint 14 cumulative visual effects would occur in relation to a tertiary road in close proximity to the Development where the primary visual receptors would be residents of properties on this road and where views of the existing Dunbeg cluster are screened from view by woodland along the Curly River corridor. This level of effect would be limited to the area in immediate proximity to this Viewpoint and would not be experienced from other roads in the area. All policy documents (the SPPS, PPS 18 and its best practice and supplementary guidance) recognise that wind farms may be prominent elements in close range views but that this does not necessarily equate to unacceptable development. Taking into account that only three of the 27 viewpoints assessed as part of the LVIA are deemed to experience significant effects, and that no significant landscape effects have been identified, the LVIA concludes that the Development is acceptable in landscape and visual terms.

CONSENTED (LA01/2018/0200/F)

5

Archaeology & Cultural Heritage

CONSENTED (LA01/2018/0200/F)

5 Archaeology & Cultural Heritage

Introduction

5.1 This Archaeology and Cultural Heritage Assessment of the Dunbeg South Wind Farm, hereinafter referred to as 'the Development', has been prepared by Gahan and Long on behalf of RES. The Development will involve construction of 9 wind turbines (maximum tip height 149.9m) and associated ancillary works (Figures 5.1 and 5.2). Full details can be found in Chapter 2: Proposed Development.

5.2 This archaeological impact assessment has been compiled by Audrey Gahan and Chris Long.

5.3 Audrey Gahan has an honours degree from Trinity College, Dublin and has been a professional archaeologist since 1985, working on projects throughout Ireland. In 2000 she successfully completed a course in Archaeological Project Management at Oxford University. She is an expert in medieval ceramics and has published extensively on this subject. She has particular expertise in large scale urban development and has considerable experience in liaising with both developers and the statutory bodies. Audrey was made a Fellow of the Society of Antiquaries of London in 2006.

5.4 Chris Long has a BSc Hons in Archaeology with Palaeoecology and an MSc in Environmental Management, specialising in the preparation of environmental impact assessments (EIA). He has worked as a professional archaeologist for over 20 years and has undertaken numerous large and small scale excavations throughout Ireland. Since establishing Gahan and Long, he has overseen the production of a high volume of archaeological impact assessments for a wide variety of development types including numerous wind farms.

5.5 This chapter is supported by:

- Technical Appendix 5.1: Known archaeological monuments within 5 km of the Development;
- Technical Appendix 5.2: Known industrial heritage sites within 5 km of the Development;
- Technical Appendix 5.3: Known historic buildings within 5 km of the Development;
- Technical Appendix 5.4: Historic Scotland- "EIS Scoping of Wind Farm Proposals, Assessment of the Impact on the Setting of the Historic Environment Resource, Some General Considerations";
- Technical Appendix 5.5: Known archaeological monuments of regional importance within 10 km of the Development;

- Figures 5.1-5.16 are referenced in the text where relevant.

CONSENTED (LA01/2018/0200/F)

Legislation & Planning Policy

5.6 This impact assessment was undertaken using the planning guidelines as set out in the Planning Policy Statement (PPS) 6, Planning, Archaeology and the Built Heritage and Section 6 of The Strategic Planning Policy Statement for Northern Ireland (SPPS). This document sets out the Northern Ireland Environment Agency's (now Department of Communities: Historic Environment Division, (DfC:HED)) planning policies relating to the protection and conservation of archaeological remains and features of the built heritage.

5.7 Particular reference was paid to sections BH1, BH2, BH4 and BH11 within PPS6, which deal with the Preservation of Archaeological Remains of Regional Importance and their Settings, the Protection of Archaeological Remains of Local Importance and their Settings, Archaeological Mitigation and Development Affecting the Setting of a Listed Building respectively.

Potential Impact on the Setting of Archaeological Sites

5.8 The setting of a monument relates to its relationship with the landscape both in historical terms and in its modern day guise. At present in Northern Ireland there is no standardized methodology for assessing the impact of a proposed development on the setting of an archaeological monument. A number of bodies have established guidelines for assessing the impact upon the setting of archaeological monuments as outlined in the following sections.

International Council on Monuments and Sites

5.9 The International Council on Monuments and Sites (ICOMS) is an association of professionals throughout the world that works closely with UNESCO and national governments. The Xi'an Declaration on the Conservation on the Setting of Heritage Structures, Sites and Areas adopted by the 15th General Assembly of ICOMS in October 2005 states that: "The setting of a heritage structure, site or area is defined as the immediate and extended environment that is part of, or contributes to, its significance and distinctive character."

5.10 The Declaration goes on to explain that "Beyond the physical and visual aspect, the setting includes interaction with the natural environment; past or present social or spiritual practices, customs, traditional knowledge, use or activities and other forms of intangible cultural heritage aspects that created and form the space as well as the current and dynamic cultural, social and economic context."

Institute of Field Archaeologists (UK)-Working Group on the Setting of Cultural Heritage Features

5.11 The Institute of field archaeologists (IFA) have produced a document titled "Setting Standards - A Review" (April 2008) which assesses current guidelines and research in the analysis of the impact on the setting of heritage features. The review

CONSENTED (LA01/2018/0200/F)

summarises the broad areas of agreement in relation to the setting of monuments. The points relevant to this application are listed below:

- 'Setting' is how the physical surroundings of an asset are perceived in relation to its value, understanding or appreciation
- The importance of an asset is not the same as the sensitivity of its setting to change; both need to be considered
- Since no asset normally retains its setting in an unchanged form, it is not helpful to distinguish 'original' from 'existing' settings
- Evidence of why an asset is located where it is and how its surroundings have changed as a result is always relevant
- Modern features are part of an asset's setting and may either diminish or assist its appreciation and understanding
- People's appreciation of the setting of a place may be instinctive or subliminal and incidental to why they are there
- In assessing setting impacts, physical and visual changes of the surroundings of a place must be related to how they affect the special interest of the asset.

Historic Scotland

5.12 The Historic Scotland publication 'Managing Change in the Historic Environment - Setting' (2010) provides guidance notes on managing change in the historic environment for use by planning authorities and other interested parties. It sets out the principles that apply to developments affecting the setting of historic assets or places including scheduled monuments, listed buildings, inventory parks/ gardens/designed landscapes, World Heritage Sites, conservation areas and designated wrecks. When used in conjunction with the 2008 Historic Scotland guidance note "EIS Scoping of Wind Farm Proposals, Assessment of the Impact on the Setting of the Historic Environment Resource, Some General Considerations", it provides a comprehensive methodology and set of parameters with which to assess the impact upon the setting of an historic asset.

Planning Policy

5.13 Planning Policy Statement PPS 6 Planning, Archaeology and the Built Heritage (PPS6) and Section 6 of The Strategic Planning Policy Statement for Northern Ireland (SPPS) set out the Department of the Environment's (DOE) planning policies for the protection and conservation of archaeological remains and features of the built heritage and advises on the treatment of these issues in development plans. Policy BH1 of PPS 6 considers the preservation of archaeological remains of regional importance and their settings. It states that "The department will operate a presumption in favour of the physical preservation in situ of archaeological remains of regional importance and their settings. These comprise monuments in State Care, scheduled monuments and other important sites and monuments that would merit scheduling. Development which would adversely affect such sites of regional

CONSENTED (LA01/2018/0200/F)

importance or the integrity of their setting will not be permitted unless there are exceptional circumstances."

5.14 ".....the Department will pay particular attention to the impact of the proposal on:

- the critical views of, and from the site or monument;
- the access and public approaches to the site or monument; and
- the understanding and enjoyment of the site or monument by visitors."

5.15 Policy BH11 considers development affecting the setting of a listed building. It states that "the Department will not normally permit development which would adversely affect the setting of a listed building. Development proposals will normally only be considered appropriate where all the following criteria are met:

- The detailed design respects the listed building in terms of scale, height, massing and alignment
- The works proposed make use of traditional or sympathetic building materials and techniques which respect those found on the building; and
- The nature of the use proposed respects the character of the setting of the building."

5.16 Whilst the policy criteria is not strictly applicable to wind farm developments, the overarching aim of this policy has been considered with respect to the character and quality of the setting; and the extent to which the Development and the listed buildings will be seen in juxtaposition.

5.17 This archaeological impact assessment has been produced in full compliance with the above policy documents.

Scope of Assessment

5.18 The scope of this report is to assess the potential impact of the Development on the known and potential archaeological and cultural sites within the site itself and its wider landscape. To facilitate the assessment of the wider landscape a 5 km search radius has been utilised. A further 10 km search radius was used to identify those monuments of regional importance and 6 km for historic buildings which may be visually impacted upon by the Development. The assessment of the Development will look at both the potential physical impact upon any known or potential sub-surface archaeological features within the Preliminary Site Boundary, hereinafter referred to as 'the Site' and will further assess the impact upon the setting of those monuments of regional importance within the 10 km search area.

Consultation

5.19 Consultation was carried out by way of an informal meeting with DFC:HED, Historic Monuments Unit in August 2017. The purpose of this consultation was to identify any particular issues and set out the scope of the desktop survey. It was agreed that a 5 km search radius for the desktop survey would be adequate to provide a comprehensive assessment of the Development.

CONSENTED (LA01/2018/0200/F)

5.20 Further to this, it was agreed to consider all state care/scheduled monuments and historic gardens within 10 km for potential visual analysis. Preliminary analysis of potential inter-visibility between regionally important monuments and the Development identified a number of monuments which may require further in-depth analysis. Further discussions with DFC:HED established the scope of this analysis and identified a number of additional monuments for consideration (see paragraphs 5.55-5.57)

Assessment Methodology

Baseline Characterisation

Study Area

5.21 The study area included the Site itself and also the wider historical landscape. To facilitate the assessment of the wider landscape a 5 km search radius has been utilised. A further 10 km search radius was used to identify those monuments of regional importance and 6 km for historic buildings which may be visually impacted upon by the Development. All search radii extend from a central point within the Planning Application Boundary. The assessment of the Development will look at both the potential physical impact upon any known or potential sub-surface archaeological features within the Site and will further assess the impact upon the setting of those monuments of regional importance within the 10 km search area.

Desk Study / Field Survey

5.22 A detailed desktop survey was undertaken for the Site and the wider landscape. This entailed a review of the Sites and Monuments Records, the Industrial Archaeological Records, the Historic Buildings Archive and the Defence Heritage Records, which are maintained by DFC:HED.

5.23 An inspection was undertaken of the Site by a qualified archaeologist. The purpose of the site inspection was to assess the archaeological potential of surviving sub-surface strata within the Site.

5.24 In addition to the inspection of the Site, each of the sites of regional importance for which visual impact analysis is required was also visited. The objective of this inspection was to establish the surviving nature of the monuments and assess the potential for localised features to affect the extent of the inter-visibility with the Site. The assessment of the visual impact of the Development will be made using a combination of wireframes and photomontages.

5.25 For the purposes of assessing the impact upon the setting of monuments of regional importance, this assessment considers the stipulations in PPS6 Policies BH1 & BH11 and also Historic Scotland's guidance documents, 'Managing Change in the Historic Environment-Setting' and 'EIS Scoping of Wind Farm Proposals; Assessment of the Impact on the Setting of the Historic Environment Resource, Some General Considerations'.

CONSENTED (LA01/2018/0200/F)

5.26 The Historic Scotland documents state "in general, it is the relationship of the historic environment asset with its current surroundings, not with any hypothetical sense of 'original' (i.e. historic) setting which is of concern, though clearly any elements of original, historic setting will be very important'.

5.27 The 2008 Guidance Note also lists a number of factors, specific to wind farm developments, that contribute to the characterisation of the setting of an historic building or other feature of the historic environment, and which may also be of relevance to the development of a proposed wind farm. For example, the contribution of factors such as topography, past and present land use, and inter-visibility with other historic sites make to the setting of a listed building, and the manner in which a proposed development would affect these factors.

5.28 The specific factors used to assess the effects of the Development on the historic assets in question are contained within Appendix 5.4. The parameters with which to assess the magnitude of change and significance of impact are those detailed in sections 5.32 and 5.33.

Sensitivity Criteria

5.29 The main thresholds of archaeological importance defined in PPS 6 are Regional Importance and Local Importance.

5.30 Sites of Regional Importance comprise State Care Monuments, Scheduled monuments and other important sites and monuments which would merit scheduling.

5.31 Sites of Local Importance are those that are not scheduled, but have significance within a regional or local context. This may, for example, apply to their importance to regional or local history, or they may be the only local example of a monument type. Also included within this are other archaeological sites, findspots, sites identified from aerial photographs, sites identified from OS Memoirs whose locations are unknown and sites of now destroyed monuments. Such sites may comprise component parts of a landscape rich in archaeological monuments, and thereby gain greater significance.

CONSENTED (LA01/2018/0200/F)

Magnitude of Effect

5.32 Table 5.1 provides definitions for the assessment of potential magnitude of change on cultural heritage resources following the construction of the Development.

Table 5.1: Consideration of the scale, extent of change, nature and duration of effect are important in determining the magnitude of change.

Level of Magnitude	Definition of Magnitude
High	Total loss or major alteration to key elements/ features/ characteristics of the baseline conditions such that post development character/ composition/ attributes will be fundamentally changed.
Medium	Partial loss or alteration to one or more key elements/ features/ characteristics of the baseline conditions such that post development character/ composition/ attributes will be partially changed.
Low	Minor loss of or alteration to one or more key elements/ features/ characteristics of the baseline conditions. Change arising from the loss / alteration will be discernible but underlying character/ composition/ attributes will be similar to pre development circumstances /patterns.
Negligible	Very minor loss or alteration to one or more key elements /features /characteristics of the baseline conditions. Change barely distinguishable, approximating to the “no change” situation.

Significance Criteria

5.33 Table 5.2: An assessment of importance and magnitude can then be undertaken to determine how significant an impact is.

Table 5.2: parameter for assessing level of EIA significance

		IMPORTANCE		
		Lesser	Local	Regional
MAGNITUDE	Negligible	No Change	No Change	No Change
	Low	Slight	Slight	Moderate
	Medium	Slight	Moderate	Substantial
	High	Moderate	Substantial	Substantial

Baseline Conditions

The Site

5.34 A detailed site walkover of the proposed application site was conducted by a qualified archaeologist. The site inspection focused on the locations of the turbine bases and those known archaeological monuments within the development area.

5.35 The proposed development site is located on the northern slopes of Keady Mountain. The ground slopes relatively steeply from south to north with localised

CONSENTED (LA01/2018/0200/F)

undulations and exposed rock faces. It is broken up by a series of small streams which flow to the north. These steams have cut narrow, steeply sided gullies into the landscape. Much of the vegetation consists of somewhat improved upland pasture with the western half of the site being covered with more of a mixture of heather and grasses.

5.36 The area of each turbine base was inspected and no evidence of any archaeological features was identified within them or their immediate vicinity. No evidence of any archaeological features (other than those previously known) was identified throughout the remainder of the site.

5.37 The locations of those monuments identified within the development area were also inspected. Of these, no surface remains could be identified for LDY 10:15, LDY 10:18 or LDY 10:19. Some surface features where identified for the remaining monuments.

LDY 10:20

5.38 This site is recorded as a multi period occupation site which was partially excavated in the 1940s. It is described as a low mound approximately 13m in diameter with a stone bank surrounding it. The mound is located on a natural hillock overlooking one of the river gullies. It survives today as a small mound covered with bog cotton (plate 1). There is very little evidence of the stone bank which appears to have been covered over by bog/vegetation.

Plate 1: LDY 10:20 looking west

CONSENTED (LA01/2018/0200/F)

LDY 10:21

5.39 This site is recorded as a series of field systems and hut sites. The SMR grid reference suggests it is located on the lower slopes of the site extending over an area some 900m x 800m. At the time of the inspection the vegetation cover within the location was particularly dense making it almost impossible to identify surface features. One field bank was identified extending roughly north-south from the A37 field boundary (plate 2). It was possible to trace this feature for approximately 150m and it is likely that it continued beyond this point.

Plate 2: field bank within LDY 10:21 looking south

LDY 10:22

5.40 This is recorded as a series of field boundaries within the vicinity of LDY 10:20. There are no further details relating to this site. A single field boundary was identified extending northwest-southeast approximately 30m west of LDY 10:20 (plate 3). This survives as a low bank with some exposed stone.

CONSENTED (LA01/2018/0200/F)

Plate 3: LDY 10:22 looking northeast

5.41 The 1st edition OS map (1830s) shows a single building within the application site (Figure 5.3). This survives today as a small farm cottage and at the time of the site inspection was used as part of a sheep pen (plate 4). It lies well outside the area for the proposed turbines and will not be impacted upon by their construction.

Plate 4: Farm cottage shown on 1st edition OS map looking northeast

CONSENTED (LA01/2018/0200/F)

5.42 A desktop survey was conducted to identify the location of known archaeological sites within the proposed application boundary. (Figure 5.2). The Sites and Monuments Records (SMR) were examined and indicated that there are 6 recorded archaeological monuments within the area of the proposed application boundary.

Table 5.3: Summary of known archaeological sites contained within the proposed application boundary.

Site Number	SMR Number	Site Type	Comments
1	LDY 10:21	Field system and huts	Limited evidence of field system noted during site inspection- vegetation cover was too dense to identify huts. The SMR grid reference locates the site well outside the location of the turbines, however it may extend a considerable distance beyond this.
2	LDY 10:20	Multi period occupation site	Location of site identified and survives as low mound covered with bog cotton. Very limited evidence of surrounding stone bank. Site positioned within turbine area but at sufficient distance to prevent impact.
3	LDY 10:22	Field system	No documentary evidence relating to this feature. A single field bank was noted extending NW-SE down the ravine. May be marked on 1:10,000 map. Site positioned within turbine area but at sufficient distance to prevent impact.
4	LDY 10:19	Burial Mound	Site excavated in 1940s. No visible traces of it could be identified on the ground, however it is not clear whether all features have been removed or are too ephemeral to identify within the landscape. Area lies well outside the location of the turbines.
5	LDY 10:15	Stone circles	The site is recorded as 2 stone circles either side of a steep gully. This appears to be the gully to the immediate west of sites 2 and 3. There is no evidence of a stone circle in this area and no such feature was identified throughout the remainder of the site.

CONSENTED (LA01/2018/0200/F)

Site Number	SMR Number	Site Type	Comments
6	LDY 10:18	Megalithic complex	This site is reported to have been '30yds NE of LDY 10:19'. Again this site was excavated in the 1940s. No visible traces of it could be identified on the ground, however it is not clear whether all features have been removed or are too ephemeral to identify within the landscape. Area lies well outside the location of the turbines.

5.43 The desktop survey identified no sites relating to the Industrial Heritage Records, (IHR), Historic Buildings Records, Battle Sites, Historic Gardens Register, Defence Heritage Records or battle sites within the proposed application boundary

5.44 A review of cartographic sources identified no pre-Ordnance Survey maps for the Site. The first edition OS map of the 1830s shows the Site as being an area of open land and mostly free from development (Figure 5.3). The exception to this is the small building identified along the A37 Broad Road frontage of the Site. This survives today as a small farm cottage and at present is used as part of a sheep pen. The second edition map of the 1850s shows a similar picture, with additional detail of some field boundaries and an access lane extending from the cottage to the top of the hill (Figure 5.3).

Archaeological sites and monuments within 5 km of the Site

5.45 The desktop survey has indicated that 78 locally important recorded archaeological sites (inclusive of those within the application boundary) are located within a 5 km radius of a central point within the Planning Application Boundary (Figure 5.4). In addition 8 regionally important sites were also identified within this search area.

5.46 Details of the 78 locally important monuments are given in Appendix 5.1, while details of those monuments of regional importance are given in Appendix 5.5. None of these archaeological monuments will be directly physically impacted upon by the Development.

Industrial Heritage records

5.47 A review of the Industrial Heritage Records (IHR) was conducted for the 5 km search radius from a central point within the Planning Application Boundary. This review has revealed total of 15 Industrial Heritage sites within the 5 km search area (Figure 5.5). See Appendix 5.2 for full details.

5.48 These Industrial Heritage sites will not be directly physically impacted upon by the Development.

Historic Buildings

5.49 A review of the Historic Buildings Records was conducted for the 5 km search radius from a central point within the Planning Application Boundary. This review

CONSENTED (LA01/2018/0200/F)

revealed that no listed buildings are located within the Site. A total of 4 listed buildings were identified within the 5 km search area (Figure 5.6). Details of the listed buildings can be found in Appendix 5.3. The Historic Buildings will not be directly physically impacted upon by the Development.

Battle Sites

5.50 A review of the battle sites database was conducted for the 5 km search radius from a central point within the Planning Application Boundary. This review identified no battle sites within the search area.

Historic Gardens

5.51 A review of the Register of Historic Parks and Gardens was conducted. This review identified one known historic garden within the 5 km search area (Figure 5.5). This is Drenagh Estate (L-006). The demesne is part walled and dates from the early 18^{th} century. The present house was built in 1837 (Listed HB02/11/002), which sits amidst lawns. There are fine woodland, parkland and shelter belt trees. The ground within the demesne is undulating, descending to the Castle River running to the south of the house and to the Curly River to the north and east. Neither river is used as an ornamental feature. The terrace presently overlooks what has become dense woodland, including exotics and rhododendrons. Two formal gardens were laid out by Frances Rhodes – The “Moon Garden”, an enclosed area influenced by both Chinese and Arts and Crafts garden design, and the “Orbit Garden”, planted with shrubs, trees and herbaceous material. An area south-east of and adjacent to the house had a late 20^{th} Century ornamental garden, which is now grassed. The walled garden is used for nursery planting.

5.52 This historic garden will not be directly physically impacted upon by the Development.

Defence Heritage

5.53 A review of the Defence Heritage Records was undertaken. This consists of a record of structures and sites related to WWI, WWII and Cold War defences within Northern Ireland. It includes pill boxes, airfields and communication centres. This review has revealed that there are 21 recorded defence heritage sites located within the 5 km search area (Figure 5.5). Details of the defence heritage sites can be found in Appendix 5.4. The defence heritage sites will not be directly physically impacted upon by the Proposed Wind Farm Development.

Identification of Historic Assets for Visual Impact Analysis

5.54 Following consultation with DFC:HED, Historic Monuments Unit (August 2017) it was agreed to consider all state care/scheduled monuments and historic gardens within 10 km for potential visual analysis (Figure 5.6). A 6 km search area was used for historic buildings in line with previous requirements for similar developments.

CONSENTED (LA01/2018/0200/F)

5.55 A total of 40 regionally important monuments, 4 historic gardens and 15 historic buildings were identified within the within the 10km search area. These monuments were subject to varying levels of analysis to establish those which required further visual impact analysis. In the first instance, they were then plotted on a Zone of Theoretical Visibility map. This map is produced using topographical information and provides an indication as to how much of the Development will be visible from the surrounding area. The ZTV does not take into consideration potential screening from very localised topography, vegetation or other development. Wireframes were then produced for those monuments which were shown to be inter-visible according to the ZTV information. Wireframes produce a more detailed topographical profile for the views between the monuments and the proposed wind farm. Inspection of the wireframes established a reduced set of monuments which were then subject to site inspections to establish the nature of their setting. The site inspections also established whether any localised features such as vegetation or agricultural buildings screened the monuments from the proposed wind farm development. On the basis of this 12 monuments and 1 historic garden were identified as being inter-visible with the Development. Consultation with DFC:HED was conducted to establish which of these would require further analysis. Table 5.4 details these monuments and specifies the agreed reasoning for those monuments not requiring further analysis.

Table 5.4: Monuments identified as being inter-visible with the proposed wind farm development.

No	SMR No	Site Type	Montage	Reason For no Montage
84	LDY 06:05	Rath	Yes	
85	LDY 06:09	Fortification	Yes	
90	LDY 06:25	Cairn	Yes	
93	LDY 09:05	Rath	No	View to WF looks across Limavady
94	LDY 09:06	Mound	No	View to WF looks across Limavady and currently in golf course
95	LDY 09:48	WWII Trainer dome	No	In semi-urban location
96	LDY 09:50	WWII airfield	No	In semi-urban location
98	LDY 10:06	Rath	Yes	
100	LDY 10:10	Counterscarp rath	Yes	
103	LDY 10:16	Wedge Tomb	Yes	

CONSENTED (LA01/2018/0200/F)

No	SMR No	Site Type	Montage	Reason For no Montage
114	LDY 17:58	Cairn	Yes	
116	LDY 18:16	Rath	Yes	
	Garden No	Garden Name	Montage	DFC:HED comments
	L-006	Drenagh	Yes	Given the size of the estate and the extent of tree cover within it DFC:HED requested a single montage from a point along the main access route into the site.

5.56 In addition to these monuments, DFC:HED also identified 2 additional sites for potential analysis (LDY 07:01 and LDY 07:04). Wireframe analysis of these sites indicated that they are not inter-visible with the proposed wind farm development.

Likely Significant Effects

5.57 The likely significant effects of the Proposed Wind Farm Development fall into two categories:

- Direct physical impacts upon previously unknown sub-surface archaeological remains
- Direct visual impact upon the setting of monuments of regional importance which are inter-visible with the Proposed Wind Farm Development

Construction Effects

5.58 The desktop survey and site inspection have revealed that the proposed Site is located within an area of archaeological interest. The site contains 6 known archaeological monuments. Furthermore an additional 80 monuments were identified within a 5km radius of the Site. Of the monuments located within the Site, only LDY 10:21 will be directly affected by the Development. This monument consists of a number of early field systems and hut circles which extend over a relatively large area in the north western section of the Site. The full extent of this monument is not known but it is believed to cover approximately 900m x 800m. It is likely that the infrastructure for turbines T1, T2 and T3 and possibly the turbine bases themselves will come into some contact with elements of this monument. Should this occur, the construction of the proposed development would result in a minor loss of some elements of the baseline conditions of the monument. This would result in a slight effect upon the monument. This effect is not considered significant in EIA terms and would be significantly reduced through the implementation of an appropriate mitigation strategy.

5.59 Given the presence of the known monuments within the proposed application boundary and the extent of archaeological sites within the wider area, it is likely

CONSENTED (LA01/2018/0200/F)

that previously unknown archaeological deposits could survive within the site. Such remains may be identified during the construction phase of the development. Should this occur, and given the nature of the proposed development, any such remains may be substantially, adversely impacted upon. This effect is not considered significant in EIA terms and would be significantly reduced through the implementation of an appropriate mitigation strategy.

Operational Effects

Impacts upon the setting of regionally important monuments

LDY 06:05

5.60 The monument LDY 06:05 consists of a rath. The landowner of the site did not permit access to it and therefore it was agreed with DFC:HED that the montage viewpoint would be taken from as close as possible to the site. The wireframe for this viewpoint shows that all nine turbines will be visible from the monument, however the montage indicates that localised vegetation cover from within the local landscape will reduce this to five turbines being visible (Figure 5.7). The nearest turbine will be located at a distance of approximately 3.14km. The monument has no public access and is not visible from any of the infrastructure routes approaching it. Raths are defended farmsteads dating to the Early Medieval period (c 500-1100 AD) and are typically (although not exclusively) constructed within locally high areas to provide views of any approaches to it. The main approaches to this monument are from the south-southwest while the Development will be located to its southeast. The construction of the Development will result in a very minor change in the existing baseline conditions of the setting of the monument in that it will introduce a slight view of the Development in an otherwise rural viewpoint. This minor change of the baseline characteristics will have a negligible effect upon the public understanding and enjoyment of it. The introduction of the proposed wind farm development into the local landscape will not have a significant impact upon the setting of monument LDY 06:05.

5.61 Cumulatively no other wind farm developments are visible from the monument and as such there is no cumulative impact presented by the construction of the proposed wind farm development.

LDY 06:09

5.62 The monument LDY 06:09 consists of a fortification. It is located on the top of Sconce Hill, a small hill located to the northeast of the proposed wind farm development. The montage shows that all nine turbines will be fully visible from the monument (Figure 5.8). The nearest turbine will be located at a distance of approximately 5.07km. The montage shows that the views towards the proposed wind farm place it centrally within the view from the monument towards an existing wind farm. The introduction of the Development will not alter the existing baseline conditions and as such will have no further effect upon the setting of the monument LDY 06:09.

CONSENTED (LA01/2018/0200/F)

5.63 Cumulatively the view towards the Development shows that it is contained within the vista across an existing wind farm. This results in a no change effect upon the setting of the monument. The introduction of the Development will have no significant cumulative impact upon the setting of the monument.

LDY 06:25

5.64 The monument LDY 06:25 consists of a round cairn located on high ground to the northwest of the Development. The surrounding landscape is heavily covered with gorse making access to the cairn impossible, however it is evident from its topographic position that the monument has panoramic views in all directions. The montage for this site was taken from an access lane located further down the slope from the monument. The montage shows that all nine turbines will be visible from the monument (Figure 5.9). The nearest turbine will be located at a distance of approximately 4.09km. The monument is not publically accessible and is not visible along the any of the infrastructure routes approaching it. Cairns are prehistoric monuments, typically dating to the Bronze Age (c2000-500BC). They are usually found in upland areas, often with views extending over a wide vista. The construction of the Development will result in a very minor change in the existing baseline conditions of the setting of the monument in that it will introduce a view of additional turbines within the panoramic vistas from the site. This very minor change of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the monument. The introduction of the Development into the local landscape will not have a significant impact upon the setting of the monument LDY 10:10.

5.65 Cumulatively the Development is likely to represent a south-westerly extension of existing and consented wind farms. This will result in a slight increase in the cumulative effect upon the setting of the monument. The effect is very minor in nature and will not have a significant impact upon the setting of the monument.

LDY 10:06

5.66 The monument LDY 10:06 consists of a rath located on low lying ground to the south of the Development. The montage shows that five turbines will be visible at hub height with the tips of an additional two also visible (Figure 5.10). Raths are defended farmsteads dating to the Early Mediaval period (c 500-1100 AD) and are typically (although not exclusively) constructed within locally high areas to provide views of any approached to it. In this instance, the rath is located in lower lying ground and its approaches are from west along the valley created by Keady Mountain and the high ground to the north of the Bolea Road. The Development is not visible in this vista. The monument is not publically accessible and is not visible along the any of the infrastructure routes approaching it. The nearest turbine will be located at a distance of approximately 1.19km. The construction of the Development will result in a very minor change in the existing baseline conditions of the setting of the monument in that its proximity will introduce the

CONSENTED (LA01/2018/0200/F)

turbines into an otherwise rural setting. This very minor change of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the monument. While the Development will slightly alter the baseline conditions, it' proximity will not dominate the monument. The introduction of the Development into the local landscape will not have a significant impact upon the setting of the monument LDY 10:06.

5.67 Cumulatively, the Development will represent a slight south-westerly extension of existing and consented wind farms. This will result in a slight increase in the cumulative effect upon the setting of the monument. The effect is very minor in nature and will not have a significant impact upon the setting of the monument.

LDY 10:10

5.68 The monument LDY 10:10 consists of a counterscarp rath. It is located on the fringes of the existing Dunmore Wind Farm and access to it could not be gained. The montage for this site was taken from the Bolea Road, looking across the monument towards the Development (figure 5.11). The montage shows that all nine turbines within the Development will be visible. The nearest turbine will be located at a distance of 2.31km. Raths are defended farmsteads dating to the Early Medieval period (c 500-1100 AD) and are typically (although not exclusively) constructed within locally high areas to provide views of any approaches to it. In this instance the approaches to the monument are from the west, along the valley created by Keady Mountain and the high ground to the north of the Bolea Road, along which the monument has extensive views. The Development will be visible on the southern fringes of this vista. The monument is not publically accessible and is not visible along the any of the infrastructure routes approaching it. The construction of the Development will result in a very minor loss in the existing baseline conditions of the setting of the monument in that it will introduce a view of the Development on the fringes of what is an otherwise rural vista. This view is not along the functionally important view from the monument which is to the west. This minor loss of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the monument. The area to the immediate east of the monument consists of an existing wind farm development. These turbines overshadow the monument and significantly impact upon its setting. The introduction of the Development into the local landscape will not have a significant impact upon the setting of the monument LDY 10:10.

5.69 Cumulatively, the introduction of the Development will result in an increase in the visible extent of wind farm developments from the monument. In the current setting of the monument, existing turbines are located in close proximity to it from the north through to the southeast. The introduction of the Development into the landscape would increase the view of turbines through to the southwest of the monument, however the additional turbines would be located at a greater distance from the monument than those already in existence. This will have a minimal effect upon the already compromised setting of the monument.

CONSENTED (LA01/2018/0200/F)

LDY 10:16

5.70 The monument LDY 10:16 consists of a wedge tomb. It is located on the south facing slope of the valley created by the Curly River to the north of the Development. The montage shows that all nine turbines will be fully visible from the monument (Figure 5.12). The nearest turbine is located at a distance of 1.73km. The monument survives as facade 5.4m across of 5 stones with a central horizontal sill stone facing southwest. The chamber immediately behind the facade has largely collapsed but further towards the rear of the cairn a capstone 1.5m x 1.4m is still in situ. The surviving cairn is 5.7m southwest-northeast x 5.2m southeast-northwest. While all nine turbines are visible from the monument, they are not evident in its critical view. This lies to the southwest along the orientation of the chamber and in the direction the façade faces. The monument is not accessible to the public and is not visible from any of the road infrastructure approaching it. The construction of the Development will result in a very minor loss in the existing baseline conditions of the setting of the monument. This minor loss of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the monument. The introduction of the Development into the local landscape will not have a significant impact upon the setting of the monument LDY 10:16.

5.71 Cumulatively, there are no other wind farm developments visible from the monument and as such there will be no cumulative effect upon its setting.

LDY 17:58

5.72 The monument LDY 17:58 consists of a prehistoric cairn. It is located within agricultural land to the south of the development. The montage shows that three turbines will be visible at hub height with the blade tips of an additional two turbines also evident (Figure 5.13). The nearest turbine will be located at a distance of approximately 4.91km. The monument is not accessible to the public and is not visible from any of the road infrastructure approaching it. While cairns are often found in upland locations they can also be found in lower lying areas. There is no indication in the morphology of this cairn as to whether it has been constructed to take into consideration any particular viewpoint. The construction of the Development will result in a very minor loss in the existing baseline conditions of the setting of the monument in that it will introduce a limited view of the Development within an otherwise rural landscape. This very minor loss of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the monument. The introduction of the Development into the local landscape will not have a significant impact upon the setting of the monument LDY 17:58.

5.73 Cumulatively, there are no other wind farm developments visible from the monument and as such there will be no cumulative effect upon its setting.

CONSENTED (LA01/2018/0200/F)

LDY 18:16

5.74 The monument LDY 18:16 consists of a rath. It is located on a slight prominence within agricultural land to the southeast of the proposed wind farm development. The montage shows that four turbines will be visible at hub height with the blade tips of an additional two turbines also evident (figure 5.14). The nearest turbine will be located at a distance of approximately 9.81km. The monument is not accessible to the public but is visible looking south from the Gorran Road. The Development is not visible in this vista. The rath has good views in all directions with two other raths within the local landscape being visible from it. The construction of the proposed Development will result in a very minor loss in the existing baseline conditions of the setting of the monument in that is will introduce a view of the Development in an otherwise rural vista. This very minor loss of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the monument. The introduction of the Development into the local landscape will not have a significant impact upon the setting of the monument LDY 18:16.

5.75 Cumulatively, one existing and one proposed wind farm are evident within the view along the northern horizon from the monument. The proposed wind farm would be located centrally between these other developments. The distance at which the monument is located from these and the Development is such that any cumulative effect is negligible upon its setting.

L006- Drenagh Estate

5.76 Drenagh Estate is located on the north-eastern fringes of Limavady, to the west of the Development. The montage for this site was taken from a point on the access lane to the main estate buildings. This was one of the few points within the estate which offered views towards the Development. The wireframe for this viewpoint shows that all nine turbines will be visible from the Estate, however the montage indicates that localised vegetation cover from within the Estate will screen it from the proposed development (Figure 5.15). The nearest turbine will be located at a distance of approximately 4.69km. The Estate has limited public access, which is restricted to wedding events held there. Its outer walls are visible from the surrounding road infrastructure however the proposed wind farm is not visible in these vistas. The construction of the Development will result in a very minor loss in the existing baseline conditions of the setting of the Estate. This very minor loss of baseline characteristics will have a negligible effect upon the public understanding and enjoyment of the Estate. The introduction of the proposed wind farm development into the local landscape will not have a significant impact upon the setting of the estate L006.

5.77 Cumulatively the wireframe from the Estate shows the proposed wind farm development to represent a south-westerly extension of existing and consented wind farms. The montage suggests that these additional sites are not visible from all areas of the estate. As with the Development, it appears likely that the extent

CONSENTED (LA01/2018/0200/F)

of tree cover throughout the Estate limits the views to the wider surrounding countryside. The introduction of the Development will increase the opportunity to view wind turbines from the Estate and therefore will result in a slight increase in the cumulative effect. The effect is very minor in nature and will not have a significant impact upon the setting of the Estate.

Decommissioning Effects

5.78 The decommissioning of the Development will have no physical effect on archaeology or cultural heritage. The decommissioning will reverse any impacts placed upon the setting of regionally important monuments by the operation of the Development.

CONSENTED (LA01/2018/0200/F)

Summary

Table 5.5: Summary of significant effects upon the setting of regionally important monuments and listed buildings.

Site	Monument Number	Likely Significant Effect	Mitigation	Residual Effect
84	LDY 06:05	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
85	LDY 06:09	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
90	LDY 06:25	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
98	LDY 10:06	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
100	LDY 10:10	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
103	LDY 10:16	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
114	LDY 17:58	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
116	LDY 18:16	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument
	L-006- Drenagh Estate	Very minor loss of baseline conditions resulting in negligible effect on setting of monument	N/A	Negligible effect on setting of monument

CONSENTED (LA01/2018/0200/F)

Mitigation

5.79 A desktop survey and site inspection have identified six known sites of archaeological interest within the Preliminary Site Boundary. Furthermore, the Site itself is situated within an area of archaeological interest, with a number of recorded archaeological sites located within a 5 km radius of the Site. It is possible therefore that previously undiscovered, surviving archaeological material may exist sub-surface within the development area, which may be negatively impacted upon by the Development. Therefore during the construction phase, archaeological mitigation will be required.

5.80 Prior to construction commencing, an archaeological programme of works should be presented to and approved by the Local Planning Authority in consultation with DfC:HED. This approved programme should be incorporated into a pre-build Construction Method Statement, prepared by the Applicant. The written scheme should specify the methodology and timetable for a programme of work covering the investigation and evaluation of archaeological remains within the Planning Application Boundary, for mitigation of any impacts through excavation or recording and preservation of the remains in situ.

5.81 The programme of works should include the following recommendations:

- If possible, a series of test trenches should be excavated across the footprints of each of the 9 proposed turbines. Two test trenches will be excavated in a cross formation across each turbine footprint.
- The test trenches will be excavated using a back acting machine fitted with a toothless bucket and under strict archaeological supervision. The test trenches will be excavated to the level of undisturbed subsoil or archaeological strata, whichever is highest. The test trenches will be a minimum of 1.8 m wide.
- The infrastructure extending out to turbines T1, T2 and T3 and the turbine bases themselves should be topsoil stripped to identify
- If test trenching is not possible then it is recommended that archaeological monitoring of topsoil/moorland removal be conducted for the footprint of each turbine and associated access routes.
- Those carrying out site works should work closely with the archaeologist and provide all necessary access and other arrangements. Care will need to be taken to avoid over excavation. The advice of the archaeologist on-site should be adhered to regarding this.
- It is recommended that each excavating machine should be watched by at least one archaeologist at all times (1:1 ratio). This means that sufficient archaeological staff will need to be on site to provide this cover. Work should not begin on site until this cover has been set up.
- The archaeologist must be given every reasonable aid by contractors to enable the archaeological work to be carried out. Contractors may need to

CONSENTED (LA01/2018/0200/F)

use differing work practices on site than usual to enable the archaeologist to identify any archaeological features and complete the work. This must be catered for and adhered to.

- DFC:HED be consulted to agree the appropriate course of action in the event of the discovery and identification of any archaeological remains, which may include preservation in situ or excavation and recording.
- Any unexpectedly significant or complex discoveries, or any other unexpected occurrences or conditions, which might affect the agreed project work or its timetable, should be notified immediately to the client and the DFC:HED. Revised arrangements will be required and the archaeologist must organise a site meeting with the client and DFC:HED to agree a course of action. No further archaeological work should take place upon the features requiring extra time until the meeting has been held and appropriate arrangements agreed. In the meantime site works may continue on other areas within the site.
- It is recommended that on completion of site works, the archaeologist should undertake post-excavation works, including artefact processing and analysis, sample processing, specialist reports and report writing. Once any post-excavation work is completed the archaeologist must prepare a full report on the results to publication standard.
- At all stages of the archaeological site works, the DFC:HED Inspector should be kept informed.

RESIDUAL EFFECT

5.82 Following the implementation of the recommended mitigation strategy, the Development will have no residual effects upon any upstanding or sub-surface archaeological features within the proposed application boundary or its wider landscape.

CUMULATIVE EFFECTS

5.83 The introduction of the Development will have no cumulative effect upon any upstanding or sub-surface archaeological features within the proposed application boundary. Any cumulative effects will relate to the setting of those monuments of regional importance which have been identified above (table 5.4). An assessment of the cumulative effect on each monument has been undertaken. This established that the introduction of the Development into the landscape will result in a negligible effect upon the setting of those monuments.

SUMMARY

5.84 It is proposed to construct a 9 turbine wind farm to be known as Dunbeg South on land to the immediate south of the A37, east of Limavady. A desk top survey and

CONSENTED (LA01/2018/0200/F)

site inspection have been conducted for the area of the Development and its wider landscape extending out to an approximate radius of 5km. In addition all listed buildings within 6km, all regionally important monuments and all historic gardens within a 10km radius have been assessed for potential impact upon their setting.

5.85 The desk top survey and site inspection identified 6 known monuments within the area of land ownership and an additional 80 known archaeological monuments within the 5km search radius. Of the monuments located within the Site, only LDY 10:21 will be directly affected by the Development. This monument consists of a number of early field systems and hut circles which extend over a relatively large area in the north western section of the Site. The full extent of this monument is not known but it is believed to cover approximately 900m x 800m. It is likely that the infrastructure for turbines T1, T2 and T3 and possibly the turbine bases themselves will come into some contact with elements of this monument. Should this occur, the construction of the proposed development would result in a partial or minor loss of some elements of the baseline conditions of the monument. Any effect this would have on the monument would be significantly reduced through the implementation of the recommended mitigation strategy.

5.86 Given the presence of the known monuments within the proposed application boundary and the extent of archaeological sites within the wider area, it is likely that previously unknown archaeological deposits could survive within the site. Such remains may be identified during the construction phase of the development. Should this occur, and given the nature of the proposed development, any such remains may be substantially, adversely impacted upon. This effect is not considered significant in EIA terms and would be significantly reduced through the implementation of the recommended mitigation strategy.

5.87 An assessment was made on the potential impact of the Development upon the setting of historic buildings, regionally important monuments and historic gardens. Through analysis of ZTV information, wireframes and site inspections a total of 12 monuments and 1 historic garden were identified for further assessment. An assessment of these sites established that the introduction of the Development into the landscape will have a negligible-slight effect upon their setting.

CONSENTED (LA01/2018/0200/F)

6

Ecology

CONSENTED (LA01/2018/0200/F)

6 Ecology

Introduction

6.1 This chapter constitutes the ecology and nature conservation assessment for the Environmental Impact Assessment of the proposed wind farm at Dunbeg South, near Limavady, hereinafter referred to as 'the Development'. This study addresses the potential impacts of the proposal to erect nine turbines and to construct associated access tracks and infrastructure on the habitats and species in the study area, as shown in Figure 6.2 – NVC Phase 2 Habitat Map.

6.2 Blackstaff Ecology Ltd was commissioned by RES Ltd to undertake an Ecological Impact Assessment (EcIA) for this proposed wind farm. The ecological surveys used to describe the baseline conditions on site and to inform the EcIA were undertaken during both the 2016 and 2017 survey seasons.

6.3 The proposed wind farm will involve construction of nine wind turbines (overall height 149.9 m; hub height 100 m; rotor diameter 100 m) and associated ancillary works. Full details can be found in Chapter 2: The Proposed Project.

6.4 Insert The chapter is supported by:

- Technical Appendix 6.1: Information to Inform a Habitats Regulations Assessment
- Technical Appendix 6.2: NVC Phase 2 Quadrat Data (2016)
- Technical Appendix 6.3: NVC Phase 2 Quadrat Data (2017)
- Technical Appendix 6.4: GWDTE Survey Data
- Technical Appendix 6.5: Bat Annex
- Technical Appendix 6.6: Badger Survey Report (Confidential)
- Technical Appendix 6.7: Herpetofauna Survey Report
- Technical Appendix 6.8: Outline Habitat Management Plan
- Technical Appendix 6.9: (DAERA NED) Consultations

6.5 Figures 6.1 to 6.9 area referenced in the text where relevant.

Statement of Authority

6.6 The vegetation surveys, habitat assessments and bat surveys were carried out by Cormac Loughran and Karl Hamilton, with badger, smooth newt, viviparous lizard and other surveys carried out by Katy Bell and Dr Brian Sutton. Technical support, including deployment of automated (bat) detectors, GIS figure production (habitat loss/benefit calculations) and UAV (drone) imagery (capture and production) was provided by Philip Leathem.

6.7 The author of this chapter is Cormac Loughran, a Chartered Environmentalist (CEnv), and a full member of the Chartered Institute of Ecology and Environmental

CONSENTED (LA01/2018/0200/F)

Management (CIEEM). Cormac has worked professionally as a Consultant Ecologist for over 13 years. He holds an MSc (Distinction) in Environmental Management from the University of Ulster, and has extensive experience in a broad range of flora & fauna surveys. He has undertaken and/or coordinated a wide range of ecological surveys and associated impact assessments for over 20 renewable energy projects. Cormac is also an experienced field naturalist and prior to his consultancy work, he worked as a ranger on a number of important nature reserves. As a result, he also has considerable habitat management experience across a broad range of habitats in including broadleaved woodland, wetland, grassland and wet & dry heathland.

6.8 Dr Brian Sutton was awarded a PhD in Environmental Science by the University of Ulster. Prior to working at Blackstaff Ecology, he worked as a member of the Habitat Survey Team of the Environment and Heritage Service (now NIEA) for 2 years. During this time, he carried out habitat surveys of, principally, designated sites or candidate designated sites across Northern Ireland. In so doing he gained experience of most of the habitat types that are present in the Province. Following this, he worked as a consultant ecologist for AECOM Ltd for 15 years, carrying out habitat and faunal surveys for a wide range of governmental and private clients. Projects undertaken were at a range of scales, from small private developments to major infrastructure projects.

6.9 Karl Hamilton has extensive experience in providing ecological consultancy advice, including habitat monitoring & management advice for a wide range of native flora & fauna. He has extensive experience in surveying, birds, mammals, herpetofauna, (extended) phase 1 and phase 2 (NVC) habitat survey and other protected species surveys. His recent consultancy work includes priority species surveys; extended phase one habitat surveys; National Vegetation Classification surveys; protected species surveys; habitat assessment & management as mitigation for breeding waders, vantage point surveys for raptors and migratory species; walkover surveys including Breeding Bird Surveys and Brown & Shepard surveys; wetland bird surveys (WeBS), and surveys of lowland species-rich meadows.

6.10 Katy Bell has worked in the ecological and conservation industry for 7 years since graduating as a zoologist. She went on to complete her MSc in Ecological Management and Conservation Biology. During this time, she carried out her thesis on reptiles and amphibians. She has worked for universities around the world on several research projects and locally for Ulster Wildlife. Since she commenced working for Blackstaff Ecology Katy has been involved in post-construction bird surveys for four windfarms, NVC habitat surveys for a proposed 33kV overhead line as well as numerous otter, badger and smooth newt surveys.

6.11 Philip Leathem is a UAS (Unmanned Aerial Systems) Operator & GIS Technician who has worked in the environmental sector for the past 3 years. Philip's role as a technician includes the maintenance, monitoring and deployment of a suite of automated bat detector units (SM2 Bat+, SMZC's and Anabat Express') which are used during static (bat) monitoring. In addition to the above role, Philip is also a GIS Technician and had considerable experience in the production of Figures for

CONSENTED (LA01/2018/0200/F)

Environmental Statements. He also has permission to fly from the CAA (Civil Aviation Authority (BNUC)) for the operation of a fully autonomous professional mapping drone used to capture high-resolution aerial photos, 2D orthomosaics & 3D models).

Legislation & Planning Policy

International Treaties, Conventions & Directives

Bonn Convention of the Conservation of Migratory Species of Wild Animals (June 1979)

6.12 The Convention requires the protection of the endangered migratory species listed and encourages separate international agreements covering particular species. An agreement covering the conservation of bats in Europe came into force in January 1994. It deals with the need to protect bats and their feeding and roosting areas.

Bern Convention on the Conservation of European Wildlife and Natural Habitats (September 1979)

6.13 The Convention carries obligations to conserve wild plants, birds and other animals, with emphasis on endangered and vulnerable species and their habitats. The provisions of the Convention underlie the EC Habitats Directive as well as the UK's wildlife legislation.

UN Biodiversity Convention (The Rio Convention) (June 1992)

6.14 The Convention provides a framework for international action to protect species and habitats. The UK's overall goal under the Convention is to conserve and enhance biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms.

Convention on Biological Diversity (93/626/EEC) (CBD)

6.15 The Convention requires contracting parties, in accordance with its conditions and capabilities, to develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes. It also requires contracting parties to integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectorial and cross sectorial plans, programmes and policies.

EC Council Directive on the Conservation of Natural Habitats of Wild Fauna and Flora (92/43/EEC) (The Habitats Directive)

6.16 Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the EU Habitats Directive) is transposed into law in Northern Ireland by the Conservation (Natural Habitats, etc.) Regulations 1995 (as amended), the Habitats Regulations.

CONSENTED (LA01/2018/0200/F)

6.17 The Habitats Directive covers habitats and non-avian species of fauna of nature conservation importance and in danger of disappearance, for which the European Commission (EC) has responsibility in view of the proportion of their global range. Habitats are listed and detailed on Annex I of the Directive.

6.18 To conserve these habitats, listed on Annex I of the directive, and species, listed and described on Annex II, a European network of Special Areas of Conservation (SAC) is being established.

6.19 As the Habitats Directive encapsulates a presumption in favour of maintaining Annex I habitats in good conservation status wherever they occur, prior assessment is therefore required to determine whether any areas of habitat within a development site meets the criteria for recognition as Annex I habitat types.

6.20 The Directive also requires appropriate assessment of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, but likely to have significant effects upon a Natura 2000 site, either individually or in combination with other plans or projects.

Annex 1 Habitats

6.21 Northern Atlantic wet heaths (H4010) with *Erica tetralix*, European dry heaths (H4030), Transition mires and quaking bogs (H7140), Alkaline fens (H7230) and Blanket Bog (H7130) are listed in Annex 1 of the EU Habitats Directive and this indicates that they are protected habitats. 'Active' blanket bog is classified as a priority habitat.

6.22 The main aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats listed in Annex 1 at a favourable conservation status, introducing robust protection for those habitats of European importance (i.e. priority habitats, such as 'active' blanket bog).

Domestic Legislation

Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995 (as amended)

6.23 The Regulations give effect to requirements relating to the designation of protected sites under the Birds Directive and Habitats Directive. The Regulations provide for the protection and management of European Sites and place obligations on all competent authorities to have regard to the requirements of the Habitats Directive. The Regulations also provide for the protection of species of European importance.

Environment (Northern Ireland) Order 2002

6.24 The Order provides for the designation, management and protection of Areas of Special Scientific Interest (ASSIs). ASSIs may be designated for important geology and land forms as well as for wildlife and habitats. The legislation repeals Part VI of the Nature Conservation and Amenity (Northern Ireland) Order 1985.

CONSENTED (LA01/2018/0200/F)

Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 (as amended)

6.25 The Order provides for the establishment of National Nature Reserves (NNRs), Nature Reserves (NRs) and Marine Nature Reserves (MNRs). It also provides for the designation and formulation of proposals for National Parks and Areas of Outstanding Natural Beauty (AONBs).

The Wildlife (Northern Ireland) Order 1985 (as amended)

6.26 The Order prohibits the intentional killing, taking or injuring of certain wild birds or wild animals; or the intentional destruction, uprooting or picking of certain wild plants. It also allows for the establishment of Wildlife Refuges (akin to Nature Reserves) for the special protection of certain species of rare plants or animals.

The Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009

6.27 The Regulations implement Directive 2004/35/EC and require those carrying out certain activities to prevent, limit and remediate significant environmental damage to protected species, natural habitats, ASSIs, surface water, ground water and land. Operators of activities such as discharges to water sources and water impounding are liable for any significant environmental damage, regardless of whether they intended to cause the damage or were negligent.

Wildlife and Natural Environment Act (Northern Ireland) 2011

6.28 The Act makes provision about biodiversity; amends the Wildlife (Northern Ireland) Order 1985 and Part 4 of the Environment (Northern Ireland) Order 2002; abolishes game licences and game dealers' licences; prohibits hare coursing events and amends the Game Preservation Act (Northern Ireland) 1928.

Planning Policy

Regional Development Strategy (RDS) 2035: Building a Better Future

6.29 The Strategy takes account of European and national policies which would have an influence on the future development of Northern Ireland. The Strategic Planning (Northern Ireland) Order 1999 requires Northern Ireland Departments to have regard to the Regional Development Strategy in exercising any functions in relation to development. There are two types of Strategic Guidance: Regional Guidance (RG) and Spatial Framework Guidance (SFG). RG applies to everywhere in the region and is presented under the three sustainable development themes of Economy, Society and Environment.

6.30 RG 9 - RG 12 (Environment) have been adjusted to meet obligations under the Habitats Regulations. Of relevance to the Development is RG 11: Conserve, protect and, where possible, enhance our built heritage and our natural environment. This Strategy Guidance refers to the need to;

CONSENTED (LA01/2018/0200/F)

6.31 Sustain and enhance biodiversity in line with the objective of the Northern Ireland Biodiversity Strategy to halt the loss of indigenous species and habitats. By protecting existing, or creating new, ecological or wildlife corridors particularly in our cities and towns we can provide valuable help to arrest the decline in biodiversity.

6.32 Identify, establish, protect and manage ecological networks. Ecological networks, including the protection of priority species, are needed to maintain environmental processes and help to conserve and enhance biodiversity. A well-established ecological network, including designated sites, should provide the habitats needed for ecosystems and species populations to survive in an increasingly human dominated landscape. Such networks could also be of amenity value if linked to the green infrastructure provided by walking and cycle routes to heritage and other recreational interest.

Strategic Planning Policy Statement for Northern Ireland (SPPS)

6.33 In addition to reiterating the statement made in PPS18 (below) the SPPS States:

'Active peatland is of particular importance to Northern Ireland for its biodiversity, water and carbon storage qualities.'

and

'Renewable energy reduces our dependence on imported fossil fuels and brings diversity and security of supply to our energy infrastructure. It also helps Northern Ireland achieve its targets for reducing carbon emissions and reduces environmental damage such as that caused by acid rain.'

Planning Policy Statement 18: Policy RE1

6.34 Policy RE1 States:

'The wider environmental, economic and social benefits of all proposals for renewable energy projects are material considerations that will be given significant weight in determining whether planning permission should be granted'.

'Development that generates energy from renewable resources will be permitted provided the proposal, and any associated buildings and infrastructure, will not result in an unacceptable adverse impact on:

(a) public safety, human health, or residential amenity;

(b) visual amenity and landscape character;

(c) biodiversity, nature conservation or built heritage interests;

(d) local natural resources, such as air quality or water quality; and

(e) public access to the countryside.

…..

Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures, such as a habitat management plan or the creation of a new habitat. This matter will need to be agreed before planning permission is granted.

…..

CONSENTED (LA01/2018/0200/F)

Any development on active peatland will not be permitted unless there are imperative reasons of overriding public interest.'

Planning Policy Statement 2 - Policy NH5

6.35 Policy NH 5 - Habitats, Species or Features of Natural Heritage Importance, states:

Planning permission will only be granted for a development proposal which is not likely to result in the unacceptable adverse impact on, or damage to known:

- *priority habitats;*
- *priority species;*
- *active peatland;*
- *ancient and long-established woodland;*
- *features of earth science conservation importance;*
- *features of the landscape which are of major importance for wild flora and fauna;*
- *rare or threatened native species;*
- *wetlands (includes river corridors); or*
- *other natural heritage features worthy of protection.*

A development proposal which is likely to result in an unacceptable adverse impact on, or damage to, habitats, species or features may only be permitted where the benefits of the proposed development outweigh the value of the habitat, species or feature. In such cases, appropriate mitigation and/or compensatory measures will be required.

PPS 21 Sustainable Development in the Countryside

6.36 PPS 21 aims to, *"Manage development in the countryside in a manner consistent with achieving the strategic objectives of the Regional Development Strategy for Northern Ireland 2025." Objectives include to "Conserve the landscape and natural resources of the rural area and to protect it from excessive, inappropriate or obtrusive development and from the actual or potential effects of pollution," and to "Promote high standards in the design, siting and landscaping of development in the countryside."*

Northern Ireland Biodiversity Strategy

6.37 A new strategy has just been published by the DoE entitled, Valuing Nature – A Biodiversity Strategy for Northern Ireland to 2020 (01st July 2015). This document describes 20 targets arising from the 2010 Convention on Biological Diversity (CBD) which was held in Noyoga, Japan during October 2010. A key decision at the Convention was the adoption of a new ten-year strategic plan to guide international and national effort to save biodiversity. The strategic plan, or the Aichi Target, adopted by the meeting is the overarching, internationally agreed, framework on biodiversity. The 20 Aichi Targets form the basis for the Implementation Plan for the NI Biodiversity Strategy. The CBD fully adopted the ecosystem services approach that stresses the need to look at maintaining the functionality of ecosystems as key to protecting biodiversity and delivering benefits for humanity.

CONSENTED (LA01/2018/0200/F)

Sustainable Development Strategy for Northern Ireland

6.38 The Strategy sets out the Government agenda for ensuring that sustainable practice becomes an integral part of development policy in Northern Ireland. The following six principles of the strategy continue to echo those developed from the previous strategy, and are as follows;

- Living within Environmental Limits;
- Ensuring a Strong, Healthy, Just and Equal Society;
- Achieving a Sustainable Economy;
- Promoting Good Governance;
- Using Sound Science Responsibly;
- Promoting Opportunity and Innovation.

6.39 The strategic objective most relevant to this development is: Ensuring reliable, affordable and sustainable energy provision and reducing our carbon footprint.

UK and Northern Ireland Biodiversity and Habitat Action Plans

6.40 The UK Biodiversity Action Plan (UKBAP) and equivalent Northern Ireland Habitat Action Plan, as well the internal NIEA Guidance Document, have been consulted regarding what constitutes ‘active’ blanket bog.

6.41 The UKBAP indicates that ‘active’ peatlands include the EU Habitats Directive priority habitat 'active' blanket bog, the definition of ‘active’ being given as 'still supporting a significant area of vegetation that is normally peat forming'. The UKBAP indicates that the principal vegetation (NVC) types covered and so defined as Blanket bog are M1, M2, M3, M15, M17, M18, M19, M20 and M25, together with their intermediates.

6.42 The Northern Ireland Habitat Action Plan (NIHAP) provides a similar definition of the habitat type, The NI HAP notes the EC Habitats Directive definition of what constitutes ‘active’ bog, and note the following in respect of relevant NVC types: -

‘Within Northern Ireland, blanket bog encompasses a range of plant communities that are similar to those identified in the National Vegetation Classification (NVC) of Great Britain (Rodwell, 1991). NVC descriptions and codes are given to associations of plants that are characteristic of particular environmental and management conditions. Plant communities that are typical of natural blanket bogs include the bog pool communities M1 to M3, M17 Scirpus cespitosus - Eriophorum vaginatum blanket mire, M18 Erica tetralix - Sphagnum papillosum raised and blanket mire and M19 Calluna vulgaris - Eriophorum vaginatum. A number of additional NVC communities are characteristic of the extensive areas of blanket bog which have been subject to some disturbance such as drainage or peat-cutting. These include M15 Scirpus cespitosus - Erica tetralix wet heath, M20 Eriophorum vaginatum blanket and raised mire, M25 Molinia caerulea - Potentilla erecta mire, together with their intermediates. Other wetland plant communities, such as flush M10 Carex dioica-Pinguicula vulgaris mire and poor-fen M6 Carex echinata-Sphagnum recurvum/auriculatum mire, are often closely associated with blanket bog. For the purposes of this plan, these are treated as an integral part of the blanket bog habitat.’

CONSENTED (LA01/2018/0200/F)

6.43 The UKBAP, NIHAP and European Commission (2007) Interpretation Manual of European Union Habitats has been utilised in the current report to determine whether peatlands are 'active' and hence require consideration in policy and impact assessment terms.

Guidance on Species/Habitats of Conservation Concern

Red Data Book

6.44 Vascular plant species that are rare and/or threatened on an all-Ireland or European scale have been identified as Red Data Book (RDB) species (Curtis & McGough, 1988).

Northern Ireland Species of Conservation Concern

6.45 NIEA has produced a list of Northern Ireland Priority Species (NIPS) and Species of Conservation Concern (SOCC), which includes Biodiversity Action Plan species, not all of which are Red Data Book species. Rarity is also a criterion for inclusion in the list. NIEA is also in the process of identifying vascular plant species that are of conservation concern as the NI response to the adoption by the UK of the Global Strategy for Plant Conservation (Palmer, 1994). The proposed list will be comprehensive and include species that are near-threatened as well as those protected by the Wildlife Order or listed as NIPS and SOCC. This process of evaluation of the current list of species of conservation concern is on-going.

Local Biodiversity Action Plans (LBAPs)

6.46 Local Authorities have been able to employ Biodiversity Officers, with financial aid from NIEA, since 2004. Their duties include raising awareness of biodiversity issues within local areas, and the development of LBAPs as a means of conserving and enhancing biodiversity at a local scale.

NIEA Internal Guidance Note on Active Peatland

6.47 The Northern Ireland Environment Agency (NIEA) provide internal guidance to their personnel indicating the site conditions, and which NVC types, may indicate that blanket bog is 'active'. In terms of NVC communities, the Guidance states: -

'The list below indicates the NVC classifications that could be active. In these habitats, the full details of quadrats surveyed will be needed to aid identification of active peatland. They should be provided within the environmental statement (ES).

NVC classifications which are likely to be found in active peatland:

- *M1 Sphagnum auriculatum bog pool community*
- *M2 Sphagnum cuspidatum/recurvum bog pool communities*
- *M3 Eriophorum angustifolium bog pool community*
- *M17 Scirpus cespitosus - Eriophorum vaginatum blanket bog*
- *M18 Erica tetralix- Sphagnum papillosum raised and blanket mire*
- *M19 Calluna vulgaris-Eriophorum vaginatum blanket mire*

CONSENTED (LA01/2018/0200/F)

- *M20 Eriophorum vaginatum blanket mire*
- *M25 Molinia caerulea-Potentilla erecta mire'*

6.48 Other criteria from the Guidance, including site-specific characteristics which could indicate the presence of 'active' peat include:

- *Sphagnum is present*
- *If the surface is spongy underfoot*
- *Deep peat is present (>0.5m)*
- *Intact peat is present or the hydrology is still intact*
- *E. vaginatum/ angustifolium is present in significant quantities with some Sphagnum*
- *The typical range of blanket bog and raised bog species is present as indicated within the interpretation manual*
- *There is a hummock and pool topography*

6.49 Consideration of this Guidance is essential in the design and layout of wind energy projects to ensure compliance with Planning Policy.

Scope of Assessment

Ecological Impact Assessment

6.50 The assessment is based mainly on a study area surrounding the Development and associated infrastructure. Surveys for bats were extended to 200m outside the Planning Application Boundary, as required by NIEA guidance. Sites designated for their nature conservation features within a radius of 2km of the site boundary (Figure 6.1) were also considered to assess potential remote effects on valuable ecological site-based receptors.

6.51 The aim of EcIA is therefore to describe and assess potential significant effects upon ecological receptors within the application site and zone of ecological influence within the wider environment as applicable. This is achieved by informed decision making in accordance with published methodologies and after having collected a range of primary survey data across the site of proposed development. Identification and evaluation of likely significance of effects associated with the Development during construction, operation and decommissioning phases is followed by the recommending of appropriate mitigation measures to avoid and/or reduce the predicted adverse effects of the proposed development on the recorded ecological receptors identified as part of the baseline survey.

6.52 The baseline survey, characterisation of the environment and the likely significance of effects of the Development on ornithology, fisheries (aquatic ecology) and the water environment are reported upon in Chapter 7: Ornithology, Chapter 8: Fisheries and Chapter 9: Geology & Water Environment.

CONSENTED (LA01/2018/0200/F)

Habitat Regulations Assessment

6.53 A Habitat Regulations Assessment (HRA) is required where a project may give rise to likely significant effects upon a Natura 2000 site. Natura 2000 is a European network of protected sites which includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA). A HRA comprises a 'Test of Likely Significance' and if necessary an 'Appropriate Assessment'.

6.54 The proposed wind farm is hydrologically linked to the River Roe & Tributaries SAC, a Natura 2000 site, via a few minor tributaries of the Curly River.

6.55 The sites have been considered in the Environmental Impact Assessment (EIA) process presented in this Environmental Statement (ES). Relevant environmental information and evidence required for the Competent Authority to undertake a HRA has been compiled in this ES. Information to inform a HRA can be found in Appendix 6.1.

Consultation

6.56 Consultation was undertaken with the statutory and non-statutory organisations listed below regarding the proposed scope of the EcIA; the location of any statutory and non-statutory designated nature conservation sites that have the potential to be impacted by the Development; identification of potential ecological receptors; the existence of any ecological records within 2 km of the Preliminary Site Boundary; and the existence of bat records within 15 km of the site.

- Centre for Environmental Data & Recording (CEDaR);
- National Biodiversity Network (NBN);
- NIEA – Natural Environment Division;
- Northern Ireland Bat Group (NIBG).

6.57 CEDaR, NIBG and NBN provided biological records. NIEA provided a written response. Appendix 6.9 summarises pertinent points raised in this response. The appendix also contains the minutes of a meeting held with DAERA NED on the 4th August 2017 in which the following issues were discussed; NVC Habitat Survey, Habitat Management Plan and the Ecology Chapter of the ES.

6.58 A consultation meeting was also held with NIEA on 04th August 2017. The design of the infrastructure layout to avoid blanket bog habitats was illustrated, as was the efforts made to reuse the existing tracks on site by incorporating them into the site design. The avoidance of more species-rich habitats was illustrated using imagery taken by drone. The main issue of NIEA concern was the potential adverse impact of the development on Northern Ireland priority habitats, such as: M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture and M15 *Scirpus cespitosus – Erica tetralix* wet heath.

6.59 NIEA requires the identification of the ecological baseline of the area that will be affected by the scheme and the identification of areas which are likely to be of high conservation value or particularly vulnerable to impact from the proposed

CONSENTED (LA01/2018/0200/F)

scheme. NIEA requires that the EIA should cover both habitats and species of flora and fauna, especially protected species, and that it should cover both the site and its surroundings, in all seasons.

6.60 The developer will be required to consider the potential impact of the scheme on designated sites. Where there is a potential for impacts on a European protected site (SPA, SAC) the developer will be responsible for informing a HRA as mandated by Article 6 of EC Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive"). Appendix 6.9 provides a summary of the consultation responses received from the NIEA.

6.61 The consultation and desk study identified those ecological receptors most likely to be impacted by the proposed wind farm. Ecological receptors identified included; Northern Ireland or European priority habitat and protected species. The ecological surveys and EcIA therefore concentrate on the potential effects of the Development on these ecological receptors.

Assessment Methodology

Baseline Characterisation of the Study Area

6.62 The study methodology includes both desktop and field survey methods in order to assess the potential impact on the local ecological and nature conservation interest. Features of conservation interest and importance were recorded and their locations were one of the key criteria that affect the wind farm layout. The location of the wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this was not possible, mitigation and/or enhancement measures have been incorporated into the design to balance any detrimental impact.

6.63 Habitats were surveyed across the whole Preliminary Site Boundary, hereafter referred to as ‘the site’, while signs of mobile species were assessed outside the site to determine their point of origin. The study area was thus extended to take account of the potential for species to use the vicinity of the proposed development as part of wider territories or foraging areas. Watercourses within the site, and some tributaries outside the site, were surveyed for signs of otter. Specific study areas for each species are as follows;

- Bats (450 m around proposed turbine locations);
- Otter & badger (site +25 m buffer);
- Common lizard & smooth next (site);
- Marsh fritillary/argent & sable (site);

6.64 Sites designated at international, national and local level for their conservation value within a potential impact zone were considered. The nearest designated sites to the study area were identified, to assess the potential for remote effects of the scheme on valued habitats and species outside the immediate area.

CONSENTED (LA01/2018/0200/F)

6.65 The Fauna section of the EIA considers information gathered from the following sources:

- Consultations, with statutory and non-statutory stakeholders
- Desk study, including review of published/unpublished sources/literature
- A walkover survey of the entire study area and any other areas likely to be affected
- Specialist surveys, as detailed in paragraph 6.66 below
- Assessment of the data acquired
- Consideration of ecological interests in the scheme design and identification of mitigation to be incorporated into the design
- Impact assessment
- Proposed additional mitigation measures to address any likely significant adverse impacts

6.66 The data collection methodology adopted involves both a desktop search and field survey. The relevant statutory and non-statutory bodies were contacted to obtain ecological data for the study area. CEDaR was approached for records of species of conservation concern in the study area. Detailed surveys were undertaken to establish the baseline conditions for the various habitats and for the species groups that are likely to occur around the proposed scheme. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are valued in some way for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken:

- Phase 1 Habitat survey
- NVC Phase 2 Habitat survey
- Bat (*Chiroptera spp*) survey
- Otter (*Lutra lutra*) survey
- Badger (*Meles meles*) survey
- Smooth Newt (*Lissotriton vulgaris*) habitat survey
- Common Lizard (*Zootoca vivipara*) survey
- Marsh Fritillary (*Euphydryas aurinia*) habitat survey
- Argent & Sable (*Rheumaptera hastata*) habitat survey

Habitat Survey Methodology

Phase 1 Habitat Survey

6.67 The Site was visited and habitats of the proposed development site were allocated to the JNCC Phase 1 Habitat (JNCC 2010) derived NIEA habitat classification. Notes were made of the main plant species, and other species that are indicative of the condition and management of the habitat.

CONSENTED (LA01/2018/0200/F)

6.68 Phase 1 Habitat survey methodology is intended for auditing of habitats and is generally accurate and of wide application. It is noted also that habitat types may frequently merge, grade from one to another, or form complex mosaics.

6.69 Frequently encountered habitat mosaics in Ireland include various mixtures of grassland/pasture types, heathlands and blanket bogs. Mosaics and transitional, modified and degraded habitats can be very difficult to assign to any one Phase 1 Habitat category yet may have very different sensitivities and implications for project planning and assessment.

6.70 The area covered by the Phase 1 Habitat survey is illustrated on Figure 6.2. Phase 1 Habitat methodology is not considered to be sufficiently sensitive (for heathlands or (species-rich) grassland) to describe and map them in sufficient detail for this study, and is not sufficiently informative to determine whether blanket bog is active or not. Thus, the Phase 1 Habitat survey results were used to scope and plan a Phase 2 National Vegetation Classification survey.

National Vegetation Classification (NVC) Survey

6.71 NVC survey methodology was commissioned in 1975 by the Nature Conservancy Council (NCC) to provide a comprehensive and systematic catalogue and description of the plant communities of Britain. NVC has now been accepted as a standard, not only by the statutory nature conservation and countryside organisations, but also by forestry, agriculture and water agencies, local authorities, non-governmental organisations, major industries and universities. The NVC is a system of classifying natural plant communities in Britain according to the species they contain and provides a standardised methodology for detailed environmental assessments. The methodology is repeatable and incorporates the use of quadrat sampling within which the types and relative abundance of plant species is recorded. From these results, plant community types can be classified.

6.72 The survey method employed at Dunbeg South was based on the NVC survey methodology described by Rodwell (Volumes 1 to 5, 1991 to 2000), which provides for the detailed classification and map-based survey of a wide range of plant communities found in Britain. At the time of the Rodwell reports, NVC did not extend to covering Ireland. Despite this, the vegetation communities described in Rodwell's reports are equally applicable to those present in Northern Ireland.

6.73 Plant species were identified and recorded using the keys and nomenclature of Stace (2010) for higher plants and Atherton et al. (2010) for bryophytes (mosses and liverworts).

6.74 The NVC survey was undertaken by a Karl Hamilton who is a qualified and experienced ecologist. The study area covered by NVC survey is shown in Figure 6.2. NVC communities and sub-communities were recorded by taking detailed target notes (TN) of representative samples of vegetation communities. Quadrats were used for sampling. For low growing vegetation, a quadrat size of $4m^2$ was used. No woodland or shrub communities were required to be sampled. Plant

CONSENTED (LA01/2018/0200/F)

species abundances were made using percentage cover (as this allows the quadrat data to be more readily analysed using computer software such as MAVIS).

6.75 NVC plant communities and sub-communities were mapped on a 1:10,000 OS map. A hand-held GPS was used to record the location of target notes accurately. A digital camera was used to take representative photographs of each quadrat location for future reference. Analysis of the NVC community and sub-communities that were present were made using the relevant NVC Volumes (Rodwell 1991a to 2000). For the sake of clarity this report uses a combination of common and scientific species names, although the latter are only used by Rodwell (1991a to 2000). The most important references for this work are Rodwell 1991a and 1992).

6.76 NVC quadrat surveys (Phase 2 surveys) were carried out in both the 2016 and 2017 survey seasons, and the combined quadrat results were compiled to produce an NVC map (Figure 6.2). Plant community details were recorded in line with the above methodology in 245 quadrats overall, chosen to represent the range of plant communities found across the site and to describe vegetation conditions at important locations of the Development layout. GPS locations of every quadrat were recorded and the results mapped using geo-referenced OSNI maps (Figure 6.2). All quadrat data is provided in Appendices 6.2 & 6.3.

6.77 Each NVC community was then assessed to determine its condition and signs of degradation or damage, such as the presence of sheep/cattle grazing, trampling and dunging, artificial drainage, past burning, peat cutting, mowing or any other biotic or abiotic factor likely to cause vegetation communities to be degraded compared to typical NVC communities provided in Rodwell (1991b and 1992).

6.78 NVC survey results were used to identify valuable vegetation communities and provided input into the assessment of active blanket peat within the study area. These were included in a constraints mapping exercise, along with other environmental constraints, to evolve the final layout design and layout of the wind farm. This process is described in Chapter 3: Design Evolution & Alternatives.

6.79 Site visits, including NVC survey, were carried out on the following dates:

- 15th, 20th,23rd, 27th & 28th June 2016;
- 14th & 15th & 20th July 2016;
- 4th, 6th, 7th, 10th & 24th July 2017; and,
- 1st September 2017.

6.80 In addition to the work on mapping the habitats on site to NVC level, further surveys were carried out, which particularly focused on flushes. A specific survey was carried out on the 2nd September 2016 to locate, record and map any flushes on site. The results of this exercise are presented in Appendix 6.4 and on Figure 6.3. This was work was completed in order to ensure that important localised habitats (i.e. base rich flushes such as M10 which qualifies as a Habitats Directive Annex I habitat (Alkaline Fens) as well as a NI priority habitat). These small flushes can be easily overlooked but have significant conservation value, including being home to

CONSENTED (LA01/2018/0200/F)

the very rare *Vertigo* snails. This also fulfils an NIEA recommendation for additional survey work to locate these habitats on this site.

6.81 Vegetation assessments were carried out by Karl Hamilton with assistance from Cormac Loughran and Dr Brian Sutton.

Blanket Bog Condition Assessments

6.82 Peatland habitats within the site were assessed to determine whether there were any areas of 'active' blanket bog present. The criteria used included the following:

- criteria provided in the NIEA Guidance note (2012);
- the presence and condition of NVC communities;
- the eco-hydrological conditions found in each part of the site, particularly the presence and condition of artificial drainage;
- past and present land management practices which have the potential to damage the habitat, including: peat cutting, burning, vegetation topping, sheep grazing, etc.

Mammal Surveys

Bat Surveys

Pre-Survey Visits

6.83 A site visit was undertaken to walk the Site during daylight hours in April 2017, to identify the potential value of habitats and landscape features (buildings, built structures, individual trees and watercourse etc.) potentially used by bats in accordance with Chapter 10 of the BCT Bat Surveys: Good Practice Guidelines (2012). Ordnance Survey mapping and aerial photographs were used to identify potential features prior to the site visit.

6.84 An external inspection survey of the single abandoned building within the site was also undertaken to determine the presence of bats or likely presence of bats. Both direct and indirect methods were used to search for evidence of bats. Direct methods involved surveying for observations of bats or the remains of dead bats. Indirect methods involved identification of faecal pellets, urine, oil stains and feeding remains, which indicate evidence of bat activity. Photographs taken during the building are presented in Appendix 6.5: Bat Annex.

Manual Bat Activity Surveys

6.85 Bat surveys were undertaken in accordance with NIEA survey specification for wind farms as requested by NIEA in their EcIA scoping response. Manual bat activity surveys were undertaken (seasonally) during spring, summer and autumn 2017.

6.86 A total of three dusk surveys and one dawn survey was completed (see Figures 6.5 – 6.7). The location of sample points was determined by suitable habitat features for bats, access, health and safety considerations and turbine locations. Ground conditions (in places) consisted of uneven ground conditions, post & wire stock fencing and drainage ditches, raised banks and deep gullies making some parts of

CONSENTED (LA01/2018/0200/F)

the site difficult to traverse during nocturnal manual transects. Each pre-defined sample point (or listening stop) was surveyed for three minutes to record the level of bat activity near a specific feature within the Site. Bat activity that occurred between sample points was also recorded.

6.87 Bat activity surveys were undertaken when weather conditions were forecast to consist of temperatures >10°C with little or no wind or precipitation when bat activity is known to increase. Meteorological information including temperature, wind speed, cloud cover and precipitation were recorded for each survey session.

6.88 An EM Touch bat detector, or a Batlogger M were used to record bat echolocation calls for later sound analysis using sound analysis software (Kaleidoscope Pro, AnalookW (v4.1) or BatExplorer (v1.11)). For each bat observed, the location was automatically recorded using an (internal) Global Position System module (accurate to within ±3 m). The number of bats, bat species, bat behaviour and the direction of flight of each bat was also recorded where visibility permitted.

6.89 In order to assist analysis of data collected during manual bat activity surveys, bat echolocation calls were converted into a Bat Activity Index (BAI) providing an indicator of the overall bat activity at the site. It should be noted that a bat activity index does not represent the number of bats present at a site but an indication of their abundance and/or activity only. Bat activity levels can therefore be compared between sites, between different parts of a site or between seasons (Hayes et al 2009), to reveal differences in bat activity in areas or at different times. The bat activity index is calculated as the number of bat passes (or other measure of presence) per unit time (e.g. per hour).

Automated Bat Activity Surveys

6.90 Automated passive monitoring was also undertaken during spring (May), summer (July) and autumn (September) 2017 (see Figure 6.4: Static Detectors). Several (paired and calibrated) broadband ultrasonic bat detectors (SM2BAT+ and Anabat Express) were placed to record for a minimum of five days at numerous locations across the site on a seasonal basis, including proposed turbine locations and adjacent habitat features (see Appendix 6.5: Bat Annex (which contains photographs of each location along with a brief description)). Each static detector was programmed to automatically operate during set time periods to record bat activity between dusk and dawn each night.

6.91 Detectors were placed with the microphone directed at a 90^{o} angle towards the area to be monitored (e.g. the proposed turbine location or the adjacent habitat feature (i.e. fenceline, plantation edge or stream). Whenever possible microphones were placed on a fence post or pole. This helps to prevent recording extraneous noises and places the microphone closer to or within the flight path of the bats; this tends to provide higher quality recordings.

6.92 AnalookW and Kaleidoscope Pro UK was used to undertake analysis of data collected during automated passive monitoring. Bat activity was measured using the number

CONSENTED (LA01/2018/0200/F)

of files containing a bat call or bat call sequence irrespective of length, for a complete night of recording. Passive monitoring enables determination of species composition and temporal activity patterns between different times of year and different times of night at a fixed-point location. Bat activity indices (for all survey types) are provided in the survey results, included in Appendix 6.5.

6.93 Photographs were taken during each deployment, to check for disturbance, and as a record of work undertaken. Appendix 6.5 contains photographs of each location along with dates and a description of the area (i.e. habitat feature or proposed turbine location).

Otter Survey

6.94 An otter survey was undertaken in accordance with the NIEA survey specification (NIEA 2017) to establish the presence of otter holts and/or foraging areas within the Site. Surveys took place for the presence of otter holts and otter activity; field signs included footprints, spraints, anal jelly, paths along river banks, flattened vegetation, holts and 'couches' and feeding remains. The location of otter holts and holt entrances were recorded and mapped, where present. Areas of potentially suitable otter habitat were noted.

Badger Survey

6.95 A badger survey was undertaken in accordance with the NIEA survey specification (NIEA 2017) to establish the presence of badger setts and/or foraging areas within the site and the surrounding area (within 25 m of the Preliminary Site Boundary). Preliminary badger surveys took place during 2016 over the wider area, prior commencing infrastructure design. The current surveys to inform the final layout were undertaken on the 17th May 2017, during which the study area (infrastructure +50m) was searched for the presence of badger setts and badger activity including paths, snuffle holes, latrines, badger hair and bedding material. The location of badger setts, sett entrances and the direction of sett tunnels was recorded and mapped where present. A (confidential) badger survey report is included in Appendix 6.6.

Herpetofauna

Common Lizard Survey

6.96 A common lizard survey was undertaken in accordance with the NIEA survey specification (in force at the time of survey) to establish the presence of common lizard on the site. An initial site visit was undertaken in May 2016 to identify suitable basking habitat and to design a walked transect. Surveys also included the use of artificial refugia (under NIEA licence: LRS/2/16), these consisted of 40 X (500 x 500 mm) rubber backed carpet tiles.

6.97 In addition to the NIEA methodology, consideration was also given to the Draft survey protocols for the British herpetofauna. The latter document references (Sewell et al. 2012) who demonstrated that four to five survey visits (depending on

CONSENTED (LA01/2018/0200/F)

species) is usually sufficient to detect 95% of occupied sites, for the commoner British reptile species, providing a combination artificial refugia are used in addition to walked transect searches. The document also recommends that artificial refugia should be laid for a few weeks before surveys begin. The same study suggested that at least 30 refugia should be laid for presence/absence purposes, and that this number applied regardless of the size of site if the artificial refugia were appropriately positioned.

6.98 Transects were walked slowly scanning the ground 3-4 m in front for the presence of basking lizards in suitable habitat. Surveys were undertaken across four visits between April and September 2016. All surveys were undertaken when weather conditions were forecast to consist of temperatures >9^{o}C (and <18^{o}C) with sunshine and little or no wind or precipitation. Surveys were also undertaken early in the day, whenever possible on a day when the preceding night was cool, with little cloud cover. This is when lizards are in greater need of the thermal benefits of basking on artificial refugia and are therefore more easily observed.

Smooth Newt Survey

6.99 An assessment of the potential for smooth newt to be present on the site was undertaken. Any suitable waterbodies/drainage channels which were identified during both the Phase 1 and NVC Phase 2 habitat surveys of the Site were subject to a newt habitat suitability assessment. OSNI aerial photographs were also reviewed, as were bespoke images of the site which were taken from a height of 120 m above the ground and which have 5 cm resolution per pixel.

6.100 The presence of a dam pond (on vector mapping and aerial photographs) was noted, as was a larger quarry pond (500m NE of T9), therefore a smooth next survey was undertaken. The methodology was in accordance with the NIEA survey specification (in force at the time of survey).

6.101 Due to the absence of natural refugia (other than tussocks of *Juncus effusus)* several artificial refugia were placed around the pond (but within 100m). This was completed to fulfil the NIEA requirement that;

> "*The survey must establish whether newts are present, and if applicable, their status in the water-body and surrounding potential terrestrial refugia sites. The survey must include any suitable terrestrial habitat within 200m of the water body.* "

6.102 The techniques employed during the survey were:

- Refuge Search - all suitable and accessible terrestrial refugia (logs, rocks, moss hummocks, and artificial refugia) within 200m of the pond were searched;
- Egg Search - any submerged and emergent vegetation was searched for the presence of newt eggs.
- Netting - a long-handled pond net was used to search within the pond for newts; this was undertaken at an approximate rate of 15 minutes searching per 50m of pond to ensure thorough coverage.

CONSENTED (LA01/2018/0200/F)

- Torchlight Survey - this element of the survey was undertaken after dusk to search for newts within the pond using a high-powered hand-held torch.

6.103 It should be noted that the pond was only accessible on one side (along the dam) because the remainder of the shore consists of floating mats of vegetation.

6.104 All work was carried out under licence from NIEA (SNP/5/16) and the survey took place on the 6th June 2016.

Lepidoptera

Marsh Fritillary Survey

6.105 A devil's-bit scabious *Succisa pratensis* survey was undertaken as part of both the JNCC Phase 1 & NVC Phase 2 habitat surveys (2016 & 2017) in accordance NIEA recommendations (arising out of their consultation response) to establish the presence/abundance within the site of devil's-bit scabious, which is the larval host plant of the marsh fritillary butterfly. Specific marsh fritillary butterfly habitat surveys were also undertaken on the 15th and 23rd September 2016.

6.106 Adults fly by day usually in warm, fine weather from late May to early July. Marsh fritillary butterfly is best surveyed by looking for adults on sunny days. The location of devil's-bit scabious (and frequency) was assessed to establish the extent of suitable habitat for the butterfly. The locations of the *S. pratensis* can be viewed on Figure 6.2.

Argent & Sable Survey

6.107 A bog myrtle *Myrica gale* survey was undertaken as part of the Phase 1 habitat survey (during both 2016 & 2017) in accordance NIEA recommendations (arising out of their consultation response) to establish the presence/abundance within the Site of bog myrtle, which is main food plant of the argent & sable moth.

6.108 Adults fly by day usually in warm, fine weather from late May to early July. Argent & Sable is best surveyed by looking for adults on sunny days, however, searches for occupied spinnings in late summer can be a worthy alternative and have the advantage of not being weather dependent.

6.109 The location of bog myrtle (and frequency) was assessed to establish the extent of suitable habitat for the moth. A survey report is unnecessary as patches of the food-plant for this species was not recorded during the NVC surveys. This species has therefore been removed from the assessment.

Ecological Impact Assessment

6.110 The assessment of the impact of a scheme on a species or habitat must consider the conservation value of the species or habitat. This assessment of the potential impact of the Development on the conservation interest of the construction area and associated access routes adopts the Guidelines for Ecological Impact Assessment in the UK (CIEEM 2016).

CONSENTED (LA01/2018/0200/F)

6.111 The objective of the EIA process, in relation to the natural environment, is to undertake sufficient assessment to identify and quantify any significant impacts on the natural environment likely to arise from turbine construction, operation and eventual decommissioning. Following identification of the final infrastructure layout, the baseline ecological (or biodiversity) conditions in the Site are described, based on information provided by consultees, background sources of information and the results of dedicated surveys carried out for the scheme.

6.112 As a means of achieving this objective, ecological constraints on development of the scheme at international, national, regional and local levels are identified and assessed. This includes the main ecological constraints that should be avoided or that could affect the design of the scheme or delay progress.

Sensitivity Criteria

6.113 Potential significant impacts are assessed according to the ecological value of a site, which is derived from the criteria outlined below. The sensitivity (importance) of a receiving habitat is defined by its position in a hierarchy of site importance and conservation value. This hierarchy extends, highest to lowest, from International, National, Regional, Local, to negligible importance. This range of values is expressed in the protection afforded a site by international and national legislation, and in planning policy at a more local level (Table 6.1).

6.114 The biodiversity value of a site, is measured by such factors as:

- animal or plant species, subspecies or varieties that are rare or uncommon, either internationally, nationally or more locally;
- endemic species or locally distinct sub-populations of a species;
- ecosystems and their component parts, which provide the habitats required by the above species, populations and/or assemblages;
- habitat diversity, connectivity and/or synergistic associations (e.g. networks of hedges and areas of species-poor pasture that might provide important feeding habitat for rare species);
- notably large populations of animals or concentrations of animals considered uncommon or threatened in a wider context;
- plant communities (and their associated animals) that are typical of valued natural/semi-natural vegetation types, including examples of naturally species-poor communities;
- species on the edge of their range, particularly where their distribution is changing because of global trends and climate change;
- species-rich assemblages of plants or animals; and
- typical faunal assemblages that are characteristic of homogenous habitats.

6.115 The secondary value of a site can be as part of a corridor or a series of stepping stones that facilitate the migration, dispersal and genetic exchange of wild species,

CONSENTED (LA01/2018/0200/F)

or as a buffer zone that protects a valued site from adverse or beneficial environmental impacts.

Magnitude of Effect

6.116 This relates to the magnitude of the impacts on the features during the construction, operation and decommissioning phases. The magnitude of ecological impacts is assessed by considering the change in the ecology of a site that will arise because of the direct and indirect effects of a development on that ecology. Factors to be considered when considering the magnitude of an impact are outlined in Table 6.2. The criteria for determining the magnitude of impact are listed in Table 6.3. Both direct and indirect impacts, and the duration of these impacts are examined.

Significance Criteria

6.117 This relates to the significance of impacts on species and habitats of conservation importance, based on their presence as determined by survey. Factors to be considered when assessing the ecological significance of impacts are outlined in Table 6.4. Taking the factors in Table 6.4 into account the significance of an impact may be broadly categorised according to Table 6.5.

Table 6.1: Criteria for assessing ecological sensitivity/importance at a geographic scale

Value/Importance	Criteria
Internationally important sites (very high conservation value)	*World Heritage Sites identified under the Convention for the Protection of World Cultural & Natural Heritage, 1972.* *Biosphere Reserves identified under the UNESCO Man & Biosphere Programme.* *Wetlands of International Importance designated as Ramsar Sites under the terms of the Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) formulated at Ramsar, Iran, in 1971.* *Special Protection Areas (SPAs) designated in accordance with the 1979 European Communities Directive on the Conservation of Wild Birds (79/409/EEC): The Birds Directive. This Directive requires member states to take measures to protect birds, particularly rare or endangered species as listed in Annex I of the Directive, and regularly occurring migratory birds.* *Special Areas of Conservation (SACs and cSACs) designated in accordance with the 1992 European Commission Habitats Directive 92/43/EEC (1992): The Habitats Directive. This Directive requires member states to establish a network of sites that will make a significant contribution to conserving habitat types and species identified in Annexes I and II.* *Other sites maintaining habitats and/or species listed under the Birds and/or Habitats Directives (see above).* *Sites hosting significant populations of species annexed under the Bonn Convention.* *Sites hosting significant populations annexed under the Bern Convention.* *Biogenetic Reserves (UNESCO Man and the Biosphere Programme).*
Nationally important sites (high conservation value)	*Areas of Special Scientific Interest are the principal national designation for sites of nature conservation interest. They are notified under Section 28 of the Environment (NI) Order 2002 and are chosen by virtue of any of their flora, fauna, geological, or physiographic features to represent the best national and regional example of natural habitat, physical landscape features*

CONSENTED (LA01/2018/0200/F)

Value/Importance	Criteria
	or sites of importance for rare or protected species. *National Nature Reserves (NNRs) and Marine Nature Reserves (MNRs) are designated under the Environment Order.* *Sites maintaining UK Red Data Book species that are listed as being either of unfavourable conservation status in Europe, of uncertain conservation status or of global conservation concern. Sites maintaining species listed in Schedules 1, 5 and 8 of The Wildlife (NI) Order 1985, as amended.*
Regionally important sites (medium conservation value)	*Sites that reach criteria for Local Nature Reserve but do not meet ASSI selection criteria.* *Sites of Local Importance for Nature Conservation (SLNCIs) are recognised by Planning Service and are intended to complement the network of nationally and regionally important sites. SLNCIs receive special consideration in relation to local planning issues.* *Sites supporting viable areas or populations of priority habitats/species identified in the UK Biodiversity Action Plan or smaller areas of such habitat that contribute to the maintenance of such habitat networks and /or species populations.* *Sites maintaining habitats or species identified in Regional Biodiversity Action Plans based on national rarity or local distribution.* *Other sites of significant biodiversity importance (e.g. sites relevant to Local Biodiversity Action Plans).*
Local (lower conservation value)	*Sites not in the above categories but with some biodiversity interest. Examples of lands of lower ecological value include; intensive agricultural lands and coniferous forestry.*
Negligible conservation value	*Sites with little or no local biodiversity interest.*

Table 6.2: Factors to be considered when assessing magnitude of ecological impacts

Parameter	Description
Extent	The area over which an impact occurs.
Duration	The period required for a feature to recover or be replaced following an impact. Duration of an activity may have a shorter duration than the impact of the activity.
Reversibility	A permanent impact is one from which recovery is unlikely within a reasonable timescale. A temporary impact is reversible either through natural recovery or because of mitigation.
Timing and frequency	In some cases, an impact may only occur if it occurs during a critical season or part of a species' life-cycle, and may be avoided by careful scheduling of work activities. Frequency of an activity may also affect the magnitude of its impact by reinforcement of the impact.

Table 6.3: Criteria for assessing magnitude of ecological impact

Significance	Description
Severe adverse	The development fails to satisfy the subject environmental objective and results in major fundamental deterioration of the environment at national and international levels of importance. Proposed development activities will result in a major alteration to the baseline ecological conditions, resulting in fundamental change and major environmental deterioration. Large adverse impacts are attributed to any significant adverse impact on habitat and species (or other valued ecological receptors) identified as being of International significance. Highly significant impact, warrants refusal of planning permission.

CONSENTED (LA01/2018/0200/F)

Significance	Description
Major adverse	The proposal (either on its own or in-combination with other proposals) may adversely affect the site, in terms of coherence of its ecological structure and function, that enables it to sustain the habitat, complex of habitats and/or the population levels of species of interest.
Moderate adverse	The site's integrity will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as a major adverse.
Minor adverse	Neither of the above applies, but some minor adverse impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Negligible	Very minor alteration to one or more characteristics, features or elements.
Neutral	No observable impact in either direction.

Table 6.4: Factors to be considered when assessing ecological significance of impacts

Factor	Defining criteria
Site integrity	*Extent to which site/ecosystem processes will be removed or changed.* *Effect on the nature, extent, structure and function of component habitats.* *Effect on the average population size and viability of component species, size and viability of component species.*
Conservation status	*Habitats: conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of 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 the long-term distribution and abundance of its populations within a given geographical area.* *Conservation status may be evaluated for any defined study area at any defined level of ecological value. The extent of the area used in the assessment will relate to the geographical level at which the feature is considered important.*
Probability of expected outcome	*Known or likely trends and variations in population size/habitat extent.* *Likely level of ecological resilience.*

Table 6.5: Significance of impacts

Significance	Description
Severe adverse	The proposal (either on its own or with other proposals) is likely to adversely affect the integrity of a European or nationally designated site, in terms of coherence of its ecological structure and function, across its whole area, that enables it to sustain the population levels of species of interest, or is likely to adversely affect the numbers, distribution or viability of a species or population of conservation concern. A major change in a site or feature of local importance may also enter this category.
Major adverse	The integrity of a European or nationally designated site will not be adversely affected, but the effect on the site is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly illustrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as very large adverse.
Moderate adverse	The proposal may adversely affect the integrity of a locally important conservation site, or may have some adverse effect on the numbers, distribution or viability of a species or population of conservation concern.
Minor adverse	None of the above applies, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).

CONSENTED (LA01/2018/0200/F)

Significance	Description
Neutral	No observable impact in either direction.
Minor beneficial	The development partly satisfies the subject environmental objective and partly contributes to the environmental context. Proposed development activities will result in minor improvements to baseline ecological conditions and should result in minor environmental gains. Slight beneficial impacts can be attributed to benefits to any valued ecological receptors. Environmental gains which can easily be achieved through standard practices.
Moderate beneficial	The development satisfies the subject environmental objective and contributes to the environmental context. Proposed development activities will result in recognisable improvements to baseline ecological conditions and will result in notable environmental gains. Moderate beneficial impacts can be attributed to benefits to any valued ecological receptors where improvements are expected to be significant. Environmental gains which require detailed design consideration – potentially employed to offset slight/moderate adverse impacts elsewhere.
Major beneficial	The development satisfies the subject environmental objective and results in a major contribution to the environmental context. Proposed development activities will result in quantifiable improvements to baseline ecological conditions and will result in significant environmental gains. Large beneficial impacts are only attributed to substantial benefits to valued ecological receptors identified as being of National or International importance and where such benefits will result in the consolidation and/or expansion of areas of habitats or ensure the security and/or expansion of viable populations of species. Environmental gains which require very detailed design consideration – potentially employed to eliminate and offset potential significant adverse impacts elsewhere.

6.118 Cumulative impacts may also arise. Other projects that have been included in the cumulative impact assessment are:

- Wind farm projects which have received planning consent; and
- Other development projects with valid planning permissions, and for which formal EIA is a requirement or for which non-statutory EIA has been undertaken. Other projects should be included as appropriate, subject to consultation with DOE Planning and other statutory bodies. The cumulative impacts of different projects are assessed against the significance criteria outlined in Table 6.6.

Table 6.6: Criteria for assessing the significance of cumulative effects

Significance	Effects
Severe	Effects that the decision-maker must consider as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issue.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not Significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

CONSENTED (LA01/2018/0200/F)

Baseline Conditions

6.119 The site is situated 5km east of Limavady, Co. Derry, located in the townland of Gortcorbies. The site itself is within the Binevenagh Area of Outstanding Natural Beauty (AONB) and the Development, consisting of 9 turbines and associated infrastructure, is hydrologically linked to the River Roe & Tributaries SAC, a statutory designated site of international importance. This SAC, encompasses 87km of watercourses and supports internationally important populations of Atlantic Salmon *Salmo salar*. The number of returning Salmon that enter the River Roe & Tributaries make it one of the most important Salmon rivers in the British Isles. Otters are also a designation feature of the SAC. The River Roe and Tributaries ASSI/SAC is located approx. 500m north of the Site and is hydrologically connected to the site via several tributaries of the Curly River.

6.120 The site lies on the northern slopes of Keady Mountain which has a maximum elevation of approximately 337m AOD. The preliminary site boundary, planning application boundary and nature conservation designations, are shown in Figure 6.1. The study area occupies approximately 300ha.

6.121 The site topography falls in a northerly direction from the summit ridge of Keady Mountain with lie along the southern boundary. Elevations fall from approximately 330m AOD in the south west corner of the site to 135m AOD towards the northwest corner along the boundary with the A37 road.

6.122 The principal habitat types found on the site are extensive areas of purple moor-grass and rush pasture within a mosaic with semi-improved grassland, wet heath and poor fen. Upland blanket bog is also present within the (preliminary) site boundary (on the southern plateau) but none lies within the Planning Application Boundary. Overall, the habitat of greatest conservation value, the blanket bog, has been avoided. Although the lower enclosed land contains extensive linear drainage, overgrazing by sheep and cattle, and historic peat harvesting.

6.123 Although there a coniferous plantation to the east, (but none within the site itself), a noticeable feature of the site is the lack of woodland and scrub. While this can be attributed to several factors such as the upland topography of the site, climatic factors and poor edaphic conditions; undoubtedly historic and on-going human activities have greatly contributed to this lack of woodland and scrub. There are several suitable, deep and well sheltered river and stream ravines throughout the Site yet they contain little in the way of trees or scrub (aside from some patches of gorse) and this is most likely due to overgrazing by sheep in the past.

6.124 It is reasonable to assume that in the past, a far greater part of the site was covered by peatland and associated ericoid and moss-dominated communities, but peat cutting, drainage and land reclamation for sheep grazing has resulted in the modified (grassland) habitats which are present today. Most land parcels on the site

CONSENTED (LA01/2018/0200/F)

have been drained, to lower the water-table, and take water off-site as rapidly as possible, to improve the conditions for livestock grazing.

6.125 The Site falls within the newly formed Causeway Coast and Glens Borough Council.

Consultation & Desk Study Results

6.126 A copy of relevant consultee responses is summarised in Appendix 6.9. The results of the desk study detail designated nature conservation sites and/or ecological records of protected species or species of natural heritage importance within 2km of the Planning Application Boundary.

Plants of additional conservation interest

6.127 Although neither devil's-bit scabious (*Succisa pratensis*) or bog myrtle (*Myrica gale*) are designated species of conservation concern or rarity, they are larvae host plants (LHP) for these two species of invertebrate, both of which are afforded a high priority designation. Devil's-bit scabious is the food plant for the larvae of the EU Annex II protected marsh fritillary (*Euphydryas aurinia*) and occurs principally to the south of the site, with a small stand near to T4. It is also locally scattered in the blanket bog & heath to the south of the Planning Application Boundary.

6.128 Stands of bog myrtle Myrica gale (food plant for the larvae of the argent and sable moth (*Rheumaptera hastate*), a UK priority species) do not occur on the site.

Habitat descriptions

6.129 The habitats on the site consist of a complex habitat mosaic dominated by purple moor-grass and rush pasture (PMGRP), along with wet heath (M15 & M15d), poor-fen (M6d), the grasslands (U4d & M25b), as well as the occasional flushed area. A consequence of this mosaic is that habitat transitions are common, which makes NVC mapping difficult, as defined boundaries between the various habitats are few. The habitats transition gradually from one to another across the site depending on slope, drainage and grazing pressure. In addition to this, the main habitat, PMGRP, frequently occurs as both species-rich, and species-poor variants. And again, these variants can grade into one another and into the other habitats present.

6.130 The agricultural management (grazing, drainage & nutrient inputs) affecting the (PMGRP) habitat on the site is also a microcosm of the same factors which influence this habitat in the wider countryside. For example, most of the area is grazed by both cattle and sheep, however some areas are grazed by sheep only; while others are also much more heavily grazed, and in some areas little grazing pressure is apparent. Efforts to drain the area and improve it for agriculture also vary widely across the site, with some of the lower elevation fields near the site entrance quite agriculturally improved.

6.131 As a consequence of the management described above the PMGRP habitat varies greatly in diversity, with some areas quite species-poor and transitional. These areas mostly consist of U4d *Festuca ovina-Agrostis capillaris-Galium saxatile*

CONSENTED (LA01/2018/0200/F)

grassland. Here the sward contains clumps of *Luzula multiflora* and *Deschampsia cespitosa*, and scattered plants of damp loving species such as *Viola palustris* and *Carex panacea* as well as *Rhytidiadelphus loreus, Thuidium tamariscinum* and *Hylocomium splendens*. These species-poor communities commonly exist as a patchwork with other habitats e.g. M25, or even to wet heath (M15 *Scirpus cespitosa – Erica tetralix*). In fact, M25 and M15d are the next most commonly encountered communities on site after PMGRP.

6.132 The area of the site in which the M23a is more likely to fall under the PMGRP NI Priority Habitat is located to the north, between T9 and the A37 road. Although this area contains a dense network of drains, it is lower lying and has less of a gradient than other parts of the site. The increased wetness may contribute to the sheep spending less time grazing in this area and allow a more diverse sward to persist.

6.133 The species-poor variants (which are not included in the PMGRP HAP), include modified wet grasslands, characterised by Yorkshire fog *Holcus lanatus* and soft-rush *Juncus effusus*, and species-poor acid flushes dominated by sharp-flowered rush and *Sphagnum spp*. mosses. One of the more species-poor variants includes, M25 grasslands which are dominated by tall dense tussocks of *Molinia caerulea*. The M25b (*Anthoxanthum odoratum*) sub-community, (which is the one found on site), is characterised as containing by a mixed sward of grasses, including; *A. odoratum*, *Agrostis canina, Nardus stricta, Festuca ovina* and *Holcus lanatus* within the *Molinia* dominated sward.

6.134 Some areas of the site are more akin to M6d (an acidic species-poor mire (*Carex echinata-Sphagnum fallax/denticulatum* mire)), but again this is transitional with M23a grassland. For example, in the JNCC's An Illustrated Guide to British Upland Vegetation describes the differences between the two as "*The Juncus effusus and J. acutiflorus sub-communities of Carex echinata-Sphagnum mire <u>can only be confused with Juncus-Galium rush pasture M23</u>, which has a richer flora of herbs and mosses such as Calliergonella cuspidate, Brachythecium rutabulum and b. rivulare rather than Sphagna and Polytrichum commune*.''

Results of National Vegetation Classification (NVC) Survey

6.135 An initial NVC survey took place on a few dates July 2016 (see Appendix 6.2). This was followed up by further work along the route of the proposed infrastructure during July and September 2017. The 2016 NVC survey consisted of the sampling of 130 quadrats, each 2m x 2m in size, with an initial emphasis on a 100m grid across the Site which was used to map the habitats deemed to be of higher conservation value. Once this was completed, and a layout designed which avoided these habitats (i.e. blanket bog) a further 115 quadrats were surveyed (see Appendix 6.3) during 2017 along the route of the infrastructure to confirm/refine the final layout.

6.136 Survey methodologies and habitat classifications followed the JNCC Phase 1 guidelines (2010), the keys and descriptions in the National Vegetation Classification User's Handbook (Rodwell, 2006).

CONSENTED (LA01/2018/0200/F)

6.137 Irish Grid References were recorded for all quadrats sampled and boundaries of vegetation communities were confirmed using drone aerial imagery. The results of the NVC survey were compiled to form the NVC map of the site (Figure 6.2) and all quadrat data is provided in Appendices 6.2 and 6.3.

6.138 Six different NVC communities (in the main) were recorded within the site, in addition to fields of semi-improved grassland. These are listed below:

- M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire (*Juncus acutiflorus* sub-community)
- M15/M15d *Scirpus cespitosus – Erica tetralix* wet heath (*Vaccinium myrtillus* sub-community)
- M23a *Juncus effusus/acutiflorus – Galium palustre* rush-pasture (*Juncus acutiflorus* sub-community)
- M25b *Molinia caerulea – Potentilla erecta* mire (*Anthoxanthum odoratum* sub-community)
- U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland (*Luzula multiflora-Rhytidiadelphus loreus* sub-community)
- M17 Scirpus cespitosus-Eriophorum vaginatum blanket mire

6.139 Each is described in more detail below.

M6d Carex echinata-Sphagnum recurvum /auriculatum mire (Juncus acutiflorus sub-community)

6.140 This habitat type is very variable and occurs in a small number of stands on the Site in naturally occurring wet areas or formerly drained areas that have become waterlogged over time. Due to the variable nature of this habitat type, a few sub-communities are recognised depending on species composition and abundance. The M6 habitat type encountered on the Site is dominated by *Juncus acutiflorus* along with a ground layer of *Sphagnum fallax*. Other species present in low abundance include *P. commune* and *C. echinata*. Due to this low species diversity and dominance by *J. acutiflorus*, the M6d *Juncus acutiflorus* sub-community was assigned. This habitat type typically grades into areas of PMGRP or wet heath on the Site, which makes exact boundary definition challenging.

M15 Scirpus cespitosus – Erica tetralix wet heath (Vaccinium myrtillus sub-community)

6.141 Wet heath is found on the Site in areas with shallow peat depths and occurs more naturally as a transitional habitat type as the blanket bog (on the summit plateau) grades into PMGRP downslope. Wet heath is principally found in the mid-elevations of the Site, particularly atop several of the rocky outcrops and moraines above the numerous watercourse gullies. The principal indicative feature of wet heath is the peat depth; generally, less than 0.5 m deep, differentiating this habitat type from the deeper blanket bog.

CONSENTED (LA01/2018/0200/F)

6.142 Typical species occurring in M15 wet heath include *Juncus squarrosus*, *T. germanicum*, *C. vulgaris*, *Molinia caerulea*, *V. myrtillus*, *Rhytidiadelphus loreus* and *Polytrichum commune*. The wet heath on the Site continues to suffer from degradation, principally land drainage and livestock grazing resulting in the encroachment of *J. acutiflorus* and other marshy grassland species. In areas where historic peat harvesting occurred, an additional vegetation species are noted with *Sphagnum fallax, E. angustifolium, N. ossifragum* and *E. tetralix* occurring due to wetter ground conditions and pockets of deeper peat.

M23a Juncus effusus/acutiflorus – Galium palustre rush-pasture (Juncus acutiflorus sub-community)

6.143 The most abundant habitat type found on the site is grassland comprising of both marshy and acid types. Due to both grazing pressure and natural variations in topography and soil depths, these two grassland types occur side by side and form a mosaic type habitat. Determining the exact extent and range of these individual grassland habitats is extremely challenging and time consuming so it was decided to treat this grassland mosaic as a single entity. In certain situations, it was possible to identify and separate acid grassland habitat from the surrounding habitats, particularly on sloped ground with thinner soils with a distinct abundance of indicator species such as *N. stricta* and *F. ovina*.

6.144 PMGRP are a NI Priority Habitat, however there is a complication in that not all examples of the relevant NVC communities are included in the NI Habitat Action Plan definition. For example, two of the main constituent NVC communities (M23 and M25) can occur as very species-poor variants, and these are generally excluded from the HAP (Corbett, 2003).

6.145 The species-rich variants of PMGRP which are a NI Priority Habitat include the two main NVC communities M23 *Juncus effusus/acutiflorus – Galium palustre* community "rush pasture", (usually found on mineral soils), and M24 *Molinia caerulea–Cirsium dissectum* fen meadow, (often found on shallow peaty soils (Cooper & MacKintosh 1996)). However, because of biogeographical differences, M23 and M24 communities in Ireland differ significantly from their British counterparts in that they can include a range of species e.g. *Succisa pratensis*, that are not common in the same habitat classification in Britain.

6.146 M23 is by fall the more commonly encountered habitat type in N. Ireland. While the M24 variant is more common in East Anglia, Central and Eastern England and south-western Britain[1]. It is also more frequently found in the lowlands. M24 is also not considered to occur in Scotland[2].

6.147 The NI Priority Habitat (PMGRP) can be difficult to define as it comprises a wide range of species assemblages determined by a range of local factors including soil

[1] National Vegetation Classification: Field guide to mires and heaths T. Elkington, N. Dayton, D.L. Jackson and I.M. Strachan. JNCC 2001.
[2] Information and Advisory Note Number 107 EC Habitats Directive: a provisional atlas of Annex I habitats of the uplands and peatlands of Scotland.

CONSENTED (LA01/2018/0200/F)

condition, aspect and management practices. In general, these are grasslands with varying proportions of grasses, sedges and rushes together with a mixture of herbs characteristic of grasslands, wetlands and heathlands.

6.148 The M23a *Juncus acutiflorus* sub-community is the one that is found on site. In this variant, *Molinia* is infrequent, but grasses are an important component of the sward. *Holcus lanatus* is the most frequent grass and this was recorded in 68 of the 115 (2017) quadrats, while *Anthoxanthum odoratum* and *Agrostis canina* are also abundant. The moss *Calliergonella cuspidatum* is frequent along with *Rhytidiadelphus squarrosus* and less commonly *Brachythecium rutabulum*. *Cirsium palustre* is common, along with *Ranunculus flammula, R. acris* and *R. repens.*

M25b Scirpus cespitosus – Eriophorum vaginatum blanket mire (Anthoxanthum odoratum sub-community)

6.149 M25b grassland dominated by purple moor-grass on peat <0.5 m deep has developed within the survey site. This habitat has been derived from wet modified bog and still retains some of the associated semi-natural vegetation cover, but with a dominance of purple moor-grass. This community has developed due to land management practices such as drainage and grazing. The wet modified bog is represented by the NVC community M25b *Scirpus cespitosus–Eriophorum vaginatum* blanket mire (*Anthoxanthum odoratum* sub-community). These communities indicate degraded blanket bog when found to occur on peat >0.5 m deep.

6.150 These communities are the result of floristic changes to blanket bog that result in the loss of characteristic species and the dominance of a few species and are species poor in comparison to the original communities.

U4d Festuca ovina-Agrostis capillaris-Galium saxatile grassland (Luzula multiflora-Rhytidiadelphus loreus sub-community)

6.151 These areas mostly consist of U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland. Here the sward contains clumps of *Luzula multiflora* and *Deschampsia cespitosa*, and scattered plants of damp loving species such as *Viola palustris* and *Carea panacea* as well as *Rhytidiadelphus loreus, Thuidium tamariscinum* and *Hylocomium splendens*.

Semi-improved grassland

6.152 The history of these type of grasslands in the upland margins is long and complex. By the processes of agricultural improvement, grassland of this kind has been derived from an extremely wide range of precursors, not just more traditionally managed meadows. These semi-improved swards are a secondary vegetation type (i.e. are derived from other habitats by grazing and agricultural activities) commonly improved by the addition of fertiliser and artificial drainage. Although dunging along track verges and on drier areas along stream sides in the upland margins where the sheep lie up is likely to be the more significant influence on this site.

CONSENTED (LA01/2018/0200/F)

6.153 Climate and soils also play a part in determining the floristic variation within this habitat, and it can be derived from calcicolous or calcifugous grasslands, drained blanket bog or heath, and species characteristic of these vegetation types, persist at low frequency, making some stands difficult to categorise.

6.154 Thus, on site the semi-improved grasslands are a mosaic of acid grassland, marshy grassland and even some areas with some base-rich components. Overall however the main habitat type also conforms to the U4 and U5 categories, with *Festuca rubra/Holcus lanatus/Anthoxanthum* odoratum provisional grassland community (Rodwell et al. 2000) also a good fit in some places.

M17 Scirpus cespitosus-Eriophorum vaginatum blanket mire

6.155 The unenclosed lands on the open plateau to the south are a complex mosaic of M17 blanket bog and M15 wet heath (with pockets of PMGRP). The peat is not particularly deep over large sections of this area which is perhaps why much of the area is wet heath than would be typical on a similar expanse of blanket bog elsewhere. The heath is particularly evident on the numerous rocky out crops across the area. However, peat depths are greater in the wetter hollows and low-lying areas between the outcrops. The eastern edge and south-eastern corner of the plateau contains the deepest peat and it is also in this area that the blanket bog is most diverse. Although numerous cutover haggs are also adjacent to this part of the site, evidence of past exploitation.

6.156 The complex micro-topography described above (and which is also visible on the ortho-photography) is the likely cause of the wet heath/blanket bog mosaic. Although the influence of grazing animals, particularly on the drier outcrops has contributed to the development of the wet heath and the pockets of grassland. Pockets of erosion and degradation area also evident, however overall the habitat in this area is in moderate to good condition and some ‘hummock & pool’ topography is even present in a few places.

Ground Water Dependent Terrestrial Ecosystems (GWDTEs)

6.157 Across the site there are numerous localised patches of upland flushes, fens and swamps (which are also GWDTEs) within the wider mosaic of M23a marshy grassland with wet heath and blanket bog (on the plateau). The majority of these occur upslope of the infrastructure within the large expanse of blanket bog & heath towards the summit of Keady Mountain. Although, a few do occur within 200m of the infrastructure below the feneline which separates the two halves of the site.

6.158 The majority of these are poor (acid) flush, or poor fen (e.g. M6d), however a few are representative of more base-rich variants (i.e. M9b) and thus would fall under the EU Annex 1 habitat (H7140) Transition mires and quaking bogs. Another variant recorded is M13a which is also an EU Annex 1 Habitat, that of (H7230) Alkaline fens. Others, while not Annex 1 Habitats, would fall under the NI Priority Habitat definition of an upland swamp (i.e. S8c). Appendix 6.4 contains more details on these features.

CONSENTED (LA01/2018/0200/F)

Designated Nature Conservation Sites

Internationally Designated Nature Conservation Sites

6.159 The Curly River, constitutes part of the River Roe and Tributaries SAC, and flows westwards approximately 750m to the north of the Planning Application Boundary. Approximately five minor streams and their tributaries flow through the development site and enter the Curly River. The boundary of the SAC in relation to the proposed wind farm is illustrated in Figure 6.1.

6.160 The primary reason for designation is the presence of the Annex II species Atlantic salmon *Salmo salar*. Other qualifying features present include the Annex I listed habitats 'Old sessile oak woodland with *Ilex* and *Blechnum* in the British Isles' and 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' and the Annex II species otter *Lutra lutra*. Other Annex II species present include sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis*. Appendix 6.1 describes the qualifying features for the designation of the Natura 2000 site.

Nationally & Locally Designated Nature Conservation Sites

6.161 The Site is situated within the Binevenagh Area of Outstanding Natural Beauty (AONB). There are three nationally designated sites adjacent to the Site. These are Gortcorbies ASSI, Ballyrisk More and the River Roe & Tributaries ASSI (contiguous with the SAC of the same name). The two former sites are designated for their species-rich grassland (Purple Moor-grass and rush pasture). Gortcorbies is an area of Purple Moor-grass and rush pasture (lying between the A37 and the Curly River), and is an important site for both the lesser butterfly-orchid and the latticed heath moth. Ballyrisk More is situated on the lower western slope of Keady Mountain and its wet grassland supports species such as greater butterfly-orchid, common twayblade and lesser clubmoss. A map illustrating the location of the ASSI can be found in Figure 6.1.

6.162 The Curly River, the River Roe and Ballyrisk More are all also designated as Sites of Local Nature Conservation Importance (SLNCI). SLNCIs are designated for their habitats, species and/or earth science. In addition to contributing to natural heritage on a local level, they are also important from a national and European perspective.

Biodiversity Action Plan (BAP)

Habitat Action Plan habitats

6.163 NIEA requires reference to be made to any potential impacts of the scheme on habitats that are the subject of Northern Ireland Habitat Action Plans (HAPs). There are significant areas of blanket bog habitat within the site, but these are outside (upslope from) the planning application boundary and thus are outside the zone on impact.

CONSENTED (LA01/2018/0200/F)

6.164 There are significant areas of PMGRP (M23a) within the site and the species-rich variant of this habitat type is a NI Priority Habitat. However, the species-poor variant is not. The PMGRP in Northern Ireland are defined for the purposes of the HAP, as being grasslands which;

1. are dominated by purple moor-grass *Molinia caerulea* and/or tall rushes, predominantly sharp-flowered rush *Juncus acutiflorus*.
2. include a suite of characteristic plant species, which vary according to the dominants – for example, species associated with Molinia-rich pastures often include *S. pratensis*, *Cirsium dissectum* and *Potentilla erecta*, whilst rush-dominated sites may include *Galium palustre* and *Angelica sylvestris*.
3. have < 25% cover of scrub or dwarf shrub.

6.165 The HAP goes on to say that "*There is a need to distinguish the species-rich priority habitat, outlined above, from species-poor Molinia grassland and rush pastures which are not included in this HAP. These include species-poor modified wet grasslands, characterised by Yorkshire fog Holcus lanatus and soft-rush Juncus effusus, and species-poor acid flushes dominated by sharp-flowered rush and Sphagnum spp. mosses*."

6.166 The PMGRP habitat on site meets the first and third criteria (as listed in the bullet points above), however it is less clear if the second criteria is met. The NI HAP expands upon this criteria in the extracted paragraph below;

> *"Although species assemblages will differ between species-rich Molinia-dominated pastures and rush-dominated pastures, broadly speaking, characteristic species are: devil's-bit scabious, meadow thistle, glaucous sedge Carex flacca, carnation sedge C. panicea, flea sedge C. pulicaris, tawny sedge C. hostiana, cross-leaved heath Erica tetralix, quaking grass Briza media, lesser spearwort Ranunculus flammula, lesser butterfly orchid Plantanthera bifolia, orchids of the Dactylorhiza genus, marsh hawk's-beard Crepis paludosa, primrose Primula vulgaris, water mint Mentha aquatica, ragged robin Lychnis flos-cuculi, marsh pennywort Hydrocotyle vulgaris, creeping jenny Lysimachia nummularia, marsh bedstraw, wild angelica and the mosses Breutelia chrysocoma and Ctenidium molluscum."*

6.167 The species assemblage on site (see Appendix 6.2 & 6.3) was reviewed against that listed in the text extracted from the HAP (above). The PMGRP on site contains less than 50% of the species list; the habitat present lacks the tall herb assemblage of more species-rich sites, with wild angelica, meadowsweet, ragged-robin and *Dactylorhiza spp* and water mint, either absent or rare. Overall the number of species recorded in each of the 115 (4m^2) quadrats surveyed along the infrastructure route averaged 15 (range 9 – 22). While this is much higher than your average agricultural field it is less than 50% of what would be typical of more species-rich areas of PMGRP; for example, in the Gortcorbies ASSI adjacent to the site.

CONSENTED (LA01/2018/0200/F)

6.168 While the PMGRP HAP does not give a number of species per quadrat, the broadly analogous HAP for Calcareous Grasslands does. The calcareous grasslands in Northern Ireland are defined, for the purposes of this plan, as being grasslands which, are species rich (generally >20 species/4m^2 quadrat).

6.169 The results of the MAVIS analysis on the 115 quadrats (which lie along the route of the proposed infrastructure) is also worth noting here. While several groups (i.e. clusters of 5 or more quadrats (plots) analysed for statistical purposes as a group) yielded M23/M23a as the most likely NVC habitat, the percentage 'Goodness of Fit' was only around 50-52%. In addition to this, the next most likely NVC was M25b, usually one 1-2 percentage points below the M23a. This result demonstrates that the habitats on site have been degraded by agricultural activities. For a good fit to an NVC class, the % goodness of fit should be around 80-100%. The lower the goodness of fit percentage, the more degraded is the vegetation community. Therefore, much of the M23a (potential Priority Habitat) is transitional with M25b (it is also worth noting that the *Molinia*-dominated M25 vegetation found very commonly and extensively on shallow (<50 cm) peat in unenclosed upland areas of Britain, especially in the west, does not belong in this or any other priority habitat).

6.170 Therefore, overall the habitats within the Planning Application Boundary do not support the PMGRP HAP, or at best are borderline examples of this NI Priority Habitat as they lack many of the species characteristic of more species rich swards and are transitional with other more impoverished (semi-improved) habitats. Although it is considered likely that the habitats were indeed likely to have been PMGRP Priority Habitat in the recent past and have been or degraded by agricultural intensification (primarily intensive sheep grazing, and also influenced by drainage). There are also likely to be more diverse areas within the site that do conform to the NI HAP for PMGRP (on the northern slopes between T9 and the A37), where the gradient is shallower and consequently the ground conditions are wetter. These more diverse areas of sward have been avoided during the emplacement of infrastructure.

6.171 However, precautionary compensation for the loss of these habitats has been recommended, albeit on a ratio of 2:1 which reflects the poor conservation status of the PMRGP as opposed to the more typical 5:1 ratio for Priority Habitats in more favourable condition.

6.172 In addition to the PMGRP there are also a few pockets of wet heath within the zone of influence. This is also an NI Priority Habitat. Turbines 3 & 6 are located on habitat which conforms to the type as listed in the HAP for wet heath.

Species Action Plan species

6.173 Several non-avian species for which NIEA has published Species Action Plans (SAPs) occur or may occur in the study area. SAP species that are known to occur or may occur at the site include; Irish hare, all bat species (the subject of an all-Ireland

CONSENTED (LA01/2018/0200/F)

SAP) and otter. Occurrence of and significance of impact on these species are discussed below.

Existing Ecological Records (NIPS)

6.174 The desk study revealed historical records of two plant species which are listed as Northern Ireland Priority Species (NIPS). These are outlined in Table 6.7 below.

Table 6.7: CEDaR records for NIPS (plants) within 2 km of the study area

Common name	Latin name	Grid Reference	Location
Frog orchid	*Coeloglossum viride*	C7426	Keady Mountain NE of Limavady
Lesser butterfly-orchid	*Platanthera bifolia*	C7225	Curly River, River Roe

Bats

6.175 Records were obtained from the Northern Ireland Bat Group (NIBG) prior to the design of the bat surveys during May 2016. A total of 46 records within 10km of the Site were provided by the NIBG. As is typical for such records they are dominated by *pipistrellus* species and are clustered in proximity to human habitation. Only one of the records were of Leisler's bats *Nyctalus leisleri,* and that was for a single individual. There were also no records for *Nathusius pipistrelle*, although there were 15 records for 'bats' or 'unidentified'.

Mammals

6.176 The desktop study revealed only two records for NIPS of mammal (hedgehog *Erinaceus europaeus*, badger *Meles meles*), both were located on Carrydoo, Keady Mountain.

Amphibians

6.177 The desk study revealed no historical records of smooth newt *Lissotriton vulgaris* from within the site or within 2km.

Lepidoptera

6.178 There are no records of marsh fritillary butterfly on the site or within 2 km. Colonies formerly existed in the coastal sand dunes of Magilligan and Ballycarry but these became extinct over 20 years ago and there are still no confirmed colonies in the County.

6.179 There are no records of argent and sable from County Derry since 1875 (CEDaR) and despite searches in parts of the county by volunteers the nearest known site is in West Tyrone (Killeter area).

6.180 Consultation with CEDaR revealed a historical record for Small heath *Coenonympha pamphilus* from Carrydoo, Keady Mountain, grid reference C721245.

CONSENTED (LA01/2018/0200/F)

Coleoptera

6.181 There is a record for Davis's river diver *Oreodytes davisii* is a small water beetle of clean highland streams (which is an NIPS which has been red-listed as Near Threatened in Ireland (Foster et al., 2009)). This species is local in Ireland with two main areas, one in the north-east centred upon Derry, Tyrone and Antrim, and one in the south-east, centred on Dublin and Wicklow. Species Baseline

Bat Survey

Pre-Survey Assessment for Bats

6.182 A site visit was undertaken during April 2017 to consider the potential value of habitats and landscape features within 200m of the site (i.e. the study area). The value of each habitat and landscape feature was recorded as 'low', 'medium' or 'high' according to its quality and its potential use by bats for roosting, foraging or commuting in accordance with BCT (2012) guidelines.

6.183 The landscape surrounding the site consists of several features that have potential to provide habitat for bats, notably open moorland of 'low' value; coniferous plantation shelterbelts; and several watercourses, issuing from moorland of 'medium' value for foraging and commuting.

6.184 The overall foraging potential of the study area is considered 'low' in accordance with BCT (2012) as it comprises mostly blanket bog, heath and marshy grassland. However, the site is also connected to the wider landscape by (medium value) linear features that could be used by commuting bats (minor tributaries of the Curly River). Habitats and landscape features that may be used by bats are illustrated in Figure 6.2.

6.185 The overall potential of the site was of 'low' value taking into consideration the landscape of the general area, the habitats and landscape features identified on the site, the distance to the nine turbines and the potential use of the site by bats for roosting, foraging and/or commuting. Therefore, the survey effort which was conducted was for a 'low' value site.

Manual Bat Activity Surveys

6.186 The bat activity surveys aimed to determine the level of bat activity within the Site. The results provide information on species composition and qualitative information on temporal and spatial bat activity patterns, such as the location of key foraging areas and commuting routes. The full results of bat activity surveys can be found in Appendix 6.5 - Bat Annex, while the (5.4km) transect route and associated listening stops are illustrated on Figures 6.5 – 6.7.

Table 6.8: Dates, times and weather conditions bat activity surveys (transects)

Date	Sunset	Sunrise	Start / Finish	Weather Conditions		
				Temp	Wind (mph)	Cloud

CONSENTED (LA01/2018/0200/F)

29th May 2017	2117		2102 - 2332	12°C	1-2	60%
29TH & 30th July 2017	2157		2142 – 0012	14°C	1-2	50%
		0459	0259 – 0529	12°C	1-2	100%
17th Sep 2017	1936		1921 – 2151	11°C	0-1	20%

6.187 A total of 10 hours of recording time was saved across the four manual bat activity surveys. During this time, an estimated number of 14 bat passes were recorded across the survey season. A total of three dusk surveys were completed, with one dawn survey. See Appendix 6.5 - Bat Annex for details regarding the estimated number of bats encountered during the manual transect surveys.

6.188 Temporal patterns of bat activity most likely reflect changing weather conditions across the survey season. Bat activity was low during all transect surveys. All surveys were completed during settled periods of weather, which would yield more representative results.

6.189 The results of bat activity surveys confirmed commuting (primarily at dusk) and foraging activity within the site. The results yielded low numbers of bats which would corroborate the initial assessment of Dunbeg South as a 'low' value site for bats under Chapter 10 of the (2012) BCT guidelines.

6.190 The bat species recorded during activity surveys included Pipistrelle spp., common pipistrelle, soprano pipistrelle and Leisler's bat. A summary of the bat activity survey results can be found in paragraphs 6.191 to 6.194. A visual representation of the spatial variation in bat activity for each survey can be found on Figures 6.5 – 6.7 (seasonal) Bat Transect Results.

6.191 The spring transect yielded only nine bat passes for the three commonly encountered species on the site. Three of the four bat passes for *N. Leisleri* were actually recorded at the end of the transect near the proposed site entrance (which is remote from any turbine locations), with the remaining pass recorded from northeast of the pond (between turbines 8 & 9). The *P. pygmaeus* (3) and *P. pipistrellus* (2) calls were all recorded in the same area (between the pond and the tree line).

6.192 The summer transect also yielded low numbers with four bats recorded. The transect was walked in a clockwise direction (alternating from the spring direction as per BCT guidance). The three bats (1 *N. leisleri,* 1 *P. pipistrellus* and 1 *Myotis spp*) were all recorded between T4 & T9. The dawn survey of the following morning recorded no bat activity on site.

6.193 The autumn transect only yielded a single bat pass from a *P. pygmaeus.*

6.194 When translated into a Bat Activity Index (BAI) the results from the manual activity surveys were; *P. Pipistrellus* (0.3); *P. pygmaeus* (0.4); *Myotis spp* (0.1) and Leisler's bat (0.5). All figures are numbers of bat passes per hour.

CONSENTED (LA01/2018/0200/F)

Automated Passive Monitoring

6.195 Automated passive monitoring was undertaken at the site across spring, summer and autumn during 2017. Monitoring took place at all turbine locations and a range of 'paired' habitat features (see Figure 6.4 – Static Detectors).

Table 6.9: Automated Monitoring carried out during (spring, summer & autumn) 2017

Location	May	Sept	July
T1 & Feature	22nd - 26th	1st - 5th	7th - 11th
T2 & Feature	22nd - 26th	1st - 5th	7th - 11th
T3 & Feature	22nd - 26th	1st - 5th	7th - 11th
T4 & Feature	22nd - 26th	1st - 5th	7th - 11th
T5 & Feature	27th - 31st	6th - 10th	13th - 17th
T6 & Feature	22nd - 26th	1st - 5th	13th - 17th
T7 & Feature	27th - 31st	6th - 10th	13th - 17th
T8 & Feature	27th - 31st	6th - 10th	13th - 17th
T9 & Feature	27th - 31st	6th - 10th	13th - 17th

6.196 Across the three seasons (spring, summer & autumn), automated monitoring was carried out for 27 nights (estimated total hours = 432 hours (based on an average of eight hours recording per night (although night length varies across the survey season)). Bat species recorded during automated passive monitoring included; common pipistrelle, soprano pipistrelle, pipistrelle spp., Nathusius pipistrelle, Leisler's bat, Myotis species. (*Myotis daubentonii*, *M. nattereri* and *M. mystacinus*) bat are the most difficult species to identify and are therefore collectively referred to as *Myotis* bats (Russ 1999[3] & Russ 2012[4])), as well as a few records for brown long-eared bat.

6.197 Appendix 6.5 contains Bat Activity Indices (BAI) for the static surveys, broken down by location (see Figure 6.4 – Static Detectors). These indices are based on the total number of ZC files of each species, divided by the total number of survey hours for that location. Most bat activity was recorded along the edge of coniferous forestry plantations or along watercourses, which is unsurprising given the lack of other linear features (i.e. hedgerows) on the site.

6.198 Overall only 484 bat passes were recorded at the turbine locations across the entire 2017 survey season. The most commonly recorded bat was *N. leisleri*, with 203 bat passes (41.9%) of all activity at turbine locations (recorded during the automated monitoring sessions). There was 151 bat passes of *P. pipistrellus*, which accounted for 31.2%; and *P. pygmaeus* accounted for 128 (26.45%) of bat passes; taken together the pipistrelle species assemblage accounted for 57.65% of all activity.

[3] Russ, J. (1999) *The Bats of Britain and Ireland, Echolocation Calls, Sound Analysis and Species Identification*, Alana Ecology Ltd, Shropshire.
[4] Russ, J. (2012) British Bat Calls, A Guide to Species Identification, Pelagic Publishing, Exeter.

CONSENTED (LA01/2018/0200/F)

The only other species recorded at the turbine locations was *Myotis daubentonii,* with two separate individual passes recorded.

6.199 Overall there were 704 bat passes were recorded at the adjacent habitat features. Again, the most commonly recorded bat was *N. leisleri,* with 255 bat passes (36.22%). There was 241 bat passes of *P. pipistrellus,* which accounted for 34.23%; and *P. pygmaeus* accounted for 202 (28.69%) of bat passes; taken together the pipistrelle species assemblage accounted for 62.9% of all activity. Other species recorded at the habitat features were *M. daubentonii (1 pass), Pipistrellus nathusii (1 pass)* and (4 passes) for *Plecotus auritus*.

6.200 This demonstrates that activity was more strongly correlated with habitat features, such as the edges of adjacent coniferous forestry plantations and along watercourses, than at proposed turbine locations.

Other Mammals

Otter Survey

6.201 The presence of this species within the site was not confirmed during otter surveys. There were no otter holts, foraging areas or field signs recorded. The watercourses within the site are small upland streams, which are devoid of any significant riparian vegetation. However, these small rivers flow downstream in to the Curly River ASSI which is home to otters. Therefore, there is the potential for otters to come upstream during dispersal of young animals or when travelling between the numerous minor catchments within the River Roe & Tributaries system.

Badger Survey

6.202 The results of the badger survey are presented as a confidential appendix.

Herpetofauna Survey Results

Common Lizard

6.203 Lizard *Lacerta vivipara* surveys commenced when forty (500x500mm) bitumen backed carpet tiles (artificial refugia) were placed across the site (20 on the 27th April and a further 20 on the 4th May 2016). These were left in-situ for a week to allow the lizards to become acclimatised to their presence, with the first survey visit completed during May. This coincides with the NIEA Specific Requirements (in force at the time of survey) for this species, which states that "surveys should be carried out between March and October. With the best time for surveys to be undertaken is generally April-May and in September."

6.204 Table 6.10 (below) outlines the results of the lizard surveys undertaken between April and September 2016.

Table 6.10: Results of the common/viviparous lizard surveys carried out during 2016

Date/Time	Weather	Results	Notes
21/06/16	12.5°C at start, and 17.5°C by end. Fine, dry and warm, but	3 lizards recorded	Smooth newt metamorph under one

CONSENTED (LA01/2018/0200/F)

Date/Time	Weather	Results	Notes
(start 1005, finish 1335hrs)	with a cool breeze after a clear cold night		of the refugia also
08/07/16 (start 1730, finish 1930hrs)	15^{o}C, 70% sun with a light breeze	3 lizards recorded (one while walking (& 2 newts also under refugia))	
31/08/16 (start 1030, finish 1230hrs)	16^{o}C, 50% sun with a gentle breeze	No lizards recorded	1 newt metamorph (waypoint 353)

6.205 A maximum total of 6 adult lizards were recorded using a total of five refugia (see Figure 6.8). The results of the common lizard surveys reveal a population score of 2 (good population[5]) (with 6 individuals recorded). It is likely that the habitats surrounding T3 as well as adjacent to T5 and T6 are optimal habitat for this species. Albeit, optimal habitat that is partially degraded via overgrazing. Whereas the habitats surrounding T1, T2 & T4 are poorer quality habitat for common lizard (i.e. improved grassland). Finally, the habitats surrounding T7, T8 & T9 are likely to be sub-optimal (due to heavy sheep grazing) but that lizards are likely to be present (at low population densities).

Smooth newt survey

6.206 The presence of smooth newt was confirmed within the site during the ecology surveys. A brief survey report is included in Appendix 6.7. One large pond was identified and a Habitat Suitability Index (HIS) was carried out. The area was deemed suitable and a survey was carried out on the 8th June 2016. Two smooth newts *Lissotriton vulgaris* were found, both within the pond.

Table 6.11: Results of the 2017 surveys for smooth newt

Date/Time	Weather	Results	Notes
08/06/16 nocturnal survey	17^{o}C, cloudy, dry and mild with little wind.	2 adults recorded.	No eggs were found; however, 2 were recorded during torching. None under refugia

6.207 Many of the habitats on site are not considered suitable for smooth newts, due to the absence of woodland, however, the pond is highly suitable. This area has all the elements necessary for the smooth newts to complete their life-cycle.

6.208 The dam pond contains extensive mats of dense vegetation cover, floating on its surface. This is a suitable waterbody in which to breed and drier areas with abundant hibernacula are available nearby. The only desirable element that is absent, is woodland cover (often favoured by smooth newts), however the dense vegetation surrounding the pond is very thick and in many areas over 1m high. This

[5] Froglife Advice Sheet 10 Reptile Survey, an introduction to planning, conducting and interpreting surveys for snake and lizard conservation

CONSENTED (LA01/2018/0200/F)

potentially provides sufficient canopy cover for a species as diminutive as a smooth newt.

Lepidoptera

Marsh Fritillary Survey

6.209 The presence of *S. pratensis* (the LHP of *Euphydryas aurinia*) was confirmed within the site. The habitat map at Figure 6.2 illustrates the areas where the marsh fritillary Larval Host Plant is abundant.

6.210 Over the whole site there were a number of minor localised patches of *S. pratensis* recorded, each patch was estimated to contain between 15 and 25 plants. In view of the limited extent of suitable habitat and the distance from any known breeding colonies, the site is considered to have negligible potential for breeding marsh fritillaries.

6.211 The presence of marsh fritillary larval webs was not confirmed on any of these plants. This butterfly exists in a series of linked meta-populations, forming numerous temporary sub-populations, which frequently die out and recolonise. Where unable to do this, populations do not seem to be able to persist in habitat fragments.

6.212 In addition to this marsh fritillary is typically found in either dry calcicolous grassland or damp neutral or acidophilous grassland and mires. A common factor in many occupied sites is the presence of low-intensity cattle grazing which creates the preferred sward for the butterfly. The intensive sheep grazing across much of the site has created poor sward conditions and the absence of suitable habitat which is highly unlikely to favour marsh fritillary; therefore, this species has been removed from any further assessment.

Assessment of Impacts

General

6.213 Having defined the ecological baseline characteristics of the study area, it is necessary to describe the potential resultant scheme-related changes to the baseline and to assess the impact on valued ecological resources (CIEEM 2016)[6]. The process of identifying impacts refers to aspects of ecological structure and function on which a resource feature depends. Examples of aspects of ecological structure and function to consider when predicting impacts include (CIEEM 2016):

- Available resources (Territory: hunting/foraging grounds; shelter and roost sites; breeding sites; corridors for migration and dispersal; stop-over sites);
- Stochastic processes (Flooding, drought, wind blow and storm damage, disease, eutrophication, erosion, deposition and other geomorphological processes, fire and climate change);

[6] Chartered Institute of Ecology & Environmental Management (CIEEM) (2016) *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal (Second Ed. January 2016)*.

CONSENTED (LA01/2018/0200/F)

- Ecological processes (Population dynamics: population cycles; survival rates and strategies; reproduction rates and strategies; competition; predation; seasonal behaviour; dispersal and genetic exchange; elimination of wastes. Vegetation dynamics: colonisation; succession; competition; and nutrient-cycling);
- Human influences (Animal husbandry, cutting, burning, mowing, draining, irrigation, culling, hunting, excavations, maintenance dredging, earth shaping, ploughing, seeding, planting, cropping, fertilising, pollution and contamination, use of pesticides and herbicides, introduction of exotics, weeds and genetically modified organisms and disturbance from public access and recreation, pets and transport);
- Ecological relationships (Food webs, predator-prey relationships, herbivore-plant relationships, herbivore-carnivore relationships, adaptation and dynamism);
- Ecosystem properties (Fragility and stability, carrying capacity and limiting factors, productivity, community dynamics; connectivity; source/sink; numbers in a population or meta-population, minimum viable populations; sex and age ratios; patchiness and degree of fragmentation);
- Ecological role or function (decomposer, primary producer, herbivore, parasite, predator, keystone species);

6.214 Impacts on ecosystem structure and function are assessed by reference to the following parameters:

- Positive or negative impacts, with international, national and local policies increasingly pressing for projects to deliver positive biodiversity outcomes
- Magnitude, or size of an impact, which in the case of habitat may be coincident with extent
- Extent over which an impact is felt
- Duration of time over which the impact is expected to last prior to recovery or replacement of the resource or feature
- Reversibility, or whether an impact is permanent or temporary
- Timing and frequency of an activity, which may have different impacts depending on, for example, the season during which it is carried out.

6.215 EIA legislation requires the enumeration of significant negative or positive impacts of an activity on ecological features. An ecologically significant impact is here defined as an impact on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area (CIEEM 2016). The significance of an impact depends on the importance of a receptor as defined in Table 6.1 and on the magnitude of the impact on that receptor as defined in Table 6.2. Receptor impacts may be averaged against each other to assess the significance of the impact of the scheme on the site's natural environment, but in some cases a single receptor, for example an internationally important species or habitat, may be of sufficiently critical importance that the

CONSENTED (LA01/2018/0200/F)

magnitude of impact on that single receptor defines the significance of the impact on the site. The following narrative assesses the significance of the impact of the Development.

Construction Phase

6.216 Activities that may be associated with construction of the Development and that may generate impacts on the natural environment near the proposed scheme include:

- Disturbance of designation features/sites;
- Disturbance to protected species;
- Construction of hard surfaces for access roads, turbine bases and construction platforms;
- Construction on new ground, leading to habitat and population constriction and/or fragmentation;
- Storage of materials and plant, and construction of site compounds;
- Environmental incidents and accidents (e.g. spillages, noise and emissions;
- Excavation works;
- Removal and redistribution of topsoil and subsoil;
- Provision of temporary access routes;
- Disruption or modification of drainage;
- Vegetation clearance; and
- Implementation of landscape design and habitat management.

6.217 The significance of the potential effects of the proposed scheme on valued ecological receptors during the construction phase has been assessed and outlined in the following sections.

Permanent loss of habitats due to land-take

6.218 The footprint of wind farm infrastructure will involve permanent land-take of approximately 4ha, due to the construction of 4.25km of access tracks and approximately 1.393 ha for the construction of 9 crane pads and turbine bases (see Chapter 2, Proposed Development). Including land take for the substation and control building, this amounts to a total land take of just over 4.5ha.

6.219 The design of the wind farm layout has evolved in part by taking into account information on NI Priority Habitats and the NIEA, Natural Heritage, Development Management Team Advice Note – Active Peatland and PPS18.

6.220 The location of all 9 turbines and the route of the access tracks have been chosen to avoid all areas of blanket bog on the plateau of Keady Mountain that have been assessed to represent active blanket bog. There is thus no direct effect on active blanket bog. Two turbines, T3 and T6, are located on wet heath (which have been heavily influenced by sheep grazing, resulting in a reduction in habitat quality in these locations).

6.221 Table 6.12 lists the NVC communities and habitat condition at each turbine location.

CONSENTED (LA01/2018/0200/F)

Table 6.12: NVC community and habitat condition at each turbine location

Turbine	NVC community	Habitat condition
T1	*U4 – acid grassland*	*Acid grassland with transitional areas of wet heath and marshy grassland nearby.*
T2	*M23a - PMGRP*	*Species poor and very uniform sward, lacks tall herbs indicative of NI Priority Habitat. Drainage and overgrazing the likely cause.*
T3	*M15d*	*Likely derived from degraded M17 due to past over-grazing, drainage and subsequent drying out. It is also located on shallow peat <0.5m deep. Moderate quality as a heathland, although over-abundance of Calluna vulgaris an issue.*
T4	*M23a - PMGRP*	*Species poor and very uniform sward, lacks tall herbs indicative of NI Priority Habitat. Drainage and overgrazing the likely cause. Although there are remnants of better quality habitat (M15/M17) immediately to the south as the slope lessens and ground wetness increases. However, the turbine has been positioned to avoid this area.*
T5	*M23a/M6d Transitional*	*This turbine is near an existing track on a dry elevated position. The habitat is transitional between PMGRP (Marshy grassland) and M6d (species-poor) mire. There are also (acid) U4 influences where the sheep lie-up and dung near the track.*
T6	*M15*	*Conservation status would be moderate M15 changing to (acid) grassland due to over grazing*
T7	*M23a/M25b - PMGRP*	*Species poor and very uniform sward, lacks tall herbs indicative of NI Priority Habitat. Drainage and overgrazing the likely cause. This is also evidenced by the M25b influences. There was <1% point between M23a (49.76%) & M25b (50.20%) on the MAVIS analysis of a group of 7 quadrats in this location.*
T8	*M23a/M25b - PMGRP*	*Species poor and very uniform sward, lacks tall herbs indicative of NI Priority Habitat. Drainage and overgrazing the likely cause. This is also evidenced by the M25b influences. There was 3% points between M23a (50.65%) & M25b (47.52%) on the MAVIS analysis of a group of 8 quadrats in this location.*
T9	*M23a/M25b PMGRP*	*Slightly more diverse assemblage of species and a less uniform sward, a few more tall herbs indicative of NI Priority Habitat. Drainage and overgrazing still evident, but the wetter conditions are the likely cause of the improved sward. Although, again there was <1% point between M23a (49.37%) & M25b (49.97%) on the MAVIS analysis of a group of 12 quadrats in this location.*

6.222 Turbine 1 is in U4d *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, while the associated access track traverses a more semi-improved variant of the same habitat as well as some M23a marshy grassland.

6.223 Turbines 2 and 4 are in a large field parcel of marshy grassland (M23 Juncus effusus/acutiflorus – Galium palustre rush-pasture) which runs from the semi-improved fields near the road up to the plateau to the south. For most of the area this is quite uniform species-poor grassland, but there are a few patches of *S. pratensis* upslope of T4 and a transitional zone into M15 and M17 type habitat.

6.224 T3 is in M15 wet heath which has become quite dried out, and dominated by heather. This area has elements of M19 and is likely to have been derived from blanket bog in the past, however it lacks *Sphagnum papillosum* and is also on peat <0.5m deep. MAVIS analysis produced a 53.74% 'Goodness of Fit' to M15d (*Scirpus cespitosus – Erica tetralix* wet heath (*Vaccinium myrtillus*) sub-community when 8 NVC quadrats (along the route of the infrastructure) were analysed.

CONSENTED (LA01/2018/0200/F)

6.225 T6 is also located on wet heath, this one is more classic M15 on a shallow rocky outcrop. MAVIS analysis of a group of 6 quadrats in this location confirmed this with a 59.94% 'Goodness of Fit'.

6.226 T5 is on a transitional above the track where U4 grades into M23 and ultimately into a modest patch of M6d (*Carex echinata-Sphagnum recurvum*) mire. Although this is quite localised and the wider area is all M23a PMGRP.

6.227 The remaining three turbines (T7, T8 and T9) are in M23a PMGRP (marshy grassland). T7 & T8 are located on either side of a sloped area which is quite species-poor and transitional M25b. T9 is located downslope on a wetter area and on the edge of more typical PMGRP habitat. The turbine has been located just outside this area of potentially higher quality habitat.

6.228 The land take areas of each habitat that will lost to the development are summarised in Table 6.13 below.

Table 6.13: Temporary and Long-Term Habitat Loss

Habitat	Temporary Loss (m^2)*	Long Term Loss (m^2)	Total Loss (m^2)
M15/M15d	*1785*	*7038*	*8823*
M23a (turbines)	*5355*	*21114*	*26469*
M23a (new tracks)	*21250*	*29750***	*51000*
M23a (upgraded track (existing track +3m)	*2917.5*	*3500*	*6417.5*
(M23a) subtotal	*29522.5*	*54364*	*83886.5*
U4d (turbines)	*892.5*	*3519*	*4411.5*
Semi-improved grassland (Compound & substation)	*982.9*	*4006.26*	*4989.16*
Totals	*62705.4*	*123291.3*	*185996.7*

**Based on a continuous 2.5m buffer around all construction structures*
***Based on 7m wide track (5m for running surface and 1m either side for drainage.*

6.229 In summary, Figure 6.2 shows that six of the nine turbines and most of access track are in areas of species poor PMGRP (NVC M23a community).

6.230 The loss of approximately 54364m^2 (5.44ha) of species-poor PMGRP habitat is a permanent and direct effect of medium to high magnitude on a receptor of low value and sensitivity. The significance of the effect is assessed as being negligible to minor and hence is acceptable for the Development without further mitigation.

6.231 However, under the "*Biodiversity Net Gain Good practice principles for development*" the loss of 5.44ha of species-poor M23a PMGRP will be mitigated for, to achieve net gain locally to the Development while also contributing towards nature conservation priorities at local, regional and national levels. This will take the form of enhancing existing or creating new habitat.

6.232 Two turbines are in areas classed as wet heath. Although these habitats are moderately degraded, they are still classed as NI priority habitats and hence are assessed as being of high value.

CONSENTED (LA01/2018/0200/F)

6.233 The combined land take and hence loss of this priority habitat for the lifetime of the Development is 7038 m^2 (0.7ha) (Table 6.13). The loss of 0.7 ha of NI priority habitat is assessed to be an adverse effect of medium magnitude on receptors of high value. Since land take (and hence habitat loss) will be long term, this means that the effect is of moderate adverse significance and further mitigation is required.

Bats

6.234 Construction activities have the potential to remove foraging habitat or reduce its value, and to disrupt flight-lines. Studies in Britain indicate that most bat activity is near habitat features. Activity declines with distance from features such as treelines and woodland edge and is generally not significant at distances greater than 50 m (Natural England 2014[7]). This decline occurs both when bats are commuting and when foraging, although the decline is greater when animals are commuting. The potential impact of loss of feeding habitats may vary seasonally, with greater impact during the summer, and lower impact during migration.

6.235 Low numbers of bats were recorded foraging over the site, while the main bat foraging and commuting routes have all been avoided during the emplacement of infrastructure. A few river crossings will be required during construction, and therefore this may cause some limited disruption to foraging areas. However, most bat activity will likely continue as the main areas of better foraging along the ravines and along the edges of adjacent coniferous forestry plantations will remain untouched during construction activities and key commuting routes will therefore be unaffected.

6.236 The other main potential impact on bat populations that may arise due to construction is the loss of roost sites. However, no roosts were identified on the site during survey, and the nearest potential roosting location is 470 m away from the nearest turbine. Therefore, this impact will not arise at the Development. The magnitude of construction activities on bats is likely to be neutral, and the significance of the impacts will be neutral.

Otter

6.237 Impacts of construction works on otters includes damage to holts, disturbance at holts, disruption of dispersion and foraging routes and displacement of foraging or breeding animals. Disturbance of otters is possible during the construction phase, but the shy species is likely to avoid areas of intense human activity, particularly when this involves significant noise. Potential indirect impacts include adverse effects on fish prey species. The species is largely crepuscular in its habits, and it is likely that much of its activity will take place outside normal working hours. However, the reaction of individual otters to disturbance is unpredictable, with some inquisitive animals drawn to investigate work sites, whilst others avoid them.

[7] Natural England Technical Information Note TIN051 Third edition February 2014, Bats and onshore wind turbines Interim guidance.

CONSENTED (LA01/2018/0200/F)

The likely sporadic nature of any use by otters of the site, indicates that there is unlikely to be any significant impact on the species as a result of construction activities. Magnitude of impacts is likely to be negligible to neutral and of neutral significance.

Badger

6.238 Potential conflicts with badgers (arising from construction) include damage to setts, disturbance at setts, and removal of foraging areas and displacement of foraging or breeding animals. Construction works may present additional hazards to badgers, with a potential for entrapment within excavations, accidental injuries on construction plant or materials, diversion from traditional trails by plant and site compounds and exposure to oils and other toxic materials.

6.239 There are numerous of badger setts located within the Development and thus there is the potential for such disturbance to occur. Badgers have crepuscular and nocturnal foraging habits, and it is unlikely that daytime construction activities will disturb or reduce the foraging range of the local social group. However, construction of access tracks, crane bases, foundations and erection of turbines will reduce the area available for foraging.

6.240 There is also the potential risk of displacement of sensitive animals unaccustomed to high levels of anthropogenic activities. The potential magnitude of impact (without mitigation) on badgers during the construction phase is moderate adverse magnitude and significance.

6.241 However, the location of known badger setts have been identified and taken into consideration during the emplacement of site infrastructure such that there are no sett entrances are within 25m of any infrastructure. As a result of this mitigation measure, the potential impacts are of minor adverse magnitude and minor significance during construction.

Common Lizard

6.242 Construction of infrastructure will remove habitat for this species and cause disturbance leading to displacement of animals over a limited area of the site. It also has the potential to impact the habitat feature/requirements that lizards need within suitable habitat; this includes areas for basking, foraging, diurnal shelter and hibernation. The recorded use of the site by this species indicates that these impacts have the potential to be of moderate adverse magnitude and of moderate adverse significance. Therefore, mitigation is required.

Smooth newt

6.243 Construction of infrastructure and turbine/crane bases has the potential to remove habitat for this species and to cause disturbance leading to displacement of animals from the site. It has the potential to impact all the habitat features that smooth newts require across the year within wider areas of suitable habitat. This includes

CONSENTED (LA01/2018/0200/F)

breeding ponds as well as areas for nocturnal foraging, diurnal shelter and seasonal hibernation.

6.244 The recorded use of the site by this species indicates that these impacts will be of moderate adverse magnitude and of moderate adverse significance during the construction phase, as a known breeding pond and associated terrestrial habitat are within 200m distance from small section of track between T5 and T8. Therefore, mitigation is required.

Operational Phase

6.245 Characteristics of wind farms that may generate impacts on the natural environment in the vicinity of the proposed scheme include:

- Occupation of former semi-natural habitats by turbines and associated infrastructure;
- Occupation of a swept volume of air space by turbine rotors;
- Vehicular use of access routes; and
- Improved access to remote sites.

6.246 Many of the impacts on biological receptors noted for the construction phase are also relevant during the operational phase. However, effective land take is reduced following the construction phase, as temporary site compounds and vehicle and plant running surfaces are returned to their former vegetation cover, and disturbance pressures arising from human presence along the route are significantly reduced.

6.247 Impacts on valued ecological receptors are outlined below.

Habitats

6.248 No adverse effects on vegetation communities and habitats are anticipated during the operation of the Development. Significant positive effects, through habitat restoration and enhancement, i.e. the reinstatement of wet heath and PMGRP vegetation, are anticipated through implementation of the HMP (Habitat Management Plan).

Bats

6.249 The main potential impacts on bats during the operational phase arise from collision with rotors and from ‘barotrauma’, the often-fatal injuries that occur as a result of bats flying through air of rapidly changing atmospheric pressure in the immediate vicinity of a moving blade. The turbines have been located away from the habitat features that many species of bat use as flightlines or as a focus for foraging.

6.250 There is potential for loss of foraging area because bats may avoid a turbine site. Alternatively, there is some evidence that bats may be attracted to turbines (Kunz

CONSENTED (LA01/2018/0200/F)

et al 2007[8]), possibly because insects may congregate in these locations as a response to the heat radiating from the structures (Ahlén 2003[9]). This effect is most likely to occur in calm conditions, or at low wind speeds, when collision risk for bats is likely to be at its highest.

6.251 A further possible operational impact is that ultrasound emissions from turbines may interfere with bats' echolocation capabilities. The literature addressing this effect is sparse and it is likely that impacts on Irish bat species is limited (European Commission 2010[10]). Table 6.14 outlines the bats likely to be at risk from wind turbines.

6.252 Seasonal variation in impacts of operational turbines on bats in Ireland is at present not fully understood. Movement of bats over long distances within a limited time period may produce a concentration of animals that are available for collision. Studies have shown that there is a peak in mortality in late summer and autumn during dispersal and migration, and that migrating species are most susceptible (Rodrigues et al 2008[11]). However, it is not known to what extent Irish bats migrate, which species, if any, are involved, whether migration is on a broad or narrow front, and whether there are discernible migration routes. It has been suggested that collisions during migration may be exacerbated because echolocation is not used in order to save energy (Keeley et al 2001[12]).

6.253 Late summer and autumn is also the period during which there may be increased activity associated with finding mates, and differentiating between migration and mating-related causality of mortality at turbines is problematic (Cryan and Barclay 2009[13]). Recent research into Leisler's bat in Ireland (Boston, 2008[14]) showed that this species does not migrate long distances between summer ranges and hibernation sites. Leisler's have been shown to hibernate within Ireland and do not appear to migrate in numbers on a broad front. This is likely to significantly reduce the collision risk for this species in the Irish context. However, in the absence of definitive data for all species, it is not possible to assess the likelihood, and hence the significance, of collision risk during putative migration periods. Table 6.15 outlines the risk of collision fatalities affecting bat populations identified from the site.

[8] Kunz, T.K., Arnett, E.B., Erickson, W.P., Alexander, A.R.H., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W. & Tuttle, M.D. (2007) Ecological impacts of wind energy development on bats: questions, research, needs and hypotheses. – Frontiers in Ecology and the Environment 5: 315-324.R.

[9] Ahlén, I. (2003) Wind turbines and bats – a pilot study. – Report to the Swedish National Energy Administration, Dnr 5210P-2002-00473, P-nr P20272-1.R.

[10] European Commission (2010) Guidance on wind energy development in accordance with the EU nature legislation. European Commission, Brussels.

[11] Rodrigues, L., Bach, L., Duborg-Savage, M-J., Goodwin, J. & Harbusch, C. (2008) Guidelines for consideration of bats in wind farm projects. – EUROBATS Conservation Series No. 3, UNEP/EUROBATS Secretariat, Bonn.

[12] Keeley, B., Uogretz, S. & Strickland, D. (2001) Bat ecology and wind turbine considerations. –pp135-141 in Schwartz, S.S. (2001, ed) Proceeding of the National Avian-Wind Power Planning Meeting IV, Carmel, CA, May 16-17, 2000.

[13] Cryan, P.M. and Barclay, R.M.R. (2009) Causes of bat fatalities at wind turbines: hypotheses and predictions. Journal of Mammalogy, 90(6):1330–1340.

[14] Boston (2008) Molecular ecology and conservation genetics of the Leisler's bat (*Nyctalus leisleri*) in Ireland. Unpublished Ph.D Thesis.

CONSENTED (LA01/2018/0200/F)

Table 6.14: Bats likely to be at risk from wind turbines (Natural England 2014[15])

Low	Medium	High
Myotis spp.	Soprano Pipistrelle	Leisler's Bat
Brown Long-eared Bat	Common Pipistrelle	Nathusius' Pipistrelle

Table 6.15: The risk of collision fatalities affecting bat populations (Natural England)

Species	Relative Population Size and Status	Risk of Collision	Population Threat
Myotis spp.	Common / Fairly Common / Locally Distributed	Low	Low
Leisler's Bat	Scarce (relatively common in NI)	High	High
Pipistrelle spp.	Common	Medium	Low
Soprano Pipistrelle	Common	Medium	Low
Common Pipistrelle	Common	Medium	Low
Nathusius' Pipistrelle	Rare	High	High
Brown long-eared bat	Common	Low	Low

6.254 In the absence of mitigation, bats flying along edge habitats would be potentially in close proximity to the rotor swept areas during foraging and commuting activity. This could potentially result in bat fatalities. Therefore, under the precautionary principle (and without mitigation) this project has the potential to have a moderate adverse impact magnitude, of major adverse significance during the operational phase. As a result, detailed mitigation by design has been developed and implemented.

6.255 All turbines have been positioned to maintain a minimum 50m stand-off distance from the tip of the turbine blade to the top of the adjacent habitat feature. Bat buffers of 36m and 65m were added to major watercourses and forestry edge respectively, based on a blade length of 49.9m and a hub height of 100m.

6.256 With mitigation, and based on currently available data on all species of (Irish) bat species, the impact magnitude can be reduced to neutral significance during the operational phase of the Development.

6.257 The results of bat activity surveys confirmed that most of commuting and foraging was along linear features such as watercourses and edges of adjacent industrial tree monoculture plantations. The infrastructure layout has taken account of bat activity along these features and turbines have been sited to avoid these areas.

Otter

6.258 The level of potential disturbance to otters is less during wind farm operation as compared with the construction phase, as the site reverts to minimal human

[15] Natural England Technical Information Note TIN051 Third edition 11 March 2014, Bats and onshore wind turbines Interim guidance.

CONSENTED (LA01/2018/0200/F)

presence. There is likely to be neutral impact magnitude and significance during the operational phase.

Badger

6.259 The use of access tracks will be mainly limited to single-vehicle journeys for maintenance and there will be minimal collision risk to badgers. There will be no additional impacts on badgers as a result of the operation of the Development. There is likely to be neutral impact on magnitude and significance during the operational phase.

Common Lizard

6.260 The use of access tracks will be mainly limited to single-vehicle journeys for maintenance, and there will be minimal traffic risk to lizards. The additional likely impacts on this species as a result of the operation of the Development will include species specific habitat management and enhancement measures. Overall the successful implementation of these measures during the operational lifetime of the wind farm is likely to be of minor positive magnitude and of beneficial significance.

Smooth newt

6.261 As for common lizard above, the use of access tracks will be mainly limited to single-vehicle journeys for maintenance, and there will be minimal traffic risk to newts (given that they tend to move on land during the hours of darkness). The additional likely impacts on this species as a result of the operation of the Development will include species specific habitat management and enhancement measures. Overall the successful implementation of these measures during the operational lifetime of the wind farm is likely to be of minor positive magnitude and of beneficial significance.

Decommissioning Phase

6.262 Impacts associated with decommissioning a wind farm bear many similarities to those arising during construction. Many of the work processes are similar and plant and vehicle movements are likely to be at a similar scale. It is assumed that decommissioning will require the removal of all above ground structures; the removal of all underground structures to one metre below ground level; and reinstatement of disturbed areas.

Habitats

6.263 Two types of activities have the potential to disrupt and damage vegetation communities and peatland habitats during decommissioning. These are:

- Removal of above-ground infrastructure; and
- Laydown of waste demolition materials or spillages or leaks of fuels from decommissioning plant.

6.264 The types of decommissioning effects are as follows:

CONSENTED (LA01/2018/0200/F)

- Disruption/damage to peatland vegetation, compaction/rutting of the peat surface and disruption of peat hydrology that supports peatland (especially blanket bog) vegetation
- Contamination of the peat surface and peatland vegetation with demolition waste materials or spilled/leaked fuels.

Species of Conservation Concern

6.265 Impacts on protected mammals and herpetofauna during decommissioning are likely to be of a similar scale and nature to those that occurred during construction and are unlikely to be significant.

6.266 Each of these impacts is described and assessed below and the unmitigated impacts, mitigation measures and residual impacts are summarised in tabular form (Tables 6.16 & 6.17).

Table 6.16: Significant Effects upon Valued Ecological Receptors (Prior to Mitigation)

Impact	*Nature of Effect*	*Magnitude*	*Significance*
Construction			
Designated Sites / Watercourses	*Statutory: River Roe & Tributaries ASSI/SAC; and Lough Foyle ASSI/SPA* *There is significant potential for waterborne pollution and increased sediment loading during the construction phase in the absence of mitigation*	*Moderate*	*Major adverse*
Wet heath	*Land take associated with construction of access tracks and turbines and associated infrastructure.*	*Moderate*	*Moderate*
Bats	*Disturbance of European Protected Species during construction activities*	*Neutral*	*Neutral*
Otter	*Temporary disturbance from construction works unlikely*	*Neutral*	*Neutral*
Badger	*Temporary disturbance from construction works probable*	*Minor*	*Minor Adverse*
Common lizard	*Temporary disturbance from construction works and loss of habitat*	*Moderate*	*Moderate Adverse*
Smooth newt	*Temporary disturbance from construction works and loss of habitat*	*Moderate*	*Moderate Adverse*
Operational			
Designated Sites / Watercourses	*Statutory: River Roe and Tributaries ASSI/SAC and Lough Foyle ASSI/SPA* *Water pollution, sediment loading, is extremely unlikely during the operational phase*	*Neutral*	*Neutral*
Wet heath	*Heathland restoration and enhancement to be conducted in accordance with methods defined in the Outline HMP*	*Neutral*	*Neutral*
Bats	*Potential collision of European Protected Species with turbine blades (or barotrauma) during the operational phase*	*Moderate adverse*	*Major Adverse*
Otter	*Operational Effects unlikely*	*Negligible to Neutral*	*Neutral*

CONSENTED (LA01/2018/0200/F)

Impact	*Nature of Effect*	*Magnitude*	*Significance*
Badger	*Operational Effects unlikely*	*Negligible to Neutral*	*Neutral*
Common lizard	*Loss of habitat for the operational lifetime of the wind farm*	*Negligible to Neutral*	*Neutral*
Smooth newt	*Loss of habitat for the operational lifetime of the wind farm*	*Negligible to Neutral*	*Neutral*
Decommissioning			
Designated Sites / Watercourses	*Statutory: River Roe & Tributaries ASSI/SAC; and Lough Foyle ASSI/SPA* *There is significant potential for waterborne pollution and increased sediment loading during the decommissioning phase in the absence of mitigation*	*Moderate*	*Major Adverse*
Wet heath	*Removal of turbines and associated infrastructure will permit reinstatement of impacted areas of this habitat.*	*Moderate*	*Moderate Adverse*
Bats	*Disturbance of European Protected Species during decommissioning activities unlikely*	*Neutral*	*Neutral*
Otter	*Temporary disturbance from decommissioning works unlikely*	*Neutral*	*Neutral*
Badger	*Temporary disturbance from decommissioning works possible*	*Minor*	*Minor Adverse*
Common lizard	*Temporary disturbance from decommissioning works probable*	*Moderate*	*Moderate Adverse*
Smooth newt	*Temporary disturbance from decommissioning works probable*	*Moderate*	*Moderate Adverse*

Design Evolution & Mitigation

6.267 The purpose of what is broadly classed as mitigation is to maintain the conservation value of a development site as far as is possible, and to exploit opportunities to enhance the site's conservation value wherever possible. This can be achieved by (CIEEM 2016):

- avoiding negative ecological impacts - especially those that could be significant;
- reducing negative impacts that cannot be avoided; and
- compensating for any remaining significant negative ecological impacts.

6.268 The aims of mitigation can be best achieved by choosing locations that allow sites or features of conservation value to be avoided; Chapter 3: Design Evolution & Alternatives provides a full description of the design evolution process which includes details on avoidance measures.

6.269 Avoidance and impact reduction techniques relate to reducing the footprint of the development and any ancillary works as far as is practicable. Measures required to address ecological concerns described in this ES during the construction phase will be incorporated within a Construction & Decommissioning Method Statement (CDMS), which will be submitted to and agreed with the Department at the pre-construction stage. Avoidance and impact reduction measures include:

CONSENTED (LA01/2018/0200/F)

- No turbine rotors are within 50m from the edge flight-lines such as streams and shelterbelts), which is the minimum stand-off distance from blade tip to the nearest habitat feature likely to be used by bats, (Natural England 2014).
- Consideration will be given to the provenance of fill materials for roads, in terms of the similarity of their physicochemical properties (particularly pH) to the present substrate.
- The contractor will prepare a CDMS prior to construction activities to provide a method statement for working practices that will include measures, among others, to prevent adverse impacts on rivers and other watercourses. Please also refer to the SUDS design Statement in Appendix 9.
- A “no access” buffer will be implemented along sensitive watercourses to prevent damage to banks and to prevent disturbance of riparian habitats, apart from the narrow corridor required during construction.
- Access of all machinery and personnel will be limited to the working area corridor.
- Site compounds and stores have been sited away from any features of conservation interest, including watercourses. Any of these features in close proximity to the works or to compounds will be fenced to prevent damage by plant or stored materials.
- Dust suppression filters and appropriate wetting of running and work surfaces will be used to prevent masking of vegetation outside construction corridors, where appropriate.
- Appropriate speed limits will be imposed to reduce the potential for dust production.
- Excavations left unattended overnight should be ramped in at least one location to allow mammals to avoid becoming trapped.
- It is also recommended that, to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be carried out during periods of low rainfall and therefore minimum run-off rates.

6.270 Of particular importance for the maintenance of habitats and associated fauna is the institution of good management practices that prevent the discharge of silt and pollutants into the local drainage system. Containment measures will include:

- Where works near or in watercourses are unavoidable, working practices will include standard methods designed to minimise sedimentation and pollution, and measures will be put in place before the works begin to ensure containment of any released sediments. These may include silt containment booms or sediment barriers, as appropriate. Land stripping will be done in stages to minimise the potential for concentrated, long-lasting pulses of silt to discharge into watercourses. All filtration systems will be monitored frequently, and they will be replaced before they become ineffective.

CONSENTED (LA01/2018/0200/F)

- Material storage compounds have been located remote from any watercourse. Surface water run-off high in suspended solids should be contained and treated prior to discharge to any watercourse. All storage tanks should be bunded and should be sited remotely from any watercourse. Works should incorporate the relevant Pollution Prevention Guidelines. Additionally, a Pollution Incident Response Plan should be put in place as part of the Construction Management Plan.
- Water should be pumped from turbine bases during construction either to areas of ground capable of absorbing the water or to settlement ponds prior to discharge. Any discharged water must be free of cementitious products.
- All tracks and drains should be maintained and monitored to ensure that surface water flow is directed as designed, and that ponding and blockages are prevented.

6.271 Further details about the proposed SuDS are included in Technical Appendix 9.1.

6.272 Avoiding or mitigating impacts arising from construction-initiated alterations of drainage patterns and infiltration regimes is of importance for preventing damage to both aquatic and terrestrial habitats. It must be appreciated that hydrological characteristics of peatland and the habitats that they support are inextricably linked, and that changes in hydrological regime will lead to changes in these habitats. The areas of blanket bog have been avoided by sensitive siting during the design process. The site hydrological regime is considered in detail in Chapter 9: Geology & the Water Environment and measures outlined there will be carried out in order to maintain the limited areas of conservation interest on the Site.

6.273 Sympathetic management of the wind farm habitats during the operational phase will provide the greatest opportunity for enhancing the conservation value of the Site, and should be regarded as compensatory mitigation for the permanent land take required for the new turbines and infrastructure.

6.274 The landowner will incorporate compensation and enhancement for lizard into the habitat management plan for the site. This will include the removal of grazing for the first three years post construction from the habitat management area shown in Figure 6.9 (and reduced stocking density (cattle only) thereafter).

Habitat Specific Mitigation

6.275 Mitigation measures are required during both the construction and decommissioning phases of the Development. These consist of both generic, standard, good construction working practices and controls described in the CMS, together with site specific and activity specific measures. Only the latter, the specific mitigation measures, are described here.

6.276 Adverse effects during the construction phase that were assessed to be potentially significant and require mitigation are:

- Land take (0.7ha), resulting in loss of wet heath which, despite being degraded is still considered to be an NI priority habitat.

CONSENTED (LA01/2018/0200/F)

- Excavation of turbine bases and cable trenches, potentially severing hydrological routing and causing dewatering of areas of soils.

6.277 The prime mitigation to reduce to an absolute minimum any disturbance or damage to vegetation, over and above the strict controls provided in the CMS, is habitat restoration and enhancement and vigorous supervision by the ECoW of all activities and at all stages of the Development.

6.278 Habitat restoration and enhancement is described in the Outline Habitat Management Plan (OHMP) in Appendix 6.8 to provide compensation for the loss of small areas of degraded M15 wet heath and a larger area of species-poor PMGRP.

6.279 Quantification of anticipated areas enhanced via turve translocation and reinstatement of a heather sward indicate that approximately 3.5ha of wet heath will be restored. The overall area enhanced (14.5ha) is a combination of 3.5ha (for restoration of wet heath) plus 10.88ha (for restoration of PMGRP). The former is approximately 5-times greater than the areas of NI priority habitat (wet heath) lost to the Development through land take for the footprint (0.7ha). While the latter is approximately twice the area of PMGRP that will be lost during construction.

6.280 This is considered to be an appropriate level of compensation, considering that the restored and enhanced habitats will also be protected from drainage, flailing and burning; and that grazing will be strictly controlled throughout the 30-year lifetime of the Development.

6.281 As detailed in the OHMP, the Applicant has arranged with the landowner to cease specific land management activities, should the Development be constructed.

Mitigation for Wet Heath

6.282 Turves of heathland vegetation and associated topsoil from construction activity represent a valuable resource that can be used in the restoration of bare areas. Turves must be cut so that they capture the root systems of mineral soil as this will ensure any viable seeds are present. Turves can be laid in blocks or in a patchwork and over time heathland will develop within gaps and will provide a mosaic of structure.

6.283 Prior to the commencement of the main works, the areas of wet heath (T3 & T6) will be translocated into the restoration area using large-scale turfing equipment, using a technique known as "macro-turfing", moving large, thick turves. This method has many advantages over traditional turfing, virtually eliminating problems of frost and drought damage, and because the turves are thick, most burrowing invertebrates and deep-rooted plants survive. At both locations (around T3 & T6) the vegetated turves will be lifted to a depth of approximately 25-40cm, (i.e. total depth of topsoil at each location).

6.284 Approximately 7089 m^2 of turves, each measuring approximately 1·2m x 2·3m x c. 35cm, will be transferred to the translocation site using an excavator fitted with a steel tine bucket (or macro-turf attachment). Any prolonged spells of dry weather will necessitate irrigation of the turves between May and September (inclusive).

CONSENTED (LA01/2018/0200/F)

Simultaneously (or immediately prior) the turves on the recipient site will be removed. This will be done both to prepare the site, remove nutrients (in the top layers of the soil) and to make this turves available for restoration along the construction corridor (under direction from the project ECoW).

6.285 The timing of the main construction works will likely dictate when the area destined for restoration will become available. However, this work will be completed during autumn/winter if possible using macro-turfing methods to remove turf to the site, with the most species-rich turf being placed in the optimum positions and the less rich in less favourable areas.

6.286 A comparison of techniques for restoring heathland on abandoned farmland[16], found that the best result was from translocating turves. Although there is the potential for the loss of *E. tetralix* to potentially occur, causing the plant community to change from wet heath to one which is transitional between humid and dry heathland, to one typical of dry heath only. Therefore, methods have been recommended to match the soil drainage/retention characteristics of the donor and recipient sites and to maintain the soil moisture regime of the turves. This will involve both cutting at a depth of 350mm (as deep as possible)) in order to lift all the roots and as much of the soil as possible. In addition to this, the ground in the receptor site will be prepared in advance in order to create a varied surface topography, immediately prior to the placement of the donor turves. This varied topography will result in a range of hydrological conditions

6.287 It should be noted however that dry heath is also an NI Priority Habitat (or high value) and this habitat (or indeed any transitional heathland habitat) is acceptable compensatory habitat for the loss of wet heath.

Mitigation for GWDTE's

6.288 Where tracks cross a watercourse (spring or seepage) which feeds (or emanates) from a GWDTE (upland flush, fen or swamp), water flow under the track will be preserved by installing numerous flow-balancing cross drainage pipes laterally through the track structure, thus retaining the hydraulic gradient across the footprint of the track. Pipes will be installed at a high frequency (nominally 5-10m intervals), subject to observational design by the ECoW to suit particular water channels observed on site. No longitudinal drainage is to be installed parallel to and adjacent to the tracks (in proximity to these areas (immediately north of T6 and south of T7), in order that no unnecessary flow path that would significantly alter flow routes is introduced. Drainage arrangements are shown on site layout drawings (Appendix 9.1) appended to the Water Framework Directive Assessment prepared by McCloy Consulting.

6.289 The layout has also been designed so that the vast majority of flushes are located upslope of the infrastructure (to the south of turbines 6 and 7 (within the mosaic of wet heath & blanket bog). This further reduces the potential for impact and

[16] Journal of Applied Ecology (1995) 32, 400-411

CONSENTED (LA01/2018/0200/F)

ensures that mitigation is only required in two locations, one on the approach to T6, the other near T7.

Species Specific Mitigation

Mitigation for Bats

6.290 Under the precautionary principle, and due to the presence of species of bat known for open-air foraging (i.e. considered at risk from turbine associated mortality; Leisler's bat (*N. leisleri*) high risk; and Common pipistrelle (*P. pipistrellus*); Soprano pipistrelle (*P. pygmaeus*) medium risk) a Bat Monitoring Plan (BMP) has been recommended.

6.291 The BMP will be agreed with NIEA/The Council and monitoring will be undertaken in years 1, 2, 3 & 5 and will be reviewed after each survey period to determine whether remedial action is required to mitigate the effects of the Development on bats. At the end of year 5, the data will be reviewed to determine whether monitoring should continue.

Remedial Measures

6.292 The trigger threshold for remedial measures will be linked to 'significance' in line with the CIEEM guidelines for EcIA. Remedial measures will be triggered by an impact predicted to be of significance to bats at the Local level or greater.

6.293 For geographic context, the local level is considered to represent the site boundary plus a 15km radius. A significant effect would be triggered where the level of bat mortality is considered to reduce the ability of the bat population at the Local scale to sustain a viable and stable population, as informed by monitoring.

6.294 The requirement for and design of remedial measures will depend upon the findings and conclusions of monitoring and specific measures will be developed as appropriate to mitigate and significant impact predicted (those considered significant to bat populations at the Local scale or above). Where significant impacts are predicted, potential remedial options may include, but are not limited to, the feathering of individual turbines.

6.295 Feathering of turbines during the bat activity season to ensure that their operation cuts in only above certain wind speeds at certain times of year. This will be informed by an assessment of the effects of meteorological variables on bat activity and mortality at turbine locations.

Mitigation for Common Lizard

6.296 In the case of common lizard, it has been impossible to avoid impacts to this species, given the layout constraints. Therefore, the next course of action is to mitigate for any potential impacts.

6.297 The results of the common lizard surveys for the Development were assessed against the Key Reptile Site Survey Assessment Categories (HGBI 1998). This revealed that parts of the Site had a good population (with seven individuals

CONSENTED (LA01/2018/0200/F)

recorded). However, given the location of the records, it is also likely that much of the site is sub-optimal habitat for this species. This is likely a consequence of over-grazing and drainage.

6.298 Depending on the commencement of construction on site, the works corridor will be mowed. If possible, this work will be undertaken before the end February (to avoid a conflict with the bird breeding season). If this is not possible, then mowing will take place between August and September, when common lizards are likely to be fully active. Should the latter be required, the corridor will be subjected to an active nest survey by a suitably qualified ornithologist immediately prior to the commencement of mowing operations.

6.299 Clearance of stones, tree stumps, logs, brash, rocks or piles of similar debris will be undertaken carefully and by hand. Although this is only required in a few areas where the proposed site tracks traverse low stone walls. This work will not take place during the hibernation period for common lizard (i.e. mid-October to mid-March).

6.300 Clearance of tall vegetation will be undertaken using a strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which will either include:

- Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or;
- Cutting vegetation over three consecutive days to a height of no less than 150mm at the first cut, 75mm at the second cut and 30mm at the third cut;

6.301 Following removal of tall vegetation using the methods outlined above, the remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common lizards from returning. Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works described above.

6.302 As an additional precaution the ECoW will be present from the commencement of clearance/construction with a watching brief to ensure that no common lizards remain within the construction corridor and remain in situ until the area is cleared to ensure no species or habitat conflicts emerge affecting damage to the local lizard population.

6.303 If any common lizards are found during excavation works, all works within the affected area will cease until the ECoW has safely removed them (under licence) from the construction corridor.

6.304 Should it prove necessary during site supervision (i.e. lizards are observed returning to the construction corridor); a protective lizard barrier fence will be installed along both sides of the construction corridor in order to prevent common lizards and/or smooth newts from entering the works area.

6.305 In total, there is >500 ha (of blanket bog; dry heath and marshy grassland) adjacent to the proposed construction corridor. These areas together provide more than sufficient suitable habitat.

CONSENTED (LA01/2018/0200/F)

Mitigation for Smooth Newt

6.306 The current infrastructure layout includes sections of track (illustrated on Figure 6.8) within the 200m buffer which surrounds the smooth newt breeding pond. Therefore, mitigation is required in order to reduce any potential significant effects to this protected species.

6.307 It is proposed that any newts migrating from adjacent coniferous plantation (Springwell Forest) towards the pond would be captured using a combination of drift fencing (during the construction phase), along with pitfall traps in order to prevent access by newts to the works area.

6.308 The drift fencing would consist of UV-resistant plastic stretched between poles with wire to present a barrier 50-60cm high and would be dug into a depth of 10-20cm below ground level to prevent access underneath. This would be positioned for 200m along both sides of the proposed access track (southwest of the smooth newt breeding pond (as shown on Figure 6.8)).

6.309 Twenty number plastic 10-litre buckets would be buried with the rim at ground level and placed firmly against the fence (ten either side of the track) in order to catch any newts migrating towards the pond. The traps would contain 10cm depth of water at all times and would be checked daily (between the first erection of the fence (prior to the 15 March) and the completion of construction. This mitigation program would be carried out during both the spring migration (mid-Feb to mid-Apr) towards the pond and the autumn migration (mid-June to mid-August) towards hibernation areas.

6.310 This would be carried out under licence; and once construction is completed the newt fencing would be removed to allow the newt's access to the wider site again. The Project EcoW would also be present on the site immediately prior to and during clearance of site vegetation in order to comply with any likely Wildlife Licence relating to the proposed mitigation. The EcoW would also supervise the erection of the drift fence, the checking of the pitfall traps (and associated removal of any newts to the breeding pond).

6.311 A newt hibernaculum would also be created (to the southeast side of the pond); so as to reduce the need for newts to have to cross the wind farm access track towards the conifer plantation (located on the opposite side of the new access track). An example of a suitable hibernaculum can be found in Appendix 6.7).

Residual Impacts

6.312 Residual effects relating to land management that is designed to provide ecological benefits through the establishment of grazing measures which are appropriate within peatland and associated habitats (See Appendix 6.9 – Outline Habitat Management Plan) will result in more diverse and ecologically valuable habitat than the present degraded habitats that cover the majority of the site. Continuity of effective, appropriate management should result in the area becoming more

CONSENTED (LA01/2018/0200/F)

biodiverse over time. With improved land management, it is anticipated that in the long term there will be at least a neutral residual impact on fauna of conservation concern. For habitats, a beneficial impact is likely if site management results in more diverse habitats of greater conservation value

6.313 Table 6.17 provides details of the residual impacts.

Table 6.17: Summary of Residual Impacts after Mitigation and Enhancement

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
Construction			
Designated Sites / Watercourses	*Major adverse*	*Avoidance during infrastructure design and SuDS drainage management (Appendix 9.1). No in-stream works will be required.*	*Neutral*
Wet heath	*Moderate*	*Heathland restoration and enhancement according to the Outline HMP.*	*Neutral*
Temporary disturbance to bats	*Neutral*	*No mitigation required during construction.*	*Neutral*
Temporary disturbance to otters	*Negligible to Neutral*	*None required, no evidence of otters was found within construction area.*	*Neutral*
Temporary disturbance to badgers	*Moderate*	*The infrastructure layout has been designed to ensure the implementation of a (minimum) 25m buffer around all badger setts.*	*Negligible to Neutral*
Temporary disturbance to common lizard	*Moderate*	*Implementation of species specific mitigation to off-set potential significant effects including phased mowing of the vegetation within the construction corridor.*	*Negligible to Neutral*
Temporary disturbance to smooth newt	*Moderate*	*Implementation of species specific mitigation to off-set potential significant effects including erection of newt fencing and construction of an artificial refugia.*	*Negligible to Neutral*
Operational			
Designated Sites / Watercourses	*Major Adverse*	*Application of the SuDS drainage management and CMS as detailed in Appendix 9.1*	*Neutral*
Wet heath	*Moderate*	*Heathland restoration and enhancement according to the Outline HMP.*	*Beneficial*
Potential collision of bats with turbine blades	*Major adverse*	*The proposed turbine layout was amended to ensure a minimum stand-off distance of 50 m (Natural England TIN051) to all habitat edges (shelterbelts and natural watercourses) which will be maintained through the lifetime of the Development. A Bat Monitoring Plan (BMP) will be implemented under the Precautionary Principle.*	*Neutral*
Disturbance to otters	*Neutral*	*None required, no otters found within construction area*	*Neutral*
Disturbance to badgers	*Neutral*	*None required, no badger setts found within 25m of the construction area.*	*Neutral*
Disturbance to common lizard	*Minor*	*Implementation of species specific enhancement to off-set potential significant effects includes;* *Management of ~15 hectares of habitat which will also benefit this species.*	*Beneficial*

CONSENTED (LA01/2018/0200/F)

Impact	Ecological Impact Significance without Mitigation	Mitigation & Enhancement	Ecological Impact Significance with Mitigation
		Installation of artificial refugia to act as basking sites within the habitat management area.	
Disturbance to smooth newt	*Minor*	*Implementation of species specific enhancement to off-set potential significant effects includes;* *Installation of artificial refugia to act as hibernaculum within 100m of the existing dam pond.*	*Beneficial*
Decommissioning			
Designated Sites / Watercourses	*Major adverse*	*SuDS and standard Pollution Prevent Guidelines will be adhered to during decommissioning.*	*Neutral*
Wet heath	*Minor*	*Heathland restoration and enhancement according to the Outline HMP.*	*Beneficial*
Temporary disturbance to bats	*Neutral*	*No mitigation required*	*Neutral*
Temporary disturbance to otters	*Neutral*	*None required, no otters found within construction area*	*Neutral*
Temporary disturbance to badgers	*Neutral*	*One old inactive sett was recorded in the area and a low level of foraging activity means that disturbance to this species is unlikely to occur.*	*Neutral*
Temporary disturbance to common lizard	*Neutral*	*No mitigation required as no impact during the decommissioning phase is considered likely.*	*Neutral*
Temporary disturbance to smooth newt	*Neutral*	*No mitigation required as no impact during the decommissioning phase is considered likely.*	*Neutral*

Cumulative Impacts

6.314 When considered in the context of the overwhelming dominance of trends in agricultural land-use as determinants of changes in the extent and quality of habitats, and natural variation over time in species populations, it is credible to assume that in only very exceptional circumstances will direct effects in aggregation between wind farm sites have any potential to be cumulatively of concern let alone significant (in EIA terms). It is not unreasonable to assume that any such aggregate effects that may be of significance are likely to be readily apparent to those considering individual applications who can inform consideration of specific detailed measures to avoid unacceptable effects[17].

6.315 The potential for a cumulative impact between proposed and operational wind farms arises principally if species from the same population are using more than one of the sites. The likelihood of this can be assessed through an analysis of the species assemblage and by examining the likely range and territory size of those species.

[17] Review of Guidance on the Assessment of Cumulative Impacts of Onshore Windfarms, Phase 1 Report, ENTEC, September 2008

CONSENTED (LA01/2018/0200/F)

6.316 The area over which a cumulative impact may be felt should also be considered, and in the present case, wind farms within a radius of 30km have been identified. However, Dunbeg, Dunbeg extension, Dunmore and Dunmore 2 are considered to be the only wind farms likely to have the potential to have a significant cumulative effect.

6.317 The following sections assess the potential cumulative impacts, as a result of the Development with other proposed and operational wind farms, where relevant.

Designated sites

6.318 Wind farms have the potential to have an adverse impact on the quality of downstream waters and on the diversity and conservation value of aquatic ecosystems, in this case the River Roe & Tributaries SAC. Flow of peat- and silt-laden water from a number of wind farms within a restricted catchment has the ability to increase these impacts cumulatively to a level that could reduce fish and invertebrate populations and diversity. Measures to retain surface water on site and to enable infiltration to groundwater at acceptable rates are required at all wind farm sites, as standard best practice. This includes the implementation of detailed mitigation arising from the development of a CMS (Construction Method Statement). Issues of potentially major significance, particularly where salmonid waters are present, are considered to be not significant as a result of the routine implementation of these measures.

6.319 Gorcorbies ASSI and Ballyrisk More ASSI are both located in close proximity to the application site. However, both are separated from the application site by roads and given that their designation features are species-rich wet grassland, there is limited potential for any cumulative impact(s). There is the remote chance of air or water borne pollution during construction reaching these adjacent lands. However, with the successful implementation of the mitigation measures previously outlined (including a detailed CMS, the likelihood of any impact (cumulative or otherwise) is considered to be not significant.

Habitats

6.320 In the uplands there is some concern over the potential effects of the access track network required by wind farm developments on the hydrology of peatlands which are important both because they are generated by and support highly valued specialised vegetation, and as natural carbon stores.

6.321 The Development will result in a loss of low and moderate quality habitats, which are of local conservation value. Restricted areas of habitat of higher conservation value have been avoided and their interest maintained. In the case of Dunbeg South, this additional loss of habitats is considered to be not significant because the degraded wet heath habitat is of local conservation value and is widespread both locally and throughout the region. It is therefore within the ability of the resource to absorb this loss. Those habitats that are of greater value, principally residual

CONSENTED (LA01/2018/0200/F)

areas of blanket bog and upland flush/fen/swamp, have been avoided and there will be no significant impact on them.

Bats

6.322 Overall only 484 bat passes were recorded at the turbine locations across the entire 2017 survey season. In contrast, there were 704 bat passes recorded at the adjacent habitat features, again this is considered to be a low level of activity. This demonstrates that activity was more strongly correlated with habitat features, such as the edges of adjacent coniferous forestry plantations, than at proposed turbine locations. Therefore, low numbers of bats were recorded foraging over the site, both at proposed turbine locations and adjacent habitat features. The main bat foraging and commuting routes have also been avoided during the emplacement of infrastructure.

6.323 Outcomes which must be considered are whether the cumulative impact of wind farm developments will adversely affect the distribution of these species of European conservation concern, and whether there will be population-scale effects on any bat species. The most contentious species issue currently is the extent to which bats may be at risk of collision with turbines. There is potential for bats to forage across more than one wind farm and to be subject to at least the potential of an increased risk of collision. As yet there is no agreement on how best to address it, though specific impacts on bats have been addressed through the incorporation of precautionary stand-offs to habitat features (foraging and commuting areas), as well as the selection of windfarm sites with ‘low’ levels of bat activity.

6.324 The development therefore has the potential to increase bat mortality resulting from collision and barotrauma, and this impact is likely to be additive to similar impacts arising from the operation of other wind farms, at both local and regional scales. The absence of data relating to bat life cycles and to the intensity and spatial variation of activities during different parts of those life cycles means that there is difficulty in determining the significance of the cumulative impacts on bat species. It is likely that the significance of cumulative impacts will also vary between species, depending on inter alia local and regional abundance of different species, prey preferences, preferred flight height, preferred foraging habitat, degree of attraction to or deflection from turbines, extent of migratory behaviour, swarming characteristics and variability of behaviour in response to varying weather conditions. Bat behaviour and collision risk are likely to be highly site-specific during much of the annual cycle, but more generalised patterns, such as those relating to migration, may be superimposed on these local factors.

6.325 Whilst evidence is beginning to be revealed through a combination of academic research and on-going monitoring at wind farm sites, certainty with regard to cumulative effects is far from clear. This is because the effects of wind farms on bat populations is dependent on a wide variety of factors including; the turbine layout, the species of bats present, existing environmental conditions and the

CONSENTED (LA01/2018/0200/F)

mitigation measures proposed at each wind farm (or individual turbine). Therefore, a clear understanding of the patterns of bat activity at individual wind farms (during the development of EIA's) is essential.

6.326 In the case of the Development a clear understanding of the patterns of bat activity at the site and surrounding area was used to inform the final layout and recommend mitigation, in the form of precautionary stand-off distances to habitat features, and the maintenance of said buffers for the 30-year lifetime of the wind farm.

6.327 The potential cumulative impact of the Development with (the wind farms and single turbines (within 5km)) was specifically considered in relation to bats. These included;

- Dunbeg (1.35km From T9);
- Dunbeg Extension (0.8km from T9);
- Dunmore (2.25km from T9);
- Dunmore Extension (2.36km from T9);
- Rigged Hill (4.29km from T6);
- Croaghan (4.55km from T9);
- Single Turbine (3.30km from T4);
- Single Turbine (3.25km to T4); and,
- Single Turbine (0.49km from T9)).

6.328 The stand-off distances of the existing turbines were measured (in addition to the 9 turbines in the Development), in relation to habitat features such as watercourses and plantation edges (areas which are known to have higher levels of bat activity). None of the approved turbines encroached on the Natural England stand-off distance to the edge habitat features. Therefore, if precautionary stand-off distances were applied retrospectively to the windfarms described, the layouts would comply with the guidance (with the implementation of agreed mitigation at the respective sites listed above). The cumulative impact (of the 9 proposed Dunbeg South turbines) is not considered to alter the existing predicted impacts, therefore the cumulative impact is not considered to be significant.

Otter

6.329 The Development will not have adverse impacts on the ability of otters to forage in local watercourses (i.e. barrier effect), and will not prevent the use of watercourses as dispersion routes. The Development will not add to any cumulative effects on the species that might have been detected as the result of the cumulative presence of wind farms in the local area. The potential for disturbance to otters during the construction of the Development was assessed and any cumulative impact on otters is not considered to be significant.

Badger

6.330 It is not anticipated that the Development will have a measurable impact on local badger social groups and the wind farm will therefore not contribute to any cumulative impacts that may be detectable from the operation of other wind farms

CONSENTED (LA01/2018/0200/F)

in the local area. The cumulative impact on badgers is considered to be not significant.

Herpetofauna

6.331 The limited distribution of these species across much of the site and the habitat improvements specifically designed to favour them, indicate that the Development will not add to any adverse cumulative effects that may arise from wind farm developments generally. The cumulative impact on the site herpetofauna is therefore considered to be not significant.

Trans-boundary effects

6.332 Potential trans-boundary effects of the Development on designated sites and on mobile species (i.e. bats) were assessed. The effects are considered to be the same as those described in the relevant sections (i.e. cumulative effects). Trans-boundary effects are therefore not considered to be significant. Potential trans-boundary effects of the Development on Annex 1 migratory bird species are assessed in Chapter 7 – Ornithology.

Conclusions

6.333 There is no regular usage of the area by otter, marsh fritillary or argent & sable moth, therefore no impacts to these species is likely. Mitigation for the herpetofauna found on site (smooth newt and common lizard) is proposed. This involves the provision of artificial refugia and habitat management, as well as drift fencing and mowing/hand clearance during the construction phase. Badger setts found during survey have all been buffered by 25m.

6.334 The proposed outline HMP will ensure compensation for areas of NI Priority Habitat lost under the footprint of the Development and should also result in enhancement of the local site ecology.

6.335 The mitigation measures specified in Table 6.18 will be adhered to, ensuring that any potential impacts to bats will be negligible. In conclusion and based on current knowledge this would appear to be a site posing little risk to bats or bat populations, however a BMP has been recommended as a precaution.

6.336 Therefore, the potential effects of the Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a minor adverse or neutral effect that would not adversely affect the ecological integrity of the site and the wider area.

6.337 An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that there is no significant impact.

CONSENTED (LA01/2018/0200/F)

References

6.338 References have been inserted as footnotes within the body of the document.

Abbreviations

AONB	Area of Outstanding Natural Beauty
ARGUK	Amphibian and Reptile Groups of the UK
ASSI	Area of Special Scientific Interest
BSBI	Botanical Society of the British Isles
CEDaR	Centre for Environmental Data and Recording
CIEEM	Chartered Institute of Ecology and Environmental Management
CNCC	Council for Nature Conservation and the Countryside
EC	European Commission
EcIA	Ecological Impact Assessment
EIA	Environmental Impact Assessment
HRA	Habitat Regulations Assessment
HSI	Habitat Suitability Index
IROPI	Imperative Reasons of Overriding Public Interest
JNCC	Joint Nature Conservation Committee
LHP	Larval Host Plant
MNR	Marine Nature Reserve
NBN	National Biodiversity Network
NIBG	Northern Ireland Bat Group
NIEA	Northern Ireland Environment Agency
NIPS	Northern Ireland Priority Species
NNR	National Nature Reserve
NR	Nature Reserve
PPS	Planning Policy Statement
SAC	Special Area of Conservation
SLNCI	Sites of Local Nature Conservation Importance
SPA	Special Protected Area
UWT	Ulster Wildlife Trust

CONSENTED (LA01/2018/0200/F)

7

Ornithology

CONSENTED (LA01/2018/0200/F)

7 Ornithology

Introduction

7.1 This chapter assesses potential effects of the Development on bird communities. The principal objectives of the chapter are:

- To outline the scope of the assessment;
- To describe the methodologies used in completing the assessment;
- To describe the baseline bird communities found within the site and in defined surrounding buffer areas;
- To describe the potential effects on bird communities and assess the significance of these effects;
- To detail any mitigation or compensation measures that may be required and to describe any residual effects remaining after the implementation of these measures.

7.2 The ornithology assessment is supported by:

- Figures 7.1 - 7.10 and Confidential Figures 7.11 and 7.12;
- Appendices 7.1 - 7.8;
- Confidential Appendix *(containing information on breeding raptors not for release into the public domain);*
- Photographic Plates 1 – 3 (contained in the Confidential Appendix).

7.3 The Figures and Appendices are referenced in the text as necessary and listed in full at the end of the chapter.

Statement of Authority of the Author

7.4 The ornithology assessment (including all associated field-work) has been carried out by David Steele:

- Professional qualifications - B.Sc. (2i Honours), Zoology, University of Aberdeen (1988);
- Professional experience – 29 years working as a professional ornithologist throughout Britain and Ireland, covering a wide range of bird species and methodologies including those relevant to on-shore wind farm work - raptor monitoring, moorland bird surveys and breeding wader surveys. For the last 15 years working as a freelance consultant and has completed the fieldwork and ornithology assessments for 15 wind farm proposals in Northern Ireland and also carried out ornithological monitoring at several operational wind farm sites.

CONSENTED (LA01/2018/0200/F)

Legislation and Policy Guidance

Legislation

7.5 The ornithology assessment has been carried out with reference to the following key pieces of legislation:

- The Wildlife (Northern Ireland) Order 1985 (amended) which describes general protection measures for wild birds and in particular Schedule 1 to the Order which details those species (for example raptors) that have special levels of protection;
- Annex 1 of the EC Birds Directive which details those bird species which are of particular conservation concern in Europe and which should be subject to special measures concerning their habitats in order to ensure they maintain a favorable conservation status.

Policy Guidance

7.6 In line with the current policy of the Northern Ireland Environment Agency (NIEA) the assessment has been carried out with reference to the published guidance of Scottish Natural Heritage (SNH) on assessing the effects of on-shore wind farms on bird communities outside designated conservation areas[1].

Scope of Assessment

General Effects of Wind Farms on Birds

7.7 On-shore wind farms can potentially effect birds in two main ways – by displacement of birds around the turbine array (leading to indirect habitat loss) or by creating a risk of collisions with the turbines. Direct habitat loss from wind farms is usually relatively small scale compared to other sorts of developments and in most cases is unlikely to be significant for bird communities[2].

7.8 The ornithology assessment therefore focuses on assessing potential displacement effects and (where relevant) collision risk effects of the Development. The assessment considers the potential effects on the bird communities found within the site and in defined surrounding buffer areas. Where relevant, the assessment also considers the potential cumulative effects resulting from other existing, consented or proposed wind farms in the vicinity of the Development.

Bird Species Requiring Assessment

7.9 All wild birds are subject to a general level of protection through the Wildlife and Countryside Act (Wildlife Order in Northern Ireland) and the EU Birds Directive but

[1] SNH (2006): Assessing the significance of impacts of on-shore wind farms on birds out-with designated areas (Guidance Note, July 2006)

[2] Percival, S. (2005): Birds and wind farms, what are the real issues? (British Birds 98 / 4)

CONSENTED (LA01/2018/0200/F)

in line with SNH guidance only some bird species should generally be of concern in relation to wind farms:

- Birds on Annex 1 of the EU Birds Directive;
- Birds on Schedule 1 to the Wildlife and Countryside Act (Wildlife Order in Northern Ireland);
- Regularly occurring migratory species;
- Species listed on the non-statutory lists of birds of conservation concern for the UK and Ireland.

7.10 The SNH guidance recommends that assessment of the effects of a wind farm on birds normally need not consider bird communities that do not come under the above categories. *Additionally, SNH are of the view that passerine species are not significantly impacted by wind farms*[3]*.* However, all bird species (including passerine species) need to be considered in relation to the general levels of statutory protection afforded by the Wildlife (Northern Ireland) Order[4].

Consultation

7.11 Ornithology scoping responses in relation to the Development were received from NIEA and the Royal Society for the Protection of Birds (RSPB).

7.12 Northern Ireland Raptor Study Group (NIRSG) responded to a formal request for information on breeding raptors in the vicinity of the Development and also discussed raptor breeding activity in the area on an informal basis.

Assessment Methodology

Field Survey Methods

7.13 Field surveys were carried out in line with the current SNH guidance for bird surveys at on-shore wind farms[5]. The different methodologies employed during the field surveys are described below.

Breeding Bird Surveys

7.14 Breeding bird surveys were carried out over the site and a 500 m buffer around the proposed turbine locations. The surveys were completed between mid-March and early July in two consecutive breeding seasons as detailed in Table 7.1. Five survey visits were completed in the first baseline year (2016) and six visits in the second baseline year (2017). The early (March) visits were particularly aimed at detecting those species which return to their territories early in the spring (e.g. curlew and lapwing).

[3] SNH (2014): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Note, May 2014)

[4] NIEA: The Wildlife Law and You in Northern Ireland (Northern Ireland Environment Agency Biodiversity Series Booklet)

[5] SNH (2014): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Note, May 2014)

CONSENTED (LA01/2018/0200/F)

7.15 The surveys were completed using an adapted Moorland Bird Survey (MBS) method (also known as "Brown and Shepherd" method). This method is suitable for surveying breeding waders (e.g. curlew) and also red grouse. SNH do not generally recommend survey of moorland passerines, however, on sites were breeding waders are present only in small numbers then it is possible to include passerines in the MBS method.

Curlew

7.16 In line with the current requirements of NIEA and RSPB the survey area for curlew was extended to include an 800 m buffer around the proposed turbine locations. This additional survey coverage was achieved by several methods: (1) by scanning the additional buffer area with binoculars during the standard MBS visits (any areas with access permissions were also walked through); (2) during the activity assessment surveys by scanning areas of potential curlew habitat from the vantage points and also by listening for calling / singing birds; (3) by way of general "look-see" survey from roads while moving around the area during the wider area raptor searches.

Table 7.1 – Breeding Bird Survey Visits

Visit Date (D/M/Y)	Observer	Start and Finish Time	Weather / Remarks
22/03/16	D. Steele	0830-1230	Overcast, mild, dry, almost calm
29/04/16	D. Steele	0800-1300	Mainly sunny, partial white cloud, moderate northwest breeze F3-4
30/05/16	D. Steele	0730-1300	Overcast becoming sunny, light or moderate northerly breeze F2-3, quite warm
10/06/16	D. Steele	0700-1300	Bright start then increasing cloud, warm and humid, light variable breeze F2-3, thunder storm by end of survey
09/07/16	D. Steele	0830-1230	Early rain clearing then fine, light southwest breeze F2-3
28/03/17	D. Steele	0915-1515	Hazy sun then cloudy, light southwest breeze F2-3, mainly dry (light shower), mild
06/04/17	D. Steele	1000-1600	Sunny spells then cloudy, dry, feeling cool in light northwest breeze F2-3
26/04/17	D. Steele	0830-1430	Partial cloud, sunny spells, light variable breeze F1-2 or nearly calm, cold start and staying cool, light hail shower
10/05/17	D. Steele	0730-1300	Sunny cold start, light variable breeze F1-2, increasing high cloud and becoming mild
24/05/17	D. Steele	0730-1330	Cloudy start, warm and sunny for a time then cloudy again, humid, light westerly breeze F3
21/06/17	D. Steele	0915-1515	Light cloud, warm, humid, light southwest breeze F1-2

Winter Season Surveys

7.17 Surveys for wintering and migrating birds were carried out over the same area as the breeding bird surveys. Surveys were completed at approximately monthly intervals during December 2015 to early March 2016 (total four surveys) and during October 2016 to February 2017 (total six surveys) as detailed in Table 7.2. The

CONSENTED (LA01/2018/0200/F)

surveys were completed using the same adapted MBS method as used for the breeding bird surveys. Migratory species (e.g. golden plovers) were also looked for during the early season breeding bird survey visits.

Table 7.2 – Winter Season Survey Visits

Visit Date (D/M/Y)	Observer	Start and Finish Time	Weather / Remarks
03/12/15	D. Steele	1030-1430	Cloudy, cold, light variable breeze F1-2 or almost calm
07/01/16	D. Steele	0800-1200	Partial cloud, cold, long sunny spells, light or moderate westerly breeze F3-4
18/02/16	D. Steele	1200-1700	Partial cloud, long sunny spells, light southwest breeze F2, passing snow showers clearing later in survey
10/03/16	D. Steele	0800-1300	Light cloud, sunny spells, light or moderate northwest breeze F3-4, showers of sleet later in survey
20/10/16	D. Steele	0930-1430	Light cloud, long sunny spells, nearly calm, cold start but feeling mild later in sun
01/11/16	D. Steele	1200-1730	Sunny then partial cloud, light northwest breeze F2-3; survey till dusk (sunset at1650)
21/11/16	D. Steele	1015-1515	Sunny (increasingly hazy over day), cold (just above freezing), light northeast breeze F1-2, patchy lying snow over top of site (above 300m)
12/12/16	D. Steele	1030-1530	Partial cloud, sunny spells, quite mild, moderate southeast breeze F3-4
05/01/17	D. Steele	1030-1530	Partial cloud, long sunny spells, cold, light to moderate southerly breeze F2 increasing F3
03/02/17	D. Steele	1100-1630	Sunny then light cloud, light to moderate southerly breeze F2-3

Activity Assessments (Vantage Point Surveys)

7.18 An assessment of activity by raptors and other relatively large aerial species (e.g. migrating swans and geese) within the site and a surrounding buffer area (to within 500 m of the proposed turbine locations) was carried out from three vantage points during 21 consecutive months commencing in December 2015 as summarized in Tables 7.3A and 7.3B. A more detailed (monthly) summary of survey effort is provided in Appendix 7.1 and details of the individual watches (dates, times and weather conditions) are provided in Appendix 7.2.

Table 7.3A – Summary of Vantage Point Survey Effort (Hours Completed)

Baseline Year	VP1	VP2	VP3	Total
Non-breeding 1 (Dec 2015 – Feb 2016)	20.25	17.75	14.25	52.25
Breeding 1 (Mar – Aug 2016)	35.75	36.5	39	111.25
Non-breeding 2 (Sep 2016 – Feb 2017)	36	34.75	36.5	107.25
Breeding 2 (Mar – Aug 2017)	34	38.75	42	114.75
Total	126	127.75	131.75	385.5

CONSENTED (LA01/2018/0200/F)

Table 7.3B – Summary of Vantage Point Survey Effort (No. of Watches Completed)

Baseline Year	VP1	VP2	VP3	Total
Non-breeding 1 (Dec 2015 – Feb 2016)	10	6	5	21
Breeding 1 (Mar – Aug 2016)	12	13	13	38
Non-breeding 2 (Sep 2016 – Feb 2017)	17	12	15	44
Breeding 2 (Mar – Aug 2017)	12	13	14	39

7.19 Vantage points were selected in line with current SNH guidance, within any constraints imposed by access restrictions. The locations of the vantage points and the associated visibility coverage are shown in Figure 7.1. Note that there is a degree of overlap in the visibility coverage from the different vantage points – this means that over a significant part of the area of interest the cumulative survey effort is greater than the individual vantage point hourly totals given in Table 7.3A.

7.20 In line with SNH guidance, visibility is shown at the lowermost height passed through by the rotor blade tips (which in this case is 50 m above ground level). For the assessment of collision risk, visibility at rotor height is more important than visibility at or near the ground. However it is important to note that during the vantage point surveys the observer was content with visibility at or near ground level.

7.21 The activity assessment surveys were completed in line with the SNH method statement for vantage point watches[6]. The target species were: (1) all raptor species, but with priority given to the three Annex 1 species (hen harrier, peregrine and merlin); (2) whooper swans and geese (winter and migration periods only). Other species (e.g. golden plovers, gulls, cormorants and grey herons) were recorded as secondary species.

7.22 Vantage point watches were carried out at different times of day and in a range of weather conditions within the constraints imposed by the SNH method statement. Most watches were of three hours duration but some shorter or longer watches (not shorter than one hour or longer than four hours) were also completed.

Roost Surveys

7.23 During the course of the activity assessment surveys a series of vantage point watches were targeted at detecting any roosting or pre-roosting activity by hen harriers. These watches were mostly carried out during the winter season. Watches commenced at least 30 minutes before sunset and continued till dusk (typically 30-40 minutes after sunset). A total of 17 watches were completed as

[6] SNH (2014): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Note, May 2014)

CONSENTED (LA01/2018/0200/F)

summarized in Table 7.4. Further details of the watches are provided in Appendix 7.3.

Table 7.4 – Summary of Vantage Point Watches Completed to Dusk

Baseline Year	VP1	VP2	VP3	Total
Non-breeding 1 (Dec 2015 – Feb 2016)	4	2	2	8
Breeding 1 (Mar – Aug 2016)	0	0	0	0
Non-breeding 2 (Sep 2016 – Feb 2017)	3	4	1	8
Breeding 2 (Mar – Aug 2017)	0	1	0	1
Totals	7	7	3	17

Wider Area Raptor Surveys

7.24 Surveys of breeding raptors were carried out in the wider area around the Development. The surveys focused on the three Annex 1 species (hen harrier, peregrine and merlin) although signs of breeding activity by the two non-Annex 1 species (buzzard and kestrel) were also looked for. In line with current SNH guidance[7] the area of interest of these surveys was limited to a 2 km radius around the proposed turbine locations for the Annex 1 species and 1 km radius for the non-Annex 1 species. For hen harriers, however, based on the foraging observations made during the activity assessment surveys and also considering the distribution of potential nesting habitat in the surrounding area, the area of interest was extended to 3 km radius.

7.25 The surveys were completed in two consecutive breeding seasons (2016 and 2017) and using appropriate methodologies for the different target species[8]. Importantly, the fieldworker for the surveys (David Steele) has extensive experience of searching for the target species and of their preferred breeding habitats in a Northern Ireland context. During the course of the surveys the fieldworker also had contact with NIRSG fieldworkers who were active in the area - contact was on an informal basis only and was additional to the formal request for hen harrier records.

7.26 The surveys were carried out from roads, forestry tracks and other areas with public access within the area of interest. To avoid disturbance, any breeding activity was watched from remote or unobtrusive locations and under no circumstances were nests approached or visited. Further details of the survey activity carried out within the area of interest during the two survey years are provided in Appendix 7.4. (Note: signs of raptor breeding activity were also looked for during the activity assessment surveys).

[7] SNH (2014): Recommended bird survey methods to inform impact assessment of onshore wind farms (Guidance Note, May 2014)

[8] Hardy, J. et al. (2009): Raptors – a Field Guide to Survey and Monitoring (2nd Edition)

CONSENTED (LA01/2018/0200/F)

Assessing Significance of Effects

Favourable Conservation Status

7.27 The assessment of the significance of effects on bird communities follows the Favourable Conservation Status (FCS) approach recommended by SNH[9]. This approach considers any potential effects (*see paragraph 7.7*) on a given species and any expected reduction in numbers and sets these in the context of the total national or regional population and distribution of the species. This should then enable an evaluation of the test: *will an effect be such as to adversely affect the favourable conservation status of the species concerned (or to prevent a recovering species from achieving favourable conservation status) at the national or regional level.* The conservation status of the bird communities and species considered by the ornithology assessment (*see paragraphs 7.9 – 7.10*) follows the current non-statutory list of birds of conservation concern published for the island of Ireland[10].

Significance Threshold

7.28 For assessing the significance of bird populations (or any expected losses at the national or regional level) the generally accepted 1% threshold level is used: *if a population (or loss to a population) exceeds 1% of the national or regional population of the species then it should be considered to be significant.*

Confidence in Predictions

7.29 In the assessment of effects, the probability of any given effect occurring (and the probability of any likely effects being significant at the regional level) are described using the scale suggested by the Institute of Ecology and Environmental Management (IEEM)[11] – the scale is given in Appendix 7.8.

Description of Baseline Bird Communities

Breeding Birds

Red Grouse

7.30 Sightings or other signs (e.g. droppings or feathers) of red grouse during the baseline surveys are detailed in Table 7.5 and the locations of the sightings / signs are shown in Figure 7.2. Within the area of interest (the site plus a 500 m turbine buffer) there was one sighting of a red grouse and signs (droppings) were found on one date. There was one additional red grouse sighting (of a pair) from outside the area of interest but included here as it was in a contiguous area.

[9] SNH (2006): Assessing the significance of impacts of on-shore wind farms on birds out-with designated areas (Guidance Note, July 2006)

[10] Colhoun, K and Cummins, S (2013): Birds of Conservation Concern in Ireland 2014-2019 (Irish Birds 9: 523-544)

[11] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

CONSENTED (LA01/2018/0200/F)

7.31 The distribution and very low incidence of sightings and signs of presence would indicate that just one wide-ranging pair of red grouse is present in the vicinity and that overlap of their territory with the area of interest is minimal.

Table 7.5 – Red Grouse Sightings within the Site and 500 m Buffer

Date	Survey Method	Details	Distance to Nearest Proposed Turbine	Remarks
03/02/2016	MBS (winter)	Fresh droppings	250 m (T6)	
30/03/2017	Vantage point	Territorial male	400 m (T4)	
26/04/2017	MBS (breeding)	Pair	950 m (T3)	Additional sighting (outside area of interest)

Snipe

7.32 Records of territorial activity by snipe during the baseline surveys are detailed in Table 7.6 and the locations of the territorial activity are shown in Figure 7.3. All the records were of birds calling from the ground ("chipping") or engaged in brief, low-level display flights with the birds subsequently seen to settle on the ground – such observations are likely to give a good indication of territory locations.

7.33 The records of territorial activity indicate the presence of four territories (or four breeding pairs) of snipe within the area of interest (the site plus a 500 m turbine buffer).

7.34 The approximate distances of all territorial birds to the nearest proposed turbine location (measured in GIS) are shown in the table. From these observations, the distance of each of the four territories (centre of territory) to the nearest proposed turbine location is measured as: 120 m, 240 m, 300 m and 420 m.

Table 7.6 – Records of Territorial Snipe within the Site and 500 m Buffer

Date	Survey Method	No. of Territorial Snipe Recorded	Distance of Bird(s) to Nearest Proposed Turbine Location
29/04/2016	MBS	1	70 m (T5)
09/06/2016	Vantage point	1	380 m (T2)
10/06/2016	MBS	4	20 m (T5), 200 m (T9), 270 m (T6), 400 m (T9)
26/04/2017	MBS	1	400 m (T2)
28/04/2017	Vantage point	1	260 m (T9)
10/05/2017	MBS	1	450 m (T2)
24/05/2017	MBS	2	240 m (T6), 260 m (T5)

Curlew

7.35 Curlew activity during the baseline surveys is summarized in Table 7.7. During the two year baseline period there was one curlew sighting (of a single bird) within the

CONSENTED (LA01/2018/0200/F)

area of interest (the site plus an 800 m turbine buffer). The sighting was made during an MBS visit on 30th May 2016 (in baseline year 1).

7.36 The location of the sighting is shown in Figure 7.3. It was approximately 60 m from the northern boundary of the site and the A37 road, and approximately 4004 m from the nearest proposed turbine location (T9). At the approach of the surveyor the bird flew directly away to the southwest - no alarm calls or other behaviours indicative of breeding were noted, and the bird was not seen again during the rest of the survey (the location was checked again carefully several hours after the initial sighting).

No Curlew Sightings in Year 2

7.37 Importantly, there were no curlew sightings during the two early season MBS visits in year 1 (curlew are establishing their territories at this time and are usually relatively easy to locate) and no curlew sightings were made at any stage during the six MBS visits completed in baseline year 2.

7.38 Also importantly, no curlews were located during the activity assessment surveys in either baseline year. The vicinity of the 2016 sighting is just 300 m from the location of VP1 and is clearly visible from the vantage point - any curlew activity in this area would have been readily detected by the surveyor during the total 35.75 hours of watches completed at VP1 during March to August of year 1 and 34 hours during March to August of year 2.

7.39 Considering the above observations and the level of survey effort it is certain that no curlew territories have been established within the area of interest during the two year baseline period. The single curlew sighting in May 2016 is most likely to relate either to a wandering individual (for example a non-breeding bird or a failed breeder from a distant location) or possibly a late spring migrant heading north.

Table 7.7 – Summary of Curlew Activity within the Site and 800 m Buffer

Date	Survey Method	No. of Curlew Pairs Recorded	No. of Single Curlews Recorded
22/03/16	MBS	0	0
29/04/16	MBS	0	0
30/05/16	MBS	0	1
10/06/16	MBS	0	0
09/07/16	MBS	0	0
28/03/17	MBS	0	0
06/04/17	MBS	0	0
26/04/17	MBS	0	0
10/05/17	MBS	0	0
24/05/17	MBS	0	0

CONSENTED (LA01/2018/0200/F)

Date	Survey Method	No. of Curlew Pairs Recorded	No. of Single Curlews Recorded
21/06/17	MBS	0	0

Passerines and Other Bird Species

7.40 The baseline for breeding passerines and other bird species within the area of interest (the site plus a 500 m turbine buffer) is summarized in Table 7.8 and the locations of these species (breeding pairs / territories or singing males) are shown in Figures 7.4, 7.5A and 7.5B. The baseline presented in the table and the bird locations shown in the figures are for the most recent year of survey (2017).

7.41 A total of 22 passerine and other species were confirmed or probably breeding within the area of interest. An additional three species (grey heron, sand martin and wheatear) were recorded as transient visitors that were not breeding within the area of interest. Most species were present in small numbers only and were distributed very locally within or around the fringes of the area of interest. Only two passerine species (skylark and meadow pipit) were widespread over the area of interest.

Table 7.8 – Summary of Breeding Passerines and Other Bird Species within the Site and 500 m Buffer

Species	No. of Breeding Pairs / Territories	Remarks
Little grebe	1	At small pond on eastern boundary of 500 m buffer
Moorhen	1	At small pond on eastern boundary of 500 m buffer
Grey heron	0	Non-breeding transient (max. count one bird)
Mallard	1	At small pond on eastern boundary of 500 m buffer
Cuckoo	2	Singing males on the site boundary
Swallow	2	Nesting in road culvert at site boundary with the A37
Sand martin	0	Non-breeding transient (max. count 20 birds)
Skylark	23	Widespread over the area of interest
Meadow pipit	37	Widespread over the area of interest
Stonechat	6	
Wheatear	0	Non-breeding spring transient (max. count 20 birds)
Robin	2	
Song thrush	3	
Mistle thrush	1	
Wren	6	
Grey wagtail	2	

CONSENTED (LA01/2018/0200/F)

Species	No. of Breeding Pairs / Territories	Remarks
Pied wagtail	1	
Willow warbler	4	
Grasshopper warbler	1	
Blackcap	1	
Starling	1	Nesting in old hawthorn tree
Chaffinch	3	
Hooded crow	2	Two nests
Jackdaw	2	Nesting in old building near site entrance
Reed bunting	1	At small pond on eastern boundary of 500 m buffer

Winter Season Birds

Golden Plovers

7.42 Sightings of golden plovers within the area of interest (the site plus a 500 m turbine buffer) during the baseline surveys are detailed in Table 7.9 and the locations of the sightings are shown in Figure 7.10. The observed distribution, small flock sizes and low incidence of sightings of golden plovers indicates that use of the area of interest by this species is minimal and confined to the winter period. There has been no indication of use of the area by migrating flocks in spring.

Table 7.9 – Golden Plover Sightings within the Site and 500 m Buffer

Date	Survey Method	No. of Birds	Remarks
03/12/2015	MBS (winter)	32	Flock disturbed from ground
08/12/2015	Vantage point	20	Flock circling then settled on ground
18/02/2016	MBS (winter)	4	Flock disturbed from ground
03/02/2017	MBS (winter)	1	Single bird disturbed from ground
03/02/2017	MBS (winter)	9	Flock disturbed from ground

Other Species

7.43 Sightings of other species within the area of interest (the site plus a 500 m turbine buffer) during the winter and migration season are summarized in Table 7.10 and the locations of selected species of interest are shown in Figure 7.10. The baseline presented in the table and the bird locations shown in the figure are for the two baseline winter periods combined (total of ten winter MBS visits).

7.44 A total of 23 species (excluding golden plover) were recorded within the area of interest during the winter and migration seasons. The most regularly recorded species (noted on all surveys) were snipe, stonechat and raven. Snipe were recorded widely over the area of interest but the density of birds was low and most

CONSENTED (LA01/2018/0200/F)

records were of single birds – there has been no indication of any significant snipe roosting or resting areas within the area of interest.

7.45 Wren, hooded crow, magpie and jackdaw were recorded on about half of the survey visits. Numbers of hooded crows in the area were generally small (less than ten birds in a day) except for one record of a flock of 30 birds which had been attracted to a sheep carcass on the hill.

7.46 The remaining species were recorded on a small number of survey visits only. There are two small ponds within the area of interest but there has been no suggestion that these are used by wildfowl on a regular basis – mallard was the only species recorded and the numbers involved were very small.

Table 7.10 – Summary of Winter Bird Records within the Site and 500 m Buffer

Species	Max. Count	No. of MBS Visits on which Species Recorded (N=10)	Remarks
Snipe	10	10	Max. flock size six birds
Jack snipe	1	2	Singles on 18/02/2016 and 19/12/2016
Woodcock	1	1	Disturbed from ground, 13/12/2016
Grey heron	1	1	At small pond within site boundary
Mallard	3	2	At small pond within site boundary
Skylark	2	2	October and February only
Meadow pipit	20	6	
Dipper	1	1	
Grey wagtail	2	3	
Pied wagtail	2	4	
Mistle thrush	1	2	
Redwing	10	2	
Fieldfare	1	1	
Stonechat	4	10	
Wren	4	5	
Jackdaw	20	5	
Hooded crow	30	5	
Raven	7	10	
Magpie	4	5	
Starling	60	2	At fields near A37 road
Goldfinch	80	2	At fields near A37 road
Redpoll	15	2	

CONSENTED (LA01/2018/0200/F)

Species	Max. Count	No. of MBS Visits on which Species Recorded (N=10)	Remarks
Snow bunting	12	1	Small flock, 19/12/2016

Activity Assessments

Hen Harriers

7.47 Activity by hen harriers within the area of interest (the site plus a 500 m turbine buffer) during the baseline period is summarized in Tables 7.11A and 7.11B. The respective flight-lines are shown in Figure 7.6. Further details of the individual hen harrier sightings are provided in Appendix 7.5.

7.48 The sightings indicate negligible hen harrier activity within the area of interest during the non-breeding season (both baseline years) and during the breeding season in baseline year 1. However during the breeding season in baseline year 2 a significant amount of hen harrier foraging activity was observed. (Note: no harrier nesting activity was recorded within the site and 500 m buffer area during the baseline period).

Male Foraging

7.49 The foraging activity recorded during the breeding season in baseline year 2 was mostly attributable to an adult male harrier. The sightings indicated that a single male bird was involved and it was also confirmed that this was the same male bird that was attending the confirmed harrier nest located within the wider surrounding area in baseline year 2 (Table 7.17 and Confidential Appendix). The complete absence of male foraging activity during the breeding season in baseline year 1 would correlate with the absence of a confirmed nest in the wider surrounding area in that year.

7.50 The male foraging activity observed within the area of interest in baseline year 2 was in the range of 2.5 – 4 km from the location of the confirmed nest and this would be in keeping with the expected foraging range for breeding hen harriers in Northern Ireland (*D. Steele personal observations*). The observed activity was distributed widely over the site and 500 m buffer area but the density of the flight-lines suggests relatively greater activity in the area to the south of the turbine array (between the proposed turbine locations and the southern boundary of the site).

7.51 Foraging activity by the male harrier was greatest during July, which is the period during which the young harriers are approaching fledging and therefore in greatest need of a food supply. Foraging activity seemed to be significantly less during May and June, which is in keeping with the timing of the nesting attempt. During observations made at the confirmed nest site (Confidential Appendix and Confidential Figures 7.11 and 7.12) it was confirmed that the male harrier was also foraging in areas immediately surrounding the nest (within 1 km) and also in areas

CONSENTED (LA01/2018/0200/F)

extending generally to the south of the nest (i.e. in areas other than the site of the Development and buffer area).

Female Foraging

7.52 The two sightings of a foraging female harrier within the site and buffer area were also during July and it was confirmed that this was the same female bird that was attending the confirmed nest. As with the male bird, the female bird was also observed (in July) foraging in areas immediately surrounding the nest and in areas extending generally to the south of the nest (Confidential Appendix). Indications are that the female bird was using these areas (which are generally closer to the nest) in preference to the site and 500 m buffer area, as sightings in the latter area where significantly less than for the male bird. There were no sightings of the female bird foraging during the earlier part of the nesting period – this is in keeping with the nesting behaviour of hen harriers (female birds remain in the close vicinity of the nest during the incubation and early nestling periods, with foraging during these times being predominantly by the male bird).

Juvenile Foraging

7.53 During August (baseline year 2) there were three sightings of juvenile harriers (involving at least two different individuals) foraging within the site and buffer area – all three sightings were on the same date (18th August) with no further sightings during follow-up surveys on 22nd and 30th August. These sightings of juveniles were confirmed to refer to the fledged young from the confirmed nest site (Confidential Appendix) involved in post-fledging dispersal – during the immediate fledging period (about 10 - 14 days) juvenile harriers remain within 500 m or so of the nest site, then disperse into the wider surrounding area and then further afield (*D. Steele personal observations).*

General Remarks

7.54 Note that no foraging activity was recorded for the adult male and female harriers within the site and buffer area after the end of July (i.e. after the juvenile birds had fledged and dispersed).

Table 7.11A – Summary of Hen Harrier Activity within the Site and 500 m Buffer

Baseline Year	No. of Harrier Sightings	Remarks
Non-breeding 1 (Dec 2015 – Feb 2016)	1	Adult male in travelling flight
Breeding 1 (Mar – Aug 2016)	1	Foraging “ringtail” (female or immature bird)
Non-breeding 2 (Sep 2016 – Feb 2017)	1	Foraging “ringtail” (female or immature bird)
Breeding 2 (Mar – Aug 2017)	20	Foraging birds (see Table 7.11B)
Total	23	

Table 7.11B – Details of Hen Harrier Activity in Breeding Season Year 2

CONSENTED (LA01/2018/0200/F)

Survey Month (2017)	No. of Harrier Sightings (Site + 500 m Buffer)			
	Adult males	Females	Juveniles	Total
March	2	0	0	2
April	3	0	0	3
May	1	0	0	1
June	1	0	0	1
July	8	2	0	10
August	0	0	3	3
Total	15	2	3	20

Other Annex 1 Species

Peregrines

7.55 Activity by peregrines within the area of interest (the site plus a 500 m turbine buffer) during the baseline period is summarized in Table 7.12 and the respective flight-lines are shown in Figure 7.7. Further details of the individual peregrine sightings are provided in Appendix 7.5.

7.56 The sightings indicate occasional activity by peregrines within the area of interest during the non-breeding period but there has been no indication of peregrine activity during the breeding season. The absence of activity during the breeding season would correlate with the absence of any breeding activity by peregrines within the wider surrounding area during the baseline period (Table 7.12 and Confidential Appendix).

Table 7.12– Summary of Peregrine Activity within the Site and 500 m Buffer

Baseline Year	No. of Peregrine Sightings	Remarks
Non-breeding 1 (Dec 2015 – Feb 2016)	1	Foraging or travelling flight through area
Breeding 1 (Mar – Aug 2016)	0	
Non-breeding 2 (Sep 2016 – Feb 2017)	6	Foraging or travelling flights through area
Breeding 2 (Mar – Aug 2017)	0	
Total	7	

Merlins

7.57 Activity by merlins within the area of interest (the site plus a 500 m turbine buffer) during the baseline period is summarized in Table 7.13 and the respective flight-lines are shown in Figure 7.7. Further details of the individual merlin sightings are provided in Appendix 7.5. The sightings indicate very occasional activity by merlins within the area of interest during the baseline period. Additional evidence of merlin presence (e.g. plucking posts) was looked for during the MBS visits but no signs were found.

CONSENTED (LA01/2018/0200/F)

7.58 All merlin sightings were of single birds and all (bar one) were of birds in female / immature plumage. The single sighting of an adult male bird was in early February. The single sighting during the breeding season of baseline year 1 was of a bird in female-type plumage in late May and was considered likely to relate to an immature (1^{st}-summer) bird. The two sightings during the breeding season of baseline year 2 were about one week apart in late March / early April and were considered to relate to the same individual (in female-type plumage), probably a late wintering bird or a bird returning north on migration.

7.59 All merlin sightings relate to birds engaged in foraging (or foraging-related) activity – there has been no indication of any merlin breeding activity (for example plucking posts, presence of a pair, birds giving anxiety calls or recently fledged juveniles) within the site or 500 m buffer area.

Table 7.13 – Summary of Merlin Activity within the Site and 500 m Buffer

Baseline Year	No. of Merlin Sightings	Remarks
Non-breeding 1 (Dec 2015 – Feb 2016)	0	
Breeding 1 (Mar – Aug 2016)	1	Foraging or travelling flight through area
Non-breeding 2 (Sep 2016 – Feb 2017)	2	Foraging or travelling flights through area
Breeding 2 (Mar – Aug 2017)	2	Foraging or travelling flights through area
Total	5	

Whooper Swans

7.60 Sightings of whooper swans within the area of interest (the site plus a 500 m turbine buffer) during the baseline period are summarized in Table 7.14 and the respective flight-lines are shown in Figure 7.7. Further details of the individual whooper swan sightings are provided in Appendix 7.5.

7.61 Just three flights by whooper swans were observed during the baseline period and flock size was small. The sightings are considered likely to relate to occasional movements of birds between the River Bann and Lough Foyle rather than larger scale migrations or regular diurnal movements between roosts and feeding sites. In all three instances there was relatively minor infringement of the flight-lines into the area of interest and the surveyor gained the strong impression that the birds were following the line of the A37 road.

Table 7.14 – Whooper Swan Sightings within the Site and 500 m Buffer

Date	No. of Birds	Details / Remarks
20/10/2016	6	Flock (five adults and one juvenile) flying southwest
01/11/2016	8	Flock flying northeast
21/11/2016	18	Flock flying southwest

CONSENTED (LA01/2018/0200/F)

Non-Annex 1 Raptor Species

Kestrels

7.62 Activity by kestrels within the area of interest (the site plus a 500 m turbine buffer) during the baseline period is summarized in Table 7.15 and the respective flight-lines are shown in Figure 7.8. The flight-lines are shown separately for baseline year 1 (December 2015 to August 2016) and baseline year 2 (September 2016 to August 2017). Further details of the individual kestrel sightings are provided in Appendix 7.5.

7.63 The sightings indicate that kestrels occur within the area of interest throughout the year but that activity levels are generally low – for the baseline period as a whole, an average of 0.5 minutes of activity per hour of VP effort (or one kestrel sighting per ten hours of VP effort). Over the baseline period as a whole, there is an indication of greater activity during the breeding season (one kestrel sighting per eight hours of VP effort) compared to the non-breeding season (one kestrel sighting per 13 hours of VP effort).

7.64 The distribution of the flight-lines indicates a wide spread of activity over the area of interest and there is no apparent difference in the distribution of activity between the two baseline years. *Note that the density of the flight-lines should not be interpreted as representing frequency of kestrel activity – the flight-lines indicate the distribution of flight activity only (frequency of activity should be inferred from Table 7.15).*

7.65 All sightings were of single birds engaged in foraging (or foraging-related) activity – there has been no indication of any kestrel breeding activity (for example birds giving anxiety calls, display flights or the presence of recently fledged juveniles) within the site or 500 m buffer area. The great majority of kestrels seen (31 out of total 40 birds) were identified as adult males – the observations indicate that most (if not all) of the observed male activity relates to the same wide-ranging male bird.

7.66 Five birds were identified as adult females and three birds as juveniles. The juvenile birds were observed in August and were certainly referable to dispersing birds (they were not fledged within the site or within 500 m).

Table 7.15 – Summary of Kestrel Activity within the Site and 500 m Buffer

Baseline Year	No. of Kestrel Sightings	Duration of Observed Activity (Minutes)	Activity Index (Minutes per Hour of VP Effort)
Non-breeding 1 (Dec 2015 – Feb 2016)	4	28.25	0.5
Breeding 1 (Mar – Aug 2016)	14	76.98	0.7
Non-breeding 2 (Sep 2016 – Feb 2017)	8	33	0.3
Breeding 2 (Mar – Aug 2017)	14	55.1	0.5
Totals	40	193.33	0.5

CONSENTED (LA01/2018/0200/F)

Buzzards

7.67 Activity by buzzards within the area of interest (the site plus a 500 m turbine buffer) during the baseline period is summarized in Table 7.16 and the respective flight-lines are shown in Figure 7.9. The flight-lines are shown separately for baseline year 1 (December 2015 to August 2016) and for baseline year 2 (September 2016 to August 2017). Further details of the individual buzzard sightings are provided in Appendix 7.5.

7.68 The sightings indicate that buzzard activity within the area of interest is negligible during the non-breeding season but that some activity occurs during the breeding season. The highest level of activity recorded during the baseline period has been during the breeding season of baseline year 2 - average 0.7 minutes of activity per hour of VP effort (or one buzzard sighting per six hours of VP effort). Slightly less activity was observed during the breeding season in baseline year 1. For the baseline period as a whole, there has been an average of 0.4 minutes of activity per hour of VP effort (or one buzzard sighting per 11 hours of VP effort).

7.69 The distribution of the flight-lines indicates a wide spread of activity over the area of interest and there is no apparent difference in the relative distribution of activity between the two baseline years. *Note that the density of the flight-lines should not be interpreted as representing frequency of buzzard activity – the flight-lines indicate the distribution of flight activity only (frequency of activity should be inferred from Table 7.16).*

7.70 Most sightings (23 out of total 33 birds) were of foraging (or foraging-related) activity and most sightings were of single birds. Ten sightings related to birds in soaring or direct travelling flight and there were four sightings of two or more birds (up to maximum three birds together) – however there has been no indication of any buzzard breeding activity (for example birds giving anxiety calls, display flights or the presence of recently fledged juveniles) within the site or 500 m buffer area.

Table 7.16 – Summary of Buzzard Activity within the Site and 500 m Buffer

Baseline Year	No. of Buzzard Sightings	Duration of Observed Activity (Minutes)	Average Activity (Minutes per Hour of VP Effort
Non-breeding 1 (Dec 2015 – Feb 2016)	3	10.2	0.2
Breeding 1 (Mar – Aug 2016)	12	62.9	0.6
Non-breeding 2 (Sep 2016 – Feb 2017)	0	0	0
Breeding 2 (Mar – Aug 2017)	18	82.1	0.7
Totals	33	155.2	0.4

CONSENTED (LA01/2018/0200/F)

Wider Area Raptors

Hen Harriers

7.71 Breeding activity by hen harriers within the wider surrounding area of interest (to within 3 km radius of the Development) during the baseline period is summarized in Table 7.17. Further details of breeding activity (including the location of the confirmed nest and details of nest success, fledging dates and brood size) are provided in the Confidential Appendix and the location of the nest is shown in Confidential Figures 7.11 and 7.12. *Note: the table summarizes the results of the wider area surveys completed for the ornithology assessment, with reference also to the results of the formal hen harrier data request to NIRSG. The full results of the formal data request to NIRSG (which are to a resolution of 10 km) are provided separately in the Confidential Appendix.*

7.72 During the two year baseline period one discrete pair of hen harriers was present within the area of interest but nesting occurred in only one year (baseline year 2). The records of hen harrier breeding activity provided by NIRSG for the relevant 10 km square (C72) for the seven year period 2010 – 2016 indicate presence of usually one discrete pair of harriers within square C72 (however two pairs were present in 2013) but also indicate that nesting was confirmed in just three of the seven years.

Nesting Within the Development Site

7.73 In their comments on ornithology in relation to the Development[12] NIEA indicated that hen harriers probably nested within the site in 2011 and 2013. Further details of these records are not available (records provided by NIRSG are to a resolution of 10 km only) however it is important to note that these records do not refer to confirmed nests. *During the two year baseline period there has been no suggestion of any nesting activity by harriers within the site or 500 m buffer area.*

7.74 It should also be noted that the habitat within the site is not typical of hen harrier moorland nesting sites in Northern Ireland (*D. Steele personal observations).* In particular, heather is largely absent over most of the site and where heather is present it is sparse and of low-stature, therefore not providing good cover for nesting – these points are illustrated by Photographic Plates 1-3 in the Confidential Appendix. In this regard it is significant that the confirmed nest in the wider surrounding area in baseline year 2 was not located within moorland / heather habitat but within young second-rotation conifer plantation habitat. Furthermore, all confirmed harrier nests in the two 10 km squares adjoining square C72 (squares C71 and C73) during the two year baseline period (total three nests in 2016 and three nests in 2017) were also located in young second-rotation conifer plantation habitat (*D. Steele personal observations and NIRSG pers. com.)* indicating that this is currently the preferred habitat of nesting harriers in the wider area surrounding the Development.

[12] NIEA (NED) Comments on Natural Heritage (Planning Reference LA01/2017/0781/DETEIA)

CONSENTED (LA01/2018/0200/F)

7.75 In their comments NIEA also indicated that nesting by harriers was likely within 1 km of the site boundary in 2016. Again, further details of this record are not available, however, it should be noted that while a pair of harriers was indeed present in the surrounding area in 2016 (as confirmed by the results of the baseline surveys and the NIRSG data request) a nest was not confirmed in that year.

Table 7.17 – Summary of Hen Harrier Breeding Activity within 3 km Radius of the Development

Baseline Year	Maximum Possible No. of Discrete Pairs	No. of Confirmed Nests	Distance from Nest Location to Nearest Proposed Turbine Location
2016	1	0	-
2017	1	1	3.1 km

Other Annex 1 Species

Peregrines

7.76 Breeding activity by peregrines within the wider surrounding area of interest (to within 2 km radius of the Development) during the baseline period is summarized in Table 7.18. Further details (including the locations of the potential nest sites checked) are provided in the Confidential Appendix. In their comments on ornithology in relation to the Development[13] NIEA indicated that several potential peregrine nest sites are present within 4 km of the site but that nesting is not known to have occurred at any of these locations since at least 2008. Two potential nest sites (both quarries) are located within 2 km of the site and both these locations were checked for occupancy by peregrines during the baseline period.

Table 7.18 – Summary of Peregrine Breeding Activity within 2 km Radius of the Development

Baseline Year	Breeding Activity	
	Site 1	Site 2
2016	Not occupied	Not occupied
2017	Not occupied	Not occupied

Merlins

7.77 Breeding activity by merlins within the wider surrounding area of interest (to within 2 km radius of the Development) during the baseline period is summarized in Table 7.19. In their comments on ornithology in relation to the Development NIEA indicated that merlins have been recorded within 2 - 5 km of the site and are

[13] NIEA (NED) Comments on Natural Heritage (Planning Reference LA01/2017/0781/DETEIA)

CONSENTED (LA01/2018/0200/F)

therefore likely to occur occasionally in the vicinity but that there are no records of nesting within 2.5 km.

Table 7.19 – Summary of Merlin Breeding Activity within 2 km Radius of the Development

Baseline Year	No. of Pairs	No. of Confirmed Nests	Distance from Nest Location to Nearest Proposed Turbine Location
2016	0	-	-
2017	0	-	-

Non-Annex 1 Species

Buzzards

7.78 Breeding activity by buzzards within the wider surrounding area of interest (to within 1 km radius of the Development) during the baseline period is summarized in Table 7.20. Further details of breeding activity (including the location of the confirmed nest) are provided in the Confidential Appendix.

Table 7.20 – Summary of Buzzard Breeding Activity within 1 km Radius of the Development

Baseline Year	No. of Pairs	No. of Confirmed Nests	Distance from Nest Location to Nearest Proposed Turbine Location
2016	1	1	1.1 km
2017	1	1	1.1 km

Kestrels

7.79 Breeding activity by kestrels within the wider surrounding area of interest (to within 1 km radius of the Development) during the baseline period is summarized in Table 7.21. In their comments on ornithology in relation to the Development[14] NIEA indicated that kestrels have been recorded within 2 -5 km of the site and are therefore likely to occur occasionally in the vicinity but that there are no records of nesting within 2.5 km.

Table 7.21 – Summary of Kestrel Breeding Activity within 1 km Radius of the Development

Baseline Year	No. of Pairs	No. of Confirmed Nests	Distance from Nest Location to Nearest Proposed Turbine Location
2016	0	-	-

[14] NIEA (NED) Comments on Natural Heritage (Planning Reference LA01/2017/0781/DETEIA)

CONSENTED (LA01/2018/0200/F)

Baseline Year	No. of Pairs	No. of Confirmed Nests	Distance from Nest Location to Nearest Proposed Turbine Location
2017	0	-	-

Assessment of Effects

Breeding Birds

7.80 The potential effects of the Development on breeding birds are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.22. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale[15].

General Remarks

7.81 Results of research for breeding birds[16] have suggested that the main adverse effects of wind farms for these species are probably due to disturbance displacement during construction and that wind farm operation is unlikely to have a significant effect on local breeding bird populations. The research also suggested that there are potential beneficial effects of wind farm construction on some passerine bird species.

Red Grouse

Displacement Effects

7.82 Densities of red grouse were found to be significantly reduced at wind farms during construction but had recovered one year after construction, therefore any displacement of birds due to construction would be likely to be temporary. The baseline surveys for the Development have indicated minimal activity by red grouse within the site and 500 m buffer. It is therefore extremely unlikely that there would be any significant displacement effects on red grouse.

Snipe

Displacement Effects

7.83 Densities of breeding snipe were found to decline by 53% at wind farms during construction with no recovery in densities after construction. This finding was similar to that of other research, which indicated a decline of 47% in snipe breeding densities within 500 m of operating wind turbine arrays, with the disturbance effect

[15] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[16] Pearce-Higgins, J.W. et al. (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

CONSENTED (LA01/2018/0200/F)

extending up to 400 m from turbines[17]. The baseline surveys for the Development have indicated the presence of four breeding pairs of snipe within 500 m of the proposed turbine locations. A decline in the range of 47% - 53% would therefore indicate the potential displacement of two pairs of snipe. It is not certain that this displacement would occur, but the results of the research would suggest that displacement would be probable. The distribution of breeding snipe within the site suggests that it might be possible for the displaced birds to relocate and breed successfully in areas of adjacent habitat within the site boundary that are >400 m from turbines, however it is not certain that this would occur.

7.84 Snipe is an Amber-listed species of conservation concern in Ireland[18]. The breeding population in Northern Ireland is estimated at 1,123 pairs (within a possible range of 527 – 1,782 pairs) and has declined by 78% since 1987[19]. Following the 1% significance threshold the qualifying level for significance would be 11 pairs, therefore the loss of two breeding pairs would not be significant at the regional (Northern Ireland) level. It is therefore certain / near-certain that the loss of two breeding pairs would not have any significant effect on the overall distribution and abundance or conservation status of breeding snipe.

Passerines

Displacement Effects

7.85 Densities of two passerine species (skylark and stonechat) increased at wind farms during and after construction and there was also a suggestion of a beneficial effect for meadow pipits during construction[20]. It is suggested that vegetation disturbance during the construction of wind farms results in changes to the vegetation (in particular more openness) that are known to favour these species. The significance of any beneficial effects is likely to be at a local level only (i.e. there are unlikely to be any significant beneficial effects at the regional population level for the species concerned) however it is significant that no adverse effects were observed for these species.

7.86 It should also be noted that SNH are of the view that passerine species are generally not adversely affected by wind farms[21]. Two passerine species (skylark and meadow pipit) are distributed widely over the site and 500 m buffer area, but the other passerine species are distributed very sparsely and mostly around the periphery of the area of interest. All of the species concerned are also widespread

[17] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[18] Colhoun, K and Cummins, S (2013): Birds of Conservation Concern in Ireland 2014-2019 (Irish Birds 9)

[19] Colhoun, K., et al. (2015): Population Estimates and Changes in Abundance of Breeding Waders in Northern Ireland up to 2013 (Bird Study 62)

[20] Pearce-Higgins, J.W. et al. (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[21] SNH (2006): Assessing the significance of impacts of on-shore wind farms on birds out-with designated areas (Guidance Note, July 2006)

CONSENTED (LA01/2018/0200/F)

in the wider surrounding area (*D. Steele personal observations)*. It is therefore extremely unlikely that there would be any significant displacement effects on skylarks, meadow pipits, stonechats and other passerine species.

Table 7.22 – Summary of Potential Effects on Breeding Birds

Species / Species Group	Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects
Red grouse	Displacement	Extremely unlikely	-
Snipe	Displacement of two breeding pairs	Probable	Not significant
Passerine species	Displacement	Extremely unlikely	-

Winter Season Birds

7.87 The potential effects of the Development on winter season birds are described under the headings below. Potential effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.23. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale[22].

General Remarks

7.88 The potential effects of the Development on winter season birds are likely to be similar to those described for breeding birds. Therefore the main adverse effects for these species are also likely to be due to disturbance displacement during construction and wind farm operation is unlikely to have a significant effect on local populations of these species. In addition it is also likely that there may be potential beneficial effects of wind farm construction on some winter passerine bird species.

Golden Plovers

Displacement effects

7.89 Densities of golden plovers were not found to decline significantly at wind farm sites during construction[23]. However, other research suggested a 39% reduction in density of golden plovers within 500 m of operating wind turbine arrays, with the disturbance effect extending up to 200 m from turbines[24]. The results refer to breeding golden plovers but wintering birds are likely to be affected in a similar way. The baseline surveys for the Development have indicated minimal activity by golden plovers during winter within the site and 500 m buffer – there was a low incidence of sightings, flock sizes were small and there was no suggestion of use of

[22] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[23] Pearce-Higgins, J.W. et al. (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

[24] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

CONSENTED (LA01/2018/0200/F)

the area by migrating flocks in spring. It is therefore extremely unlikely that there would be any significant displacement effects on wintering and migrating golden plovers.

Other Species

7.90 Other wintering bird species recorded within the site and 500 m buffer area are present in small numbers only. All of the species concerned are also widespread in the wider surrounding area (*D. Steele personal observations)*. It is therefore extremely unlikely that there would be any significant displacement effects on other wintering bird species.

7.91 For some species it is possible that habitat changes associated with wind farm construction may be beneficial. For example, wintering snow buntings are often associated with man-made habitat features such as vehicle tracks / gravel roads and areas of bare ground *(D. Steele personal observations)*, although it is unlikely that any such beneficial effects due to the Development would be significant at the regional population level.

Table 7.23 – Summary of Potential Effects on Winter Season Birds

Species / Species Group	Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects
Golden plover	Displacement	Extremely unlikely	-
Other species	Displacement	Extremely unlikely	-

Hen Harriers

7.92 The potential effects of the Development on hen harriers are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.24. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale[25].

Direct Disturbance (Nest site)

7.93 Personal observations and published guidance[26] indicate an upper disturbance limit for nesting hen harriers in the range of 500 – 750 m around occupied nests, though in most instances the upper limit will be closer to 500 m. Any activity beyond this distance is unlikely to be of concern. During the two year baseline period there have been no confirmed hen harrier nests within the potential disturbance zone of 500 – 750 m from the proposed turbine locations. The confirmed nest in baseline year 2 was located 3.1 km from the nearest proposed turbine location. Nesting was successful at this location and it is therefore likely that the birds will continue to nest at this location (or in the near vicinity) for a number of years. When they do

[25] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[26] Ruddock, M and Whitfield, D.P (2007): A review of disturbance distances in selected bird species (Report from Natural Research Projects Ltd to SNH)

CONSENTED (LA01/2018/0200/F)

relocate (after a number of years as the small trees mature) is also likely that these birds will choose the same habitat type in which they have previously nested successfully (i.e. young second-rotation conifer plantation). Other hen harrier pairs known in the wider surrounding area (beyond the area of interest) during the two year baseline period have also exclusively used this habitat type (*see paragraph 7.74)*.

7.94 Based on the results of the baseline surveys, an assessment of habitat suitability within the site and 500 m buffer (*see paragraph 7.73 and Photographic Plates 1-3*) and the current favouring by harriers of young second-rotation plantation habitat, it is considered extremely unlikely that harriers would attempt to nest within the boundary of the proposed site or within 500 m of the proposed turbine locations and there is no reason to suppose that this prospect will change in the near to medium-term. Currently there is no young second-rotation habitat within 500 – 750 m of the proposed turbine locations - this will change in the future as harvesting proceeds in the adjacent pole-stage plantation but the amount of conifer plantation habitat within this zone is very limited, therefore it is unlikely that a nest would be located within this area.

7.95 Considering all of the above, it is therefore extremely unlikely that direct disturbance of a hen harrier nest would occur due to the construction or operation of the proposed wind farm.

Displacement Effects (Foraging)

7.96 Flight activity by hen harriers has been shown to decline by 52% within 500 m of turbine arrays with the disturbance effect extending up to 250 m from turbines[27]. It is unclear if this observed displacement was due to the construction or operation of the wind farms, however subsequent research (though not relating specifically to hen harriers or other raptor species) indicated that displacement effects on birds are more likely to be due to construction disturbance than to wind farm operation[28].

7.97 The baseline surveys have demonstrated a foraging range extending to 4 km from the confirmed nest location for the male harrier and up to at least 3 km for the female harrier. It has also been confirmed that the birds forage in other areas in addition to the proposed site and 500 m buffer area – for example in areas around Keady Mountain lying immediately to the west and south of the Development, in areas extending immediately around and to the south of the nest site and in areas to the east of the nest site. Use of these areas for foraging has either been confirmed by direct observations of foraging birds or can be confidently implied through the travelling direction of foraging birds (Confidential Figures 7.11 and 7.12). The observations of birds arriving at the nest with prey have also confirmed

[27] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[28] Pearce-Higgins, J.W. et al. (2012): Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis (Journal of Applied Ecology 49)

CONSENTED (LA01/2018/0200/F)

significant use of areas lying to the south of the nest for foraging (Confidential Appendix).

7.98 From observations made in the field to confirm the habitat types present and measurements made from aerial imagery in a GIS, it is estimated that there is approximately 2,090 ha of suitable foraging habitat available to the birds within 4 km radius of the nest site. The measurement includes areas of habitat identified as upland grassland, heath, bog, scrub, rough fields and young second-rotation conifer plantation (all habitats that are used by hen harriers for foraging) but excludes areas of improved grassland, pole-stage conifer plantation (though harriers will sometimes hunt along rides in pole-stage plantation) and any other areas that appeared unsuitable. The measurement also includes 257 ha of foraging habitat that is within 4 km of the nest and also within 500 m of the proposed turbine locations. Further details of the foraging habitat areas and habitats are given in the Confidential Appendix and Confidential Figure 7.12. The areas used (or considered likely to be used) for foraging have been assessed as generally of comparable quality / suitability to the habitat found within the proposed site and 500 m buffer area. Based on the observed fledged brood size for the confirmed nest (which was above average for harrier nests in Ireland) prey availability (which is related to habitat quality) is not currently a significant limiting factor for this harrier pair / nest site.

7.99 The 257 ha of foraging habitat within 500 m of the proposed turbine locations accounts for 12.3% of the total 2,090 ha of suitable habitat within the indicated 4 km foraging range. A 52% reduction in foraging activity within 500 m of the proposed turbines can be considered to be equivalent to the loss of 134 ha of habitat, or 6.4% of the total foraging habitat available to the birds. Full details of the habitat calculations are provided in Appendix 7.6. Because harriers mostly foraging along linear routes through the landscape (D. Steele personal observations) then the relationship between foraging displacement and the area of habitat lost is unlikely to be as direct as the calculations imply, and the habitat “loss” figures should not therefore be regarded as absolute but as a guide to quantifying the potential magnitude of any displacement effect. In reality, actual habitat “loss” is likely to be less than indicated by the calculations.

7.100 It should be noted that other research in Ireland has indicated that foraging hen harriers were not displaced by wind turbines (at least in the short term) and birds were observed foraging regularly to within 50 m of turbines and one bird to within 10 m of a turbine[29]. There is also other published evidence that foraging hen harriers are not significantly displaced by wind turbines and it is suggested that this species is therefore of low to medium sensitivity to displacement effects[30].

[29] Madden, B. and Porter, B. (2007): Do wind turbines displace hen harriers from foraging habitat? Preliminary results of a case study at the Derrybrien Wind Farm, County Galway (Irish Birds 8)

[30] Madders, M. and Whitfield, D.P. (2006): Upland raptors and the assessment of wind farm impacts (Ibis 148)

CONSENTED (LA01/2018/0200/F)

7.101 Another recent study in Ireland[31] found that for a sample of 84 hen harrier nests located at varying distances from wind turbines, nest success (the proportion of nests that fledge young) was lower at nests located within 1 km of wind turbines but that there was no adverse effect on success of nests located at greater distances. The effects were limited to nest success only – fledged brood sizes for successful nests close to turbines (up to 1 km) were similar to those from successful nests located further away.

7.102 Hen harrier is an Amber-listed species of conservation concern in Ireland[32]. The breeding population in Northern Ireland is currently estimated at 46 pairs, a decline from 59 pairs in 2010[33]. Following the 1% significance threshold then the loss of one hen harrier nest / breeding pair due to foraging displacement effects would be significant at the regional (Northern Ireland) level.

7.103 Assuming that foraging displacement occurs then the significance of the displacement needs to be assessed in the context of the wider foraging range that has been demonstrated for the birds and also the observation (see above) that the relationship between foraging displacement and the area of habitat lost is unlikely to be a direct one. As the displacement effect would extend to not more than 12.3% of the total available foraging range (and be equivalent to the loss of not more than 6.4% of total habitat) and in view of the fact that the relationship between displacement and habitat "loss" is unlikely to be a direct one, then it is extremely unlikely that any foraging displacement would have a significant effect on either nest success or fledged brood size. Therefore it is extremely unlikely that the estimated foraging displacement would have any significant adverse effect on the overall distribution and abundance or conservation status of breeding hen harriers.

Collision Risk

7.104 The collision risk for hen harriers due to the Development has been estimated using the SNH Collision Risk Model (CRM). Full details of the CRM (including the wind farm parameters, bird parameters, watch data and bird flight data input to the model) are provided in Appendix 7.7. Using the 99% hen harrier avoidance rate recommended by SNH[34] then the CRM predicts a very low collision risk equivalent to one bird every 126.1 years. For a lower avoidance rate of 98% the collision risk is still very low, equivalent to one bird every 63.1 years. This very low collision risk is due partly to the behaviour of the birds recorded within the site and buffer area (predominantly foraging) and partly also the turbine parameters, in particular the

[31] Fernandez-Bellon, D. et al. (2015): Reproductive output of heh harriers in relation to wind turbine proximity (Irish Birds 10)

[32] Colhoun, K and Cummins, S (2013): Birds of Conservation Concern in Ireland 2014-2019 (Irish Birds 9)

[33] RSPB Media Release, June 2017

[34] SNH (2016): Avoidance rates for the SNH onshore wind farm Collision Risk Model (SNH Guidance Note, October 2016)

CONSENTED (LA01/2018/0200/F)

minimum rotor height of 50 m above the ground which is very significantly above the typical flying height of foraging harriers.

Table 7.24 – Summary of Potential Effects on Hen Harriers

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Direct disturbance (nest site)	Extremely unlikely	-	Confirmed nest located 3.1 km distant from nearest proposed turbine
Displacement (foraging)	Probable but not certain	Extremely unlikely to be significant	Displacement effect limited to not more than 12.3% of suitable habitat within 4 km range and equivalent to "loss" of not more than 6.4% of habitat (*note that the relationship between displacement and habitat loss is unlikely to be as direct as the habitat calculations imply – the figures are as a guide only)*
Collision risk	Extremely unlikely	-	Collision rate equivalent to one bird every 126.1 years

Peregrines

7.105 The potential effects of the Development on peregrines are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.25. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale[35].

Direct Disturbance (Nest site)

7.106 Two potential peregrine nesting sites (both quarries) are located within 2 km of the Development. However information provided by NIEA has indicated that neither site has been occupied since at least 2008. Both sites were unoccupied during the two year baseline period and there is no particular reason to suppose that this prospect will change in the near to medium-term. It is also highly unlikely that both sites would be occupied simultaneously (in the same year) as they are in relatively close proximity.

7.107 Personal observations and published guidance[36] indicates an upper disturbance limit for nesting peregrines in the range of 500 – 750 m around nest sites, however depending on the circumstances peregrines can tolerate disturbance (for example that experienced in quarries) at a significantly lower limit. The closest of the two potential nesting sites is located 1.3 km from the nearest proposed turbine and both potential sites are completely screened from the site of the Development by

[35] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[36] Ruddock, M and Whitfield, D.P (2007): A review of disturbance distances in selected bird species (Report from Natural Research Projects Ltd to SNH)

CONSENTED (LA01/2018/0200/F)

the topography. Therefore even in the event of either of the two sites being re-occupied it is extremely unlikely that direct disturbance of a peregrine nest would occur due to the construction or operation of the proposed wind farm.

Displacement Effects (Foraging)

7.108 The low levels of activity recorded within the site and 500 m buffer area indicate that this area is not currently of significance for peregrines. In the event of either of the potential nest sites being occupied (which at present seems unlikely) then there might be an increase in peregrine foraging activity in the vicinity. However there is no particular reason to suppose that the vicinity of the Development would be particularly attractive to foraging peregrines – the typical prey species for peregrines (for example pigeons, gulls and crow species) are not common within the proposed site and buffer area. Peregrines are also highly aerial birds (taking prey out of the air-space regardless of the habitat beneath) and have very extensive foraging ranges, certainly extending up to 10 km (*D. Steele personal observations*). Therefore even in the (currently unlikely) event of either of the two nest sites being re-occupied it is extremely unlikely that displacement of foraging birds would be significant.

Collision Risk

7.109 Recorded activity levels by peregrines (just seven sightings) are considered to be too low to provide sufficiently robust data for input to the CRM. However based on the observed very low activity levels a subjective assessment would indicate that collision risk would be expected to be very low.

Table 7.25 – Summary of Potential Effects on Peregrines

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Direct disturbance (nest site)	Extremely unlikely	-	Closest potential nest site located 1.3 km distant from nearest proposed turbine
Displacement (foraging)	Extremely unlikely	-	-
Collision risk	Extremely unlikely	-	-

Merlins

7.110 The potential effects of the Development on merlins are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.26. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale.

CONSENTED (LA01/2018/0200/F)

Direct Disturbance (Nest site)

7.111 During the two year baseline period merlins were not recorded nesting within 2 km of the Development. This species does move around between years and there is a small amount of potential nesting habitat (edge of pole stage plantation) within 500 m of the proposed turbine locations, however the likelihood of a nest being located within this area is very low. Therefore it is extremely unlikely that direct disturbance of a merlin nest site would occur due to the construction or operation of the proposed wind farm.

Displacement Effects (Foraging)

7.112 The very low levels of merlin activity recorded within the site and 500 m buffer area would indicate that displacement of foraging birds is unlikely to be significant for this species.

Collision Risk

7.113 Based on the observed very low activity levels a subjective assessment would indicate that collision risk for merlins would be expected to be very low.

Table 7.26 – Summary of Potential Effects on Merlins

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Direct disturbance (nest site)	Extremely unlikely	-	Not nesting within 2 km radius during the baseline period
Displacement (foraging)	Extremely unlikely	-	-
Collision risk	Extremely unlikely	-	-

Whooper Swans

7.114 The potential effects of the Development on whooper swans are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.27. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale.

Displacement / Barrier Effects and Collision Risk

7.115 The results of the baseline surveys indicate that it is extremely unlikely that any significant displacement or barrier effects would occur and a subjective assessment would indicate that collision risk for whooper swans would be expected to be very low.

Table 7.27 – Summary of Potential Effects on Whooper Swans

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Displacement	Extremely unlikely	-	-

CONSENTED (LA01/2018/0200/F)

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Barrier effects	Extremely unlikely	-	-
Collision risk	Extremely unlikely	-	-

Buzzards

7.116 The potential effects of the Development on buzzards are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.28. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale[37].

Direct Disturbance (Nest site)

7.117 Personal observations (published guidance does not refer to buzzards) indicate an upper disturbance limit for nesting buzzards of 500 m around nest sites. The confirmed nest site is located 1.1 km from the nearest proposed turbine and is also separated from the Development by the busy A37 road. As buzzards are site-faithful it is likely that they will continue to nest at this location for a number of years. Therefore it is extremely unlikely that direct disturbance of a buzzard nest would occur due to the construction or operation of the proposed wind farm.

Displacement Effects (Foraging)

7.118 Flight activity by buzzards has been shown to decline by 41% within 500 m of turbine arrays with the disturbance effect extending up to 500 m from turbines[38]. There is no published research indicating non-avoidance of wind turbines by buzzards, however current (2017 year) multiple sightings of buzzards foraging for prolonged periods within the turbine array at Gruig Wind Farm in Co. Antrim (*D. Steele personal observations)* would suggest that significant long-term displacement may not occur at some sites (Gruig Wind Farm is in year 10 of operation).

7.119 Assuming displacement does occur then the significance of this effect needs to be assessed in the context of other habitat that is likely to be available to the birds (for the confirmed nest this will certainly include extensive areas of mixed farmland and related habitats located to the north of the A37 road) and also in the context of the favourable conservation status[39] and very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole[40]. Placed in this context, it is extremely unlikely that any foraging displacement would have a

[37] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[38] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[39] Colhoun, K and Cummins, S (2013): Birds of Conservation Concern in Ireland 2014-2019 (Irish Birds 9)

[40] Balmer, D. *et al*. (2013): Bird Atlas 2007-2011 (BTO Books)

CONSENTED (LA01/2018/0200/F)

significant adverse effect on the overall distribution and abundance or conservation status of breeding buzzards.

Collision Risk

7.120 The collision risk for buzzards due to the Development has been estimated using the CRM (Appendix 7.7). Using the 98% default avoidance rate recommended by SNH[41] and assuming (as indicated by the baseline survey results) that buzzards are likely to be absent from the area of interest (the site plus a 500 m buffer area) during the three winter months November to January then the CRM predicts a collision risk for buzzard equivalent to one bird every 10.8 years. Assuming buzzards are active within the area of interest year-round (though this is not indicated by the survey results) then the CRM predicts a collision risk equivalent to one bird every 8.1 years.

7.121 The predicted collision risk is equivalent to the loss of 2 – 3 buzzards during the expected 30 year operational life of the proposed wind farm. However this loss needs to be assessed in the context of other "background" mortality effects on buzzards as well as the favourable conservation status and very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole. Placed in this context, then it is extremely unlikely that the predicted small number of collisions would have a significant adverse effect on the overall distribution and abundance or conservation status of breeding buzzards. It should also be noted that collision risk has been predicted from the baseline conditions, before any possible reduction in buzzard activity due to displacement effects - if significant displacement of birds occurs (even if the effect is only temporary) then collision risk would be expected to be lower than predicted.

Table 7.28 – Summary of Potential Effects on Buzzards

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Direct disturbance (nest site)	Extremely unlikely	-	Confirmed nest located 1.1 km distant from nearest proposed turbine
Displacement (foraging)	Probable but not certain	Extremely unlikely to be significant	Favourable conservation status and very widespread distribution
Collision risk	Probable	Extremely unlikely to be significant	Collision rate equivalent to one bird every 10.8 years

Kestrels

7.122 The potential effects of the Development on kestrels are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.29. The

[41] SNH (2016): Avoidance rates for the SNH onshore wind farm Collision Risk Model (SNH Guidance Note, October 2016)

CONSENTED (LA01/2018/0200/F)

likelihood / probability of an effect occurring or being significant are described using the IEEM scale[42].

Direct Disturbance

7.123 During the two year baseline period kestrels were not recorded nesting within 1 km of the Development. This species does move around between years and there is a small amount of potential nesting habitat (edge of pole stage plantation) within 500 m of the proposed turbine locations, however the likelihood of a nest being located within this area is very low. Therefore it is extremely unlikely that direct disturbance of a kestrel nest site would occur due to the construction or operation of the proposed wind farm.

Displacement Effects

7.124 The research that has predicted displacement of foraging hen harriers and buzzards around wind turbine arrays[43] does not provide any results relating to kestrels. This does not mean that kestrels may not be sensitive to displacement, however during the last decade a large number of sightings have been made of kestrels foraging for prolonged periods within turbine arrays at several different wind farms located across Northern Ireland, including many observations of birds foraging to with a few tens of metres of operating turbines (D. Steele personal observations) suggesting that significant long-term displacement may not occur for this species.

Collision Risk

7.125 The collision risk for kestrels due to the Development has been estimated using the CRM (Appendix 7.7). Using the 95% kestrel avoidance rate recommended by SNH[44] and assuming that kestrels are active in the area of interest (the site plus a 500 m buffer area) year-round then the CRM predicts a collision risk for kestrel equivalent to one bird every 8.0 years.

7.126 The predicted collision risk is equivalent to the loss of three kestrels during the expected 30 year operational life of the proposed wind farm. However this loss needs to be assessed in the context of other “background” mortality effects on kestrels and also in the context of the very widespread distribution of this species in Northern Ireland and in the island of Ireland as a whole – although it is an Amber-listed species of conservation concern in Ireland, kestrel is nevertheless one of the most widespread and abundant raptor species in Britain and Ireland (present in almost 90% of 10 km squares) and is the most widely distributed raptor species in Ireland[45]. Placed in the context of the normal “background” losses to the kestrel population (for example due to predation and annual mortality) and also in view of

[42] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[43] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

[44] SNH (2016): Avoidance rates for the SNH onshore wind farm Collision Risk Model (SNH Guidance Note, October 2016)

[45] Balmer, D. *et al*. (2013): Bird Atlas 2007-2011 (BTO Books)

CONSENTED (LA01/2018/0200/F)

the still very widespread distribution of the species in a wide range of upland habitats in Northern Ireland, then it is unlikely that the small number of collisions that could occur would have a significant adverse effect on the overall distribution and abundance or conservation status of breeding kestrels.

Table 7.29 – Summary of Potential Effects on Kestrels

Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Direct disturbance (nest site)	Extremely unlikely	-	Not nesting within 1 km radius during the baseline period
Displacement (foraging)	Unlikely	-	-
Collision risk	Probable	Unlikely to be significant	Collision rate equivalent to one bird every 8.0 years; Amber-listed species of conservation concern but with very wide distribution in Ireland

Cumulative Effects

Scope

7.127 In line with the guidance of NIEA[46], the cumulative assessment for ornithology has been carried out with reference to other existing, consented or proposed wind farms (including single turbines) within 10 km radius of the Development. The locations of wind farms within 10 km radius are shown in Drawing 4.4 of the Environmental Statement.

Species Requiring Assessment

7.128 The selection of bird species for the cumulative assessment follows the guidance of SNH[47] which recommends that cumulative assessment should be limited to those species that:

- Use the proposed wind farm site on a regular basis;
- Are also likely to be sensitive to the effects of a wind farm development;
- And are of unfavorable conservation status.

7.129 Following the above criteria and with reference to the results of the baseline bird surveys then those species that should be considered for cumulative assessment are summarized in Table 7.30. Only those species which qualify under all three of the listed criteria should be considered for cumulative assessment.

Table 7.30 – Bird Species Considered for Cumulative Assessment

[46] NIEA (NED) Comments on Natural Heritage (Planning Reference LA01/2017/0781/DETEIA)

[47] SNH (2012): Assessing the cumulative impact of onshore wind energy developments (Scottish Natural Heritage Guidance Note, March 2012)

CONSENTED (LA01/2018/0200/F)

Species / Species Group	Regularly Present Site	Potentially Sensitive to Wind Farm Developments	Unfavourable Conservation Status	Cumulative Assessment Required
Red grouse	Yes	No	Yes	No
Snipe	Yes	Yes	Yes	Yes
Passerine species	No	No	-	No
Hen harrier	Yes	Yes	Yes	Yes
Peregrine	No	Yes	No	No
Merlin	No	Yes	Yes	No
Whooper swan	No	Yes	No	No
Kestrel	Yes	Yes	Yes	Yes
Buzzard	Yes	Yes	No	No

Assessment

7.130 The potential cumulative effects of the Development on birds are described under the headings below. Potential adverse effects and the significance of any likely effects at the regional (Northern Ireland) level are summarized in Table 7.31. The likelihood / probability of an effect occurring or being significant are described using the IEEM scale[48].

Snipe

7.131 The upper limit for potential wind farm displacement effects on snipe extends to 400 m from the location of territories[49]. No additional wind turbines are located within 400 m of the snipe locations that have been identified by the baseline bird surveys. A single consented turbine (ST3) is located just over 400 m from one of the snipe territories, so is just beyond the upper limit of any likely displacement effects and the location is also screened by a shelterbelt of pole-stage spruce trees, therefore it is extremely unlikely that there would be any additional adverse effects on snipe due to this turbine.

Hen Harrier

7.132 The likely upper limit of potential cumulative effects on hen harriers would extend to the limit of the foraging range, which the baseline surveys have indicated extends to 4 km around the location of the confirmed nest (Confidential Figure 7.12). Within this range there is one additional existing wind farm (Rigged Hill / ten turbines) and two consented / under construction single turbines (ST1 and ST2).

[48] IEEM (2006): Guidelines for Ecological Impact Assessment in the United Kingdom

[49] Pearce-Higgins, J.W. et al. (2009): The distribution of breeding birds around upland wind farms (Journal of Applied Ecology 46)

CONSENTED (LA01/2018/0200/F)

Comments on the Rigged Hill Array

7.133 The existing Rigged Hill turbine array is a long-standing feature of the local landscape and the confirmed hen harrier nest site is located 1.2 km from the closest existing turbine in that array - the nest was successful and fledged brood size was above the average for hen harrier nests in Ireland. During baseline year 2 a second hen harrier pair / nest was also confirmed (beyond the area of interest for the proposed Dunbeg South Wind Farm) at a location 1.0 km from the closest existing Rigged Hill turbine (*D. Steele personal observations and NIRSG fieldworkers pers. com.*). The location of this nest (also located within young second-rotation conifer plantation) is shown in Confidential Figure 7.12. This nest failed, with the NIRSG fieldworkers confirming predation as the reason for the failure.

7.134 The presence of two hen harrier pairs / nests within 1.2 km of the long-standing Rigged Hill array (and the fact that nest success for these birds is certainly comparable to that of the wider hen harrier population in Northern Ireland) would strongly suggest that the Rigged Hill turbines are not causing any significant foraging displacement effect on the local hen harrier population – therefore it is considered probable that there would not be any significant cumulative effects due to the existing Rigged Hill array.

Worst-case Cumulative Scenario (including Rigged Hill)

7.135 Of the total estimated 2,090 ha of available habitat within the 4 km foraging range, 155 ha are within 500 m of the Rigged Hill array and 65 ha within 500 m of the ST1/ST2 cluster, giving a total 220 ha within 500 m of the additional turbines. Combined with the 257 ha of foraging habitat within 500 m of the proposed Dunbeg South Wind Farm turbines this gives a cumulative total of 477 ha or 22.8% of the total 2,090 ha of suitable habitat. A 52% reduction in harrier foraging activity within the cumulative total 477 ha is equivalent to the loss of 248 ha of habitat, or 11.8% of the total foraging habitat available to the birds. (Full details of the cumulative assessment calculations are provided in Appendix 7.6). *As noted previously (paragraph 7.99) the relationship between foraging displacement and the area of habitat lost is unlikely to be as direct as the calculations imply, and the habitat "loss" figures should not therefore be regarded as absolute but as a guide to quantifying the potential magnitude of any displacement effect. In reality, actual habitat "loss" is likely to be less than indicated by the calculations.*

Lesser Cumulative Scenario (No Rigged Hill Effects)

7.136 If it is accepted that the Rigged Hill array is not (as is indicated) causing any significant foraging displacement for the harriers then it can be excluded from the cumulative assessment, leaving the ST1 / ST2 turbine cluster alone to be considered. Under this scenario the cumulative total of habitat over which displacement effects might occur is reduced to 322 ha (65 ha within 500 m of ST1/ ST2 and 257 ha within 500 m of the proposed Dunbeg South Wind Farm) or 15.4% of the total 2,090 ha of suitable habitat. A 52% reduction in harrier foraging activity

CONSENTED (LA01/2018/0200/F)

within the revised cumulative total 322 ha is equivalent to the loss of 167 ha of habitat, or 8% of the total foraging habitat available to the birds. *As noted previously (paragraph 7.99) the relationship between foraging displacement and the area of habitat lost is unlikely to be as direct as the calculations imply, and the habitat "loss" figures should not therefore be regarded as absolute but as a guide to quantifying the potential magnitude of any displacement effect. In reality, actual habitat "loss" is likely to be less than indicated by the calculations.*

Significance of Cumulative Displacement Effects

7.137 In assessing the possible significance of foraging displacement effects the first consideration is whether there is likely to be any effect on nest success (i.e. would nests fail completely due to adverse effects on foraging). Under either of the two cumulative scenarios (worst-case including Rigged Hill or the lesser scenario involving ST1/ST2 only) then it is considered extremely unlikely that a nest would fail completely due to the scale of the displacement predicted. This assessment would also be in keeping with published research on hen harrier nest success and wind turbine proximity, which has indicated that effects do not extend greater than 1 km from turbines[50].

7.138 The second consideration is whether there would be any significant effect on fledged brood size (the number of chicks fledging from a nest). This is more difficult to assess, but under the worst-case scenario it is considered unlikely that there would be any significant adverse effects on fledged brood size due to the scale of the displacement predicted and under the lesser scenario it is considered highly unlikely that there would be a significant effect. This assessment would also be in keeping with published research on hen harrier fledged brood size and wind turbine proximity, which indicated that nests close to turbines (up to 1 km) had comparable fledged brood size to nests located further away.

7.139 In terms of potential effects on the wider regional (Northern Ireland) hen harrier population, reduced nest success would be the factor that is most likely to have a significant impact. As there is high confidence that nests would not fail due to the potential displacement effect, then it is therefore considered extremely unlikely that cumulative foraging displacement would have any significant adverse effects on the overall distribution and abundance or conservation status of breeding hen harriers.

Kestrel

7.140 During the baseline period kestrels were regularly present (foraging) within the site and 1 km buffer area but were not confirmed nesting. Within the area of interest (the site plus 1 km buffer area) there is one consented single turbine (ST3) and part overlap with the three turbines of the Dunbeg Extension (consented). In view of the fact that displacement effects are unlikely for kestrels (Table 7.29) and only a

[50] Fernandez-Bellon, D. et al. (2015): Reproductive output of heh harriers in relation to wind turbine proximity (Irish Birds 10)

CONSENTED (LA01/2018/0200/F)

small number of kestrel collisions are predicted due to the Development, then it is considered unlikely that the single turbine ST3 and the three turbines of the Dunbeg Extension would lead to any significant additional displacement effects or significantly increase collision risk.

Table 7.31 – Summary of Potential Cumulative Effects

Species	Potential Effect	Likelihood of Additional Effect Occurring	Significance of Likely Effects	Remarks
Snipe	Displacement	Extremely unlikely	-	-
Hen harrier	Displacement	Probable but not certain	Extremely unlikely to be significant	Displacement effect equivalent to loss of between 8% of habitat (lesser scenario excluding Rigged Hill array) to 11.8% of habitat (worst-case scenario including Rigged Hill array; (*note that the relationship between displacement and habitat loss is unlikely to be as direct as the habitat calculations imply – the figures are as a guide only)* Current indications are that Rigged Hill is not causing a significant displacement effect on foraging harriers
Kestrel	Displacement and collision risk	Extremely unlikely	-	-

Mitigation

7.141 Proposed mitigation measures are summarized in Table 7.31 and would be implemented in full by the Developer. Full details of the proposed pre-construction bird surveys and Ornithological Mitigation Strategy (OMS) would be provided in reports prior to commencement of construction.

Table 7.31 – Proposed Mitigation Measures

Proposed Mitigation	Timing	Reason
Pre-construction bird surveys	Year prior to construction commencement	To reassess use of the proposed wind farm site and relevant buffer areas by sensitive bird species and to provide a revised ornithology baseline for input to the OMS
Ornithological Mitigation Strategy (OMS)	During construction	To allow construction work to take place during the bird breeding season (1st March – 31st August) whilst avoiding any significant adverse effects on breeding birds

CONSENTED (LA01/2018/0200/F)

Summary

7.142 The potential effects (including potential cumulative effects) of the Development on birds are summarized in Table 7.32.

Table 7.32 – Summary of Potential Effects of the Development on Birds

Species	Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Red grouse	Displacement	Extremely unlikely	-	-
Snipe	Displacement of two breeding pairs	Probable	Not significant	1% threshold for regional significance is 11 pairs
Snipe	Displacement (CUMULATIVE)	Extremely unlikely	-	-
Passerine species	Displacement	Extremely unlikely	-	-
Hen harrier	Direct disturbance (nest site)	Extremely unlikely	-	Confirmed nest located 3.1 km distant from nearest proposed turbine
Hen harrier	Displacement (foraging)	Probable but not certain	Extremely unlikely to be significant	Displacement effect equivalent to loss of not more than 6.4% of habitat
Hen harrier	Collision risk	Extremely unlikely	-	Collision rate equivalent to one bird every 126.1 years
Hen harrier	Displacement (foraging – CUMULATIVE)	Probable but not certain	Extremely unlikely to be significant	Displacement effect equivalent to loss of not more than 8% - 11.8% of foraging range
Peregrine	Direct disturbance (nest site)	Extremely unlikely	-	Closest potential nest site located 1.3 km distant from nearest proposed turbine
Peregrine	Displacement (foraging)	Extremely unlikely	-	-
Peregrine	Collision risk	Extremely unlikely	-	-
Merlin	Direct disturbance (nest site)	Extremely unlikely	-	Not nesting within 2 km radius during the baseline period
Merlin	Displacement (foraging)	Extremely unlikely	-	-
Merlin	Collision risk	Extremely unlikely	-	-
Whooper swan	Displacement	Extremely unlikely	-	-
Whooper swan	Barrier effects	Extremely unlikely	-	-

CONSENTED (LA01/2018/0200/F)

Species	Potential Effect	Likelihood of Effect Occurring	Significance of Likely Effects	Remarks
Whooper swan	Collision risk	Extremely unlikely	-	-
Buzzard	Direct disturbance (nest site)	Extremely unlikely	-	Confirmed nest located 1.1 km distant from nearest proposed turbine
Buzzard	Displacement (foraging)	Probable but not certain	Extremely unlikely to be significant	Favourable conservation status and very widespread distribution
Buzzard	Collision risk	Probable	Extremely unlikely to be significant	Collision rate equivalent to one bird every 10.8 years
Kestrel	Direct disturbance (nest site)	Extremely unlikely	-	Not nesting within 1 km radius during the baseline period
Kestrel	Displacement (foraging)	Unlikely	-	-
Kestrel	Collision risk	Probable	Unlikely to be significant	Collision rate equivalent to one bird every 8.0 years; Amber-listed species of conservation concern but with very wide distribution in Ireland
Kestrel	Displacement and collision risk (CUMULATIVE)	Extremely unlikely	-	-

Conclusions

7.143 This chapter has described the baseline bird communities found within the Development site and in surrounding buffer areas. The potential effects of the Development on the bird populations has been assessed following recommended guidance and with reference to key published research on the potential effects of wind turbines on birds.

7.144 For red grouse and for all passerine species it is extremely unlikely that any adverse effects would occur. For snipe, displacement of two breeding pairs is probable but the effect falls well short of being significant at the regional (Northern Ireland) level. It is possible that displaced snipe could relocate to other areas of habitat within the site but it is not certain that this would happen.

7.145 Collision risk for all raptor species which use the site on a regular basis has been estimated using the SNH Collision Risk Model. For hen harrier collision risk is predicted to be negligible. For kestrel and buzzard a small number of collisions is predicted to occur during the expected 30 year operational life of the wind farm, however when placed in the context of the very widespread distributions of both these species and also other relevant factors (discussed in the assessment) then it is extremely unlikely that the predicted collisions would have a significant adverse

CONSENTED (LA01/2018/0200/F)

effect on the distribution and abundance of these species at the regional (Northern Ireland) level.

7.146 The baseline surveys have indicated that hen harriers do not currently nest within the site or 500 m buffer area and are extremely unlikely to do so in the foreseeable future, therefore it is extremely unlikely that the Development would lead to direct disturbance of a hen harrier nesting attempt. In years when hen harriers nest in the wider surrounding area it is likely that some foraging activity can be expected to occur within the site and therefore there may be some potential for displacement of foraging birds, either due to construction activity or the operation of the wind farm. The amount of foraging activity that occurs in any year is likely to depend on the location of the nest, however the baseline surveys have indicated a foraging range of up to 4 km around the nest for the male harrier, and this is in keeping with observations of breeding hen harriers elsewhere in Northern Ireland.

7.147 Current evidence suggests that, overall, foraging hen harriers are probably of low to moderate sensitivity to displacement effects and there are published observations of harriers foraging very close to operating wind turbines. The "worst-case scenario" predicts a 52% reduction in harrier foraging activity within 500 m of turbine arrays, due to a displacement effect extending up to 250 m from turbines. The ornithology assessment has quantified this potential displacement effect and considered it within the context of the wider foraging range available to the birds and also in view of the foraging behaviour of harriers and the significance of this for the likely relationship between displacement and assumed habitat "loss". In the context of these various considerations (and also in view of the published evidence in relation to wind turbine proximity and hen harrier nesting success) it is considered that any displacement of foraging birds that might occur is extremely unlikely to cause a nest to fail or to cause a reduction in fledged brood size, therefore it is extremely unlikely that there would be any significant effect on the distribution or numbers of hen harriers at the regional (Northern Ireland) level.

7.148 Current evidence also suggests that adverse effects of wind farms on birds are likely to be greatest during construction and that wind farm operation may have no significant effects on local bird populations. This would suggest that any displacement effects on foraging harriers may be temporary in any case and confined to the construction phase, with no significant effects during the operational life of the wind farm. It is proposed that pre-construction bird surveys and an Ornithological Mitigation Strategy would be implemented by the Developer in order to avoid or mitigate any possible adverse effects due to construction.

7.149 In view of the key points discussed above and assuming implementation of the proposed mitigation measures then it is concluded that the Dunbeg South Wind Farm would not have any significant adverse effects on local bird populations or on the distribution and abundance of sensitive species at the regional (Northern Ireland) level.

CONSENTED (LA01/2018/0200/F)

References

References are given in full in the footnotes to the Ornithology Assessment.

List of Appendices

List of Figures

CONSENTED (LA01/2018/0200/F)

8

Fisheries

CONSENTED (LA01/2018/0200/F)

8 Fisheries

Introduction

8.1 This chapter describes the fisheries interests of the watercourses draining the Proposed Dunbeg South Wind Farm, hereinafter referred to as 'the Development', and considers the potential effects of the construction, operation and decommissioning of the development on these interests. The assessment consists of a desk based assessment using available published and online information in combination with data and observations collected in the field. The specific objectives of the chapter are to:

- describe the fisheries baseline;
- describe the assessment methodology and significance criteria used in completing the impact assessment;
- describe the potential effects, including direct, indirect and cumulative effects;
- describe the mitigation measures proposed to address likely significant effects;
- assess the residual effects remaining following the implementation of mitigation.

8.2 The assessment has been carried out by Paul Johnston Associates, an independent fisheries consultancy specialising in freshwater fisheries in Ireland. Paul Johnston holds a BSc (Hons) in Zoology and a PhD in Fisheries Ecology; he is also registered member of the Institute of Fisheries Management (MIFM) and Chartered Environmentalist (CEnv). Also involved was David Kelly who holds a BSc (Hons) degree in Zoology, and a PhD in Freshwater Ecology; he is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and a member of the New Zealand Freshwater Sciences Society.

8.3 The practice has completed a wide range of assignments in the areas of environmental impact assessment, fisheries development and catchment management. This includes fisheries assessments in connection with a series of onshore wind farm developments in Northern Ireland.

8.4 Figures 8.1 – 8.7 are referenced in the text where relevant.

Legislation, Policy & Relevant Guidance

Fisheries Administration

8.5 With regard to fisheries administration and legislation, the footprint of the development lies within the Loughs Agency's geographic area of responsibility.

8.6 Under Section 11 (6) of the Foyle Fisheries Act (Northern Ireland) 1952 and the Foyle Fisheries Act 1952 (Republic of Ireland) the Foyle Fisheries Commission was given the responsibility for "the conservation, protection and improvement of the

CONSENTED (LA01/2018/0200/F)

Fisheries of the Foyle Area generally". Under the North/South Co-Operation (Implementation Bodies) (Northern Ireland) Order 1999 and the British Irish Agreement Act 1999 these functions were extended to include the Carlingford Area, and the Foyle Fisheries Commission transferred its functions to the Loughs Agency.

8.7 The Loughs Agency is an agency of the Foyle, Carlingford and Irish Lights Commission (FCILC), established under the 1998 Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of Ireland.

Legislation

EU Legislation

8.8 EU and local legislation relevant to fisheries and the water environment in the area of the Development includes the following:

- EC Habitats Directive (92/43/EEC);
- EU Water Framework Directive (2000/60/EC) [incorporating standards from the Fish Directive [Consolidated] (2006/44/EC) – this Directive was repealed in 2013];
- European Eel Regulation (EC) 1100/2007.

Domestic Legislation

- Fisheries (Northern Ireland) Act 1966;
- Foyle Fisheries Act (Northern Ireland) 1952;
- North/South Co-Operation (Implementation Bodies) (Northern Ireland) Order 1999;
- Drainage (Northern Ireland) Order 1973;
- Environment (Northern Ireland) Order 2002;
- Nature Conservation and Amenity Lands (Amendment) (Northern Ireland) Order 1989;
- Water (Northern Ireland) Order 1999;
- Water Environment (Water Framework Directive) (Northern Ireland) Regulations 2003;
- Wildlife (Northern Ireland) Order 1985;
- Wildlife and Natural Environment Act (Northern Ireland) 2011.

Policy

8.9 Policy with regard to Atlantic salmon and European eel in this region is set out in the following:

- River Roe and Tributaries ASSI Citation;
- River Roe and Tributaries SAC Conservation Objectives;
- River Roe Local Management Area Plan;
- Atlantic Salmon Management Strategy for Northern Ireland and the Cross-Border Foyle and Carlingford catchments to meet the objectives of NASCO resolutions and agreements, 2008–2012 (DCAL);

CONSENTED (LA01/2018/0200/F)

- North Western International River Basin District Eel Management Plan (Northern Regional Fisheries Board/Loughs Agency/DCAL).

Guidance

8.10 Specific guidance relevant the Development includes the following:

- Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas); Environmental Guidelines Series – No. 1 (Loughs Agency, 2011);
- Culvert Design and Operation Guide (C689) (CIRIA, 2010);
- Environment Agency Policy Regarding Culverts: Technical Guidance on Culverting Proposals (EA, 1999);
- PPG1: General guide to the prevention of pollution;
- PPG2: Above ground oil storage tanks;
- PPG3: Use and design of oil separators in surface water drainage systems;
- PPG4: Treatment and disposal of sewage where no foul sewer is available;
- PPG5: Works and maintenance in or near water;
- PPG6: Working at construction and demolition sites;
- PPG7: Refuelling facilities;
- PPG8: Safe storage and disposal of used oils;
- PPG13: Vehicle washing and cleaning;
- PPG18: Managing fire water and major spillages;
- PPG21: Pollution incident response planning;
- PPG26: Storage and handling of drums & intermediate bulk containers.

Scope of Assessment

8.11 The fisheries assessment has involved desk study, field work, data processing and analysis and interpretation using professional judgement. The key receptors are the River Roe, the Curly River and a series of tributary streams which drain the area within the Site Boundary, hereinafter referred to as 'the Site'.

8.12 Existing fisheries data and relevant conservation information on the River Roe and Curly River is assimilated and supplemented through a bespoke fisheries survey of the Site covering the principal watercourses draining the area.

8.13 The fisheries survey of these watercourses includes:

- An outline fish habitat assessment;
- A semi-quantitative juvenile fish stock assessment.

8.14 The sensitivity of each watercourse with regard to fisheries has been assessed according to a methodology for environmental sensitivity outlined in the Design Manual for Roads and Bridges, specifically with regard to effects on the water environment (DMRB, 2009). Potential effects of the construction, operation and decommissioning phases of the Development were then assessed. This assessment was based primarily on the potential effects on resident fish stocks either directly or upon their habitats.

CONSENTED (LA01/2018/0200/F)

Consultation

8.15 The principal consultee during the study was the Loughs Agency as the statutory body with authority for fisheries matters in the local waters. Consultee responses are summarised in Table 8.1.

8.16 Consultations were also conducted with other sub-consultants on the project, notably in relation to hydrology and drainage issues which are contained within Chapter 9: Geology and Water Environment of this ES.

Table 8.1: Consultee Responses

Consultee		Summary of Response	Addressed in Assessment
Loughs Agency		Summary of potential impacts: • Obstruction of fish migration • Disturbance of spawning • Increase in silt and sediment loads during construction • Point source pollution during construction • Drainage issues Surveys indicate the presence of both salmon and trout in the Curly River. The Agency would be concerned about the construction and decommissioning phases and the potential for increased sediment loading of watercourses. Agency is aware of some wind farm schemes where the use of coffer dams to create drainage plugs after construction, and advises that this situation is to be avoided.	Mitigation 8.154 - 8.173
DAERA	Marine & Fisheries Division	No issues with regard to aquaculture.	n/a
Rivers Agency		Area with Site Boundary is not affected by any watercourses designated under the terms of the Drainage (Northern Ireland) Order 1973. Site investigations should be undertaken to identify undesignated watercourses at this location. Flood Maps indicate that part of the site lies within the 1 in 100 year fluvial floodplain and part of the site will be affected by surface water flooding Any works which might affect a watercourse will require Schedule 6 consent under the Drainage (Northern Ireland) Order 1973, from Rivers Agency.	Chapter 9

CONSENTED (LA01/2018/0200/F)

Consultee		Summary of Response	Addressed in Assessment
The Hon. The Irish Society	(Owner of fishing rights on River Roe)	RES hold under licence the necessary Sporting Rights over the entire site.	8.96

Assessment Methodology

Baseline Characterisation

Study Area

8.17 The study area focussed on the streams draining the area within the Site, all of which are headwaters of the Curly River. Field survey work was carried out on these streams both within the Site Boundary and downstream to the confluence with the Curly River.

8.18 The desk assessment includes an evaluation of fisheries in downstream reaches of the Curly River and the wider catchment of the River Roe (Figure 8.1).

Desk Study

8.19 A desk study was carried out to assimilate baseline information relating to salmonid fisheries, ecological status (under WFD) and water quality (chemical and biological) for the study area. The following sources were consulted/used:

- Loughs Agency
- Northern Ireland Environment Agency (NIEA) – Water Management Unit (WMU) (Rivers and Lakes Team) www.doeni.gov.uk/niea/water/wfd.htm
- NIEA - Protected Areas www.doeni.gov.uk/niea/protected_areas_home
- Joint Nature Conservation Committee (JNCC) www.jncc/defra.gov.uk

Field Survey

Stream Quality

8.20 A survey site was selected on each stream at the northern edge of the Site to define the quality of each stream based on water chemistry, physical habitat and aquatic ecology.

Water Chemistry

8.21 A series of basic water quality parameters were measured at each site using portable meters to provide an outline profile of chemical quality.

8.22 Turbidity was measured using a EUTECH NT-100 turbidimeter which records in Nephelometric Turbidity Units (NTU). pH was measured using a WTW 3110 pH meter, dissolved oxygen with a Hanna Oxy-Check oxygen meter, and conductivity with a Hanna HI86303 conductivity meter; temperature measurements were made with both the pH and oxygen meters.

CONSENTED (LA01/2018/0200/F)

Physical Habitat

8.23 In addition the following physical characteristics were measured at each site:

- Stream width and depth (m)
- Substrate composition (visually estimated as per Bain et al., 1985);
- Percentage of deposited fine sediment (<2mm grain) on the river bed as per Clapcott et al. (2011), with the dominant fine sediment type (sand, silt, clays) determined by running the grain through the observer's fingers.

8.24 Percent bed cover was estimated from 10 sampling points across 10 equidistant transects in each stream except on very narrow (<0.3m width) and overgrown streams where it was difficult to observe the riverbed; on these streams, whole reach estimates were made based on broad visual observations.

Aquatic Ecology

8.25 Stream benthic communities are sensitive to a range of environmental conditions, including fine sediment, and have taxa with relatively long lifespans and restricted mobility that allows for the integration of stressor effects over longer timescales than may be indicated by physico-chemical parameters alone (Matthaei et al. 2006; Extence et al. 2013).

8.26 Baseline ecology of the streams within the development site was assessed by sampling the benthic macroinvertebrate community during July 2016 using a standard three minute kick sample hand (held 1mm mesh net) followed by a one minute search; this method is recommended by the United Kingdom Technical Advisory Group (UK-TAG) for assessing the condition of the quality element "benthic invertebrates" for WFD reporting (WFD-UKTAG, 2014).

8.27 Sampling was conducted in locations at the downstream extent of the site boundary but upstream of the main A37 (see map) to exclude potentially confounding effects of road and traffic on stream ecology. Where possible, samples were collected from riffle/run habitats, fixed in 4% formalin for 1 week, followed by preservation in 70% ethanol prior to sorting and identification.

8.28 In the laboratory, macroinvertebrate samples were spread across a 4 x 5, 20-square grid sorting tray to facilitate identification and to estimate relative abundance. Abundant taxa were counted in a subset of 5 squares and scaled to whole sample estimates as recommended in Murray-Bligh (2002). Less abundant taxa were counted in all grid squares.

Fisheries Habitat

8.29 An outline assessment of the streams draining the Site was carried out in April and July 2015 and consisted of walkover surveys recording general characteristics to provide an outline assessment for these watercourses. This was then complimented through a fish stock survey by electrofishing.

CONSENTED (LA01/2018/0200/F)

8.30 The descriptive terminology used in the survey is based on the Life Cycle Unit method (Kennedy, 1984) currently used by DCAL and the Loughs Agency. Habitat type is recorded as:

- Nursery (shallow rock/cobble riffle areas for juvenile fish - fry/parr);
- Holding (deeper pools/runs for adult fish);
- Spawning (shallow gravel areas for fish spawning);
- Unclassified (unsuitable for fish – shallow bedrock areas or heavily modified sections of channel).

Juvenile Fish Stocks

8.31 Monitoring of fish stocks by the Loughs Agency tends not to include sampling sites in the upper reaches of tributaries in most river systems. Therefore, this part of the fisheries assessment considered the principal streams draining the Site and set out to obtain details on salmonid distribution in reaches not covered in routine sampling by the Loughs Agency.

8.32 A juvenile fish stock survey of the streams draining the site and the Curly River was carried out by electrofishing at selected locations in August and September 2016.

8.33 Electrofishing was carried out according to a semi-quantitative methodology described by Crozier and Kennedy (1994). The procedure involves two operators fishing continuously in an upstream direction for five minutes at each sampling location, using a single anode backpack electrofishing set (24V DC input; 250V, 100W 50 Hz DC output). All fish were caught using a dip net and retained for inspection and then returned to the water live. Any additional Age 0 salmonids seen but not captured were also recorded. This method is consistent with Loughs Agency monitoring procedures.

Assessment of Effects

8.34 The assessment of effects was derived from methodologies outlined by:

- the Design Manual for Roads and Bridges specifically with regard to Road Drainage and the Water Environment, Volume 11, Section 3, Part 10 HD45/09 (DMRB, 2009);
- Institute of Environmental Management and Assessment guidelines (IEMA, 2004).

Sensitivity Criteria

8.35 Desk study and site inspections were carried out with regard to each watercourse draining the Site to assess fisheries status and potential effects. The Fisheries Importance/Site Sensitivity of each watercourse was graded, broadly in line with the guide to estimating the importance of water features outlined in the Design Manual for Roads and Bridges (2009) as outlined in Table 8.2.

CONSENTED (LA01/2018/0200/F)

Magnitude of Effect

8.36 The magnitude of effect was assessed according to the criteria set out in Table 8.3 and includes a consideration of the timescale of the effect (short, medium or long term).

Significance Criteria

8.37 The correlation of magnitude against the sensitivity of the receptor determines a qualitative expression for the significance of the effect on the basis of a standard matrix shown in Table 8.4. The greater the sensitivity or value of a receptor or resource, and the greater the magnitude of the impact, the more significant the effect.

Table 8.2: Estimating the Sensitivity/Importance of Receptors (DMRB, 2009)

Sensitivity	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on a regional or national scale	WFD Class 'High'. Site protected/designated under EC or UK habitat legislation (SAC, ASSI, salmonid water)/Species protected by EC legislation. Watercourse containing salmon and supporting a nationally important fishery or river ecosystem.
High	Attribute has a high quality and rarity on a local scale	WFD Class 'Good'. Species protected under EC or UK habitat legislation. Watercourse containing salmon or trout and supporting a locally important fishery or river ecosystem.
Medium	Attribute has medium quality and rarity on a local scale	WFD Class 'Moderate'. Watercourse containing trout and upstream of locally important fishery or river ecosystem.
Low	Attribute has low quality and rarity on a local scale	WFD Class 'Poor'. Watercourse without salmon or trout but upstream of locally important fishery or river ecosystem.
Negligible	Attribute has very low quality and rarity on a local scale	WFD Class 'Poor'/unspecified.

Table 8.3: Estimating the Magnitude of Effect on Receptors

Magnitude	Criteria	Type and Scale of Effect
Major	Results in loss of attribute and/or quality and integrity of the attribute	Loss or extensive change to a fishery. Loss or extensive change to a designated Nature Conservation Site. Major alteration to fish population levels in catchment as a whole, through fish mortality, habitat destruction or barrier to migration. Duration: long-term (>5 years).

CONSENTED (LA01/2018/0200/F)

Magnitude	Criteria	Type and Scale of Effect
Moderate	Results in effect on integrity of attribute, or loss of part of attribute	Partial loss in productivity of a fishery. Appreciable alteration to fish population levels in specific sub-catchment or zone. Duration: medium-term (1-5 years).
Minor	Results in some measurable change in attribute's quality or vulnerability	Minor loss in productivity of a fishery. Minor alteration to fish population levels in specific sub-catchment or zone. Duration: short-term (up to 1 year).
Negligible / No impact	Results in effect on attribute, but of insufficient magnitude to effect the use or integrity	Unlikely to affect the integrity of the water environment. No measurable alteration to fish population levels.

Table 8.4: Estimating the Significance of Potential Effects (DMRB, 2009)

Sensitivity	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large/Very Large	Moderate/Large	Neutral
High	Large/Very Large	Moderate/Large	Slight/Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight/Moderate	Slight	Neutral	Neutral

8.38 The five significance categories with typical effects are shown in Table 8.5. Effects evaluated as being Moderate, Large or Very Large are considered to be significant for the purpose of the EIA in line with the EIA Regulations and will require mitigation. Those effects assessed as Slight or Neutral are not considered to be significant in terms of the EIA.

Table 8.5: Descriptors of the Significance of Effect Categories (DMRB, 2009).

Significance category	Descriptors of effects
Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall

CONSENTED (LA01/2018/0200/F)

Significance category	Descriptors of effects
	adverse effect on a particular resource or receptor.
Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Baseline Conditions

Outline

8.39 The study focussed on the stream network draining the Site, all of which are headwaters of the Curly River. Field survey work was carried out on these streams within the Site and, in the case of the largest stream, extending downstream to the confluence with the Curly River.

Catchment Status

Designated Sites

8.40 The Site drains into the Curly River which forms part of the River Roe and Tributaries ASSI and SAC.

Legislative Context

8.41 The EC Habitats Directive (92/43/EEC) requires member states to designate Special Areas of Conservation (SACs) in order to protect habitats and species listed in Annex I and Annex II of the directive. The Habitats Directive was transposed into Northern Ireland legislation by the Conservation (Natural Habitats, etc) (Northern Ireland) Regulations 1995.

8.42 The Environment (Northern Ireland) Order 2002 provides the legislative basis for the protection of important nature conservation sites in Northern Ireland through the declaration of Areas of Special Scientific Interest. ASSIs are the major statutory mechanism for protecting nature conservation sites and generally provide the underpinning protection measure for the designation of European sites.

River Roe and Tributaries ASSI

8.43 The River Roe and Tributaries was declared an Area of Special Scientific Interest (ASSI) in 2007 (ASSI 246), having due to selected because of the physical features of the river and its associated riverine flora and fauna.

8.44 The ASSI extends over approximately 87 km of watercourse encompasses the main channel of the River Roe and several significant tributaries including the Curly River which drains the Development site (See Figure 9.4 – Designated Sites). The ASSI is noted for the physical diversity and naturalness of the banks and channels,

CONSENTED (LA01/2018/0200/F)

especially in the upper reaches. The richness and naturalness of its plant and animal communities are also significant features, in particular the population of Atlantic salmon, which is of international importance.

River Roe and Tributaries SAC

8.45 The River Roe and Tributaries was designated as a Special Area of Conservation (SAC) in 2007 (UK0030360) with Atlantic salmon noted as the Annex II species selected as the primary reason for designation of the site. The Roe SAC was also selected for the following Annex I habitat:

- Water courses of plain to montane levels with *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation.

8.46 Otter *Lutra lutra*, also listed in Annexe II, was identified as a qualifying feature but not a primary reason for site selection.

8.47 The conservation objectives for this SAC with regard to salmon are:

- Maintain and if possible expand existing population numbers and distribution (preferably through natural recruitment), and improve age structure of population.
- Maintain and if possible enhance the extent and quality of suitable Salmon habitat - particularly the chemical and biological quality of the water and the condition of the river channel and substrate.

8.48 Salmon is included in Annex II as a species of European importance, and other SACs in the Foyle catchment with salmon as the primary selection feature are:

- River Foyle and Tributaries
- River Faughan and Tributaries

EU Water Framework Directive

Local River Catchments

8.49 The Development is located in the Curly River sub-catchment of the River Roe. The Curly River flows in a south-westerly direction to join with the Roe at Limavady. The Roe forms one of the major sub-catchments of the Foyle system (Fig 8.2), which is assigned to the North Western International River Basin District (NWIRBD) under the Water Framework Directive.

8.50 The River Roe drains a catchment area of 385km^2 through a river length of approximately 132km including tributaries. The river flows in a general northerly direction to discharge into Lough Foyle near Limavady.

8.51 The river rises in the Sperrin Mountains and land use in the upper reaches is predominantly rough grazing for sheep with extensive conifer forestry plantation. In the middle reaches the river flows through a deep narrow gorge then emerging onto an alluvial flood plain to form a meandering channel between open grassy embankments.

CONSENTED (LA01/2018/0200/F)

8.52 The Roe is a top quality salmon system with excellent quality habitats populated by sustainable stocks of salmon and trout. The river is particularly suited to a flourishing stock of Atlantic salmon and supports a popular recreational fishery. This is borne out in the accumulated data recorded by the Loughs Agency which indicates consistent levels of spawning by salmon and generally favourable densities of juvenile salmon.

Ecological Status

8.53 To achieve the ecological objectives of the Water Framework Directive (WFD), River Basin Management Plans (RBMPs) have been implemented through a series of Local Management Areas (LMAs) during the 2010 to 2015 planning cycle.

8.54 The Development lies entirely within the Roe LMA, with all of the application area located in the waterbody defined as Curly River (UKGBNI1NW020202049). Proceeding downstream from the application area there is sequential hydrological connection between the following waterbodies in the Roe LMA (ecological status as assessed in 2014 is noted):

- Curly River (UKGBNI1NW020202013): Good
- River Roe (UKGBNI1NW020202024): Good

8.55 The ecological assessment for these waterbodies in 2014 is summarised in Table 8.6 which indicates the overall classification and status with regard to each of the principal parameters monitored.

Table 8.6: Classification of individual quality elements contributing to overall WFD status of relevant water bodies in Roe LMA, 2014

Parameter	Curly River (Ref 2049)	Curly River (Ref 2013)	River Roe (Ref 2024)
Ammonia	High	High	High
Benthic Invertebrates	Good	Moderate	Good
Dissolved oxygen	High	High	High
Fish	-		Good
Macrophytes	High	High	Good
pH	High	High	High
Phytobenthos	-	Good	Moderate
SRP	High	High	High
BOD*	High	Good	High
Temperature*	High	High	High
Hydrological regime	High	High	Good
Overall Status	Moderate	Moderate	Moderate

8.56 From the end of 2015 the number of water bodies within the Roe LMA was reduced from 22 to 19, and the two Curly River waterbodies noted above were merged to

CONSENTED (LA01/2018/0200/F)

form a single entity as Curly River (UKGBNI1NW020204060). The ecological assessment for these waterbodies in 2015 is summarised in Table 8.7.

Table 8.7: Classification of individual quality elements contributing to overall WFD status of relevant water bodies in Roe LMA, 2015

Parameter	Curly River (Ref 4060	River Roe (Ref 2024)
Ammonia	Good/High	Good/High
Benthic Invertebrates	Good	Good
Dissolved oxygen	High	High
Fish	-	Good
Macrophytes	High	Good
pH	High	High
Phytobenthos	Good	Good
SRP	High	Good
BOD*	High	High
Temperature*	High	High
Hydrological regime	High	Good
Overall Status	Good	Good

8.57 For the current planning cycle to 2021 NIEA has developed a series of RMBPs for each River Basin District including the North Western RBD. These documents set out the latest assessment of pressures and impacts on the water environment, describe the progress NIEA made towards achieving objectives for 2015, and explain the significant water management issues that still need to be addressed.

EC Fish Directive

8.58 The EC Freshwater Fish Directive (Consolidated) 2006/44/EC (FWFD) set physical and chemical water quality objectives for salmonid waters and cyprinid waters, specifically with regard to dissolved oxygen, ammonia, pH and total zinc.

8.59 The Fish Directive was repealed by the Water Framework Directive at the end of 2013, and the ecological status defined in the WFD sets the same protection to waterbodies designated for fish under the original directive. Areas designated under the Fish Directive have become areas designated for the protection of economically significant aquatic species under WFD and placed on a Register of Protected Areas.

8.60 The main stem channel of the River Roe (including the Curly River up to Bolea) was designated as “salmonid” under the Surface Waters (Fish Life Classification) Regulations (Northern Ireland) 1997, which implements the EC Freshwater Fish Directive. In 2003 this designation was extended to include several tributaries and extending the designation to the source of the Curly River.

CONSENTED (LA01/2018/0200/F)

Water Quality Monitoring

8.61 Chemical and biological quality of individual water bodies have been monitored by NIEA Water Management Unit on a monthly basis since 2009 to comply with statutory monitoring for Water Framework Directive reporting. There is a single monitoring station on the lower Curly River some distance downstream of the Development.

Chemical Quality

8.62 Summary results for a selection of chemical quality parameters at the Curly River monitoring site are presented in Table 8.8. It should be noted that this sampling location is approximately 10.5 km downstream of the Site.

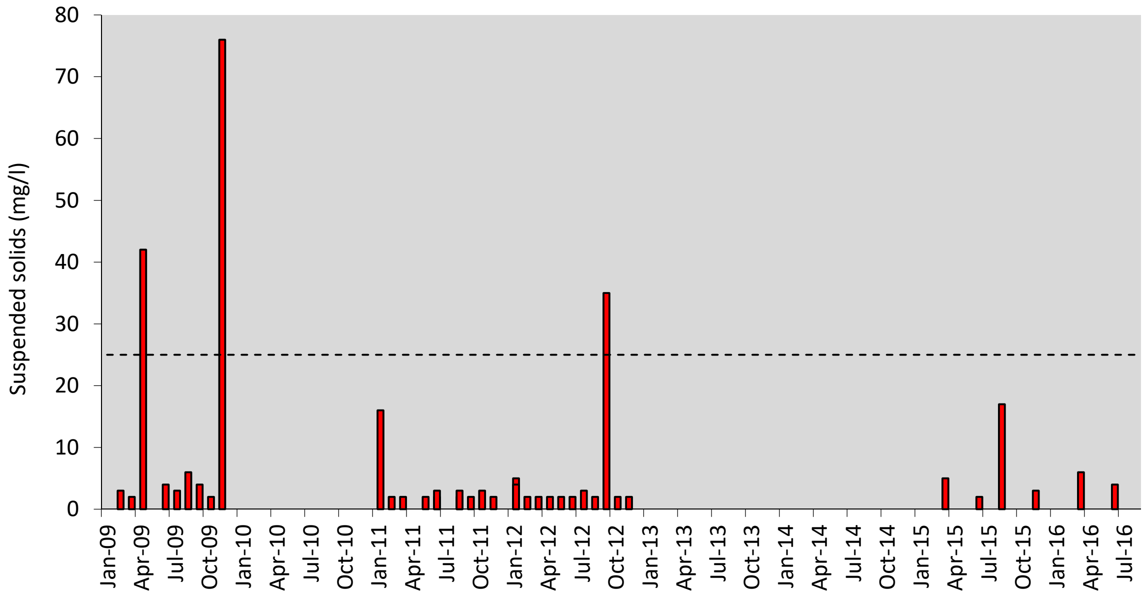
Table 8.8: Selected Chemical Monitoring Data from Curly River, 2009-16 (Source: NIEA)

Curly River (C684246)		pH	Cond (µs/cm)	DO (mg/l)	DO (%)	BOD (mg/l)	NH3 (mg/l)	P-Sol (mg/l)	S.Solids (mg/l)
2009	Min	7.60	170	9.2	90	1.2	<0.001	0.01	<2
	Max	8.00	411	13.0	103	3.4	0.001	0.08	76
	Mean	7.86	316	10.9	96	1.8	<0.001	0.03	13
2011	Min	7.50	168	9.3	86	<1.0	<0.001	0.01	<2
	Max	8.40	422	14.5	115	2.4	0.002	0.03	16
	Mean	7.90	325	11.2	98	1.4	<0.001	0.02	3
2012	Min	7.40	172	9.5	92	<1.0	<0.001	0.01	<2
	Max	8.10	398	12.9	102	3.7	0.001	0.06	35
	Mean	7.89	275	11.0	96	1.6	<0.001	0.02	5
2015/16	Min	7.4	188	9.9	92	<2.0	<0.001	0.01	<2
	Max	8.0	399	12.7	101	2.5	0.001	0.06	17
	Mean	7.7	269	11.4	96	2.1	0.001	0.03	6

8.63 Of particular relevance to salmonid fish is suspended sediment as it has significant potential to impact on both directly on the fish and also on their habitat. The variation in suspended solids in the Curly River over a four year period is illustrated in Chart 8.1.

CONSENTED (LA01/2018/0200/F)

Chart 8.1: Monthly Measurements of Suspended Solids in Curly River, 2009-16 (Source: NIEA).



8.64 During the sampling period the level of suspended solids was generally below 5 mg/l in both rivers and exceeded the WFD guideline for salmonid fish (25 mg/l) in only three of 41 samples over three years from the Curly River. These figures are indicative of generally low levels of sediment run-off in these catchments where any rises in suspended solids are likely to be due to spate conditions following periods of heavy or sustained rainfall.

Biological Quality

8.65 Summary results for biological quality monitoring in the Curly River under the BMWP system are presented in Table 8.9; there has been no biological monitoring carried out at this location since 2012. In general terms these results reflect a *Good* standard of biological quality as was indicated in the WFD classifications for the Curly River in 2014.

Table 8.9: Biological Monitoring of Curly River, 2009-12 (Source: NIEA)

Date	BMWP score	No. Taxa	ASPT
29/04/2009	127	21	6.05
19/10/2009	111	20	5.55
18/04/2011	112	20	5.60
02/11/2011	91	16	5.69
18/04/2012	135	21	6.43
24/10/2012	101	18	5.61
Mean	113	19	5.82

CONSENTED (LA01/2018/0200/F)

WFD Fish Monitoring

8.66 Water Framework Directive compliant fish surveys at surveillance stations are required under national and European law. Annex V of the WFD stipulates that rivers should be included within monitoring programmes and that the composition, abundance and age structure of fish fauna should be examined (Council of the European Communities, 2000). Within the Roe catchment there are seven WFD fish monitoring stations which have each been subject to monitoring at least once over the last six years with fish classifications as noted in Table 8.10 (Niven, 2010; Niven and Scott, 2013; NIEA, *unpublished data*).

Table 8.10: Summary classifications of relevant sites under WFD fish monitoring (Source: Loughs Agency).

Water body	2011	2012	2013	2014	2015
Owenalena River	-	-	-	High	High
River Roe (Limavady)	-	Good	Good	Good	High
Owenbeg River	Good	Good	Good	Good	Good
River Roe (Ballycarton)	Good	Good	Good	Good	Good
River Roe (Corick)	-	-	-	High	High

8.67 The following fish species are recorded as being present in the Roe catchment (Loughs Agency, 2010):

- Atlantic salmon (*Salmo salar*);
- Brown trout and Sea trout (*Salmon trutta*);
- Eel (Anguilla anguilla);
- Three-spined stickleback (*Gasterosteus aculeatus*);
- Minnow (Phoxinus phoxinus);
- Smelt (Osmerus eperlanus)
- River/Brook lamprey (*Lampetra* sp);
- Sea lamprey (Petromyzon marinus).

Significant Freshwater Species

8.68 This section outlines the current status of Annexe II freshwater species and other species of conservation interest.

Atlantic salmon

8.69 The salmon is an anadromous species having both a freshwater stage and a marine stage to its life cycle. The species is listed under Annexe II of the Habitats Directive and was added to the UK Biodiversity Action Plan (BAP) list in 2007 as a priority species for conservation action. More recently the salmon achieved an IUCN threat status of Vulnerable in the Irish Red List No 5 (King *et al*, 2011).

CONSENTED (LA01/2018/0200/F)

8.70 Northern Ireland's Atlantic salmon management strategy is aligned to the agreement reached by the North Atlantic Salmon Conservation Organisation (NASCO) and its Parties to adopt and apply a precautionary approach to the conservation, management and exploitation of the salmon resource and the environments in which it lives. Northern Ireland, through the UK and EU, is a Party to NASCO.

8.71 Atlantic salmon stocks in general are in serious decline and southern stocks, including some in North America and Europe, are threatened with extinction. As a conservation measure commercial netting for salmon was significantly reduced by the Loughs Agency in 2007, and has been suspended on an annual basis since 2009 due to the River Finn stock falling below its conservation limit.

8.72 Condition Assessments for the River Roe & Tributaries SAC, undertaken as part of Habitats Directive reporting requirements, indicate that the Atlantic salmon population was at *Favourable status* in both 2007 and 2011.

Lamprey

8.73 There are three species of lamprey in Northern Ireland:

- Brook lamprey (*Lampetra planeri*)
- River lamprey (*Lampetra fluviatilis*)
- Sea lamprey (*Petromyzon marinus*)

8.74 Sea and River lampreys are parasitic and migrate between the freshwater and marine environments, returning to freshwater to breed. In contrast, Brook lamprey are resident freshwater throughout their life cycle and are non-parasitic. Brook lamprey are widely distributed in Northern Ireland but River and Sea lamprey have a more limited distribution (Goodwin *et al*, 2009).

8.75 All three species are designated under Annex II of the EU Habitats Directive (Directive 92/43/EEC) and there are five large river SACs designated in the Foyle area. None of the three species is listed as a site selection feature of the River Foyle and Tributaries SAC but River/Brook lamprey are known to be present.

8.76 The Loughs Agency carried out a baseline survey in 2013 to record the abundance and distribution of juvenile lamprey in the Roe SAC; it was found that River/Brook lamprey populations were at Favourable conservation status while Sea lamprey populations were Unfavourable (Niven & McCauley, 2013). The assessment also demonstrated the presence of River/Brook lamprey in the Curly River.

Eel

8.77 The European eel the stock has been in rapid decline throughout its range since around 1980. This has led to the passing of the European Eel Regulation (EC) 1100/2007 which aims to return the European eel stock to more sustainable levels of adult abundance and juvenile eel recruitment. Member States are required to implement Eel Management Plans in each eel river basin, in this case the North Western International River Basin District.

CONSENTED (LA01/2018/0200/F)

8.78 The European eel is not listed under Annexe II but has recently been added to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species in the category of Critically Endangered (King *et al*, 2011).

8.79 There is limited data available on the distribution of eel in the River Roe but the catchment status report for 2009 records the occurrence of the species during salmonid electrofishing surveys and indicates a regular distribution throughout the catchment, including the Curly River (Loughs Agency, 2010).

Brown trout

8.80 Brown trout are a priority species for conservation action in Northern Ireland, as required under the Wildlife and Natural Environment Act (Northern Ireland) 2011. They are widely distributed in the River Roe catchment and a significant proportion of the stock migrates to sea and returns to freshwater to spawn.

Salmon Stock Data

8.81 Annual monitoring of salmon (and trout) stocks in the Foyle system is conducted by the Loughs Agency based on:

- Adult salmon runs;
- Salmon spawning;
- Juvenile fish stocks.

The River Roe and Curly tributary support significant stocks of Atlantic salmon and brown trout.

Adult Salmon Runs and Conservation Limits

8.82 A key factor in assessing the status of salmon stocks is determination of Conservation Limits for individual river systems. The Conservation Limit for Atlantic salmon is defined by NASCO as: *the spawning stock level that produces long term average maximum sustainable yield as derived from the adult to adult stock and recruitment relationship*. In simpler terms the Conservation Limit for a river is the number of spawning salmon required to ensure that salmon are reproducing in sufficient quantities to produce the next generation of fish.

8.83 The Loughs Agency operates a “real time” management regime for the Foyle system which aims to manage salmon fisheries and spawning populations in a sustainable manner. Management targets and spawning targets are set for each river catchment with egg deposition levels are set according to the area and quality grading of each section of nursery habitat. 25% is deducted from the management target allowing for loss of salmon by angling (15%), and poaching and predation (10%). The remaining figure is referred to as the conservation limit/spawning target.

8.84 A management target of 1833 adult Atlantic salmon has been set for the Roe Catchment, this equates to a conservation limit/spawning target of 1466 or 2,062,125 eggs.

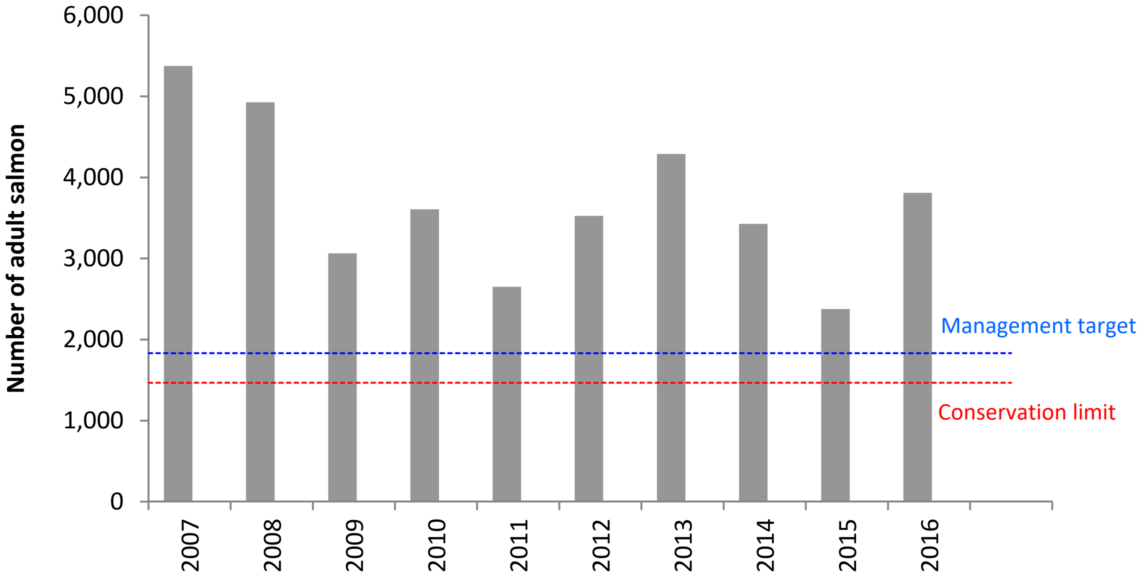
8.85 Adult salmon runs are now measured by electronic fish counters at six counting stations in the Foyle system; the Roe counter is located downstream of Limavady on

CONSENTED (LA01/2018/0200/F)

a purpose-built crump weir spanning the full width of the river and has been in operation since 2001.

8.86 The numbers of adult fish returning to the river each year since 2007 are shown in Chart 8.2 along with the conservation limit (CL) and management target (MT) for the river. There is some evidence of a decline in the stock but both CL and MT have been exceeded in each of the last 10 years.

Chart 8.2: Numbers of salmon ascending River Roe fish counter, 2007-16 (Source: Loughs Agency)



Juvenile Fish Stocks

Monitoring

8.87 Fry distribution and abundance are an indication of the distribution and level of spawning by adult fish. Trends in abundance of juvenile salmon and trout are monitored by the Loughs Agency through annual semi-quantitative electrofishing surveys according to a methodology developed by Crozier & Kennedy (1994). Over 450 sites are sampled each year throughout the Foyle area with 60 in the Roe catchment including eight on the Curly River as shown in Fig 8.3.

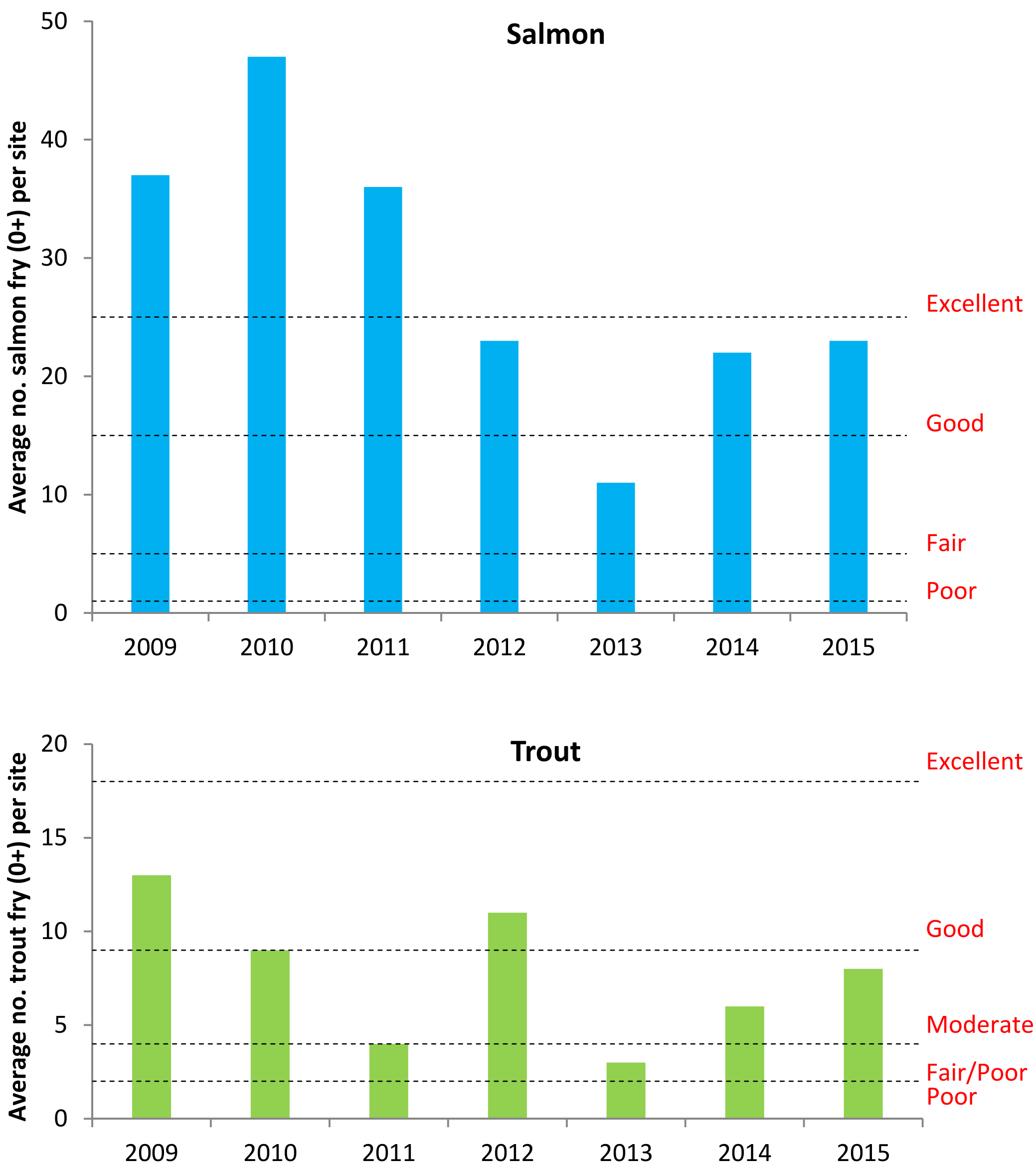
Abundance Index

8.88 The semi-quantitative electrofishing method has been calibrated separately for trout and salmon based on extensive studies in river reaches of known juvenile salmonid density. This has resulted in the development of an abundance classification system (Abundance Index) for salmon with five categories: Absent, Poor, Fair, Good, Excellent (Crozier and Kennedy, 1994). The Abundance Index for trout has six classifications: *Absent, Poor, Poor/Fair, Moderate, Good, Excellent* (Kennedy, *unpublished*).

CONSENTED (LA01/2018/0200/F)

8.89 Chart 8.3 shows the average catch of salmon and trout fry at survey sites on the Roe over the most recent seven-year period with abundance categories indicated. Salmon fry are generally more abundant than trout and there is some evidence of a decline in both stocks during this period, consistent with the apparent decline in adult fish runs. However average salmon fry abundance remains in the *Good* category while trout abundance is *Moderate*.

Chart 8.3: Salmon and trout fry Abundance Indices based on mean fry numbers at electrofishing sites on the Roe, 2009-15 (Source: Loughs Agency)



8.90 The locations of the survey sites on the Curly River are shown in Fig 8.3 and summary results for fry abundance at these sites during the period 2005-15 are indicated in Table 8.11.

Table 8.11: Average fry abundance indices at survey sites on the Curly River, 2005-15; listed upstream to downstream (Source: Loughs Agency)

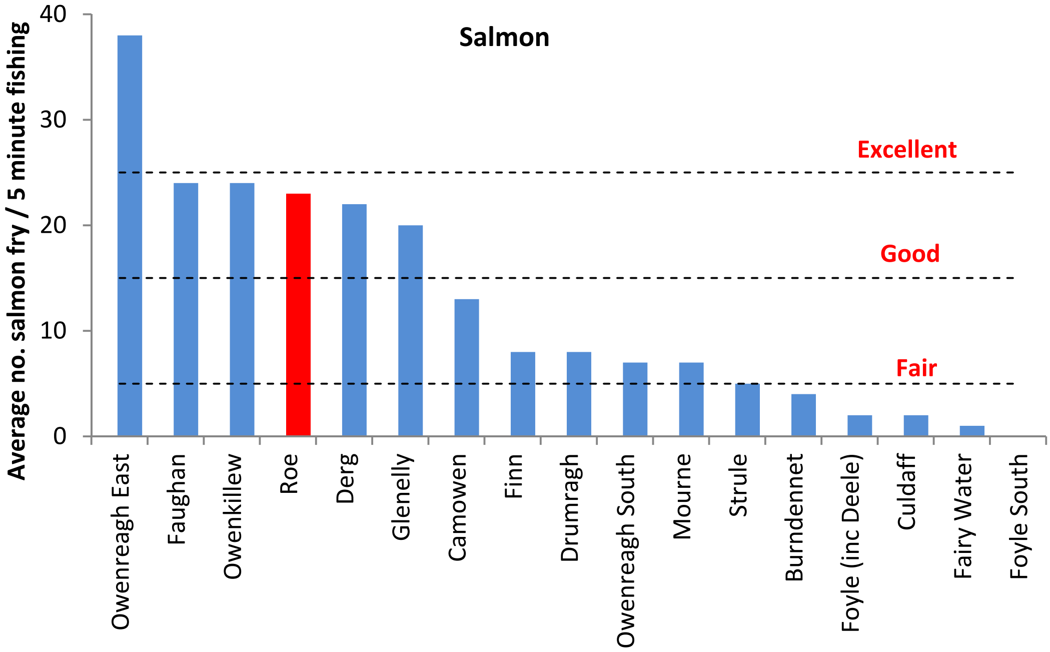
CONSENTED (LA01/2018/0200/F)

Site ID	Grid ref		Fry abundance	
	Easting	Northing	Salmon	Trout
17_071	273406	426862	Poor	Moderate
17_070	273184	426733	Fair	Moderate
17_069	272186	425827	Excellent	Good
17_068	271294	425624	Good	Moderate
17_067	270931	424851	Excellent	Good
17_066	268920	424590	Excellent	Moderate
17_065	268705	424741	Excellent	Poor
17_030	268371	424549	Excellent	Moderate

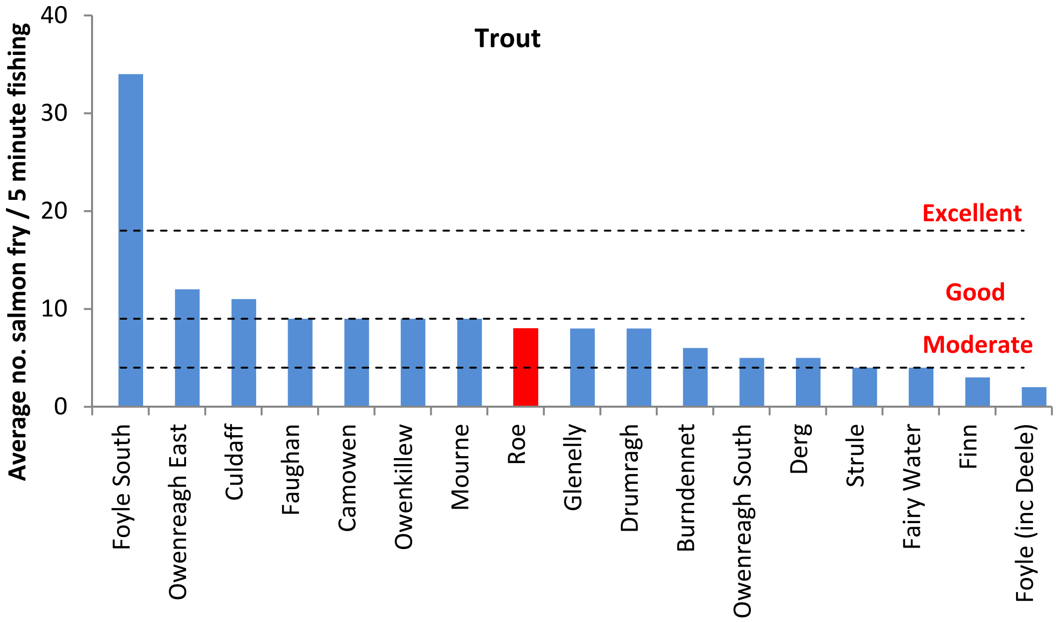
8.91 This data demonstrates that salmon spawning takes place throughout the reach surveyed and directly adjacent to the Site (within 1km of boundary), with *Excellent* fry densities indicated at five out of six sampling sites in the reach extending downstream to connect with the Roe – this is indicative of widespread spawning in this reach. Trout densities are more uniform with an average *Moderate/Good* abundance at most sites but fewer fish at the lower end of the river.

8.92 Fry densities in the Roe for 2012 are compared with those from other leading catchments in the Foyle system in Chart 8.4. This illustrates that for both salmon and trout the Roe is one of the most productive rivers in the region.

Chart 8.4: Salmon and trout fry index based on mean fry numbers in 17 principal catchments of the Foyle, 2015 (Source: Loughs Agency)



CONSENTED (LA01/2018/0200/F)



Angling

8.93 The Roe is one of the leading angling waters in the Foyle system providing a popular rod fishery for both the local population and visitors to the area. Fishing rights on the freshwater reaches of the main channel and tributaries are owned by The Honourable Irish Society while the tidal section is owned by the Loughs Agency. RES holds under Licence the necessary Sporting Rights from The Honourable Irish Society.

8.94 Angling is controlled and administered by the Roe Angling Ltd which leases the fishing rights on both the freshwater and tidal sections.

8.95 Details of angling activity and catches of salmon and sea trout are shown in Table 8.12. As these returns are based on incomplete licence/logbook returns, a raising factor is applied in line with Loughs Agency methodology which is based on an analysis by Small (1991). Adjustment of the catch returns for 2009-15 would suggest an average annual catch of 379 salmon which would indicate a very productive fishery. Voluntary catch and release is now practised widely on the Foyle system reaching 58% in 2012.

Table 8.12: Salmon angling catches for the Roe indicating adjustment according to annual rate of licence/logbook returns, 2009-15 (Source: Loughs Agency)

Catch statistics	2009	2010	2011	2012	2013	2014	2015	Average
% licence/logbook return	44%	56%	46%	16%	10%	15%	38%	32%
Raising factor	1.38	1.24	1.35	2.58	3.70	2.70	1.49	2.06
Reported salmon catch	197	500	398	379	11	34	78	228
Adjusted salmon catch	273	619	538	976	41	92	116	379

CONSENTED (LA01/2018/0200/F)

Habitat Improvement Works

8.96 Roe Angling Ltd has invested significant funds and labour in conducting fisheries enhancement works on various tributaries, notably the Owenbeg River, to upgrade spawning and nursery habitats. Grant funding has been obtained from ARC North West (NI Rural Development Programme), NGO Challenge Fund (NIEA) and the Lough Agency.

8.97 The Loughs Agency has also carried out a series of habitat improvement measures in tributaries such as the Bovevagh River and the Wood Burn. The works were designed to improve in-channel flow and to introduce sequences of spawning, nursery and holding water.

Field Studies

Water Chemistry

8.98 Basic water quality parameters in the five streams draining the Site were measured at the northern edge of the Site during low to medium flow conditions using portable meters on three occasions between April and August 2016; the sampling site locations are shown in Fig 8.4 and the results are presented in Table 8.12.

Table 8.12: Water chemistry parameters measured in five drainage stream, Jul-Sept 2016.

Date	Stream	Temp (°C)	pH	Diss. Oxygen (mg/l; % sat)	Conductivity (µS/cm)	Turbidity (NTU)	Comment
14/07/16	A	12.9	7.9	10.4 (99%)	150	1.48	
	B	15.3	7.6	8.9 (89%)	100	1.66	
	C	15.5	7.7	10.4 (104%)	114	1.01	
	D	14.9	7.1	10.6 (104%)	62	1.54	
	E	16.8	6.9	9.9 (102%)	50	0.79	
09/08/16	A	-	-	-	-	-	
	B	-	-	-	-	-	
	C	12.3	7.7	10.8 (94%)	182	0.68	
	D	12.8	7.7	10.1 (94%)	115	0.62	
	E	-	-	-	-	-	
31/08/16	A	13.1	8.2	10.3 (97%)	-	1.29	
	B	14.2	7.2	7.4 (72%)	-	2.56	Static
	C	14.4	8.2	10.3 (99%)	-	0.15	
	D	13.7	7.8	9.3 (89%)	-	0.68	Static
	E	-	-	-	-	-	Dry

8.99 These readings suggest satisfactory conditions with regard to general stream ecology. All five streams are alkaline with low to moderate conductivity. They

CONSENTED (LA01/2018/0200/F)

generally indicate well oxygenated waters although Streams B and D had depressed oxygen saturation in late August, most likely due to lack of flow. Low turbidity readings indicate low levels of suspended solids, well within the guidelines set by the former EU Freshwater Fish Directive and now listed on the Register of Protected Areas under the Water Framework Directive. However, sampling in spate conditions would have been likely to detect higher turbidity readings.

Aquatic Ecology

8.100 For each survey site, the baseline was summarized as the total number of invertebrate taxa identified, total site BMWP-WHPT score, and average score per taxon (ASPT), using the abundance weighted sensitivity scores developed by Walley and Hawkes (1997) as recommended for the Water Framework Directive (WFD-UKTAG, 2014).

8.101 Sites were classified following the Water Framework Directive approach for assessing the condition of the quality element “benthic invertebrates”. Environmental quality ratios (EQRs) were calculated for the number of taxa and ASPT by dividing observed by expected values (Table 8.13). Both metrics were then assessed in a “worst of” approach to give an overall invertebrate classification (WFD-UKTAG, 2014).

Table 8.13: Environmental Quality Ratios used to classify stream sites based on benthic invertebrates.

Quality status/ condition	WHPT NTAXA EQR	WHPT ASPT EQR
High/Good	0.80	0.97
Good/ Moderate	0.68	0.86
Moderate/ Poor	0.56	0.72
Poor/ Bad	0.47	0.59

8.102 Expected (predicted) metric values were determined from site-specific physical and chemical data using the RIVPACS IV model incorporated in the online River Invertebrate Classification Tool (RICT):

https://www.sepa.org.uk/environment/water/classification/river-invertebrates-classification-tool/

Predictions require input of the following test site data: altitude; distance from source; discharge category; percent substrate composition; electrical conductivity. Geographic environmental data were obtained from 1:50,000 ordnance surveys maps and from stream physical habitat assessments, whereas discharge category was estimated from width, depth and flow velocity estimates (Murray-Bligh, 2002).

CONSENTED (LA01/2018/0200/F)

8.103 Although samples from at least two seasons are recommended, site classifications can be generated from single season samples. In RICT, the default RUN settings were selected with season set to summer and the taxon end-group and predictive environmental variables both set for Northern Ireland.

8.104 Summary results of the physical habitat survey and benthic macroinvertebrate assessment carried on 14 July 2016 are presented in Table 8.14.

Table 8.14: Summary of WFD invertebrate-based biological quality and physical indices/ quality classes for streams within the site development.

Stream	Grid Ref	Mean width (m)	Depth (m)	Fine sediment		Benthic invertebrate assessment			
				% cover	Type	BMWP WHPT total score	No. taxa	WHPT ASPT	WFD class
A	274068 426085	0.5	0.1	9	Silt/ clay	109.4	18	6.07	High
B	273900 426009	0.3	0.15	100	Silt/ clay	122.4	22	5.56	Good
C	273524 425825	1.5	0.2	16	Silt/ clay	139.8	22	6.35	High
D	273405 425824	0.2	0.15	50	Silt/ clay	107.7	18	5.98	High
E	272884 425513	0.7	0.1	10	Silt	88.4	17	5.2	Moderate

8.105 Apart from Stream E, all streams were classified as “Good” or “High” ecological quality. Although streams B and D had a higher percent fine sediment cover as “silt”, this was mainly composed of natural peat and humic material rather than the fine erodible clays and silts that can impair ecological quality.

8.106 The streams also had pH values indicative of neutral conditions such that the benthic communities did not appear to be impacted by stream acidity. The classification of stream E as of “Moderate” ecological quality may be related to the long reach (~35m) that was piped just above the sampling location, and the habitat further upstream, which was steep and of low substrate complexity.

8.107 The generally good ecological condition of the streams was supported by very low turbidities (<2.0 NTU). There are no environmental standards for fine sediment in the UK, though an annual mean total suspended solids (TSS) concentration of 25 mg/L is specified as a guideline for salmonid waters in the EC Freshwater Fish Directive 2006/44/EC (FWFD); the FWFD is now repealed by Article 6 of the Water Framework Directive, which provides the same level of protection (UKTAG, 2010). Turbidity is a good proxy for suspended sediment levels at low NTU values, and the values recorded are also indicative of generally high water clarity within the development site. However, it should be noted that the “baseline” assessment of

CONSENTED (LA01/2018/0200/F)

sediment could underestimate levels, particularly since soil water saturation levels in the winter period would be higher and the potential for sediment rich run-off to enter streams would be high (Cournane et al. 2011).

Fish Habitat

Catchment Overview

8.108 The Development is located entirely within the River Roe catchment and specifically within the Curly River sub-catchment. The application area drains via a series of small un-named streams flowing north to the Curly River. Site drainage is described in further detail in Ch10 Geology & Hydrogeology.

8.109 The Curly River flows in a westerly direction joining with the Castle River approximately 5.5km from the Site at Limavady and subsequently discharges to the River Roe after further 0.7km.

8.110 The fish habitat survey consisted of a walkover assessment of the five un-named streams and a small area of standing water identified within the Site (Site Boundary) (Figure 8.4).

Minor Drainage Streams

8.111 Of the five streams draining the site only Stream C is significant in terms of fisheries status and potential (Figure 8.5: Plates 8.3 - 8.5. Streams A, B, D and E are generally less than 0.5m wide within the site boundary, heavily infiltrated with surrounding vegetation, and all but Stream A were noted to be without any discernible flow at the end of August 2016 (Figure 8.5: Plates 8.1, 8.2, 8.6 & 8.7). The late summer walkover also included the lower reaches of these watercourses where they connect with the Curly River and, apart from Stream C, only Stream A had any discernible flow in this area. It can be concluded that Streams A, B, D and E are of no fisheries interest within the site area and of very limited fisheries potential throughout their course before joining the Curly River.

Principal Drainage Stream

Within Site Boundary

8.112 Stream C is the principal stream draining the Site to the Curly River. At the northern edge of the site the stream is 1-2m wide with a substrate of gravel, cobble and boulder with extensive moss growth in faster flowing reaches which is indicative of substrate stability. A riffle pool sequence provides good quality habitat for juvenile trout (Figure 8.5: Plate 8.8).

8.113 Moving upriver the stream divides in two - the eastern branch is slightly larger and is superior in terms of habitat quality. It is wider and deeper with occasional pools but has sections of steep gradient (Figure 8.5: Plates 8.9 - 8.11). The western branch initially consists of shallow riffles with little habitat for larger fish (Figure 8.5: Plates 8.14 & 8.15); there is also a small waterfall near to the confluence of the two streams.

CONSENTED (LA01/2018/0200/F)

8.114 The gradient in both streams increases in the upper reaches with frequent cascades, riffles and occasional small falls (Figure 8.5: Plates 8.11 & 8.12). Substrate materials in both branches are generally coarser with a higher proportion of boulder evident interspersed with cobble and occasional pockets of gravel (Figure 8.6: Plates 8.13, 8.16 & 8.17), and both appear to be populated throughout with brown trout and a small number of eels (see following section: Juvenile Fish Stocks).

Downstream of Site Boundary

8.115 In contrast to the upper reaches this section of stream is heavily shaded over most of its course. Stream width increases from an initial 1-2m to 3½m in sections before the confluence with the Curly River. Instream habitat continues to be good with similar substrate materials abundant in cobble, boulder and gravel. There are patches of exposed clay and deeper pools in the approach to the Curly River (Figure 8.7: Plates 8.18 - 8.21).

Curly River

8.116 At the confluence with stream C the Curly River is 6-7m wide with frequent riffles/runs interspersed with holding pools and moderate shading from tree cover on both banks. The substrate is composed mainly of boulder/cobble, gravel and pebble. This reach forms part of the River Roe Tributaries SAC and is an important spawning area for salmon (Figure 8.7: Plates 8.22 - 8.24).

Juvenile Fish Stocks

8.117 A juvenile fish stock survey of Stream C was carried out on 9 August 2016 at 12 sampling points within the site area; an additional five sites were surveyed on 30 September 2016 downstream (north) of the Site and extending to the Curly River (Figure 8.3). Trout were found to present at all sites with eels occurring at some points and salmon appearing at the lower end of the stream and in the main channel Curly River.

Population Age Structure

8.118 The age structures of the trout and salmon stocks in Stream C and the Curly River site were verified by constructing separate length frequency distributions for each species (Charts 8.5 and 8.6).

Chart 8.5: Length frequency distribution of trout caught in Stream C.

CONSENTED (LA01/2018/0200/F)

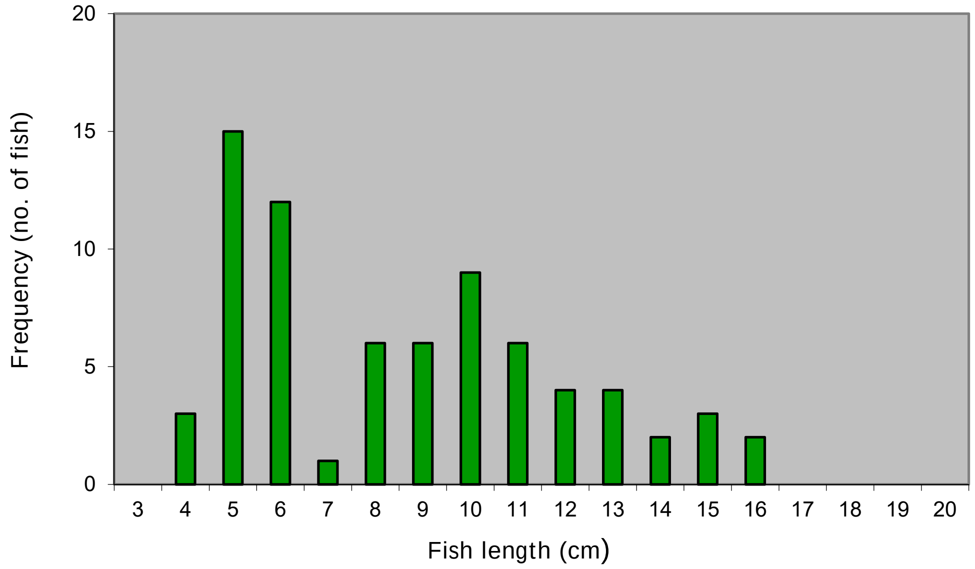
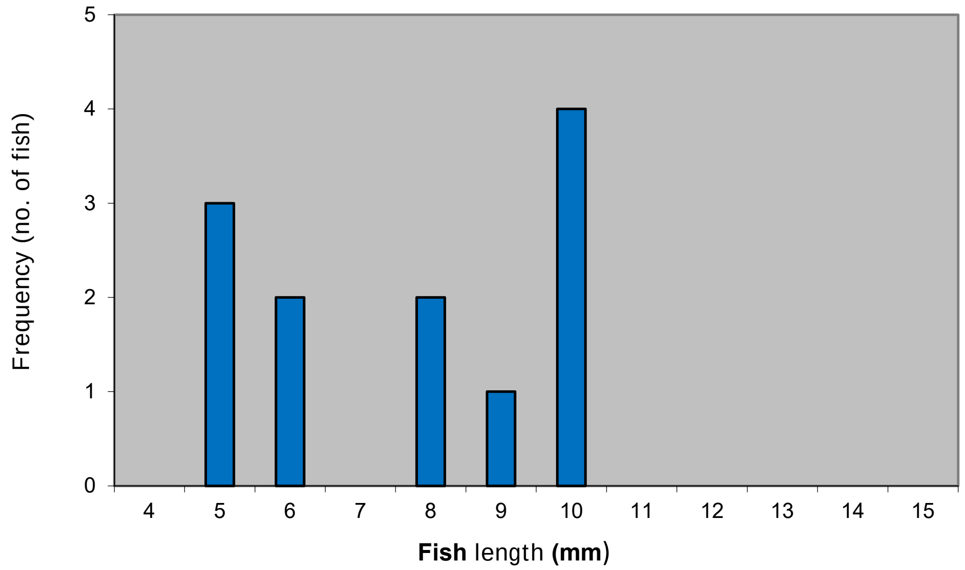


Chart 8.6: Length frequency distribution of salmon caught in the Curly River.



8.119 The trout length frequency indicates a bimodal distribution separating Age 0 fry (4-7 cm) from 'older fish' (8-17cm), made up of Age 1 and Age 2 fish. The salmon length frequency shows a clear separation of Age 0 fry (5-6 cm) from Age 1 fish (8-11 cm).

Distribution & Abundance

8.120 The results of the semi-quantitative electrofishing survey are shown in Table 8.15. Juvenile trout in the range Age 0 to Age 2 were observed to have a widespread distribution in Stream C both within the Site and throughout its course to the confluence with eth Curly River but were absent from the Eastern tributary.

8.121 Streams A, B, D and E were adjudged to incapable of supporting fish life within the site area and only Stream A had the potential to be inhabited by fish in its lower reach adjacent to the Curly River.

CONSENTED (LA01/2018/0200/F)

Table 8.15: Summary results of electrofishing survey indicating numbers of age 0 and older trout and salmon caught; trout fry abundance is also indicated.

Site	Stream	Grid Ref		Trout		Salmon		Trout Fry Abundance
		East	North	Age 0	Older	Age 0	Age 1	
1	Stream C	273729	425353	4	2	0	0	Moderate
2	Stream C	273680	425381	0	1	0	0	Absent
3	Stream C	273675	425428	2	3	0	0	Poor
4	Stream C	273608	425625	12	0	0	0	Good
5	Stream C	273603	425705	6	0	0	0	Moderate
6	Stream C	273952	425450	0	3	0	0	Absent
7	Stream C	273866	425502	1	9	0	0	Poor
8	Stream C	273798	425559	1	9	0	0	Poor
9	Stream C	273729	425598	0	1	0	0	Absent
10	Stream C	273657	425647	0	6	0	0	Absent
11	Stream C	273604	425710	7	5	0	0	Moderate
12	Stream C	273560	425776	5	8	0	0	Moderate
13	Stream C	273414	426013	2	2	0	0	Poor/Fair
14	Stream C	273347	426119	6	5	0	0	Moderate
15	Stream C	273232	426291	4	6	0	0	Moderate
16	Stream C	272973	426547	8	7	0	1	Moderate
17	Curly River	272953	426537	11	8	7	9	Good

8.122 Applying the abundance index developed by Kennedy (*unpublished data*) indicates trout fry (Age 0) densities ranging from *Absent* to *Good* in Stream C and the Curly River. This data indicates a significant level of spawning by adult trout in these streams.

8.123 The presence of salmon in Stream C (Site 16) and in the Curly River is consistent with Loughs Agency data which indicates that the Curly River is an important salmon spawning and nursery tributary for the Roe as a whole.

Assessment of Effects

8.124 Potential effects were assessed for construction, operational and decommissioning phases of the Development. Construction impacts cover the discharge of suspended solids, release of other pollutants and interruption of fish passage. Post-construction (operational) impacts include habitat loss at watercourse crossings, obstruction of fish passage and surface water run-off.

8.125 Impact assessments are primarily based on their effect on salmonids either directly or upon their habitats. However, these assessments would be equally relevant to eels and lamprey if present in these waters.

CONSENTED (LA01/2018/0200/F)

Fisheries Significance / Sensitivity

8.126 Using the information assembled through the baseline assessment, the Fisheries Significance/Sensitivity for the main watercourses draining the area within the Site Boundary and downstream of this area are shown respectively in Table 8.16. A watercourse was deemed to have a High/ Very High sensitivity if the WFD class was at least Good and Annex II species were present (e.g. salmon, lamprey). Similarly, the streams draining the site were mostly of High/Good ecological status, but streams B, D and E were assessed as of Negligible sensitivity because they are not populated by any significant fish species. Stream A was classified at Low sensitivity as it may contain trout in the lower reaches, while stream C was adjudged to be of Medium sensitivity as it is populated by trout throughout its course.

Table 8.16: Sensitivity of receiving watercourses within Site Boundary and downstream to River Roe main channel.

River/Stream	Key Species	ASSI/SAC	Sensitivity
Stream A	No fish present within Site Boundary. Brown trout possible adjacent to Curly River.	-	Low
Stream B	No fish present within Site Boundary and unlikely throughout stream.	-	Negligible
Stream C	Brown trout & European eel present within Site Boundary and throughout course of stream. Annexe II species: Atlantic salmon adjacent to Curly River.	-	Medium
Stream D	No fish present within Site Boundary and unlikely throughout stream.	-	Negligible
Stream E	No fish present within Site Boundary and unlikely throughout stream.	-	Negligible
Curly River	Receiving watercourse located downstream of application area; Annexe II species: Atlantic salmon, River/Brook/Sea lamprey. Brown trout & European eel also present.	ASSI/SAC	Very High
River Roe	Receiving watercourse located downstream of application area; Annexe II species: Atlantic salmon, River/Brook/Sea lamprey. Brown trout & European eel also present.	ASSI/SAC	Very High

Construction Phase

Sediment Run-off

8.127 Salmonid fish are particularly sensitive to reductions in water quality and habitats can be damaged by siltation from settlement of Suspended Solids (SS) (Alabaster & Lloyd, 1980). This is recognised through the EC Freshwater Fish Directive which specifies a normal maximum SS concentration of 25 mg/l for salmonids, although the Directive has now been repealed by the WFD.

8.128 All waters designated under the EC Freshwater Fish Directive are included as or within water bodies under the WFD and water quality standards and monitoring

CONSENTED (LA01/2018/0200/F)

requirements to ensure the protection of coarse and game fisheries are covered by the standards and procedures adopted in the WFD.

8.129 The impacts of SS on fish have been reviewed by Bilotta & Brazier (2008) who confirm that there are a range of potential impacts notably with regard to the deposition of sediments in salmonid spawning areas of rivers and its impact on development on eggs and fry. There can also be a direct effect on fish gills either through physical damage to the gill tissue or through clogging of the gills with waterborne particulate matter.

8.130 The settlement of sediments on the substrate can smother invertebrates and fish eggs, while the infiltration of coarse sediments (gravel and cobble) with fines can have longer term implications for the productivity of both groups. The characteristics of the riverbed are critical for fish spawning (Fluskey, 1989), and the tolerance of salmon eggs to sedimentation has been examined on the River Bush by O'Connor & Andrew (1998) who found that alevin survival was closely related to the level of fines with impacts detectable at a level of 10% fines.

8.131 Sediment run-off during construction could result from:

- Excavations associated with construction of access roads and turbine foundations;
- Engineering works associated with stream crossings;
- Surface peat disturbance and subsequent erosion of the underlying soils;
- Run-off from access roads;
- Peat slide resulting from slippage of access roads or excavated materials - a full Peat Slide Risk Assessment (PSRA) has been undertaken which concludes that the peat slide risk of the Development is *Very Low* to *Low* (see Chapter 10, Technical Appendix 10.4).

8.132 The survey has shown that the principal drainage stream (Stream C) is populated by brown trout throughout its course within the Site Boundary and downstream of the site to the Curly River. In addition, the connected section of the Curly River, approximately 1km downstream of the Site, is an important spawning and nursery area for Atlantic salmon and is also included as part of the SAC designation.

8.133 A significant sediment run-off could therefore have a localised impact on trout stocks and habitats both within the Site and in the downstream section of stream. A major incident such as a peat slide event could have more serious impacts extending downstream into main channel stretches of the Curly and Roe rivers with corresponding implications for salmon and trout stocks.

8.134 Much of the natural drainage at the Site will be by soakage rather than direct run-off. However, whenever the ground is saturated a high percentage of the rainfall will run off quickly to receiving watercourses. The main risk to these streams will therefore be during and following periods of heavy and sustained rainfall; such events are more likely during the autumn/winter period.

CONSENTED (LA01/2018/0200/F)

Release of other pollutants

8.135 As the Site drains into the headwaters of the Curly River which connects to River Roe, there is some potential for spillage or release of diesel, oil or other polluting substances to reach these key waters with consequences for resident fish together with invertebrate organisms, including key Annexe II listed species.

8.136 During construction, with high usage of plant fuel and oil, there is an increased risk of accidental spillage and discharge to the any of the five drainage streams and thence to the Curly River. Similarly the application of ready-mix concrete in construction processes carries some risk of inadvertent discharge with the potential to impact on resident fish and invertebrate organisms in these watercourses.

Fish Passage: temporary obstruction

8.137 Improperly managed instream or bank works at crossing points can result in the obstruction of the stream channels during periods of upstream fish migration prior to spawning. A lack of spawning in the headwaters could reduce the overall productivity of juvenile fish in this area of the catchment during the construction phase.

8.138 The layout for the Development requires seven watercourse crossings in total. Two watercourse crossings are required on potential fish migration routes on Stream C in the provision of access tracks to T5, T6, T7 T8 & T9 located in the eastern half of the site.

8.139 The remaining five crossings comprise of one crossing on major watercourse (near T1), two crossings of the minor watercourses (near T1) and two crossings of minor watercourses (near T3). The field evidence indicates that fish passage will not be an issue for any of these watercourses i.e. the crossings are not on fish migration routes.

Operational Phase

8.140 The potential for any impacts will be significantly reduced during the operational phase with the construction process complete, site infrastructure in place, and a reduced requirement for any hazardous materials on-site.

Habitat loss at stream crossings

8.141 A watercourse crossing may result in significant loss of habitat if an extensive length of channel is enclosed in a culvert structure or significantly altered at a bridge structure, particularly where the original channel bed is lost and cannot be restored. Unnecessary removal of bed materials at stream crossing points can also result in long term loss of habitat and loss of channel diversity. Enclosure of the channel over significant lengths restricts light penetration which inhibits growth of benthic algae and aquatic plants, in turn leading to reduced potential for macroinvertebrates and fish. This effectively reduces productivity of the channel in the enclosed or shaded section.

CONSENTED (LA01/2018/0200/F)

8.142 The two watercourse crossings on Stream C could each result in the loss of a small area of fish habitat. Proposed crossings on the other four watercourses are located in reaches of little or no fisheries interest and are therefore not considered further.

Fish Passage: permanent obstruction/inhibition

8.143 The construction of stream crossings and installation of culverts can create permanent obstructions to fish passage if the movements of fish are not taken into account at the detailed design stage.

8.144 Obstructions usually result from the installation of inappropriate invert structures which may introduce either a steep slope to the channel with associated high water velocity, or an impassable vertical drop at the downstream edge.

8.145 There could be potential effects of this nature on fish passage at the two watercourse crossings on Stream C.

Surface Water Run-off

8.146 Surface water run-off from an increased area of hard surface in the form of access tracks and hardstanding areas (crane hardstanding areas; onsite substation / control building compound) could lead to sediment-laden run-off to the receiving watercourses with potential effects on fish and other forms of aquatic life as outlined above.

8.147 Wash-out of areas of excavated peat during or following periods of heavy rainfall could also result in run-off of sediment to the receiving watercourses with potential increases in sediment load.

Decommissioning Phase

8.148 Decommissioning of the Development would have potential effects on fish stocks and aquatic habitats in Stream C and the Curly River. These impacts will be similar to those predicted for the construction phase but will ultimately depend on the level of reinstatement required.

8.149 In this case the decommissioning process will involve the removal of all above ground structures, removal of underground structures to one metre below ground level, and reinstatement of disturbed areas; access tracks are likely to remain for farm use. However, it is unlikely that any of the structures at or near to the main watercourses will be removed or modified in any way.

8.150 The effects of decommissioning on fish habitats and fish stocks are therefore likely to be similar to those of construction, although of lower magnitude.

CONSENTED (LA01/2018/0200/F)

Mitigation

Construction Phase

Sediment Run-off

8.151 Mitigation measures to control sediment run-off are described in detail in Chapter 9 (Geology & Water Environment) and summarised as follows:

Buffer Zones

8.152 During the construction phase it is important that works should be avoided within the area of sensitive watercourses, with the preservation of intact vegetated buffer zones between development infrastructure and stream channels. To this end, buffer zones of 50m minimum width are specified in Chapter 9 for significant watercourses (catchment area within site >0.25 km^2). This is in line with NIEA guidance and will apply to Stream C, the key watercourse in terms of fisheries sensitivity.

8.153 Turbine bases, access roads and associated infrastructure will be located outwith buffer zones, with the exception of essential watercourse crossings, as required at two locations on Stream C for the provision of access tracks to T5, T6, T7, T8 & T9 located in the eastern half of the site. Minor watercourses (catchment area within site <0.25 km^2) will be subject to 10m buffer strips based on SEPA and SNH guidance.

8.154 The application of buffer zones will minimise the risk of sediment run-off from site construction works to Stream C and more sensitive downstream reaches in the Curly River.

Construction Methods & Timing of Works

8.155 The Loughs Agency has produced Guidelines for Fisheries Protection during Development Works (2011) which identifies the likely impact of construction and development work on fisheries habitat and outlines practical measures for the avoidance and mitigation of damage.

8.156 The Development will require watercourse crossings on Streams C, D and E, and a series of minor drainage features including dry or partially dry agricultural ditches, ephemeral drains etc., but only Stream C has been identified as sensitive with regard to fisheries. The required crossings on Stream C will be achieved using bottomless culverts to minimise disturbance of the river channel and the release of sediments – this is in line with the published Loughs Agency guidance (2011).

8.157 The Loughs Agency guidance also recommends that instream river works should be avoided during the salmonid spawning season and egg incubation phases, 1 October – 30 April. This restriction need not apply at the two crossing locations on Stream C as the level of engineering required to install the bottomless culverts will be unlikely to have a significant impact on fish spawning.

8.158 The other watercourse crossings are relatively minor and will be completed using standard culvert structures which may be installed without any seasonal restriction.

CONSENTED (LA01/2018/0200/F)

8.159 All works at stream crossings will adhere to the measures outlined in the Good Practice Guidance notes PPG5: Works In, Near or Liable to Affect Watercourses (Environment Agency, 2014). It is also recommended that to minimise the risk of suspended sediment entrainment in surface water run-off, the site drainage system should only be constructed during periods of low rainfall and therefore low run-off rates.

Surface Water Management

8.160 The potential for pollution of watercourses by silt-laden runoff is addressed in detail in Chapter 9: Geology & Water Environment. A surface water management plan will be developed using the principles of Sustainable Drainage, based on the on-site retention of flows and use of buffers and other silt removal techniques. An established Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management.

8.161 The surface water management plan outlined in Chapter 9 will include a series of measures minimise modification and disruption of the existing hydrology. This approach will include a system for the drainage of the temporary works during the construction phase, with use of swales, check dams and settlement ponds to provide a surface water management system that will prevent any adverse effects on the ecology of the principal receiving watercourses during the construction phase of the project.

Water Quality Monitoring

8.162 Chapter 9 also proposes the implementation of a water quality monitoring programme to examine the effects of the infrastructure construction works on surface water quality. It is recommended that the monitoring programme be continued through the operation and decommissioning phases of the Development.

Release of other pollutants

Site Management

8.163 All precautions will be taken to avoid spillages of diesel, oil or other polluting substances during the construction phase. This will be achieved through good site practices as described in the Good Practice Guidance notes proposed by EA/SEPA/NIEA (Environment Agency, 2014), including:

- PPG1: General Guide to the Prevention of Water Pollution;
- PPG5: Works In, Near or Liable to Affect Watercourses;
- PPG10: Working at Construction and Demolition Sites.

8.164 A Pollution Prevention Plan will be included as part of the Construction & Decommissioning Method Statement (CDMS) for the Development, to be agreed with the local planning authority at the pre-construction stage. This will incorporate a contingency plan setting out the procedure to be followed in the event of a significant spillage occurring.

CONSENTED (LA01/2018/0200/F)

Surface Water Management

8.165 The proposed surface water management plan and associated SuDS system will also facilitate the interception of diesel, oil or other polluting substances during the construction phase.

Fish Passage: temporary obstruction

Construction Methods & Timing of Works

8.166 The installation of bottomless culverts at the two watercourse crossing locations on Stream C has been noted above. There will be no instream works required in the construction process and this will ensure that there is no interruption of fish movements during the pre-spawning period for resident trout in these waters. For this reason it is also noted that there will be no requirement for any seasonal restriction with regard to timing of construction at these locations.

Site Management

8.167 Appropriate site management during all works near watercourses will ensure that the channel will remain unobstructed and passable for migratory fish at all times.

Operational Phase

Habitat loss at stream crossings

8.168 The use of bottomless culverts at the two sensitive watercourse crossings in Stream C will retain the natural streambed and will therefore ensure that there will be no loss of fish habitat at these locations.

Fish Passage: permanent obstruction/inhibition

8.169 Long term free passage of fish at the two sensitive watercourse crossings will be assured through the installation of bottomless culverts which will have no significant morphological effect on the channel.

Surface Water Run-off

8.170 As outlined in Chapter 9, site drainage will use the principles of SuDS, with installations to incorporate a "treatment train" of two to three stages of pollutant removal to all surface water runoff during the operational phase, as with the construction and decommissioning phases. Additional measures to prevent the release of suspended solids will include:

- Preservation of natural run-off patterns;
- Reduction of flow rates from access tracks through use of attenuating check-dams;
- Use of shallow ponds to aid settlement;
- Linear track drainage swales with regular outflow points throughout the SuDS system to limit the potential for large flows at single outflow points;

CONSENTED (LA01/2018/0200/F)

- Avoidance of peat storage within denoted watercourse buffer zones or in areas of overland water flow.

Decommissioning Phase

8.171 Mitigation measures during decommissioning will be the same as during the construction phase with regard to addressing the potential for run-off of suspended solids and other polluting substances. However the level of mitigation will be determined by the level of reinstatement required.

Residual Effects

8.172 The potential effects of the Development on fish stocks and their habitats in the Curly River and the River Roe are measured against proposed mitigation measures, as a means of assessing the residual effects of the project. Of particular importance in this context are the impacts on the Annex II listed Atlantic salmon as the primary feature of the River Roe & Tributaries ASSI/SAC.

8.173 The magnitude of the potential effects and their residual significance were assessed according to the procedure outlined in the Methodology section of this chapter. It is the residual effects associated with the Development that most accurately reflect the overall predicted effects on fisheries and the aquatic environment during the construction, operational and decommissioning phases.

Construction Phase

8.174 Mitigation measures employed through the surface water management plan outlined in Chapter 9 based on SuDS technology to control drainage and silt management on the Development site will remove the potential for direct damage to fish or siltation of spawning and nursery habitats. These measures in association with the Pollution Prevention Plan will also minimise the risk for release of other construction related polluting substances into the river network.

8.175 As there are no instream works scheduled in Stream C, the only stream of fisheries significance within the site, there will be no effects on upstream trout migration or spawning activity.

8.176 The magnitude and significance of potential effects during the construction phase before mitigation are summarised for each watercourse in Table 8.17 along with the predicted residual effects after mitigation.

8.177 Without mitigation the effects during the construction phase are predicted to be at worst of Major Magnitude and of Very Large Significance, depending on specific effects and the sensitivity of individual watercourses e.g. sediment run-off to the Curly River as a significant salmon spawning and nursery river. However, with mitigation the effects are reduced to Neutral.

CONSENTED (LA01/2018/0200/F)

Operational Phase

8.178 As there will be no instream works in Stream C there will be no loss of salmonid habitat or reduced productivity. Similarly, there will be no long term obstruction or inhibition of fish passage as bottomless culverts will be deployed for stream crossings at the two sensitive sites on this watercourse.

8.179 Although there will be an increase in the area of hard surface due to the Development, the surface water management plan / drainage design features for the control and attenuation of storm water run-off will protect receiving watercourses from excessive inputs of sediment.

8.180 The magnitude and significance of potential effects during the operational phase before mitigation are summarised for each watercourse in Table 8.18 along with the predicted residual effects after mitigation.

8.181 Without mitigation the effects during the operational phase are predicted to be at worst of Major Magnitude and of Very Large Significance, depending on specific effects and the sensitivity of individual watercourses. However, with mitigation the effects are reduced to Neutral.

Decommissioning Phase

8.182 The magnitude and significance of potential effects during the decommissioning phase before mitigation are summarised for each watercourse in Table 8.19 along with the predicted residual effects after mitigation.

8.183 Without mitigation the effects during the decommissioning phase are predicted to be at worst of Major Magnitude and of Very Large Significance, depending on specific effects and the sensitivity of individual watercourses. Mitigation measures will ensure that the effects remain as Neutral.

Table 8.17: Construction Phase - Magnitude and Significance of Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Designation	Key Species	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Stream C	None	Annexe II species: none. Brown trout & European eel present.	Medium	Sediment run-off	Moderate	Moderate	Neutral
				Release of other pollutants	Moderate	Moderate	Neutral
				Fish Passage: temporary interruptio n	Moderate	Moderate	Neutral
Curly River	ASSI / SAC	Annex II species: Atlantic salmon,	Very High	Sediment run-off	Major	Very Large	Neutral
				Release of	Major	Very Large	Neutral

CONSENTED (LA01/2018/0200/F)

River/ Stream	Designation	Key Species	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
		River/Brook/Sea lamprey. Brown trout & European eel also present.		other pollutants			
River Roe	ASSI / SAC	Annex II species: Atlantic salmon, River/Brook/Sea lamprey. Brown trout & European eel also present.	Very High	Sediment run-off	Moderate	Large/Very Large adverse	Neutral
				Release of other pollutants	Moderate	Large/Very Large adverse	Neutral

Table 8.18: Operational Phase – Magnitude and Significance of Potential Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Designation	Key Species	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Stream C	None	Annexe II species: none. Brown trout & European eel present.	Medium	Habitat loss at stream crossings	Moderate	Moderate	Neutral
				Fish Passage: permanent obstruction	Moderate	Moderate	Neutral
				Sediment run-off	Moderate	Moderate	Neutral
Curly River	ASSI / SAC	Annex II species: Atlantic salmon, River/Brook/Sea lamprey. Brown trout & European eel also present.	Very High	Habitat loss at stream crossings	Major	Very Large	Neutral
				Sediment run-off	Major	Very Large	Neutral
River Roe	ASSI / SAC	Annex II species: Atlantic salmon,	Very High	Habitat loss at stream crossings	Moderate	Large/Very Large adverse	Neutral

CONSENTED (LA01/2018/0200/F)

River/ Stream	Designation	Key Species	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
		River/Brook/Sea lamprey. Brown trout & European eel also present.		Sediment run-off	Moderate	Large/Very Large adverse	Neutral

Table 8.19: Decommissioning - Magnitude and Significance of Effects without Mitigation, and Residual Effects after Mitigation.

River/ Stream	Designation	Key Species	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
Stream C	None	Annexe II species: none. Brown trout & European eel present.	Medium	Sediment run-off	Moderate	Moderate	Neutral
				Release of other pollutants	Moderate	Moderate	Neutral
Curly River	ASSI / SAC	Annex II species: Atlantic salmon, River/Brook/Sea lamprey. Brown trout & European eel also present.	Very High	Sediment run-off	Major	Very Large	Neutral
				Release of other pollutants	Major	Very Large	Neutral
River Roe	ASSI / SAC	Annex II species: Atlantic	Very High	Sediment run-off	Moderate	Large/Very Large adverse	Neutral

CONSENTED (LA01/2018/0200/F)

River/ Stream	Designation	Key Species	Sensitivity	Potential Effect	Magnitude of Effect	Significance without Mitigation	Residual Effect after Mitigation
		salmon, River/Brook/Sea lamprey. Brown trout & European eel also present.		Release of other pollutants	Moderate	Large/Very Large adverse	Neutral

Cumulative Effects

Additional Wind Farm Developments

8.184 This section considers other wind farm developments within a 20 km radius which have either been constructed or are at different stages of the planning process in Northern Ireland. Along with the proposed development, these developments/proposals could give rise to the potential for cumulative effects on local rivers.

8.185 With regard to fisheries and the aquatic environment, the potential for cumulative effects is only relevant when proposed or existing developments are either hydrologically connected or which drain to the same receiving environment. It is therefore more important to consider additional developments in the context of river catchments, both locally and on a wider river basin scale.

8.186 Within a 20 km radius of the Development a total of ten additional wind farm developments have been identified which are wholly or partly located within River Roe catchment and might therefore be considered to have the potential for cumulative impacts on the river (Table 8.20). Moreover, four of these developments, Dunbeg, Dunmore, Dunmore II Extension and Dunbeg Extension, are also located within the immediate Curly River catchment and have the potential for more localised cumulative impacts in this sub-catchment.

Table 8.20: Additional wind farm developments/proposals within a 20 km radius of the Development indicating their location within the River Roe catchment and the Curly River sub-catchment.

Wind Farm	Planning Reference	Location: (River Catchment)	No. of Turbines	Status
Dunbeg	B/2007/0560/F	Curly	14	Operational
Dunmore	B/2007/0563/F		7	Operational
Dunmore II	B/2013/0241/F		8	At Appeal
Dunbeg Ext	LA01/2016/0061/F		3	Consented
Rigged Hill	B/1993/0377/F	Roe	10	Operational

CONSENTED (LA01/2018/0200/F)

Wind Farm	Planning Reference	Location: (River Catchment)	No. of Turbines	Status
Altahullion I	B/2000/0118/F		20	Operational
Altahullion II	B/2004/0795/F		9	Operational
Altahullion III	B/2007/0006/F		12	Operational
Glenconway	B/2011/0272/F		8	Operational
Craiggore	B/2012/0268/F		10	Consented

8.187 Whilst there has been one noted problem relating to sediment run-off at Bin Mountain Wind Farm in the Fairy Water catchment, there does not appear to have been any problems relating to other sites in Northern Ireland or specifically to the seven sites currently operational in the Roe catchment.

8.188 The two consented sites (Dunbeg Ext & Craiggore) along with the proposed developments (Dunmore II & Dunbeg South) will involve civil engineering works including land excavation and possibly including in-river works, each with the potential for similar effects on the aquatic environment including fisheries. As such there is the potential for the run-off of sediments to local watercourses with resultant damage to aquatic fauna and habitats.

8.189 The greatest risk to fisheries and the aquatic environment is during the construction phase of these projects when the civil engineering works are carried out. It follows that it is vital for the highest standards to be maintained with regard to site preparation, temporary works and site drainage issues, and that full mitigation measures must be applied to remove any potential for this type of incident.

Assessment

8.190 There is no evidence that existing wind farm developments in the area have had any adverse impact on either the Curly River or the wider River Roe catchment which in turn could have affected the integrity of the River Roe & Tributaries ASSI/SAC.

8.191 However there are a range of activities that currently have an influence on conservation and management of the SAC, primarily in relation to water quality e.g. point-source pollution from urban and industrial sources; point-source pollution from development including proposed wind farm developments; and diffuse pollution from commercial forestry in the upper catchment and farming in the lower catchment. There is potential for these impacts to act in combination to produce cumulative impacts on water dependant qualifying features, affecting their conservation status, and the overall integrity of the SAC.

8.192 The likelihood of significant cumulative impacts on the aquatic environment is increased if two or more wind farms are to be constructed or decommissioned at the same time. Craiggore and Dunbeg Extension have been consented and construction is likely to proceed within the next three and five years respectively.

CONSENTED (LA01/2018/0200/F)

The likelihood of simultaneous construction with Dunbeg South further reduces the potential for any cumulative effects.

8.193 Implementation of the mitigation measures as described will ensure that the proposed Dunbeg South development will not contribute to any cumulative impact on the SAC, in particular on Atlantic salmon as the primary feature of the site.

Summary

8.194 This chapter outlines the potential effects of the Development on the fish stocks and fish habitats of the receiving watercourses in the River Roe catchment. It provides relevant baseline information on fisheries enabling the potential effects to be identified and evaluated.

8.195 It has been determined that potential impacts are primarily related to the sediment run-off to the receiving watercourses with related effects on fish stocks and their habitats. Without mitigation it is considered that these impacts have the potential to be of Major Magnitude and of Very Large Significance depending of the sensitivity of individual watercourses

8.196 A series of specific mitigation measures have been designed to avoid adverse effects on fisheries with regard to both construction and operational phases of the project.

8.197 Hydrology and site drainage issues have been considered in detail in Chapter 9 which outlines a surface water management system and drainage (SuDS) designed to control drainage and silt management on the Site.

8.198 It is concluded that, provided the mitigation measures are implemented as specified, construction and operation of the proposed development will have a neutral impact on the fish stocks and aquatic biology of the Curly River and the wider River Roe catchment. It follows that the development will have no effect on the Atlantic salmon as the primary feature of the River Roe and Tributaries ASSI/SAC.

References

Alabaster JS & Lloyd R (1980) Water quality criteria for freshwater fish [in Europe]. FAO, Rome (Italy), Butterworths.

Bilotta GS & Brazier RE (2008). Understanding the influence of suspended solids on water quality and aquatic biota. Water Research 42: 2849-2861.

Crozier WW & Kennedy GJA (1994) Application of semi-quantitative electrofishing to juvenile salmonid stock surveys. Journal of Fish Biology 45, 159-164.

Environment Agency (2014) Pollution prevention guidance (PPG). [online] Available at: https://www.gov.uk/government/collections/pollution-prevention-guidance-ppg

CONSENTED (LA01/2018/0200/F)

Fluskey RD (1989) An analysis of the gravels used by spawning salmonids in Ireland. Irish Fisheries Investigations Series A (Freshwater) No 32.

Goodwin CE, Dick JTA & Elwood RW (2009) A Preliminary Assessment of the Distribution of the Sea lamprey (Petromyzon marinus LL)), River lamprey (Lampetra fluvialilis (L)) and Brook lamprey (Lampetra planeri (Bloch)) in Northern Ireland. BIOLOGY AND ENVIRONMENT: PROCEEDINGS OF THE ROYAL IRISH ACADEMY, VOL. 109B, NO. 1, 4752

JNCC (2005) Common Standards Monitoring Guidance for Rivers. Version March 2005. ISSN 1743-8160 (online).

Kennedy GJA (1984) The ecology of salmon habitat re-instatement following river drainage schemes. IFM Annual Study Course, Magee College, Londonderry, 18pp.

King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., Fitzpatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Loughs Agency (2010) River Roe and Tributaries Catchment Status Report 2009. Loughs Agency of the Foyle Carlingford and Irish Lights Commission, LA/CSR/17/10.

Loughs Agency (2011) Guidelines for Fisheries Protection during Development Works (Foyle and Carlingford areas); Environmental Guidelines Series – No. 1.

Niven AJ (2010) Loughs Agency Water Framework Directive Fish Classification Report 2009. LA/WFDFISH/09.

Niven, A.J. & McCauley, M. (2013) Lamprey Baseline Survey No3: River Foyle and Tributaries SAC. Loughs Agency, 22, Victoria Road, Derry~Londonderry

Maitland PS (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

O'Connor WCK & Andrew TE (1998) The effects of siltation on Atlantic salmon, Salmo salar L, embryos in the River Bush. Fisheries Management and Ecology 5 (5), 393-401.5 (5), 393-401.

Small, I. (1991) Exploring data provided by angling for salmonids in the British Isles. In: Catch Effort Sampling Strategies - their application in Freshwater Fisheries Management. I.G. Cowx (Ed.), Blackwell Scientific Publications Ltd.

CONSENTED (LA01/2018/0200/F)

9

Geology & Water Environment

CONSENTED (LA01/2018/0200/F)

9 Geology & Water Environment

Introduction

Terms of Reference

9.1 This chapter considers the likely significant effects on the receiving hydrological, geological and hydrogeological environments, associated with the construction, operation and decommissioning of the proposed Development.

9.2 Assessment techniques used are aimed at identifying hydrological, hydrogeological and geological constraints within the preliminary boundary provided by the applicant at the outset of the project, hereafter referred to as 'the Site', including areas in which development should be avoided and areas in which additional mitigation measures are required.

9.3 This chapter is supported by:

- Technical Appendix 9.1: Water Framework Directive Assessment;
- Technical Appendix 9.2: Geology & Water Environment Consultation Records;
- Technical Appendix 9.3: Abstraction Records;
- Technical Appendix 9.4: Peat Slide Risk Assessment;
- Technical Appendix 9.5: Peat Management Plan;
- Technical Appendix 9.6: Drainage Assessment; and
- Figures 9.1 – 9.5 which are referenced within the text where relevant.

Statement of Authority

9.4 The assessment has been carried out by McCloy Consulting Ltd; an independent environmental consultancy specialising in the water environment, with specialist knowledge of hydrological and hydrogeological assessments, sustainable drainage systems (SuDS), drainage, river modelling and flood risk assessment.

9.5 McCloy Consulting has ongoing involvement in numerous geology and water environment studies and SuDS projects across the UK and has developed a particular expertise in surface water management for wind farms. The company has successfully designed a number of SuDS/silt management solutions for wind farms in accordance with current best practice guidance. The primary personnel responsible for undertaking this hydrology assessment are:

- Catherine McQuillan BSc(Hons) MSc FGS - Environmental Consultant with particular expertise in Geological assessment, environmental assessment and monitoring for onshore wind energy projects in the UK, groundwater screening and hydrogeological assessments.
- Kyle Somerville BEng (Hons) CEng MIEI - Chartered Engineer specialising in the fields of engineering hydrology, surface water management, groundwater

CONSENTED (LA01/2018/0200/F)

screening assessments and geology assessments. He has provided technical input to planning applications for over 20 onshore wind farms in Northern Ireland and has been responsible for planning and construction-phase surface water management design and monitoring for a number of the largest onshore wind farm developments in the UK, including particular experience of upland sites in environmentally sensitive watersheds.

Complementary Assessments

9.6 The majority of potential effects arising due to wind farms are caused by construction activities; therefore reference should be made to Chapter 2: The Proposed Site for information regarding detailed construction proposals.

9.7 Changes to the hydrological / hydrogeological regime may create resultant effects on ecology with hydrological dependant ecosystems such as fisheries and peat. Therefore, this chapter is further supported by:

- Chapter 6: Ecology;
- Chapter 7: Ornithology;
- Chapter 8: Fisheries;

Legislation and Planning Policy

9.8 Environmental planning policy and industry best-practice guidance relevant to an assessment of hydrology and the water environment are summarised in Table 9.1 and the following sections.

Relevant European and National Planning Policy

Table 9.1: Relevant European and National Planning Policy

Legislation	
EU	EU Water Framework Directive (2000/60/EC)
	Groundwater Daughter Directive to the Water Framework Directive (2006/118/EC)
	Priority Substance Daughter Directive to the Water Framework Directive (2008/105/EC)
	Freshwater Fish Directive (2006/44/EC)
	Environmental Liability Directive (2004/35/EC)
	Dangerous Substances Directive (2006/11/EC)
UK	UK Environmental Standards and Conditions Phase 1 and Phase 2 (UK TAG 2008)
NI	Control of Pollution (Oil Storage) (Amendment) Regulations (NI) 2011

CONSENTED (LA01/2018/0200/F)

	Drainage (Environmental Impact Assessment) Regulations (NI) 2006
	Environmental Liability (Prevention and Remediation) (Amendment) Regulations (NI) 2009
	Groundwater Regulations (NI) 2009 / Groundwater (Amendment) Regulations (NI) 2014
	Nature Conservation and Amenity Lands (NI) Order 1985
	Private Water Supply Regulations (NI) 2009 / Private Water Supply (Amendment) Regulations (NI) 2010
	Surface Waters (Dangerous Substances) (Classifications) Regulations (NI) 1998
	The Drainage (NI) Order 1973 / The Drainage (Amendment) (NI) Order 2005
	The Environment (NI) Order 2002
	The Fisheries (NI) Act 1966
	Water Act (Northern Ireland) 1972 / The Water (NI) Order 1999
	Water Supply (Water Quality) Regulations (NI) 2007 / (Amendment) Regulations (NI) 2010
	Water Environment (Water Framework Directive) Regulations (NI) 2003
	Water Framework Directive (Priority Substances and Classification) (Amendment) Regulations (NI) 2015
	The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017
	Sustainable Development Strategy, "Everyone's Involved" (2010)

Regional and Local Planning Policy

9.9 The Site has been reviewed in relation to local planning policy specific to geology and the water environment. A detailed planning policy and legislation review is included within Chapter 1: Introduction and Planning Policy.

Northern Area Plan 2016

9.10 The Site lies within Causeway Coast & Glens BC; the current area plan is Northern Area Plan 2016. The plan contains limited information regarding planning policy related to water environments; other that reference to habitation regulations.

9.11 A Habitats Regulation Assessment on the Northern Area Plan provides details of a screening assessment undertaken on SPA and SAC sites within the Council area which may be affected by the Northern Area Plan. The scale of importance of summarised in the below table.

Table 9.2: Designations Summary

CONSENTED (LA01/2018/0200/F)

Scale of Importance	Designation Type	Designated By
INTERNATIONAL Nature Conservation Importance	RAMSAR Sites	Convention on Wetlands of International Importance1975
	Special Protection Areas Special Areas of Conservation	European Commission Directive on the Conservation of Wild Birds (79/409/EEC) The Conservation (Natural Habitats, etc.) Regulations (NI) 1995
NATIONAL Nature Conservation Importance	Nature Reserves, National Nature Reserves, Marine Nature Reserves Areas of Special Scientific Interest	Nature Conservation and Amenity Lands (NI) Order 1985
LOCAL Nature Conservation Importance	Sites of Local Nature Conservation Importance and Earth Science Interests / Assets	Northern Ireland Council Area Plans

PPS15 – Revised Planning and Flood Risk

9.12 Revised PPS15 sets out planning policies to "minimise flood risk to people, property and the environment", emphasising sustainable development and the conservation of biodiversity. The policy refers to the use of SuDS to minimise effects on the receiving water environment.

9.13 The policy notes that development proposals facilitating sustainable drainage would be considered favourably by the planning authority; as such a sustainable drainage approach should be adopted by the proposed Development.

Guidance on Conservation of Geological Features - Earth Science Conservation Review

9.14 The Earth Science Conservation Review (ESCR) is the means whereby areas of geological interest in Northern Ireland are assessed to determine their importance to science and hence to earth science conservation.

9.15 The objective of the ESCR is to define systematically all earth science localities (geological and/or geomorphologic) in Northern Ireland. The overall aim of the process is to encourage conservation of such areas to protect them from potential threats such as landfill, changes to natural systems and coastal defence work.

Industry Guidelines

9.16 The Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (PPG) published by the Northern Ireland Environment Agency (NIEA) in conjunction with the Environment Agency for England and Wales, and the Scottish Environment Protection Agency (SEPA) include the documents referred to below.

9.17 Guidance notes relevant to the Proposed Development include:

NIEA Guidance for Pollution Prevention (GPPs)

- GPP 2 Above Ground Oil Storage Tanks;

CONSENTED (LA01/2018/0200/F)

- GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer;
- GPP 5 Works and Maintenance in or near Water;
- GPP 21 Pollution Incident Response Planning.

9.18 In the absence of revised specific guidance, this assessment shall similarly consider the lapsed NIEA Pollution Prevention Guidance Notes (PPGs):

- PPG 1 Understanding Your Environmental Responsibilities Good Environmental Practice;
- PPG 3 Use and Design Of Oil Separators in Surface Water Drainage Systems;
- PPG 6 Working at Construction and Demolition-sites;
- PPG 7 The Safe Operation of Refuelling Facilities;
- PPG 18 Managing Fire, Water and Major Spillages;
- PPG 20 Dewatering Underground Ducts and Chambers;
- PPG 26 Drums and Intermediate Bulk Containers.

9.19 Other relevant industry guidance includes:

- BS6031 - Code of Practice for Earthworks (2009);
- CIRIA C523 - Sustainable Urban Drainage Systems; Best Practice Manual (2001);
- CIRIA C532 - Control of Water Pollution from Construction Sites (2001);
- CIRIA C692 - Environmental Good Practice on-Site (2010);
- CIRIA C609 - Sustainable Drainage Systems: hydraulic/structural/water quality (2004);
- CIRIA C753- The SuDS Manual (2015);
- CIRIA C689- Culvert Design and Operation Guide (2010);
- Environment Agency Policy: Technical Guidance on Culverting Proposals (1999);
- DEFRA Good Practice Guide for Handling Soils (2000);
- DEFRA Code of Practice for Sustainable Use of Soils on Construction Sites (2009);
- PPS 18 Renewable Energy and supplementary Planning Guidance;
- DOE / NIEA - Water Feature Surveys: A Guide to EIA and Planning Considerations (2015);
- DOE / NIEA - Water Feature Surveys: Wind Farms and Groundwater Impacts (2015).

Scope of Assessment

9.20 This report assesses the effects of the proposed Development on hydrology and surface water quality, hydrogeology and groundwater quality, and geological features. The assessment covers construction, operation, maintenance and decommissioning phases.

9.21 The report identifies and assesses the potential effects on the following:

- Existing natural and artificial drainage patterns

CONSENTED (LA01/2018/0200/F)

- Runoff rates and volumes
- Flooding and impediments to flows
- Surface water dependent ecosystems including hydrological units of peat bog
- Hydrogeological patterns
- Water quality of surface water and groundwater
- Usage of surface water and groundwater including abstractions
- Aquifer systems and their vulnerability
- Existing solid geology and superficial geology
- Structural geology of the area and its environs.

9.22 In order to quantifiably assess the preceding, this report:

- Outlines relevant policy relating to the water and geological environment;
- Summarises and responds to consultations provided in response to scoping requests to inform particular requirements of the assessment;
- Provides baseline information and identifies sensitive receptors;
- Identifies potential likely effects, including potential likely cumulative effects;
- Assesses the significance of any adverse effects and resulting impacts based on the magnitude of the impact and the sensitivity of the receptors;
- Discusses management of design evolution and detailed mitigation measures;
- Provides a residual impact assessment;
- Discusses cumulative effects of the proposed Development in conjunction with other proposed and existing developments in the vicinity.

Consultation

9.23 Formal consultation to form opinion and requirements with regards to the hydrological and geological environments was sought from local and regional organisations as summarised within. Consultation took the form of a proposed scope of this assessment and a request for any amendment or additional requirements sought by the consultee.

9.24 A summary of the specific requests made by the various consultees is included in the following table and input provided that was specific to the proposed Development is included in the subsequent baseline assessment.

Table 9.3: Consultee Summary

Consultee		Summary of Response	Addressed in Assessment
Causeway Coast and Glens Council	Environmental Health	No Private Water Supplies within 1 km.	9.123
	Shared Environmental Services	Indicated that a planning application for the proposal will be subject to a Habitat Regulations Assessment (HRA) to be completed by Shared Environmental Service (SES) on behalf of Causeway Coast and Glens Borough Council Planning.	Chapter 6: Ecology

CONSENTED (LA01/2018/0200/F)

Consultee		Summary of Response	Addressed in Assessment
		Northern Ireland European Sites are potentially connected by a hydrological route and therefore may have the potential to be affected by this proposal: River Roe and Tributaries SAC and Lough Foyle SPA/Ramsar.	9.134
Department of Agriculture, Environment and Rural Affairs	Inland Fisheries	The Site lies within the Loughs Agency area of jurisdiction.	-
	Fisheries Inspectorate	No aquaculture sites in the area we have no issues or concerns. Reminded that it is an offence under Article 47 of the Fisheries Act (NI) 1966 to cause pollution which is subsequently shown to have a deleterious effect on fish stocks.	9.128 to 9.133
Department of Infrastructure	DfI Rivers	Indicated that the Site is not affected by any watercourses that are designated under the terms of the Drainage (Northern Ireland) Order 1973, however considering their records would suggest there are several undesignated watercourses. Indicated that there is no record of flooding at the Site however part of the Site lies within the indicative 1 in 100 year fluvial floodplain and part of the Site will be affected by surface water flooding.	9.90 to 9.93
Loughs Agency		Fish surveys carried out by the Agency indicate the presence of both salmon and trout in the Curly River. Raised concerns on the potential for increased sediment loading of watercourses. Reminded that it is an offence to remove or disturb any material, including sand or gravel from the bed of any freshwater river within the Foyle and Carlingford Areas without the consent of the Loughs Agency contrary to Section 46 of the Foyle Fisheries Act (NI) 1952, as amended by Article 18(3) of the Foyle and Carlingford Fisheries (NI) Order 2007. The applicant may apply to the Loughs Agency for consent prior to the construction of any culverts associated with this proposal.	Chapter 8: Fisheries
Department for Economy	Geological Survey of Northern Ireland (GSNI)	Indicated that Gortcorbies and Wellglass Springs are located to the north of the Site. Both provide a significant amount of baseflow in to the resulting streams and adjoining rivers. The Ulster White Limestone (Chalk), outcrops beneath the basalt and is known to be karstified and in other parts of the province has resulted in enclosed depression, sinks and springs. GSNI karst dataset does not contain any details of karst features within this area other than Wellglass Spring. Peat: A large proportion of the proposed Site is composed of upland peat, covering high ground and moderate to steep slopes. Peat depth may be in excess of 3 m. Cutting into peat is liable to result in dewatering and incipient peat failure.	109.52-9.61

CONSENTED (LA01/2018/0200/F)

Consultee		Summary of Response	Addressed in Assessment
Northern Ireland Environment Agency (NIEA)	Natural Environment Division	Although the River Roe and Tributaries SAC is not located within the Site, Salmon spawning may occur within the Site which should also be considered. There is peatland within the Site which should be considered.	Chapter 8: Fisheries Chapter 6 Ecology
	Drinking Water Inspectorate	One PWS within 5km and two Dairy Farms.	109.115 to 9.124
	Land and Groundwater	No waste sites within 5km	9.73
	Water Management Unit	Current abstractions licences held by NIEA identify no downstream surface water abstractions in the catchment. Curly River is classified as Good.	109.115 to 9.124

9.25 Northern Ireland Water (NI Water) were also contacted. NI Water confirmed abstractions located to the north of the Site are no longer in use. There are abstractions within 5km however they are upstream or considered in their opinion to be within a different catchment.

9.26 A copy of consultee responses is included in Technical Appendix 9.2.

Assessment Methodology

Baseline Characterisation

9.27 This water environment and geology assessment has been undertaken using a qualitative assessment based on experienced professional judgement and assessment of compliance with statutory and industry guidance, including site visits for verification.

Study Area

9.28 Potential effects were considered within the study area defined as: the area within the Preliminary Boundary (within which the planning application boundary lies) hereafter referred to as the Site; and the wider geological and hydrogeological setting of the area.

9.29 The hydrological study area includes the downstream river reaches affected by the Site and the surface water catchments draining the Site as defined by the relevant River Basin Management Plans, Local Management Areas and Catchment Stakeholder Groups outlined within 9.74 and as shown on Figure 9.1: Site Hydrology.

9.30 The hydrogeological and geological study area extends to the underlying aquifer catchments and the extents of geological units.

Additional Areas Considered

9.31 Consideration has been given to potential likely significant effects in respect of the proposed turbine delivery route and access route. Details of the work comprising

CONSENTED (LA01/2018/0200/F)

junction widening, passing bays and general road widening, and potential effects on the geology and water environment are summarised within Chapter 11: Transport & Traffic.

9.32 A potential grid connection route is described within Technical Appendix 2.1: Assessment of Potential Grid Connection. Although the grid route is not part of the proposed Development consideration has been given to potential likely significant effects.

Desk Study

9.33 The desktop study involved collation and assessment of the relevant information from the following sources:

- Consultation responses (summarised in Table 9.3)
- Ordnance Survey raster and vector mapping in addition to aerial photography to assess land use and environs and to identify water features and watercourse catchments
- GSNI Geoindex (aquifers and aquifer vulnerability)
- GSNI 1:50,000 Drift and bedrock Map (Sheet 12 Limavady)
- NIEA Groundwater quality data and abstractions / discharges database
- NIEA Drinking Water Inspectorate and Water Management Unit data
- NIEA river quality data and natural heritage data
- CEH Flood Estimation Handbook (Version 3) for details of river catchment data
- DfI Rivers Flood Maps NI
- and Lough Agency information.

Field Survey

9.34 Field walk over surveys of the Site were undertaken on 22 October 2015, 27 June 2016, 2 March 2017 and 21 April 2017, with the purpose of identifying / verifying existing natural and artificial site drainage characteristics and hydrological features, and identifying the nature of superficial geology where visible.

9.35 The walkover survey incorporated the Site, with particular emphasis on areas affected by preliminary turbine locations and known / mapped watercourses in order to fully assess potential issues with regards to:

- New or upgraded watercourse crossings (bridges and culverts) required to facilitate the proposed infrastructure;
- Disruption to watercourses through construction of roads/hard standing etc;
- Likelihood of adverse effects on surface water quality due to construction and operation of wind farms;
- Potential for impact on natural geological conditions and groundwater movement / quality.

CONSENTED (LA01/2018/0200/F)

Determination of Sensitivity, Magnitude, Likelihood and Significance

9.36 This assessment determines the nature, scale and significance of the effects of the proposed Development on the baseline (current) scenario in accordance with a methodology stated within The Institute of Environmental Management and Assessment guidance[1].

9.37 The potential impact significance is defined by the combination of the sensitivity of the receptor (Table 9.4) and the magnitude of the effect (Table 9.5). Following this an overall impact significance is determined by considering the potential impact significance and the likelihood of the effect occurring (Table 9.7).

Sensitivity Criteria

9.38 The scale and sensitivity of the receiving environment (receptor) has been categorised on a scale of “Very High” to “Low”. The sensitivity criteria used for this assessment are presented in Table 9.4 and are based on:

- Vulnerability of a receptor to a particular pressure (degree of environmental response to any particular effect); and
- The importance or ‘value’ of the receptor e.g. an area of international importance should be considered more sensitive to effect than a local area of little or no conservation value.

1 Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment.

CONSENTED (LA01/2018/0200/F)

Table 9.4: Evaluation of Receptor Sensitivity Criteria

Scale / Sensitivity of the Environment (Receptor)		Definition of Criteria	
International and / or Very High	Attribute has a very high quality / rarity at an international scale.	Geology / Soils	Important on a European or global level, e.g. World Heritage Site, Geopark, Ramsar Sites, Special Areas of Conservation (SAC), Special Protected Areas (SPA), Habitats Directive Sites or protected sites under EC legislation with respect to the geological environment.
		Water Environment	Important on a European or global level, e.g. Ramsar Sites, SAC, SPA and Habitats Directive Sites with dependence on the water environment.
National and / or High	Attribute has a high quality and rarity at a national scale.	Geology / Soils	Important in Northern Ireland, e.g. Area of Special Scientific Interest (ASSI), with respect to the geological environment or protected site under UK or NI legislation.
		Water Environment	Important in Northern Ireland, e.g. ASSI or National Nature Reserve (NNR) with respect to the hydrological environment. WFD classification of 'High' with the watercourse providing a nationally important resource or supporting river ecosystem. Public water supplies and highly productive aquifers or local water supplies, including private water supplies where there is no alternative to private supplies. Principal aquifer providing a nationally important resource. Source Protection Zone 2 (Outer Source Protection Zone).
Regional and / or Medium	Attribute has a medium quality and rarity at a regional scale.	Geology / Soils	Site of regional geological importance. Sites of Nature Conservation Importance in relation to earth science interest.

CONSENTED (LA01/2018/0200/F)

Scale / Sensitivity of the Environment (Receptor)		Definition of Criteria	
		Water Environment	Important in the context of the region, e.g. catchment scale issues, main river within the catchment, local Nature Reserves or Sites of Local Importance for Nature Conservation (SLNCI). WFD classification of 'Good' with the watercourse providing an important resource or supporting river ecosystem or upstream of a designated fishery. Active floodplain area. Designated fishery, catchment regionally important for fisheries. Domestic private water supplies, located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Principal aquifer providing a regionally important resource e.g. industrial use with limited connection to surface water. Source Protection Zone 3 (catchment of groundwater source).
Local and / or Low	Attribute has a low quality and rarity at a local scale.	Geology / Soils	Areas with properties abundant on a local or regional scale or with little or no agricultural value.
		Water Environment	WFD classification of 'Moderate' or less with the watercourse providing a locally important resource or supporting river ecosystem. Domestic private water supplies, located within vicinity of mains water supply or private water supplies used only for agricultural purposes and not drinking water. Groundwater dependent terrestrial ecosystems in hydraulic continuity with the Site. Aquifer providing a locally important resource e.g. For agricultural or small-domestic supplies.

Magnitude of Effect

9.39 The magnitude of change / effect is influenced by the timing, scale, size and duration of the hazardous effect; magnitude has been categorised on a scale of “High” to “Low” as defined in Table 9.5.

CONSENTED (LA01/2018/0200/F)

Table 9.5: Evaluation of Magnitude of Effect Criteria

Magnitude of Effect / Description		Definition of Criteria	
High	Fundamental change resulting in loss of an attribute and /or the quality and integrity of conditions.	River morphology / fluvial geomorphology	Significant and permanent change over large scale i.e. Large changes in erosion and deposition regimes.
		Water Quality	Potential high risk of pollution to surface water changing water quality status.
		Water Supply	Loss of local water supply or change in quality with respect to drinking water standards (DWS).
		Flood Risk / Erosion Potential	Significant increase in risk due to a significant change in the proportion of hard standing and altered surface water flows.
		Surface Water Dependant Ecosystem	Loss of or extensive change to a surface water dependant ecosystem or fishery.
		Groundwater	Significant change in groundwater levels, flow regime, groundwater quality or extensive change to an aquifer.
		Geology / Soils	Loss of the resource and / or quality and integrity of resource; severe damage to key characteristics, features or elements.
Medium	Detectable change to conditions resulting in non-fundamental temporary or permanent consequential changes.	River morphology / fluvial geomorphology	Detectable change to river morphology / fluvial geomorphology over a small scale i.e. some changes in erosion and deposition regimes.
		Water Quality	Potential medium risk of pollution to surface water, changing water quality status.
		Water Supply	Temporary loss of local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Detectable increase in flood risk and erosion potential due to a medium change in the proportion of hardstanding and altered surface water flows.
		Surface Water Dependant Ecosystem	Partial loss or change to a surface water dependant ecosystem or fishery.

CONSENTED (LA01/2018/0200/F)

Magnitude of Effect / Description		Definition of Criteria	
		Groundwater	Measurable change in groundwater levels, groundwater flow regime, groundwater quality or identifiable change to an aquifer.
		Geology / Soils	The Site's integrity would not be adversely affected, but the scheme may lead to a loss of or damage to key characteristics, features or attributes.
Low	Results in minor effect on attribute of insufficient magnitude to affect the use or integrity.	River morphology / fluvial geomorphology	Unquantifiable or unqualifiable change to river morphology / fluvial geomorphology.
		Water Quality	Minor deterioration in water quality unlikely to affect the most sensitive receptor or insignificant change in water quality conditions not exceeding those expected due to naturally occurring fluctuations.
		Water Supply	No change in pressure or flow to local water supply or minor change in quality of supply with respect to drinking water standards.
		Flood Risk / Erosion Potential	Minor changes in the proportion of hardstanding and altered surface water flows result in no detectable increase in flood risk and erosion potential.
		Surface Water Dependant Ecosystem	Any measurable change in groundwater levels does not affect groundwater flow regime, groundwater quality with regards to DWS or result in any change to an aquifer.
		Groundwater	Minor alteration to one or more characteristics, features or elements or no observable effect
		Geology / Soils	No significant loss of or damage to key characteristics, features or attributes.

Impact Significance Criteria

9.40 The magnitude of effect and receptor sensitivity are combined to evaluate and qualify if an impact is of high, moderate, low or negligible significance as outlined below.

Table 9.6: Evaluation of Potential Impact Significance

CONSENTED (LA01/2018/0200/F)

Scale / Sensitivity of the Environment	Effect Magnitude		
	Low	Medium	High
International / Very High	Moderate	High	High
National / High	Moderate	Moderate	High
Regional / Medium	Low	Moderate	Moderate
Local / Low	Negligible	Low	Low

Likelihood of Occurrence Criteria

9.41 The likelihood of the potential effects occurring is assessed based on historical data, quantitative analysis and professional judgement based on relevant experience as shown in the below Table.

Table 9.7: Evaluation of Likelihood of Occurrence

Likelihood of occurrence	Criteria
Certain	Likely consequential effect in medium term and inevitable in long term (within the life of the development).
Likely	Possible consequential effect in the medium term and likely but not inevitable in the long term.
Unlikely	Unlikely that any consequential effect would arise within the lifetime of the development.
Rare	It is unlikely that any consequence would ever arise.

Determination of Overall Impact Significance

9.42 Potential Impact Significance and Likelihood of Occurrence (Table 9.7) are combined to determine an Overall Impact Significance as shown in the matrix in the elbow table.

Table 9.8: Evaluation of Overall Significance

Potential Significance	Likelihood of Occurrence			
	Rarely	Unlikely	Likely	Certain
High	Minor	Moderate	Major	Major
Moderate	Minor	Minor	Moderate	Major
Low	Not Significant	Minor	Minor	Moderate
Negligible	Not Significant	Not Significant	Minor	Moderate

Baseline Conditions

Site Description

9.43 The proposed Development is located approximately 8 km to the east of Limavady, and lies on the north-eastern slopes of Keady Mountain which has a peak of approximately 337 m AOD (Above Ordnance Datum).

CONSENTED (LA01/2018/0200/F)

9.44 The Site the area considered within this assessment occupies an area of approximately 306 hectares (Ha).

Topography

9.45 Topography on the Site is dictated by the slopes of Keady Mountain. Levels fall from approximately 341 m AOD in the south-eastern area of the site to 137 m AOD adjacent the northern boundary where it meets the Broad Road (A37).

9.46 Topography dictates surface water catchments on the site as summarised within Section 9.74 - 9.80. The majority of the Site slope gradients vary from 0^o to 5^o, however within the centre of the Site within river valleys gradients increase to 17^o. Towards the western boundary gradients are typically 15^o.

Land Cover

9.47 Land cover on the site is more thoroughly described in Chapter 6: Ecology; the site is undeveloped and is in agricultural use for grazing pasture of varying quality. The land comprises a mosaic of rush pasture, wet heath, and occasional flushed areas.

Meteorological Data Summary

9.48 The Standard Percentage Runoff (SPR) is a parameter used in runoff and flood estimation, which represents the percentage of total rainfall likely to contribute to direct runoff and storm flows. For context, SPR values in the UK range from 2% (sand or chalk with slow response / low runoff) to a maximum of 60% (peat bog with rapid response / high runoff).

9.49 A review of the Site in relation to Hydrology of Soil Types (HOST) class mapping indicates a SPR of approximately 40-52 %, i.e. the general permeability of Site is low and catchments are therefore likely to have a moderate response to rainfall events falling on open ground.

9.50 Rainfall data for the catchment extracted from Centre for Ecology and Hydrology Flood Estimation Handbook at location centroid E272950 N426550 shows the Annual Average Rainfall (1961 – 1990) is 1221 mm and Annual Average Rainfall (1941 – 1970) is 1278 mm.

9.51 Based on the Meteorological Office banding of annual average rainfall, the above statistics indicate that rainfall in the area is just within the 4th highest band of rainfall (1250-1500 mm) of the nine bands; and the rainfall climate in the vicinity of the Site is similar to the UK average and is typical for regions in the north-east of Northern Ireland.

Geology

9.52 The Site has been reviewed in relation to GSNI 1:50,000 series mapping (Limavady Sheet 12 Bedrock and Superficial Deposits), GSNI borehole data, GeoIndex mapping, and additional published information in order to determine potential geohazards that may restrict development and identify existing geological features that may be adversely affected by the proposed Development.

CONSENTED (LA01/2018/0200/F)

Solid Geology

9.53 The Site has been reviewed in relation to GSNI 1:50,000 mapping indicates the majority of the Site is situated on the Upper Basalt Formation.

9.54 The Upper Basalt Formation is underlain by the Ulster White Limestone Formation (12 m to 30 m in thickness), Hibernian Greensands Formation (<4 m) and the Mercia Mudstone Group.

9.55 The Upper White Limestone Formation is indicated to outcrop at the surface in the north-western corner of the Site.

9.56 The Upper Basalt Formation is indicated to be at the surface in the southern area of the Site. Features on Keady Mountain indicate at least 13 flows, ranging from less than 1m to 30m thickness. In the centre of the Site the stratum is indicated to dip 10° to the east.

9.57 Two faults are located to the west of the Site. The eastward extent of the faults are indicated to be 640 m to the west of the Site. No other structural faults are indicted on Site nor within 4 km.

Soils and Drift Geology

9.58 1:50,000 mapping indicates the northern area (low lying areas) of the Site to be situated on Diamicton Till. Glacial sand and gravel are confined to the eastern area of the Site, with glacial drainage channels indicating a northerly flow.

9.59 Till exposures are present on site within a number of incised watercourse channels. Till generally displays low permeability hydraulic properties and as such may inhibit the flow of water both vertically and laterally.

9.60 Landslip material is located 100 m to the west of the Site. This is associated with gradients greater than 15^{o} on the western and southern flanks of Keady mountain.

Peat

9.61 The 1:50,000 GSNI map indicates peat to be confined to the south-eastern area of the application area.

9.62 A detailed Peat Slide Risk Assessment (PSRA) has been undertaken and is included in Technical Appendix 9.4. Peat depths within the area of survey range up to a depth of 2.5 m.

Agricultural Land Classification

9.63 DAERA published a classification index for Agricultural Land Classification (ALC) in 1997 based on a document “Agricultural Land Classification of England and Wales” published by the Ministry of Agriculture and Fisheries and Food (now Department for Environment, Food and Rural Affairs) in 1988. The index classifies agricultural land into five grades based on climate, topography, soil, slope and altitude characteristics; with Grade 1 excellent quality and Grade 5 very poor quality.

9.64 Using an ALC classification summary table along with available site information including site walkover observations and gradients; the lower gradient regions on the

CONSENTED (LA01/2018/0200/F)

Site would be anticipated to be classified as Grade 4 (Poor quality) agriculture land with higher regions classified as 5 (very poor). As such loss of the land would not be considered of significant consequence in the context of the region.

Radon

9.65 Radon in Northern Ireland UK Maps of Radon[2] interactive mapping indicates the north-western portion of the Site is located within an area, where 1-3 % of homes are above the action level.

9.66 Radon is a radioactive dust which upon inhalation becomes trapped in the respiratory system and emits radiation leading to damage that may increase the risk of lung cancer. Where buildings are permanently manned in action level area protection measures will be required.

9.67 The occurrence of radon is potentially a constraint to permanent manned / occupied buildings as part of the development.

Waste and Minerals

9.68 The GSNI Geoindex shows no mine shafts / adits immediately adjacent to the Site.

9.69 Keady Quarry (basalt quarry) is located 750 m to the west of the Site.

9.70 A historical unnamed Gravel Pit is located 80 m to the north-east of the Site.

9.71 The Site is identified as being located within an Area of Constraint on Mineral Developments as defined within the Northern Area Plan 2016.

9.72 Tellus Survey 2005 - 2006 recorded no gold within the Curly River. A single sample to the north of the Site returned the presence of gold within sediments in an undesignated watercourse. Considering the absence of gold in the Curly River and the SAC designation, any future mining activity is unlikely within the vicinity and as such would not constrain development.

9.73 NIEA has confirmed that their records show no licensed or unlicensed landfills within 5 km of the Site centroid.

Geology Summary

Table 9.9: Evaluation of Geohazards

Geohazard Type	Applicable to Proposed Dunbeg South Wind Farm & Rational	
Extractions	No	Keady quarry (basalt) is located 750 m to the west of the Site. A Former Gravel Pit is situated to the 80 m east of the Site. The extent of both quarries will not impact on the proposed Development.
Land Slip	No	A historical landslip is situated on the western and southern slopes of Keady mountain. Whilst the Site is located 100 m to the east of the landslip, the nearest Wind Farm infrastructure will be located 400 m to the east of the slip. Peat slide risk is considered separately in Technical Appendix 9.4

2 Public Health England: Radon in Northern Ireland: Indicative Atlas (2015) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/453711/PHE-CRCE-017__maps_with_place_names_.pdf [Accessed 12/06/2017]

CONSENTED (LA01/2018/0200/F)

Geohazard Type	Applicable to Proposed Dunbeg South Wind Farm & Rational	
Running Sand	No	No significant sand deposits recorded on the Site.
Compressible Ground	No	Bedrock is considered to have sufficient bearing capacity for development. Isolated areas of compressible ground may be present within till deposits.
Landfill	N/A	No licensed landfills on the Site, no illegal landfill activity on the Site.
Karst Features	No	OSNI mapping indicates several issues and sinks 600 m to the south of the Site which correspond with the location of landslip material on the superficial geology map. These are a sufficient distance from the Site. The GSNI dataset does not contain any details of karst features within this area other than Wellglass Spring (1.2 km to the north of the Site). A review of OSNI DTM height data does not identify any typical surface depression features which may be evidence of sinks. No karstic features were identified during extensive walkover surveys. Extensive basalt lava flows are recorded on Keady Mountain. The potential for any karst features within the Site that would affect or be affected by the proposed Development is considered unlikely, and not considered further.
Radon	Yes	The north western area is within a classified Radon Action Area as 1-3 % of homes are above the action level.

Catchment Hydrology

Surface Water Bodies

9.74 The DfI Rivers Map of Designations approved by Drainage Council (NI) indicate there are no designated watercourses on the Site; as such all watercourses on the Site are subject to riparian ownership and maintenance only.

9.75 Walkover observations indicated that the natural hydrology of the Site and undesignated water features consist of a number of natural source streams, artificially modified ditches adjacent to field boundaries. A number of artificially modified peat drains are situated in the southern area of the Site.

9.76 A pond is located in the eastern area of the Site which, is considered to be the result of historical peat extraction.

9.77 NIEA River Basin Management Plan boundaries, verified through desktop analysis of terrain models and ground truthing, indicate that all water features on the Site discharge to the north into the Curly River which is located 600 m to the north. Consequently the Site and it's downstream catchment are situated within the Roe Local Management Area (LMA) which is within the Lower Foyle Catchment Stakeholder Group and falls under the control of the North Western River Basin District.

9.78 The Curly River becomes a Designated Watercourse approved by Drainage Council (NI) 3.7 km to the west of the Site. The Curly River joins the main section of the River Roe 5.2 km to the west of the Site. The Roe River discharges into Lough Foyle 8.2 km to the north-west of the Site.

CONSENTED (LA01/2018/0200/F)

Watersheds

9.79 The following is based on a combination of desktop study and walkover survey observations. Main stream reach lengths identified are as per OSNI 1:2,500 scale mapping, validated or otherwise by means of visual survey during the walkover. Consideration has also been given to the DoI River Water Bodies.

9.80 The whole Site is located entirely with the catchment of the Curly River, within waterbody reference UKGBN1NW020204060 as defined by the Water Framework Directive (extending from Springwell Forest (east) to Artikelly Bridge, Limavady (west)). The Site influences 7.4 % of this catchment.

Surface Water Quality

9.81 The following section is intended to provide a qualitative appraisal of existing surface water quality in those waterbodies whose catchment the proposed Development lies within.

9.82 Following publication of the Water Framework Directive (Priority Substance and Classification) Regulations (NI) 2015 (WFD) waterbodies are given a classification based on annual average / percentile results from several individual monitoring stations. WFD classification is a combination of chemical, biological and hydromorphological elements, whereby the overall status is the lowest of the combined constituents. The quality elements considered for WFD classification are: biological quality elements; general chemical quality elements; specific pollutants; and hydromorphology.

9.83 For purposes of classification, under the WFD, watercourses draining the Site lie within the Roe Local Management Area and local NIEA water quality monitoring locations in the vicinity of the Site are shown on Figure 9.3: Water Quality.

9.84 WFD results are summarised below with overall WFD classification for the waterbody draining the Site outlined within Table 9.10: and classifications for individual monitoring stations contributing to the overall WFD classification summarised within Table 9.11.

9.85 From the end of 2015 the number of water bodies within the Roe LMA was reduced. This resulted in the two Curly River waterbodies (2013 & 2049) noted below to be merged to form a single entity as Curly River (UKGBNI1NW020204060).

Table 9.10: Surface Water Body Classification[3]

Water Body Name (identification code)	Overall WFD Classification				WFD Objectives 2021 / 2027
	2012	2013	2014	2015	
Curly River UKGBNI1NW0202022013	Good	Moderate	Moderate	Good	Good
Curly River UKGBNI1NW020202049	Good	Moderate	Moderate	Good	Good

[3] DAERA (2014): Reason for status for water bodies within the Roe Local Management Area https://www.daera-ni.gov.uk/publications/reasons-status-water-bodies-within-roe-local-management-area [Accessed 01/06/2017]

CONSENTED (LA01/2018/0200/F)

Water Body Name	Overall WFD Classification				WFD Objectives 2021
Curly River UKGBNI1NW020204060	-	-	-	Good	Good

Table 9.11: Contributing Surface Water Stations Classifications

	Station WFD Classification				
Station Name and Number	Grid Ref	2011	2012	2013	2014
F10177 Curly River at Artikelly Bridge	C684246	Good	Good	Moderate	Moderate

Project Specific Water Quality Assessment

9.86 In addition to a review of water quality data held by statutory agencies, independent water quality monitoring has been undertaken as part of this assessment to provide baseline water quality standards within the immediate environs prior to any proposed Development.

9.87 The baseline assessment collected and assessed representative samples of water from watercourses draining the Site. A monitoring location was also located on the Curly River, down gradient of the Site as shown on Figure 9.3: Water Quality.

9.88 Water quality results were measured for compliance against key parameter limits outlined in the WFD and the UK Technical Advisory Group on the Water Framework Directive (UK Environmental Standards and Conditions) 2015. In terms of key indicators of water quality and / or pre-existing pollutants, chemical results obtained showed:

- Classifications of "High" based on WFD standards for pH was recorded, and a High and Moderate for Dissolved oxygen indicating good water quality;
- However, Orthophosphate and Ammoniacal Nitrogen classifications were Moderate to Poor. BOD classifications also varied from Poor to Good, with the poor classifications corresponding to areas of grazing.
- Biological results had 'good' Biological Monitoring Working Party (BMWP) biotic scores (calculated from the presence of key family groups) and average Score per Taxon (ASPT) with samples containing taxa from family groups 1 – 3 (considered to be pollutant intolerant species and a sign of good water quality). Overall quality ratio calculated from the BMWP and ASPT scores resulted in a classification of 'Excellent' or 'Good' at all water quality sampling locations.

9.89 Water quality for watercourses draining the Site is generally consistent with the WFD status of Good and Moderate for the downstream waterbody outlined in Section 9.82[4]. Therefore, preservation of the baseline water quality results within the upper reaches would be important at a local level to preserve the downstream NIEA classifications.

4 Note: Independent water quality parameter assessments were carried out at face value over one round of monitoring rather than annual average / percentile as required under the WFD. The data is presented in order to give context to the water quality observed on Site.

CONSENTED (LA01/2018/0200/F)

Flood Data

9.90 The proposed Development was considered in relation to Flood Maps (NI) which provide an indication of predicted flood extents for a 1% Annual Equivalent Probability (AEP) fluvial flood and 0.5% AEP Surface Water Flood.

9.91 Areas of indicative fluvial flooding are predicted on the Site along the banks of a watercourse channel in the eastern area of the Site.

9.92 Areas of indicative pluvial (surface water) flooding are predicted on the site coinciding with minor watercourse channels. Isolated areas of surface water flooding were noted associated with the pond in the eastern area of the site and adjacent the central northern boundary.

9.93 PPS15 states development will not be permitted within the 1% AEP fluvial floodplain therefore flood extents would pose a constraint to development. Flood extents are shown on Figure 9.1: Site Hydrology. Mitigation of flood risk is described in subsequent sections and is addressed in detailed in Appendix 9.6 – Drainage Assessment in the format normally requested by DfI Rivers in consultation.

Hydrogeology

Groundwater Body

9.94 The Site is situated within the Milligan Groundwater Body area (UKGBNI4NW001). This groundwater body is defined to the west and south mostly by the geological contact between older Carboniferous and Triassic (Sherwood Sandstone Group) rocks of the adjacent body with the younger Triassic (Mercia Mudstone Group) and Palaeogene (basalts) rocks which comprise the majority of the body. The eastern boundaries are defined by the surface water catchment with the northern boundary formed by the coastline.

9.95 Depth to water is determined in combination of the underlying geology and topography. Groundwater within the Upper Basalt will be dependent on fracture flow and may be in hydraulic conductivity to the Ulster White Limestone. The fracture flow within the Upper Basalt is expected to be >10 m below ground level considering the topography on Site.

9.96 A shallow groundwater table may be present within the Glacial sand and gravel deposits approximately 2 m to 5 m below ground level in the east of the Site.

9.97 Where Glacial Till is present, the deposits will act as an aquitard limiting the vertical migration of any groundwater.

Bedrock Aquifers

9.98 The Upper Basalt Formation underlying the majority of the Site is classified as Bm(f) indicating the aquifer has moderate productivity potential, intergranular porosity is negligible and fracture flow is dominant and the aquifers have mostly short flow (tens to hundreds of meters) with some regional flow. Bm(f) is consistent with palaeogene basalt.

CONSENTED (LA01/2018/0200/F)

9.99 The Ulster White Limestone bedrock aquifer underlying the north-west of the Site is classified as Bh(f-k) is indicated to have a high productivity potential locally or where exploited with overlying basalts. Intergranular flow is negligible with fracture flow dominant.

Superficial Aquifers / Aquifer Risk Ratings

9.100 The Glacial Sand and Gravel is classified as a potential superficial aquifer.

9.101 The northern area of the Site where the majority of the development will occur has a vulnerability classification of “2” indicating low vulnerability[5], where the aquifer is vulnerable to some pollutants, but only when continuously discharged/leached.

9.102 In the southern area of the Site where Superficial Deposits are indicated to be absent, the Upper Basalt is classified as “5’’ indicating high vulnerability. This informs the aquifer in this area is vulnerable to most water pollutants with rapid impact in many scenarios.

9.103 In the north-eastern area of the Site where Glacial Sand and Gravel Deposits over lie the Upper Basalt Formations is classified as “4e”. This is described as where the aquifer is vulnerable to those pollutants not readily absorbed or transformed, where superficial aquifers are present.

9.104 It is noted that the aquifer vulnerability classification does not take into account the nature of the underlying 'receiving' aquifer with respect to resource value or significance of pollution occurring, and is only a reflection on the protection afforded to the aquifer by overlying deposits. The value of the receiving water is determined by the nature of the water use.

Springs / Seepages

9.105 Historical NIEA Mapping6 identify springs situated 270 m to the north of the Site. The historical maps indicate no others springs within 1 km.

9.106 GSNI records show the presence of the Gortcorbies springs located 280 m and 290 m to the north of the Site.

9.107 Any groundwater within the fractured basalt bedrock is sufficiently deep so as not to have potential to be directly impacted by the proposed Development.

Boreholes / Wells

9.108 GSNI Geoindex indicates no recorded boreholes on the Site. The nearest borehole record is located 1 km to the west of the Site.

[5] BGS (2005) A groundwater vulnerability screening methodology of Northern Ireland, Groundwater Management Programme CR/05/103N http://nora.nerc.ac.uk/11296/1/CR05103N.pdf

6 NIEA (2015) Historical Environment Map Viewer
http://doeni.maps.arcgis.com/apps/webappviewer/index.html?id=f30dc61c86e44bb5bc19b5cacfe43cdc [Accessed 12/06/2017]

CONSENTED (LA01/2018/0200/F)

Groundwater Quality

9.109 For purposes of classification, under the implementation of the WFD the groundwater body underlying the Site is the Milligan Groundwater Body which falls within the North Western River Basin District; initial characterisation of which was undertaken in 2012.

9.110 NIEA Water Management Unit (WMU) consultation provided the location of two groundwater monitoring points within the Magilligan groundwater body, which has a WFD Classification of Poor.

9.111 The NIEA River Basin Monitoring Plan provided groundwater quality information as summarised within Table 9.12:

Table 9.12: Groundwater Body Classification

Waterbody Name and Number	WFD Classification	WFD Objectives	
	2014	2021	2027
Milligan (GBNI4NW001)	Poor	Poor	Poor

Contaminated Groundwater

9.112 NIEA Guidance[7] recommends identifying potential areas of saline or contaminated groundwater based on historic land use. The baseline assessment aims to identify the potential for any existing contaminated or low quality groundwater at the Site as its presence could dictate construction methods required.

9.113 NIEA Historical Land Use mapping noted no significant historic activities on Site.

9.114 NIEA:WMU provided a list of consent agricultural discharges in the surrounding area within the consultation response. The closest is located immediately to the north of the Site (reference licence GR107/03). No further information has been provided. The contamination source has no potential to a have a new pathway introduced as a result of the development.

Abstractions

9.115 Consideration has been given to the potential for the proposed Development to affect downstream water use (abstractions). Abstraction data has been obtained from a number of sources, as follows:

- NIEA: WMU provided information on current licensed abstractions including public water supplies within 5 km of the Site;
- NIEA: Drinking Water Inspectorate (DWI) has provided information on private water supplies registered with the Inspectorate under The Private Water Supplies Regulations (NI) 2009, including private drinking supplies and agricultural (dairy farm) supplies within 5 km of the Site;

[7] NIEA (2015) Water Feature Surveys: A Guide to EIA and Planning Considerations. Available: http://www.planningni.gov.uk/index/advice/northern_ireland_environment_agency_guidance/water_features_surveys.pdf [Accessed 08/06/2017]

CONSENTED (LA01/2018/0200/F)

- Causeway Coast and Glens Council provided addresses of properties within 1 km of the Site which have a private water supply (PWS).

9.116 Guidance relating to abstraction constraints has been sought from the following UK sources:

- WMU recommendations of a 250 m buffer to development around any spring, well or borehole used for public or private drinking water.
- SEPA Guidance Note 4 which indicates that roads, tracks and cable trenches associated with wind farm development must be situated greater than 100 m from any abstraction points and foundations must be situated greater than 250 m from any abstraction points.

9.117 Abstractions have therefore been screened for further investigation where they are within 500 m of the Site i.e. twice the recommended buffer to offer a conservative appraisal.

Surface Water Abstractions

9.118 A review of all information obtained from WMU and DWI indicates that no recorded active surface water abstractions are located within the identified screened area.

9.119 All other registered abstractions identified by the consultees lie sufficiently down gradient of the Site so as not to fall within the conservative screening assessment and / or are outwith the hydrological catchments affected by the proposed Development.

9.120 NI Water has confirmed two springs identified as Gortcobies located 280 m to the north of the Site are no longer in use as intakes for public water supply.

Groundwater Abstractions

9.121 For purposes of determining the area affected by any potential effect on groundwater, it is assumed that groundwater flow direction reflects local topography. A review of all information obtained indicates that no active groundwater abstractions exist within the screened area.

9.122 All other groundwater abstractions identified by the consultees lie sufficiently down gradient of the Site so as not to fall within the conservative screening assessment and / or are outwith the hydrological catchments affected by the proposed Development.

Other Abstractions

9.123 Causeway Coast and Glens BC provided information on a spring situated 1 km to the south-west of the Site which is used as a PWS. The spring located at No.84 Ringsend Road serves six properties.

9.124 The PWS abstraction location is hydrologically separate to the Site, lying in a different hydrological catchment, and lies well in excess of the conservative screening distance for consideration. There is no potential for the abstraction to be affected by the proposal.

9.125 The various consultees indicated that they do not hold a definitive database of individual properties served by a private water supply. Therefore, in order to ensure a

CONSENTED (LA01/2018/0200/F)

robust assessment this assessment has screened other properties in order to further identify properties potentially served by a local unrecorded water abstraction.

9.126 No properties are located within a 250 m screening radius of the proposed Development. Two properties are situated within the additional conservative 500 m screening radius. Both of these properties are uninhabited, and as such cannot indicate the presence of a water supply of value.

Eco-Hydrology and Water Dependant Habitats / Wetlands

9.127 Consideration has been given to local surface water and groundwater dependant ecosystems and habitats dependant on or prone to change due to variation in surface water and groundwater patterns on the Site within Chapter 6: Ecology. No further consideration is given to those aspects within this chapter.

Fisheries

9.128 A full fisheries assessment is included within Chapter 8: Fisheries and is intended to qualify the significance of water quality on and downstream of the Site to habitats and fish populations.

9.129 The Fisheries Assessment concluded that of the five streams draining the Site, a single watercourse in the centre of the Site, referred to as Stream C within the Fisheries Assessment is significant in terms of fisheries status and potential. The Streams are shown on Figure 9.1.

9.130 Stream C is populated with brown trout both within and downstream of the Site.

9.131 The other watercourses (Stream A, B, D and E) surveyed by fisheries are concluded to be of no fisheries interest and of limited potential through their course before joining the Curly River.

Water Framework Directive – Fisheries Classification

9.132 Following the repeal of Directive 2006/44/EC ‘on the quality of freshwaters needing protection or improvement in order to support fish life’, commonly known as the Freshwater Fish Directive; watercourses in Northern Ireland are classified by the WFD as outlined within Section 9.81.

9.133 NIEA Water Management Unit data showed that the Curly River is designated as a protected area under the WFD due to the presence of Salmon and trout which informs the subsequent assessment of the sensitivity of watercourses and water quality.

Designated Sites

9.134 Environmental receptors such as Special Protected Areas (SPA), Special Areas of Conservation (SAC), Areas of Special Scientific Interest (ASSI), Sites of Local Nature Conservation Importance (SLNCI), Nature Reserves (NR) and Earth Science Conservation Review sites (ESCR) have been investigated as part of this assessment. Assessed designated sites are detailed below and shown on Figure 9.4: Designated Sites.

CONSENTED (LA01/2018/0200/F)

9.135 Designated sites were identified based on datasets available from NIEA at the time of the assessment and the datasets were screened to identify:

- Hydrological sites with sensitivities to the water environment that are connected to the Site, i.e. sites which lie in the upstream catchment of or are on downstream streamlines of the watercourses draining the Site;
- Terrestrial sites of geological importance on or immediately adjacent to the Site.

9.136 Only sites meeting these criteria as discussed further in this assessment. Terrestrial sites with ground or surface water dependant habitats are not included within this assessment; those sites are considered in Chapter 6: Ecology. Terrestrial sites with water-related reliance for birds are not considered further within this assessment and are considered in Chapter 7: Ornithology.

9.137 There are no areas of Earth Science Interest identified within or immediately adjacent to the Preliminary Boundary.

9.138 Those sites whose designations relate to the water environment, earth science, or water-influenced habitats are detailed as follows:

Table 9.13: Designated Sites

Site Name	Designation	Reason for Designation	Distance from Site at Nearest Point (km)
Roe River and Tributaries	SAC and ASSI	Selected for N2K status due to presence of Annex II species (Atlantic Salmon)	0.56 north

River Roe and Tributaries: SAC and ASSI

9.139 All on site water features drain into the Curly River. The Curly River is a sub-catchment of the designated River Roe and Tributaries SAC[8] and ASSI[9].

9.140 The Curly River joins the main branch of the River Roe 5.2 km to the west of the Site. The Roe River discharges into Lough Foyle 8.2 km to the north-west of the Site.

9.141 Maintenance of water quality is key to the preservation for the main reason for the designation (i.e. habitat for Atlantic Salmon and brown trout), and as such any significant development work within the catchment would have a potentially adverse effect.

9.142 Management of pollution including silt is a particular objective set out in the management principles for the ASSI[10].

[8] Joint Nature Conservation Committee. (2015). Natura 2000 Standard Data Form - River Roe and Tributaries. Available from: http://jncc.defra.gov.uk/ProtectedSites/SACselection/n2kforms/UK0030360.pdf. [Accessed: 14/8/2017].

[9] Department of the Environment. (2005). Declaration of Area of Special Scientific interest at River Roe and Tributaries, County Londonderry. Article 28 of the Environment (Northern Ireland) Order 2002. Available from: https://www.daera-ni.gov.uk/sites/default/files/publications/doe/River-Roe-and-Tributaries-ASSI-citation-documents-and-map.pdf. [Accessed: 14/8/2017].

CONSENTED (LA01/2018/0200/F)

Baseline Summary and Receptor Sensitivities

9.143 The baseline assessment identified the receptors which have the potential to demonstrate sensitivity to the proposed Development; the receptors and their sensitivity / value are summarised within the following Table. Sensitivity is based on the baseline assessment and determined in accordance with the rationale previously described in Table 9.4.

Table 9.14: Receptor Sensitivity

Type	Receptor	Sensitivity	Rational
Geological	Soils / Drift Deposits	Local / Low	Site with little geological value or of widespread local abundance. Loss of the land on the Site would not be considered significant in the context of the region.
Hydrological	On Site Watercourse : Stream C (Central Catchment)	Regional / Medium	Stream C within the Fisheries Assessment is classed as medium sensitivity in terms of fisheries potential due to the presence of brown trout throughout its course, a Northern Ireland Priority Species. Within the Local Biodiversity Action Plan[11] the species has been selected as a priority species for conservation action.
	On-Site watercourses (Eastern and Western Catchments)	Local / Low	The remaining on-site watercourses have low fisheries and other ecological potential, and have no other use of significant value.
	Curly River (River Roe and Tributaries which are designated SAC and ASSI)	International and / or Very High	Watercourses on-site flow into the Curly River which is included within the River Roe and Tributaries SAC designation due to its importance to Atlantic salmon and other fish species. WFD Classification for the Curly River is Good.
Hydro-Geological	Bedrock Groundwater / Aquifers	Local / Low	The northern area on the which development will occur is situated on Superficial Deposits comprising Till. Under lying basalt is classed as high to moderate productivity potential, however in places dependence on fracture flow makes poorer yields possible. Groundwater WFD Classification is "Poor". An isolated area of Glacial Sand and Gravel is located in the north-western area and is classified as a potential superficial aquifer. No groundwater water abstractions have been identified within 1 km of the Site.
	Shallow	Local / Low	An isolated area of Glacial Sand and Gravel is

[10] River Roe & Tributaries SAC Conservation Objectives (2017) https://www.daera-ni.gov.uk/sites/default/files/publications/doe/Conservation%20Objectives%20%282017%29.%20%20River%20Roe%20%26%20Tributaries%20SAC.%20%20Version%203....pdf [Accessed 06/10/2017]

[11] Local Biodiversity Action Plan for The Causeway Coast and Glens Council Cluster, 2013-2018 https://www.causewaycoastandglens.gov.uk/uploads/general/Causeway_Coast__Glens_Council_BC_LBAP_27.02.13.pdf [Accessed 06/10/2017]

CONSENTED (LA01/2018/0200/F)

	Groundwater / potential superficial Aquifers		located in the north-western area and is classified as a potential superficial aquifer. No surface water abstractions have been identified within 1 km of the Site.
Terrestrial	Tracks and turbines	Local / Low	Proposed infrastructure prone to damage including potential for water damage of electrical infrastructure in a flood event; potential for structural damage of access infrastructure in the event of hydraulic incapacity.
	Buildings	Local / Low	The north-western area of the Site is shown to be within the radon affected area. Any buildings located within this area would be subject to inclusion of protection measures.

Predicted Environmental Effects

Preamble

9.144 This section describes the potential likely effects on hydrological patterns and water quality on the Site, and in the downstream environment, that have the potential to arise in the absence of mitigation, during the following development phases of the proposed Development:

- Wind farm construction;
- Wind farm operation and maintenance;
- Wind farm decommissioning.

9.145 During each of these phases a number of activities will be undertaken, some of which will have the potential to modify hydrological regimes and affect water quality on the Site and in the downstream environment. Due to the nature of the Site and work undertaken, hazards and associated effects will be similar for each phase, with an increased likelihood during the construction phase due to the nature of the work undertaken.

9.146 Measures to prevent or reduce impacts are identified in the following sections, after which residual effects post-application of mitigation are assessed.

Components Contributing to Predicted Environmental Effects

Activities Associated with Construction, Operation and Decommissioning

9.147 During construction, the proposed Development comprises construction of infrastructure which would be likely to cause change to local hydrology and water quality, comprising earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with construction of temporary compounds, turbine foundations, building foundations, access tracks, and cable trenches.

9.148 The operational phase of the proposed Development over the designed operating life (estimated to be 30 years) would cause runoff from access tracks, turbine bases and

CONSENTED (LA01/2018/0200/F)

hard standings via drainage features; and would cause presence of onsite welfare facilities with waste arising and potentially storage and use of oils, fuels and lubricants on-site.

9.149 Activities associated with the decommissioning phase at the end of the operating design life are generally as per those for the construction phase, whereby activities associated with decommissioning comprise earthworks, plant movements with associated use of lubricants and fuel oils, spoil handling and placement of aggregates and cementitious materials, and dewatering associated with removal of turbines, buildings, hard standing areas and buried structures followed by reinstatement and restoration of ground cover.

Likely Significant Effects

9.150 The likely effects of the proposed Development on the surface and ground water environment prior to any avoidance or mitigation are summarised in the following sections.

Changes in Runoff and Flow Patterns

9.151 New temporary and permanent impermeable surfaces, as well as temporary compaction of soils due to construction phase plant and site traffic movements, may cause increased rate and volume of surface water runoff due to the reduced permeable area on the Site through which rainfall can infiltrate. Impermeable surfaces will cause an increased “flashy” response to rainfall events, with increased water velocities in new and existing drainage features. As a consequence, the effect would be likely to cause temporary or permanent increases in surface water runoff rates and volumes, leading to increased flood risk and increased effects of erosion and scour in down gradient watercourses, affecting downstream watercourses. Similarly, loss of permeable areas is likely to cause reduced potential for groundwater recharge affecting aquifers.

9.152 Significant excavations, in particular linear works such as access tracks, drainage ditches and cable trenches are likely to act as barriers to runoff resulting in ponding, or development of preferential flow routes, diverting surface water away from its current route. As a consequence, temporarily or permanently redirected surface water flows may to starve areas where water currently flows, or cause flooding of areas where water currently does not flow.

9.153 Works to existing surface watercourses (such as installation of culverts or bridges) are likely to cause an obstruction to flows and significantly alter conveyance capacities, with the consequence of potentially causing temporary or permanent restrictions in watercourse channels, affecting upstream water levels and increasing flood risk.

9.154 Significance of the identified potential effects is dependent on the particular catchment and is considered in Table 9.21: Potential Magnitude and Significance of Impact to Receptors – Including effect of Avoidance.

Silt / Suspended Solid Pollution

9.155 Temporary activities required to construct wind farm infrastructure would require excavations, ground disturbance (due to excavations and trafficking), stripping and

CONSENTED (LA01/2018/0200/F)

excavation of peat and soils, and temporary spoil deposition. Exposed soils have potential to release fine sediments in surface water runoff or where excavations come in contact with surface watercourses.

9.156 Construction of access tracks and other hard standing areas would require importing, handling and placement of aggregate, which would have the potential to release fine sediments into surface water runoff or where tracks are built over surface watercourses.

9.157 Temporary surface water or shallow groundwater gathering in significant excavations has the potential to be significantly polluted due to contact with excavated surfaces and aggregates. Discharging of untreated water by pump or gravity would potentially cause release of potentially heavily polluted effluent to watercourses.

9.158 As a consequence, suspended sediments and debris entering watercourses would have the potential to adversely modify stream morphologies, smother habitats and harm aquatic flora and fauna.

9.159 Significance of the identified potential effects is dependent on the particular catchment and is considered in Table 9.21: Potential Magnitude and Significance of Impacts to Receptors – Including effect of Avoidance

Chemical Pollution of Surface Water and Groundwater

9.160 Temporary storage and use on the Site of chemicals, fuels and oils associated with construction activity, and use of wet concrete and other cementitious material results in the potential for these substances to enter the surface water environment through accidental spillages, improper transport and refuelling or inappropriate storage and disposal procedures, by gradual leakage or single failure of storage tanks or refuelling mechanisms. Temporary presence of alum-based flocculants, (used to remove suspended solids from surface water) if unregulated, has potential to enter surface waters.

9.161 Permanent presence of oils and lubricants associated with maintenance of turbines for the life of the wind farm has a similar potential to enter the surface water environment.

9.162 Temporary and permanent wastewater effluent from temporary construction phase welfare facilities and permanent substation building welfare facilities has the potential to enter surface water or shallow groundwater.

9.163 As a consequence, chemical pollutants from construction activities, storage of materials, or from coliforms from wastewater entering watercourses have the potential to adversely affect water quality, with associated effects to potable supplies, fish and aquatic ecology.

9.164 Significance of the identified potential effects is dependent on the particular catchment and is considered in Table 9.21: Potential

CONSENTED (LA01/2018/0200/F)

Design Evolution: Avoidance Measures / Buffer Zones

9.165 The magnitude and significance of those effects determined as being likely to be a consequence of the proposed Development can be substantially reduced or eliminated through sympathetic design to avoid those baseline receptors established previously, with particular emphasis and concern in relation to fishery habitats.

9.166 This section identifies the avoidance measures imposed and subsequently identifies the resulting magnitude and significance of residual effects. Additional mitigation is then specified to further reduce or eliminate remaining effects.

9.167 Detail of the design evolution showing considerations made with regards to hydrology and water quality management is presented in Chapter 3: Design Evolution & Alternatives.

9.168 The proposed Development layout has evolved so that the design avoids conflict with the water and geology environment, as demonstrated in the following sections.

Water Features

9.169 As a precautionary measure and in accordance with the guidance previously advocated by NIEA Natural Environment Division, buffer (exclusion) zones to water features are adopted as constraints to built development, and for incorporation as a construction buffer in relation to permissible land uses in proximity to watercourses.

9.170 Impact avoidance and the design of mitigation have been developed in accordance with best practice, using legislation and guidance as outlined in previous sections. Of particular importance are the implications of the WFD and FFD. Mitigation for all water features aims to preserve existing water quality ratings as a minimum.

9.171 Establishment of intact vegetated buffer zones between infrastructure and water features allows:

- Protection of water quality by filtering runoff within riparian vegetation before it enters the watercourse;
- Space for natural fluvial processes such as channel shape and planform adjustment which help restore and maintain the natural dynamic balance of river systems and associated habitats;
- Establishment of vegetation to stabilise banks and reduce soil erosion;
- Access for the maintenance and inspection of watercourses and for dealing with any residual risk of pollution incidents; and
- Habitat for plants and animals to form part of a habitat network.

9.172 The sensitivity of the water feature, and the associated degree of protection it is afforded, is primarily dependent upon:

- Environmental designations on the water feature or downstream environment;
- Fisheries or ecological potential in the water feature or in the downstream environment;

CONSENTED (LA01/2018/0200/F)

- Water feature morphology (natural substrate or artificial channel, soil/ground type);
- Water feature size, capacity to convey water and hydrological potential (flows);
- Nature and topography of the surrounding land, i.e. wet, poorly drained soils and steep slopes (>10°) would require greater protection;
- Sensitivity of the water feature, i.e. silts / nutrient enrichment / chemical pollution.

9.173 The rationale adopted in relation to water feature buffers is informed by NIEA Natural Environment Division guidance, which normally requests no infill, disturbance, construction activity or storage of materials within 50 m of all natural watercourses. NIEA has indicated that justification for buffer zones applied is the responsibility on the Applicant, while any rationale for reducing the scale of the buffer zone must be demonstrated requiring the submission of detailed information using a number of additional factors e.g. soil typology, topography, size of watercourse and climatic conditions.

9.174 Additionally, NIEA in its Practice Guide to EIA and Planning Considerations[12] outlines buffer zones for water features (including surface watercourses) as per the below table.

Table 9.15: NIEW Buffer Zones for Water Features

Width of Watercourse	Width of Buffer Strip
Surface Watercourse	10 m (minimum detailed in GGP 5)
Water Feature (surface watercourse, spring, well, borehole used for Drinking Water (public or private)	250 m
Water Feature (surface watercourse, spring, well, borehole not used for Water Supply (but could provide preferential flow pathway)	50 m
Designated Wetland	250 m

9.175 Additional reference has been sought and taken into account from planning and policy guidance adopted or promoted elsewhere in the UK. SEPA and Scottish Natural Heritage (SNH) endorse guidance provided in Scottish Planning Advice as per Table 9.16. Additional qualification notes that wet, poorly drained soils and steep slopes (>10°) will require a larger buffer strip.

Table 9.16: SEPA / SNH Buffer Guidance

Width of Watercourse	Width of Buffer Strip
Ditches	3 m
Less than 1 m	6 m
1-5 m	6-12 m

12 NIEA (2015) Wind farms and Groundwater Impacts: A guide to EIA and Planning considerations. Available: http://www.planningni.gov.uk/index/advice/northern_ireland_environment_agency_guidance/wind_farms_and_groundwater_impacts-3.pdf [Accessed 08/02/2016]

CONSENTED (LA01/2018/0200/F)

5-15 m	12-20 m
15 m+	20 m+

9.176 Additional industry guidance relevant and similar in nature to the construction and operational activities for the proposed Development has been reviewed and taken into account, in particular:

- Guidance for Pollution Prevention (GPPs): GGP5-Works and Maintenance in or near water.
- Pollution Prevention Guidance (PPGs)
- Best practice[13] in relation to forestry works (in particular on upland and peat sites) recommends riparian buffer reflecting stream size, with buffers from 5 – 20 m.
- Best practice[14] in management of sediments and runoff from exposed ground in relation to agriculture recommends buffers of up to 10 m in order to protect surface waters from pollution by suspended solids, and nutrient enrichment by organic/inorganic fertilisers.

9.177 All water features (rivers, streams, drains and waterbodies) considered significant for the purposes of this assessment and requiring application of a buffer to the proposed Development are shown on Figure 9.1: Site Hydrology and drainage management drawings within Technical Appendix 9.1: Water Framework Directive Assessment.

Significant watercourses

9.178 Significant watercourses identified and requiring application of a buffer to the proposed turbines and infrastructure are largely as per OS close scale vector mapping and were subject to ground truthing on Site.

9.179 A 50 m buffer has been applied to the significant watercourses identified in the baseline assessment, i.e. significant where catchment within Site is >0.25 km^2.

13 Forestry Commission (2015) Managing Riparian Buffer Areas. Available: http://www.forestry.gov.uk/fr/INFD-6MVK4U [Accessed 08/06/2017]

14 DEFRA (2009) Protecting our Water, Soil and Air - A Code of Good Agricultural Practice. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69344%2Fpb13558-cogap-090202.pdf [Accessed 08/06/2017]

CONSENTED (LA01/2018/0200/F)

Plate 9.17: Significant Watercourse Examples

Location	Stream C between T6 and T7	120 m east of T5
Grid Ref.	274225, 424938	273933, 425379
Photo Ref.	GPSe-170618-073221	20170421_135053
		
Location	Eastern Tributary of Stream C, 200 m south of T5	Western Tributary of Stream C: 100m east of Control Building
Grid Ref.	273898, 425460	273578, 425637
Photo Ref.	BSW02C	BSW03C
		

Minor Watercourses

9.180 Minor watercourses were given buffers of 10 m based on SEPA and SNH guidance previously referenced and sensitivity criteria outlined within Section 10.150 above, and represent tributaries where the catchment area was less than 0.25 km^2.

CONSENTED (LA01/2018/0200/F)

Plate 9.18: Minor Watercourse Examples

Location	Western area : 80 m south of Turbine 2	Stream A adjacent eastern boundary. 200 south east of T9
Grid Ref.	273423, 425040	274411, 425669
Photo Ref.	GPSe-170618-083801	GPSe-170618-051051
		

Other Drainage Features

9.181 All other minor drainage features (mapped or otherwise) comprising; dry or partially dry agricultural ditches, ephemeral drains, grips, peat cuttings or other drainage features are considered insignificant in the context of site hydrology and habitat potential.

9.182 Such features would be managed during and following construction by means of diversion and/or temporary blocking (with prior settlement features upstream of and outwith the drainage channel), using filtration check dams or similar, in order to prevent residual indirect potential pollution downstream caused by connectivity to downstream waterways.

CONSENTED (LA01/2018/0200/F)

Plate 9.19: Other Drainage Features Examples

Location	Ditch west of T7.	Ephemeral water feature: 50 m south of T8
Grid Ref.	274040, 424819	274561, 425380
Photo Ref.	GPSe-170618-074021	GPSe-170618-065131
		

Adopted Watercourse Buffers

9.183 Conservative minimum hydrological buffer zones are therefore adopted on the Site as summarised in the Table 9.20 and imposed as shown on Figure 9.1: Site Hydrology. The buffer widths adopted exceed those recommended in industry guidance; the allowance provided gives due consideration to the nature of peat soil conditions on the Site, antecedent weather, moisture and base flow and a significantly increased factor of safety in all instances given the significance of fishery interests within downstream catchments.

CONSENTED (LA01/2018/0200/F)

Table 9.20: Minimum Hydrological Buffer Zones

Water Features	Minimum Width of Buffer Strip
Significant Watercourses (catchment >0.25 km^2)	50 m
Minor Watercourses (catchment <0.25 km^2)	10 m
Other Drainage Features	Managed on-site by diversion / temporary blocking in accordance with GGPs and PPGs.

9.184 Infrastructure is designed to lie outwith stated hydrological buffer zones comprises those elements of the works associated with significant earthworks and greatest potential for spillage or leakage of chemical pollutants, i.e.:

- All turbine bases, crane pads and associated working areas;
- Temporary and permanent spoil storage areas;
- Enabling works compound, substation and construction compound, fuel and chemical storage areas and any other platforms.
- Spoil movements and earthworks (placement of donor turves and contour ploughing) associated with proposed habitat enhancement and ecological mitigation.

9.185 New permanent access tracks are to lay outside buffer zones; with the exception of unavoidable crossings of water features. Careful consideration has been given to the routing of access tracks in order to avoid crossings of watercourses and to avoid instances where roads run parallel to watercourses over long distances.

9.186 An access track between WTG6 - WTG5 and the substation / temporary compound follows the alignment of an existing agricultural track, and as such encroaches on hydrological buffers. The consequence of this work is offset by the re-use of the pre-existing track and existing drainage features that would be re-used for control of runoff. Control of runoff and pollution risk shall be managed through use of additional surface water management measures, discussed subsequently.

9.187 Temporary track infrastructure (such as temporary widenings and turning heads) that may encroach into buffers shall be managed through use of additional surface water management measures, discussed subsequently.

Abstraction Buffers

9.188 The screening assessment of abstractions from surface and groundwater did not identify any abstractions for private water supplies and as such no abstraction buffers are necessary.

Floodplains

9.189 All permanent structures have been located outside areas denoted as lying within the 1% AEP fluvial floodplain based on Flood Maps (NI) indicative mapping.

CONSENTED (LA01/2018/0200/F)

9.190 Pluvial and fluvial flood extends noted along watercourses on-site (outlined within Section 9.90 and shown on Figure 9.1: Site Hydrology) do not extend beyond the extent of the buffers established in Section 9.183 and therefore do not further constrain development.

9.191 Infrastructure is designed to ensure that conveyance of surface water flooding is not impeded by means of providing drainage culverts / under track crossings where necessary. Electrical infrastructure that would be susceptible to damage by floodwater is designed such that it does not have potential to be affected by surface water flooding.

9.192 Areas of isolated surface water flooding generally coincide with source areas of on-site water features or isolated low-points. Site drainage and culverts shall allow passage of local surface flooding as considered within Appendix 9.1: Water Framework Directive Assessment, Appendix 9.6 Drainage Assessment, and accompanying drainage management drawings.

Radon

9.193 The north western area of the Site is within a radon affected area, where 1-3% of homes are above the action level. The permanent sub-station and Control building is sited beyond the area identified as being above Radon Action Levels

Effect of the Development

9.194 Magnitude and likelihood of the environmental effects identified previously in the qualitative analysis presented in Section 9.117 have been determined based on criteria outlined within Sections 9.36 - 9.42 and taking into account the effect of avoidance measures proposed.

9.195 The associated impact significance of these effects on the receptors affected (following the implementation of avoidance and design measures proposed) has been determined in accordance with the rationale previously described and the results are presented in summary Table 9.21: Potential Magnitude and Significance of Impacts to Receptors – Including effect of Avoidance overleaf.

CONSENTED (LA01/2018/0200/F)

CONSENTED (LA01/2018/0200/F)

Table 9.21: Potential Magnitude and Significance of Impacts to Receptors – Including effect of Avoidance

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Soils / Drift Deposits (Local / Low)	Ground Movement / Instability	Low	Negligible	Unlikely	Not Significant	The Quantitative Risk Assessment within the Peat Slide Risk Assessment has concluded that the hazard ranking associated with all aspects of the development, subsequent to control measures, is "Insignificant".
On Site Central Catchment (Stream C) (Regional / Medium)	Changes in runoff and flow patterns	Medium	Moderate	Likely	Moderate	Introducing crossings at 2 locations would have potential to restrict fish passage and if not subject to careful design, be likely to change or restrict channel capacity, with potential to cause a detectable but minor and localised increase in flood risk / flood levels upstream of the structure (i.e. within the confines of the Site). Increased runoff from impermeable infrastructure would cause a detectable effect in terms of flood risk on the Site and shortly downstream of the Site. Temporary and permanent infrastructure comprising linear works installed (drainage channels, cable routes etc) would be likely to cause minor and local change to runoff patterns on the Site.
	Silt / suspended solid pollution of surface waters	High	Moderate	Likely	Moderate	Temporary short-term construction activities associated with construction of watercourse crossings and works in proximity to the watercourse would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site. Avoidance of watercourses by infrastructure would result in there being no direct discharge of silt laden runoff from infrastructure to watercourses other than at watercourse crossings. Filtration of runoff across intact riparian buffers is likely to sufficiently reduce concentrations of pollutants sufficiently that there would be no significant effect. Where track drainage is located within the riparian buffer zone it will be directed away from the watercourse.

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
	Chemical pollution of surface waters	High	Moderate	Likely	Moderate	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.
Western and Eastern surface catchments: On- Site Watercourses (Local / Low)	Changes in runoff and flow patterns	Medium	Low	Likely	Minor	Increased runoff from impermeable infrastructure would cause a detectable effect in terms of flood risk on the Site and shortly downstream of the Site. Temporary and permanent infrastructure comprising linear works installed (drainage channels, cable routes etc) would be likely to cause minor and local change to runoff patterns on the Site. Introducing crossings at five locations within channels within the western surface water catchment, if not subject to careful design, be likely to change or restrict channel capacity, with potential to cause a detectable but minor and localised increase in flood risk / flood levels upstream of the structure (i.e. within the confines of the Site).
	Silt / suspended solid pollution of surface waters	Medium	Low	Likely	Minor	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary fundamental change in water quality in watercourses on the Site. Avoidance of watercourses by infrastructure would result in there being no direct discharge of silt laden runoff from infrastructure to watercourses other than at watercourse crossings. Filtration of runoff across intact riparian buffers is likely to sufficiently reduce concentrations of pollutants sufficiently that there would be no significant effect.
	Chemical pollution of surface waters	Medium	Low	Likely	Minor	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in watercourses on the Site.

CONSENTED (LA01/2018/0200/F)

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
Curly River (River Roe and Tributaries - SAC, ASSI (International / Very High)	Changes in runoff and flow patterns	Low	Moderate	Unlikely	Minor	Given the proportionate effect of the development on the Curley River catchment, increased runoff from impermeable infrastructure would cause an unmeasurable and insignificant effect.
	Silt / suspended solid pollution of surface waters	High	High	Likely	Major	Temporary short-term construction activities within watercourses would be likely to cause a significant but temporary change in water quality in the immediate downstream environment that would have a short-term effect on the habitat that is a reason for environmental designation.
	Chemical pollution of surface waters	High	High	Likely	Major	Spillage of oils, chemicals, or cementitious material associated with temporary construction and arising due to improper site management would be likely to cause a fundamental but temporary change in water quality in the downstream environment that would have a short-term effect on the habitat that is a reason for environmental designation.
Bedrock Groundwater / Aquifers (Local / Low)	Alteration of Groundwater	Low	Negligible	Rare	Not Significant	Significant dewatering with the potential for affecting groundwater levels is not anticipated. Groundwater within the bedrock is sufficiently deep as to not be affected by the proposed Development.
	Chemical pollution of groundwater	Low	Negligible	Unlikely	Not Significant	Groundwater within the bedrock is sufficient deep as to not be affected by the proposed Development. The northern area of the Site is situated on Till which is of low permeability and will generally mitigate through slow downward migration of pollution into deep groundwater. In the southern area of the Site the aquifer is at ground surface. Significance is not significant due to the low value of the aquifer.
Shallow Groundwater / Potential superficial	Alteration of shallow Groundwater	Low	Negligible	Rare	Not Significant	Dewatering with the potential for affecting groundwater levels may be required during the construction of T9. The location is initially indicated to be situated on Glacial

CONSENTED (LA01/2018/0200/F)

Receptor and Sensitivity	Effect and Magnitude		Potential Effect Significance	Likelihood	Overall Effect Significance	Rationale
aquifer (Local / Low)						sand and gravel which are typically highly permeability and may contain a water table. The stratum is classified as a potential superficial aquifer. Presence of an aquifer would be determined by future intrusive investigations. Any dewatering would cause temporary insignificant change in the shallow water table of insignificant consequence due to value of the potential aquifer.
	Chemical pollution of shallow groundwater	Low	Negligible	Unlikely	Not Significant	The northern area of the Site is situated on Till which is of low permeability and will generally mitigate through slow downward migration of pollution into deep groundwater. However, a significant pollution event arising due to improper site management would be likely to cause detectable but temporary pollution to the aquifer.
Tracks, turbines and associated buildings. (Local / Low)	Risk to occupants and infrastructure due to identified potential risk of flooding.	Low	Negligible	Unlikely	Not Significant	The proposed Development has been designed to avoid areas of fluvial flooding and infrastructure is designed to be resilient to surface water flooding.
	Risk to occupants due to presence of Radon	Low	Negligible	Unlikely	Not Significant	Proposed buildings have been sited outside Radon affected areas.

CONSENTED (LA01/2018/0200/F)

Additional Mitigation Measures

All Phases

9.196 Additional mitigating measures over and above the avoidance and buffer zones previously detailed are intended to reduce or prevent the residual significant hazards not fully mitigated by the design evolution and avoidance, identified in the preceding Table 9.21: Potential .

Site Drainage Management and SuDS Design

9.197 The proposed Development will adopt a surface water management plan / site drainage design using the principles of Sustainable Drainage, promoting the principles of on-site retention of flows and use of buffers and other silt removal techniques. All drainage-related mitigation measures proposed will be encompassed by a robust and proven Sustainable Drainage System (SuDS) design which will be used to control drainage and silt management on the Site.

9.198 In summary, drainage will minimise modification and disruption of the existing hydrology by:

- Maintaining existing overland flow routes and channels. All existing natural flow paths lateral to access roads will be maintained through the use of piped crossings under road alignments at natural depressions and at regular intermediate intervals. The spacing of cross drains will be specified at detailed design stage;
- Avoiding transporting rainfall runoff in long linear drainage swales by providing regular channel "breakouts", whereby water is encouraged to flow overland throughout the Site, thus maintaining existing natural hydrological patterns;
- Reducing surface water flow rates and volumes by attenuating runoff from tracks and hard standings "at source" by providing check-dams in swales, whereby the flow velocity and rate of discharge is artificially reduced to mimic natural properties;
- Providing settlement ponds at turbine hard standing areas and other main surface water discharge locations, where runoff from significant new impermeable areas is treated and attenuated before being released overland;
- All swales, crossings and other hydraulic features will be engineered to ensure that dimensions etc. are suitable to convey predicted flows and so prevent build-up of surface water and / or flooding.

9.199 Drainage design will reduce chemical, silt and other suspended pollutant transport by providing a "treatment train" of two to three stages of pollutant removal to all surface water runoff, nominally by:

- Ensuring that drainage swales are designed to convey flows at a low velocity by using a wide, flat bottomed drain;

CONSENTED (LA01/2018/0200/F)

- Providing settlement and filtration features in all linear drainage swales (check dams, filtration dams) to reduce flow velocity and encourage settlement;
- Encouraging appropriate vegetation growth in the base of all linear drainage to provide additional filtration to flows;
- Providing settlement ponds at turbine hard standing areas and other key discharge locations in order to provide treatment to contaminated runoff prior to discharge;
- Discharging surface water runoff over undisturbed vegetated ground, hence allowing any remaining silts and other pollutants to drop out of flows before entering the watercourse (having the effect of polishing the runoff);
- Preventing the discharge of surface water runoff flows directly to existing watercourses or drainage. All discharges shall seek to be via SuDS and buffer zones which will act as a filter strip, allowing deposition of suspended solids and other pollutants.
- Providing settlement features in water channels downstream of areas of peat infilling and ditch blocking area proposed as part of habitat management and enhancement planning.

9.200 Considerations specific to the proposed infrastructure elements are documented in the detailed site specific drainage management / SuDS design - Technical Appendix 9.1: Water Framework Directive Assessment and accompanying Drainage Management Drawings.

Design and Construction of Watercourse Crossings

9.201 As noted previously, the number of watercourse and drainage crossings has been minimised through the principle of avoidance at the layout design stage. Proposals submitted in conjunction with this assessment indicate:

- Three crossings of hydrologically significant watercourses (two of which are considered sensitive with respect to fisheries potential); and
- Four crossings of minor watercourses.

9.202 Culverts will be designed to accommodate track crossings and minimise length of affected channel in order to comply with Revised PPS15 policy FLD4.

9.203 Hydraulic design of crossings will be undertaken as per the guidance and requirements provided in CIRIA C689 "Culvert Design and Operation Guide" (or other standard as may be required by DfI Rivers in post-consent consultation), with primary parameters likely to include:

- Width of the culvert will be greater than the width of the active drainage channel;
- Alignment of the culvert will suit the alignment of the drainage channel, i.e. preserve the existing direction of flow;
- The slope of the culvert will not exceed the slope of the bed of the existing drainage channel.

CONSENTED (LA01/2018/0200/F)

9.204 Detailed design of crossings will assume a hydraulic capacity requirement of 1% Annual Equivalent Probability flow as a conservative measure. Detailed hydraulic design of culverts and similar structures post permission is normal and accepted practice for wind farms in Northern Ireland.

9.205 Fisheries shall be protected by adopting the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency.

9.206 Culvert form will be informed by the site specific fisheries assessment (Chapter 8: Fisheries). In instances where fish passage is a requirement (at Stream C, Central Catchment), culverts will be designed to ensure that the channel bed and banks remain intact in order to preserve fisheries habitats and allow continued fish passage; i.e. the structure will be a bottomless culvert. Elsewhere culverts shall be of a closed conduit type. Typical design drawings for a bottomless culvert and closed culvert have been provided as part of the planning application and are included as part of the Drainage Management Drawings within Technical Appendix 9.1: Water Framework Directive Assessment.

9.207 Consultation and approval will be sought from all relevant parties as required by the Department of the Environment Surface Waters Alteration Handbook (December 2013), including Loughs Agency permitting under Section 69 of the Foyle Fisheries Act (Northern Ireland), and DfI Rivers in particular, at the pre-construction detailed design stage for all works in and affecting watercourses and drains, as per the requirements of Schedule 6 of the Drainage (Northern Ireland) Order 1973 and subsequent amendments.

Water Quality Monitoring

9.208 A water quality monitoring program will be implemented to monitor effects on the hydrological and groundwater regime and water quality during the infrastructure construction, operation and decommissioning phases of the wind farm in order to:

- Demonstrate that the mitigation measures and surface water management is performing as designed;
- Provide validation that the in-place mitigation measures are not having an adverse effect upon the environment;
- Indicate the need for additional mitigation measures to prevent, reduce or remove any effects on the water environment, such as additional temporary settlement or filtration structures or short term flocculant dosing to suit observed site conditions.

9.209 The monitoring would be informed by existing baseline data gathered at the pre-planning stage as presented in the baseline Section 9.86 of this assessment.

9.210 It is intended that the water monitoring extent, duration and frequency will be agreed with the Department of Infrastructure or the relevant regulating body (nominally NIEA WMU) post consent and will nominally consist of physicochemical and biological monitoring. The extent, duration and frequency of the monitoring will be proportionate to the level of activity and perceived risks. Construction and Decommissioning Phases

CONSENTED (LA01/2018/0200/F)

9.211 During all phases the site manager will ensure that mitigation measures as identified within this assessment are fully implemented and that activities are carried out in such a manner as to prevent or reduce effects. The following construction / decommissioning phase-specific measures will be implemented. The following sections should be read in conjunction with the construction management information provided within Chapter 2: The Proposed Site.

Construction and Decommissioning Phases

9.212 During all phases the site manager will ensure that mitigation measures as identified within this assessment are fully implemented and that activities are carried out in such a manner as to prevent or reduce effects. The following construction / decommissioning phase-specific measures will be implemented. The following sections should be read in conjunction with the construction management information provided within Chapter 2: Proposed Development.

Pollution Prevention Guidance

9.213 To ensure best practice on site and to help avoid pollution release to watercourses and groundwater, the following NIEA Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidance (PPGs) will be adhered to:

- GPP2 Above Ground Oil Storage Tanks
- GPP 4 Treatment and disposal of Wastewater where there is no connection to the public foul sewer
- GPP5 Works and Maintenance in or near Water
- GPP 21 Pollution Incident Response Planning
- PPG 1 Understanding Your Environmental Responsibilities - Good Environmental Practices
- PPG 3 Use and Design of Oil Separators in Surface Water Drainage Systems
- PPG 6 Working at Construction and Demolition Sites
- PPG 7 Refuelling Facilities
- PPG 18 Managing Fire Water and Major Spillages
- PPG 20 Dewatering Underground Ducts and Chambers
- PPG 26 Drums and Intermediate Bulk Containers.

9.214 Key requirements for control of chemical pollution risk are identified in the above guidance and will include the following:

- Storage – all equipment, materials and chemicals on the Site will be stored away from any watercourse (i.e. outwith previously stated buffer zones). Chemical, fuel and oil stores will be sited on impervious bases in accordance with GPP2 and within a secured bund of 110% of the storage capacity, within the lay down area.

CONSENTED (LA01/2018/0200/F)

- Vehicles and refuelling – standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution. Refuelling of vehicles and machinery will be carried out on an impermeable surface in designated areas, well away from any watercourse or drainage ditches (i.e. outwith previously stated buffer zones) and will adhere to best practice as detailed in PPG 7.
- Maintenance - on site maintenance to construction plant will be avoided in all practicable instances, unless vehicles have broken down necessitating maintenance at the point of breakdown. Suitable measures in accordance with a pollution prevention plan will be put in place prior to commencement of maintenance in this instance.
- Cement and concrete batching - Preference shall be given to construction techniques that do not require use of cementitious materials where suitable practicable alternatives exist. When concrete / cement are used, concrete batching will not be permitted on Site. Wet concrete operations will not be carried out within watercourses or adjacent to watercourses. Measures to prevent discharge of alkaline wastewaters or contaminated storm water to watercourses will be outlined in a detailed Pollution Prevention Plan for the Site to be approved by NIEA before commencement of works. Wastewater spillage will be minimised by using settling tanks and recycling water.
- Mess and welfare facilities will be required during construction and decommissioning and will be located at the construction compound. Foul effluent disposal shall be via chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on site).

Pollution Prevention Plan

9.215 A detailed Pollution Prevention Plan (PPP) will be implemented and monitored by the site manager as part of a full Construction & Decommissioning Method Statement (CDMS) for the project, to be agreed with the local planning authority at the pre-construction stage. Although this will be of particular importance during construction, it will apply to potentially polluting activities during all phases of the proposed Development.

9.216 The detailed PPP will be produced following consultation and agreement with NIEA, and all appropriate personnel working on the Site will be trained in its use. As a minimum, the PPP will comply with Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidelines (in particular GPP 21: Pollution Incident Response Planning) and best practice as advocated by CIRIA. The PPP will identify site-specific measures and incorporate a Pollution Incident Plan, which will include emergency contact details, details of spill kits on the Site and instructions on actions in case of spillage / emergency.

CONSENTED (LA01/2018/0200/F)

Construction in the vicinity of Watercourses

9.217 The following procedures apply to the general construction activities either within the watercourses or in defined watercourse buffer zones:

- Due consideration will be given to the prevailing ground and weather conditions when programming the execution of the works in order to ensure that in-channel works are undertaken during periods of predicted low flow and low rainfall in order to minimise contact with water.
- Ensure that roadside drains do not discharge directly into watercourses, but rather through a riparian buffer area of intact vegetation as denoted on design drawings.

Construction of Watercourse Crossings

9.218 Measures for in-stream works including watercourse crossings will be as per the guidance stated in Guidelines for Fisheries Protection during Development Works as published by Loughs Agency.

9.219 Construction of watercourse crossings will be programmed to coincide with periods of predicted low flow in the affected channel (determined by rainfall and would generally coincide with summer months) and adhere to working period restrictions imposed. Construction will be strictly as per the design for each identified watercourse crossing and will fully implement all SuDS and additional mitigating measures proposed at the detailed design stage. For purposes of outline design, the proposed mitigation will include:

- Installation of silt fences parallel to the watercourse channel in the vicinity of the proposed crossing;
- Installation of small cut-off drains to prevent natural surface runoff entering area of construction activity;
- Installation of filtration or other silt entraining features within the watercourse channel immediately downstream of the works location;
- Use of over pumping where deemed appropriate.

Electrical Cable

9.220 Due consideration will be given to the prevailing ground conditions and season when programming the execution of cable trench excavations in order to ensure works are undertaken during periods with low rainfall and elevated shallow groundwater levels in order to reduce the likelihood of runoff entering the excavations.

9.221 Excavation of cable trenches will be carried out over short distances, with frequent backfilling of trenches to minimise opportunity for the ingress of water into open trenches, temporary silt traps will be provided in longer trench runs and on steeper slopes and spoil will be stored in line with a spoil management plan, which will be produced as part of the CDMS at the pre-construction stage.

CONSENTED (LA01/2018/0200/F)

9.222 Cable crossings of watercourses shall use a raised cable tray to bridge the river channel, with supports and footings constructed outwith the river channel. No plant shall be permitted within watercourse channels when undertaking such works.

Excavations and Spoil Management

9.223 Soil and subsoil excavation and movement will be undertaken in accordance with best practice guidelines such as Good Practice Guide for Handling Soils (MAFF, 2000) in order to minimise potential for silt laden runoff from spoil and excavations. Areas of stockpiled spoil including stored peat:

- will not be permitted within previously identified watercourse buffer zones; and
- will not be permitted to obstruct the flow of overland surface water with specific drainage to spoil mounds to be provided.

9.224 Material produced from excavations on the Site will be reused where reasonably practicable in the reinstatement of the Site. Excavated materials will be separated into rock material, subsoil, reusable peat and vegetated sod material and will be stored in the designated temporary stockpile zones, under the supervision of a geotechnical expert. These materials will be reused where possible to re-grade slopes, and to re-vegetate and stabilise the sides of access tracks and hard standing areas.

9.225 Spoil drainage will be designed on a bespoke basis for spoil storage areas to allow controlled dewatering and prevent washout of suspended solids to the receiving water environment. As part of the detailed CDMS a spoil management strategy will be developed by the appointed competent contractor for the development. Outline designs for drainage arrangements for temporary spoil areas are shown on the Drainage Management Drawings within Technical Appendix 9.1: Water Framework Directive Assessment.

Ditch Blocking and Earthworks for Habitat Enhancement

9.226 In the Outline Habitat Management Plan (Technical Appendix 6.8), areas for ditch blocking and areas of re-profiling using excavated peat have been proposed in areas where the effect could have no offsite hydrological effect (by raising water levels or impeding drainage such that water would divert or back-up onto 3rd party lands). The effect of impeded drainage would be limited to lands under control of the applicant. Drainage channels affected have been determined not to be of significant aquatic habitat value.

9.227 It is anticipated that ditch / minor watercourse blocking methods would depend upon local conditions at any given location. A number of techniques for maintaining the water levels in the drains associated with the flushes may be used and would typically comprise the installation of a barrier (e.g. (piled) corrugated sheets or drop board sluice or installation of pipe dams, in conjunction with backfilling with site-won material). Methods will comply with best practice guidance [15].

[15] Armstrong A1, Holden J, Kay P, Foulger M, Gledhill S, McDonald AT, Walker A. (2009). Drain-blocking techniques on blanket peat: A framework for best practice. Journal for Environmental Managers. Vol. 90

CONSENTED (LA01/2018/0200/F)

9.228 Downstream water quality within stream channels that may otherwise be affected by release of sediment in runoff would be protected by adopting spoil handling methods as set out in Sections 9.223 to 9.225. In particular, the channel(s) downstream of the blocked areas would have temporary filtration features (i.e. silt fences or clean drainage stone dams) installed in the channel in order to filter or settle solids, until such time as the level of washout had receded.

9.229 Overland surface flow caused by blocking of drains will not cause any offsite flood risk. Surface flows will be deliberately attenuated behind ploughed contour furrows with the intention of creating wet conditions for heath habitats. Refer to the Outline Habitat Management Plan (Technical Appendix 6.8) for further detail. Blocking and wetting areas are shown indicatively on SuDS drawings included in Technical Appendix 9.1: Water Framework Directive Assessment.

Dewatering of Excavations

9.230 The majority of the turbine base foundations will be on bedrock or other hard strata above bedrock (to be confirmed by detailed site investigation prior to detailed design); therefore deep excavations within bedrock and the associated bedrock aquifer are not anticipated and dewatering below the bedrock aquifer groundwater table is therefore not anticipated.

9.231 Shallow groundwater (e.g. in areas of glacial sand and gravel, T9) or rainfall runoff collected in excavations will be discharged via settlement ponds or filter strips prior to entry to the receiving water environment.

9.232 Any settlement lagoons or filter strips associated with dewatering will be regularly inspected, particularly after periods of heavy rainfall and prior to periods of forecast heavy rainfall. Maintenance (to clear blockages or remove silt) will be carried out in periods of dry weather where practicable. Maintenance requirements are further considered in Technical Appendix 9.1: Water Framework Directive Assessment.

Dust Management

9.233 Loose track material generated during the use of access tracks and the construction compound will be prevented from reaching watercourses by maintenance to surface water drainage systems installed at aggregate based hard standing areas. In dry weather dust suppression methods such as by dust suppression bowser will be employed.

Borrow Pits

9.234 For the avoidance of doubt, no borrow pits are proposed at the site, therefore associated pollution risks associated with rock extraction activities are not a consideration.

CONSENTED (LA01/2018/0200/F)

Maintenance of Pollution Prevention Measures

9.235 All SuDS and additional pollution prevention measures installed will be subject to a regular maintenance regime for the life of the construction phase in order to maintain functionality of all features. This will comprise:

- Unblocking of drains;
- Maintenance of access road and other hard standing surfaces;
- Replacement of filtration features;
- Removal of silt build-up from settlement and filtration features.

Mitigating Measures - Operational Phase

9.236 Mitigation of the effects of the wind farm development will comprise the following:

- Ensure best practice is adhered to on the Site and avoid pollution release to watercourses by incorporating NIEA Pollution Prevention Guidance notes into management policy.
- In the event that permanent welfare facilities are installed as part of control building / substation facilities, foul effluent will be disposed of through the use of sealed cesspools or chemical facilities with periodic tankered removal by a licensed waste haulier for licensed offsite disposal (i.e. there shall be no emission on the Site).
- Cyclical maintenance of permanent SuDS drainage features installed during the construction phase, including unblocking of drains, maintenance of access road and other hard standing surfaces, and removal of silt build-up from settlement features. An outline maintenance programme is included in Technical Appendix 9.1: Water Framework Directive Assessment.

Commentary on Proposed Development

On-Site Works

9.237 Table 9.22 summarises the potential impact of infrastructure to be installed as part of the proposed Development following adoption of the preceding mitigation for the design phase. All turbines and infrastructure are outside the recommended buffers (aside from watercourse crossings) as described in Chapter 3: Design Evolution & Alternatives.

Table 9.22: Commentary on Infrastructure Elements

Infrastructure Element	Commentary / Specific Mitigation Implemented	Mitigated Impact Magnitude
Access Track	New tracks are located outside hydrological buffer zones. Existing tracks to be upgraded and re-used within buffer zones shall cause less disruption and will re-utilise existing track drainage and be subject to additional mitigation measures to control runoff. Track is orientated in accordance with the guidance provided by the	Minor / Negligible

CONSENTED (LA01/2018/0200/F)

Infrastructure Element	Commentary / Specific Mitigation Implemented	Mitigated Impact Magnitude
	peat slide risk assessment for the Site, minimising risks to the soil and water environment. Track is orientated to cause least possible disruption by crossing watercourses perpendicular to the watercourse channel. Runoff from track hardstanding to be attenuated and treated in trackside swales / check dams. All existing watercourse paths to be maintained; culverts to be designed to ensure no restriction or diversion to flows.	
Permanent Control room & Substation Compound	Contaminated runoff from excavations, hardstanding and roof areas will be treated to remove silts / suspended solids as part of the drainage management plan for the Site using SuDS techniques prior to discharge. Runoff from new hardstanding and roof areas will be managed using SuDS techniques to attenuate, control and treat flows. Located >50 m from nearest watercourse. Permanent chemical welfare facilities to be provided to negate requirement for any foul effluent discharge from the Site.	Minor / Negligible
Temporary Enabling Works Compound	Contaminated runoff from excavations, hardstanding and roof areas will be treated to remove silts / suspended solids as part of the drainage management plan for the Site using SuDS techniques prior to discharge. Runoff from new hardstanding and roof areas will be managed using SuDS techniques to attenuate, control and treat flows.	Minor / Negligible
Temporary Construction Compound	Contaminated runoff from excavations, hardstanding and roof areas will be treated to remove silts / suspended solids as part of the drainage management plan for the Site using SuDS techniques prior to discharge. Runoff from new hardstanding and roof areas will be managed using SuDS techniques to attenuate, control and treat flows. Located >50 m from nearest watercourse. Oil containment facility to be provided. Temporary chemical welfare facilities to be provided to negate requirement for any foul effluent discharge from the Site.	Minor / Negligible
All Turbines	Contaminated runoff from excavations and earthworks will be treated to remove silts / suspended solids as part of the drainage management plan for the Site using SuDS techniques prior to discharge. Runoff from new hardstanding areas will be managed using SuDS techniques to attenuate, control and treat flows. Turbine foundation formation level bedrock (Basalt); no requirement for piled foundations or excavation in bedrock, with associated increased risk to aquifer, is anticipated.	Minor / Negligible
T1	Turbine base and associated crane pad located > 60 m from nearest watercourse.	Minor / Negligible
T2	Turbine base and associated crane pad located > 70 m from nearest watercourse.	Minor / Negligible
T3	Turbine base and associated crane pad located > 40 m from nearest watercourse.	Minor / Negligible
T4	Turbine base and associated crane pad located > 70 m from nearest watercourse.	Minor / Negligible
T5	Turbine base and associated crane pad located > 100 m from nearest watercourse.	Minor / Negligible

CONSENTED (LA01/2018/0200/F)

Infrastructure Element	Commentary / Specific Mitigation Implemented	Mitigated Impact Magnitude
T6	Turbine base and associated crane pad located > 120 m from nearest watercourse.	Minor / Negligible
T7	Turbine base and associated crane pad located > 40 m from nearest watercourse.	Minor / Negligible
T8	Turbine base and associated crane pad located > 30 m from nearest watercourse.	Minor / Negligible
T9	Turbine base and associated crane pad located > 20 m from nearest watercourse. Minor drainage channels adjacent to be diverted to comply with recommendations stated in the Peat Slide Risk Assessment.	Minor / Negligible

Mitigating Measures and Residual Effects

9.238 The following table details the assessed impact magnitude, likelihood and associated significance as a function of the matrix stated previously of all receptors identified as previously having an unmitigated impact significance greater than ‘nil’ or ‘not significant’.

9.239 Note that assessment of peat slide and water dependant habitats are excluded from this assessment and are assessed separately in Technical Appendix 9.4: Peat Slide Risk Assessment and Chapter 6: Ecology.

CONSENTED (LA01/2018/0200/F)

Table 9.23:Potential Magnitude and Significance of Impacts to Receptors (Post-Mitigation)

Receptor and Sensitivity	Effect and Mitigated Magnitude		Mitigated Effect Significance	Mitigated Likelihood	Overall Mitigated Effect Significance	Rationale
On Site Central Catchment (Stream C) (Regional / Medium)	Changes in runoff and flow patterns	Low	Low	Rare	Not Significant	Sympathetic design of infrastructure layout in relation to disruption / diversion of existing surface water and overland runoff routes results in no quantifiable change in runoff patterns on the Site. Surface water runoff from the Site will not cause a change in downstream hydrological conditions following mitigation to attenuate site runoff.
	Silt / suspended solid pollution of surface waters	Low	Low	Rare	Not Significant	Surface water management to control silt in proximity to watercourses at all phases is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Low	Low	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.
Western and Eastern surface catchments: On-Site Watercourses (Local / Low)	Changes in runoff and flow patterns	Low	Negligible	Rare	Not Significant	Surface water runoff from the Site will not cause a change in downstream hydrological conditions following mitigation to attenuate site runoff. Sympathetic design of infrastructure layout in relation to disruption / diversion of existing surface water and overland runoff routes results in no quantifiable change in runoff patterns on the Site.
	Silt / suspended solid pollution of surface waters	Low	Negligible	Rare	Not Significant	Surface water management to control silt in proximity to watercourses at all phases is likely to result in no permanent change and no significant temporary change in conditions

CONSENTED (LA01/2018/0200/F)

Receptor and Sensitivity	Effect and Mitigated Magnitude		Mitigated Effect Significance	Mitigated Likelihood	Overall Mitigated Effect Significance	Rationale
						exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Low	Negligible	Rare	Not Significant	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.
Curly River : River Roe and Tributaries) (International / Very High	Changes in runoff and flow patterns	Negligible	Low	Rare	Not significant	Surface water runoff from the proposed Development will not cause a change in downstream hydrological conditions following mitigation to attenuate site runoff. Sympathetic design of infrastructure layout in relation to disruption / diversion of existing surface water and overland runoff routes results in no quantifiable change in runoff patterns on the Site.
	Silt / suspended solid pollution of surface waters	Low	Moderate	Rare	Minor	Surface water management to control silt in proximity to watercourses at all phases is likely to result in no permanent change and no significant temporary change in conditions exceeding natural or pre-existing conditions.
	Chemical pollution of surface waters	Low	Moderate	Rare	Minor	Pollution prevention measures proposed to control chemical pollution at all phases is likely to result in no permanent or temporary change in conditions exceeding natural or pre-existing conditions.

CONSENTED (LA01/2018/0200/F)

Cumulative Effects

9.240 An assessment has been undertaken of the cumulative effect on geology and the water environment of the Development in conjunction with other known wind farms and other significant developments in planning, construction or operation at the time of the application.

9.241 The assessment aims to determine potential for cumulative impact within the hydrological and hydrogeological setting of the Site caused by an accumulation of similar developments. The hydrological and hydrogeological setting of the Site for the purposes of the assessment is the downstream Curly River catchments as identified on the NIEA Water Framework Directive interactive catchment mapping website and shown on Figure 9.5: Cumulative Assessment.

9.242 Coordinates of wind farms within 40 km of the proposed Dunbeg South Wind Farm Development were provided; two developments outlined within Table 9.24: Cumulative Assessment were identified within the Curly River catchment. Single wind turbine developments are excluded as not having potential to significantly adversely affect the water or geological environment individually or cumulatively, due to the scale and nature of construction activity involved in their construction.

Table 9.24: Cumulative Assessment

Wind Farm	Centroid	No. Of Turbines	Status	Distance between nearest Turbines
Dunbeg Extension	274773, 426512	3	Consented	0.8 km
Dunbeg	275468, 427249	14	Operational	1.4 km
Dunmore	275042, 428350	7	Operational	2.2km

9.243 As no likely significant residual water environment or geological effects are predicted arising from the development of the proposed Development, there is no potential significant cumulative effect to water or the geological environment in conjunction with any other pre-existing or proposed development.

Summary and Conclusions

9.244 This assessment identifies the potential geological, hydrological, and hydrogeological impacts, including surface and groundwater quality of the proposed Development. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

9.245 Aspects of the design, construction and operation of the proposed Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for impacts assessed. It has been determined that without

CONSENTED (LA01/2018/0200/F)

mitigation the proposed Development would be likely to cause adverse impacts of moderate significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the baseline assessment and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

9.246 Monitoring of the effect of the Development on the water environment and fisheries habitat will be provided through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance to all receptors to “not significant”.

9.247 There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.

CONSENTED (LA01/2018/0200/F)

References

British Geological Society (1996) Hydrogeology of Northern Ireland.

British Geological Society (2005) EU Water Framework Directive: groundwater-dependent terrestrial ecosystems in Northern Ireland. Available: http://nora.nerc.ac.uk/11263/1/CR05069N.pdf [Accessed 08/06/2017]

British Geological Society, Mineral Resources Northern Ireland, County Londonderry (2016) http://nora.nerc.ac.uk/18980/1/Londonderry_Mineral_Final.pdf [Accessed

Centre for Hydrology and Ecology Wallingford (2009), Flood Estimation Handbook and Associated Software Version 3.

CIRIA (1997) Culvert Design Guide Report No. C168; Construction Industry Research and Information Association, London.

CIRIA (2006) Control of Water Pollution from Linear Construction Projects, Report No C648, Construction Industry Research and Information Association.

CIRIA (2006) Control of Water Pollution from Linear Construction Projects - Site guide. Report No C649, Construction Industry Research and Information Association.

CIRIA (215) The SUDS Manual, Report No C573, Construction Industry Research and Information Association.

CIRIA (2010) Culvert Design and Operation Guide Report No. C689; Construction Industry Research and Information Association.

CIRIA, Wilson, S., Bray, R. And Cooper, P. (2004), Sustainable Drainage Systems – Hydraulic, Structural and Water Quality Advice Report No. C609.

Department of Agriculture and Rural Development and DfI Rivers (2014), Flood Maps (NI). http://riversagency.maps.arcgis.com/apps/webappviewer/index.html?id=fd6c0a01b07840269a50a2f596b3daf6 [Accessed 01/04/2017]

Department of the Environment for Northern Ireland (1993), River and Estuary Quality in Northern Ireland: Report of the 1991 Survey.

Environment and Heritage Service and National Museums and Galleries of Northern Ireland (Unknown), Geological Sites in Northern Ireland - Earth Science Conservation Review. Available: http://www.habitas.org.uk/escr/ [Accessed 08/06/2017]

Geological Survey of Northern Ireland (2001) 1:50,000 Bedrock Geology Map (Sheet 12: Limavady).

Geological Survey of Northern Ireland (2001) 1:50,000 Superficial Geology Map (Sheet 12: Limavady).

Highways Agency (2006) Design Manual for Roads and Bridges Volume 4, Section 2: Drainage.

Holden, J., Kirkby, M.J., Lane, S.N., Milledge, D.G., Brookes, C.J., Holden, V. And McDonald, A.T. (2008), Water Resources Research, Volume 44 (6) - Overland flow velocity and roughness properties in peatlands.

Met Office (2014) UK Mapped Climate Averages. Available: http://www.metoffice.gov.uk/datapoint/product/climate-averages l [Accessed 08/06/2017]

Ministry of Agriculture, Fisheries and Food (1988) Land Classification in England and Wales. Available:

http://webarchive.nationalarchives.gov.uk/20130402151656/http://archive.defra.gov.uk/foodfarm/landmanage/land-use/documents/alc-guidelines-1988.pdf [Accessed 08/06/2017]

Natural Environment Research Council (1974) Flood Studies Report.

Northern Ireland Environment Agency (2009) GQA Biological Classification System. Available: http://www.ni-environment.gov.uk/water-home/quality/rivers/river_results/gqabiolexpln.htm [Accessed 26/06/2017]

Northern Ireland Environment Agency (2009) GQA Chemical Classification System. Available: http://www.ni-environment.gov.uk/water/quality/rivers/river_results/gqachemexpln.htm [Accessed 26/06/2017]

Northern Ireland Environment Agency (2009) River Monitoring Results. Available: http://www.ni-environment.gov.uk/water-home/quality/rivers [Accessed 26/06/2015]

DAERA (2017) River Basin Plan Interactive Map. Available: http://appsd.daera-ni.gov.uk/RiverBasinViewer/ [Accessed 08/06/2017]

Northern Ireland Environment Agency (2015) Wind Farms and Groundwater Impacts: A Guide to EIA and Planning Considerations. Available: http://www.planningni.gov.uk/index/advice/northern_ireland_environment_agency_guidance/wind_farms_and_groundwater_impacts-3.pdf [Accessed 08/06/2017]

Office of Public Sector Information (1973) Drainage (Northern Ireland) Order.

DfI Rivers (Unknown) Estimation of Flood Peaks in Northern Ireland Rivers from Catchment Characteristics - DfI Rivers Design Note.

DfI Rivers (2014) Designations Approved by Drainage Council (NI). http://riversagency.maps.arcgis.com/apps/webappviewer/index.html?id=28b901c557054dd488953180d2309903 [Accessed 06/06/2017]

Scottish Executive (2000) River Crossing and Migratory Fish: Design Guidance.

Wallingford (1994) Flood Estimation for Small Catchments - Institute of Hydrology Report No IH124.

Additional references identified in specific footnotes.

CONSENTED (LA01/2018/0200/F)

List of Figures

List of Appendices

CONSENTED (LA01/2018/0200/F)

10

Noise

CONSENTED (LA01/2018/0200/F)

10 Acoustic Assessment

Introduction

10.1 This report contains an assessment of the acoustic impact of the proposed Dunbeg South Wind Farm, hereinafter referred to as 'the Development'. The report assesses wind farm operational noise and construction noise upon the most acoustically sensitive residential properties.

Statement of Authority

10.2 This assessment has been undertaken by RES, with at least one in-house Member of the Institute of Acoustics involved in its production. RES has undertaken acoustic impact assessments in every single one of its UK wind farm development applications since 2000. RES have also carried out noise assessments and reported to several local planning authorities on operational wind energy projects, including taking measurements on newly constructed wind farms to ensure compliance with planning conditions.

10.3 Additionally, RES have been project co-ordinators for several Joule[1] projects, leading European research into wind turbine noise, were involved in producing the guideline 'The Assessment and Rating of Noise from Wind Farms'[2] for the DTI in 1996, acted as peer reviewer for the 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'[3], and contributed to both the RenewableUK[4] and Institute of Acoustics[5] research into Amplitude Modulation. Publications include:

- 'An Investigation of Blade Swish from Wind Turbines', P Dunbabin, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 1, pp 463 – 469;
- 'An Automated System for Wind Turbine Tonal Assessment', R Ruffle, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 6, pp 2997 – 3002;
- 'Wind Turbine Measurements for Noise Source Identification', ETSU W/13/003914/00.REP, 1999, Dr P Dunbabin, RES et al;
- 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU W/13/00385/REP, 2000 Dr J Bass, RES;
- 'Aerodynamic Noise Reduction for Variable Speed Turbines', ETSU/W/45/00504/REP, 2000, Dr P Dunbabin, RES;

[1] DGXII European Commission funded projects in the field of Research and Technological Development in non-nuclear energy

[2] 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97

[3] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise', Institute of Acoustics, May 2013

[4] 'Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects', RenewableUK, 2013

[5] Institute of Acoustics Noise Working Group, A Method for Rating Amplitude Modulation in Wind Turbine Noise, 9 August 2016

CONSENTED (LA01/2018/0200/F)

- 'Fundamental Research in Amplitude Modulation - a Project by RenewableUK', Fourth International Meeting on Wind Turbine Noise, Rome, April 2011;
- 'Investigation of the 'Den Brook' Amplitude Modulation methodology for wind turbine noise', Dr J Bass, Acoustics Bulletin Vol 36 No 6 November/December 2011;
- 'How does noise influence the design of a wind farm?', Dr M Cassidy, Fifth International Conference on Wind Turbine Noise, Denver, 2013;
- 'Propagation of Noise from Wind Farms According to the Good Practice Guide', A Birchby, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015;
- 'Addressing the Issue of Amplitude Modulation', Dr M Cassidy, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015;
- 'A Method for Rating Amplitude Modulation in Wind Turbine Noise', Institute of Acoustics Noise Working Group, August 2016; and
- 'Pre-construction Site Prediction Tool for Wind Farm AM – Do We Now Know Enough?', A Birchby, Seventh International Conference on Wind Turbine Noise, Rotterdam, 2017.

Wind Turbine Noise

10.4 In the context of other sources of environmental noise, the noise levels produced by wind turbines are generally low and have greater dependence upon wind speed. The combination of these two factors implies that a degree of masking would often be provided by background noise.

10.5 As described by the Department of the Environment in Best Practice Guidance to Planning Policy Statement 18[6]:

"There are two quite distinct types of noise source within a wind turbine. The mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air. Since the early 1990s there has been a significant reduction in the mechanical noise generated by wind turbines and it is now usually less than, or of a similar level to, the aerodynamic noise. Aerodynamic noise from wind turbines is generally unobtrusive – it is broad-band in nature and in this respect is similar to, for example, the noise of wind in trees."

Construction Noise

10.6 The sources of construction noise, which are temporary, will vary both in location and duration as the different elements of the wind farm are constructed and will arise primarily through the operation of large items of plant.

10.7 Noise will also arise due to the temporary increase in construction traffic near the site. This level also depends on the different elements of the wind farm being constructed.

[6] 'Best Practice Guidance to Planning Policy Statement 18: Renewable Energy', PPS18, August 2009

CONSENTED (LA01/2018/0200/F)

Scope of Assessment

10.8 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. The effect of noise, both in the construction and operational phase, is therefore a material consideration in the determination of planning applications.

Operational Noise

10.9 The main focus of the acoustic impact assessment of operational noise presented here is based on the most relevant type of noise emission for modern wind turbines: aerodynamic noise, which is broadband in nature. Mechanical noise, which can be tonal in nature, is also considered albeit less relevant to modern wind turbines. Implicitly incorporated within this assessment is the normal character of the noise associated with wind turbines (commonly referred to as 'blade swish') and consideration of a range of noise frequencies, including low frequencies. An acoustic assessment considering the operation of the proposed energy storage facility can be found in Technical Appendix 10.1.

10.10 Low frequency content of the noise from wind farms shall be considered through the use of octave band specific noise emission and propagation modelling, however it is considered that specific and targeted assessment on low frequency content of noise emissions from the proposed wind farm is unjustified. Details for scoping out low frequency noise from the acoustic assessment, as well as infrasound, sleep disturbance, vibration, amplitude modulation and wind turbine syndrome can be found in Technical Appendix 10.2.

Construction Noise

10.11 The acoustic impact assessment of construction noise from the wind farm presented here is based on RES's experience of constructing wind farms and calculated for the operation of the primary large items of construction equipment. Additionally, consideration is given to the increased noise levels due to increased traffic flows during the construction phase to and from the site.

10.12 Whilst noise will also arise during decommissioning of the wind farm (through turbine deconstruction and breaking of the exposed part of the concrete bases) this is not discussed separately as noise levels resulting from it are expected to be lower than those from the construction activity.

Legislative Framework & Guidance

Operational Noise

10.13 Within Northern Ireland, noise from wind farms is defined within the planning context by Planning Policy Statement 18: Renewable Energy[7]. Best Practice Guidance to Planning Policy Statement 18: Renewable Energy[6] refers to the use of the Department

[7] 'Planning Policy Statement 18: Renewable Energy', PPS18, August 2009

CONSENTED (LA01/2018/0200/F)

of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97). In relation to noise from wind farms the Planning Policy states:

"The report, 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97), describes a framework for the measurement of wind farm noise and gives indicative noise levels calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development."

10.14 It is therefore considered that the use of ETSU-R-97, as a criterion for assessment of wind farm noise, fulfils the requirements of Planning Policy Statement 18.

10.15 The methodology described in ETSU-R-97 was developed by a working group comprised of a cross section of interested persons including, amongst others, environmental health officers, wind farm operators and independent acoustic experts.

10.16 The guidance makes it clear from the outset that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that arise through the development of renewable energy resources. The principle of balancing development needs against protection of amenity may be considered common to any type of noise control guidance.

10.17 The basic aim of ETSU-R-97, in arriving at the recommendations contained within the report, is the intention to provide:

"Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

10.18 ETSU-R-97 provides a robust basis for assessing the noise impact of a wind farm and has been applied at the vast majority of wind farms currently operating in the UK and is proposed as adequate for use in this assessment. Based on planning policy and guidance, as outlined above, a wind farm which can operate within the noise limits which have been derived according to ETSU-R-97 is considered to be acceptable. This approach has been agreed with Causeway Coast & Glens District Council.

10.19 An article published in the Institute of Acoustics Bulletin (IoA Bulletin) Vol. 34 No. 2, March/April 2009[8], recommends a methodology for addressing issues not made explicit by, or outside the scope of, ETSU-R-97, such as in relation to wind shear or noise propagation modelling. Whilst this article does not represent formal legislation or guidance it was authored by a group of independent acousticians experienced in wind farm noise issues who have undertaken work on behalf of wind farm developers, local planning authorities and third parties and as such is a good indicator of best practice techniques. The assessment presented herein adopts the recommendations made within this article.

10.20 A Good Practice Guide (IoA GPG) to the application of ETSU-R-97 for the assessment and rating of wind turbine noise[3], issued by the Institute of Acoustics in May 2013 and endorsed by the Department of Energy and Climate Change (DECC), Northern Ireland Executive, Scottish Executive and the Welsh Assembly Government, provides guidance

[8] 'Prediction and Assessment of Wind Turbine Noise', Bowdler et al, Acoustics Bulletin Vol 34 No 2 March/April 2009

CONSENTED (LA01/2018/0200/F)

on all aspects of the use of ETSU-R-97 and reaffirms the recommendations of the Acoustics Bulletin article with regard to propagation modelling and wind shear. The assessment presented herein adopts the recommendations of the Good Practice Guide.

10.21 Supplementary guidance notes were published by the Institute of Acoustics in July and September 2014, and these provide further details on specific areas of the IoA GPG[9]. The assessment presented herein adopts the recommendations made within these supplementary guidance notes.

Construction Noise

10.22 In Northern Ireland, advice on construction noise assessment is referred to in 'The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002'[10]. This legislation points to BS 5228: Part 1:1997 for guidance on appropriate methods for minimising noise from construction and open sites in Northern Ireland.

10.23 Since the 1997 version of BS 5228 has been superseded by BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'[11] this has been identified as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities, and is adopted herein.

10.24 The Pollution Control and Local Government (NI) Order 1978 provides information on the need for ensuring that best practicable means are employed to minimise noise[12].

[9] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise - Supplementary Guidance Notes', Institute of Acoustics, July & September 2014

[10] 'The Control of Noise (Codes of Practice for Construction and Open Sites) Order (Northern Ireland) 2002', The Department of the Environment, November 2002

[11] 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009

[12] 'Pollution Control and Local Government (NI) Order 1978', published by Her Majesty's Stationary Office, 1978

CONSENTED (LA01/2018/0200/F)

Consultation

10.25 Details of the consultation undertaken are outlined in Table 10.1.

Table 10.1: Acoustic Assessment Consultation

Consultees	Date of Consultation	Nature and Purpose of Consultation
Causeway Coast & Glens District Council	14/04/16	Report 'Planned Acoustic Assessment at the Proposed Dunbeg South Wind Farm' (ref. 03219-000143) sent to Causeway Coast & Glens District Council Environmental Health Officer (EHO), to review methodology and locations for background noise survey.
Causeway Coast & Glens District Council	12/05/16	Phone call received from EHO. They are satisfied with the proposed survey locations. They may not be able to visit on the set-up day but would like to be notified of the date.
Causeway Coast & Glens District Council	08/06/16	Site visit with EHO – discussed and agreed on background noise monitoring locations.
Causeway Coast & Glens District Council	16/08/16	Report 'Noise Survey Locations at the Proposed Dunbeg South Wind Farm' (ref. 03219-000214) sent to EHO. This report provided details of actual survey locations after setting up the background noise survey.
Causeway Coast & Glens District Council	12/06/17	Letter of Intention to Submit an ES was sent to Causeway Coast & Glens District Council.
Causeway Coast & Glens District Council	20/06/17	Response to scoping opinion request received from Causeway Coast & Glens District Council outlining required assessment methodology.
Public	08/08/17	Public Exhibition.
Causeway Coast & Glens District Council	24/08/17	Phone call with EHO to discuss assessment methodology including single turbines to include, daytime lower limit, use of predicted noise levels for Dunbeg & Dunmore and use of 2009 background noise data.

CONSENTED (LA01/2018/0200/F)

Methodology

Operational Noise

10.26 To ensure adequate assessment of the potential impacts of the operational noise from the proposed wind farm the following steps have been taken, in accordance with relevant guidance detailed above:

- The baseline noise conditions at each of the nearest residential properties to the wind farm are established by way of representative background noise surveys;
- The noise levels incident at the nearest residential properties due to the operation of the wind farm are predicted using a sound propagation model considering: the locations of the wind turbines; the locations of the nearest, or most noise sensitive residential properties; the intervening terrain; and the likely noise emission characteristics of the wind turbines;
- With due regard to relevant guidance or regulations the acoustic assessment criteria are derived; and
- The evaluation of the acoustic impact is undertaken by comparing the predicted noise levels with the assessment criteria.

Establishing Baseline Conditions

10.27 Similar to other assessments of noise impacts (most notably BS 4142, 'The Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas' which ETSU-R-97 identifies as forming the basis of its recommendations), the ETSU-R-97 methodology requires the comparison of predicted noise levels due to turbine emissions (which vary with hub height wind speed) with noise limits based upon the noise levels already existing under those same conditions (i.e. the baseline conditions).

10.28 Since background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, it is important when making reference measurements to put them in that context. Thus, the assessment of background noise levels at potentially sensitive residential properties requires the measurement of not only noise levels, but concurrent wind conditions, covering a representative range of wind speeds. These wind measurements are made at the wind turbine site rather than at the residential properties, since it is this wind speed that will subsequently govern the wind farm's noise generation. Often the residential properties themselves will be sheltered from the wind and may consequently have relatively low background noise levels.

10.29 To establish the baseline conditions, sound level meters and associated apparatus are set-up to record the required acoustic information at a selection of the most noise sensitive residential properties geographically spread around the proposed wind farm site and which are likely to be representative of other residential properties in the locale.

10.30 Wind speed and direction are recorded as 10 minute averages for the same period as for the noise measurements, and are synchronised with the acoustic data to allow

CONSENTED (LA01/2018/0200/F)

correlations to be established. The wind speed that is adopted for use is the same wind speed as that which drives the turbine noise levels.

10.31 The adoption of this wind speed was presented as appropriate within the article published in the IoA Bulletin and the subsequent IoA GPG. The methodology used to calculate standardised 10 m wind speed is described in Technical Appendix 10.3.

10.32 Prior to establishing the baseline conditions the acoustic data is filtered as follows:

- For each background noise measurement location, the measured noise data is divided into two sets, as specified by ETSU-R-97 and shown in Table 10.2:

Table 10.2: Definition of Time of Day Periods

Time of Day	Definition
Quiet daytime	18:00 - 23:00 every day 13:00 - 18:00 Saturday 07:00 - 18:00 Sunday
Night-time	23:00 - 07:00 every day

- Rainfall affected data is systematically removed from the acoustic data set. To facilitate this, a rain gauge is deployed at site to record 10 minute rainfall data and identify potentially affected noise data. Both the 10 minute period containing the bucket tip and the preceding 10 minute period are removed from the dataset as recommended in the IoA GPG to account for the time it takes for the rain gauge tipping bucket to fill.
- Periods of measured background noise data thought to be affected by extraneous, i.e. non-typical, noise sources are identified and removed from the data set. Whilst some 'extraneous' data may actually be real, it tends to bias any trend lines upwards so its removal is adopted as a conservative measure.
- In practice this means close inspection of the measured background noise levels, comparison with concurrent data measured at nearby locations and consideration of both directional and temporal variation.

Modelling Noise Propagation

10.33 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[13], this being identified as most appropriate for use in such rural sites[14]. The specific interpretation of the ISO 9613 Part 2 propagation methodology recommended in the aforementioned IoA Bulletin and the subsequent IoA GPG has been employed.

10.34 To make noise predictions it is assumed that:

- the turbines are identical;
- the turbines radiate noise at the power specified in this report;
- each turbine can be modelled as a point source at hub-height;

[13] 'Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation', International Organisation for Standardisation, ISO 9613-2:1996

[14] 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU Report W/13/00385/REP, 2000

CONSENTED (LA01/2018/0200/F)

- each residential property is assigned a reference height to simulate the presence of an observer.

10.35 The sound propagation model takes account of attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10 ˚C and 70 % respectively, as recommended in the IoA Bulletin and IoA GPG. Ground effects are also taken into account by the propagation model with a ground factor of 0.5 and a receiver height of 4 m used as recommended in the IoA Bulletin and IoA GPG.

10.36 The barrier attenuations predicted by ISO 9613 Part 2 have been shown to be significantly greater than those measured in practice under downwind conditions[14]. Therefore, barrier attenuation according to the ISO 9613 Part 2 method has been discounted. In lieu of this, where there is no direct line of sight between the residential property in question and any part of the wind turbine, 2 dB attenuation has been assumed as recommended in the IoA Bulletin and the IoA GPG.

10.37 Additionally, verification studies have also shown that ISO 9613 Part 2 tends to slightly underestimate noise levels at nearby dwellings in certain exceptional cases, notably in a valley type environment where the ground drops off between source and receiver. In these instances an addition of 3 dB(A) has been applied to the resulting overall A-weighted noise level as recommended by the IoA GPG. Further detail is provided in Technical Appendix 10.4.

10.38 To generate the ground cross sections between each turbine and each dwelling necessary for reliable propagation modelling, ground contours at 5 m intervals for the area of interest have been generated from 50 m grid resolution digital terrain data.

10.39 The predicted noise levels are calculated as L_{Aeq} noise levels and changed to the L_{A90} descriptor (to allow comparisons to be made) by subtraction of -2 dB, as specified by ETSU-R-97.

10.40 It has been shown by measurement based verification studies that the ISO 9613 Part 2 model tends to slightly overestimate noise levels at nearby dwellings[14]. Examples of additional conservatism modelled are:

- properties are assumed to be downwind of all noise sources simultaneously and at all times. In reality, this is not the case and additional attenuation would be expected when a property is upwind or crosswind of the proposed wind turbines;
- although, in reality, the ground is predominantly porous (acoustically absorptive) it has been modelled as ‘mixed’, i.e. a combination of hard and porous, corresponding to a ground absorption coefficient of 0.5 as recommended by the IoA Bulletin and IoA GPG;
- receiver heights are modelled at 4 m above local ground level, which equates roughly to first floor window level, as recommended by the IoA Bulletin and IoA GPG. This results in a predicted noise level anything up to 2 dB(A) higher than at the typical human ear height of 1.2-1.8 m;
- trees and other non-terrain shielding effects have not been considered;
- an allowance for measurement uncertainty has been included in the sound power levels for the presented turbine.

CONSENTED (LA01/2018/0200/F)

Significance Criteria

10.41 Noise is measured in decibels (dB) which is a measure of the sound pressure level, i.e. the magnitude of the pressure variations in the air. Measurements of environmental noise are usually made in dB(A) which includes a correction for the sensitivity of the human ear.

10.42 In accordance with the recommendations of ETSU-R-97, the acceptance of the proposed wind farm is established by comparing the noise levels produced by the combined operation of the wind turbines with appropriate noise limits at nearby residential properties.

Whilst ETSU-R-97 presents a comprehensive and detailed assessment methodology for wind farm noise, it also states a simplified methodology:

"if the noise is limited to an $L_{A90,10min}$ of 35dB(A) up to wind speeds of 10 m/s at 10 m height, then these conditions alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary".

10.43 In the detailed methodology, ETSU-R-97 states that different limits should be applied during daytime and night-time periods. The daytime limits, derived from the background noise levels measured during quiet daytime periods, are intended to preserve outdoor amenity, while the night-time limits are intended to prevent sleep disturbance. The general principle is that the noise limits should be based on existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. The suggested limits are given in Table 10.3 below, where L_B is the background $L_{A90,10min}$ and is a function of wind speed. During daytime periods and at low background noise levels, a lower fixed limit of 35–40 dB(A) is applicable. The exact value is dependent upon a number of factors: the number of nearby dwellings, the effect of the noise limits on energy produced, and the duration and level of exposure.

Table 10.3: Permissible Noise Level Criteria

Time of Day	Permissible Noise Level
Daytime	• 35-40 dB(A) for L_B less than 30-35 dB(A) • L_B + 5 dB, for L_B greater than 30-35 dB(A)
Night-time	• 43 dB(A) for L_B less than 38 dB(A) • L_B + 5 dB, for L_B greater than 38 dB(A)

10.44 Note that a higher noise level is permissible during the night than during the day as it is assumed that residents would be indoors. The night-time criterion is derived from sleep disturbance criterion referred to in ETSU-R-97, with an allowance of 10 dB for attenuation through an open window.

10.45 The wind speeds at which the acoustic impact is considered are less than or equal to 12 ms^{-1} at a height of 10 m and are likely to be the acoustically critical wind speeds. Above these wind speeds, as stated in ETSU-R-97, reliable measurements of background and turbine noise are difficult to make. However, if a wind farm meets the noise criteria at the wind speeds presented, it is most unlikely that it will cause any greater

CONSENTED (LA01/2018/0200/F)

loss of amenity at higher wind speeds due to increasing background noise levels masking wind farm generated noise.

10.46 It is important to note that, since reactions to noise are subjective, it is not possible to guarantee that a given development will not result in any adverse comment with regard to noise as the response to any given noise will vary from person to person. Consequently, standards and guidance that relate to environmental noise are typically presented in terms of criteria that would be expected to be considered acceptable by the majority of the population.

Construction Noise

10.47 To ensure adequate assessment of the potential impacts of the construction noise from the proposed wind farm the following steps have been taken:

- Baseline noise criteria are established from the appropriate guidance BS 5228-1:2009;
- Noise levels due to on-site construction activities are predicted at the most sensitive residential properties in accordance with the BS 5228-1:2009 standard;
- Predicted noise levels due to construction traffic at the same residential properties are made using the BS 5228-1:2009 standard;
- The combined effect of on-site construction activities with construction traffic is compared with the target level specified by BS 5228-1:2009.

Baseline Conditions

Operational Noise

10.48 The Development is located approximately 6 km north-east of Limavady. The surrounding area is predominantly rural in nature with an A-class road (the A37) running to the north of the site. The general noise character is typical of a rural environment with the addition of traffic noise from the A37.

10.49 Background noise measurements were undertaken by RES at three residential property locations in accordance with ETSU-R-97 as detailed in Table 10.4.

Table 10.4: Background Noise Survey Details

House ID	Measurement Period		
	Start	End	Duration (days)
H9	03/06/16	28/07/16	56
H25	03/06/16	28/07/16	56
H40	03/06/16	28/07/16	56

10.50 The background noise monitoring equipment was housed in weather-proof enclosures, and powered by lead-acid batteries. The microphones are placed at a height of approximately 1.2 m above ground, and equipped with all-weather wind shields which also provide an element of water resistance.

10.51 The proprietary wind shields used are designed to reduce the effects of wind-generated noise at the microphone and accord with the recommendations of the IoA GPG in that

CONSENTED (LA01/2018/0200/F)

they are the appropriate size and, in combination with the microphone, are certified by the manufacturer as meeting Type 1 / Class 1 precision standards.

10.52 Noise levels are monitored continuously, and summary statistics stored every 10 minutes in the internal memory of each meter. The relevant statistic measured is the $L_{A90,10min}$ (The A-weighted sound pressure level exceeded for 90 % of the 10 minute interval).

10.53 The sound level meters were placed away from reflecting walls and vegetation. Photos of the equipment, in situ, may be seen in Technical Appendix 10.5. The apparatus were calibrated before and after the survey period and the maximum drift detected was 0.3 dB, which is within the required range recommended in the IoA GPG. All instrumentation has been subject to laboratory calibration traceable to national standards within the last 24 months, as recommended in the IoA GPG. Details are provided in Technical Appendix 10.6.

10.54 Technical Appendix 10.7 - Chart 10.1 inshows the measured wind rose over the background noise survey period, as measured by the SoDAR located on-site.

10.55 Wind speed and direction were recorded by a Triton SODAR (SOnic Detection and Ranging) instrument.

10.56 A SODAR instrument is a remote sensing device that measures conditions in the atmosphere by using sound waves to detect the movement of air in the atmospheric boundary layer to measure wind speed and direction. For a SoDAR remote sensing device, sound pulses are reflected by temperature gradients in the atmosphere. SODAR provides measurements at several heights, and this enables wind speed data to be obtained that describe the wind profile across a range of heights.

10.57 The Triton SODAR employed has been successfully tested, by independent third parties using suitable test sites, against conventional anemometry[15,16]. From the technical reports, these tests have demonstrated that, over a range of relevant heights, the accuracy of the Triton SODAR is comparable to that of the conventional anemometry. The results of these validation campaigns provide confidence that the Triton SODAR can reproduce traditional wind speed measurements within the approximate uncertainty limits expected for cup anemometer measurements.

10.58 For illustrative purposes, Technical Appendix 10.7 - Chart 10.2 shows the wind rose over an extended period (10/12/11 – 15/09/15), as measured by an 80 m meteorological mast located 8 km from the proposed site. As previously discussed, the noise prediction model employed is likely to overestimate the real noise immission levels for locations not downwind of the turbines. Technical Appendix 10.7 - Chart 10.2 therefore may aid the reader as to the likelihood of over-estimation due to this factor.

10.59 The noise data has been cross-referenced with rainfall data measured at the wind speed measurement location on site using a rain gauge. Any noise data identified as

[15] Verhoef, H Van der Werff, A Oostrum, H (2009), 'Comparative Measurements Between a Triton SODAR and Meteo Measurements at the EWTW, The Netherlands', ECN report ECN-X--09-104 (rev.b), dated September 2009

[16] Scott, G Elliott, D Schwartz, M (2010), 'Comparison of Second Wind TritonTM Data with Meteorological Tower Measurements', National Renewable Energy Laboratory Technical Report NREL/ TP-550-47429, dated January 2010.

CONSENTED (LA01/2018/0200/F)

having been affected by rainfall has been removed from the analysis as shown in Technical Appendix 10.7 - Charts 10.3 to 10.8.

10.60 Short-term periods of increased noise levels considered to be atypical have been removed from the dataset. The excluded data is shown in Technical Appendix 10.7 - Charts 10.3 to 10.8.

10.61 The sound level meter at H25 fell over sometime between and 08/06/16 and 24/06/16 so data recorded at this location between these times was removed from the analysis.

10.62 The measured background noise data was checked to see if it had been influenced by noise from the existing wind farms. The noise levels with and without the data recorded when the measurement locations were situated downwind of the existing turbines were compared and no significant difference was apparent.

10.63 Technical Appendix 10.7 - Charts 10.3 to 10.5 show $L_{A90,10min}$ correlated against wind speed for quiet daytime periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

10.64 Technical Appendix 10.7 - Charts 10.6 to 10.8 show $L_{A90,10min}$ correlated against the wind speed for night-time periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

10.65 Table 10.5 and Table 10.6 detail the $L_{A90,10min}$ background noise levels calculated from the derived 'best fit' lines, as described above. The background noise levels measured at H41 in a survey undertaken in May 2009 to inform the acoustic impact assessment of the then proposed Dunbeg wind farm[17] are also shown.

Table 10.5: Quiet Daytime Noise Levels (dB(A) re 20 µPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H9	34.0	34.2	34.6	35.2	36.0	37.1	38.5	40.3	42.4	45.0	45.0	45.0
H25	31.2	31.9	32.8	33.7	34.8	36.1	37.7	39.5	41.6	44.1	44.1	44.1
H40	34.3	34.3	34.7	35.7	37.0	38.6	40.5	42.6	44.8	47.2	47.2	47.2
H41	36.4	37.1	37.9	38.8	39.8	40.8	42.1	43.5	45.1	46.9	48.9	51.2

Table 10.6: Night-time Noise Levels (dB(A) re 20 µPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H9	28.0	28.5	28.9	29.4	30.3	31.5	33.4	35.9	39.4	39.4	39.4	39.4
H25	27.6	28.6	29.0	29.3	29.6	30.3	31.5	33.6	36.7	36.7	36.7	36.7
H40	28.7	28.9	29.2	29.7	30.5	31.9	34.1	37.2	41.6	41.6	41.6	41.6
H41	34.9	34.9	35.0	35.5	36.4	37.6	39.1	40.8	42.8	45.1	47.5	50.1

[17] 'Dunmore 2 Wind Farm – Noise Impact Assessment', Hayes McKenzie, Report HM: 2776/R1, October 2013

CONSENTED (LA01/2018/0200/F)

Construction Noise

10.66 For the on-site construction noise assessment, Annex E of BS 5228-1:2009 provides guidance on setting environmental noise targets. Several methods of assessing the significance of noise levels are presented in Annex E and the most applicable to the construction of the proposed wind farm development is the ABC method. The ABC method sets threshold noise levels for specific periods based on the ambient noise levels.

Potential Impacts

Potential Operational Impacts

Noise Propagation Modelling

10.67 The locations of the Development's turbines are provided in Table 10.7 and shown in Figure 10.1.

Table 10.7: Location of Proposed Turbines

Turbine	Co-ordinates	
	X (m)	Y (m)
T1	273157	425253
T2	273584	425335
T3	273384	424987
T4	273614	424722
T5	273942	425283
T6	274056	424852
T7	274352	425088
T8	274550	425431
T9	274234	425679

10.68 The locations of the nearest properties to the proposed turbines have been determined by inspection of relevant maps and through site visits. Additional properties may have been identified but have not been considered critical to this acoustic assessment or may be adequately represented by another property. The locations are listed in Table 10.8 and are also shown in Figure 1.

10.69 Properties H1, H2, H3, H4, H5 and H20 are non-residential and are therefore not considered further. H1 is under the control of the developer of the consented Dunbeg Extension project and is to remain unoccupied for the lifetime of this project. H2 and H3 are under the control of RES and likewise will remain unoccupied for the lifetime of the Development. The inclusion of H4, H5 and H20 would make no difference to the outcome of the assessment.

10.70 The distances from each property to the nearest turbine are given in Table 10.8. It can be seen that the minimum house-to-turbine separation for an occupied property is 1239 m.

Table 10.8: Location of Nearby Properties and Distances to Nearest Proposed Turbine

CONSENTED (LA01/2018/0200/F)

House ID	Co-ordinates		Distance (m)	Nearest Turbine
	X (m)	Y (m)		
H1	274165	426481	805	T9
H2	273455	425790	473	T2
H3	272931	425514	345	T1
H4	273497	426333	985	T9
H5	273191	426602	1327	T2
H6	273008	426728	1483	T1
H7	272472	426376	1315	T1
H8	272444	426346	1305	T1
H9	272232	426087	1245	T1
H10	272050	425810	1239	T1
H11	271738	425476	1436	T1
H12	271705	425389	1458	T1
H13	271625	425273	1532	T1
H14	271608	425251	1549	T1
H15	271755	424863	1455	T1
H16	271796	424809	1432	T1
H17	271778	424682	1493	T1
H18	271807	424666	1472	T1
H19	271855	424613	1451	T1
H20	272166	424162	1471	T3
H21	271750	424052	1850	T1
H22	271921	423842	1858	T3
H23	271951	423759	1887	T3
H24	272280	423403	1876	T4
H25	272406	423257	1899	T4
H26	272854	423282	1628	T4
H27	272909	423356	1537	T4
H28	273010	423273	1570	T4
H29	273975	423247	1519	T4
H30	273989	423241	1528	T4
H31	273981	423277	1491	T4
H32	274145	423178	1633	T4
H33	274414	423279	1613	T6
H34	274449	423291	1610	T6
H35	274862	423484	1588	T6
H36	274901	423478	1613	T6

CONSENTED (LA01/2018/0200/F)

House ID	Co-ordinates		Distance (m)	Nearest Turbine
	X (m)	Y (m)		
H37	274972	423478	1651	T6
H38	274987	423479	1659	T6
H39	275513	423379	2066	T7
H40	273923	422996	1753	T4
H41	273812	427187	1566	T9

Properties highlighted grey are unoccupied and not considered further

10.71 Although not finalised, the candidate turbine type for the Development is the Nordex N100 machine. This machine is available with a 2.5 MW and a 3.3 MW rated power. The variant which results in the greatest predicted noise levels at nearby properties, the Nordex N100/2500, is used in this assessment. Acoustic data from the manufacturer's general specification for this machine has been used[18]. The manufacturer has identified these values as warranted although an additional 2 dB allowance for measurement uncertainty has been added as a conservative measure as the manufacturer notes that measured levels will be within the confidence interval according to IEC 61400-14. Details used in this analysis are as follows:

- a hub height of 100 m;
- a rotor diameter of 100 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 10.9;
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 10.10;
- tonal emission characteristics such that no clearly audible tones are present at any wind speed.

Table 10.9: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Nordex N100/2500 Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Warranted	Plus Uncertainty
1	95.9	97.9
2	95.9	97.9
3	95.9	97.9
4	97.8	99.8
5	100.7	102.7
6	104.9	106.9
7	105.9	107.9
8	106.0	108.0
9	106.0	108.0
10	106.0	108.0

[18] 'Octave sound power levels, Nordex N100/2500 – Operational Modes', F008_145_A14_EN Revision 00, October 2013

CONSENTED (LA01/2018/0200/F)

11	106.0	108.0
12	106.0	108.0

CONSENTED (LA01/2018/0200/F)

Table 10.10: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at Standardised 10m Height Wind Speeds for the Nordex N100/2500 Wind Turbine

Octave Band (Hz)	4 ms^{-1}	5 ms^{-1}	6 ms^{-1}	7 ms^{-1}	8 ms^{-1}	9 ms^{-1}
63	77.9	79.6	85.8	86.2	86.6	86.1
125	83.5	83.9	89.9	92.2	92.9	92.8
250	89.6	91.1	95.3	96.6	96.6	95.4
500	92.8	96.1	99.6	100.9	100.7	99.5
1000	94.0	97.7	102.1	103.2	103.4	103.6
2000	94.6	97.3	101.3	102.1	102.3	103
4000	90.0	92.2	97.3	97.2	97.3	97.2
8000	76.7	78.3	83.7	83.9	83.7	82.6
OVERALL	99.8	102.7	106.9	107.9	108.0	108.0

Predictions of Noise Levels at Residential Properties

10.72 Table 10.11 shows the predicted noise immission levels at the nearest residential properties at each wind speed considered, calculated from the operation of the proposed wind farm. The property with the highest predicted noise immission level of 36.9 dB(A) is H8.

10.73 Figure 10.1 shows an isobel (i.e. noise contour) plot for the site at a 10 m height wind speed of 8 ms^{-1}. Such plots are useful for evaluating the noise 'footprint' of a given development.

CONSENTED (LA01/2018/0200/F)

Table 10.11: Predicted Noise Levels At Nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	24.7	24.7	24.7	26.6	29.5	33.6	34.9	34.9	34.4	34.4	34.4	34.4
H7	26.6	26.6	26.6	28.5	31.4	35.5	36.8	36.8	36.3	36.3	36.3	36.3
H8	26.7	26.7	26.7	28.6	31.5	35.6	36.8	36.9	36.4	36.4	36.4	36.4
H9	25.6	25.6	25.6	27.5	30.4	34.5	35.7	35.8	35.3	35.3	35.3	35.3
H10	24.3	24.3	24.3	26.2	29.1	33.2	34.4	34.5	34.0	34.0	34.0	34.0
H11	22.8	22.8	22.8	24.7	27.6	31.7	32.9	33.0	32.5	32.5	32.5	32.5
H12	22.7	22.7	22.7	24.6	27.5	31.6	32.8	32.9	32.3	32.3	32.3	32.3
H13	22.3	22.3	22.3	24.2	27.0	31.1	32.4	32.4	31.9	31.9	31.9	31.9
H14	22.2	22.2	22.2	24.1	26.9	31.0	32.3	32.3	31.8	31.8	31.8	31.8
H15	22.8	22.8	22.8	24.7	27.6	31.7	32.9	33.0	32.5	32.5	32.5	32.5
H16	23.0	23.0	23.0	24.9	27.7	31.9	33.1	33.2	32.6	32.6	32.6	32.6
H17	22.6	22.6	22.6	24.5	27.4	31.5	32.8	32.8	32.3	32.3	32.3	32.3
H18	22.3	22.3	22.3	24.2	27.1	31.2	32.5	32.5	32.0	32.0	32.0	32.0
H19	22.6	22.6	22.6	24.5	27.3	31.5	32.7	32.8	32.2	32.2	32.2	32.2
H21	19.7	19.7	19.7	21.6	24.4	28.6	29.8	29.9	29.3	29.3	29.3	29.3
H22	19.4	19.4	19.4	21.3	24.1	28.2	29.5	29.6	29.0	29.0	29.0	29.0
H23	19.2	19.2	19.2	21.1	23.9	28.1	29.3	29.4	28.8	28.8	28.8	28.8
H24	19.1	19.1	19.1	21.0	23.8	28.0	29.2	29.3	28.7	28.7	28.7	28.7
H25	18.9	18.9	18.9	20.8	23.6	27.7	29.0	29.0	28.5	28.5	28.5	28.5
H26	20.4	20.4	20.4	22.3	25.2	29.3	30.5	30.6	30.0	30.0	30.0	30.0
H27	21.0	21.0	21.0	22.9	25.8	29.9	31.1	31.2	30.7	30.7	30.7	30.7
H28	20.8	20.8	20.8	22.7	25.5	29.6	30.9	31.0	30.4	30.4	30.4	30.4
H29	21.5	21.5	21.5	23.4	26.3	30.4	31.7	31.7	31.2	31.2	31.2	31.2
H30	21.5	21.5	21.5	23.4	26.3	30.4	31.6	31.7	31.1	31.1	31.1	31.1
H31	21.7	21.7	21.7	23.6	26.5	30.6	31.9	31.9	31.4	31.4	31.4	31.4
H32	20.9	20.9	20.9	22.8	25.7	29.8	31.1	31.1	30.6	30.6	30.6	30.6
H33	21.2	21.2	21.2	23.1	26.0	30.1	31.3	31.4	30.8	30.8	30.8	30.8
H34	21.2	21.2	21.2	23.1	26.0	30.1	31.3	31.4	30.9	30.9	30.9	30.9
H35	21.3	21.3	21.3	23.2	26.1	30.2	31.5	31.5	31.0	31.0	31.0	31.0
H36	21.2	21.2	21.2	23.1	25.9	30.0	31.3	31.4	30.8	30.8	30.8	30.8
H37	20.9	20.9	20.9	22.8	25.7	29.8	31.1	31.1	30.6	30.6	30.6	30.6
H38	20.9	20.9	20.9	22.8	25.6	29.8	31.0	31.1	30.5	30.5	30.5	30.5
H39	18.8	18.8	18.8	20.7	23.5	27.7	28.9	29.0	28.4	28.4	28.4	28.4
H40	19.9	19.9	19.9	21.8	24.7	28.8	30.0	30.1	29.5	29.5	29.5	29.5
H41	25.6	25.6	25.6	27.6	31.0	34.4	35.7	35.7	35.1	35.1	35.1	35.1

CONSENTED (LA01/2018/0200/F)

10.74 Noise levels at 31 of the 35 nearest residential properties are below 35 dB(A), indicating that the noise immission levels would be regarded as acceptable and the residents amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

10.75 There are four properties (H7, H8, H9 and H41) that have predicted noise levels greater than this simplified noise criteria as indicated in Table 10.11. Therefore the 'full' acoustic assessment need only be considered at these. However, as background noise measurements were carried out at H25 and H40, as agreed with the local authority, these properties have also been considered in the full acoustic assessment so as to provide a more comprehensive description of the acoustic impact of the proposed wind farm.

Acoustic Acceptance Criteria

10.76 As stated previously, during daytime periods and at low background noise levels, a lower fixed limit of 35-40 dB(A) is applicable with the exact value dependent upon a number of factors: the number of noise affected residential properties; the potential impact on the power output of the wind farm and the likely duration and level of exposure. Through consideration of these factors RES have adopted a 35 dB(A) level. Justification is provided in the following paragraph, and the resulting criteria are shown in Table 10.12.

10.77 Justification for the daytime lower limit, considering each of the factors recommended by ETSU-R-97 and the guidance provided by the IoA GPG, is as follows:

- *Number of noise affected residential properties:* There are relatively few residential properties with a predicted noise level greater than 35 dB(A), and only one of these may be classed as being predominantly downwind of the Development. Given that the proposed scheme would generate significant social, economic and environmental benefits, this would suggest a limit towards the upper end of the range;
- *Potential impact on the power output of the wind farm:* The Development can be considered a medium-to-large scale development as it has a rated power output of 22.5 - 29.7 MW should the turbine type considered in the acoustic assessment be installed. This suggests that a daytime lower limit towards the middle or upper end of the range would be appropriate however the daytime lower limit is not predicted to have an impact on the amount of energy that could be generated by such a scheme;
- *The likely duration and level of exposure:* The amount of the time that noise levels of greater than 35 dB(A) are predicted is limited to periods of sufficiently high wind speed. Noise levels will also be reduced when properties are not located downwind of the wind turbines. As mentioned above, only one of the considered residential properties is downwind in the predominant wind direction, again suggesting that a daytime lower limit towards the upper end of the range is appropriate.

CONSENTED (LA01/2018/0200/F)

10.78 Despite the explanations presented above indicating that a daytime lower limit towards the middle or the upper end of the range would be justifiable, RES has adopted a daytime lower limit of 35 dB(A) for the assessment of the Development as a conservative measure.

CONSENTED (LA01/2018/0200/F)

Table 10.12: Permissible Noise Level Criteria in Vicinity of the Development

Time of Day	Permissible Noise Level
Daytime	• 35.0 dB(A) for L_B less than 30.0 dB(A) • L_B + 5 dB, for L_B greater than 30.0 dB(A)
Night-time	• 43.0 dB(A) for L_B less than 38.0 dB(A) • L_B + 5 dB, for L_B greater than 38.0 dB(A)

Calculation of Acceptable Noise Limits from Baseline Conditions

10.79 The measured background noise levels have been used to calculate the acceptable noise limits. Table 10.13 shows the daytime noise limits and Table 10.14 the night time noise limits.

Table 10.13: Recommended Daytime Noise Limits (dB(A) re 20 µPa)

House Name	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H9	39.0	39.2	39.6	40.2	41.0	42.1	43.5	45.3	47.4	50.0	50.0	50.0
H25	36.2	36.9	37.8	38.7	39.8	41.1	42.7	44.5	46.6	49.1	49.1	49.1
H40	39.3	39.3	39.7	40.7	42.0	43.6	45.5	47.6	49.8	52.2	52.2	52.2
H41	41.4	42.1	42.9	43.8	44.8	45.8	47.1	48.5	50.1	51.9	53.9	56.2

Table 10.14: Recommended Night-time Noise Limits (dB(A) re 20 µPa)

House Name	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H9	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.4	44.4	44.4	44.4
H25	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
H40	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	46.6	46.6	46.6	46.6
H41	43.0	43.0	43.0	43.0	43.0	43.0	44.1	45.8	47.8	50.1	52.5	55.1

10.80 The recommendations of ETSU-R-97 state that where there are groups of properties that are likely to have a similar background noise environment, it is appropriate to use data from one representative location as the basis for assessment at the other properties. The survey results inferred to be representative for each property is shown in Table 10.15. The specific choice of noise survey chosen has been made considering the distance to the nearest survey location and the likelihood of experiencing a broadly similar exposure as the survey.

CONSENTED (LA01/2018/0200/F)

Table 10.15: Assumed Representative Background Noise Survey Locations

House ID	Survey Location
H6	RES Noise Monitoring Location 1 (H9)
H7	RES Noise Monitoring Location 1 (H9)
H8	RES Noise Monitoring Location 1 (H9)
H9	RES Noise Monitoring Location 1 (H9)
H10	RES Noise Monitoring Location 1 (H9)
H11	RES Noise Monitoring Location 1 (H9)
H12	RES Noise Monitoring Location 1 (H9)
H13	RES Noise Monitoring Location 1 (H9)
H14	RES Noise Monitoring Location 1 (H9)
H15	RES Noise Monitoring Location 1 (H9)
H16	RES Noise Monitoring Location 1 (H9)
H17	RES Noise Monitoring Location 1 (H9)
H18	RES Noise Monitoring Location 1 (H9)
H19	RES Noise Monitoring Location 2 (H25)
H21	RES Noise Monitoring Location 2 (H25)
H22	RES Noise Monitoring Location 2 (H25)
H23	RES Noise Monitoring Location 2 (H25)
H24	RES Noise Monitoring Location 2 (H25)
H25	RES Noise Monitoring Location 2 (H25)
H26	RES Noise Monitoring Location 2 (H25)
H27	RES Noise Monitoring Location 2 (H25)
H28	RES Noise Monitoring Location 2 (H25)
H29	RES Noise Monitoring Location 3 (H40)
H30	RES Noise Monitoring Location 3 (H40)
H31	RES Noise Monitoring Location 3 (H40)
H32	RES Noise Monitoring Location 3 (H40)
H33	RES Noise Monitoring Location 3 (H40)
H34	RES Noise Monitoring Location 3 (H40)
H35	RES Noise Monitoring Location 3 (H40)
H36	RES Noise Monitoring Location 3 (H40)
H37	RES Noise Monitoring Location 3 (H40)
H38	RES Noise Monitoring Location 3 (H40)
H39	RES Noise Monitoring Location 3 (H40)
H40	RES Noise Monitoring Location 3 (H40)
H41	Dunbeg Monitoring Location (H41)

CONSENTED (LA01/2018/0200/F)

10.81 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant has a financial involvement in the wind farm. However, whilst some of the nearby properties may qualify for such an increase, these limits have not been adopted in the presented results.

Acoustic Assessment

10.82 Table 10.16 shows a comparison of the predicted noise levels with the recommended daytime noise limits for each residential property where the full assessment procedure is being applied. The predicted noise levels at 1 ms^{-1} and 2 ms^{-1} have been assumed to be equal to 3 ms^{-1} as a conservative measure as noise levels at these wind speeds would typically be less. The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit. A negative value indicates that the predicted noise level is within the limit. Table 10.17 shows a comparison with the recommended night-time noise limits.

10.83 Noise levels at all locations are within both the daytime and night-time noise limits at all wind speeds considered. The minimum margin of predicted noise levels below the daytime noise limits is -6.5 dB(A). The minimum margin during night-time periods is -6.1 dB(A).

CONSENTED (LA01/2018/0200/F)

Table 10.16: Comparison of Predicted Noise Levels and Daytime Noise Limits - (dB(A) re 20 µPa)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H7	26.6	39.0	-12.4	26.6	39.2	-12.6	26.6	39.6	-13.0	28.5	40.2	-11.7
H8	26.7	39.0	-12.3	26.7	39.2	-12.5	26.7	39.6	-12.9	28.6	40.2	-11.6
H9	25.6	39.0	-13.4	25.6	39.2	-13.6	25.6	39.6	-14.0	27.5	40.2	-12.7
H25	18.9	36.2	-17.3	18.9	36.9	-18.0	18.9	37.8	-18.9	20.8	38.7	-17.9
H40	19.9	39.3	-19.4	19.9	39.3	-19.4	19.9	39.7	-19.8	21.8	40.7	-18.9
H41	25.6	41.4	-15.8	25.6	42.1	-16.5	25.6	42.9	-17.3	27.6	43.8	-16.2

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H7	31.4	41.0	-9.6	35.5	42.1	-6.6	36.8	43.5	-6.7	36.8	45.3	-8.5
H8	31.5	41.0	-9.5	35.6	42.1	-6.5	36.8	43.5	-6.7	36.9	45.3	-8.4
H9	30.4	41.0	-10.6	34.5	42.1	-7.6	35.7	43.5	-7.8	35.8	45.3	-9.5
H25	23.6	39.8	-16.2	27.7	41.1	-13.4	29.0	42.7	-13.7	29.0	44.5	-15.5
H40	24.7	42.0	-17.3	28.8	43.6	-14.8	30.0	45.5	-15.5	30.1	47.6	-17.5
H41	31.0	44.8	-13.8	34.4	45.8	-11.4	35.7	47.1	-11.4	35.7	48.5	-12.8

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H7	36.3	47.4	-11.1	36.3	50.0	-13.7	36.3	50.0	-13.7	36.3	50.0	-13.7
H8	36.4	47.4	-11.0	36.4	50.0	-13.6	36.4	50.0	-13.6	36.4	50.0	-13.6
H9	35.3	47.4	-12.1	35.3	50.0	-14.7	35.3	50.0	-14.7	35.3	50.0	-14.7
H25	28.5	46.6	-18.1	28.5	49.1	-20.6	28.5	49.1	-20.6	28.5	49.1	-20.6
H40	29.5	49.8	-20.3	29.5	52.2	-22.7	29.5	52.2	-22.7	29.5	52.2	-22.7
H41	35.1	50.1	-15.0	35.1	51.9	-16.8	35.1	53.9	-18.8	35.1	56.2	-21.1

The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm
The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit

CONSENTED (LA01/2018/0200/F)

Table 10.17: Comparison of Predicted Noise Levels and Night Time Limits - (dB(A) re 20 µPa)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H7	26.6	43.0	-16.4	26.6	43.0	-16.4	26.6	43.0	-16.4	28.5	43.0	-14.5
H8	26.7	43.0	-16.3	26.7	43.0	-16.3	26.7	43.0	-16.3	28.6	43.0	-14.4
H9	25.6	43.0	-17.4	25.6	43.0	-17.4	25.6	43.0	-17.4	27.5	43.0	-15.5
H25	18.9	43.0	-24.1	18.9	43.0	-24.1	18.9	43.0	-24.1	20.8	43.0	-22.2
H40	19.9	43.0	-23.1	19.9	43.0	-23.1	19.9	43.0	-23.1	21.8	43.0	-21.2
H41	25.6	43.0	-17.4	25.6	43.0	-17.4	25.6	43.0	-17.4	27.6	43.0	-15.4

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H7	31.4	43.0	-11.6	35.5	43.0	-7.5	36.8	43.0	-6.2	36.8	43.0	-6.2
H8	31.5	43.0	-11.5	35.6	43.0	-7.4	36.8	43.0	-6.2	36.9	43.0	-6.1
H9	30.4	43.0	-12.6	34.5	43.0	-8.5	35.7	43.0	-7.3	35.8	43.0	-7.2
H25	23.6	43.0	-19.4	27.7	43.0	-15.3	29.0	43.0	-14.0	29.0	43.0	-14.0
H40	24.7	43.0	-18.3	28.8	43.0	-14.2	30.0	43.0	-13.0	30.1	43.0	-12.9
H41	31.0	43.0	-12.0	34.4	43.0	-8.6	35.7	44.1	-8.4	35.7	45.8	-10.1

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H7	36.3	44.4	-8.1	36.3	44.4	-8.1	36.3	44.4	-8.1	36.3	44.4	-8.1
H8	36.4	44.4	-8.0	36.4	44.4	-8.0	36.4	44.4	-8.0	36.4	44.4	-8.0
H9	35.3	44.4	-9.1	35.3	44.4	-9.1	35.3	44.4	-9.1	35.3	44.4	-9.1
H25	28.5	43.0	-14.5	28.5	43.0	-14.5	28.5	43.0	-14.5	28.5	43.0	-14.5
H40	29.5	46.6	-17.1	29.5	46.6	-17.1	29.5	46.6	-17.1	29.5	46.6	-17.1
H41	35.1	47.8	-12.7	35.1	50.1	-15.0	35.1	52.5	-17.4	35.1	55.1	-20.0

The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm
The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit

CONSENTED (LA01/2018/0200/F)

Potential Construction Impacts

Construction Noise Assessment

10.84 Primary activities for which noise arises during the construction period are from: the construction of the turbine bases; the erection of the turbines; the excavation of trenches for cables; and the construction of associated hard standings, access tracks and construction compound. Noise from vehicles on local roads and access tracks will also arise due to the delivery of turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

10.85 It should be noted that the exact methodology and timing of construction activities cannot be predicted at this time, this assessment is therefore based on assumptions representing a worst-case approach.

Construction Noise Predictions

10.86 The plant assumed for each construction activity is shown in Table 10.18. The number of items indicates how many of each plant are required for the specified activity, and the duration of activity is a percentage of a given 12 hour day period needed for that plant to operate. Overall sound power levels are based upon the data in Annex C of BS 5228-1:2009.

Table 10.18: Construction Phases and Sound Power Levels

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
Construction Site	Tracked excavator	113	2	100	120
	Dump truck	113	2	100	
	Tipper lorry	107	4	50	
	Dozer	109	2	75	
Construct Temporary site compounds	Tracked excavator	113	2	100	119
	Dump truck	113	2	100	
	Tipper lorry	107	2	50	
	Vibratory roller	102	1	75	
	Lorry	108	1	75	
Construct site tracks	Tracked excavator	113	3	100	122
	Dump truck	113	2	75	
	Tipper lorry	107	4	50	
	Dozer	109	1	100	
	Vibratory roller	102	1	75	
	Excavator mounted rock	121	1	50	
Construct Substations	Tracked excavator	113	1	100	115
	Concrete mixer truck	108	2	50	
	Lorry	108	1	50	
	Telescopic Handler	99	1	100	

CONSENTED (LA01/2018/0200/F)

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
Construct crane hardstandings	Tracked excavator	113	3	100	120
	Dump truck	113	2	100	
	Tipper lorry	107	4	50	
	Vibratory roller	102	1	50	
Construct Turbine Foundations	Tracked excavator	113	2	75	123
	Dump truck	113	2	75	
	Concrete mixer truck	108	4	50	
	Mobile telescopic crane	110	1	50	
	Concrete pump	106	2	50	
	Water pump	93	1	100	
	Hand-held pneumatic	111	1	75	
	Compressor	103	3	50	
	Piling Rig	117	1	100	
	Poker vibrator	106	3	50	
	Excavator mounted rock	121	1	50	
Excavate and Lay Site Cables	Tracked excavator	113	2	100	122
	Dump truck	113	2	75	
	Tractor (Towing Equipment)	108	1	75	
	Tractor (Towing Trailer)	107	1	75	
	Vibratory plate	108	1	50	
	Excavator mounted rock	121	1	50	
Erect Turbine	Mobile telescopic crane	110	2	75	119
	Lorry	108	1	75	
	Diesel generator	102	1	100	
	Torque guns	111	4	100	
Reinstate Crane Bases	Tracked excavator	113	1	75	115
	Dump truck	113	1	75	
Lay Cable to Substations	Wheeled loader	108	1	100	117
	Saw	114	1	50	
	Hand-held pneumatic	111	1	50	
	Dump truck	113	1	75	
	Tipper lorry	107	1	50	
	Vibratory plate	108	1	75	
	Tandem roller	102	1	75	
	Tractor (Towing Trailer)	107	1	50	
	Lorry	108	1	75	
Construct New Water Crossing	Tracked Excavator	113	1	100	120
	Dump Truck	113	1	100	

CONSENTED (LA01/2018/0200/F)

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
	Tipper lorry	107	4	50	
	Dozer	109	1	75	
	Vibratory Roller	102	1	75	
	Telescopic Handler	99	1	100	
	Piling Rig	117	1	50	
	Concrete Pump	106	1	50	
	Concrete mixer truck	108	3	50	
	Poker vibrator	106	2	50	
	Water pump	93	2	100	

10.87 Predictions of construction noise levels have been carried out using the methods prescribed in Annex F of BS 5228-1:2009[19]. The worst case scenario, where each construction activity takes place at the nearest proposed location to the residential property being assessed, is considered. The locations of the construction activities are taken from the infrastructure drawing. The results of these predictions, made at 6 representative critical residential properties to the proposed wind farm, are shown in Table 10.19.

10.88 In all cases average noise levels over the construction period will be lower as the worst case is presented for when the activities are closest to the residential property.

Table 10.19: Predicted Sound Pressure Level due to Construction Noise (dB L_{Aeq})

Activity	H6	H10	H17	H27	H31	H35
Construction Site	46.0	44.3	41.4	39.6	39.4	38.8
Construct Temporary Site Compounds	45.5	43.8	40.9	39.1	38.9	38.3
Construct Site Tracks	48.6	48.2	47.3	46.1	46.4	45.8
Construct Substations	41.4	39.2	36.2	34.3	34.0	33.5
Construct Crane Hardstandings	44.5	46.2	44.4	44.1	44.4	43.8
Construct Turbine Foundations	47.4	49.1	47.3	47.0	47.3	46.7
Excavate and Lay Site Cables	48.1	47.4	45.6	45.3	45.6	45.0
Erect Turbine	42.8	44.5	42.7	42.4	42.7	42.1
Reinstate Crane Bases	38.8	40.5	38.7	38.4	38.7	38.1
Lay Cable to Substations	44.0	43.3	41.5	41.2	41.5	40.9
Construct New Water Crossing	45.1	45.4	43.3	43.4	43.1	41.6

Construction Traffic

10.89 Due to the provision of construction material and wind farm components, vehicle movements either into or away from the site shall increase levels of traffic flow on public roads in the area. Traffic regularly accessing the site is shown in Chapter 12: Traffic and Transport and is assumed to be characterised by the sound power levels of

[19] A 50% mixed ground attenuation has been used throughout to conservatively account for the arable nature of ground conditions at the site

CONSENTED (LA01/2018/0200/F)

Dump Trucks, Lorries and Concrete Mixers as a worst case. It is estimated that a total of 240 vehicle movements per day would be required during the most intense period of construction activity although this would only be the case for a maximum of 9 days during foundation pouring.

10.90 Construction traffic noise has been quantified using the method described in BS 5228:2009 Part 1. Using the distances from residential properties to the centre of the relevant carriageway where site traffic will be, the noise levels predicted are presented in Table 10.20. According to the assumptions made the maximum sound pressure level due to traffic flows during the most intensive period of activity will be 60 dB L_{Aeq}. The property where this occurs is adjacent to the proposed delivery route and, as such, corresponds to the worst case.

Table 10.20: Traffic Noise Predictions by Activity (dB L_{Aeq})

House ID	Dump Truck	Lorries	Concrete Mixer
H6	40.6	33.7	38.0
H10	42.4	35.6	39.8
H17	57.6	50.7	55.0
H27	38.1	31.3	35.5
H31	36.6	29.8	34.0
H35	36.2	29.4	33.6

10.91 The increase in noise level due to the presence of construction traffic on nearby roads has been quantified using the methodology set out in CRTN[20]. The maximum predicted increase in daytime average traffic noise level, during the most intense period of construction, is 0.1 dB(A). Given that a 3 dB(A) change is commonly regarded as the smallest subjectively perceptible difference in noise level, the predicted short term change in traffic noise levels are considered negligible and not significant.

General Construction Noise in Conjunction with Traffic Noise

10.92 Worst case construction noise levels may arise when the following simultaneous activities occur: construction of temporary site compounds; construction of nearest access tracks; construction of substation; excavation and laying of site cables; construction of nearest crane hard-standings; and construction of nearest turbine foundations. Therefore cumulative predictions of these construction activities and the additional noise contribution from construction traffic have been calculated and are shown in Table 10.21.

10.93 It should be noted that the predictions exclude the screening effects of local topography therefore actual levels of noise experienced at nearby residential properties could be lower.

[20] Calculation of Road Traffic Noise (CRTN), HMSO Department of Transport, 1988.

CONSENTED (LA01/2018/0200/F)

Table 10.21: Predicted Noise Due to Combined Traffic Noise and Turbine Construction (dB L_{Aeq})

House ID	Construction Plant Noise	Traffic Noise	Combined Noise
H6	54.3	43.0	54.3
H10	54.4	44.9	54.9
H17	52.7	60.0	60.7
H27	52.1	40.6	52.1
H31	52.3	39.1	52.3
H35	51.7	38.7	51.7

Assessment of Construction Noise

10.94 In accordance with the ABC method of Annex E of BS 5228-1:2009, due to the relatively low levels of ambient noise at the proposed The Development site, a Category A assessment is appropriate. This category sets threshold L_{Aeq} criteria of: 65 dB(A) during weekdays (0700-1900) and Saturdays (0700-1300); 55 dB(A) for evenings and weekends; and 45 dB(A) for night-time (2300-0700) periods.

10.95 Table 10.21 shows that predicted noise levels from the combined effect of increased traffic flows and activities associated with peak construction of the wind farm are below the 65 dB(A) daytime target level specified by BS 5228-1:2009 at all of the assessed residential properties such that significant effects would not be anticipated.

10.96 An assessment against the target levels for evenings, weekends and night-time periods has not been undertaken as construction work is not scheduled to take place during these times with the exception of turbine erection (for which predicted noise levels at the properties considered are less than 45 dB(A)), commissioning or periods of emergency work.

10.97 The predictions made represent the worst case combination of most intensive traffic activity with simultaneous construction activity at the nearest possible location to each residential property.

Mitigation

Operational Noise

10.98 One of the key turbine layout design constraint considerations was the minimisation of potential noise impacts at the nearest residential receptors. As such the turbine layout was initially designed to ensure that there is an adequate separation distance between any of the proposed turbines and the nearest residential property.

10.99 Due to consideration in the design of the wind farm, no mitigation measures are required for the operation of the proposed turbines as the proposed development complies with noise criteria when considered on its own.

10.100 It is worth noting that the operation of many modern turbines may be altered by changing the pitch of the wind turbine blades resulting in a trade-off between power production and noise reduction. This provides a potential mechanism for reducing the level of noise experienced at nearby residential properties once a wind farm becomes operational should it be required.

CONSENTED (LA01/2018/0200/F)

10.101 If planning permission is granted for the proposed wind farm, the decision notice would likely contain planning conditions which would provide a degree of protection, in the form of limits relating to noise level and tonality, to nearby residents in the event that noise from the wind farm causes disturbance.

10.102 Technical Appendix 10.8 contains a set of conditions that RES considers appropriate. Any final conditions attached to the proposal, if accepted, would be according to the discretion of the decision maker.

Construction Noise

10.103 For all activities, measures will be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Pollution Control and Local Government (NI) Order 1978.

10.104 BS 5228-1:2009 states that the 'attitude of the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local authority and Community Liaison Group should be considered along with letter drops to inform residents of intended activity. Non-acoustic factors, which influence the overall level of complaints such as mud on roads and dust generation, will also be controlled.

10.105 Furthermore, the following noise mitigation options will be implemented where appropriate:

- Consideration will be given to noise emissions when selecting plant and equipment to be used on site;
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources will be sited as far away as reasonably possible from residential properties and where necessary and appropriate, acoustic barriers will be used to screen them; and
- The movement of vehicles to and from the site will be controlled and employees will be instructed to ensure compliance with the noise control measures adopted.

10.106 Site operations will be limited to 0700-1900 Monday to Friday and 0700–1300 on Saturdays except during turbine erection and commissioning or during periods of emergency work.

Residual Effects

Operational

10.107 The acoustic assessment concludes that predicted noise levels at the nearest residential properties do not exceed the limits under all considered conditions. This should not be interpreted to mean that wind farm operational noise will be inaudible (or masked by background noise) under all conditions, but that the levels of noise are acceptable in accordance with relevant legislation and guidance.

Construction

10.108 Predicted noise from worst case combination of increased traffic and site construction noise do not exceed relevant criteria and therefore no significant impacts are expected.

CONSENTED (LA01/2018/0200/F)

Cumulative Effects

Cumulative Operational Noise Assessment

10.109 An assessment of the cumulative acoustic impact of the Development in conjunction with the existing Dunbeg, consented Dunbeg Extension, existing Dunmore, proposed Dunmore Extension Wind Farms along with three single turbine schemes (planning references B/2013/0258/F, B/2013/0041/F & B/2011/0201/F) has been undertaken in accordance with the guidance on wind farm noise assessment; ETSU-R-97 and the IoA GPG.

10.110 ETSU-R-97 states:

"It is clearly unreasonable to suggest that, because a wind farm has been constructed in the vicinity in the past which resulted in increased noise levels at some properties, the residents of those properties are now able to tolerate higher noise levels still. The existing wind farm should not be considered as part of the prevailing background noise."

10.111 The locations of the nine turbines that make up the Development, along with the other turbines considered in the cumulative assessment, are shown in Figure 10.2.

10.112 The residential properties considered in the cumulative assessment are those detailed in Table 10.8. The distances to the nearest turbine included in the cumulative assessment are given in Table 10.22.

CONSENTED (LA01/2018/0200/F)

Table 10.22: Distances from Residential Properties to Nearest Cumulative Turbine

House ID	Distance (m)	Nearest Turbine
H6	1439	A15
H7	1315	T1
H8	1305	T1
H9	1245	T1
H10	1239	T1
H11	1436	T1
H12	1458	T1
H13	1532	T1
H14	1549	T1
H15	1455	T1
H16	1432	T1
H17	1493	T1
H18	1472	T1
H19	1451	T1
H21	1850	T1
H22	1858	T3
H23	1887	T3
H24	1876	T4
H25	1899	T4
H26	1628	T4
H27	1537	T4
H28	1570	T4
H29	1519	T4
H30	1528	T4
H31	1491	T4
H32	1633	T4
H33	1613	T6
H34	1610	T6
H35	1588	T6
H36	1613	T6
H37	1651	T6
H38	1659	T6
H39	2066	T7
H40	1489	S3
H41	745	A9

Turbines prefixed “T” are the proposed Dunbeg South turbines, turbines A1-A14 are the existing Dunbeg turbines, turbines A15-A17 are the consented Dunbeg Extension turbines, turbines B1-B4 & B6-B8 are the existing Dunmore turbines, turbines B9-B16 are the proposed Dunmore Extension turbines and S2-S4 are the three single turbine schemes considered

CONSENTED (LA01/2018/0200/F)

Cumulative Assessment Methodology

10.113 ETSU-R-97 recommends that the derived noise limits applicable at nearby residential properties shall relate to the cumulative effects of noise from all wind turbines that may affect a particular location.

10.114 The methodology is therefore to:

- Predict noise immission levels at the nearest residential properties due to the Development, along with the other turbines to be considered in the cumulative assessment;
- Calculate the predicted cumulative noise levels by combining the predicted noise levels from all of the projects that are being considered; and
- Compare the cumulative predicted noise levels to acoustic acceptance criteria specified by relevant guidance, ETSU-R-97, to determine whether the cumulative acoustic impact would be deemed acceptable.

10.115 The methodology outlined above is in accordance with the appropriate guidance on cumulative wind farm noise assessment as described in ETSU-R-97 and the IoA GPG.

Predictions of Noise Levels at Residential Properties

Dunbeg Wind Farm

10.116 The existing Dunbeg wind farm is conditioned such that ETSU-R-97 limits will not be exceeded in conjunction with the Dunmore wind farm scheme[21]. However, if it was operating right up to these limits there would be no space remaining for the consented Dunbeg Extension. For the purposes of this assessment it has been modelled based on the installed turbine type for consistency with the acoustic assessment of Dunbeg Extension.

10.117 The turbine installed at Dunbeg Wind Farm is the Enercon E82 E4 3.0MW turbine. Warranted acoustic data for this turbine is taken from the Dunbeg Extension Environmental Statement[22] and an uncertainty of 1 dB has been included as recommended by the turbine manufacturer. Details used in this analysis are as follows:

- a hub height of 84 m;
- a rotor diameter of 82 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 10.23; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 10.24.

[21] PAC Appeal Decision, Appeal Reference 2009/A0363, January 2011

[22] Dunbeg Wind Farm Extension Environmental Statement, Chapter 11 – Noise Impact Assessment, December 2015

CONSENTED (LA01/2018/0200/F)

Table 10.23: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Enercon E82 E4 3.0MW Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Warranted Plus Uncertainty
1	99.0
2	99.0
3	99.0
4	99.0
5	99.0
6	103.0
7	106.0
8	107.0
9	107.0
10	107.0
11	107.0
12	107.0

Table 10.24: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 10m Standardised Wind Speeds for the Enercon E82 E4 3.0MW Wind Turbine

Octave Band (Hz)	8 ms^{-1}
63	87.5
125	94.8
250	101.0
500	102.4
1000	99.5
2000	97.2
4000	92.9
8000	86.1
OVERALL	107.0

Dunbeg Extension

10.118 The consented Dunbeg Extension scheme is conditioned to noise limits based on the predicted noise levels for the candidate turbine presented in the planning application[23].

10.119 The candidate turbine presented in the Dunbeg Extension Environmental Statement[22] is the Enercon E82 E3 3.0MW TES turbine. Warranted acoustic data for this turbine is taken from the Dunbeg Extension Environmental Statement and an uncertainty of 1 dB has been included. Details used in this analysis are as follows:

- a hub height of 84 m;
- a rotor diameter of 82 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 10.25; and

[23] Causeway Coast & Glens Borough Council, Approval of Planning Permission, Application No: LA01/2016/0061/F, December 2015

CONSENTED (LA01/2018/0200/F)

- octave band sound power level data, at the wind speeds where it is available, as shown in Table 10.26.

Table 10.25: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Enercon E82 E3 3.0MW TES Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Warranted Plus Uncertainty
1	96.5
2	96.5
3	96.5
4	96.5
5	96.5
6	100.9
7	103.3
8	104.5
9	104.5
10	104.5
11	104.5
12	104.5

Table 10.26: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 10m Standardised Wind Speeds for the Enercon E82 E3 3.0MW TES Wind Turbine

Octave Band (Hz)	8 ms^{-1}
63	85.0
125	92.3
250	98.5
500	99.9
1000	97.0
2000	94.7
4000	90.4
8000	83.6
OVERALL	104.5

Dunmore Wind Farm

10.120 The existing Dunmore wind farm is conditioned such that ETSU-R-97 limits will not be exceeded[24]. However, if it was operating right up to these limits there would be no space remaining for the existing Dunbeg, consented Dunbeg Extension or proposed Dunmore extension schemes. For the purposes of this assessment it has been modelled based on the installed turbine type for consistency with the acoustic assessment of Dunmore Extension.

10.121 The turbine installed at Dunmore Wind Farm is the Vestas V90-3.0MW turbine. Warranted acoustic data for this turbine is taken from the Dunmore 2 Wind Farm

[24] PAC Appeal Decision, Appeal Reference 2009/A0037, October 2010

CONSENTED (LA01/2018/0200/F)

Environmental Statement[17] and includes an allowance for uncertainty. Details used in this analysis are as follows:

- a hub height of 80 m;
- a rotor diameter of 90 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 10.27; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 10.28.

Table 10.27: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Vestas V90-3.0MW Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Warranted Plus Uncertainty
1	99.2
2	99.2
3	99.2
4	99.2
5	102.3
6	105.3
7	107.6
8	108.5
9	108.5
10	108.5
11	108.5
12	108.5

Table 10.28: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 10m Standardised Wind Speeds for the Vestas V90-3.0MW Wind Turbine

Octave Band (Hz)	8 ms^{-1}
63	93.3
125	95.5
250	98.8
500	101.1
1000	103.3
2000	102.0
4000	98.2
8000	88.2
OVERALL	108.5

Dunmore Extension

10.122 The proposed Dunmore Extension has been modelled based on the worst case candidate turbine presented in the Dunmore 2 Environmental Statement[17], the Nordex N90/2500. Warranted acoustic data for this turbine is taken from the Dunmore 2 Wind Farm

CONSENTED (LA01/2018/0200/F)

Environmental Statement and includes an allowance for uncertainty. Details used in this analysis are as follows:

- a hub height of 80 m;
- a rotor diameter of 90 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 10.29; and
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 10.30.

Table 10.29: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Nordex N90/2500 Wind Turbine

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Warranted Plus Uncertainty
1	99.5
2	99.5
3	99.5
4	99.5
5	103.0
6	106.0
7	107.0
8	107.5
9	108.3
10	108.5
11	108.5
12	108.5

Table 10.30: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at 10m Standardised Wind Speeds for the Nordex N90/2500 Wind Turbine

Octave Band (Hz)	8 ms^{-1}
63	92.7
125	96.8
250	101.2
500	101.6
1000	100.1
2000	99.0
4000	95.0
8000	87.4
OVERALL	107.5

Single Turbines

10.123 Acoustic emission data for the three consented single turbine schemes considered (all proposed to be 250 kW machines) is detailed in Table 10.31 and is consistent with that presented in the planning applications for the respective schemes, where such data is

CONSENTED (LA01/2018/0200/F)

available[25],[26]. An allowance for uncertainty is included. Single turbines B/2013/0258/F[27] and B/2013/0041/F[28] are consented to predicted noise levels based on the candidate turbine presented. The appeal decision for single turbine B/2011/0201/F does not have a noise condition attached[29].

10.124 An additional consented single turbine with reference B/2006/0395/F, rated at 30 kW, was found in a search of the planning database but insufficient information was discovered in order to include this scheme in the assessment. The increased impact due to the inclusion of this scheme would not be expected to be significant due to its size. No change to results of the cumulative assessment would be predicted if this site is included by making assumptions around the turbine location and acoustic emission data.

Table 10.31: A-Weighted Sound Power Levels (dB(A) re 1 pW) for Single Turbine Schemes

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	B/2013/0258/F	B/2013/0041/F & B/2011/0201/F
1	94.9	93.8
2	94.9	93.8
3	94.9	93.8
4	94.9	93.8
5	94.9	93.8
6	95.0	96.1
7	98.1	98.4
8	97.6	100.8
9	98.6	100.9
10	101.2	101.1
11	102.7	101.1
12	102.7	101.1

10.125 The predicted noise levels for day and night time periods at the nearest residential properties due to the operation of the sites considered in the cumulative assessment are detailed in Table 10.32.

10.126 The methodology used to calculate the cumulative predicted noise levels makes the assumption that the properties in question are downwind of all of the considered wind farms simultaneously which is not the case in practice. The cumulative predicted noise levels are conservative due to the reductions in noise that would be expected when a property is situated crosswind or upwind of a noise source.

10.127 When making predictions of the cumulative noise level at a given residential property and wind speed, should any of the wind farms considered have predicted noise levels of greater than 10 dB less than the maximum predicted noise level of any of the wind farms being considered, the wind farm in question is not included as in acoustic practice

[25] KRM Acoustics, 'Noise Assessment for Proposed Single Wind Turbine 824m East South East of 34 Terrydoo Road, Limavady', B/2013/0258/F, 29 December 2013

[26] Breen, 'Supporting Statement, erection of 1 no. 250kW wind turbine 675m East / South East of 34 Terrydoo Road, Limavady', B/2013/0041/F, February 2013

[27] Department of the Environment, Approval of Planning Permission, Application No: B/2013/0258/F, November 2013

[28] Department of the Environment, Approval of Planning Permission, Application No: B/2013/0041/F, February 2013

[29] PAC Appeal Decision, Appeal Reference 2013/A0173, June 2014

CONSENTED (LA01/2018/0200/F)

it is generally accepted that where there is such a difference between the noise levels from two sources, there is no cumulative impact and the smaller source can be ignored.

Table 10.32: Cumulative Predicted Noise Levels at Nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	31.3	31.3	31.3	31.9	34.0	37.4	39.3	39.8	39.8	39.9	39.9	39.9
H7	30.6	30.6	30.6	31.3	34.1	37.3	39.1	39.4	39.5	39.6	39.6	39.6
H8	30.5	30.5	30.5	31.2	34.1	37.2	39.1	39.4	39.5	39.5	39.5	39.5
H9	29.2	29.2	29.2	29.8	32.6	36.1	37.6	38.1	38.0	38.0	38.0	38.0
H10	28.3	28.3	28.3	28.9	31.7	35.1	36.7	37.0	36.9	36.9	36.9	36.9
H11	26.5	26.5	26.5	27.3	30.2	33.6	35.2	35.5	35.3	35.3	35.3	35.3
H12	26.7	26.7	26.7	27.4	30.3	33.7	35.2	35.6	35.4	35.5	35.5	35.5
H13	26.2	26.2	26.2	27.0	29.8	33.2	34.8	35.1	35.0	35.0	35.0	35.0
H14	26.3	26.3	26.3	27.0	29.8	33.2	34.8	35.1	35.0	35.0	35.0	35.0
H15	26.1	26.1	26.1	27.0	29.8	33.2	34.9	35.1	35.0	35.0	35.0	35.0
H16	26.0	26.0	26.0	26.7	29.8	33.2	34.6	35.1	34.9	35.0	35.0	35.0
H17	25.5	25.5	25.5	26.7	29.2	32.9	34.6	34.8	34.6	34.7	34.7	34.7
H18	25.3	25.3	25.3	26.2	29.3	32.7	34.0	34.5	34.4	34.4	34.4	34.4
H19	25.2	25.2	25.2	26.2	29.0	32.7	34.1	34.5	34.3	34.4	34.4	34.4
H21	22.8	22.8	22.8	23.5	26.5	30.0	31.4	31.6	31.6	31.7	31.7	31.7
H22	23.9	23.9	23.9	24.6	27.1	30.5	32.1	32.6	32.5	32.6	32.6	32.6
H23	24.0	24.0	24.0	24.5	27.0	30.4	32.0	32.6	32.4	32.5	32.5	32.5
H24	24.1	24.1	24.1	24.7	27.1	30.2	32.0	32.5	32.4	32.4	32.7	32.7
H25	24.1	24.1	24.1	24.7	26.9	30.0	31.9	32.4	32.3	32.5	32.6	32.6
H26	24.8	24.8	24.8	25.7	28.0	30.8	32.9	33.4	33.2	33.5	33.6	33.6
H27	25.1	25.1	25.1	26.0	27.9	31.3	33.1	33.8	33.6	33.7	33.9	33.9
H28	25.1	25.1	25.1	26.0	28.3	31.1	33.2	33.7	33.5	33.8	33.9	33.9
H29	26.0	26.0	26.0	26.6	28.7	32.0	33.8	34.3	34.1	34.5	34.7	34.7
H30	25.9	25.9	25.9	26.6	28.7	32.0	33.8	34.3	34.1	34.5	34.6	34.6
H31	26.0	26.0	26.0	26.7	28.9	32.2	34.0	34.4	34.3	34.6	34.7	34.7
H32	25.8	25.8	25.8	26.6	28.9	31.6	33.4	34.0	34.0	34.3	34.4	34.4
H33	25.9	25.9	25.9	26.6	28.5	31.8	33.6	34.1	33.9	34.3	34.4	34.4
H34	25.9	25.9	25.9	26.4	28.5	31.8	33.3	34.1	33.9	34.3	34.4	34.4
H35	25.7	25.7	25.7	26.2	28.5	31.6	33.4	33.8	33.9	34.2	34.3	34.3
H36	25.6	25.6	25.6	26.1	28.4	31.5	33.3	33.9	33.8	34.0	34.1	34.1
H37	25.5	25.5	25.5	26.0	28.2	31.3	33.1	33.8	33.6	33.9	34.0	34.0
H38	25.5	25.5	25.5	26.0	28.1	31.2	33.1	33.8	33.6	33.9	34.0	34.0
H39	24.5	24.5	24.5	25.0	26.8	30.1	31.8	32.6	32.5	32.8	32.9	32.9
H40	25.8	25.8	25.8	26.3	28.4	31.2	33.1	33.7	33.6	33.9	34.1	34.1
H41	36.8	36.8	36.8	37.0	39.0	42.4	44.4	45.2	45.3	45.4	45.4	45.4

10.128 Noise levels at 23 of the 35 nearest residential properties are below 35 dB(A) level, indicating that the noise immission levels would be regarded as acceptable and the

CONSENTED (LA01/2018/0200/F)

residents amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

10.129 There are 12 properties that have predicted noise levels greater than this simplified noise criteria as indicated in Table 10.32. Therefore the 'full' acoustic assessment need only be considered at these. However, as background noise measurements were carried out at H25 and H40, as agreed with the local authority, these properties have also been considered in the full acoustic assessment so as to provide a more comprehensive description of the cumulative acoustic impact.

Derived Acoustic Acceptance Criteria

10.130 Despite the greater generation capacity and therefore increased planning merit of the cumulative development, a 35 dB(A) daytime lower limit has been adopted in the cumulative assessment as per the assessment of the Development alone.

10.131 As detailed in paragraph 10.80, the background noise survey locations inferred to be representative for each property are shown in Table 10.15.

10.132 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant has a financial involvement in the wind farm. However, whilst some of the nearby residential properties may qualify for such an increase, these limits have not been adopted in the presented results.

10.133 The derived noise limits for daytime and night-time periods, for each residential property, can be found in Table 10.33 and Table 10.34.

Cumulative Acoustic Assessment

10.134 A comparison of the cumulative predicted noise levels with the recommended daytime noise limits for the nearby residential properties is shown in Table 10.33. The predicted noise levels at 1 ms^{-1} and 2 ms^{-1} have been assumed as equal to 3 ms^{-1} as a conservative measure. The term ΔL is used to denote the difference between the predicted cumulative noise level and the recommended limit. A negative value indicates that the predicted noise level is within the limit. Table 10.34 shows a comparison with the recommended night-time noise limits.

10.135 Cumulative noise levels at all residential properties are within the daytime noise limits at all wind speeds considered. The minimum margin of predicted noise levels below derived noise limits during daytime periods is -2.6 dB(A).

10.136 During night-time periods, the noise limits are predicted to be exceeded at one property and wind speed, H41 at 7 ms^{-1}, by 0.4 dB(A). The limits are predicted to be met at all other properties and wind speeds.

10.137 The predicted noise levels due to the wind farms considered in the cumulative assessment, along with the noise limits, at H41 are shown graphically in Chart 10.9 in Technical Appendix 10.7.

10.138 The developer of Dunbeg Extension states that H1 is to remain unoccupied for the lifetime of the project. A check of the acoustic impact at H1 in the event that Dunbeg Extension is decommissioned and all of the other projects considered in this assessment remain operational has been carried out in the event that it becomes occupied in future and shows that the relevant noise limits would be met.

10.139 Figure 10.2 shows a cumulative noise contour plot calculated using the ISO 9613 Part 2 propagation model. The plot is provided to illustrate the cumulative noise 'footprint'

CONSENTED (LA01/2018/0200/F)

and should be considered indicative only. Where properties are located such that they cannot be downwind of all turbines simultaneously, the predictions made using a downwind propagation model such as ISO 9613-2 are conservative given that reductions in noise would be expected when a property is crosswind or upwind of a noise source.

Table 10.33: Comparison of Cumulative Predicted Noise Levels and Daytime Noise Limits, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H6	31.3	39.0	-7.7	31.3	39.2	-7.9	31.3	39.6	-8.3	31.9	40.2	-8.3
H7	30.6	39.0	-8.4	30.6	39.2	-8.6	30.6	39.6	-9.0	31.3	40.2	-8.9
H8	30.5	39.0	-8.5	30.5	39.2	-8.7	30.5	39.6	-9.1	31.2	40.2	-9.0
H9	29.2	39.0	-9.8	29.2	39.2	-10.0	29.2	39.6	-10.4	29.8	40.2	-10.4
H10	28.3	39.0	-10.7	28.3	39.2	-10.9	28.3	39.6	-11.3	28.9	40.2	-11.3
H11	26.5	39.0	-12.5	26.5	39.2	-12.7	26.5	39.6	-13.1	27.3	40.2	-12.9
H12	26.7	39.0	-12.3	26.7	39.2	-12.5	26.7	39.6	-12.9	27.4	40.2	-12.8
H13	26.2	39.0	-12.8	26.2	39.2	-13.0	26.2	39.6	-13.4	27.0	40.2	-13.2
H14	26.3	39.0	-12.7	26.3	39.2	-12.9	26.3	39.6	-13.3	27.0	40.2	-13.2
H15	26.1	39.0	-12.9	26.1	39.2	-13.1	26.1	39.6	-13.5	27.0	40.2	-13.2
H16	26.0	39.0	-13.0	26.0	39.2	-13.2	26.0	39.6	-13.6	26.7	40.2	-13.5
H25	24.1	36.2	-12.1	24.1	36.9	-12.8	24.1	37.8	-13.7	24.7	38.7	-14.0
H40	25.8	39.3	-13.5	25.8	39.3	-13.5	25.8	39.7	-13.9	26.3	40.7	-14.4
H41	36.8	41.4	-4.5	36.8	42.1	-5.3	36.8	42.9	-6.1	37.0	43.8	-6.8

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H6	34.0	41.0	-7.0	37.4	42.1	-4.7	39.3	43.5	-4.2	39.8	45.3	-5.5
H7	34.1	41.0	-6.9	37.3	42.1	-4.8	39.1	43.5	-4.4	39.4	45.3	-5.9
H8	34.1	41.0	-6.9	37.2	42.1	-4.9	39.1	43.5	-4.4	39.4	45.3	-5.9
H9	32.6	41.0	-8.4	36.1	42.1	-6.0	37.6	43.5	-5.9	38.1	45.3	-7.2
H10	31.7	41.0	-9.3	35.1	42.1	-7.0	36.7	43.5	-6.8	37.0	45.3	-8.3
H11	30.2	41.0	-10.8	33.6	42.1	-8.5	35.2	43.5	-8.3	35.5	45.3	-9.8
H12	30.3	41.0	-10.7	33.7	42.1	-8.4	35.2	43.5	-8.3	35.6	45.3	-9.7
H13	29.8	41.0	-11.2	33.2	42.1	-8.9	34.8	43.5	-8.7	35.1	45.3	-10.2
H14	29.8	41.0	-11.2	33.2	42.1	-8.9	34.8	43.5	-8.7	35.1	45.3	-10.2
H15	29.8	41.0	-11.2	33.2	42.1	-8.9	34.9	43.5	-8.6	35.1	45.3	-10.2
H16	29.8	41.0	-11.2	33.2	42.1	-8.9	34.6	43.5	-8.9	35.1	45.3	-10.2
H25	26.9	39.8	-12.9	30.0	41.1	-11.1	31.9	42.7	-10.8	32.4	44.5	-12.1
H40	28.4	42.0	-13.6	31.2	43.6	-12.4	33.1	45.5	-12.4	33.7	47.6	-13.9
H41	39.0	44.8	-5.8	42.4	45.8	-3.4	44.4	47.1	-2.6	45.2	48.5	-3.3

CONSENTED (LA01/2018/0200/F)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H6	39.8	47.4	-7.6	39.9	50.0	-10.1	39.9	50.0	-10.1	39.9	50.0	-10.1
H7	39.5	47.4	-7.9	39.6	50.0	-10.4	39.6	50.0	-10.4	39.6	50.0	-10.4
H8	39.5	47.4	-7.9	39.5	50.0	-10.5	39.5	50.0	-10.5	39.5	50.0	-10.5
H9	38.0	47.4	-9.4	38.0	50.0	-12.0	38.0	50.0	-12.0	38.0	50.0	-12.0
H10	36.9	47.4	-10.5	36.9	50.0	-13.1	36.9	50.0	-13.1	36.9	50.0	-13.1
H11	35.3	47.4	-12.1	35.3	50.0	-14.7	35.3	50.0	-14.7	35.3	50.0	-14.7
H12	35.4	47.4	-12.0	35.5	50.0	-14.5	35.5	50.0	-14.5	35.5	50.0	-14.5
H13	35.0	47.4	-12.4	35.0	50.0	-15.0	35.0	50.0	-15.0	35.0	50.0	-15.0
H14	35.0	47.4	-12.4	35.0	50.0	-15.0	35.0	50.0	-15.0	35.0	50.0	-15.0
H15	35.0	47.4	-12.4	35.0	50.0	-15.0	35.0	50.0	-15.0	35.0	50.0	-15.0
H16	34.9	47.4	-12.5	35.0	50.0	-15.0	35.0	50.0	-15.0	35.0	50.0	-15.0
H25	32.3	46.6	-14.3	32.5	49.1	-16.6	32.6	49.1	-16.5	32.6	49.1	-16.5
H40	33.6	49.8	-16.2	33.9	52.2	-18.3	34.1	52.2	-18.1	34.1	52.2	-18.1
H41	45.3	50.1	-4.7	45.4	51.9	-6.5	45.4	53.9	-8.5	45.4	56.2	-10.8

The term L_p is used to denote the predicted noise level
The term ΔL is used to denote the difference between the predicted noise level and the recommended limit

CONSENTED (LA01/2018/0200/F)

Table 10.34: Comparison of Cumulative Predicted Noise Levels and Night Time Limits, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H6	31.3	43.0	-11.7	31.3	43.0	-11.7	31.3	43.0	-11.7	31.9	43.0	-11.1
H7	30.6	43.0	-12.4	30.6	43.0	-12.4	30.6	43.0	-12.4	31.3	43.0	-11.7
H8	30.5	43.0	-12.5	30.5	43.0	-12.5	30.5	43.0	-12.5	31.2	43.0	-11.8
H9	29.2	43.0	-13.8	29.2	43.0	-13.8	29.2	43.0	-13.8	29.8	43.0	-13.2
H10	28.3	43.0	-14.7	28.3	43.0	-14.7	28.3	43.0	-14.7	28.9	43.0	-14.1
H11	26.5	43.0	-16.5	26.5	43.0	-16.5	26.5	43.0	-16.5	27.3	43.0	-15.7
H12	26.7	43.0	-16.3	26.7	43.0	-16.3	26.7	43.0	-16.3	27.4	43.0	-15.6
H13	26.2	43.0	-16.8	26.2	43.0	-16.8	26.2	43.0	-16.8	27.0	43.0	-16.0
H14	26.3	43.0	-16.7	26.3	43.0	-16.7	26.3	43.0	-16.7	27.0	43.0	-16.0
H15	26.1	43.0	-16.9	26.1	43.0	-16.9	26.1	43.0	-16.9	27.0	43.0	-16.0
H16	26.0	43.0	-17.0	26.0	43.0	-17.0	26.0	43.0	-17.0	26.7	43.0	-16.3
H25	24.1	43.0	-18.9	24.1	43.0	-18.9	24.1	43.0	-18.9	24.7	43.0	-18.3
H40	25.8	43.0	-17.2	25.8	43.0	-17.2	25.8	43.0	-17.2	26.3	43.0	-16.7
H41	36.8	43.0	-6.2	36.8	43.0	-6.2	36.8	43.0	-6.2	37.0	43.0	-6.0

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H6	34.0	43.0	-9.0	37.4	43.0	-5.6	39.3	43.0	-3.7	39.8	43.0	-3.2
H7	34.1	43.0	-8.9	37.3	43.0	-5.7	39.1	43.0	-3.9	39.4	43.0	-3.6
H8	34.1	43.0	-8.9	37.2	43.0	-5.8	39.1	43.0	-3.9	39.4	43.0	-3.6
H9	32.6	43.0	-10.4	36.1	43.0	-6.9	37.6	43.0	-5.4	38.1	43.0	-4.9
H10	31.7	43.0	-11.3	35.1	43.0	-7.9	36.7	43.0	-6.3	37.0	43.0	-6.0
H11	30.2	43.0	-12.8	33.6	43.0	-9.4	35.2	43.0	-7.8	35.5	43.0	-7.5
H12	30.3	43.0	-12.7	33.7	43.0	-9.3	35.2	43.0	-7.8	35.6	43.0	-7.4
H13	29.8	43.0	-13.2	33.2	43.0	-9.8	34.8	43.0	-8.2	35.1	43.0	-7.9
H14	29.8	43.0	-13.2	33.2	43.0	-9.8	34.8	43.0	-8.2	35.1	43.0	-7.9
H15	29.8	43.0	-13.2	33.2	43.0	-9.8	34.9	43.0	-8.1	35.1	43.0	-7.9
H16	29.8	43.0	-13.2	33.2	43.0	-9.8	34.6	43.0	-8.4	35.1	43.0	-7.9
H25	26.9	43.0	-16.1	30.0	43.0	-13.0	31.9	43.0	-11.1	32.4	43.0	-10.6
H40	28.4	43.0	-14.6	31.2	43.0	-11.8	33.1	43.0	-9.9	33.7	43.0	-9.3
H41	39.0	43.0	-4.0	42.4	43.0	-0.6	44.4	44.1	0.4	45.2	45.8	-0.6

CONSENTED (LA01/2018/0200/F)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H6	39.8	44.4	-4.6	39.9	44.4	-4.5	39.9	44.4	-4.5	39.9	44.4	-4.5
H7	39.5	44.4	-4.9	39.6	44.4	-4.8	39.6	44.4	-4.8	39.6	44.4	-4.8
H8	39.5	44.4	-4.9	39.5	44.4	-4.9	39.5	44.4	-4.9	39.5	44.4	-4.9
H9	38.0	44.4	-6.4	38.0	44.4	-6.4	38.0	44.4	-6.4	38.0	44.4	-6.4
H10	36.9	44.4	-7.5	36.9	44.4	-7.5	36.9	44.4	-7.5	36.9	44.4	-7.5
H11	35.3	44.4	-9.1	35.3	44.4	-9.1	35.3	44.4	-9.1	35.3	44.4	-9.1
H12	35.4	44.4	-9.0	35.5	44.4	-8.9	35.5	44.4	-8.9	35.5	44.4	-8.9
H13	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4
H14	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4
H15	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4
H16	34.9	44.4	-9.5	35.0	44.4	-9.4	35.0	44.4	-9.4	35.0	44.4	-9.4
H25	32.3	43.0	-10.7	32.5	43.0	-10.5	32.6	43.0	-10.4	32.6	43.0	-10.4
H40	33.6	46.6	-13.0	33.9	46.6	-12.7	34.1	46.6	-12.5	34.1	46.6	-12.5
H41	45.3	47.8	-2.5	45.4	50.1	-4.6	45.4	52.5	-7.1	45.4	55.1	-9.7

The term L_p is used to denote the predicted noise level
The term ΔL is used to denote the difference between the predicted noise level and the recommended limit

Mitigation

10.140 Turbine management has been considered to ensure that the cumulative noise levels at H41 comply with the noise limits during the night at a standardised 10m wind speed of 7 ms^{-1}. The turbine management strategy involves reduction of noise levels at this residential property to below the criteria level through management of selected turbines within the Development.

10.141 The Nordex N100/2500 has six reduced modes of operation whereby the pitch of the turbine blades can be altered in a trade-off between power production and noise reduction. Acoustic emission data for the available modes is shown in Table 10.35. A 2 dB(A) allowance for measurement uncertainty has been included.

CONSENTED (LA01/2018/0200/F)

Table 10.35: A-Weighted Sound Power Levels (dB(A) re 1 pW) for Reduced Noise Modes

Standardised 10m Height Wind Speed, v_{10} (ms^{-1})	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5	Mode 6
1	97.9	97.9	97.9	97.9	97.9	97.5
2	97.9	97.9	97.9	97.9	97.9	97.5
3	97.9	97.9	97.9	97.9	97.9	97.5
4	99.8	99.8	99.8	99.3	99.3	98.4
5	102.7	102.2	102.5	100.9	100.7	99.1
6	106.4	105.4	104.9	101.9	104.0	101.6
7	107.3	106.3	105.8	102.9	105.9	107.2
8	107.5	106.9	106.4	103.8	107.4	107.9
9	107.5	107.0	106.5	104.0	108.0	108.0
10	107.5	107.0	106.5	104.0	108.0	108.0
11	107.5	107.0	106.5	104.0	108.0	108.0
12	107.5	107.0	106.5	104.0	108.0	108.0

10.142 A turbine management strategy has been designed at the wind speed where the night time limits are predicted to be exceeded in the cumulative assessment. Operating the turbines that make up the Development in the modes detailed in Table 10.36 is predicted to result in the limits being met. Note for all other wind speeds and during daytime periods the turbines would operate in the unconstrained Mode 0.

Table 10.36: Suggested Operational Modes at 7 ms^{-1} at Night

Turbine	Mode
T1	Mode 5
T2	Mode 4
T3	Mode 0
T4	Mode 0
T5	Mode 3
T6	Mode 0
T7	Mode 0
T8	Mode 4
T9	Mode 5

10.143 Predicted noise levels due to the Development with the above noise management strategy in place are detailed in Table 10.37. It can be seen that the noise level due to the Development at H41 at 7 ms^{-1} has been reduced to a level 10 dB below the night time noise limit. The resulting impact on the cumulative assessment can be seen in Chart 10.10 in Technical Appendix 10.7.

CONSENTED (LA01/2018/0200/F)

Table 10.37: Predicted Noise Levels due to the Development with Night Noise Management, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H6	24.7	24.7	24.7	26.6	29.5	33.6	33.5	34.9	34.4	34.4	34.4	34.4
H7	26.6	26.6	26.6	28.5	31.4	35.5	35.5	36.8	36.3	36.3	36.3	36.3
H8	26.7	26.7	26.7	28.6	31.5	35.6	35.6	36.9	36.4	36.4	36.4	36.4
H9	25.6	25.6	25.6	27.5	30.4	34.5	34.4	35.8	35.3	35.3	35.3	35.3
H10	24.3	24.3	24.3	26.2	29.1	33.2	33.2	34.5	34.0	34.0	34.0	34.0
H11	22.8	22.8	22.8	24.7	27.6	31.7	31.8	33.0	32.5	32.5	32.5	32.5
H12	22.7	22.7	22.7	24.6	27.5	31.6	31.7	32.9	32.3	32.3	32.3	32.3
H13	22.3	22.3	22.3	24.2	27.0	31.1	31.2	32.4	31.9	31.9	31.9	31.9
H14	22.2	22.2	22.2	24.1	26.9	31.0	31.1	32.3	31.8	31.8	31.8	31.8
H15	22.8	22.8	22.8	24.7	27.6	31.7	31.8	33.0	32.5	32.5	32.5	32.5
H16	23.0	23.0	23.0	24.9	27.7	31.9	32.0	33.2	32.6	32.6	32.6	32.6
H17	22.6	22.6	22.6	24.5	27.4	31.5	31.7	32.8	32.3	32.3	32.3	32.3
H18	22.3	22.3	22.3	24.2	27.1	31.2	31.4	32.5	32.0	32.0	32.0	32.0
H19	22.6	22.6	22.6	24.5	27.3	31.5	31.6	32.8	32.2	32.2	32.2	32.2
H21	19.7	19.7	19.7	21.6	24.4	28.6	28.8	29.9	29.3	29.3	29.3	29.3
H22	19.4	19.4	19.4	21.3	24.1	28.2	28.6	29.6	29.0	29.0	29.0	29.0
H23	19.2	19.2	19.2	21.1	23.9	28.1	28.4	29.4	28.8	28.8	28.8	28.8
H24	19.1	19.1	19.1	21.0	23.8	28.0	28.4	29.3	28.7	28.7	28.7	28.7
H25	18.9	18.9	18.9	20.8	23.6	27.7	28.2	29.0	28.5	28.5	28.5	28.5
H26	20.4	20.4	20.4	22.3	25.2	29.3	29.8	30.6	30.0	30.0	30.0	30.0
H27	21.0	21.0	21.0	22.9	25.8	29.9	30.4	31.2	30.7	30.7	30.7	30.7
H28	20.8	20.8	20.8	22.7	25.5	29.6	30.2	31.0	30.4	30.4	30.4	30.4
H29	21.5	21.5	21.5	23.4	26.3	30.4	31.0	31.7	31.2	31.2	31.2	31.2
H30	21.5	21.5	21.5	23.4	26.3	30.4	30.9	31.7	31.1	31.1	31.1	31.1
H31	21.7	21.7	21.7	23.6	26.5	30.6	31.2	31.9	31.4	31.4	31.4	31.4
H32	20.9	20.9	20.9	22.8	25.7	29.8	30.3	31.1	30.6	30.6	30.6	30.6
H33	21.2	21.2	21.2	23.1	26.0	30.1	30.6	31.4	30.8	30.8	30.8	30.8
H34	21.2	21.2	21.2	23.1	26.0	30.1	30.6	31.4	30.9	30.9	30.9	30.9
H35	21.3	21.3	21.3	23.2	26.1	30.2	30.6	31.5	31.0	31.0	31.0	31.0
H36	21.2	21.2	21.2	23.1	25.9	30.0	30.5	31.4	30.8	30.8	30.8	30.8
H37	20.9	20.9	20.9	22.8	25.7	29.8	30.2	31.1	30.6	30.6	30.6	30.6
H38	20.9	20.9	20.9	22.8	25.6	29.8	30.1	31.1	30.5	30.5	30.5	30.5
H39	18.8	18.8	18.8	20.7	23.5	27.7	28.0	29.0	28.4	28.4	28.4	28.4
H40	19.9	19.9	19.9	21.8	24.7	28.8	29.3	30.1	29.5	29.5	29.5	29.5
H41	25.6	25.6	25.6	27.6	31.0	34.4	34.0	35.7	35.1	35.1	35.1	35.1

10.144 It should be acknowledged that there will be many different combinations of turbine management that result in predicted noise levels below the specified criteria. The suggestion of operating turbines in the reduced operational modes presented represents

CONSENTED (LA01/2018/0200/F)

a potential turbine management scheme which may feasibly not be the most efficient from an energy capture perspective, but simply demonstrates the principle of the use of turbine management to mitigate noise levels at H41 to acceptable levels.

10.145 The presented noise management strategy is designed such that the limit would be met assuming the property in question is located downwind of all of the considered turbines at all times. The amount of noise management required is likely to reduce for certain wind directions should an assessment considering the attenuation applicable when the property is located crosswind or upwind of a noise source be undertaken.

Cumulative Construction Noise Assessment

10.146 Any noise due to the construction of the other wind farms considered in the cumulative operational noise assessment is unlikely to be ongoing at the same time as the construction of the Development. In the event that this scenario did occur, the activities would be far enough away from each other so as not to have a cumulative impact.

Summary

10.147 The acoustic impact for the operation of the Development on nearby residential properties has been assessed in accordance with the guidance on wind farm noise as issued in the DTI publication "The Assessment and Rating of Noise from Wind Farms", otherwise known as ETSU-R-97, and Institute of Acoustics Good Practice Guide (IoA GPG), as recommended for use by relevant planning policy.

10.148 To establish baseline conditions, background noise surveys were carried out at nearby properties and the measured background noise levels used to determine appropriate noise limits, as specified by ETSU-R-97 and the IoA GPG.

10.149 Operational noise levels were predicted using a noise propagation model, the proposed wind farm layout, terrain data and assumed turbine emission data. The predicted noise levels are within derived appropriate noise limits at all considered wind speeds. The proposed wind farm therefore complies with the relevant guidance on wind farm noise and the impact on the amenity of all nearby residential properties would be regarded as acceptable.

10.150 A construction noise assessment carried out in accordance with BS 5228-1:2009 "Noise control on construction and open sites Part 1 - Noise" indicates that predicted noise levels likely to be experienced at representative critical residential properties are below relevant construction noise criteria.

10.151 A cumulative operational noise assessment was completed to determine the potential impact of the Development alongside the existing Dunbeg Wind Farm, consented Dunbeg Extension, existing Dunmore Wind Farm, proposed Dunmore Extension and three single turbine schemes. The cumulative predicted noise levels, with due regard to the mitigation outlined, are within derived appropriate noise limits at all considered wind speeds. Therefore the impact on the amenity of nearby residential properties due to cumulative operational noise levels would be regarded as acceptable.

10.152 The potential impact of the Development, along with the mitigation proposed and any residual impact, is summarised in Table 10.38.

CONSENTED (LA01/2018/0200/F)

Table 10.38: Summary of Potential Impacts of the Proposed Wind Farm, Mitigation and Residual Impacts

Potential Impact	Mitigation Proposed	Means of Implementation	Outcome/ Residual Impact
Operational Noise			
Potential for operational noise to exceed night time noise limit in the cumulative scenario	Noise management to meet night time limit at one wind speed in the cumulative scenario	Operate certain turbines in reduced noise mode when necessary	Impact is deemed to be acceptable as wind farm noise meets limits specified by relevant guidance
Construction Noise			
Impact due to construction noise at nearby residential properties not predicted to be significant	Not required due to absence of identified significant impact	Not applicable	No significant impacts identified

CONSENTED (LA01/2018/0200/F)

CONSENTED (LA01/2018/0200/F)

11

Traffic & Transport

CONSENTED (LA01/2018/0200/F)

11 Traffic & Transport

Introduction

11.1 This assessment considers the potential impacts on traffic and transport associated with the construction, operation and decommissioning phases of the proposed Dunbeg South Wind Farm, hereinafter referred to as the 'the Development'.

11.2 The site entrance for the Development is located on the Broad Road (A37), within the townland of Gortcorbies, approximately 6.0 km east of Limavady, Co. Derry / Londonderry. The Planning Application Boundary, hereinafter referred to as the 'Site', is shown in Figure 1.2: Planning Application Boundary.

11.3 The following have been considered in this chapter:

- Legislation and policy
- Access routes for abnormal indivisible loads (AIL), normal construction traffic and associated road improvements
- The type and volume of traffic generated by the Development
- Identification of sensitive/critical locations along the delivery route
- Assessment of construction, operation and decommissioning traffic impacts
- Outline of suitable mitigation measures and the evaluation of residual impacts
- Cumulative impact of surrounding consented and proposed developments.

11.4 This assessment has been carried out in-house by Renewable Energy Systems Ltd (RES) with at least one in-house Member of the Institution of Engineers Ireland and Institution of Civil Engineers involved in its production.

11.5 This assessment is supported by the following Technical Appendices:

- Technical Appendix 11.1: Delivery Analysis

Legislation, Policy and Guidance

DOE – Planning Policy Statement 3 - Access, Movement and Parking (2005)

11.6 Policy AMP2 of PPS3 issued by the Department of Environment (DOE) in 2005 states that:

- "Planning permission will only be granted for a development proposal involving direct access, or the intensification of the use of an existing access, onto a public road where:

CONSENTED (LA01/2018/0200/F)

a) such access will not prejudice road safety or significantly inconvenience the flow of traffic; and
b) the proposal does not conflict with Policy AMP 3 Access to Protected Routes"

11.7 Policy AMP3 of PPS3 (Clarification) published by the Department of Environment (DOE) in October 2006 states that:

"The Department will restrict the number of new access and control the level of use of existing accesses onto Protected Routes as follows:

- Motorways and High Standard Dual Carriageways;
- Other Dual Carriageways, Ring Roads, Through-Passes and By-Passes – all Locations
- Other Protected Routes – Outside Settlement Limits
- Other Protected Routes - Within Settlement Limits"

Strategic Planning Policy Statement (SPPS)

11.8 The SPPS highlights that transportation issues to be addressed in the LDP should include Protected Routes. Whilst regional policy is to restrict the number of new access and control the level of use of existing accesses onto protected routes, there are exceptions where the principle of development accords with policy elsewhere in the SPPS.

Northern Area Plan 2016 (2015)

11.9 Protected Routes Network seeks to maintain the efficiency and safety of main road system between the Regions towns. The Broad Road (A37) Gortcorbies is under consideration as part of Proposal TRA 1: Rural Route Protection, with a view to improving the overtaking opportunity towards Coleraine.

DOE - Planning Policy Statement 18: Renewable Energy (2009)

11.10 Policy RE1 of PPS18 issued by the Department of Environment (DOE) in 2009 requires applications for wind energy development to demonstrate that no part of the development will have an unacceptable impact on roads, rail or aviation safety:

- "*Where any project is likely to result in unavoidable damage during its installation, operation or decommissioning, the application will need to indicate how this will be minimised and mitigated, including details of any proposed compensatory measures… This matter will need to be agreed before planning permission is granted.*"

CONSENTED (LA01/2018/0200/F)

DOE - Best Practice Guidance to Planning Policy Statement 18 'Renewable Energy' (2009)

11.11 Section 1 of the Guidance relates to wind energy and names the "Adequacy of local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site" as one of the main concerns that needs to be considered by the developer when applying for a wind farm development.

IEMA - Guidelines for the Environmental Assessment of Road Traffic (1993)

11.12 The Institute of Environmental Management and Assessment (IEMA) Guidelines (hereinafter referred to as IEMA Guidelines (1993)) are the most widely used guidance document for assessing traffic impacts as part of Environmental Statements, and are referred to throughout this Chapter.

11.13 The IEMA Guidelines (1993) suggest two general rules for identifying the extent of the assessed area:

- Rule 1 – include highway links where traffic flows will increase by more than 30% (or the number of heavy good vehicles will increase by more than 30%).
- Rule 2 – include any other specifically sensitive areas where traffic flows have increased by 10% or more.

11.14 Where the change is less than the above thresholds, the impact shall be considered 'negligible'.

Scope of the Assessment

11.15 The main transport effects will be associated with the movements of commercial Heavy Goods Vehicles (HGVs) and Abnormal Indivisible Loads (i.e. turbine component delivery) to and from the site during the construction phase of the Development. Once operational, it is envisaged that the amount of traffic associated with the Development would be minimal, comprising service and maintenance visits. Occasional visits may also be made to the site for more extensive maintenance/repairs. The vehicle used for maintenance visits is likely to be a 4x4 vehicle (or similar) but there may be an occasional need for HGV deliveries, road-going cranes or AILs loads to access the site for heavier maintenance and repairs. However, it is considered that the effects of such operational traffic will be negligible and therefore, detailed consideration of the operational phase of the Development is not included in this assessment.

11.16 For details of the assessment of construction noise associated with deliveries, see Chapter 10: Noise.

11.17 The proposed access routes for AILs (turbine delivery) is illustrated on Figure 11.1 – Turbine Delivery Route. It is proposed that HGV deliveries of concrete and stone respectively will also utilise the Broad Road (A37) but could do so from

CONSENTED (LA01/2018/0200/F)

either direction depending on the source of material and subject to confirmation with DfI Roads.

Abnormal Indivisible Loads (turbine component delivery) and HGV deliveries

11.18 Specialist vehicles are required to transport turbine components to the site. One vehicle would transport turbine blades, while another type would transport the tower sections. Swept path analyses have been carried out for both these types of vehicle to determine the works required to allow passage through pinch-points on the route, as illustrated in Appendix 11.1.

11.19 The proposed access route for AILs from Lisahally Port has been used previously for the construction of Dunbeg Wind Farm which also utilises access directly onto the Broad Road (A37). From Lisahally, the route will travel onto Maydown Road and turn east onto the Clooney Road and travel east for approximately 28km via both Greysteel and Ballykelly before bypassing Limavady town on the Ballykelly Road and travelling southeast onto Broad Road. The site entrance is located on the Broad Road.

11.20 The proposed return route for the delivery vehicles is similar to the proposed delivery route noted above. Once the turbine components have been delivered, the vehicles will be shortened so they are no longer than a typical articulated HGV.

11.21 Where required, approval to temporarily remove street furniture (for the minimum period as is reasonably practical), will be obtained from the appropriate bodies prior to deliveries post planning consent.

Normal HGV Delivery

11.22 Normal HGV load delivery routes (including stone and concrete) will utilise the Broad Road, with sources of material to be confirmed prior to construction. No passing bays will be required.

11.23 Where agreed by DfI Roads, circular HGV haul routes may be implemented for the construction phase of the project.

11.24 Post consent, a further detailed review of all bridges/structures along the preferred route will be undertaken and, if required, structural surveys will be carried out. The requirement (if any) of any subsequent improvement works will be undertaken following consultation with DfI Roads.

Site Entrances

11.25 The site entrance is located on the Broad Road where an existing access is provided to an unoccupied building and associated agricultural enclosures. The construction of wind farms have previously directly accessed the Broad Road (A37) for access and egress of both HGV and AIL deliveries (PAC 2009/A0363 (B/2007/0560/F).

CONSENTED (LA01/2018/0200/F)

11.26 The proposed site entrance design is shown in Figure 2.8 and has been designed in accordance with the requirements of Development Control Advice Note (DCAN) 15, 2nd Edition.

11.27 As specified in DfI Roads consultation response of 10th July 2017, visibility splays measuring 215m x 4.5m are provided in both directions from the rear of the hard shoulder. Provision is included to allow fully laden AIL delivery vehicles to access the site and stop clear of the carriageway when the gates are closed during the construction period. Following construction, those areas of the site entrance not required during operation will be reinstated to reduce the extent of hardstanding. Stock proof fencing will be erected accordingly.

11.28 DfI Roads highlighted that the Department has a proposal for a climbing lane at this location and advised RES to contact the DfI Roads, Strategic Routes Improvement Team. RES and the Strategic Routes Improvement Team where able to provide each other with details of the respective proposals and the Strategic Routes Improvement Team advised that whilst there is currently no allocated budget for the climbing lane scheme, the proposed site entrance is unlikely to effect the climbing lane proposal. The site entrance's position does not conflict with the proposed location of the climbing lane or associated earthworks.

Consultation

11.29 Consultations with stakeholders relevant to traffic, roads and infrastructure on and near the delivery routes were undertaken. The feedback from this consultation process helped to clarify the local transport strategy, identify issues of specific local importance and gather basic information on local infrastructure and structures. A summary of consultation responses and proposed mitigation measures are included in Table 11.1.

Table 11.1: Consultation Responses

Consultee	Issue	Solution / Further Steps
DfI Roads	Structures L'Derry to Limavady Bridge crossing River Faughan Bridge crossing River Roe Limavady to site entrance. Belfast to Broad Road (A37) Bridge crossing River Bann (at Coleraine).	Post consent, a review of the condition of structures along the entire route will be conducted and if required, remedial works will be proposed taking into account all DfI Roads requirements. All required permits will be applied for prior to delivery of the turbine components.
	Protected Route The A37 is a protected route and the DfI Roads have a	DfI Roads - Strategic Routes Improvement Team have

CONSENTED (LA01/2018/0200/F)

	proposal for a climbing lane at this location (NAP 2016 – Proposal TRA 1).	reviewed the Development site entrance proposal and advised it is unlikely to affect climbing lane proposal.
	Traffic & Transport Assessment A Traffic & Transport Chapter is to be included within the Environmental Statement.	Details traffic numbers during construction, installation and maintenance of the development are included in Table 11.3

11.30 Please note that, further consultation is required post consent with stakeholders relevant to traffic, roads and infrastructure on and near the delivery routes to finalise the preferred HGV access route strategy to the Development.

Assessment Methodology

11.31 The assessment has been undertaken in accordance with the Institute of Environmental Assessment's 'Guidelines for the Environmental Assessment of Road Traffic' (1993).

11.32 The IEA Guidelines (1993) is the only document available that sets out a methodology for assessing potentially significant environmental impacts where a proposed development is likely to give rise to changes in traffic flows.

11.33 The IEA Guidelines (1993) suggest that, in order to determine the scale and extent of the assessment and the level of impact the development will have on the surrounding road network, the following two 'rules' should be followed:

1. Include highway links (public roads) where traffic flows are predicted to increase by more than 30% (or where the number of heavy goods vehicle movements is predicted to increase by more than 30%).

2. Include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more.

11.34 Where possible, the significance of each impact is considered against the criteria within the IEA Guidelines (1993). However, the IEA Guidelines (1993) state that:

11.35 "for many effects there are no simple rules or formulae which define the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources."

11.36 In the absence of established significance criteria for traffic and transport impacts, professional judgement has been used to assess whether the impacts on traffic and transport are considered to be significant, using the IEA Guidelines

CONSENTED (LA01/2018/0200/F)

(1993) to identify the scale and extent of the assessment to be undertaken. The significance falls into two categories; 'not significant' and 'significant', the latter corresponding to significant impacts in accordance with the IEA Guidelines (1993).

11.37 The IEA Guidelines (1993) state projected changes in traffic of less than 10% creates no discernible environmental impact, given that daily variations in background traffic flow may fluctuate by this amount, and that a 30% change in traffic flow represents a reasonable threshold for including a highway link (public road) within the assessment. The threshold for a detailed assessment has therefore been set at a 30% change in HGV traffic flow.

11.38 The following receptors have been used for this assessment:

- Census Point 304, A37 Limavady – Coleraine, West of B66
- Census Point 307, A37 Coleraine – Limavady, at Dunderg

11.39 Automatic Traffic Count (ATC) surveys were carried out during a period of seven consecutive days starting on 2nd January 2016 and covering all roads listed in Table 11.2.

Table 11.2: Existing Annual Daily Traffic Flows

Road Reference	24 hr Annual Average Daily Flow[1]
Census Point 304, A37 Limavady – Coleraine, West of B66	12,560
Census Point 307, A37 Coleraine – Limavady, at Dunderg	10,460

Potential Significant Effects

11.40 The construction of the Development is anticipated to take approximately 18 months. Construction site working will be from 0700 to 1900, Monday to Friday and 0700 to 1300 on Saturdays but deliveries may occur outside these times to minimise disruption to local residents and/or to comply with Health and Safety, quality or any specific environmental requirements. During both turbine erection and commissioning periods site workings could be seven days a week.

11.41 The associated traffic flows will vary over that time as different elements of the Development are constructed, and will depend on the chosen Contractor's preferred method of working. A Traffic Management Plan (TMP) will be prepared by the Applicant or the chosen Contractor once the construction schedule, plant requirements and the turbine model have been defined, pre-construction. This will ensure impacts to the users of the delivery route are minimised where possible. The TMP will be submitted to Causeway Coast & Glens BC and DfI Roads for approval prior to the start of construction.

[1] 2016 Average Annual Daily Traffic Flow (AADT) (7 day), TRAFFIC and TRAVEL INFORMATION 2016, Department for Infrastructure

CONSENTED (LA01/2018/0200/F)

11.42 Estimated traffic generation during the construction stage has been based on the assumption that the following activities will take place:

- Delivery of components for site set-up
- Delivery of materials for road and hard standings
- Delivery of materials and components associated with foundation construction
- Delivery of components associated with the turbines, including meteorological masts
- Delivery of components and materials associated with cable installation
- Delivery of substation components and materials
- Other miscellaneous deliveries/removal
- Construction workers commuting.

11.43 Table 11.3 provides the estimated traffic generation across an assumed 18 month construction period. The assessment has been based on the assumption that all material has to be imported to site, including ready mixed concrete for the turbine foundations and all aggregate for the access tracks and areas of hardstanding, thus providing a worst case.

Table 11.3 Estimated traffic generation across an assumed 12 month construction period

Phase	Purpose	Vehicle	Approximate No of deliveries for project duration	Approximate highest No of daily deliveries	Approximate Period when Deliveries Occur (assumes 12 months programme)
Site Set-Up	Portacabin delivery	Low loader	5	5	1
	Skip delivery	Low loader	5	5	1
	Generator delivery	Low loader	2	2	1
	Water and fuel tank delivery	Low loader	1	1	1
	Excavator delivery	Low loader	2	2	1-2
	Tool container delivery	Low loader	2	2	2
	Roller-compactor	Low loader	1	1	2
	Articulated dumper truck	Low loader	1	1	2
Site tracks & hard standings	Stone for site tracks	Tipper lorry	1856	40	1-5
	Stone for control building and substation	Tipper lorry	13	13	1-5

CONSENTED (LA01/2018/0200/F)

Phase	Purpose	Vehicle	Approximate No of deliveries for project duration	Approximate highest No of daily deliveries	Approximate Period when Deliveries Occur (assumes 12 months programme)
	compounds				
	Stone for construction compound and gatehouse	Tipper lorry	107	40	1-5
	Stone for pathways	Tipper lorry	39	39	5-10
	Stone for crane hardstanding	Tipper lorry	1821	40	1-5
Foundation construction	Excavator delivery	Low loader	2	2	3
	Misc works	Backhoe loader	2	2	3
	Concrete for turbine foundations, piles & transformer plinths	Mixer truck	585	65	3-5
	Steel delivery	Flat bed	18	18	3-5
	Foundation bolts or steel insert delivery	Flat bed	9	9	5
	Place foundation bolt cage or steel insert	30t to 50t crane	1	1	5
Turbine erection	Tower section delivery	Clamp lift trailer	36	8	9
	Blade delivery	Extendible trailer	27	6	9
	Nacelle	Low loader	9	2	9
	Hub and rotor	Low loader	9	2	9
	Drive Train	Low loader	9	3	9
	Large crane delivery and removal	1000t to 1200t crane	2	1	9
	Crane associated equipment delivery and removal	Low loader	20	10	9
	Smaller crane delivery and removal	150t to 200t crane	2	1	9

CONSENTED (LA01/2018/0200/F)

Phase	Purpose	Vehicle	Approximate No of deliveries for project duration	Approximate highest No of daily deliveries	Approximate Period when Deliveries Occur (assumes 12 months programme)
Cable Installation	Cable delivery	Flat bed	5	5	6
	Sand delivery	Tipper lorry	105	20	6
	Excavator delivery	Low loader	2	1	6
	Cable laying	Tele handler	2	1	6
Sub-Station and Control Building	Concrete delivery	Mixer truck	36	36	6
	Brick delivery	Flat bed	3	3	6
	Roofing & Cladding	Flat bed	3	3	8
	Switchgear	Flat bed	2	2	8
	Misc electrical equipment	Flat bed	3	3	8
Energy Storage	Foundations	Mixer Truck	3	2	11-12
	Battery Containers	Flat Bed	3	2	11-12
	Cabling & Trenching	Flat Bed	4	3	11-12
Reinstatement	Removal of temporary compound	Tipper lorry	107	40	11-12
	Removal of temporary hardstanding stone	Tipper lorry	817	40	11-12
Misc	Waste removal	Skip lorry	104	1	1-12
	Water/fuel deliveries	Small tanker	104	1	1-12
Site Demobilisation	Portacabin removal	Low loader	5	5	12
	Skip removal	Low loader	5	5	12
	Generator removal	Low loader	2	2	12
	Water and fuel tank removal	Low loader	1	1	12
	Roller-compactor	Low loader	1	1	9
	Dumper truck	Low loader	1	1	12
	Excavator removal	Low loader	2	2	6-12
	Misc works	Backhoe loader	2	2	12
TOTAL Heavy Good Vehicles			5908		
Site Staff and Deliveries	Staff	Cars & minivans	6500	25	1-12

CONSENTED (LA01/2018/0200/F)

Phase	Purpose	Vehicle	Approximate No of deliveries for project duration	Approximate highest No of daily deliveries	Approximate Period when Deliveries Occur (assumes 12 months programme)
	Miscellaneous deliveries	Vans	1040	4	1-12
TOTAL Cars & Light Good Vehicles			7540		
TOTAL VEHICLES			13448		

11.44 The above has been derived from experience gained from previous wind farm construction phases and assumes approximately 40 stone deliveries per day.

11.45 It is estimated that the greatest concentration of construction traffic occurs on the days when concrete is delivered to the Development for the construction of turbine foundations.

11.46 Technical ('best practice') construction requirements may necessitate that the concrete for an individual turbine base foundation will have to be delivered and poured in one day to prevent 'cold' joints forming in the structure. As a result, there may be a period in which there will be an increased number of delivery vehicles, compared with the rest of the construction period, entering and leaving the Site. The total number of concrete deliveries for each turbine base foundation may be up to 65 journeys per day.

11.47 This equates to approximately one vehicle movement every five minutes over the working day (0700 to 1900). The following table (Table 11.4) illustrates the worst case percentage change of traffic flow along the proposed access route during the turbine base construction stage of the Development.

CONSENTED (LA01/2018/0200/F)

Table 11.4: Summary of Percentage Increase in Traffic on Local Roads

Road Reference	24 hr Annual Average Daily Flow[2]	Average Recorded Daily HGV Flow[3] as a percentage (No. of HGVs)	Percentage increase of HGVs (No. of HGVs)	Is the IEA (1993) threshold of 30% increase in HGV[4] Traffic Flow exceeded?
Census Point 304, A37 Limavady – Coleraine, West of B66	12,560	7.3% (916)	14% (130)	No
Census Point 307, A37 Coleraine – Limavady, at Dunderg	10,460	7.1% (742)	17.5% (130)	No

11.48 The IEA (1993) threshold of 30% is not exceeded on any of the aforementioned roads and therefore an assessment of potential significant impacts has not been undertaken.

11.49 The above table takes into account maximum HGVs deliveries (65 per day) accessing the site from east or west and returning by the same route.

Cumulative Impact

11.50 There are a number of operational, consented and proposed projects within 10 km of the Site (Table 11.5).

11.51 There is one consented wind farm (Dunbeg Extension Wind Farm) within close proximity to the Development that could theoretically result in cumulative traffic impacts. Similar to the existing Dunbeg Wind Farm, Dunbeg Extension has received planning permission to access onto the Broad Road within 1km of the proposed access for the Development. Whilst both developments intend to utilise the same turbine delivery route and access from the Broad Road, Dunbeg Extension was granted planning consent in April 2017 and therefore is likely to be built in advance of Dunbeg South, and in the unlikely event that the construction periods where to coincide, the peak vehicle movements per day would not exceed the 30% threshold. Dunmore Extension was refused but is the subject of a planning appeal, however, the final sections of the delivery routes are not shared as the site would be accessed from the Bolea Road. As part of the TMP,

[2] 2016 Average Annual Daily Traffic Flow (AADT) (7 day), TRAFFIC and TRAVEL INFORMATION 2016, Department for Infrastructure

[3] 2016 Average Annual Daily Traffic Flow (AADT) (7 day), TRAFFIC and TRAVEL INFORMATION 2016, Department for Infrastructure

[4] HGV corresponds to both OGV1 and OGV2 vehicle classes

CONSENTED (LA01/2018/0200/F)

consideration of any cumulative effects arising from the construction of other wind farm developments will be reviewed in detail and mitigated accordingly.

Table 11.5: Wind Farms in the Vicinity of the Development

Name	Status	Number of Turbines	Distance from Proposed Site Boundary
Cam Burn	Consented	6	8.5 km
Craiggore	Consented	10	7.7 km
Croaghan	Proposed	5	4.5 km
Dunbeg	Operational	14	1.3 km
Dunbeg Extension	Consented	3	0.8 km
Dunmore	Operational	7	2.2 km
Dunmore Extension	In Appeal	8	2.3 km
Rigged Hill	Operational	10	4.2 km
Smulgedon	Consented	7	10.0 km
Upper Ballyrogan	Consented	5	9.0 km

Mitigation

11.52 A Traffic Management Plan (TMP) will be prepared by the Applicant in accordance with the requirements of Department of Infrastructure NI, Causeway Coast & Glens BC, the local PSNI, and if required, any other relevant stakeholders. Features of the TMP will include:

- Details of the access route, conformation of any points along the access route that require street furniture removal, details of traffic numbers, delivery timings, and signage and escort requirements
- A delivery schedule for normal and abnormal loads so as to minimise disruption as far as reasonably practicable
- Details of how any movements will comply with legislation regarding the movement of abnormal loads e.g. notice procedures and notice periods
- Details on the use of escorts where required. Where long vehicles and abnormal loads would have to use the wrong side of the carriageway or need to swing into the path of oncoming vehicles a lead warning vehicle would be used. One escort vehicle would drive ahead and pull oncoming traffic into identified passing places. An escort vehicle would travel directly in front of the convoy and pull over any oncoming traffic that comes onto the road after the first escort vehicle has passed. A further convoy escort vehicle would follow the convoy

CONSENTED (LA01/2018/0200/F)

- Information about marking of vehicles as long/abnormal loads

11.53 Information will be given on how warning signs will be used. These will be used to advise other road users of '*Caution Slow Plant Turning Ahead*' and will be placed at intervals from both directions along the main road approaching the site entrance during the construction phase. The TMP will also detail additional measures to ensure impacts from traffic movements are minimised where possible, for example provision of road sweepers and/or wheel wash facilities.

11.54 If required, the wheel wash facilities will include a waterless drive over wheel wash for lorries. This will be provided at the site entrance to prevent mud and dust being brought out from the Site onto the public highway and anything being brought onto Site from public highway. Although experience has shown the majority of mud is shaken off wheels on site before the vehicle reaches the public road, the site entrance and adjacent public highway will also be monitored and cleaned if necessary.

11.55 The TMP will include details about Video Surveying and Road Repairs. A video survey of the pre-construction condition of all public roads will be recorded around the site entrances and access routes (but including the site entrance and access roads), to provide a baseline record of the state of the roads prior to construction work commencing. This will enable any repairs and maintenance work required to the relevant road due to any damage caused by the passing of heavy vehicles associated with the wind farm construction to be identified following the construction phase. The roads will be returned, at minimum, to the baseline condition at the end of the construction phase. Any damage caused by wind farm traffic during the construction period, which would be hazardous to public traffic, will be repaired immediately. These works will be carried out under permits with DfI Roads, as appropriate.

11.56 The TMP will include plans for notifying relevant stakeholders in advance of delivery periods, including the emergency services, DfI Roads, local residents, local business, local services and schools. The local community will be informed prior to the commencement of construction and prior to the commencement of turbine deliveries by letter and through local press. The contact details of the Construction Site Manager will be made available as a contact point for enquiries. Local schools on the delivery routes will be contacted to identify school and nursery drop-off and pick up locations and times. Construction deliveries will be scheduled to avoid these busy periods as far as reasonably possible.

11.57 If cutting or removal of hedges and trees is required then this should be done outside the bird breeding season (1st March to 31st August). If work is to be done during the breeding season then there should be a survey to establish whether nesting birds are present.

CONSENTED (LA01/2018/0200/F)

Summary

11.58 The main traffic impacts are associated with the increase in HGV vehicle movements along the Broad Road during the construction stage of the project. As this road has relatively high levels of existing traffic, the percentage increase in HGV vehicle movements is not significant. At worst, the frequency of vehicle movements is expected to be one vehicle every five minutes during the construction of each wind turbine foundation.

11.59 Consideration has been given to the effect of increased HGV traffic flow on Severance, Driver Delay, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation, Accidents and Safety and Cumulative Impacts. Furthermore, consideration has been given to the environmental effects of any road improvement/widening works.

11.60 A TMP will be developed and agreed with the relevant stakeholders post consent and pre-construction in order to control and mitigate impacts associated with increased vehicles movements.

11.61 Taking into account the existing vehicle movements on the affected roads, and the proposed type and frequency of vehicle numbers, it is considered that with the appropriate mitigation measures as set out above, there will be no significant impacts.

CONSENTED (LA01/2018/0200/F)

List of References, Figures and Appendices

References

Department of Environment (2009); Best Practice Guidance to Planning Policy Statement 18 – Renewable Energy, Planning and Environmental Policy Group.

Department of Environment (2005); Access, Movement and Parking Planning Policy Statement 3, PPS 3, The Planning Service.

Department of Environment (2015); Northern Area Plan 2016.

Institute of Environmental Assessment (1993); The Institute of Environmental Assessment's Guidelines for the Environmental Assessment of Road Traffic.

Figures

Appendices

CONSENTED (LA01/2018/0200/F)

12

Shadow Flicker

CONSENTED (LA01/2018/0200/F)

12 Shadow Flicker

Shadow Flicker Assessment

12.1 In sunny conditions, any shadow cast by a wind turbine will mirror the movement of the rotor. When the sun is high, any shadows will be confined to the wind farm area but when the sun sinks to a lower azimuth moving shadows can be cast further afield and potentially over adjacent properties. Shadow flicker is generally not a disturbance in the open as light outdoors is reflected from all directions. The possibility of disturbance is greater for occupants of buildings when the moving shadow is cast over an open door or window, since the light source is more directional.

12.2 Whether shadow flicker is a disturbance depends upon the observer's distance from the turbine, the direction of the dwelling and the orientation of its windows and doors from the wind farm, the frequency of the flicker and the duration of the effect, either on any one occasion or averaged over a year.

12.3 In any event and irrespective of distance from the turbines, the flickering frequency will depend upon the rate of rotation and the number of blades. It has been recommended (Clarke, 1991) that the critical frequency should not be above 2.5 Hz, which for a three bladed turbine is equivalent to a rotational speed of 50 rpm. The proposed turbines at Dunbeg South Wind Farm would rotate at a maximum of approximately 16 rpm, well below this threshold.

Reflected Light

12.4 A related visual effect to shadow flicker is that of reflected light. Theoretically, should light be reflected off a rotating turbine blade onto an observer then a stroboscopic effect would be experienced. In practice a number of factors limit the severity of the phenomenon and there are no known reports of reflected light being a significant problem at other wind farms.

12.5 Firstly, wind turbines have a semi-matt surface finish which means that they do not reflect light as strongly as materials such as glass or polished vehicle bodies.

12.6 Secondly, due to the convex surfaces found on a turbine, light will generally be reflected in a divergent manner.

12.7 Thirdly, the variability in flow within a wind farm results in slightly differing orientation of rotor directions, therefore it is unlikely that an observer will experience simultaneous reflections from a number of turbines.

12.8 Fourthly, as with shadow flicker, certain weather conditions and solar positions are required before an observer would experience the phenomenon.

12.9 It is therefore concluded that Dunbeg South Wind Farm will not cause a material reduction to amenity owing to reflected light.

CONSENTED (LA01/2018/0200/F)

Policy and Guidance

12.10 Whilst there is no specific standard for the assessment of shadow flicker in the UK, planning requirements of shadow flicker are contained within Planning Policy Statement 18 (RE 1) "Renewable Energy" (2009) which states:

"... the development will not cause significant harm to the safety or amenity of any sensitive receptors (including future occupants of committed developments) arising from noise; shadow flicker; ice throw; and reflected light;"

12.11 The Best Practice Guidance to Planning Policy Statement 18 "Renewable Energy" (2009) further describes that,

"...at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low".

Methodology

12.12 An analysis of shadow flicker throughout the year from Dunbeg South Wind Farm was carried out, taking into account the behaviour of the sun, the local topography and the turbine layout and dimensions[1]. The analysis was performed using a turbine layout consisting of 9 turbines, each with maximum tip heights of 149.9 m and maximum rotor diameters of 99.8 m.

12.13 In accordance with The Best Practice Guidance to Planning Policy Statement 18 "Renewable Energy" (2009), as described above, analysis would be performed on all occupied houses within 998 metres of any proposed wind turbine. There are no inhabited houses within ten rotor diameters of any of the proposed turbines.

Results

12.14 With due reference to The Best Practice Guidance to Planning Policy Statement 18 "Renewable Energy" (2009) there are no inhabited houses within 10 rotor diameters of the wind farm and thus no flicker is predicted.

12.15 It is therefore concluded that Dunbeg South Wind Farm will not cause a material reduction to residential amenity owing to shadow flicker.

Mitigation

12.16 Mitigation measures can be incorporated into the operation of the wind farm to reduce the instance of shadow flicker. Mitigation measures range from planting tree belts between the affected dwelling and the responsible turbine(s), or installing blinds at the affected dwellings. When there is extreme nuisance, mitigation could be to the extreme of shutting down individual turbines during periods when shadow flicker could theoretically occur.

12.17 As this assessment has illustrated that no instances of shadow flicker, mitigation is not expected to be required.

[1] Turbine ref 03219D0001-06, house ref 03219D0201-01

CONSENTED (LA01/2018/0200/F)

References

[1] The Scottish Office (2002), Planning Advice Note 45
[2] Planning Policy Statement PPS22 (2004)
[3] Clarke A.D (1991), A case of shadow flicker/flashing: assessment and solution, Open University, Milton Keynes
[4] Clarke, A.D (1995), Assessment of Proposed Wind energy Project at Meenacahan, Donegal, Ireland, for Shadow Flicker, Report for B9 Energy Services Ltd
[5] Cloud Cover Statistics from the IPCC Data Distribution Centre: Visualisation Pages (2004), http://www.ipcc-data.org/java/visualisation.html
[6] Planning Policy Statement 18 "Renewable Energy" (including Best Practice Guidance to Planning Policy Statement 18) August 2009

CONSENTED (LA01/2018/0200/F)

13

Socioeconomics

CONSENTED (LA01/2018/0200/F)

13 Socioeconomics

Introduction

Background to the Study

13.1 RES commissioned Oxford Economics in the summer of 2017 to undertake a socioeconomic impact report of the proposed Dunbeg South Wind Farm within the Causeway Coast and Glens Borough Council area.

13.2 This report presents estimates relating to the direct, indirect and induced benefits that could be generated. It also provides a brief discussion on the unquantifiable benefits associated with a development of this type and scale, and the current macroeconomic and socioeconomic environments.

13.3 The proposed Development is located in the Causeway Coast and Glens Borough Council area. The wind farm will have a capacity of up to 29.7 megawatts (MW), consisting of nine three-bladed turbines, with a planned operational lifespan of 30 years. It is anticipated that the electricity generated will be exported to the grid.

13.4 RES has developed and/or constructed 19 onshore wind farms in Northern Ireland totalling 293 MW. RES currently operates over 58 MW of wind capacity across Northern Ireland, has secured planning permission for a further 65 MW awaiting construction, and has 81 MW in the planning system.

Structure of the Report

13.5 This section of the report is structured as follows:

- Firstly, the estimated quantifiable benefits of the construction and on-going phases of the proposed Development are presented – concentrating on employment, gross value added (GVA)[1] and wages. An assessment of the potential fiscal and environmental benefits is also included;
- Secondly, an overview of the socioeconomic conditions, both at the regional and local level, is provided;
- Finally, we set out our overall conclusions in respect to the proposed Development at Dunbeg South.

Caveat

13.6 Specific information related to the proposed Development was provided where possible by RES. The estimated benefits are based on a mix of this information, published data and reasonable assumptions.

[1] Gross value added (GVA) measures the value of goods and services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

CONSENTED (LA01/2018/0200/F)

13.7 The cost of construction could inflate or deflate depending on movements in variables such as exchange rates, demand for wind turbines and metal prices. As such the information is the best current estimate at the time of writing.

13.8 This economic impact study has been developed to form part of the environmental information to be provided to the decision maker. As such, if and when the time comes that the proposed Development is granted full planning permission and has been built, the economic environment may look different. The analysis assumes all facilities contained in the proposed Development are fully developed. We have considered the possibility of displacement during both the construction and operational phases of the development. It is our view that given the current and likely future performance of the local economy, there is little scope for displacement, therefore we have assumed zero levels of displacement in the modelling – see section 13.48-13.50 for further discussion.

13.9 There is no analysis within the report focusing on how the proposed Development would impact income distribution and deprivation levels in the area. This is outside of the scope of this piece of work.

13.10 The quantifiable impacts calculated by Oxford Economics and outlined in this report come from an Economic Impact Model which uses an input-output framework, standard economic underpinnings, published data and few clearly documented reasonable working assumptions. We are aware of other reports such as the Northern Ireland Renewable Industry Group (NIRIG) commissioned study by Redpoint (referred to as “the Redpoint study”) titled “The economic effects of increasing wind deployment in Northern Ireland”[2] or from the Irish Wind Energy Association (IWEA) which try to place a figure on the number of direct and indirect jobs per activity from wind farms. We normally use these only as a test of robustness when job estimates are provided by the client. We have also used reports completed by BiGGAR Economics on behalf of RenewableUK and the Department of Energy and Climate Change (DECC)[3] and on behalf of NIRIG, IWEA and RenewableUK[4] for Northern Ireland specifically, to check the number of construction- and professional-related jobs per megawatt, and have found the figures to be similar in scale to those we have calculated.

13.11 Our modelling does not factor in industry support mechanisms.

Glossary of Definitions

13.12 **Backward linkages**: Backward linkages refer to the channels through which money, materials or information flows between a company and its suppliers, creating a

[2] http://149.255.57.18/~nirigweb/wp-content/uploads/2017/03/Economic-effects-2012.pdf

[3] Onshore Wind Direct & Wider Economic Impacts, May 2012, BiGGAR Economics. Date accessed: 26th July 2017. Accessed using:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48359/5229-onshore-wind-direct--wider-economic-impacts.pdf

[4] http://149.255.57.18/~nirigweb/wp-content/uploads/2017/03/Onshore-Wind-Economic-Benefits-NI.pdf

CONSENTED (LA01/2018/0200/F)

network of economic interdependence. In terms of this study, it refers to the fact that the construction phase of the proposed Development will require the purchase and use of raw materials from sectors like building materials; steel, architectural services etc., which themselves will create supply chain jobs in the economy.

13.13 **Full**-time **equivalents (FTE):** All the modelling completed by Oxford Economics and all the impacts associated with this modelling, assumes that employment is expressed in terms of FTE, which is important given the prevalence of part-time working especially in the construction sector. Accordingly, two part-time workers make up one full-time equivalent worker.

13.14 **Gross value added (GVA):** GVA measures the value of goods and services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

13.15 **Direct (impact**): The direct impact is defined as the economic activity and numbers of people employed by the wind farm (both in construction and in on-going roles).

13.16 **Indirect (impact):** The indirect impact is defined as the economic activity and employment supported in the wind farm's supply chain, as a result of their purchasing of inputs of goods and services from suppliers.

13.17 **Induced (impact):** The induced impact is defined as economic activity and employment supported by those directly or indirectly employed spending their wage income on goods and services in the wider UK economy.

13.18 **Jobs:** Any references to the employment benefits from the on-going phase once the proposed Development becomes operational are expressed in terms of "jobs" per annum. As noted above, these jobs are full-time equivalent in nature.

13.19 **Job years:** Any references to the employment benefits from the construction phase of the proposed Development are expressed in terms of "job years". This is necessary given that construction phase activity normally spans more than a single year. A job year does not necessarily mean one job. Instead it refers to the amount of activity that is required. So, for example two people could be employed for six months – this would equate to one job year of work. Alternatively, one person could be employed for two years - this would equate to two job years of employment. We do not need to use the term job years when talking about the on-going phase, as these benefits are all expressed in per annum terms as discussed above.

13.20 **Nominal prices:** Nominal prices are those which reflect the current situation and are not adjusted for seasonality or inflation.

13.21 **Real prices (2013 prices):** Real prices refer to values that have been adjusted to remove the effects of inflation and are thus measured in terms of the general price level in some base reference year. They give a more accurate measure. In this case, 2013 is the base year as it is consistent with the base/reference year used within UK ONS National Accounts: the Blue Book.

CONSENTED (LA01/2018/0200/F)

Quantifiable Benefits

13.22 This section analyses the estimated quantifiable benefits of the construction and operational phases of the proposed Development - concentrating on employment, GVA and wages, as well as assessing fiscal and further benefits.

Economic impact of the Construction Phase

13.23 The benefits associated with the construction phase of the proposed Development (jobs, wages, GVA and fiscal) are presented as a range. This range results from the implementation of two separate methods of estimating direct construction phase impacts. The first approach uses the value of investment expected to be realised in Northern Ireland. By assigning this to sectors of the economy we can estimate GVA levels, jobs and wages (using published and or forecast data).

13.24 The second approach uses full-time job year equivalent figures provided by RES, based on previous projects they have carried out.

13.25 We then use an input-output model to estimate the indirect and induced impacts that are likely to flow from a given level of investment / activity. An input-output table provides information on how sectors purchase from one another. It also shows how households spend their income. We use UK input-output tables and adjust them to account for the local characteristics.

Method 1: Expenditure approach

13.26 The proposed Development is estimated to result in a total capital spend of approximately £26.02 million in nominal prices. This figure is based on information provided by RES. The total construction phase spend realisable within Northern Ireland is £7.87 million (in nominal prices)[5]. This includes approximately five percent of the estimated £18.22 million turbine cost value, through activities such as the use of local haulage companies and crane companies.

13.27 This regional/total spend split (£7.87 million/£26.02 million) is within ballpark range of that observed in reports carried out by Deloitte and IWEA.[6] The split between construction related spend and professional services related spend is assumed to be £6.59 million and £1.28 million respectively. For the purposes of our modelling, we have converted all this expenditure information into 2013 real

[5] For this analysis, the total construction phase spend is defined as the cost for turbines, Balance of Plant (BoP), food, fuel, plant hire, road maintenance, miscellaneous, and professional.

[6] Jobs and Investment in Irish Wind Energy, Powering Ireland's Economy. Date accessed: 26th July 2017. Accessed from: http://www.iwea.com/contentFiles/Documents%20for%20Download/Publications/IWEA%20Policy%20Documents/2009_06_Jobs_and_Investment_in_Irish_Wind_Energy.pdf?uid=1245084750778

CONSENTED (LA01/2018/0200/F)

prices, to keep it consistent with our model inputs and national accounts publications.[7]

13.28 The construction phase of the proposed Wind Farm is scheduled to commence in January 2020 and last 18 months, starting operations in July 2021. The analysis therefore assumes a constant spend per quarter, leading to 66.6 percent of total spend being realised in 2020 and the remaining 33.3 percent in 2021. As such we use Oxford Economics baseline forecasts for GVA, productivity and wages to estimate the future impacts.

Method 2: Job posts approach

13.29 RES provided Oxford Economics with job figures based on a nine-turbine project (totalling 18MW) with a 24-month construction programme. Given the definition of job years, it is our view that the same volume of work will simply be condensed into a shorter period. For this reason, we have not adjusted the total figure provided by RES. This figure is shared across the construction and professional sector, based on the split used in Method 1 – see above. The job figures used for modelling purposes are outlined in Table 13.1.

Table 13.1: Job year information provided by RES and adjusted for proposed Development

Job years	9 turbine project
Construction	92
Professional	18
Total	**110**

Source: RES.
Note: May not add due to rounding.

Direct construction phase impacts

13.30 The proposed Development's 18-month construction phase is estimated to create or sustain between 85-110 direct job years of employment, 67-92 of which are involved with construction related activities and the remaining 18 job years account for development related activities (Table 13.2).

13.31 This direct construction phase employment would be likely to create or sustain between £2.40-£3.09 million of additional direct wages in the Northern Ireland

[7] The construction phase and operational phase benefits within this section are expressed in real/constant prices with a 2013 base year – this is because 2013 is the base year used for all financial variables within Oxford Economics' suite of models – and thus the Economic Impact Model used to calculate this development's impacts. This is not to say 2013 data has been used – we have used the latest available data and the relevant forecast year in every case – 2013 simply refers to the base year for the constant price series. The construction spend figures provided by RES have been adjusted accordingly for consistency. This base year is used as it is consistent with the base/reference year used within UK ONS National Accounts: the Blue Book.

CONSENTED (LA01/2018/0200/F)

economy. Furthermore, the investment is estimated to directly contribute between £3.10-£4.00 million to regional direct GVA.

Table 13.2: Direct benefits from the construction phase

Direct benefits	Job years	Wages (£2013m)	GVA (£2013m)
Construction related	67 - 92	£1.85 - £2.53	£2.41 - £3.30
Professional services related	18 - 18	£0.56 - £0.56	£0.69 - £0.70
Total	**85 - 110**	**£2.40 - £3.09**	**£3.10 - £4.00**

Source: Oxford Economics
Note: May not add due to rounding

13.32 Oxford Economics are aware of the argument that increased wind farm development is liable to displace jobs in fossil fuel firms (e.g. the UK Energy Research Centre commissioned a review[8] which discusses jobs that are destroyed though shifting of jobs from one industry to another). However, a U.S. based study[9] found that, in the U.S. "…all renewable energy and low carbon sources generate more jobs than the fossil fuel sector per unit of energy delivered."

13.33 Therefore, in the absence of official data, we are happy to stand over our current approach. Furthermore, it would not be feasible to suggest that the Proposed Development would itself in isolation displace any actual activity away from the three fossil fuel power stations (Ballylumford, Coolkeeragh and Kilroot) currently in operation in Northern Ireland. While it could be acknowledged that cumulatively and in the long-run there may be displacement from the fossil fuel industry because of the on-going drive for increased renewables as a collective, to meet the 2020 targets for energy production; this is itself implicit in government policy promoting such renewables in the first place. With an ever-expanding population, demand for energy as a whole is liable to continue to grow. Indeed, a report by the Economic and Social Research Institute (ESRI) for the Strategic Investment Board[10] focused on energy demand in Northern Ireland and factored in changes relating to renewables policy. The report suggested that energy demand should continue to rise in Northern Ireland up to 2025, albeit at a lower rate, and that demand for fossil fuels will remain resilient. Indeed, a scenario whereby they calibrated to ensure that the 40% target of electricity demand in the region is met from renewable sources by 2020 found that Kilroot is actually kept in operation for longer than in the baseline scenario (this baseline is what they suggest will happen using current patterns of energy use and CO2 emissions for Northern Ireland). As such, there are indications

[8] Carbon Neutrality and Carbon Offsets, UK Energy Research Centre, 19th December 2006. Date accessed: 26th July 2017. Accessed from: http://www.ukerc.ac.uk/support/tiki-download_file.php?fileId=2691

[9] Wei, M., Patadia, S., Kammen, D, M., 2010. Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US? Energy Policy 38, pp. 919-931.

[10] A Strategic Energy Scenario Planning Model for Northern Ireland, Final Report for the Strategic Investment Board, Northern Ireland. Economic and Social Research Institute. November 2011.

CONSENTED (LA01/2018/0200/F)

that both renewables and fossil fuels will be needed to meet the energy needs of Northern Ireland.

Indirect and induced construction phase impacts

13.34 The supply chain (or indirect) impacts arising from the construction related activity have been estimated using the latest 2013 UK input-output tables (published by ONS) adjusted to take account of the structure and size of the Northern Ireland economy. In doing so we use academic guidelines like those contained in academic papers such as Flegg, A. T. and Tohmo, T. (2013) “Regional input-output tables and the FLQ formula: A case study of Finland” (Regional Studies, 47 (5). pp. 703-721).

13.35 Construction activity typically has strong “backward linkages” with sectors such as building materials, architectural services, legal services and insurance. These linkages tend to result in job creation elsewhere in the local economy. This makes investment in construction particularly effective in fuelling economic growth. Typically offering high economic multipliers of 2.61 and 1.44 for the UK and Northern Ireland respectively. This means that for every £1 of direct output by the sector, an additional £1.60 and £0.44 is created in the wider UK or Northern Ireland economy, respectively.

13.36 Indirect GVA impacts in Northern Ireland are therefore estimated to be approximately £0.60-£0.79 million, creating or sustaining an estimated 15-20 job years of employment, with associated wages of £0.41-£0.54 million (Table 13.3).

Table 13.3: Total benefits from the construction phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2013m)	GVA (£2013m)
Direct	85 - 110	£2.40 - £3.09	£3.10 - £4.00
Indirect	15 - 20	£0.41 - £0.54	£0.60 - £0.79
Induced	28 - 37	£0.69 - £0.90	£1.03 - £1.33
Total	**128 - 167**	**£3.51 - £4.54**	**£4.72 - £6.12**

Source: Oxford Economics
Note: May not add due to rounding

13.37 As both direct and indirect wages generated through the construction phase are spent—a further round of benefits will spread through the region. This induced effect will support wider employment of approximately 28-37 job years alongside £0.69-£0.90 million of wages. Through the numerous rounds of supply chain and consumer spending, all sectors in the economy will experience some degree of benefit (Table 13.4).

13.38 It is worth noting that the estimated benefits are at a Northern Ireland level. An exact amount attributable to the Causeway Coast and Glens Borough area is more difficult to identify and outside the scope of this report. Invariably it depends on the location of the companies appointed that enjoy the direct benefits and the location of the suppliers who provide them with the materials. However, speaking qualitatively, RES has informed Oxford Economics that their previous projects have

CONSENTED (LA01/2018/0200/F)

utilised local contractors when possible and it remains their intention to use local suppliers for much of the Balance of Plant (BOP) work. It makes sense, not least in terms of the costs and distance argument, to use local firms (e.g. looking at the cost of transporting aggregates). That is, local firms can prove to be more cost efficient given the closer proximity to required capital, personnel and resources.

13.39 Indeed, of 18 existing wind farms developed and / or built in Northern Ireland by RES, 16 have been built by local contractors. In addition, it will always be most cost effective for a contractor to procure stone and concrete from the most locally available source. This means that the vast majority of the direct and indirect benefits are likely to be realised within Northern Ireland, with Causeway Coast and Glens Borough enjoying some uplift at the local level.

13.40 The benefits quantified above have been tested for robustness against reports compiled by BiGGAR Economics on behalf of RenewableUK and the Department of Energy and Climate Change (DECC)[11], and on behalf of NIRIG, IWEA and RenewableUK, for Northern Ireland specifically[12]. In most cases, the benefits were of a similar magnitude.

13.41 The aforementioned BiGGAR Economics report backs up the scale of benefits that can be experienced locally, citing the: "…many local economies throughout the UK over the last few years, which have experienced significant direct, supply chain and wider economic benefits from onshore deployment."

[11] Onshore Wind Direct & Wider Economic Impacts, May 2012, BiGGAR Economics. Date accessed: 26th July 2017. Accessed using:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48359/5229-onshore-wind-direct--wider-economic-impacts.pdf
http://www.renewableuk.com/en/publications/reports.cfm/BiGGAR

[12] http://149.255.57.18/~nirigweb/wp-content/uploads/2017/03/Onshore-Wind-Economic-Benefits-NI.pdf

CONSENTED (LA01/2018/0200/F)

Table 13.4: Total sectoral benefits from the construction phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2013m)	GVA (£2012m)
Agriculture, forestry and fishing	1 - 1	£0.02 - £0.03	£0.01 - £0.02
Mining and quarrying	0 - 0	£0.00 - £0.00	£0.01 - £0.01
Manufacturing	3 - 4	£0.08 - £0.10	£0.17 - £0.23
Electricity, gas, and steam	0 - 0	£0.01 - £0.01	£0.02 - £0.02
Water supply; sewerage and waste	0 - 0	£0.00 - £0.00	£0.02 - £0.02
Construction	74 - 101	£2.03 - £2.78	£2.64 - £3.62
Wholesale and retail	8 - 10	£0.18 - £0.24	£0.30 - £0.39
Transportation and storage	2 - 2	£0.04 - £0.05	£0.06 - £0.08
Accommodation and food	5 - 6	£0.09 - £0.12	£0.10 - £0.13
Information and communication	1 - 1	£0.03 - £0.04	£0.05 - £0.07
Financial and insurance	1 - 2	£0.04 - £0.05	£0.09 - £0.11
Real estate	6 - 8	£0.15 - £0.19	£0.24 - £0.32
Professional, scientific and technical	19 - 20	£0.61 - £0.63	£0.76 - £0.78
Administrative and support	4 - 5	£0.08 - £0.11	£0.09 - £0.11
Public administration and defence	0 - 0	£0.01 - £0.01	£0.02 - £0.03
Education	1 - 1	£0.03 - £0.04	£0.04 - £0.04
Human health and social work	1 - 2	£0.04 - £0.05	£0.04 - £0.05
Arts, entertainment and recreation	1 - 2	£0.03 - £0.03	£0.02 - £0.03
Other services	1 - 2	£0.03 - £0.04	£0.04 - £0.05
Total	**128 - 167**	**£3.51 - £4.54**	**£4.72 - £6.12**

Source: Oxford Economics
Note: May not add due to rounding

Economic impact of the operational phase

13.42 The starting point for modelling the operational phase of the project uses operations and maintenance direct job post figures again provided by RES, based on their extensive experience of operating projects not only in Northern Ireland but across the UK. From there, all indirect and induced estimates are produced using the Economic Impact Model.

Direct operational impacts

13.43 Following the 18-month construction phase, the development is expected to be operational in July 2021. The operational phase impact estimates have therefore been produced using Oxford Economics' 2021 forecasts of both GVA, productivity and wages. Additional earnings/wages have been estimated using Oxford Economics forecasts for average annual earnings per worker from the broad sector 'Electricity, gas and steam' in 2021 (these forecasts are themselves based on published data in the Annual Survey of Hours and Earnings).

CONSENTED (LA01/2018/0200/F)

13.44 RES have informed Oxford Economics that the proposed Development will sustain one direct FTE job per annum, in the capacity of an asset manager (Table 13.5).[13]

13.45 The total direct wage is estimated to be £0.04 million per year. After applying productivity estimates, this on-going direct employment is expected to generate £0.16 million of GVA per annum. Given the 30-year lifetime of the development, this equates to 30 direct job years of employment, £1.32 million of direct wages and £4.86 million of direct GVA over the entirety of the operational phase.

Table 13.5: Direct annual benefits from the operational phase

Direct benefits	Jobs	Wages (£2013m)	GVA (£2013m)
Asset manager	1	£0.04	£0.16
Total	**1**	**£0.04**	**£0.16**

Source: Oxford Economics
Note: May not add due to rounding

Indirect and induced operational impacts

13.46 The electricity industry plays a significant role in enabling other parts of the economy to be more productive. The sector itself is one of the most productive in Northern Ireland, with output per worker significantly above that of the regional and national average overall. This reflects both the impact of high levels of investment and improving technology on productivity in the sector.

13.47 Using the adjusted UK input-output tables to identify the supply chain spending, it is estimated that the proposed Development is likely to create or sustain a further indirect job in the Northern Ireland economy each year, with wages and GVA of £0.02 million and £0.06 million per annum respectively (Table 13.6).

Table 13.6: Total annual benefits from the operational phase

Total (direct, indirect and induced) benefits	Jobs	Wages (£2013m)	GVA (£2013m)
Direct	1.0	£0.04	£0.16
Indirect	0.7	£0.02	£0.06
Induced	0.7	£0.02	£0.03
Total	**2.4**	**£0.08**	**£0.24**

Source: Oxford Economics
Note: May not add due to rounding

[13] Given spare capacity in the economy and the relatively small scale of the development, assumptions include job displacement of zero relating to the operational phase estimates - see 6.48 – 6.50 for further discussion.

CONSENTED (LA01/2018/0200/F)

Table 13.7: Total annual sectoral benefits from the operational phase

Total (direct, indirect and induced) sectoral benefits	Jobs	Wages (£2013m)	GVA (£2013m)
Agriculture, forestry and fishing	0.0	£0.00	£0.00
Mining and quarrying	0.2	£0.00	£0.02
Manufacturing	0.1	£0.00	£0.01
Electricity, gas, and steam	1.1	£0.05	£0.18
Water supply; sewerage and waste	0.0	£0.00	£0.00
Construction	0.0	£0.00	£0.00
Wholesale and retail	0.2	£0.00	£0.01
Transportation and storage	0.0	£0.00	£0.00
Accommodation and food	0.1	£0.00	£0.00
Information and communication	0.0	£0.00	£0.00
Financial and insurance	0.1	£0.00	£0.00
Real estate	0.1	£0.00	£0.01
Professional, scientific and technical	0.1	£0.00	£0.00
Administrative and support	0.1	£0.00	£0.00
Public administration and defence	0.0	£0.00	£0.00
Education	0.0	£0.00	£0.00
Human health and social work	0.0	£0.00	£0.00
Arts, entertainment and recreation	0.0	£0.00	£0.00
Other services	0.0	£0.00	£0.00
Total	**2.4**	**£0.08**	**£0.24**

Source: Oxford Economics
Note: May not add due to rounding

The exclusion of displacement from this study

13.48 We applied a zero rate of displacement in our modelling given the significant spare capacity in the construction sector. Northern Ireland's construction sector suffered the greatest employment losses following the onset of the recession. In number terms, the value of output in NI and employment levels are nearly 29% below 2008 peaks. Elsewhere, job seekers allowance data shows that in June 2017 there were over 3,600 people seeking employment in "Skilled trade occupations". Combined this suggests that spare capacity exists. Indeed, this is further supported by the most recent Northern Ireland Construction Bulletin[14] which notes:

"The construction sector in Northern Ireland has been the most severely impacted both in terms of output and jobs since the economic downturn. Construction output peaked in 2007 and was the first sector in Northern Ireland to experience a slowdown. Since then the construction sector experienced a consistent general downward trend in output. That consistent decline appears to have occurred until Q4 2013 but since then there has been a gradual improvement in output levels in

[14] https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/Construction-bulletin-Q1-2017.pdf

CONSENTED (LA01/2018/0200/F)

the construction sector. The current levels of construction output are approximately one third lower than the levels reported in the quarters before the downturn in 2007. Relatively speaking, the Northern Ireland construction sector also experienced a more severe downturn than the Great Britain construction sector in that period.

As well as the impact on output, the downturn in construction has also impacted on the construction sector's labour market with the number of jobs and self-employment well down on peak levels. The latest figures from the Northern Ireland Labour Market Report estimate that the number of employee jobs in the Construction sector in Northern Ireland has fallen by over a third since 2007. The other employment sectors in Northern Ireland have been relatively less affected in terms of job losses than the construction sector over the same time period."

13.49 Although the UK and Northern Ireland are finally out of recession, the outlook for the sector remains one of fairly slow recovery as government and businesses make cuts in capital expenditure, and a demand from commercial and residential property is only now beginning to pick up. Job levels are likely to remain below the peak not just over the short-term, but well beyond. The boom period for the sector from pre-recession (with the aid of demand for the Republic of Ireland) is a thing of the past. Even during the boom, the construction sector always seemed to cope with extra demand as it presented itself. All this published data and information is a clear sign of the spare capacity that still exists.

13.50 We also apply zero displacement in the estimation of operational benefits. The wind farm will be located on farming land. We have been informed by RES that it will not affect day to day operations on the farm and any single farm payments lost, will be replaced directly by RES. We also assume the wind farm will not displace any other electricity generating activity in the rest of Northern Ireland.

Increased tax revenues and benefit savings

13.51 As part of this analysis it is assumed that approximately 34.2 percent of total wages would be paid to the Treasury through the channels of taxation.[15] This considers not only income tax, but value added tax through the purchase of goods and services by those in direct, indirect and induced employment.

13.52 During the construction period of the proposed Development, tax receipts are likely to reach between £1.20-£1.55 million (including direct, indirect and induced wage impacts). The operational phase is estimated to generate approximately £0.03 million in additional tax receipts each year of operation (Table 13.8). Over 30 years this would equate to £0.83 million in additional tax revenue.

[15] Based on the ONS publication 'The effects of taxes and benefits on household incomes, 2015/16'

CONSENTED (LA01/2018/0200/F)

Table 13.8: Annual tax revenues arising from the proposed Development

Tax revenue (over entire construction phase; per annum of on-going phase)	Wages (£2013m)	Tax revenue (£2013m)
Construction phase	£3.51 - £4.54	£1.20 - £1.55
Operational phase	£0.08	£0.03
Total	**£3.59 - £4.62**	**£1.23 - £1.58**

Source: Oxford Economics
Note: May not add due to rounding

13.53 In addition to tax receipts, employment creation will provide benefit savings. That is, assuming that each additional job attracts someone from the ranks of the unemployed directly or indirectly through the "job chain" effect, the construction or on-going operation of the site. While the Proposed Development may take someone from their current job, they will leave a vacancy and that will have to be filled, and so on and so forth – so eventually, a job will be filled down the line by someone from the ranks of the unemployed, though not necessarily directly. As such, the creation of a new job in the economy will lead to a reduction in the unemployed by a similar amount.

13.54 Currently, unemployment benefit varies between £57.90 and £114.85 per week.[16] Using these lower and upper levels, we estimate between £0.39-£1 million of savings will be made during the construction phase of the proposed Development (Table 13.9).

Table 13.9: Annual benefits saving arising from the construction phase

Construction phase	Unemployment savings (£2013m)	
	Upper	Lower
Direct	£0.51 - £0.66	£0.26 - £0.33
Indirect	£0.09 - £0.12	£0.05 - £0.06
Induced	£0.17 - £0.22	£0.09 - £0.11
Total	**£0.77 - £1.00**	**£0.39 - £0.50**

Source: Oxford Economics
Note: May not add due to rounding

Other quantifiable benefits of the proposed the Development

Rates, taxes and land rentals contributions

13.55 Wind farms in Northern Ireland are assigned a rateable value charged of £27,500 per megawatt per annum, based on the current average rateable value of similar

[16] Figures taken from https://www.gov.uk/jobseekers-allowance/overview. Date accessed: 27th July 2017

CONSENTED (LA01/2018/0200/F)

properties in the valuation list.[17] Using the current rateable value and given that the proposed Development will have a total capacity of 29.7MW, this means a figure of £816,750 in rates payments to the government annually, or approximately £24.5 million over the course of the project.

13.56 It should be noted that there is a difference in the rateable value charged on which the above figures are based, and the business rates revenue collected by the local Councils and the Northern Ireland Assembly – allowing for regional and district rate poundages. The most recent figures for Causeway Coast and Glens Borough Council indicate (total) non-domestic poundage rates of 57.3p for every £1, of which 32.9p is a regional rate paid to the Northern Ireland Assembly, and 24.4p of which is a district rate paid to the local Council.[18]

13.57 By applying the Non-Domestic Rate Poundage for Causeway Coast and Glens, the above rateable values would leave additional business rates revenue of £468,795 per annum and £14.1 million over the 30-year lifetime of the project. In every case, 42.6% of the totals would be attributable to the local Council (Causeway Coast and Glens Borough Council) and the remaining 57.4% would be realised by the Northern Ireland Assembly.

13.58 All these additional payments referred to in this paragraph will result in increased income to the recipients, who will spend it in the Northern Ireland economy; over and above those already accounted for in the construction and on-going operations phase results.

13.59 Over the lifetime of the project, rates, taxes and land rental will collectively amount to approximately £30.5 million.

Energy and Environmental benefits

13.60 According to a report published by Northern Ireland's Department for the Economy, namely 'Energy in Northern Ireland 2014'[19], around 2,000 businesses in the non-financial sector engaged in some Low Carbon and Renewable Energy (LCRE) activity. Of which, the Low Carbon Electricity group[20] accounted for around one fifth of all businesses, about one quarter of total turnover but less than 10% of employees.

13.61 Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[21]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens Borough Council area.

---

17 Sourced from Northern Ireland's Department of Finance

18 https://www.finance-ni.gov.uk/articles/poundages-2017-2018. Date accessed: 27th July 2017.

19 https://www.economy-ni.gov.uk/sites/default/files/publications/deti/energy-northern-ireland-2016.pdf

20 Low Carbon Electricity group includes offshore wind, Onshore wind, Solar Photovoltaic, Hydropower, Other renewable electricity, Nuclear power, Carbon capture and storage

21 This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

CONSENTED (LA01/2018/0200/F)

13.62 The proposed Development is also estimated to reduce CO_2 emissions by 40,800 tonnes each year. This equivalent to 30,100 newly registered cars.[22]

Socioeconomic Context

Global challenges remain

13.63 Global economic growth has remained fairly consistent in recent years, yet performance continues to vary across countries. Growth in the UK moderated in 2016 and is expected to weaken slightly in 2017, before improving over the medium term. Elsewhere, the Eurozone economy is expanding at the fastest pace in a decade and is expected to average growth of 1.4% a year between 2017 and 2020. Although this rate of growth lags global growth, which is likely to average 1.7% a year over the same period, it is expected to outperform the UK (1.1%).

13.64 Global prospects remain vulnerable to several risks, however. As the second largest economy, China's continued slowdown is likely to impact global trade and financial markets. Despite recent improvements in Eurozone's growth, the area continues to struggle with relatively high levels of sovereign debt, and more lately, has seen growth in populist political ideas.

13.65 Several global factors led to the fall in world oil prices, however it was strongly impacted by the slowdown in global demand. As a result, world oil prices now rest at their lowest levels in over a decade. Oxford Economics forecast that world oil prices will begin a gradual recovery over the medium term, however this is vulnerable to developments in global demand.

The UK economy and impact of Brexit

13.66 The decision made by the public to leave the EU (Brexit) will have a marked impact on growth in the UK, its regions and local areas, including Northern Ireland and Causeway Coast and Glens Council Borough. The exact outcome of Brexit is uncertain and will depend on a mix of trade deals and other domestic policies. Indeed, Brexit is likely to weigh on business and investor confidence – both domestically and further afield over the medium term. Consequently, Oxford Economics' have lowered the UK's growth prospects, which in turn will feed through to the more local level. Growth in the UK will continue to be driven by high value services, which tend to favour urban centres given their large populations. Therefore, more rural areas are likely to find the future growth more challenging.

Northern Ireland slow to regain lost ground

13.67 The impact of the recession is still evident in Northern Ireland. Having suffered the greatest job losses in the UK between 2008 and 2012 where levels contracted by 8%, employment remains below pre-recessionary peaks. Going forward we expect a slow labour market recovery, with job levels only reaching pre-recession peaks in 2023.

[22] https://www.gov.uk/government/publications/new-car-carbon-dioxide-emissions

CONSENTED (LA01/2018/0200/F)

Over the forecast period, between 2017 and 2027, growth is likely to average 0.3% a year for the region.

Causeway Coast and Glens economy facing a challenging outlook

13.68 The Causeway Coast and Glens Council area struggled with relatively weak employment growth even before the downturn. Between 2007 and 2016, employment growth in the Council area was by far the weakest in Northern Ireland, with the number of jobs contracting by 1.3% a year. Looking ahead local employment levels are expected to remain relatively unchanged from 2017 and 2027, making it one of the weakest performing areas in the region. This compares to 0.3% growth in Northern Ireland over the same period. For Causeway Coast and Glens to match regional growth it would require an additional 1,500 jobs over the period. Even then, the local area would lag the UK growth rate of 0.5% a year in the decade to 2027.

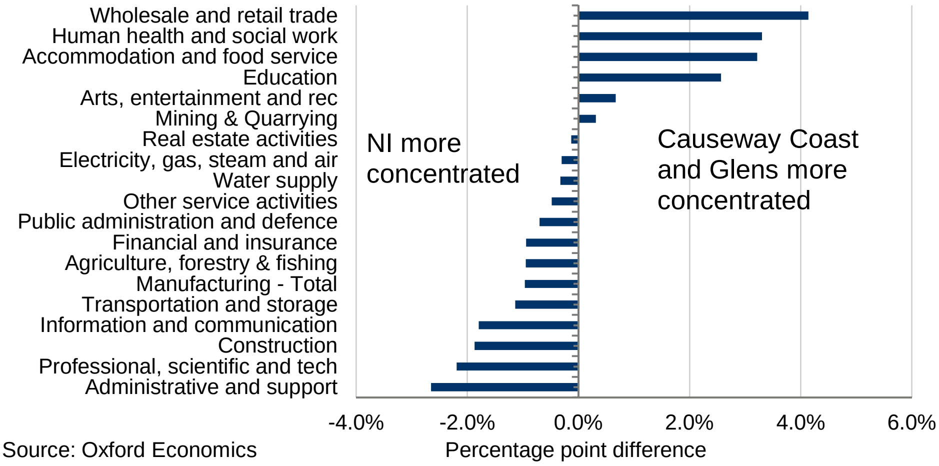
Job growth is expected from administration, professional services and construction. Between 2017 and 2027 these sectors combined are likely to create just under 500 jobs. Nonetheless these gains will be offset by losses in manufacturing and public administration, which are expected to lose over 600 jobs.

13.69 Employment growth prospects in the Council area can be, in part, explained by the area’s employment structure. The figure below plots the percentage point difference between the share of employment by sector in Causeway Coast and Glens to Northern Ireland’s average. Sectors with a positive value employ a greater share of employment in the local area than in Northern Ireland as a whole. Conversely, sectors with a negative value employ a smaller share of employment in the local area compared to the regional average.

13.70 The Causeway Coast and Glens Council area is relatively less exposed to construction (compared to the regional average) and the heavy job losses it suffered during the recession. Relative to Northern Ireland’s overall economy, the Council area has above average employment in health and education, which to an extent have been “ring-fenced” from previous rounds of budget cuts. Nonetheless, future growth in the local economy is restrained by the limited growth predicted from these areas of the economy.

CONSENTED (LA01/2018/0200/F)

Figure 13.1: Sectoral concentration of employment, Causeway Coast and Glens vs. Northern Ireland, 2017



Source: Oxford Economics

Employment measures among the weakest in the region

13.71 Working age economic activity within Causeway Coast and Glens District Council is amongst the lowest in Northern Ireland. NINIS estimates show that 69.9% of working age residents were economically active (employed or unemployed but seeking work) in 2015. However, this rate was three percentage points lower than the regional average in the same year.

13.72 Unemployment is also a concern for the local economy. We estimate that 51% of the area's resident population aged 16+ were in employment in 2016, the second weakest in Northern Ireland. Elsewhere the ILO measure of the unemployment rate was notably higher than most other local areas at 9.6% in 2016, and therefore was also considerably higher than the regional average of 6.1%.

13.73 The District Council area's population growth has been relatively weak. Between 2008 and 2016 we estimate that Causeway Coast and Glen's population has ranked toward the bottom of all local areas in Northern Ireland, averaging growth of 0.4% a year – 0.2 percentage points lower than at the regional level. This has been driven in part my migration trends, which in turn have been influenced by a subdued labour market and relatively low paid jobs (both workplace and residence based). Over the period between 2008 and 2016, cumulative net-out migration is estimated at 3,800 – the third largest net outflow from any Council area in the region.

13.74 Historically, residence based wages have remained consistently higher than workplace based wages in the Causeway Coast and Glens Borough Council area. Indeed, the gap between the two began to widen significantly following the onset of the recession. This gap has been largely sustained over recent years. This suggests residents can gain better paid jobs by commuting to other areas for work.

CONSENTED (LA01/2018/0200/F)

Local skill levels among the lowest in Northern Ireland

13.75 Skills and educational attainment are increasingly important to an individual's employment prospects in the modern services driven, "skills hungry" economy. The latest labour market statistics published by NINIS show that, the working age population in the Causeway Coast and Glens Council area had the fourth highest proportion with no qualifications at 18.2% and 1.7 percentage points higher than the regional average.

13.76 In terms of attainment of higher skills the Council area performs even less favourably. According to figures published by NINIS, the proportion of the Council area's working age residents (aged between 16 and 64) attaining degree level qualifications or above stood at 21.9% in 2015 – the lowest of Northern Ireland's 11 Council areas. This figure is below the regional average of 29.9%, marking a difference of eight percentage points.

13.77 Relatively poor skill levels are likely to mean residents invariably do not possess the skills demanded by employers and are therefore more likely be excluded from the labour market. Weak job growth coupled with below average skill levels are likely to contribute to economic inactivity and social exclusion within the local community going forward.

13.78 The local economy faces some key socio-economic challenges, which have been further exposed by the last recession. The relatively weak employment outlook is likely to make it more challenging for the local council to address economic need and development. Therefore, investment and development opportunities in the area should be encouraged in order to promote opportunities and boost economic growth prospects.

Conclusions

13.79 The proposed Development will offer substantial economic benefits to the local and regional economy. Significant job creation and economic activity will result throughout its construction, with a strong likelihood of local labour involvement. Both the construction and operational phase will generate increased tax and business rates revenue payable to central, regional and local government.

13.80 Investment of this type and scale can provide positive catalytic benefits which can in turn attract further investment into Northern Ireland. For example, the knowledge, expertise and skills accumulated can act as a contributing factor to future investments in the area. Other local areas within Northern Ireland may also benefit as a result, helping to reduce the inequality across the region as a whole. Funding for such developments are usually project specific and involve a considerable amount of sunk costs. Therefore if the development does not take place the benefits, including the catalytic impact, are unlikely to be realised elsewhere in the Northern Ireland economy. A study carried out by fDi intelligence[23]

[23] http://www.detini.gov.uk/attracting_fdi_executive_summary.pdf

CONSENTED (LA01/2018/0200/F)

on behalf of DETI states that the renewable energy sector (including wind turbines) is forecast to be the fastest growing sector for FDI globally and into the UK in the next five years, which will increase demand for R&D investment. Northern Ireland should be able to compete for R&D investment in renewable energy.

13.81 The proposed Development is estimated to involve a capital spend of £26.02 million. Of this total, £7.87 million (nominal prices) will be realised within the Northern Ireland economy. The projected 18-month construction phase is estimated to create or sustain 128-167 total (direct, indirect and induced) job years of employment, £3.51-£4.54 million of wages and £4.72-£6.12 million (£2013 prices) of GVA to the Northern Ireland economy.

13.82 The estimated total (direct, indirect and induced) benefits from the operational phase of the proposed Development includes 71 job years within Northern Ireland, with associated wages of £2.4 million and £7.3 million (£2013 prices) in GVA over the 30-year operating period.

13.83 Over the Development's construction phase the UK Exchequer is estimated to benefit from increased tax revenue and benefits saving of £1.59-£2.55 million. In addition to this, each year of operation is likely to yield a further £0.03-£0.04 million of increased tax revenue and benefit savings (in constant prices). Over the 30-year project life, we estimate that £2.6-£3.8 million would be realised in raised revenue and benefits savings.[24]

13.84 Based on rateable values of £27,500 per MW—we calculate that the proposed Development will increase rateable value by £816,750 each year, or by £24.5m over the project horizon. From these values business rates are calculated and collected for local Councils and the Northern Ireland Assembly. By applying Causeway Coast and Glens Borough Council non-domestic poundage rates, we estimate additional business rates of £468,795 each year and £14.1m over the 30-year lifetime of the project.

[24] This analysis relates to results from Method 1.

CONSENTED (LA01/2018/0200/F)

14

Summary of Effects

CONSENTED (LA01/2018/0200/F)

14 Summary of Effects

Introduction

14.1 This chapter summarises the findings of Chapters 4 – 13 of the Environmental Statement, which have firstly described the aspects of the environment likely to be significantly affected by the Development and then assessed the likely residual effects after mitigation measures have been taken into account. Each assessment has been undertaken both for the period of construction of the Development, when it is built and operational and, where appropriate, the decommissioning phase.

Assessments

Chapter 4: Landscape & Visual

14.2 The Landscape and Visual Impact Assessment (LVIA) methodology was specifically developed for wind farm development in Northern Ireland in accordance with best practice guidance. The LVIA considered a 30 km radius Study Area and involved a combination of existing desktop information (maps, planning policy and existing landscape character assessment documents), detailed site surveys of the Study Area and computer modelling.

14.3 Potential landscape and visual effects were assessed as separate but linked issues. The magnitude of landscape effects was derived from the extent to which physical changes cause changes in landscape character and value. Visual effects relate to changes in the composition of views and people's perception of/responses to these physical changes. Viewers / visual receptors include local residents, tourists, walkers, farmers, general road users etc.

14.4 For both landscape and visual effects the Significance of effect was derived from the assessment of Landscape Value, Sensitivity and Magnitude of change and also by using objective professional judgement in relation to site circumstances.

14.5 The Development is located in the south eastern part of the Binevenagh AONB and within the Binevenagh Landscape Character Area (LCA) and a detailed description is included within Chapter 4.

14.6 Although the Development is not located within the core of the Binevenagh AONB it is recognised that the proposal is within the AONB and that the site has merit in terms of its contribution to the landscape and visual character of the wider AONB. The layout and position of the Development has, therefore been designed to minimise its effect on the AONB as a whole. This has been achieved by locating it away from the core area containing the majority of visitor attractions and iconic landscape features. It is also in a location that is closely related to existing wind turbines, and that is neither highly visible from the rest of the AONB nor from other parts of the Study Area with good views to the core part of the AONB. These are

CONSENTED (LA01/2018/0200/F)

considered to be the summit / escarpment of Binevenagh and the lowlands to the north of this escarpment.

14.7 The overall conclusion of the LVIA is that the landscape effects on the Binevenagh Landscape Character Area, in which the Development is located are Not Significant due to the Development's location within the same part of the landscape as the Dunbeg cluster of wind farms, and the presence of other human factors that strongly influence the landscape character.

14.8 Of a total of 27 viewpoints representing typical levels of visibility throughout the study area, three viewpoints, which are all close range viewpoints, were assessed as being significantly affected. The remaining 24 viewpoints were assessed as experiencing No Significant visual effects.

14.9 In terms of cumulative landscape effects the Development was not deemed to have a significant effect on the receiving landscape. Clusters of wind farms located on upland areas are a relatively common landscape characteristic but there are sufficient separation distances between these clusters to ensure they are not the dominant characteristic.

14.10 Of the 27 viewpoints only one is judged to experience significant cumulative visual effects on views. This is a close range view on a tertiary road where the primary visual receptors would be residents of properties and where views towards the existing Dunbeg cluster are screened by woodland along the Curly River corridor. The remaining 26 viewpoints are deemed to experience no significant cumulative visual effects.

14.11 All policy documents (the SPPS, PPS 18 and its best practice and supplementary guidance) recognise that wind farms may be prominent elements in close range views but that this does not necessarily equate to unacceptable development. Taking into account that only three of the 27 viewpoints assessed as part of the LVIA are deemed to experience significant visual effects, and that no significant landscape effects have been identified, the LVIA concludes that the Development is acceptable in landscape and visual terms.

Chapter 5: Archaeology & Cultural Heritage

14.12 An Archaeological & Cultural Heritage impact assessment was conducted for the Development. The purpose of this was to identify the archaeological potential of the Site, assess the impact of the Development upon this and to assess the impact on known archaeological monuments in the wider landscape.

14.13 The desk top survey and site inspection identified 6 known monuments within the area of land ownership and an additional 80 known archaeological monuments within the 5 km search radius. Of the monuments located within the Site, only LDY 10:21 will be directly affected by the Development. This monument consists of a number of early field systems and hut circles which extend over a relatively large area in the north western section of the Site. The full extent of this monument is

CONSENTED (LA01/2018/0200/F)

not known but it is believed to cover approximately 900m x 800m. It is likely that the infrastructure for turbines T1, T2 and T3 and possibly the turbine bases themselves will come into some contact with elements of this monument. Should this occur, the construction of the proposed development would result in a partial or minor loss of some elements of the baseline conditions of the monument. Any effect this would have on the monument would be significantly reduced through the implementation of the recommended mitigation strategy.

14.14 For visual impact analysis, a 10 km search radius was used to identify monuments of regional importance and listed buildings. A total of 40 regionally important monuments, 4 historic gardens and 15 historic buildings were identified. Through the use of ZTV mapping, wireframe production and site inspections it was established that only twelve monuments and one historic garden would be potentially inter-visible with the Development.

14.15 Consultation with DFC:HED was conducted to establish which of these would require further analysis. The assessment found that the introduction of the Development into the local landscape will have a negligible-slight effect upon their setting.

14.16 Given the presence of the known monuments within the proposed application boundary and the extent of archaeological sites within the wider area, a mitigation strategy was recommended for the construction phase. The aim of this is to identify any potential archaeological deposits uncovered during the construction phase of the project.

14.17 An assessment of cumulative impacts on the archaeology and cultural heritage of the area was undertaken, and it was concluded that there will be no significant effects.

Chapter 6: Ecology

14.18 The study methodology for the Ecological Impact Assessment included both desktop and field survey methods in order to assess the potential impact on local ecological and nature conservation interest. The purpose of an ecological survey is to identify 'valued ecological receptors', those species and habitats that are valued in some way for their ecological function, their contribution to biodiversity or are protected by specific legislation. The following specialist surveys were undertaken during 2016/2017 on the site including suitable buffer zones:

- Habitats
- Bat survey
- Otter survey
- Badger survey
- Common Lizard survey
- Smooth Newt habitat survey
- Marsh Fritillary butterfly habitat survey
- Argent & Sable moth habitat survey

CONSENTED (LA01/2018/0200/F)

14.19 Features of conservation interest and importance were recorded and their locations were one of the key criteria that affected the wind farm layout. The location of the wind farm infrastructure avoids habitats and species of conservation interest where possible, and where this is not possible, mitigation and/or enhancement measures have been incorporated into the design to balance any detrimental impact.

14.20 Ecological constraints determined from extensive site surveys have been used to evolve the layout and design of the Development. The impact assessment is therefore based on a wind farm design that already includes a number of important mitigation measures.

14.21 Utilising existing farm access tracks (by upgrading where appropriate) has minimised the extent of the footprint on undeveloped land, in combination with reducing the extent of infrastructure using smaller crane pads and combining site infrastructure has reduced the overall footprint and resulting impacts on habitats.

14.22 A series of generic and specific mitigation measures including a Peat Management Plan and a Habitat Management Plan have been proposed to mitigate effects on wet heath vegetation.

14.23 The Development will result in permanent habitat loss of 6.9 hectares (ha) and temporary habitat loss of 3.3ha, largely comprising purple moor-grass & rush pasture (PMGRP) and wet (dwarf shrub) heath, although small areas of other habitats will also be lost, such as acid grassland mosaic and poor semi-improved grassland.

14.24 The extent of habitat loss has been used to inform the prescriptions detailed in the Habitat Management Plan, including a commitment to establish at least twice the area lost for PMGRP and five times for wet heath (an NI Priority Habitat).

14.25 After implementation of the mitigation measures proposed in this chapter it is assessed that there would be no significant residual adverse effects on Northern Ireland priority habitats (wet heathland) as a result of the Development. Indeed, it is assessed that the Habitat Management Plan would deliver a net beneficial effect during operation by enhancing currently degraded wet heath habitats.

14.26 There is no recorded usage of the area by otter, marsh fritillary or argent & sable moth, therefore no impacts to these species is likely. Mitigation for the herpetofauna found on site (smooth newt and common lizard) is proposed. This involves the provision of artificial refugia and habitat management, as well as drift fencing and mowing/hand clearance during the construction phase. Badger setts found during survey have all been buffered by 25m. Ground Water Dependent Terrestrial Ecosystems (GWDTEs) have all been buffered by 50m.

14.27 The layout of the Development, in terms of the separation distance between the wind turbines and relevant features, and the maintenance of this throughout the lifetime of the wind farm, will ensure that any potential impacts to bats will be neutral. In conclusion, and based on current knowledge, this would appear to be a Site posing little risk to bats or bat populations, however a BMP has been recommended as a precaution.

CONSENTED (LA01/2018/0200/F)

14.28 Therefore, the potential effects of the Development on ecological receptors have been assessed and it is concluded that with the implementation of appropriate mitigation measures the effects would be reduced to a minor adverse or neutral effect that would not adversely affect the ecological integrity of the site and the wider area.

14.29 An assessment of cumulative impacts on the habitats and fauna of the area was also undertaken, and it was concluded that there will be no significant effects.

Chapter 7: Ornithology

14.30 The ornithology impact assessment considered the potential effects of construction, operation and decommissioning of the Development on the following key bird communities:

- Breeding birds
- Wintering and migrating birds
- Raptors (birds of prey).

Vantage point surveys, breeding bird surveys and wintering bird surveys were carried out in the period 2015-2017.

14.31 For red grouse and for all passerine species it is extremely unlikely that any adverse effects would occur. For snipe, displacement of two breeding pairs is probable but the effect falls well short of being significant at the regional (Northern Ireland) level.

14.32 Collision risk for all raptor species which use the site on a regular basis has been estimated using the SNH Collision Risk Model. For hen harrier collision risk is predicted to be negligible. For kestrel and buzzard a small number of collisions is predicted to occur during the expected 30 year operational life of the wind farm, however when placed in the context of the very widespread distributions of both these species and also other relevant factors (discussed in the assessment) then it is extremely unlikely that the predicted collisions would have a significant adverse effect on the distribution and abundance of these species at the regional (Northern Ireland) level.

14.33 In view of these key points, and assuming implementation of the proposed mitigation measures, it is concluded that the Development would not have any significant adverse effects on local bird populations or on the distribution and abundance of sensitive species at the regional (Northern Ireland) level.

CONSENTED (LA01/2018/0200/F)

Chapter 8: Fisheries

14.34 The fisheries impact assessment outlines the potential effects of the Development on the fish stocks and fish habitats of the receiving watercourses in the Curly River and wider Roe catchment. It provides relevant baseline information on fisheries, gathered through desktop and field survey, enabling the potential effects to be identified and evaluated.

14.35 The survey has shown that the principal drainage stream (Stream C) is populated by brown trout throughout its course within the Site Boundary and downstream of the site to the Curly River. In addition, the connected section of the Curly River, approximately 1km downstream of the Site, is an important spawning and nursery area for Atlantic salmon and is also included as part of the Special Area of Conservation (SAC).

14.36 It has been determined that potential effects are primarily related to the sediment run-off to the receiving watercourses with related effects on fish stocks and their habitats. Although these impacts have the potential to be significant, a series of specific mitigation measures have been designed to avoid adverse effects on fisheries with regard to both the construction and operational phases of the project, including buffer zones around watercourses; good construction practice; the implementation of a Sustainable Drainage System (SuDS) and the use of bottomless culverts at the two most sensitive watercourse crossings.

14.37 It is concluded that, provided the mitigation measures are implemented as specified, construction and operation of the Development will have a neutral impact on the fish stocks and aquatic biology of the Curly River and the wider River Roe catchment. It follows that the Development will have no effect on the Atlantic salmon as the primary feature of the River Roe and Tributaries ASSI/SAC.

14.38 An assessment of cumulative impacts on fisheries interests of the area was also undertaken, and it was concluded that there will be no significant effects.

Chapter 9: Geology & Water Environment

14.39 The impact assessment identifies the potential impacts on geology, hydrology and hydrogeology, including surface water, groundwater, abstractions, the potential for pollution of watercourses and flooding. It summarises the relevant legislation and guidance and provides appropriate baseline information, enabling the potential effects to be identified.

14.40 Aspects of the design, construction and operation of the proposed Development that may potentially impact on the receiving geological and water environment have been identified and the pathways for effects assessed. It has been determined that without mitigation the Development would be likely to cause adverse impacts of moderate significance primarily driven by the sensitivity of fisheries interests on and shortly downstream of the Site. As such, informed by the baseline assessment

CONSENTED (LA01/2018/0200/F)

and pathways identified, mitigation integrated as part of outline design and proposed during construction phase includes:

- Avoidance of water features based on baseline constraints mapping;
- Design of site elements to minimise impact on the geological and water environment;
- Implementation of a comprehensive surface water management plan comprising the use of SuDS (drainage) and silt management in order to prevent pathways for pollution;
- Construction phase pollution prevention procedures in accordance with NIEA requirements and guidance.

14.41 Monitoring of the effect of the Development on the water environment and fisheries habitat will be provided through physicochemical and biological water quality monitoring. Implementation of the mitigation proposed eliminates or reduces the potential significance of effects to all receptors to “not significant”.

14.42 There is no likelihood of significant cumulative impacts over and above any pre-existing effect caused by existing or consented wind development.

Peat

14.43 A Peat Slide Risk Assessment (PSRA) was undertaken for the Development. The peat depths across the site are predominantly shallow (<1m) with areas of deeper peat avoided. Limited cover of superficial deposits highlights a low risk of mass movement. This is supported by British Geological Survey which does not highlight any mass movement across the site.

Chapter 10: Noise

14.44 The predicted operational noise levels are within noise limits at nearby residential properties at all considered wind speeds. The Development therefore complies with the relevant guidance on wind farm noise and the impact on the amenity of all nearby properties would be regarded as acceptable.

14.45 A cumulative operational noise assessment has also been undertaken. Considering the mitigation measures identified the predicted cumulative noise levels are within noise limits at nearby residential properties. Compliance with relevant guidance implies that the cumulative impact on the amenity of nearby properties would be regarded as acceptable.

14.46 A construction noise assessment, incorporating the impact due to increased traffic noise and considering the mitigation measures identified, indicates that predicted noise levels likely to be experienced at the nearest residential properties are below relevant construction noise criteria at all residential properties.

14.47 An acoustic assessment of the proposed energy storage facility in accordance with BS 4142: 2014 shows that the impact would be low and the levels insignificant in

CONSENTED (LA01/2018/0200/F)

comparison to the cumulative wind farm noise, which as mentioned above, is in compliance with relevant guidance.

Chapter 11: Traffic & Transport

14.48 An assessment of the potential impact of the Development on traffic and transport was undertaken, involving consultation with Department of Infrastructure (DfI) Roads.

14.49 DfI Roads have a proposal for a climbing lane at this location (NAP 2016 – Proposal TRA 1). DfI Roads - Strategic Routes Improvement Team advised that whilst there is currently no allocated budget for the climbing lane scheme, the proposed site entrance is unlikely to effect the climbing lane proposal. The site entrance's position does not conflict with the proposed location of the climbing lane or associated earthworks.

14.50 It is proposed that Normal HGV load delivery routes (including stone and concrete) will travel to the site entrance on the Broad Road (A37). This is a proven turbine transport route as demonstrated during the construction of Dunbeg Wind Farm (PAC ref. 2009/A0363 and planning ref. B/2007/0560/F). Consideration was given to the effect of increased HGV traffic flow on Severance, Driver Delay, Pedestrian Delay, Pedestrian Amenity, Fear and Intimidation, Accidents and Safety and Cumulative Impacts.

14.51 The abnormal load route and the HGV routes have been assessed as acceptable in the ES. Taking into account the existing vehicle movements on the affected roads, and the proposed type and frequency of vehicle numbers, it is considered that with the appropriate mitigation measures, there will be no significant effects.

Chapter 12: Shadow Flicker

14.52 The Best Practice Guidance to Planning Policy Statement 18 (PPS18) states that at distances greater than 10 rotor diameters from a turbine, the potential for shadow flicker is very low.

14.53 An analysis of shadow flicker throughout the year from Development was carried out, taking into account the behaviour of the sun, the local topography and the turbine layout and dimensions[1]. The analysis was performed using a turbine layout consisting of 9 turbines, each with maximum tip heights of 149.9 m and maximum rotor diameters of 99.8 m.

14.54 There are no inhabited houses within ten rotor diameters of any of the proposed turbines.

14.55 Due to both the distance of the nearest residential properties to the Development, and the recommendations pertaining to ten rotor diameter proximity, and proposed

[1] Turbine ref 03219D0001-06, house ref 03219D0201-01

CONSENTED (LA01/2018/0200/F)

mitigation if required, it is concluded that the Development should not cause a material reduction to residential amenity owing to shadow flicker.

Chapter 13: Socioeconomics

14.56 A socioeconomic assessment of the Development was carried out. It concluded that should the Development go ahead, it will deliver substantial benefits to the economies of Northern Ireland and the Causeway Coast & Glens BC area, in economic and environmental terms. It will provide significant job creation and activity in the construction sector (with a commitment to use local labour where possible); increase tax and rates revenue for local and central government; contribute to renewable energy targets; and has the potential to transfer the knowledge, expertise and skills gained and developed to other wind farms, possibly acting as a catalyst for further investment in the area.

14.57 The Development is estimated to involve a capital spend of £26.02 million. Of this total, £7.87 million (nominal prices) will be realised within the Northern Ireland economy. The projected 18-month construction phase is estimated to create or sustain 128-167 total (direct, indirect and induced) job years[2] of employment, £3.51-£4.54 million of wages and £4.72-£6.12 million (£2013 prices) of GVA[3] to the Northern Ireland economy.

14.58 The estimated total (direct, indirect and induced) benefits from the operational phase of the proposed Development includes 71 job years within Northern Ireland, with associated wages of £2.4 million and £7.3 million (£2013 prices) in GVA over the 30-year operating period.

14.59 Over the Development's construction phase the UK Exchequer is estimated to benefit from increased tax revenue and benefits saving of £1.59-£2.55 million. In addition to this, each year of operation is likely to yield a further £0.03-£0.04 million of increased tax revenue and benefit savings (in constant prices). Over the 30-year project life, we estimate that £2.6-£3.8 million would be realised in raised revenue and benefits savings[4].

14.60 Based on rateable values of £27,500 per MW we calculate that the Development will increase rateable value by £816,750 each year, or by £24.5m over the project horizon. From these values business rates are calculated and collected for local Councils and the Northern Ireland Assembly. By applying Causeway Coast and Glens

[2] **Job years**: For the construction phase 'job years' refers to the amount of activity that is required. E.g. two people could be employed for six months – this would equate to two jobs, but would actually only mean activity would take one job year of work to complete. Alternatively one person could be employed for two years - this would only equate to one job, but is actually two job years of employment.

[3] **Gross value added** (GVA) measures the value of goods & services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

[4] This analysis relates to results from Method 1 – see Chapter 13 of ES for full details..

CONSENTED (LA01/2018/0200/F)

BC non-domestic poundage rates, we estimate additional business rates of £468,795 each year and £14.0m over the 30-year lifetime of the project.

14.61 Over the lifetime of the project, rates, taxes and land rental will collectively amount to approximately £30.5 million.

Conclusion

14.62 The potential effects of the Development have been assessed in accordance with regulatory requirements and good practice. The ES incorporates technical assessments of the Development based on the requisite legislation and the relevant planning policy framework. The ES has demonstrated that significant environmental effects associated with the construction, operation and decommissioning of the Development have been avoided or minimised through the use of the iterative design process and with the application of mitigation measures.

14.63 Final wind farm capacity will vary depending on the outcome of planning permission and the turbine type selected. It is estimated that the wind farm could meet the needs of around 23,000 homes[5]. This is equivalent to 41.2 percent of the housing stock in Causeway Coast and Glens Borough Council area. In addition, the Development is also estimated to reduce CO_2 emissions by 40,800 tonnes each year. This equivalent to 30,100 newly registered cars.[6]

14.64 The Development will result in a reduction in greenhouse gas emissions from the electricity generating industry by harnessing wind as an alternative to the burning of fossil fuels, in line with the government's energy goals. It will also make a significant contribution to the Northern Ireland government target that 40% of electricity consumed should be sourced from renewable energy by 2020 (DETI).

[5] This has been calculated by taking the predicted annual electricity generation of the site (based on RES assessments has a predicted capacity factor of 36% - based on a 3.3MW turbine) and dividing this by the annual average electricity figures from the Department of Business, Energy and Industrial Strategy (BEIS) showing that the annual UK average household consumption is 3,994 kWh – November 2016.

[6] https://www.gov.uk/government/publications/new-car-carbon-dioxide-emissions

CONSENTED (LA01/2018/0200/F)



CONSENTED (LA01/2018/0200/F)

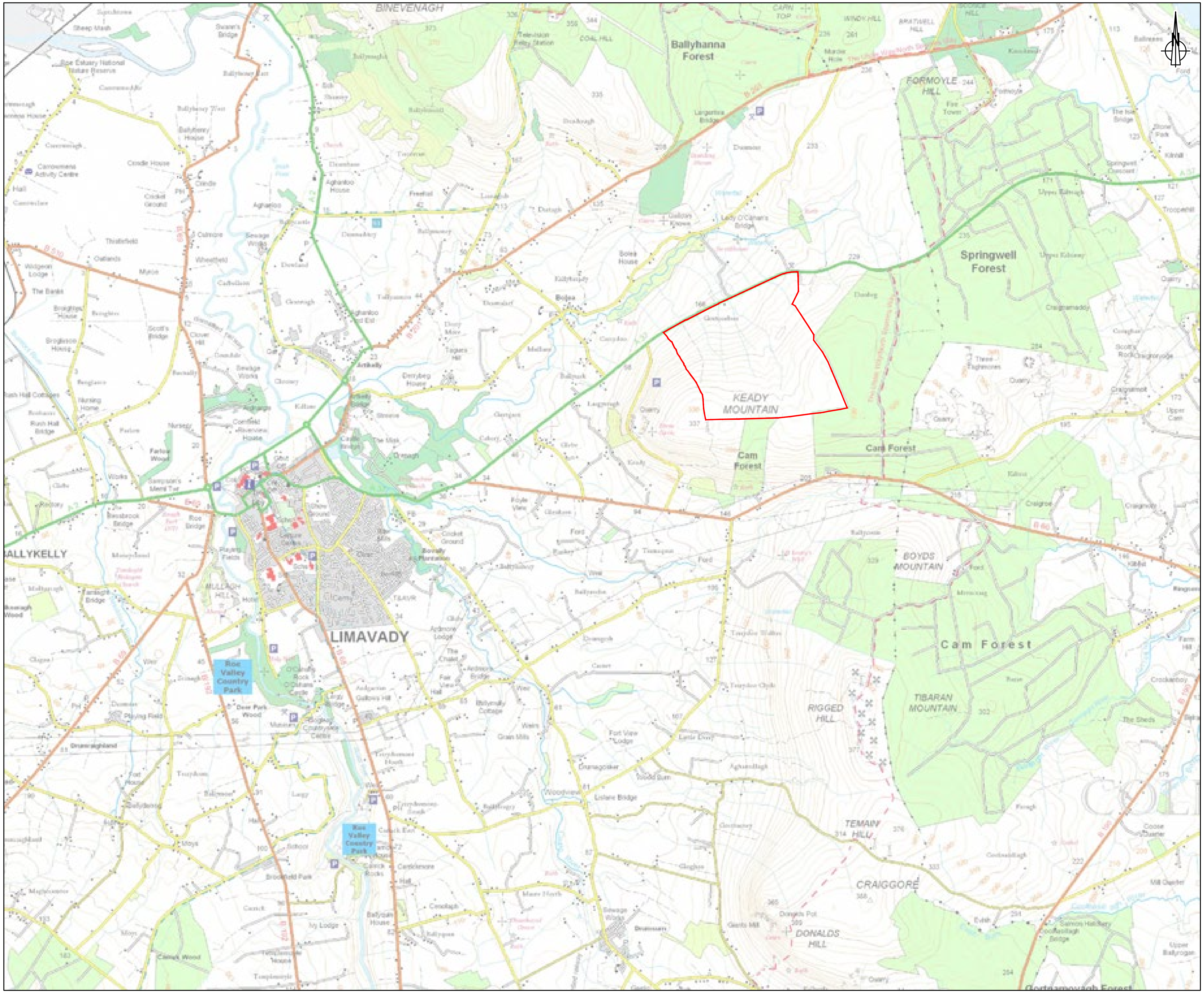
Table of Contents

CONSENTED (LA01/2018/0200/F)

1

Introduction & Policy Context

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 1.1

SITE LOCATION MAP

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

SITE LOCATION

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

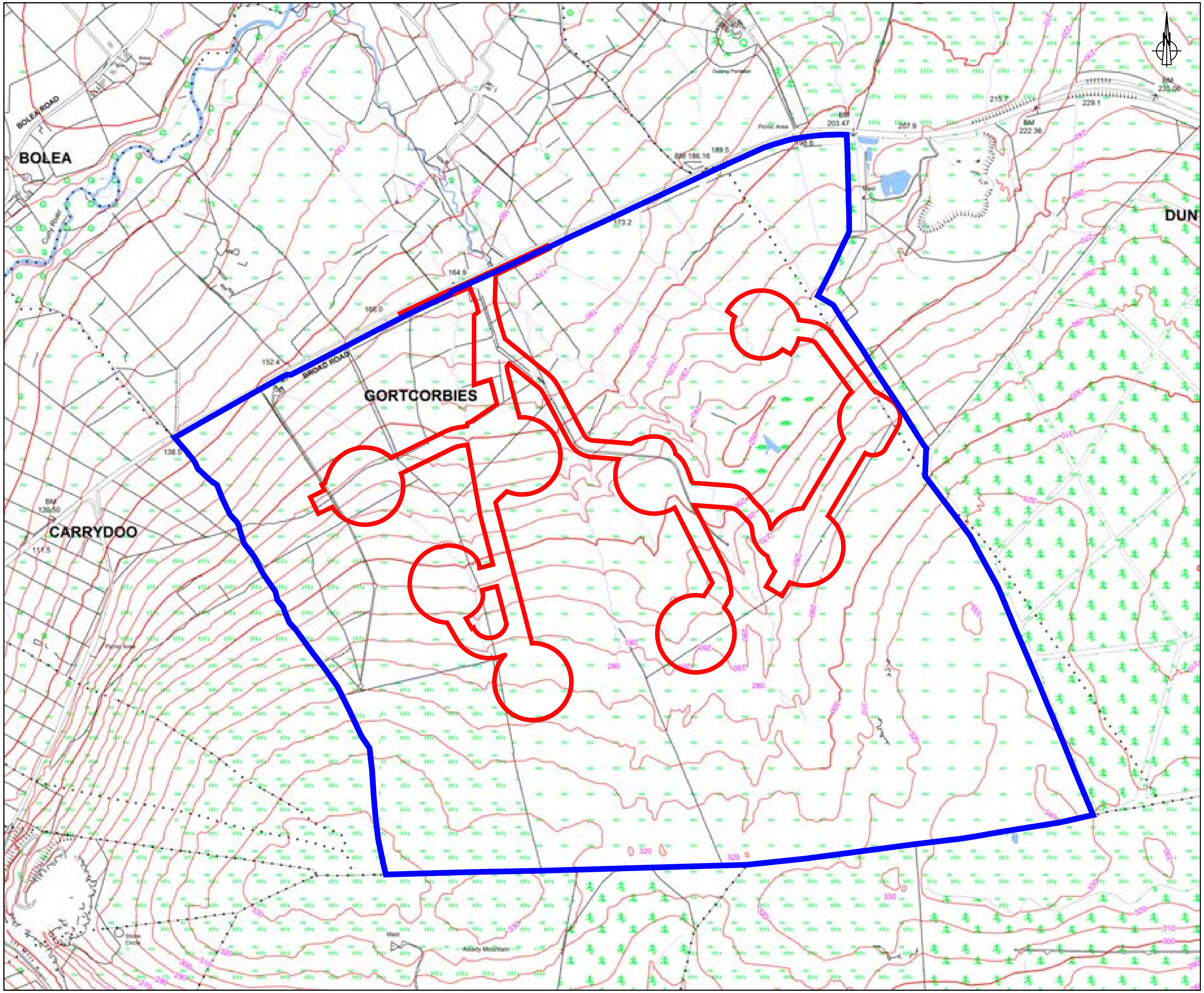
DRAWING NUMBER 03219D2202-03

SCALE - 1:50,000 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH WIND FARM

FIGURE 1.2

PLANNING APPLICATION BOUNDARY

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY

PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)

LAND UNDER APPLICANT CONTROL

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

DRAWING NUMBER
03219D2506-01

SCALE - 1:10,000 @ A3

ENVIRONMENTAL STATEMENT 2017

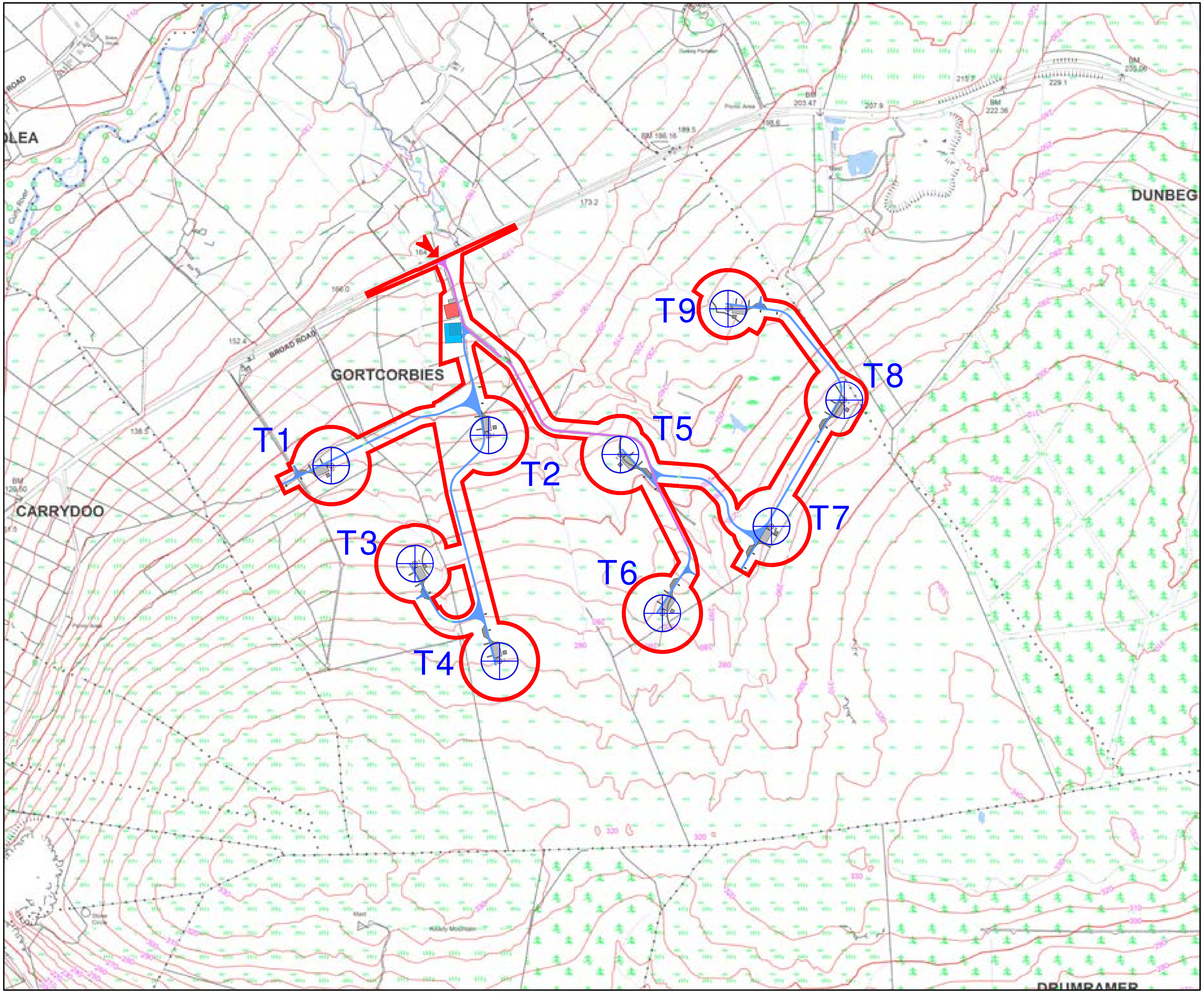
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

2

Proposed Development

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH WIND FARM

FIGURE 2.1

INFRASTRUCTURE LAYOUT

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA , PERMANENT, TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG	03219D0001-06	T-LAYOUT NO.	PNIRdbx028

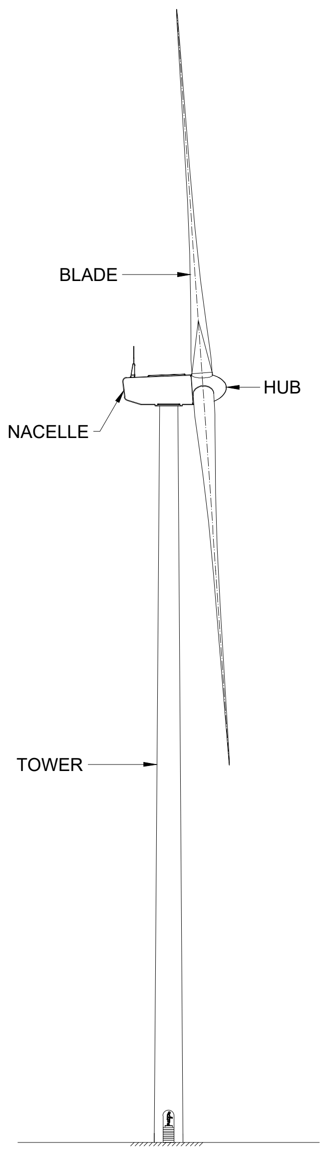
DRAWING NUMBER 03219D1001-02

SCALE - 1:10,000 @ A3

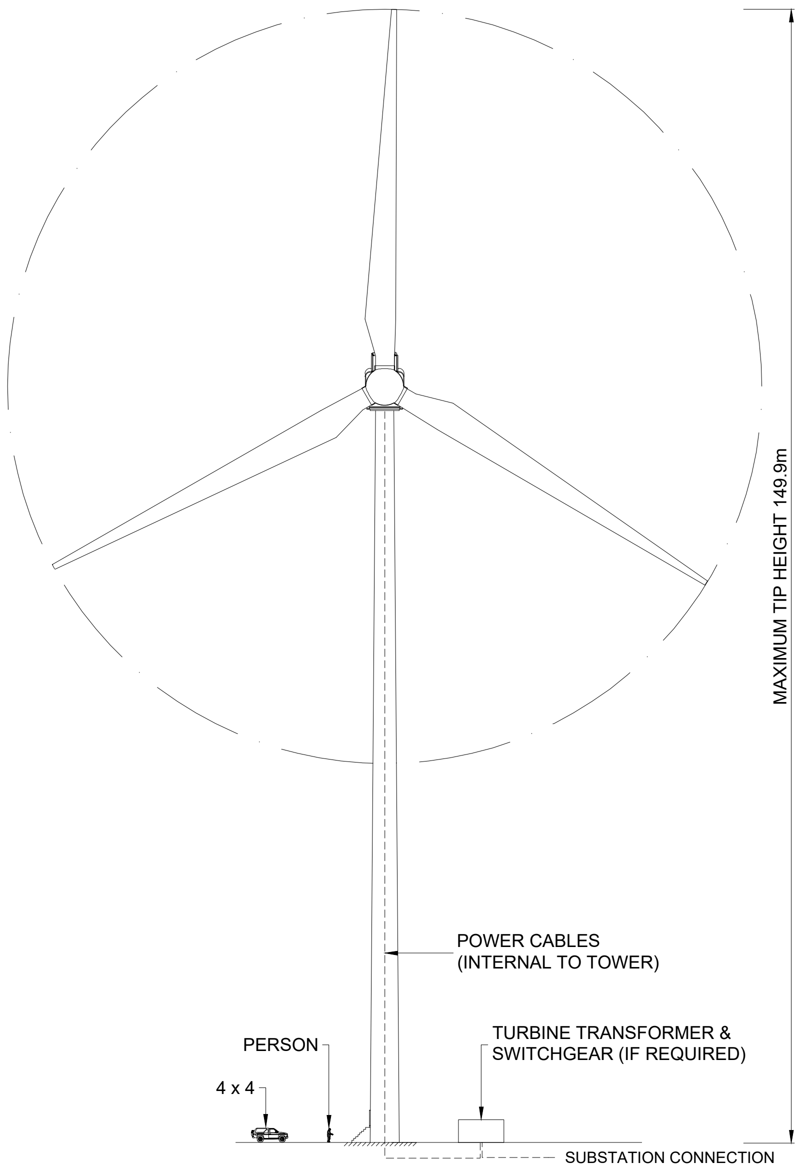
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SIDE VIEW



FRONT VIEW

PHOTOGRAPH OF TYPICAL TURBINE

DUNBEG SOUTH
WIND FARM

FIGURE 2.2

TURBINE ELEVATION

LAYOUT DWG N/A	T-LAYOUT NO. N/A

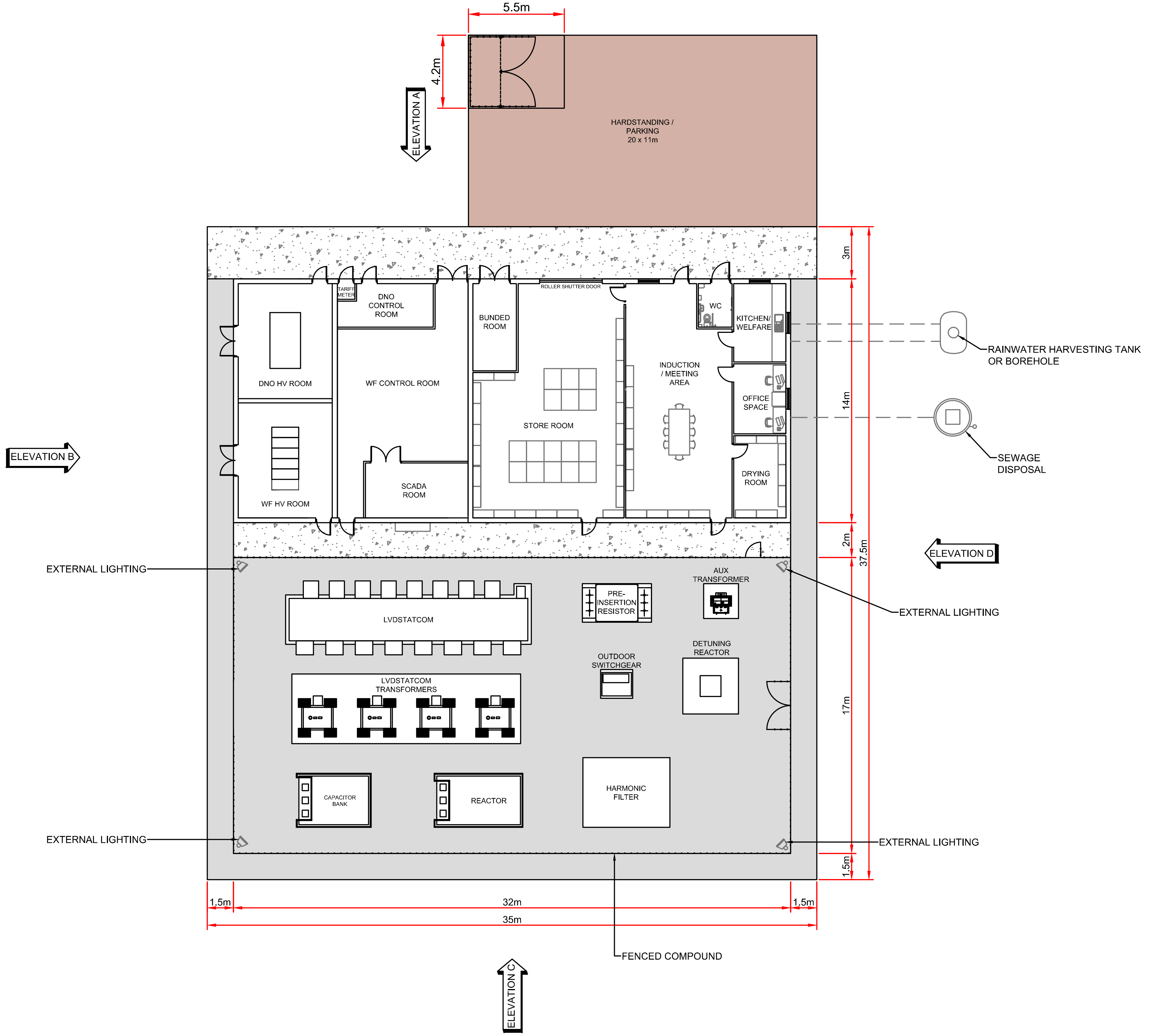
DRAWING NUMBER 03219D2901-01

SCALE - 1:1000 @ A3

ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2.3

CONTROL BUILDING & SUBSTATION COMPOUND LAYOUT PLAN

KEY:

- INDICATIVE MV CABLE DUCTING LAYOUT
- EXTERNAL LIGHTING
- 1m WIDE GRAVEL PATH
- CONCRETE APRON
- ELEVATION MARKER

NOTES:

1. FULL CONVERTOR SOLUTIONS ARE NOW REQUIRED FOR GRID CODE COMPLIANCE.
2. REACTORS ARE INCLUDED FOR BALANCING CABLE CAPACITIVE EXPORT
3. CONTROL BUILDING ROOM LAYOUT & COMPOUND LAYOUT IS INDICATIVE ONLY AND MAY CHANGE.
4. STONED HARDSTAND AREA FOR CRANE DURING INSTALLATION PHASE AND PARKING DURING OPERATIONAL PHASE
5. ALL ELECTRICAL EQUIPMENT TO HAVE A MINIMUM SEPARATION OF 1m.

LAYOUT DWG N/A	T-LAYOUT NO. N/A

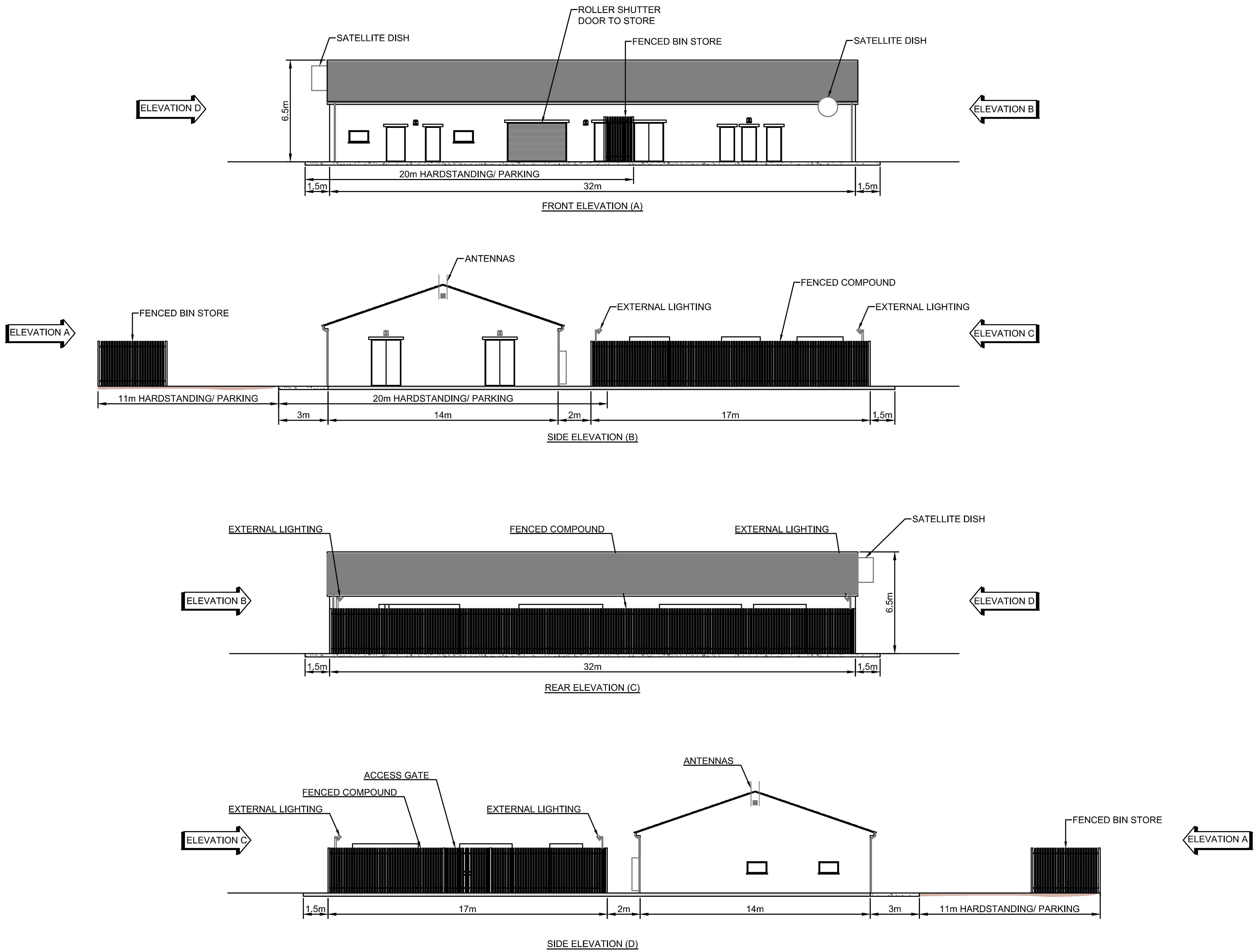
DRAWING NUMBER 03163D2207-02

SCALE - 1:250 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2.4

CONTROL BUILDING ELEVATIONS

LAYOUT DWG N/A

T-LAYOUT NO. N/A

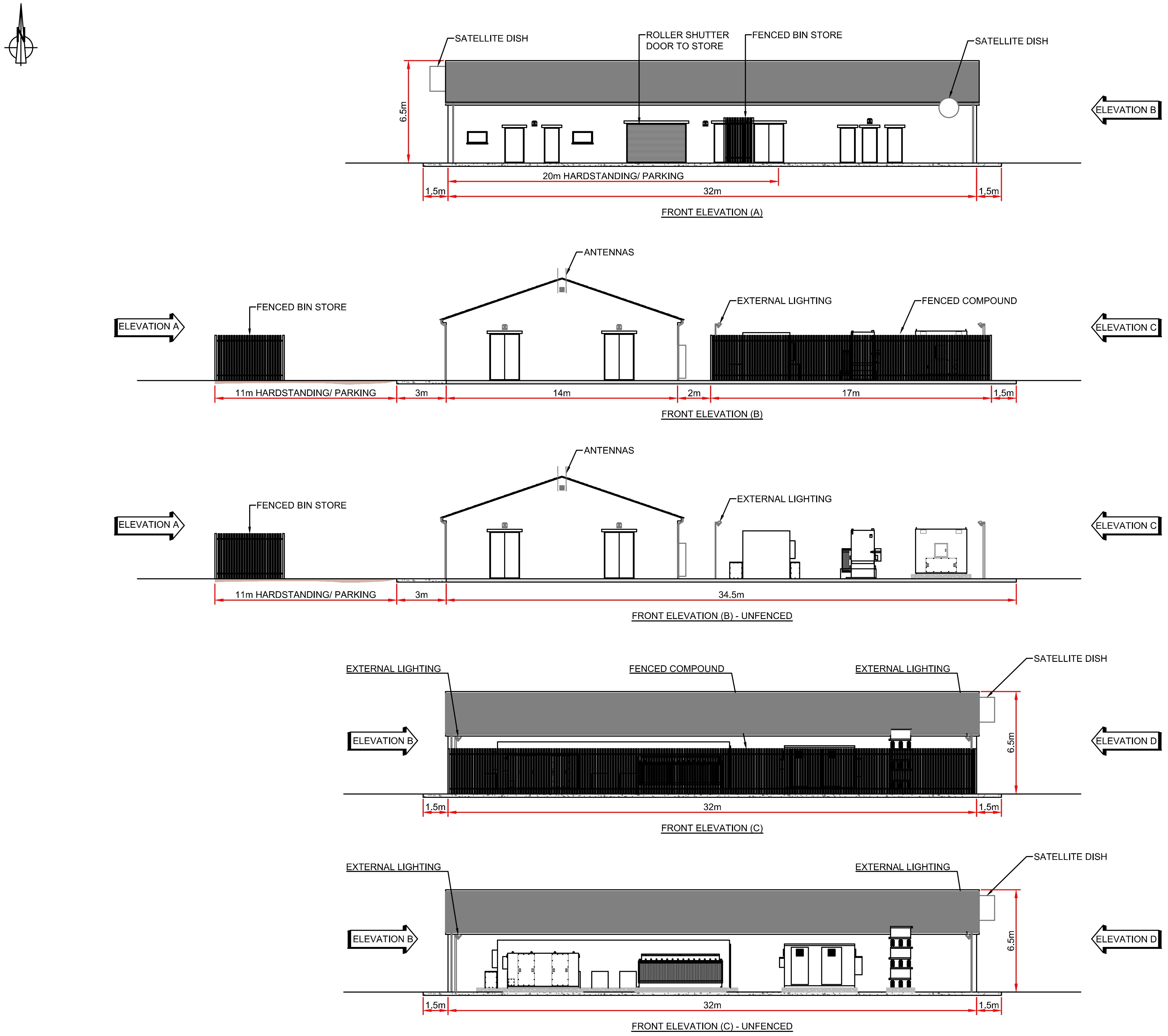
DRAWING NUMBER 03163D2208-02

SCALE - 1:250 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH
WIND FARM

FIGURE 2.5

CONTROL BUILDING &
SUBSTATION COMPOUND
ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 1 OF 12

LAYOUT DWG N/A
T-LAYOUT NO. N/A

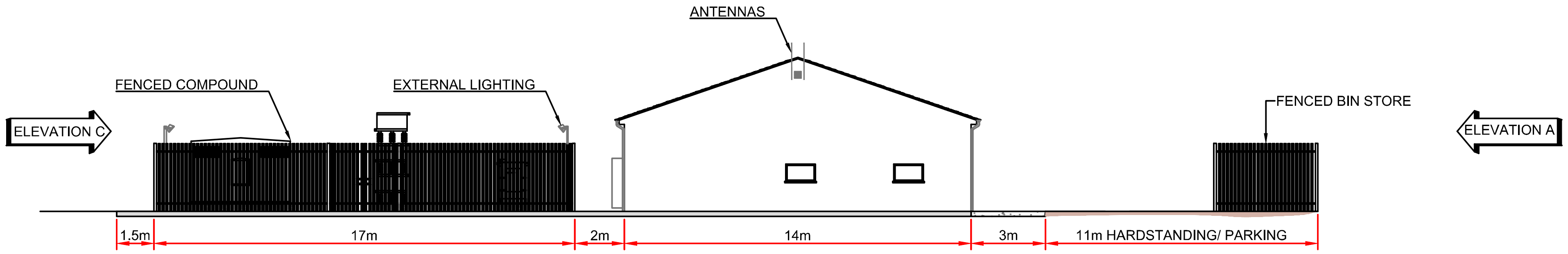
DRAWING NUMBER
03219D2209-01

SCALE - 1:250 @ A3

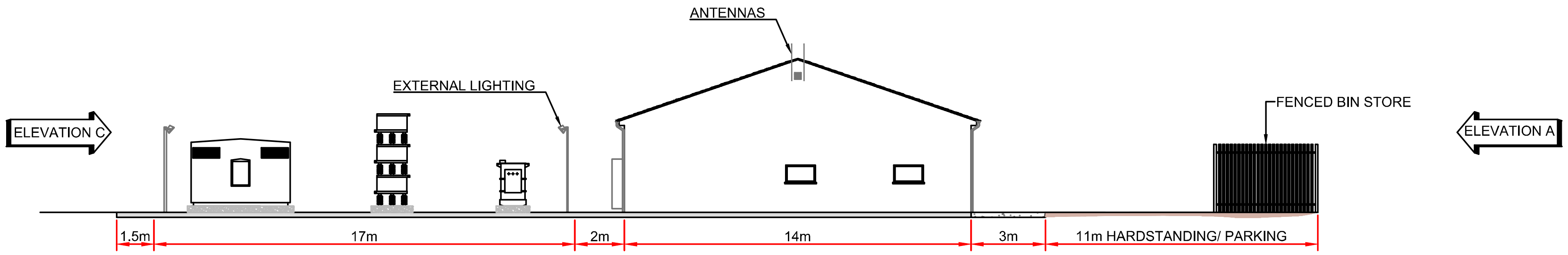
ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SIDE ELEVATION (D)



SIDE ELEVATION (D) - UNFENCED

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 2 OF 12

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

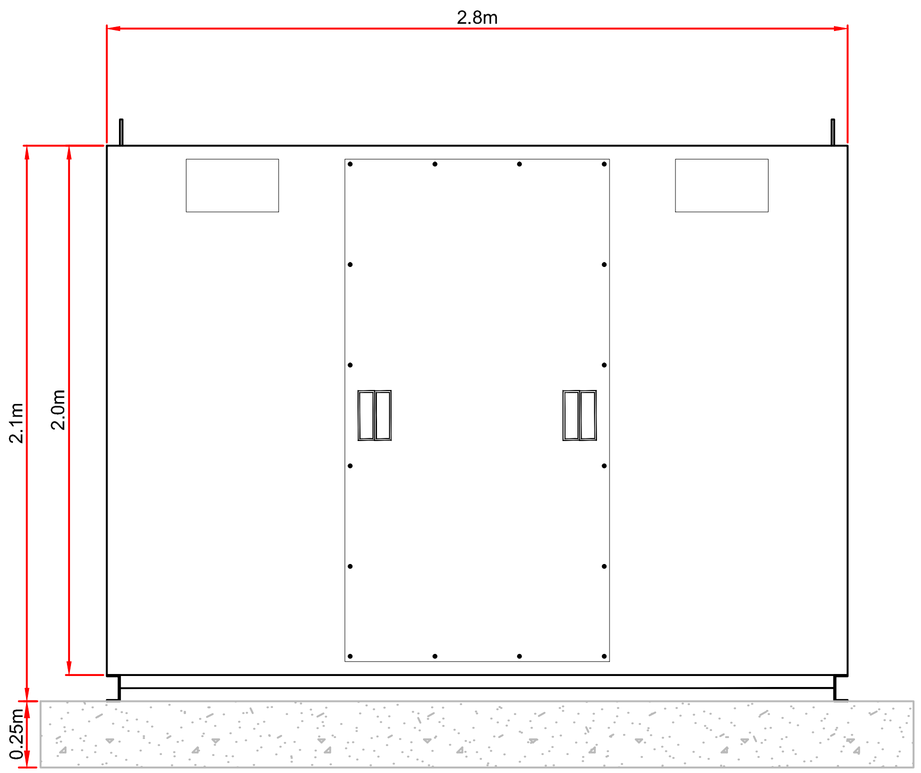
DRAWING NUMBER 03219D2209-01

SCALE - 1:250 @ A3

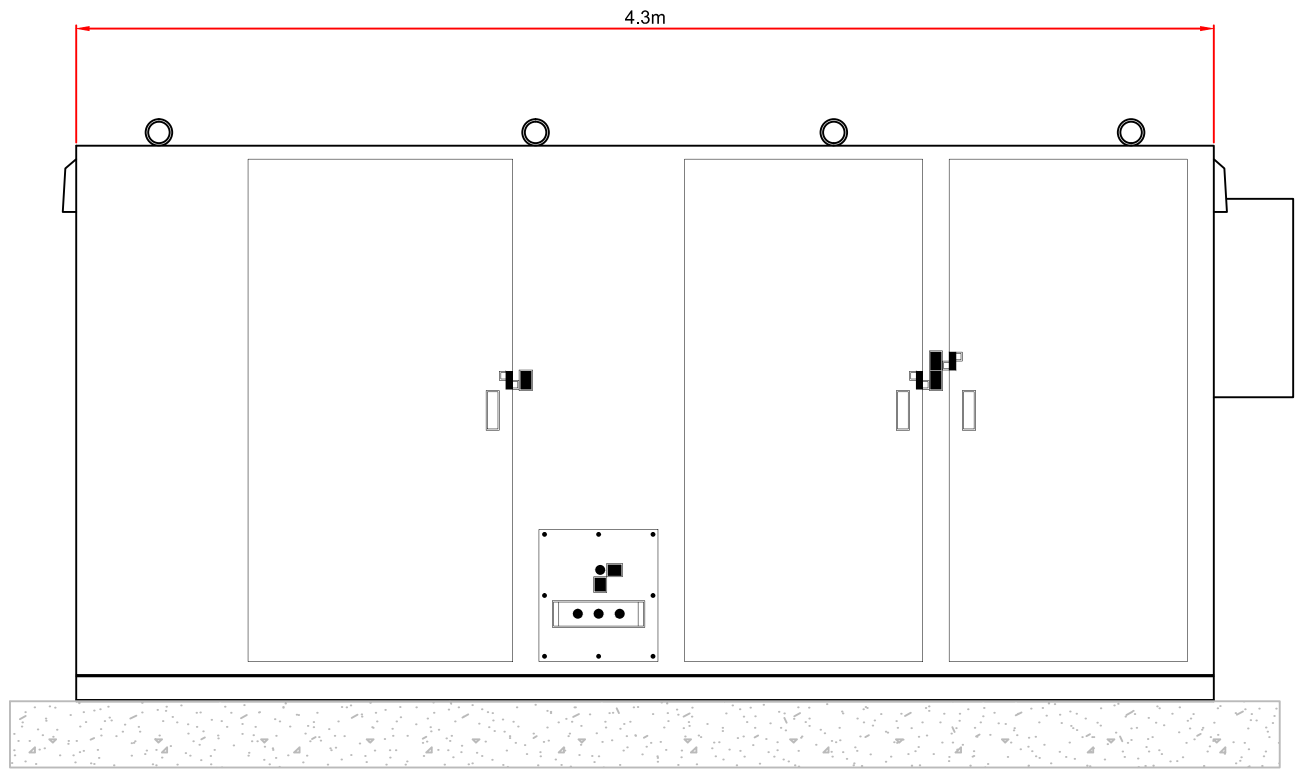
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

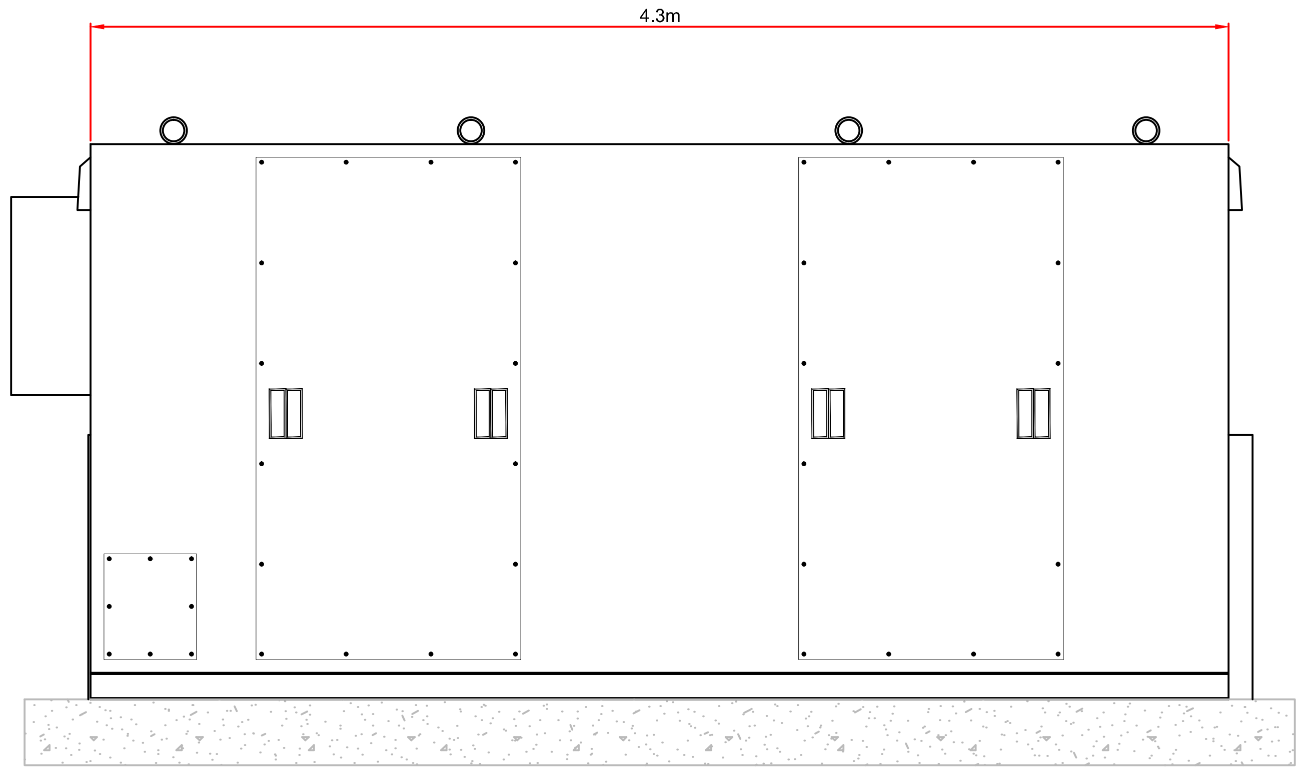
CONSENTED (LA01/2018/0200/F)



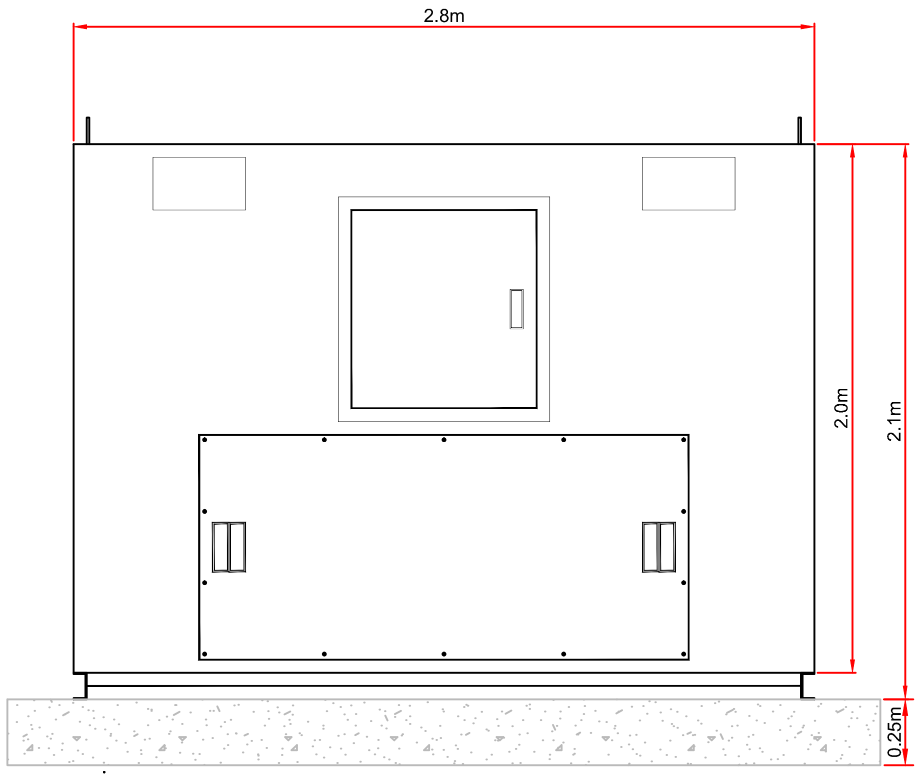
INDICATIVE CAPACITOR BANK - EXTERNAL LHS
SCALE - NTS



INDICATIVE CAPACITOR BANK - EXTERNAL FRONT
SCALE - NTS



INDICATIVE CAPACITOR BANK - EXTERNAL REAR
SCALE - NTS



INDICATIVE CAPACITOR BANK - EXTERNAL RHS
SCALE - NTS

res

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 3 OF 12

LAYOUT DWG N/A	T-LAYOUT NO. N/A

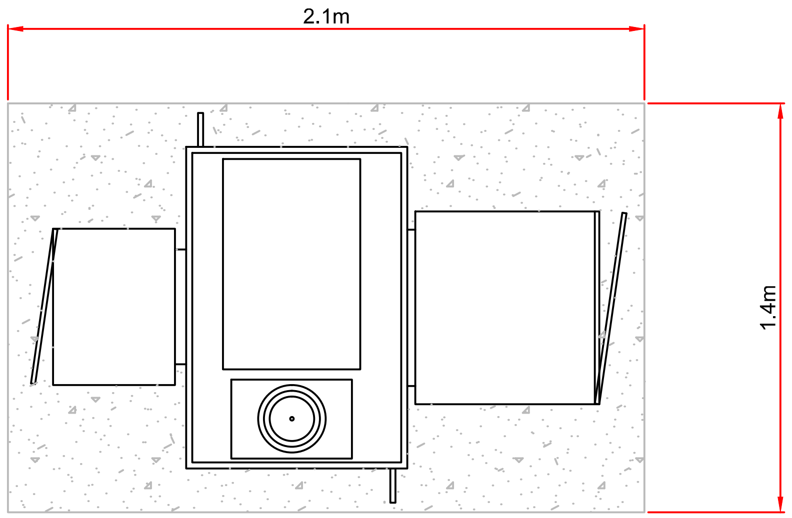
DRAWING NUMBER 03219D2209-01

SCALE - NTS @ A3

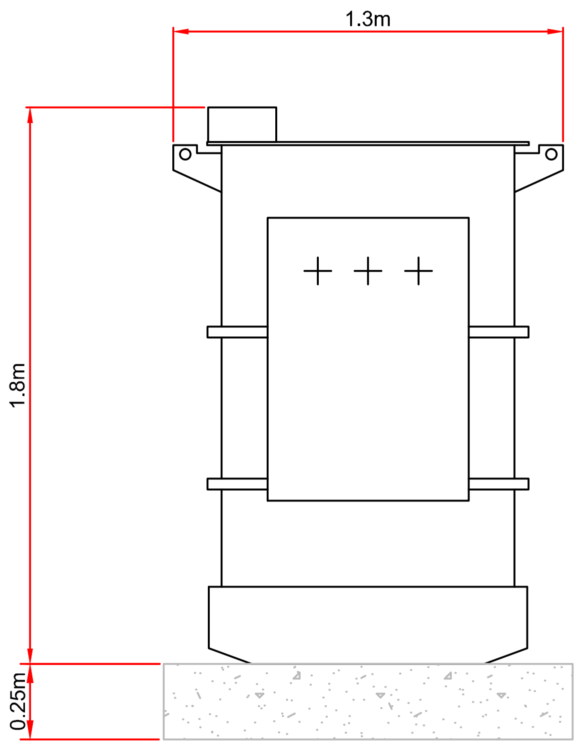
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

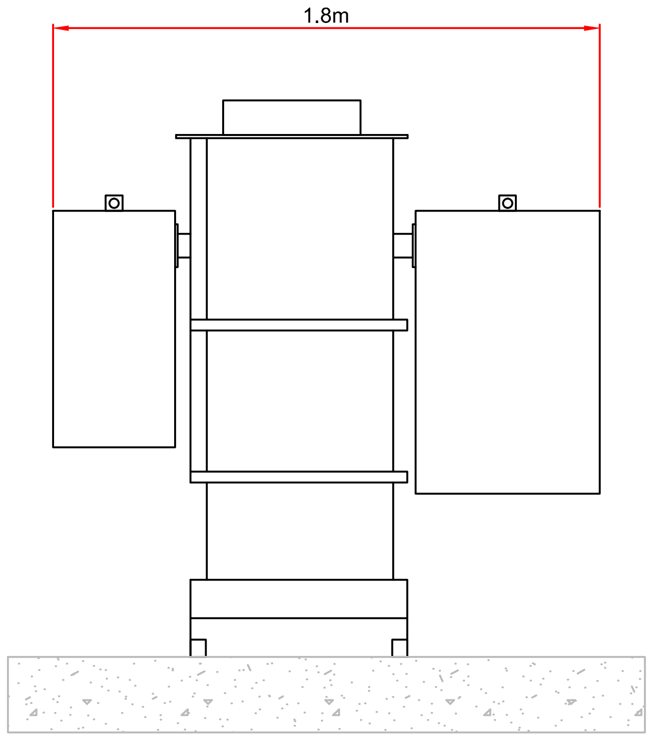
CONSENTED (LA01/2018/0200/F)



INDICATIVE AUXILIARY TRANSFORMER - PLAN VIEW
SCALE - 1:25



INDICATIVE AUXILIARY TRANSFORMER - SIDE ELEVATION
SCALE - 1:25



INDICATIVE AUXILIARY TRANSFORMER - FRONT ELEVATION
SCALE - 1:25

res

DUNBEG SOUTH
WIND FARM

FIGURE 2.5

CONTROL BUILDING &
SUBSTATION COMPOUND
ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

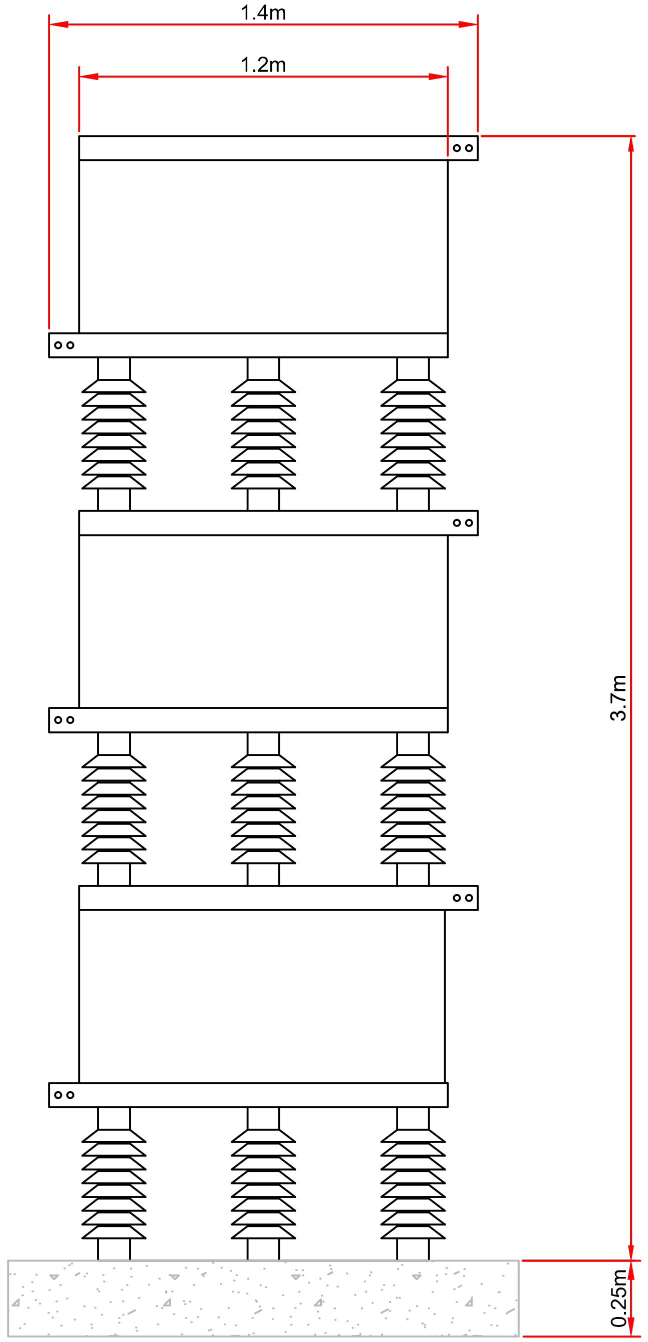
1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 4 OF 12

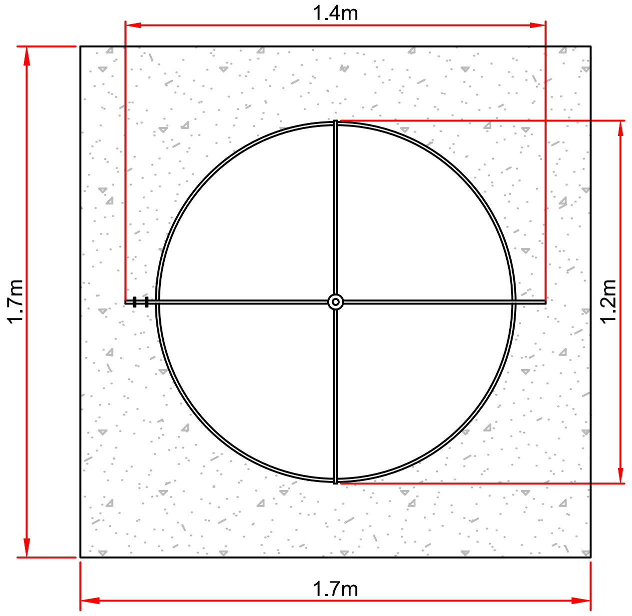
LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 03219D2209-01	
SCALE - 1:25 @ A3	
ENVIRONMENTAL STATEMENT 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



INDICATIVE DETUNING REACTOR - SIDE ELEVATION
SCALE - 1:25



INDICATIVE DETUNING REACTOR - SIDE ELEVATION
SCALE - 1:25

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 5 OF 12

LAYOUT DWG N/A
T-LAYOUT NO. N/A

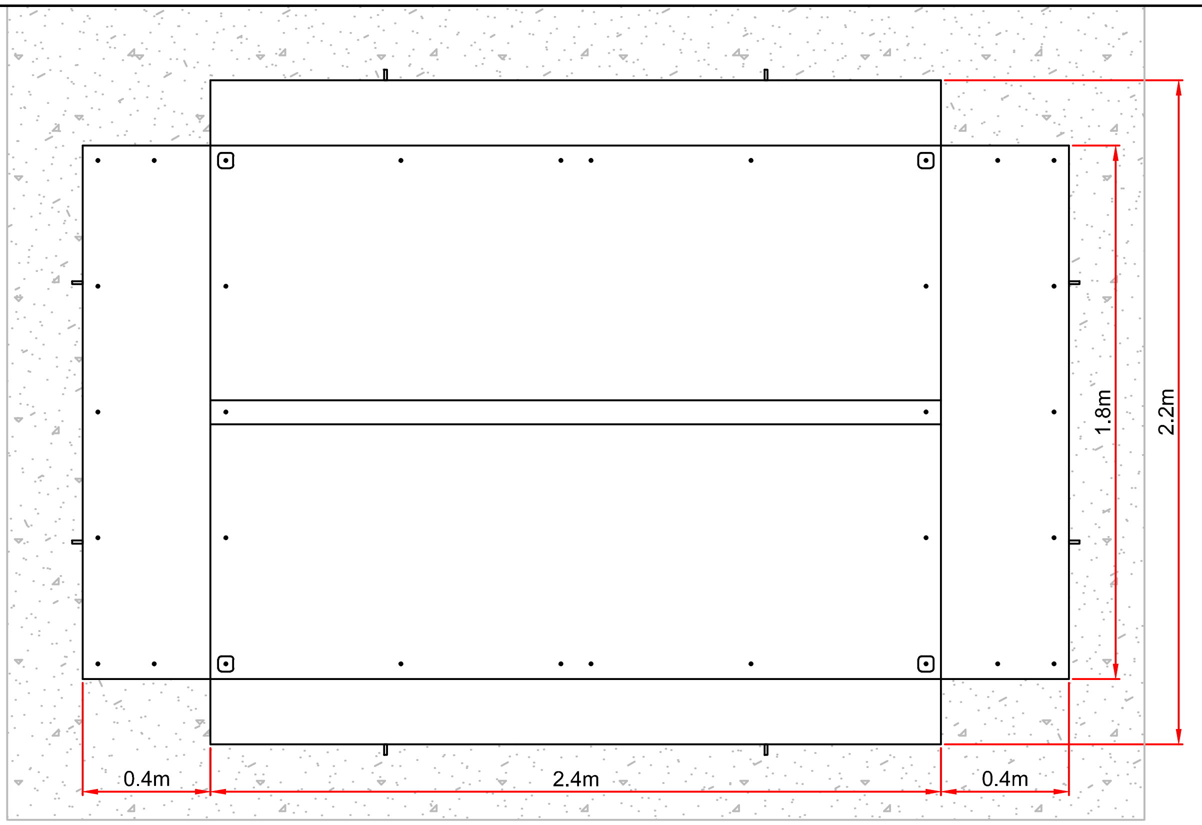
DRAWING NUMBER
03219D2209-01

SCALE - 1:25 @ A3

ENVIRONMENTAL STATEMENT 2017

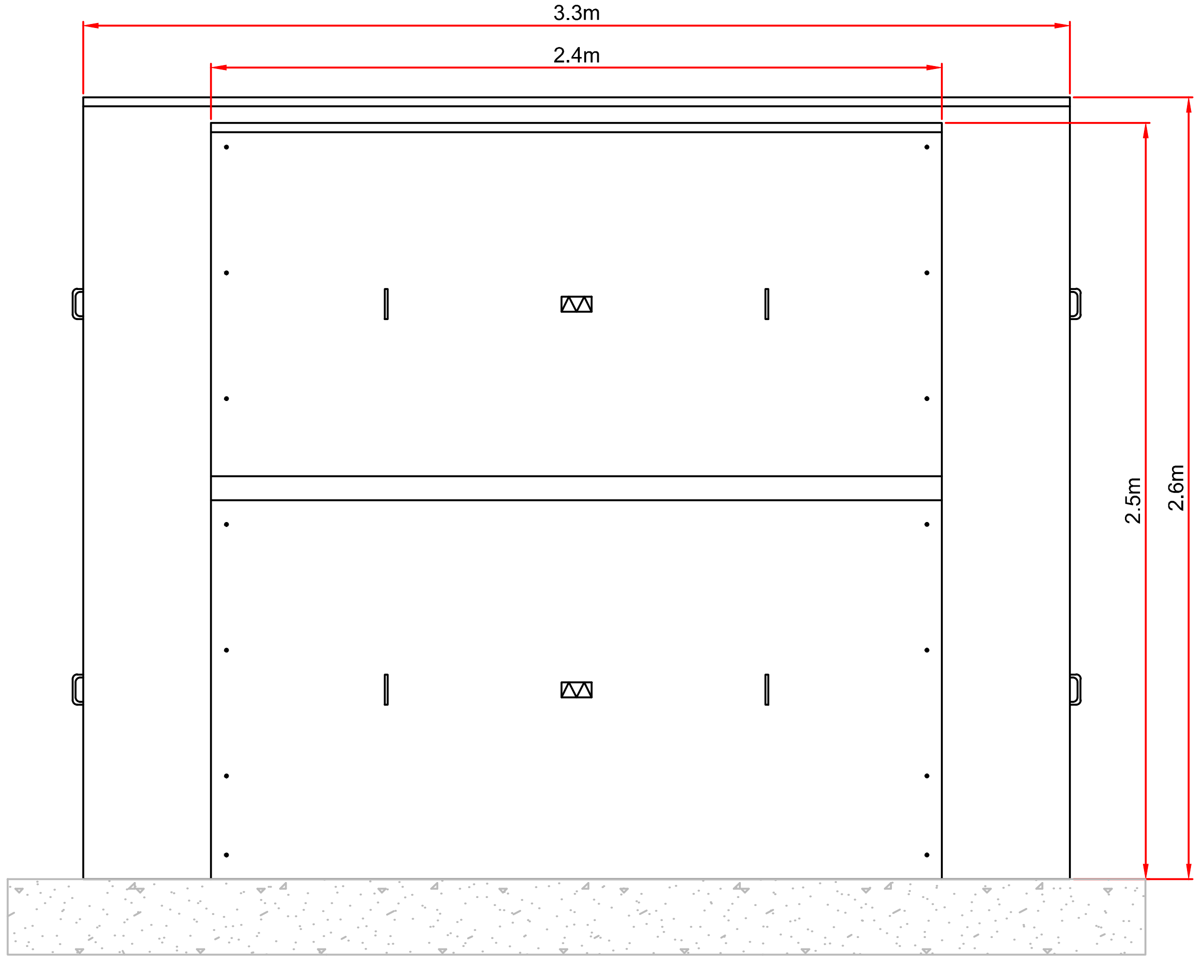
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



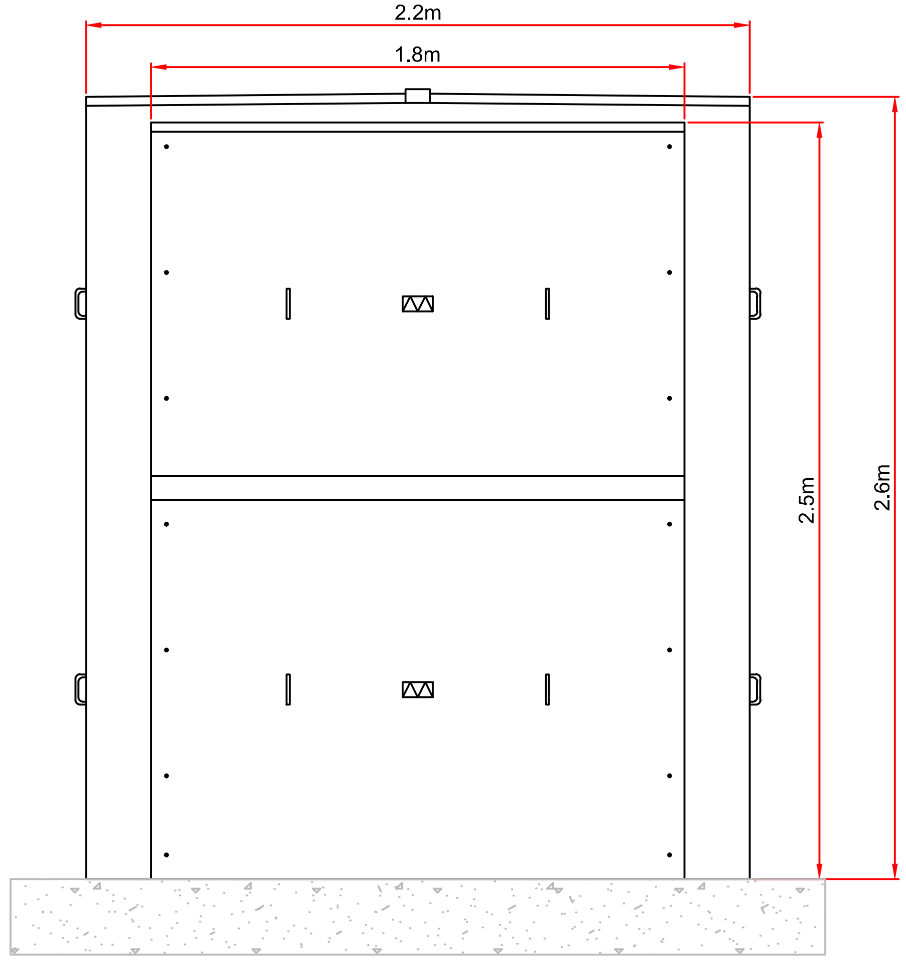
INDICATIVE PRE-INSERTION RESISTOR - PLAN VIEW

SCALE - 1:25



INDICATIVE PRE-INSERTION RESISTOR - FRONT ELEVATION

SCALE - 1:25



INDICATIVE PRE-INSERTION RESISTOR - SIDE ELEVATION

SCALE - 1:25

res

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 6 OF 12

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

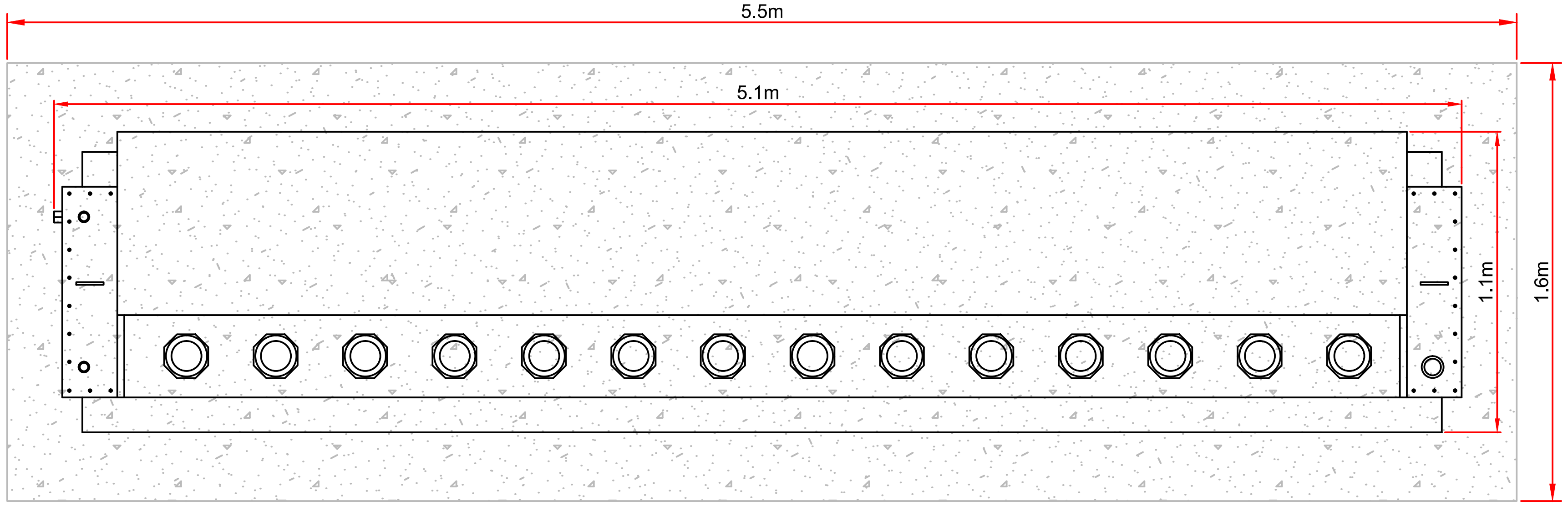
DRAWING NUMBER
03219D2209-01

SCALE - 1:25 @ A3

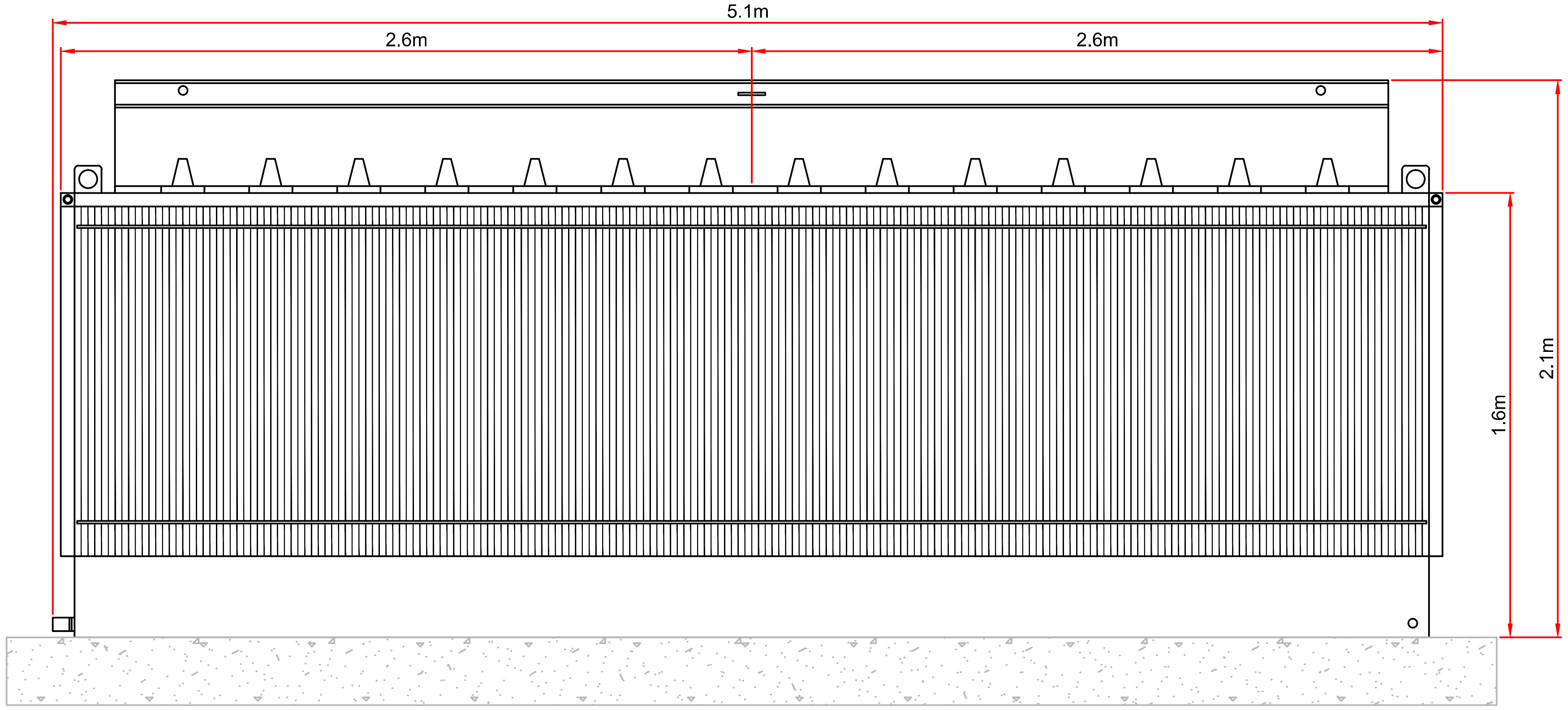
ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

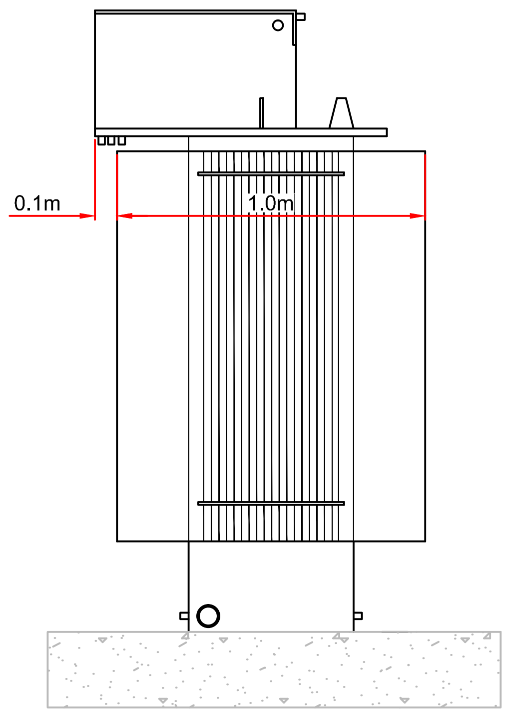
CONSENTED (LA01/2018/0200/F)



INDICATIVE SHUNT REACTOR -
PLAN VIEW
SCALE - 1:25



INDICATIVE SHUNT REACTOR -
FRONT ELEVATION
SCALE - 1:25



INDICATIVE SHUNT REACTOR -
SIDE ELEVATION
SCALE - 1:25

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 7 OF 12

LAYOUT DWG N/A
T-LAYOUT NO. N/A

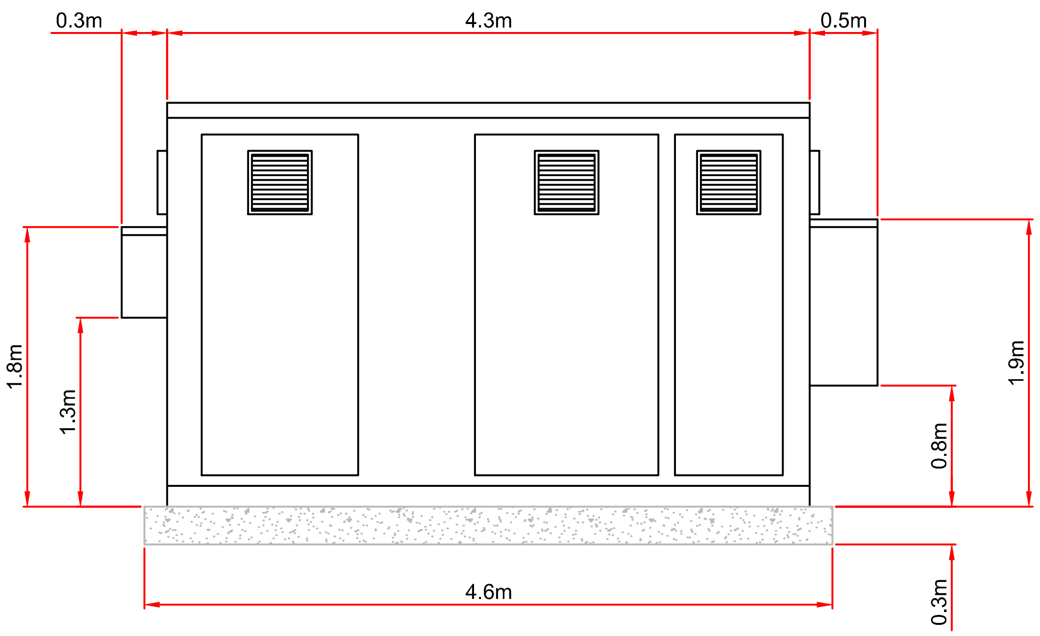
DRAWING NUMBER
03219D2209-01

SCALE - 1:25 @ A3

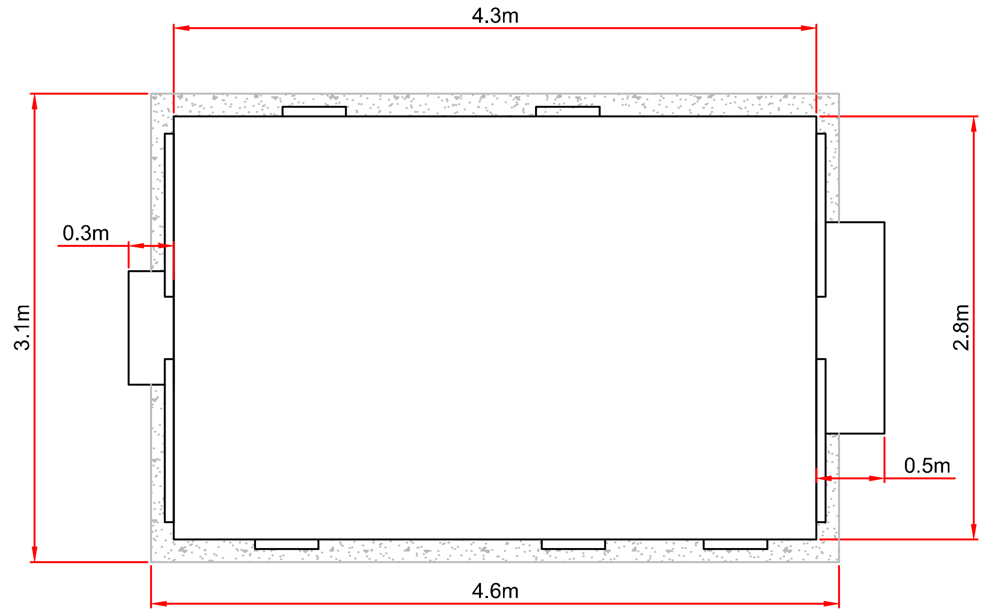
ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

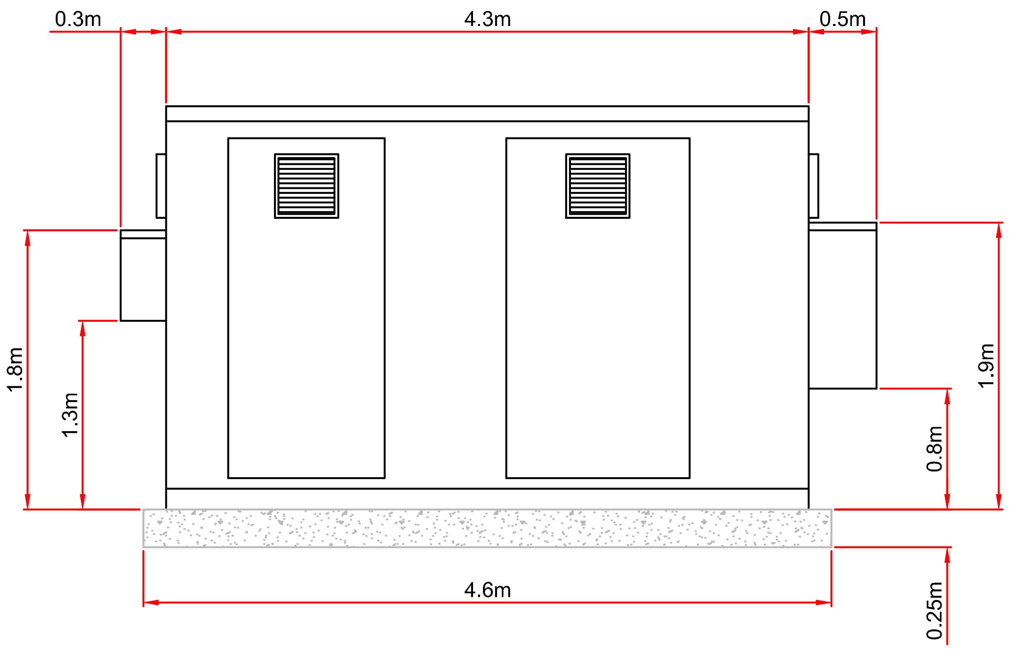
CONSENTED (LA01/2018/0200/F)



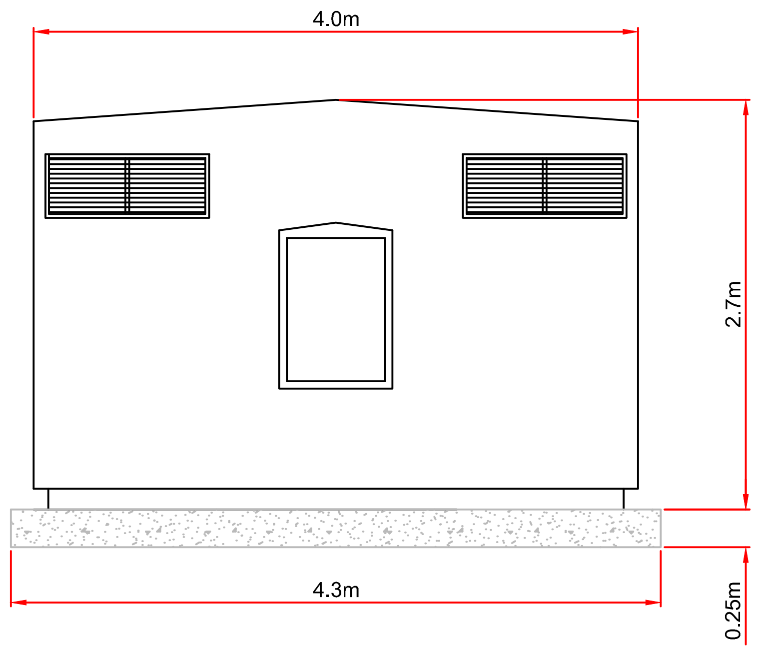
INDICATIVE HARMONIC FILTER - FRONT ELEVATION
SCALE - 1:50



INDICATIVE HARMONIC FILTER - PLAN VIEW
SCALE - 1:50



INDICATIVE HARMONIC FILTER - REAR ELEVATION
SCALE - 1:50



INDICATIVE HARMONIC FILTER - SIDE ELEVATION
SCALE - 1:50

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 8 OF 12

LAYOUT DWG N/A
T-LAYOUT NO. N/A

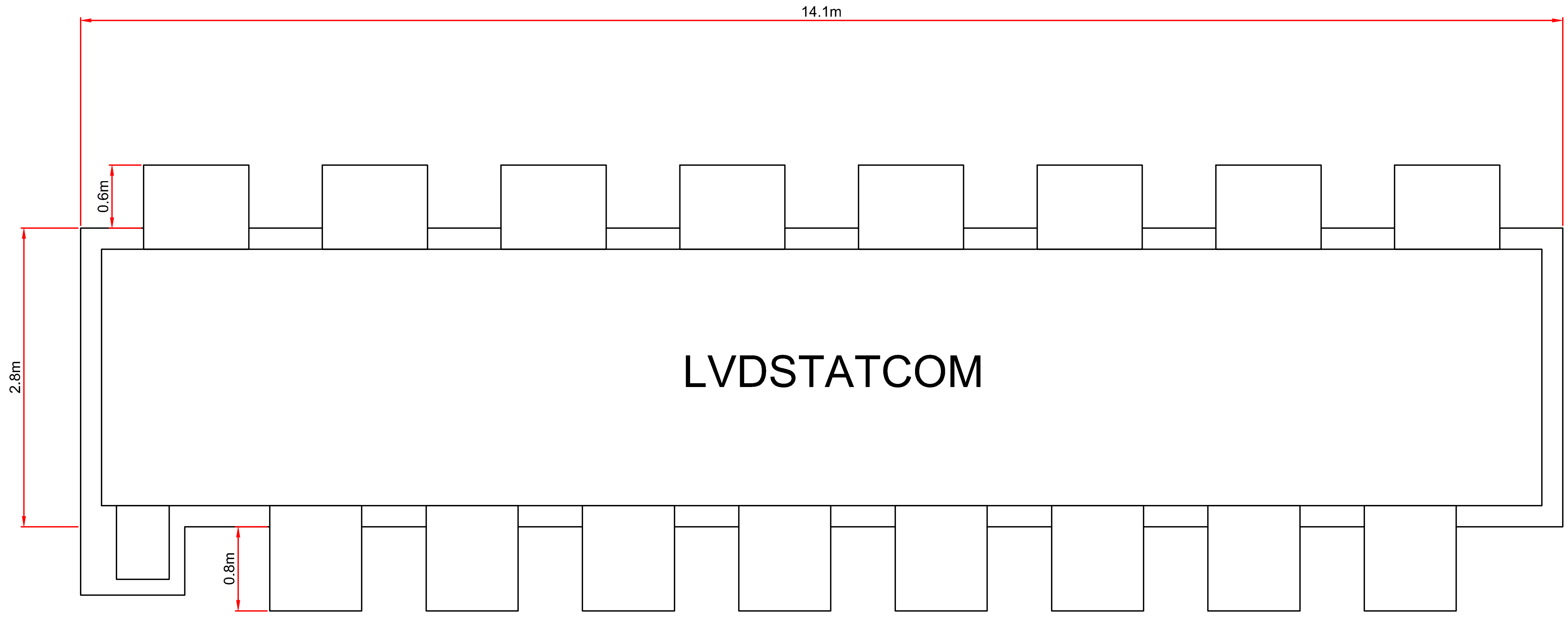
DRAWING NUMBER 03219D2209-01

SCALE - 1:50 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



INDICATIVE LVDSTATCOM - PLAN VIEW
SCALE - 1:25

DUNBEG SOUTH
WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 9 OF 12

LAYOUT DWG N/A	T-LAYOUT NO. N/A

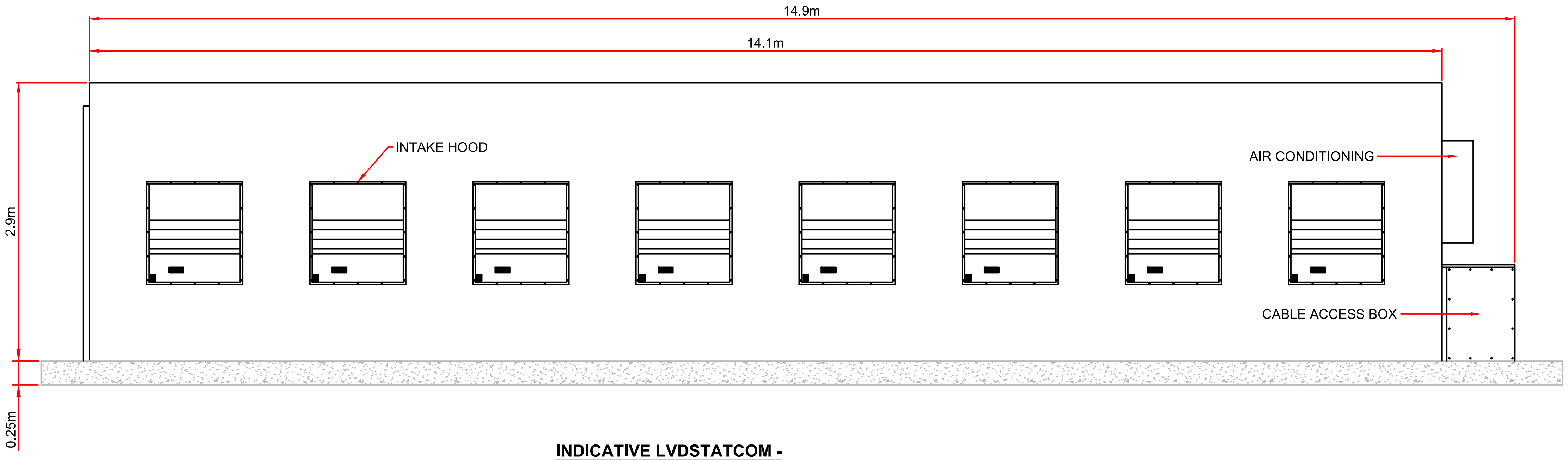
DRAWING NUMBER 03219D2209-01

SCALE - 1:25 @ A3

ENVIRONMENTAL STATEMENT 2017

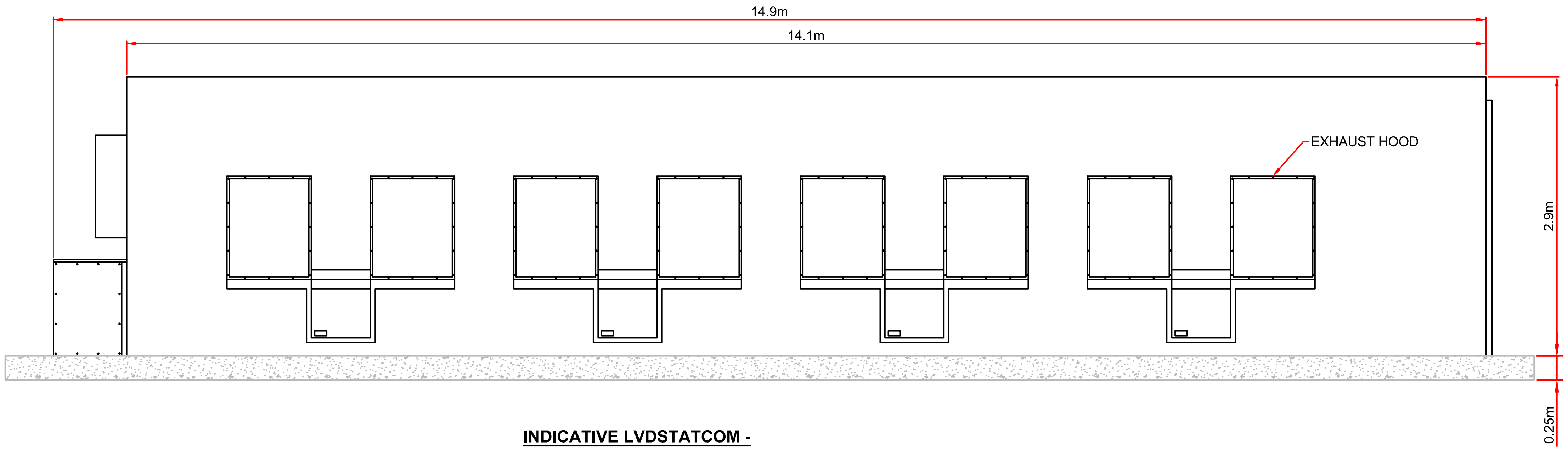
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



INDICATIVE LVDSTATCOM - FRONT ELEVATION

SCALE - NTS



INDICATIVE LVDSTATCOM - REAR ELEVATION

SCALE - NTS

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS

SHEET 10 OF 12

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

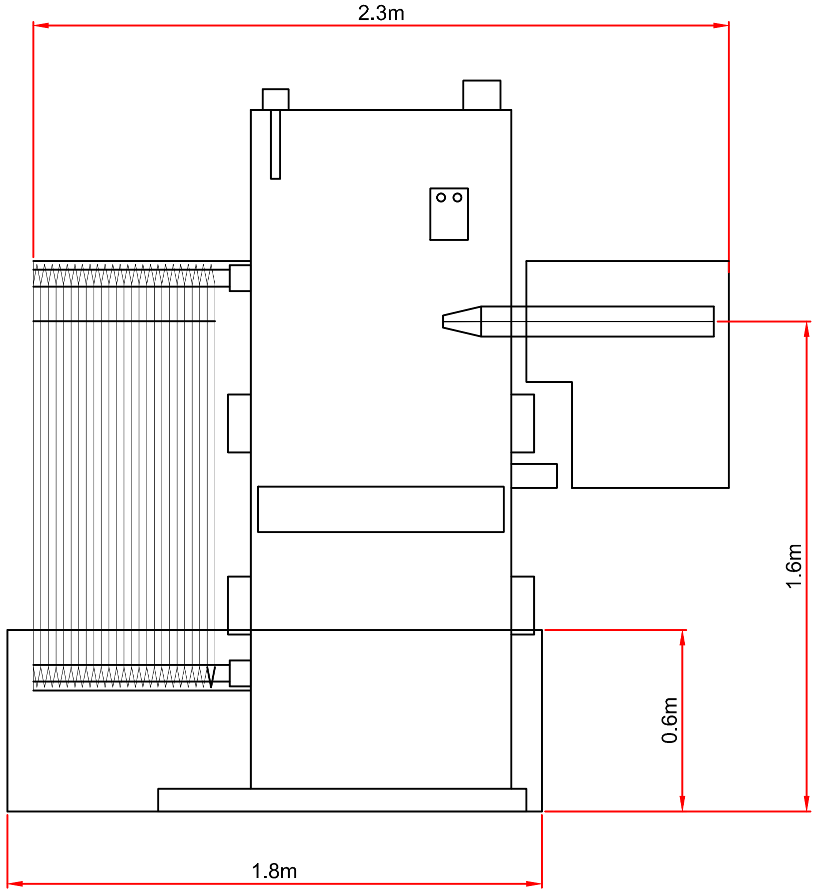
DRAWING NUMBER 03219D2209-01

SCALE - NTS @ A3

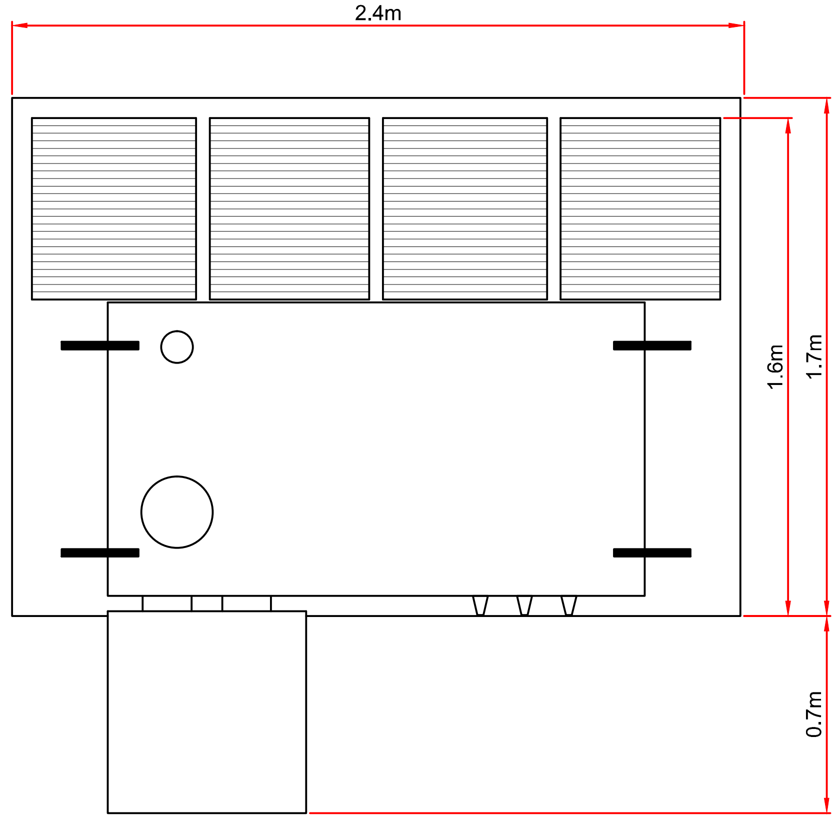
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



INDICATIVE LVDSTATCOM TRANSFORMER - SIDE ELEVATION
SCALE - 1:25



INDICATIVE LVDSTATCOM TRANSFORMER - PLAN VIEW
SCALE - 1:25

DUNBEG SOUTH WIND FARM

FIGURE 2.5

CONTROL BUILDING & SUBSTATION COMPOUND ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 11 OF 12

LAYOUT DWG N/A	T-LAYOUT NO. N/A

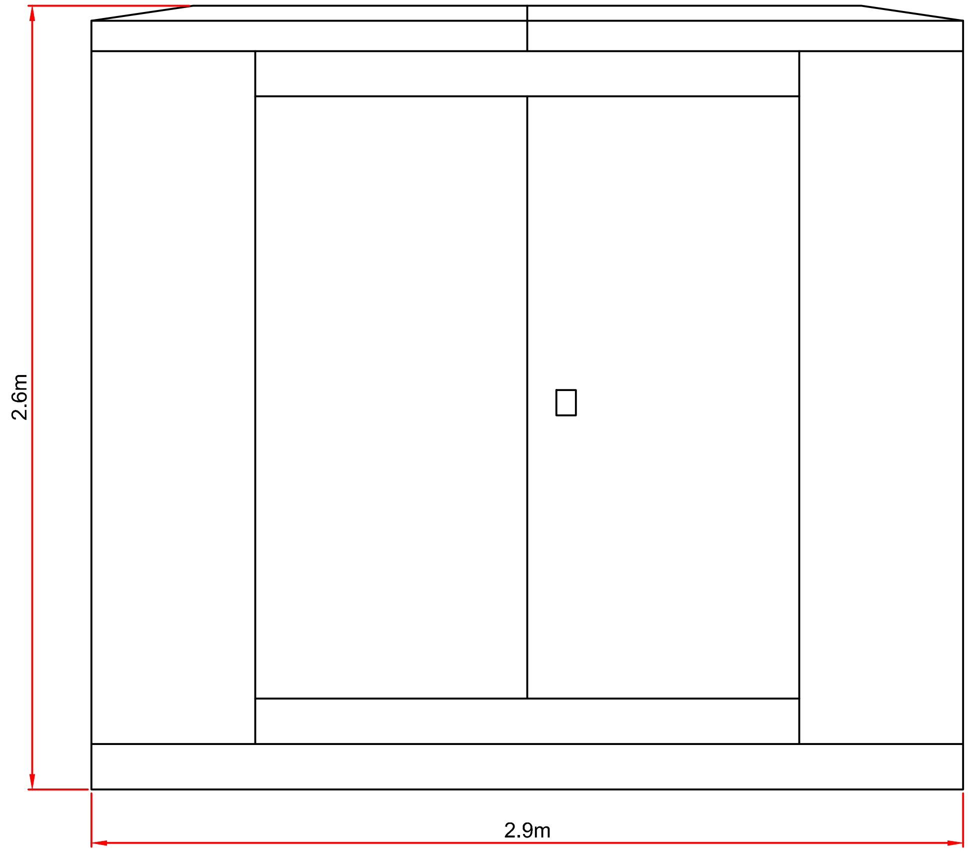
DRAWING NUMBER 03219D2209-01

SCALE - 1:25 @ A3

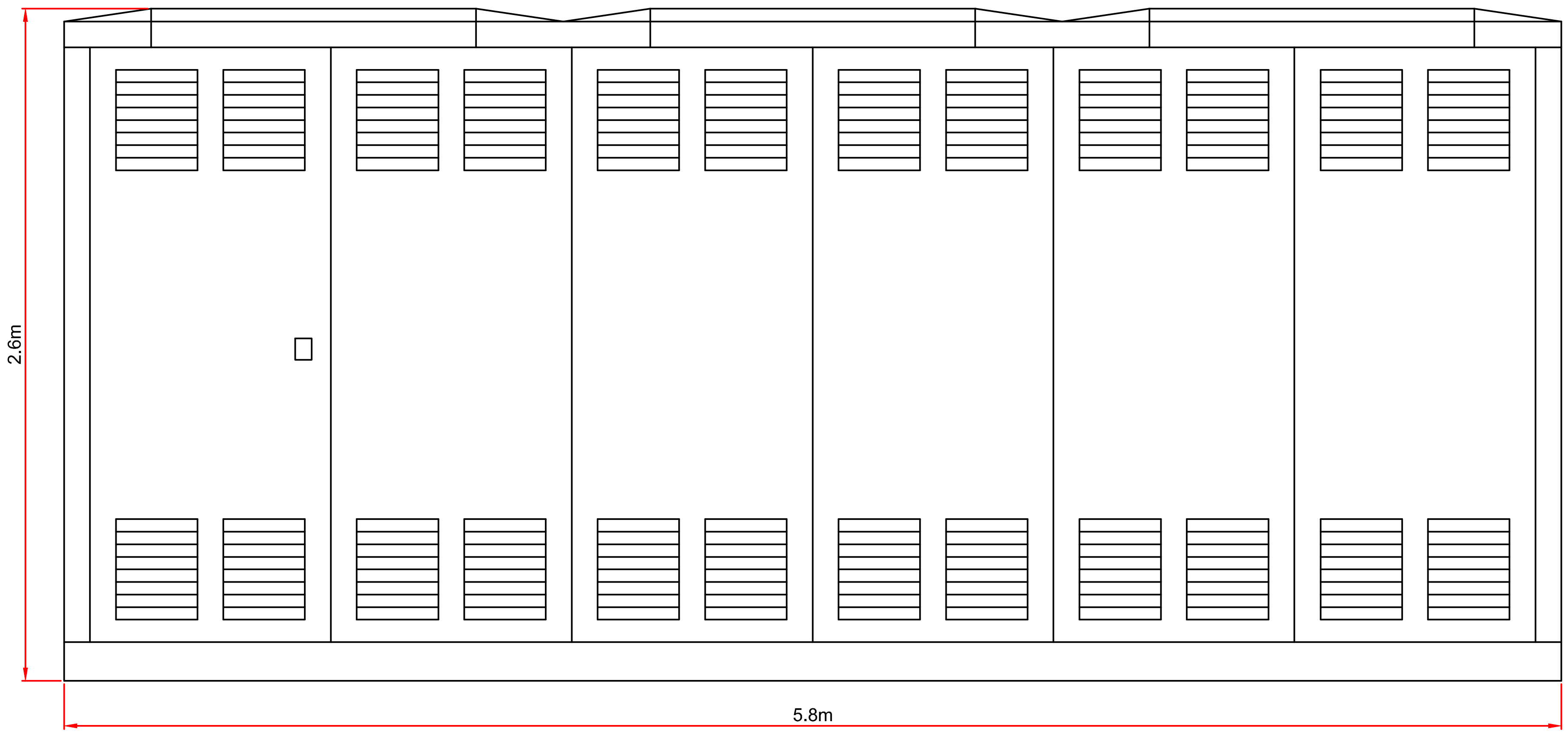
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



INDICATIVE OUTDOOR SWITCHGEAR - SIDE ELEVATION
SCALE - 1:25



INDICATIVE OUTDOOR SWITCHGEAR - FRONT ELEVATION
SCALE - 1:25

DUNBEG SOUTH
WIND FARM

FIGURE 2.5

CONTROL BUILDING &
SUBSTATION COMPOUND
ELEVATIONS

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

NOTES:

1. REFER TO SHEETS 3 - 12 FOR INFORMATION ON INDICATIVE COMPOUND COMPONENTS.

COMPOUND ELEVATIONS
SHEET 12 OF 12

LAYOUT DWG N/A
T-LAYOUT NO. N/A

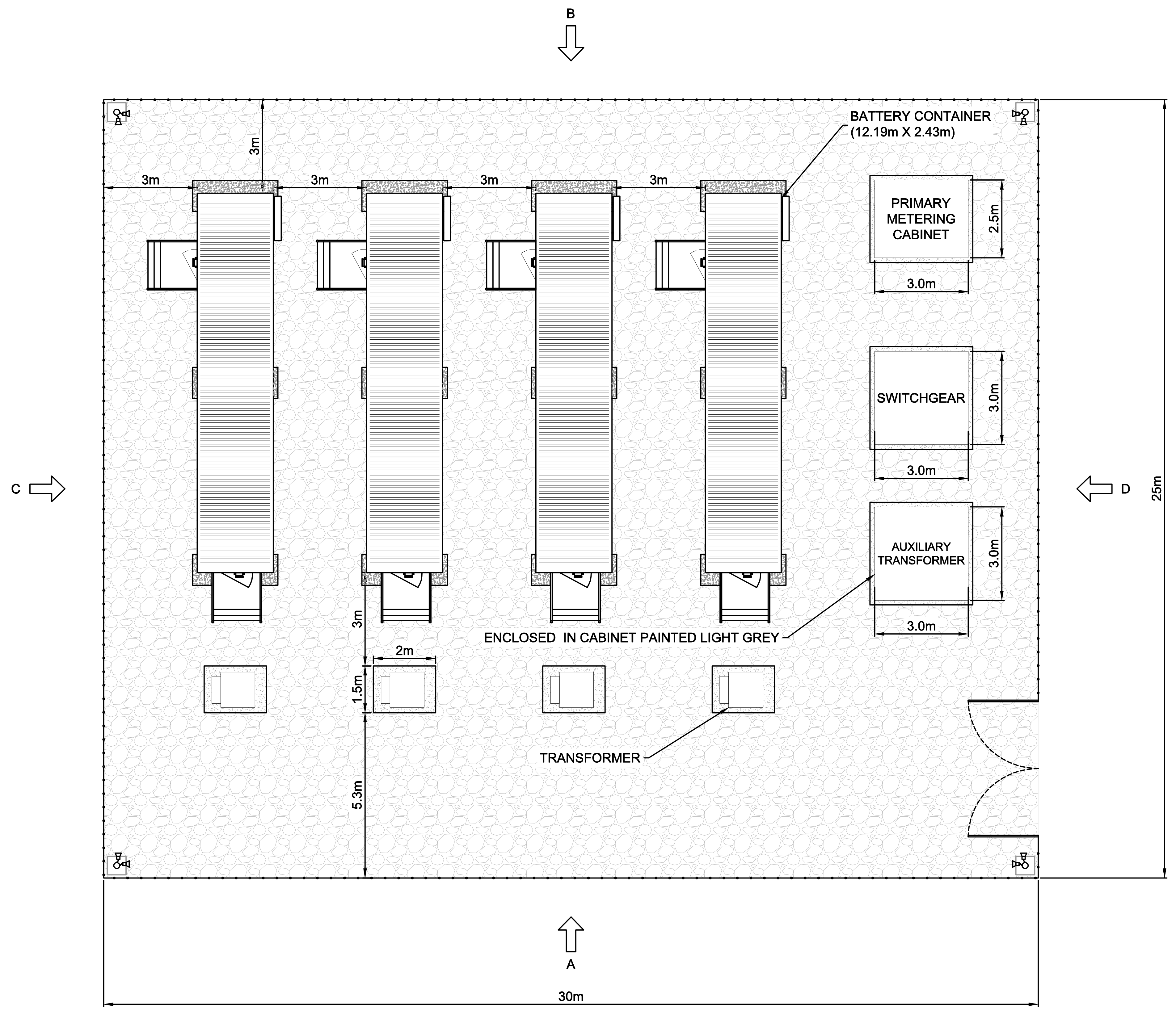
DRAWING NUMBER 03219D2209-01

SCALE - 1:25 @ A3

ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

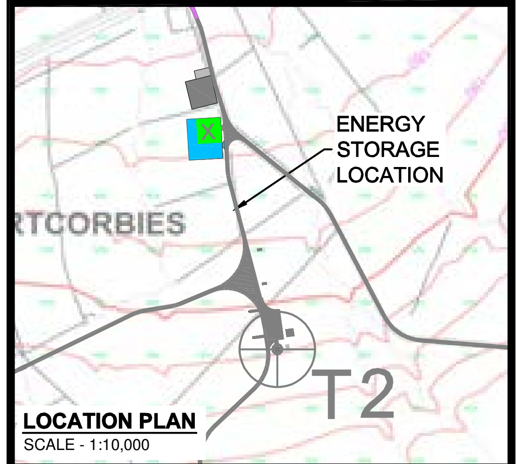
CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2.6

ENERGY STORAGE COMPOUND PLAN & ELEVATION
(SHEET 1 OF 3)
LAYOUT PLAN



LOCATION PLAN
SCALE - 1:10,000

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:
- INFRASTRUCTURE
- 18-25mm GRADE, 150mm DEEP, CLEAN CRUSHED ROCK
- TEMPORARY CONSTRUCTION COMPOUND
- PALISADE FENCE 2.4m HIGH
- ENERGY STORAGE LOCATION
- MAX. 4.5m HIGH 50W HALIDE LAMP OR SIMILAR. COLUMNS SHALL BE TELESCOPIC, HINGED OR SIMILAR TO FACILITATE GROUND LEVEL BULB REPLACEMENT. EXACT POSITIONS TBC BASED ON SELECTED PRODUCT(S).

NOTE:
1. ALL DIMENSIONS ARE MAXIMUM ANTICIPATED AND SUBJECT TO DETAILED DESIGN.

LAYOUT DWG	03219D0001-06	T-LAYOUT NO.	PNIRdbx028

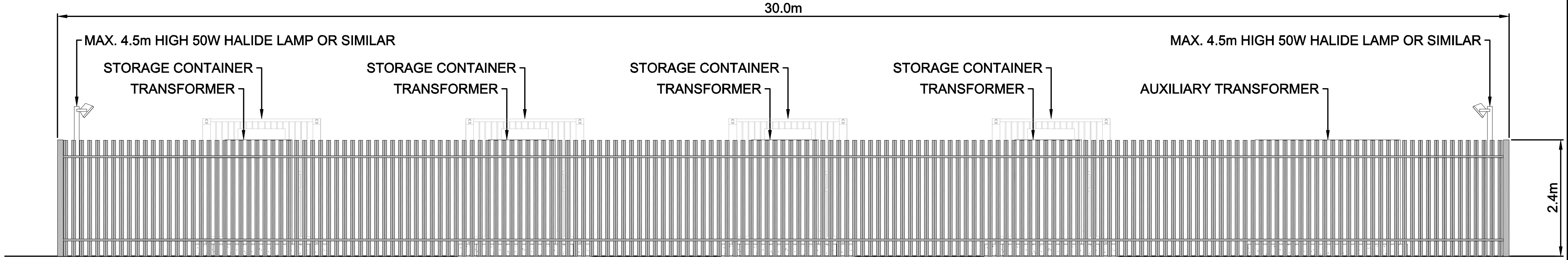
DRAWING NUMBER **03219D2210-01**

SCALE - 1:150 @ A3

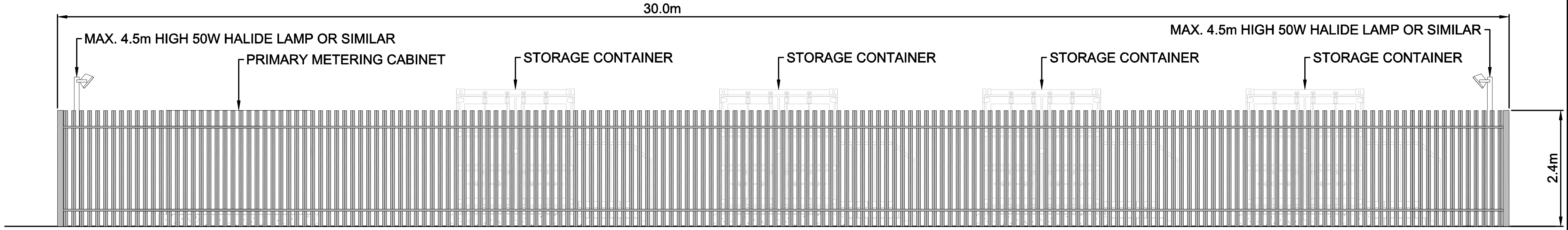
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

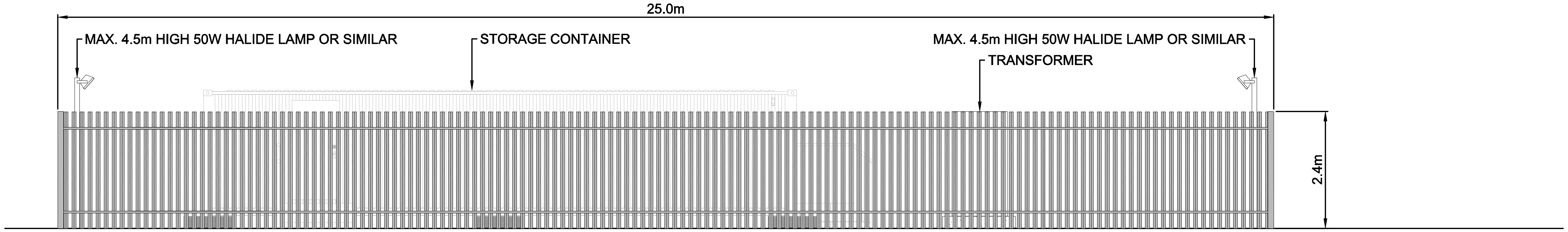
CONSENTED (LA01/2018/0200/F)



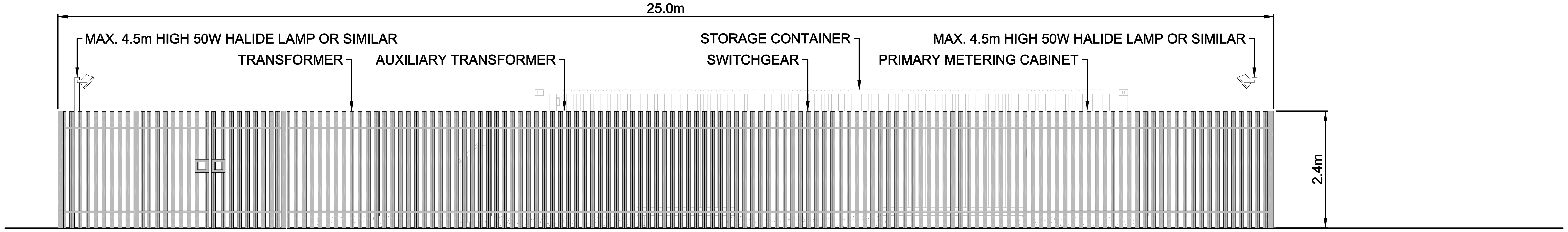
ELEVATION A



ELEVATION B



ELEVATION C



ELEVATION D

INDICATIVE PRIMARY METERING CABINET

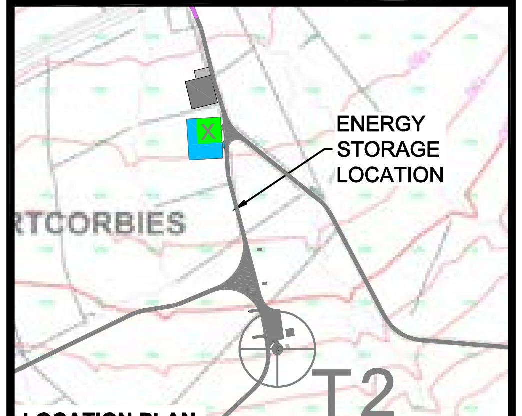
INDICATIVE SWITCHGEAR

INDICATIVE TRANSFORMER

DUNBEG SOUTH WIND FARM

FIGURE 2.6

ENERGY STORAGE COMPOUND PLAN & ELEVATION (SHEET 2 OF 3) ELEVATIONS WITH FENCE



LOCATION PLAN
SCALE - 1:10,000

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

- INFRASTRUCTURE
- TEMPORARY CONSTRUCTION COMPOUND
- ENERGY STORAGE LOCATION

NOTE:

1. ALL DIMENSIONS ARE MAXIMUM ANTICIPATED AND SUBJECT TO DETAILED DESIGN.

LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028

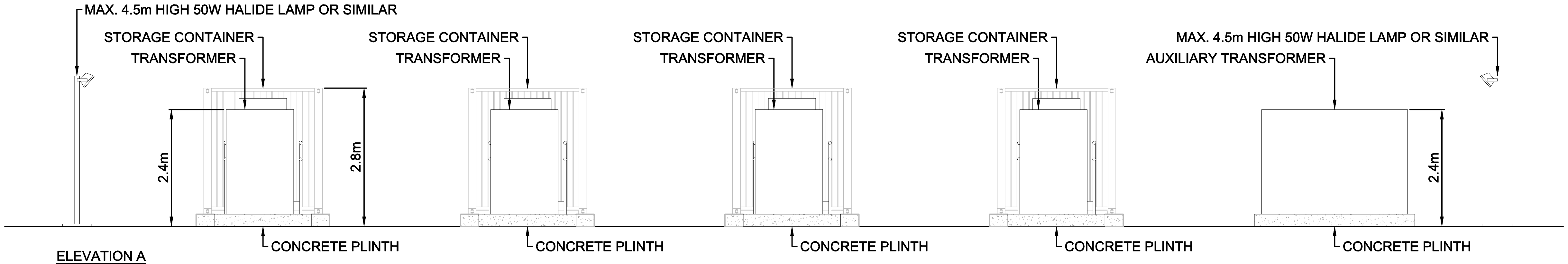
DRAWING NUMBER **03219D2210-01**

SCALE - 1:100 @ A3

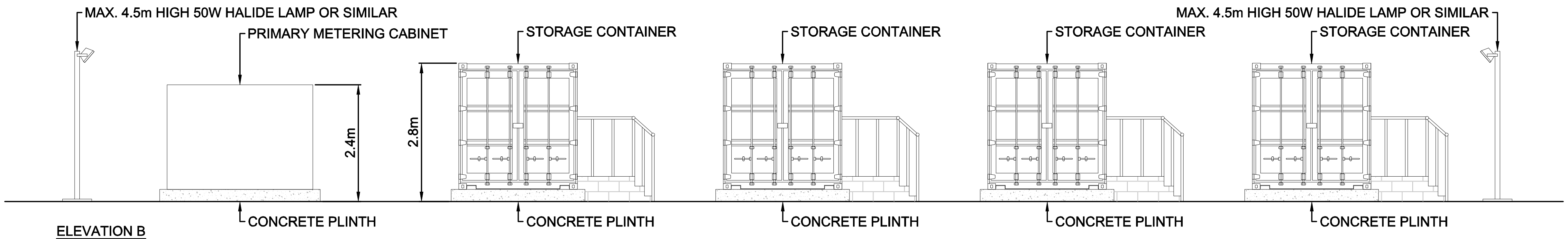
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

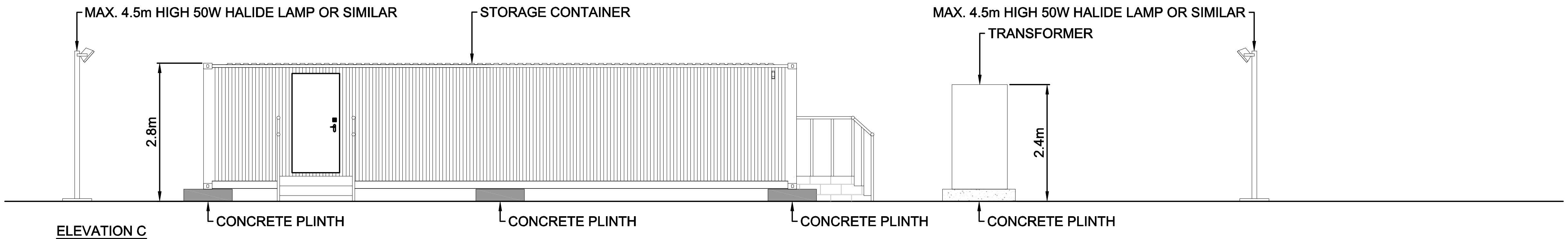
CONSENTED (LA01/2018/0200/F)



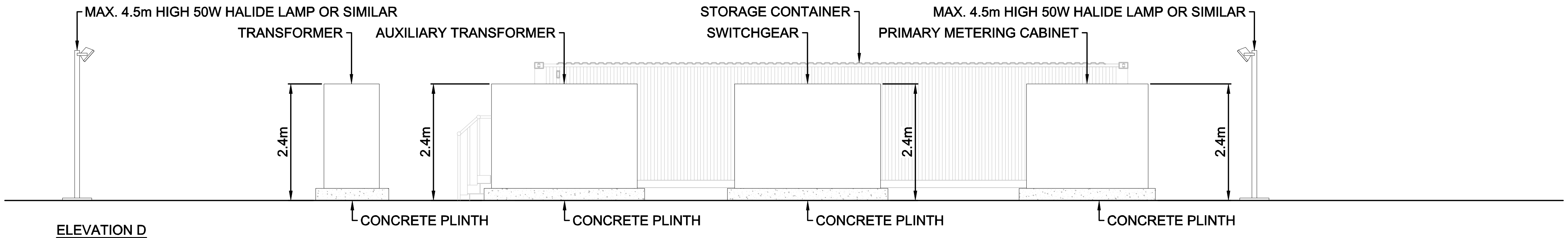
ELEVATION A



ELEVATION B



ELEVATION C



ELEVATION D

INDICATIVE PRIMARY METERING CABINET

INDICATIVE SWITCHGEAR

INDICATIVE TRANSFORMER

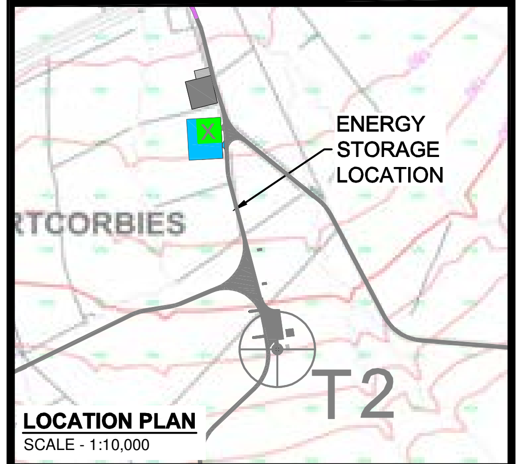
DUNBEG SOUTH WIND FARM

FIGURE 2.6

ENERGY STORAGE COMPOUND PLAN & ELEVATION

(SHEET 3 OF 3)

ELEVATIONS WITHOUT FENCE



LOCATION PLAN
SCALE - 1:10,000

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

- INFRASTRUCTURE
- TEMPORARY CONSTRUCTION COMPOUND
- ENERGY STORAGE LOCATION

NOTE:

1. ALL DIMENSIONS ARE MAXIMUM ANTICIPATED AND SUBJECT TO DETAILED DESIGN.

LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028

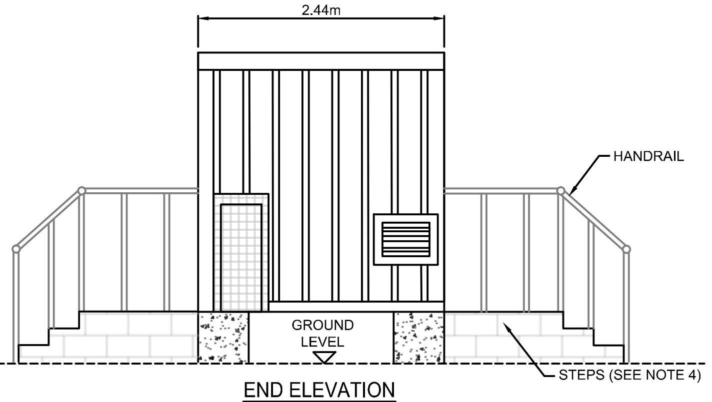
DRAWING NUMBER **03219D2210-01**

SCALE - 1:100 @ A3

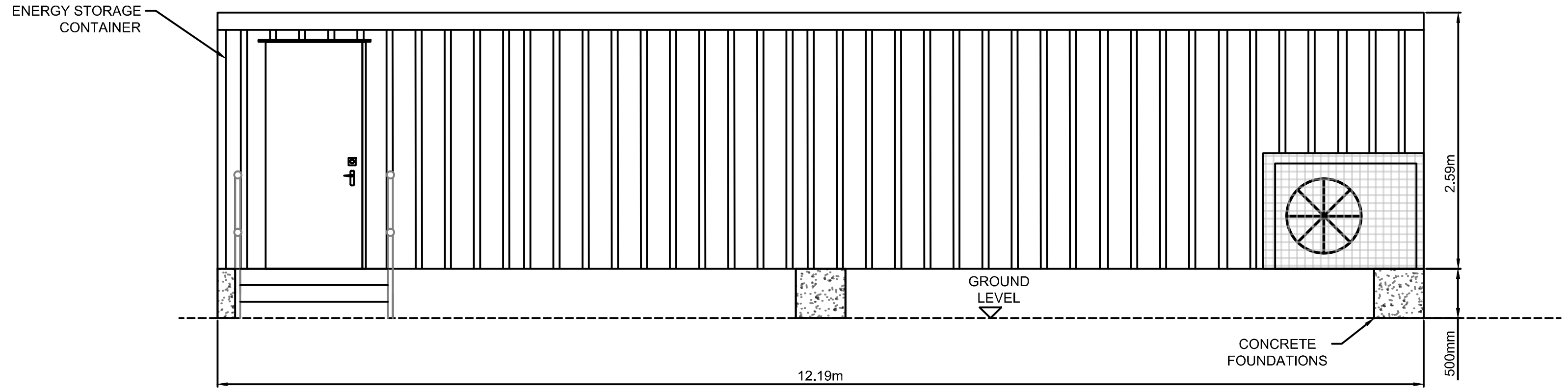
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

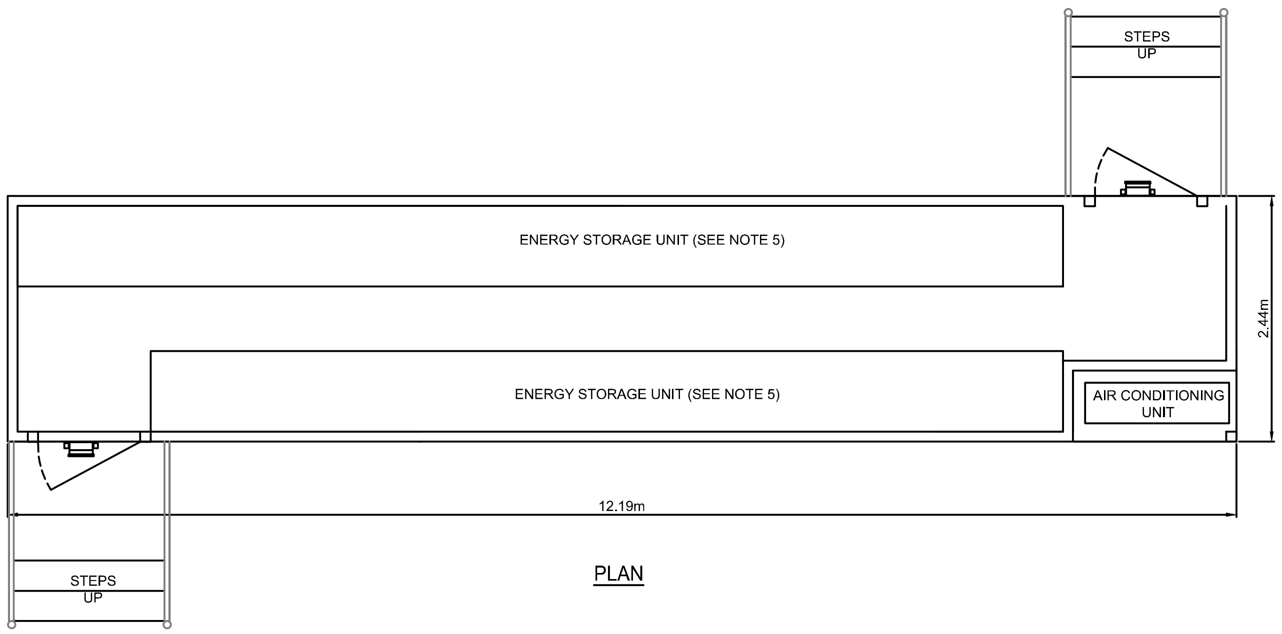
CONSENTED (LA01/2018/0200/F)



END ELEVATION



SIDE ELEVATION



PLAN

DUNBEG SOUTH WIND FARM

FIGURE 2.7

TYPICAL ENERGY STORAGE CONTAINER ELEVATION

NOTES:

1. ALL DIMENSIONS ARE MAXIMUM ANTICIPATED AND SUBJECT TO DETAILED DESIGN
2. DOOR AND STEPS POSITIONS ARE INDICATIVE AND SUBJECT TO DETAILED DESIGN.
3. APPROXIMATE FINISHED FLOOR LEVEL 500mm ABOVE EXISTING GROUND LEVEL.
4. STEPS TO BE EITHER CONSTRUCTED ON SITE FROM MASS CONCRETE OR MASONRY BLOCKS OR PREFABRICATED OFF SITE AND INSTALLED ON SITE FOLLOWING POSITIONING OF THE STORAGE UNIT.
5. THE LOCATION AND SIZE OF ENERGY STORAGE UNIT WITHIN THE CONTAINER TO BE DETERMINED AT DETAILED DESIGN STAGE.
6. EXTERNAL COLOUR OF ENERGY STORAGE UNIT TO BE AGREED WITH PLANNING AUTHORITY

KEY:

DOOR

PASSIVE INFRARED LIGHTING (PLAN)

PASSIVE INFRARED LIGHTING (ELEVATION)

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

DRAWING NUMBER

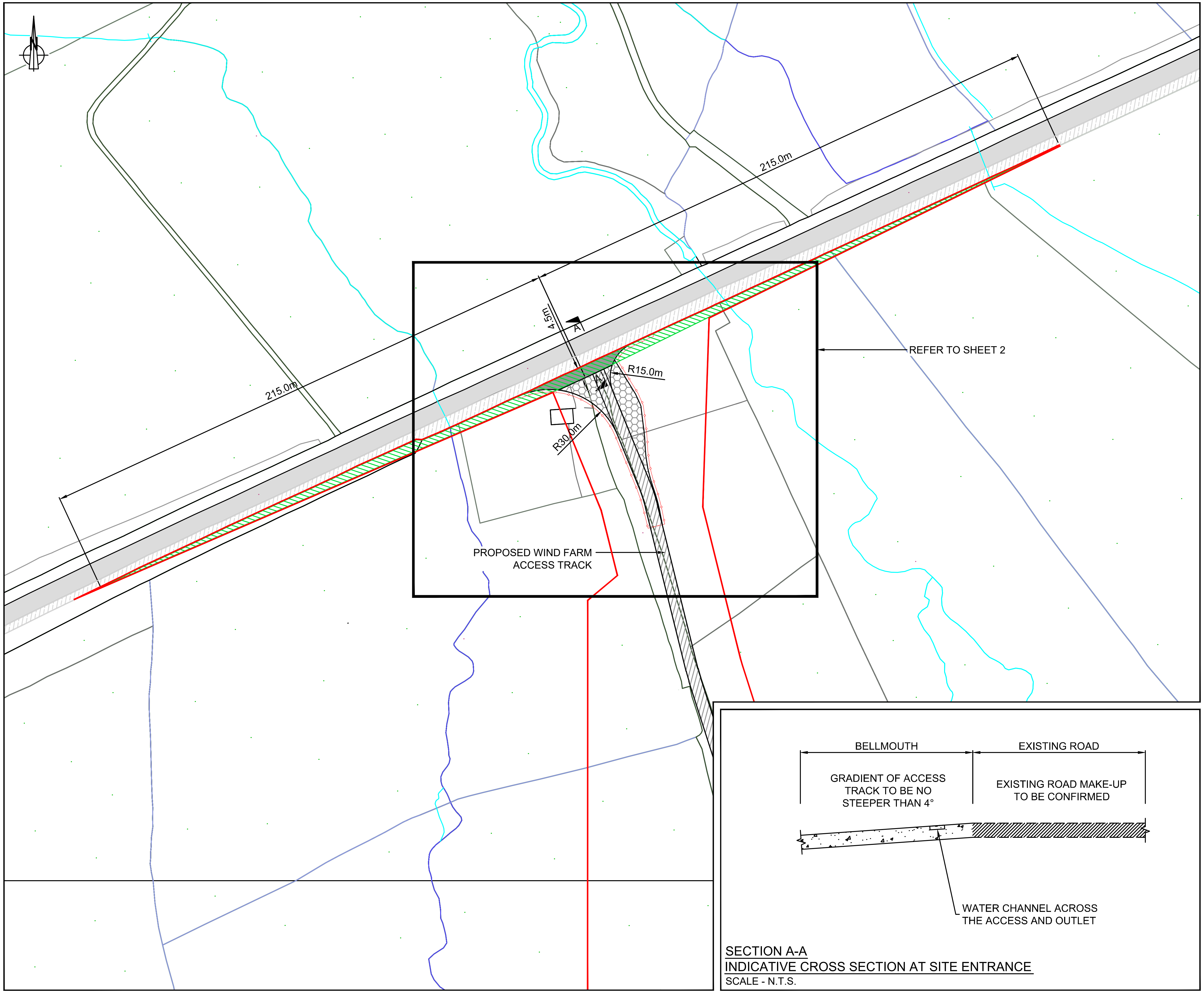
03219D2211-01

SCALE - 1:75 @ A3

ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH WIND FARM

FIGURE 2.8

SITE ENTRANCE

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

- EXISTING ROAD
- EXISTING HARDSHOULDER
- PROPOSED SITE TRACK
- PROPOSED ABNORMAL LOADS: AREA WILL BE REINSTATED ON COMPLETION OF WIND FARM CONSTRUCTION
- MINIMUM 150mm TYPE 1 SUB-BASE SOFT AREAS AND UNSUITABLE MATERIAL (PEAT, TOPSOIL, SILT) TO BE REMOVED
  - 150mm CONCRETE OR BLACK TOP
  - MINIMUM FALL FROM ENTRANCE TO PUBLIC ROAD 1:100
  - EXISTENCE OF SERVICES TO BE CHECKED WITH RELEVANT AUTHORITIES
- VISIBILITY SPLAY
  - VEGETATION TO BE CUT BACK AS NECESSARY. AREA TO BE LEVELED TO BETWEEN 150 AND 250mm ABOVE THE LEVEL OF CARRIAGEWAY.
- PROPOSED STOCK PROOF FENCE
- PROPOSED GATE
- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)

NOTES:

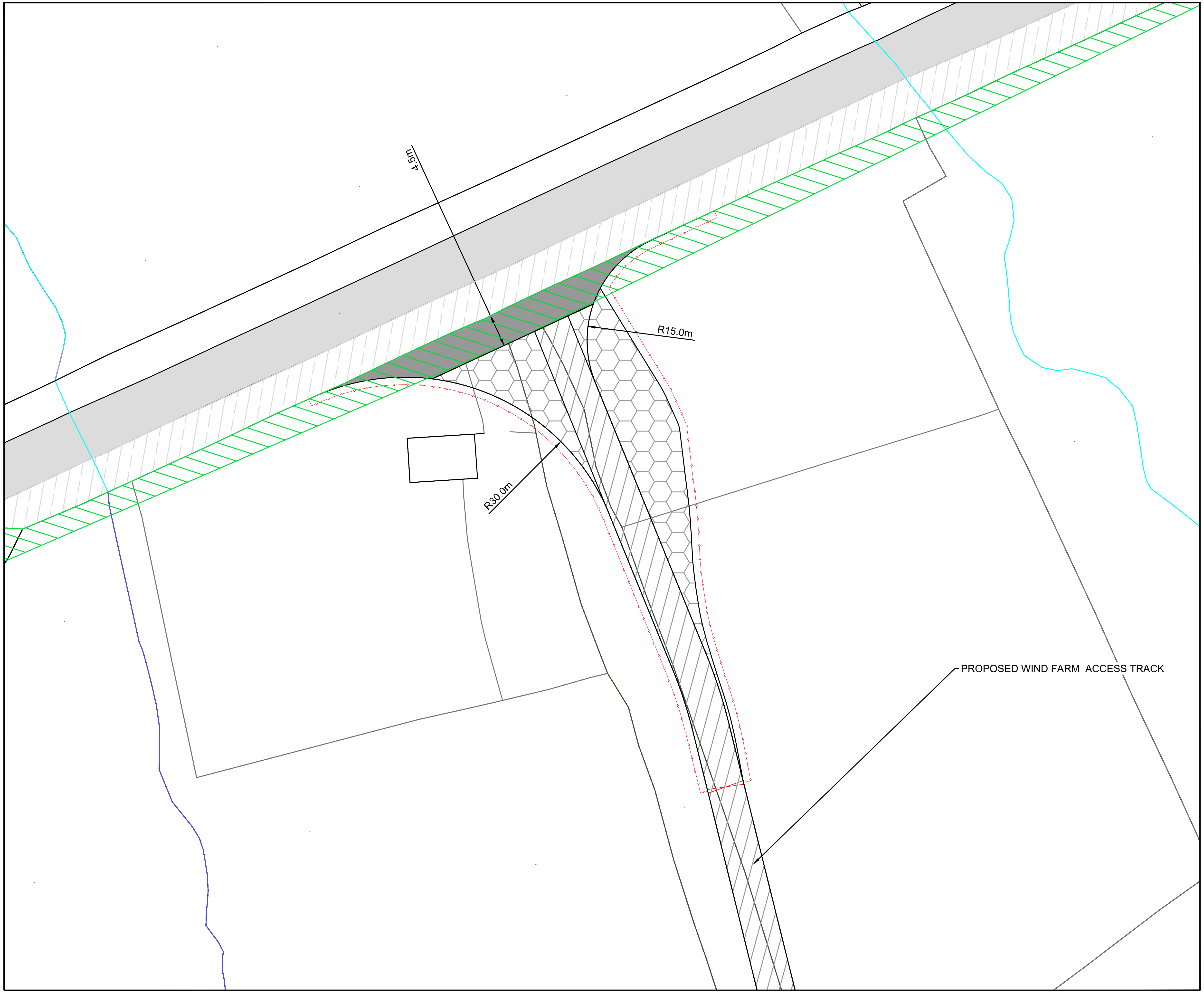
1. DO NOT SCALE FROM DRAWING
2. DETAILS AND DIMENSIONS ARE INDICATIVE ONLY AND SUBJECT TO CHANGES AT DETAILED DESIGN STAGE.
3. APPROPRIATE SUDS DESIGN MEASURES WILL BE EMPLOYED AT DETAIL DESIGN STAGE.
4. ANY SURFACE WATER RUNOFF WILL BE TARGETED USING APPROPRIATE SUDS MEASURES TO BE DESIGN AT A LATER DATE.
5. ALL VISIBILITY SPLAYS SHOWN ARE WITHIN LANDS UNDER APPLICANTS CONTROL.

SHEET 1 OF 2

LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 03219D2402-02	
SCALE - 1:1500 @ A3	
ENVIRONMENTAL STATEMENT 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2.8

SITE ENTRANCE

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY:

- EXISTING ROAD
- EXISTING HARDSHOULDER
- PROPOSED SITE TRACK
- PROPOSED ABNORMAL LOADS: AREA WILL BE REINSTATED ON COMPLETION OF WIND FARM CONSTRUCTION
- MINIMUM 150mm TYPE 1 SUB-BASE SOFT AREAS AND UNSUITABLE MATERIAL (PEAT, TOPSOIL, SILT) TO BE REMOVED
  - 150mm CONCRETE OR BLACK TOP
  - MINIMUM FALL FROM ENTRANCE TO PUBLIC ROAD 1:100
  - EXISTENCE OF SERVICES TO BE CHECKED WITH RELEVANT AUTHORITIES
- VISIBILITY SPLAY
  - VEGETATION TO BE CUT BACK AS NECESSARY. AREA TO BE LEVELED TO BETWEEN 150 AND 250mm ABOVE THE LEVEL OF CARRIAGEWAY.
- PROPOSED STOCK PROOF FENCE
- PROPOSED GATE

NOTES:

1. DO NOT SCALE FROM DRAWING
2. DETAILS AND DIMENSIONS ARE INDICATIVE ONLY AND SUBJECT TO CHANGES AT DETAILED DESIGN STAGE.
3. APPROPRIATE SUDS DESIGN MEASURES WILL BE EMPLOYED AT DETAIL DESIGN STAGE.
4. ANY SURFACE WATER RUNOFF WILL BE TARGETED USING APPROPRIATE SUDS MEASURES TO BE DESIGN AT A LATER DATE.
5. ALL VISIBILITY SPLAYS SHOWN ARE WITHIN LANDS UNDER APPLICANTS CONTROL.

SHEET 2 OF 2

LAYOUT DWG N/A	T-LAYOUT NO. N/A

DRAWING NUMBER 03219D2402-02

SCALE - 1:500 @ A3

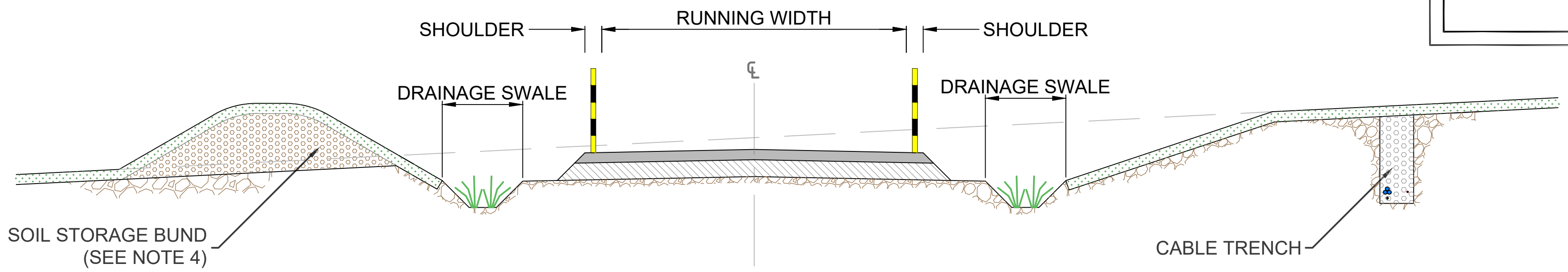
ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

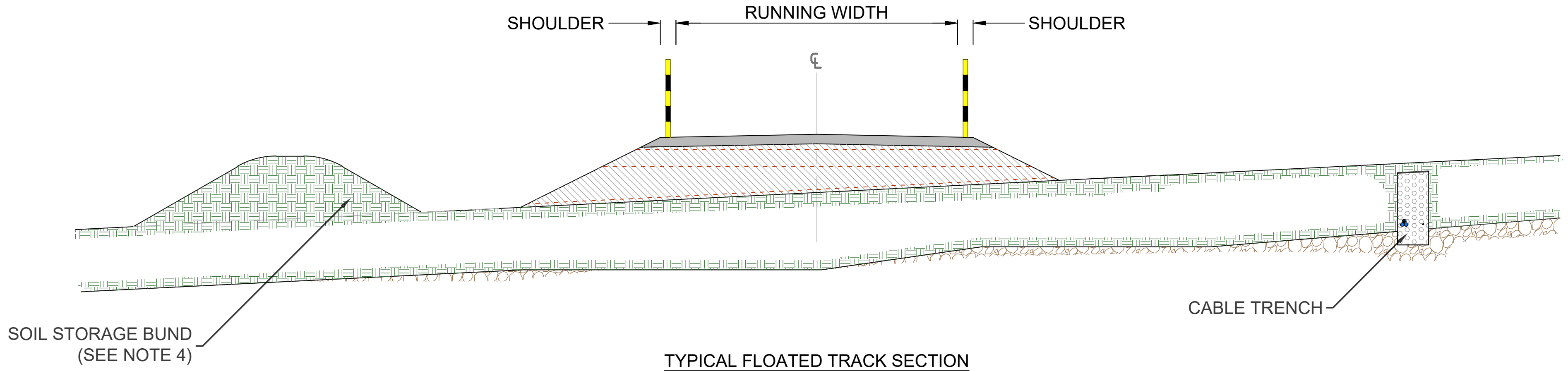
CONSENTED (LA01/2018/0200/F)

KEY:

- RUNNING SURFACE
- BASE/CAPPING LAYER
- TOPSOIL
- SUBGRADE
- PEAT LAYER/SOFT GROUND
- GEOGRID
- EXISTING GROUND LEVEL
- SNOW POLES (WHERE REQUIRED)



TYPICAL TRACK SECTION



TYPICAL FLOATED TRACK SECTION

DUNBEG SOUTH WIND FARM

FIGURE 2.9

ACCESS TRACK TYPICAL DETAILS

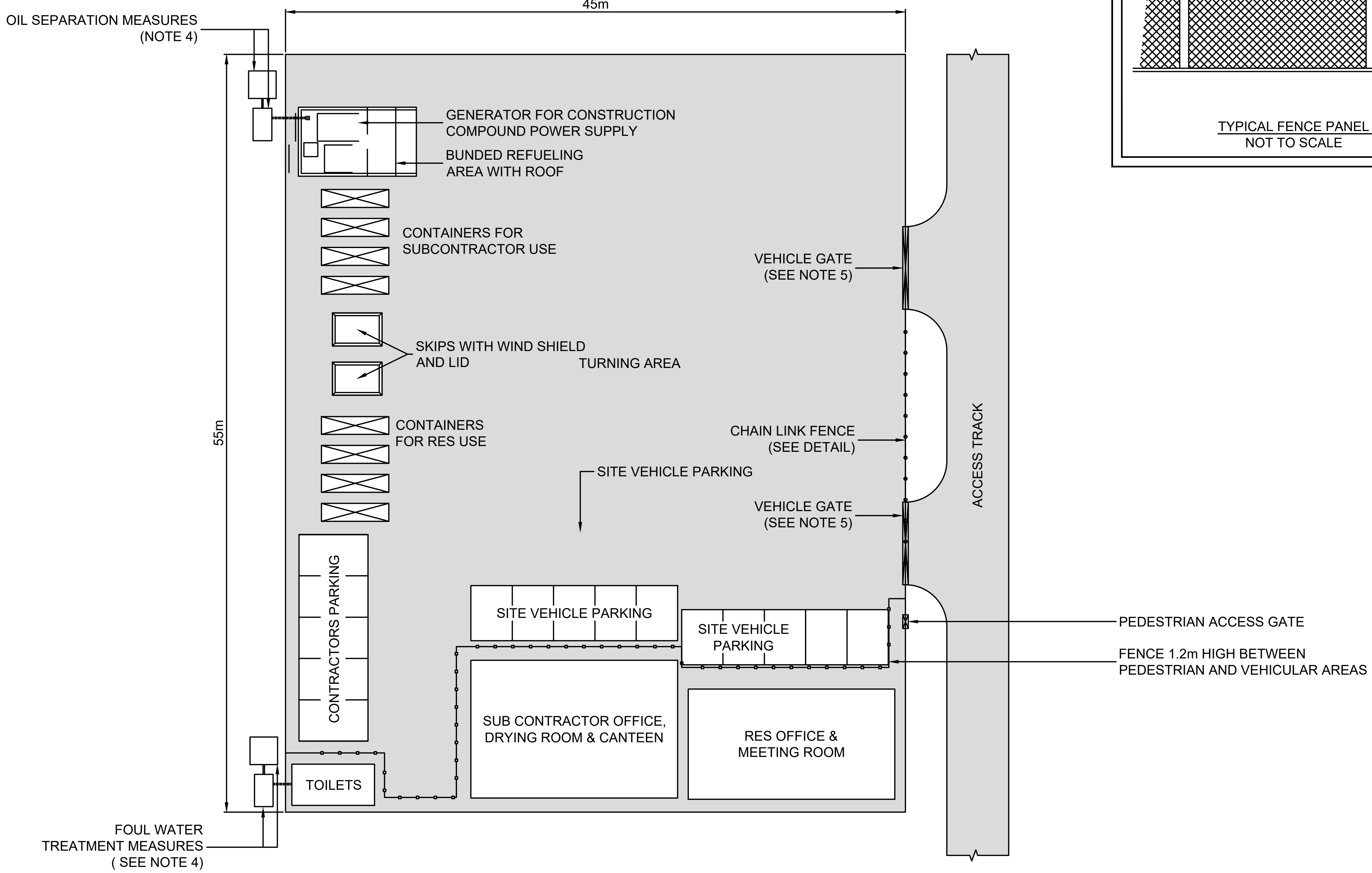
NOTES:

1. DO NOT SCALE FROM THIS DRAWING.
2. TRACK WIDTH TO INCREASE ON BENDS AND PASSING PLACES.
3. ALL EMBANKMENT SLOPES TO BE PROVIDED AT A STABLE ANGLE BASED ON THE PROPERTIES OF THE MATERIAL ENCOUNTERED ON SITE.
4. EXCAVATED MATERIAL WILL BE PLACED IN AGREED LOCATIONS. REINSTATEMENT AND/OR SPOIL MANAGEMENT PLANS WILL BE DEVELOPED IN LINE WITH CURRENT BEST PRACTICE.
5. TRACK CONSTRUCTION TYPE TO BE DETERMINED DURING DETAILED DESIGN. LAYOUT OF DRAINAGE, CABLE TRENCHES AND STORAGE BUNDS MAY VARY.
6. RUNNING SURFACE AND BASE/CAPPING LAYER TO BE FORMED FROM SUITABLE MATERIALS COMPACTED IN LAYERS.
7. GEOSYNTHETIC REINFORCEMENT OR SOIL STABILISATION MAY BE USED TO REDUCE THE DEPTH OF TRACK CONSTRUCTION. REQUIREMENT TO BE DETERMINED DURING DETAILED DESIGN.

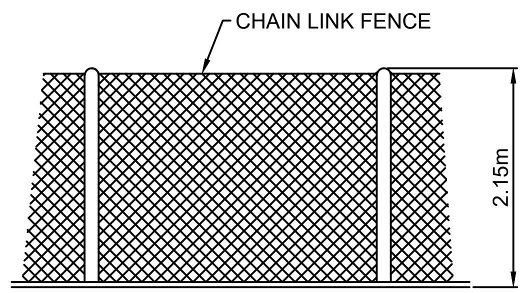
LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 03219D2301-01	
SCALE - NOT TO SCALE	
ENVIRONMENTAL STATEMENT 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



PLAN
SCALE - 1:350 @ A3



TYPICAL FENCE PANEL
NOT TO SCALE

DUNBEG SOUTH WIND FARM

FIGURE 2.10

TEMPORARY CONSTRUCTION COMPOUND LAYOUT PLAN

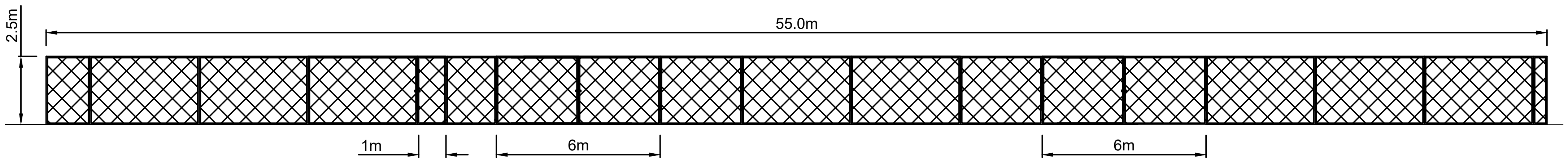
NOTES:

1. SIZE, NUMBER AND LOCATION OF COMPOUND EQUIPMENT AND FACILITIES ARE INDICATIVE ONLY
2. STRUCTURE TO BE TEMPORARY AND TO BE REMOVED AFTER CONSTRUCTION.
3. COMPOUND HARDSTANDING CONSISTING OF COMPACTED STONE OVER A LAYER OF GEOTEXTILE TO PROVIDE A CLEAN, FIRM, LEVEL AND FREE DRAINING SURFACE SUITABLE FOR CABINS AND HEAVY TRAFFIC.
4. APPROPRIATE MEASURES FOR SEPARATION OF OILS AND TREATMENT OF FOUL WATER TO BE AGREED WITH THE RELEVANT AUTHORITIES.
5. VEHICULAR GATES TO BE 6m WIDE CONSISTING OF 2 x 3m LEAVES

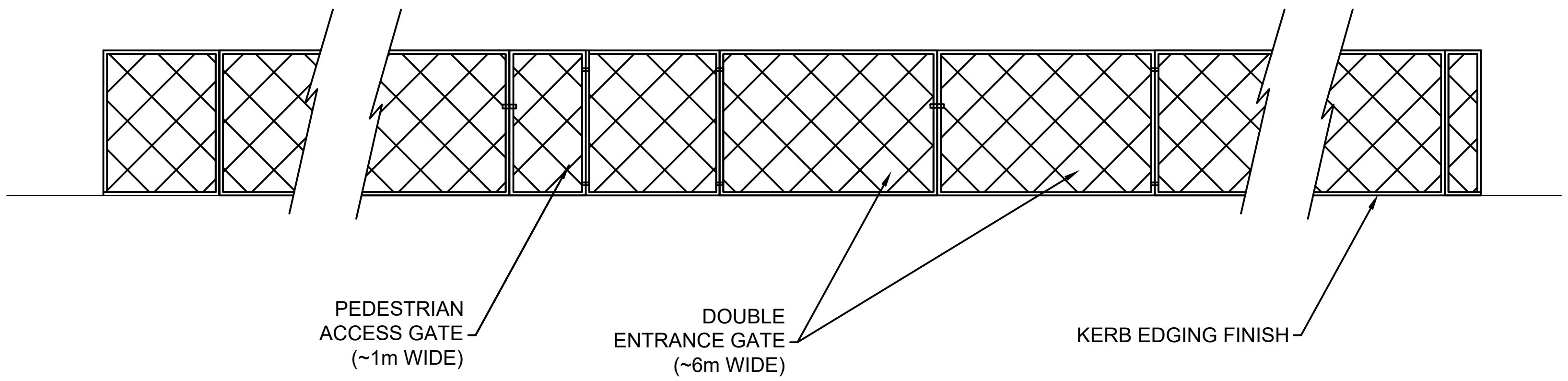
LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 03219D2212-01	
SCALE - AS SHOWN @ A3	
ENVIRONMENTAL STATEMENT 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



SECURITY FENCE ELEVATION
SCALE - 1:200



SECURITY FENCE ELEVATION
SCALE - 1:100

DUNBEG SOUTH
WIND FARM

FIGURE 2.11

TEMPORARY
CONSTRUCTION
COMPOUND ELEVATION

LAYOUT DWG N/A	T-LAYOUT NO. N/A

DRAWING NUMBER
03219D2213-01

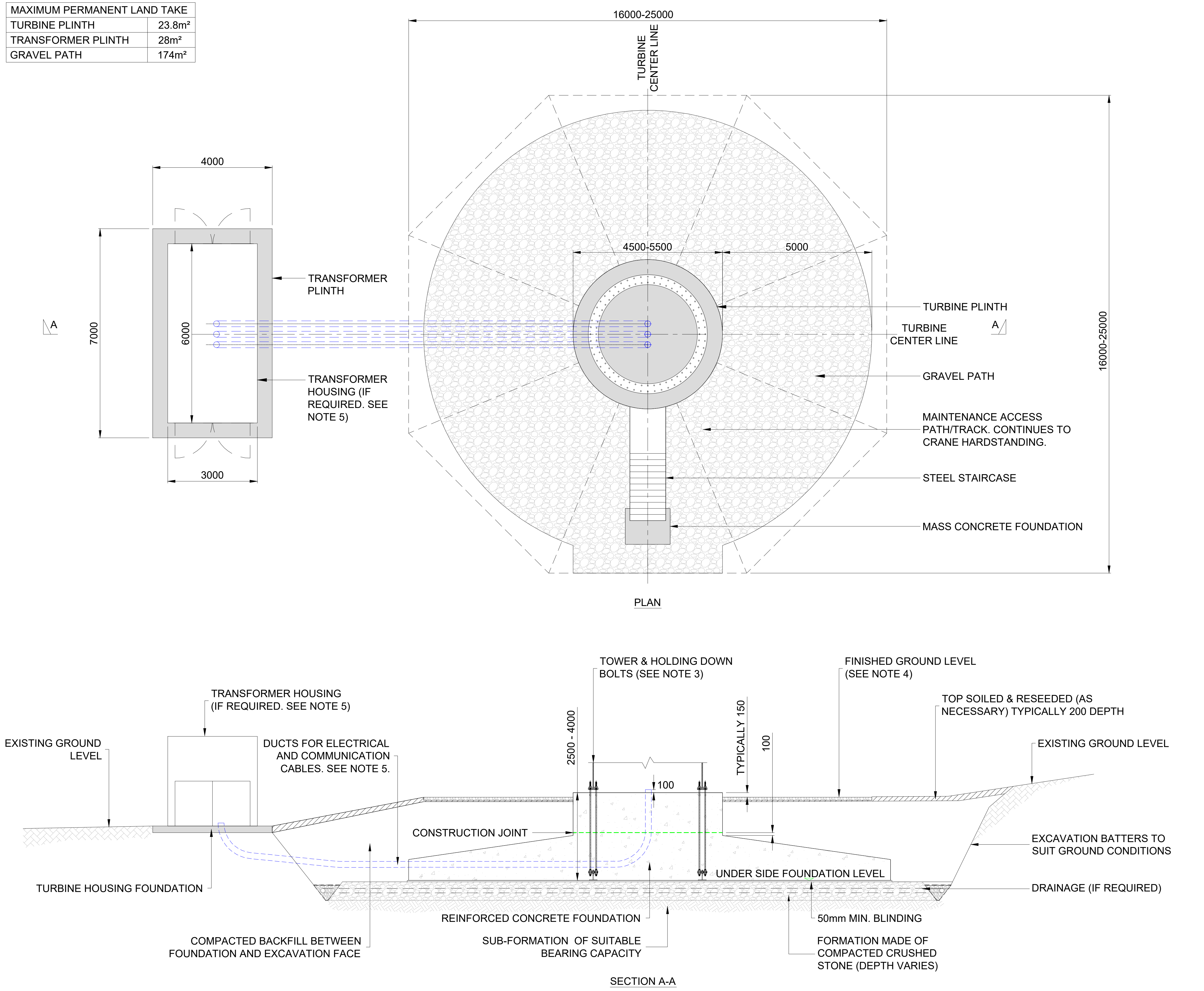
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

MAXIMUM PERMANENT LAND TAKE	
TURBINE PLINTH	23.8m²
TRANSFORMER PLINTH	28m²
GRAVEL PATH	174m²



DUNBEG SOUTH WIND FARM

FIGURE 2.12

WIND TURBINE FOUNDATION

NOTES:

1. DIMENSIONS AND DETAILS ARE INDICATIVE ONLY AND MAY VARY DUE TO SPECIFIC TURBINE OR GROUND CONDITIONS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED
3. THE HOLDING DOWN BOLT ARRANGEMENT SHOWN ON THIS DRAWING IS TYPICAL. HOWEVER ALTERNATIVE CAST IN ARRANGEMENTS ARE AVAILABLE AND MAY BE SUBSTITUTED DEPENDING ON ACTUAL TURBINE SELECTION.
4. GRADIENT OF FINISHED GROUND LEVEL OVER TURBINE BASE, MAX 1:12.
5. EXTERNAL TRANSFORMER NOT REQUIRED FOR ALL TURBINES AND NEED FOR TRANSFORMER HOUSING WILL DEPEND ON THE TURBINE SELECTED DURING DETAILED DESIGN.
6. MATERIALS ARISING FROM EXCAVATIONS TO BE SEGREGATED AND PLACED IN AGREED LOCATIONS ADJACENT TO THE WORKING AREA FOR RE-USE. REINSTATEMENT AND /OR PEAT MANAGEMENT PLANS WILL BE DEVELOPED DURING THE DETAILED DESIGN OF SITE INFRASTRUCTURE, IN LINE WITH CURRENT BEST PRACTICE.

LAYOUT DWG N/A	T-LAYOUT NO. N/A

DRAWING NUMBER 03219D2302-02

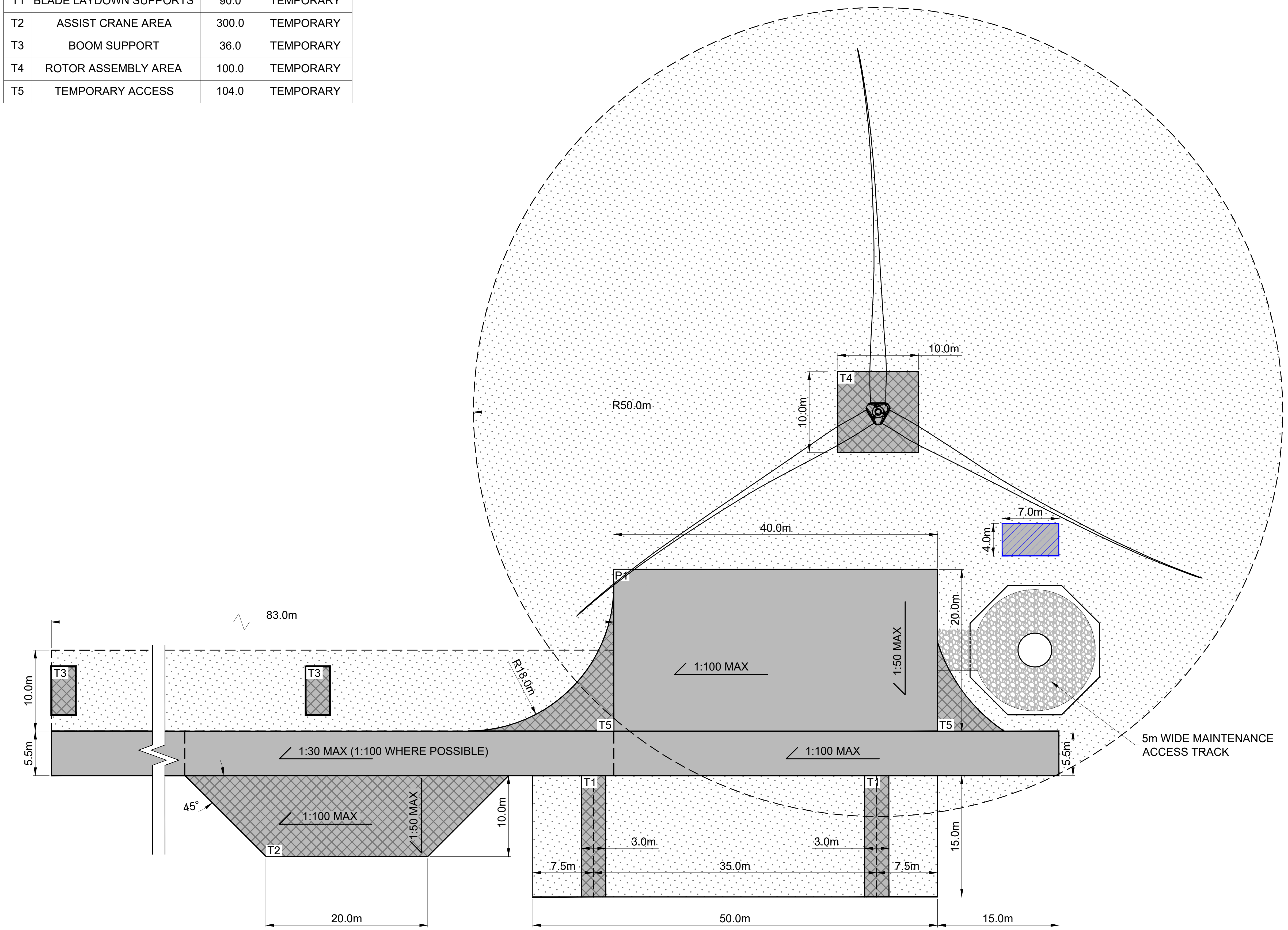
SCALE - 1:125 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

REF	DESCRIPTION	AREA (m²)	MAINTENANCE
P1	MAIN HARDSTANDING	1200.0	PERMANENT
T1	BLADE LAYDOWN SUPPORTS	90.0	TEMPORARY
T2	ASSIST CRANE AREA	300.0	TEMPORARY
T3	BOOM SUPPORT	36.0	TEMPORARY
T4	ROTOR ASSEMBLY AREA	100.0	TEMPORARY
T5	TEMPORARY ACCESS	104.0	TEMPORARY



res

DUNBEG SOUTH
WIND FARM

FIGURE 2.13

CRANE HARDSTANDING
GENERAL ARRANGEMENT

KEY:

- PERMANENT WORKS
- TEMPORARY WORKS
- EXTERNAL TRANSFORMER AND SWITCHGEAR ENCLOSURE
- AREA TO BE FREE FROM TOPOGRAPHICAL CONSTRAINTS
- MAINTENANCE ACCESS TRACK

NOTES:

1. ALL DIMENSIONS IN METRES.
2. HARDSTANDING ARRANGEMENT SUBJECT TO CHANGE DEPENDENT ON SPECIFIC WIND TURBINE MODEL SELECTED FOR CONSTRUCTION.
3. ALL HARDSTANDINGS TO BE CONSTRUCTED ON SUITABLE FOUNDATION MATERIAL.
4. ALL HARDSTANDINGS TO BE FINISHED WITH CRUSHED ROCK, FORMING A FREE DRAINING SURFACE.
5. TRACK ADJACENT TO CRANE HARDSTANDING TO BE DESIGNED TO ACCEPT CRANE OUTRIGGER LOADING.
6. THE PRELIMINARY CRANE HARDSTANDING LAYOUT HAS BEEN DEVELOPED TO ACCOMMODATE EITHER A SINGLE BLADE LIFT OR FULL ROTOR LIFT.

LAYOUT DWG N/A | T-LAYOUT NO. N/A

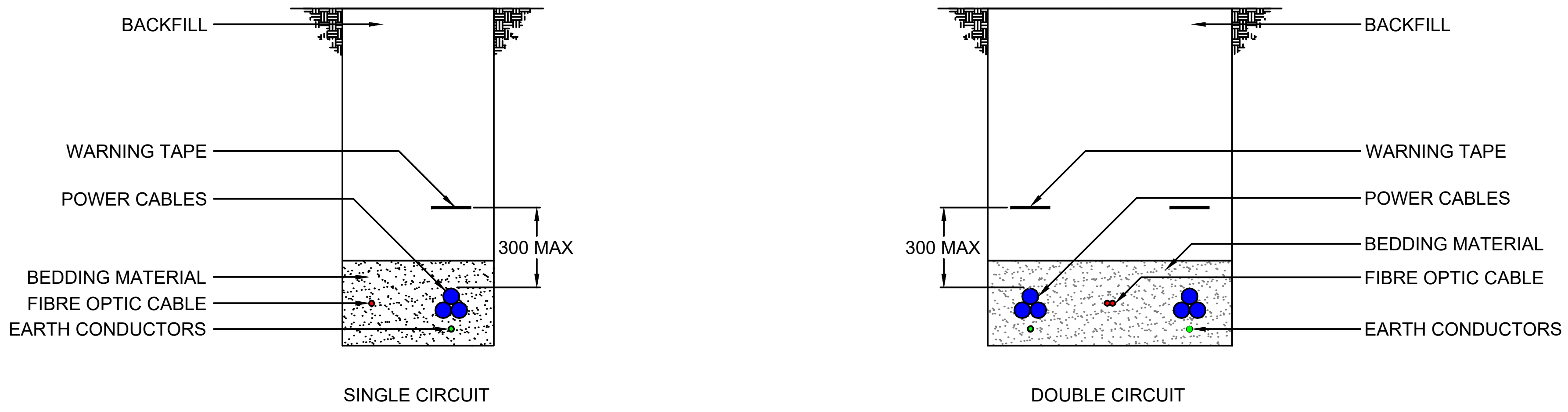
DRAWING NUMBER 03219D2303-02

SCALE - 1:500 @ A3

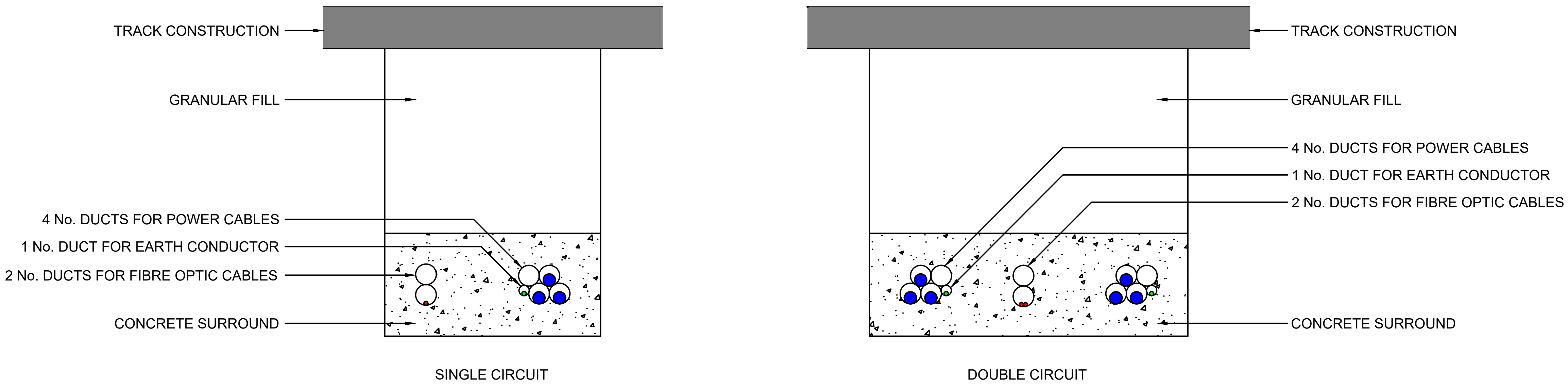
ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



TYPICAL CABLE TRENCHES



TYPICAL TRACK CROSSINGS

DUNBEG SOUTH
WIND FARM

FIGURE 2.14

CROSS SECTION
OF UNDERGROUND
CABLE TRENCH

NOTES:

1. THIS DRAWING IS INDICATIVE ONLY AND IS SUBJECT TO CHANGE AT THE DETAILED DESIGN STAGE.
2. ALL DIMENSIONS IN mm.
3. CABLES MAY BE INSTALLED BY CABLE PLOUGH FOR DISTANCES GREATER THAN 1km.

LAYOUT DWG N/A	T-LAYOUT NO. N/A

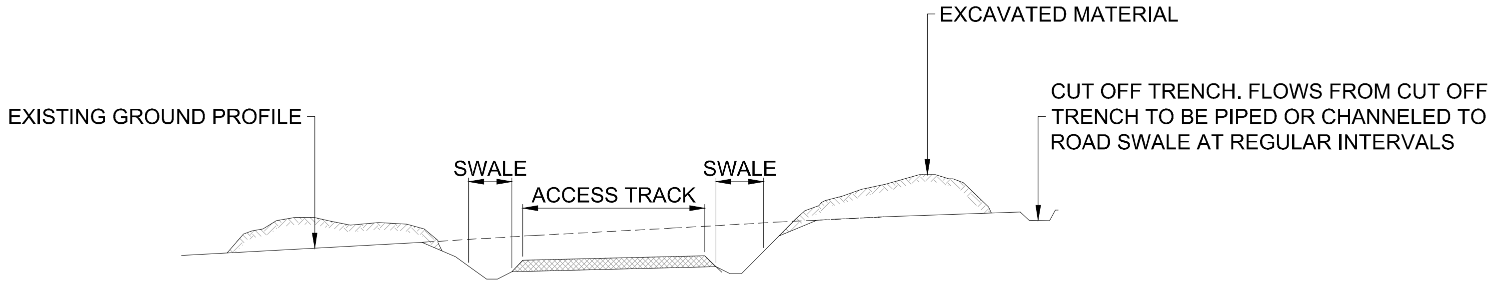
DRAWING NUMBER 03219D2304-02

SCALE - NOT TO SCALE

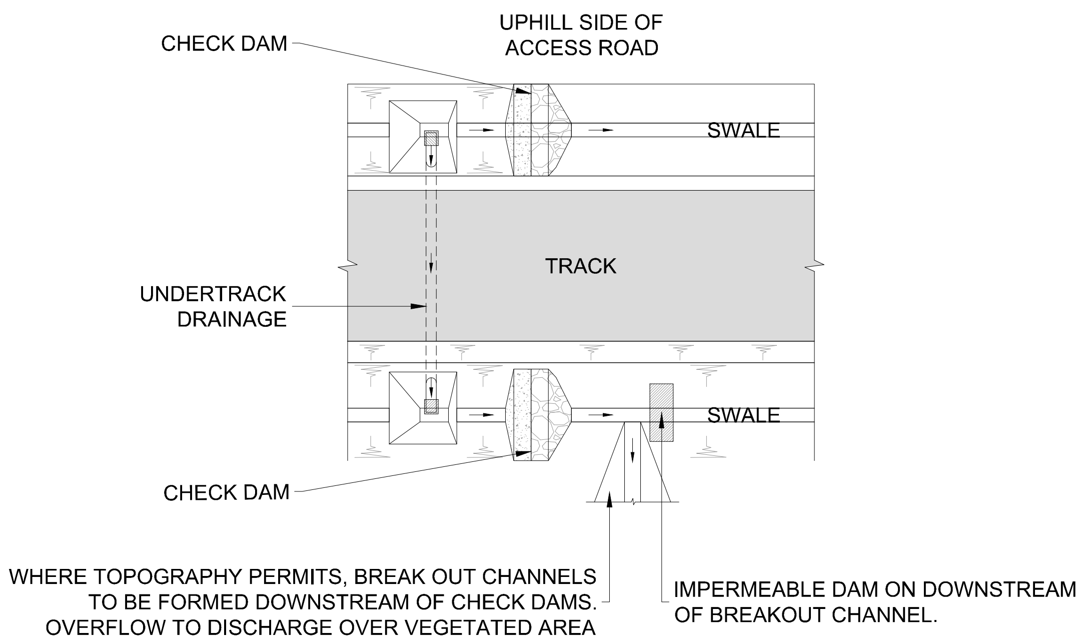
ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

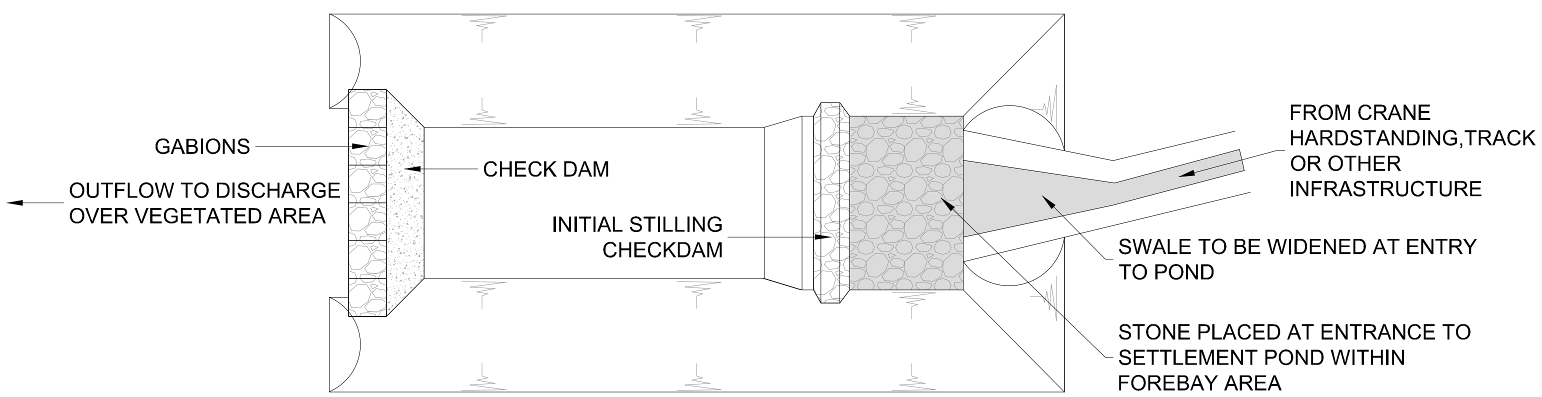
CONSENTED (LA01/2018/0200/F)



TYPICAL TRACK SECTION



TYPICAL TRACK PLAN



TYPICAL SETTLEMENT POND

TYPICAL UNDER TRACK DRAINAGE

TYPICAL CHECK DAM

TYPICAL SETTLEMENT POND

DUNBEG SOUTH WIND FARM

FIGURE 2.15

TYPICAL DRAINAGE DETAILS

NOTES:

1. SUDS SYSTEM TO BE CONSTRUCTED PRIOR TO, OR AT THE SAME TIME AS THE ACCESS ROAD.
2. SUSTAINABLE PREVENTION MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SILTS TO RECEIVING WATERCOURSE.
3. DRAINAGE SWALES TO BE EXCAVATED ADJACENT TO THE ACCESS TRACK. REGULAR CROSS DRAINS TO BE LOCATED ALONG ACCESS TRACKS TO PREVENT EXCESSIVE VOLUMES OF WATER COLLECTING IN THE SWALES.
4. ROADSIDE SWALES TO BE SHALLOW WITH MODERATE GRADIENTS TO PREVENT SCOURING. IN STEEP AREAS CHECK DAMS WILL BE DESIGNED TO REDUCE FLOW RATE AND PROVIDE SOURCE CONTROL SILT CONTAINMENT. WHERE NECESSARY THESE WILL BE DESIGNED IN CONJUNCTION WITH SETTLEMENT PONDS AND/OR CROSS DRAINS.
5. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING MAINTENANCE PROGRAMME.
6. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDENT UPON LONGITUDINAL GRADIENT OF SWALE.

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

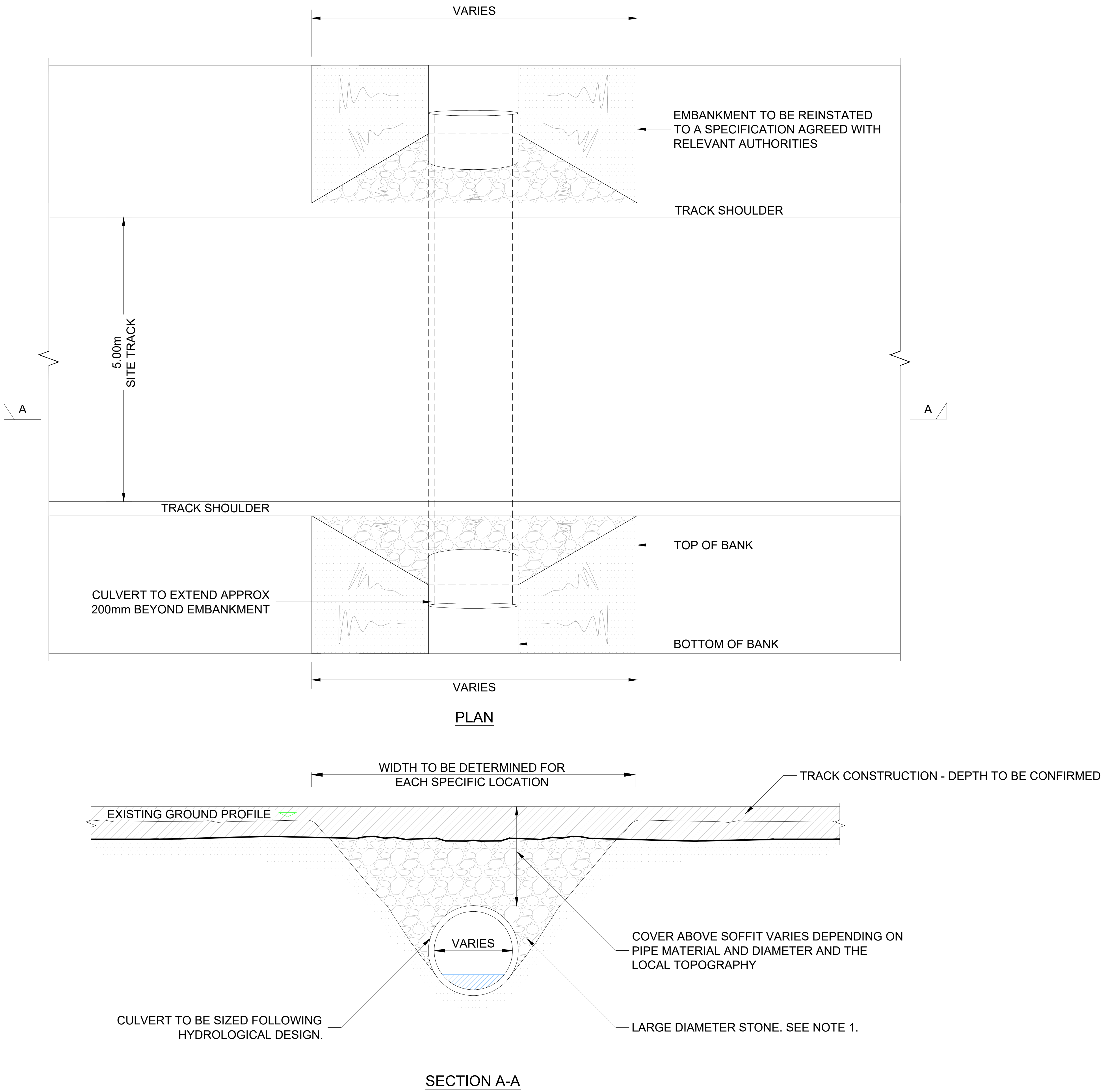
DRAWING NUMBER
03219D2305-02

SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT
2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 2.16

TYPICAL WATER CROSSING DESIGN

NOTES:

1. FINAL SPECIFICATION AND INSTALLATION METHOD TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT AUTHORITIES.
2. CULVERT TYPE AND SIZING TO BE DEFINED DURING DESIGN OF ON-SITE DRAINAGE SYSTEMS.
3. INFILL MATERIAL TO BE CLEAN CRUSHED ROCK.

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

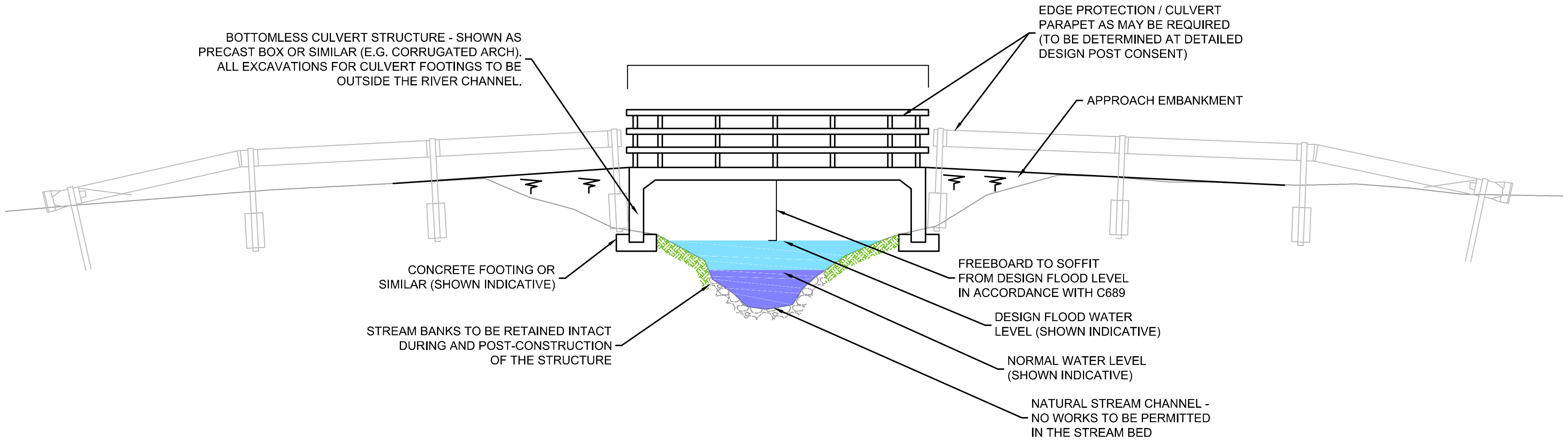
DRAWING NUMBER 03219D2214-02

SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



TYPICAL BOTTOMLESS CULVERT WATERCROSSING

SCALE - 1:100

DUNBEG SOUTH
WIND FARM

FIGURE 2.17

TYPICAL BOTTOMLESS
CULVERT

LAYOUT DWG N/A	T-LAYOUT NO. N/A

DRAWING NUMBER 03219D2215-02

SCALE - 1:100 @ A3

ENVIRONMENTAL STATEMENT
2017

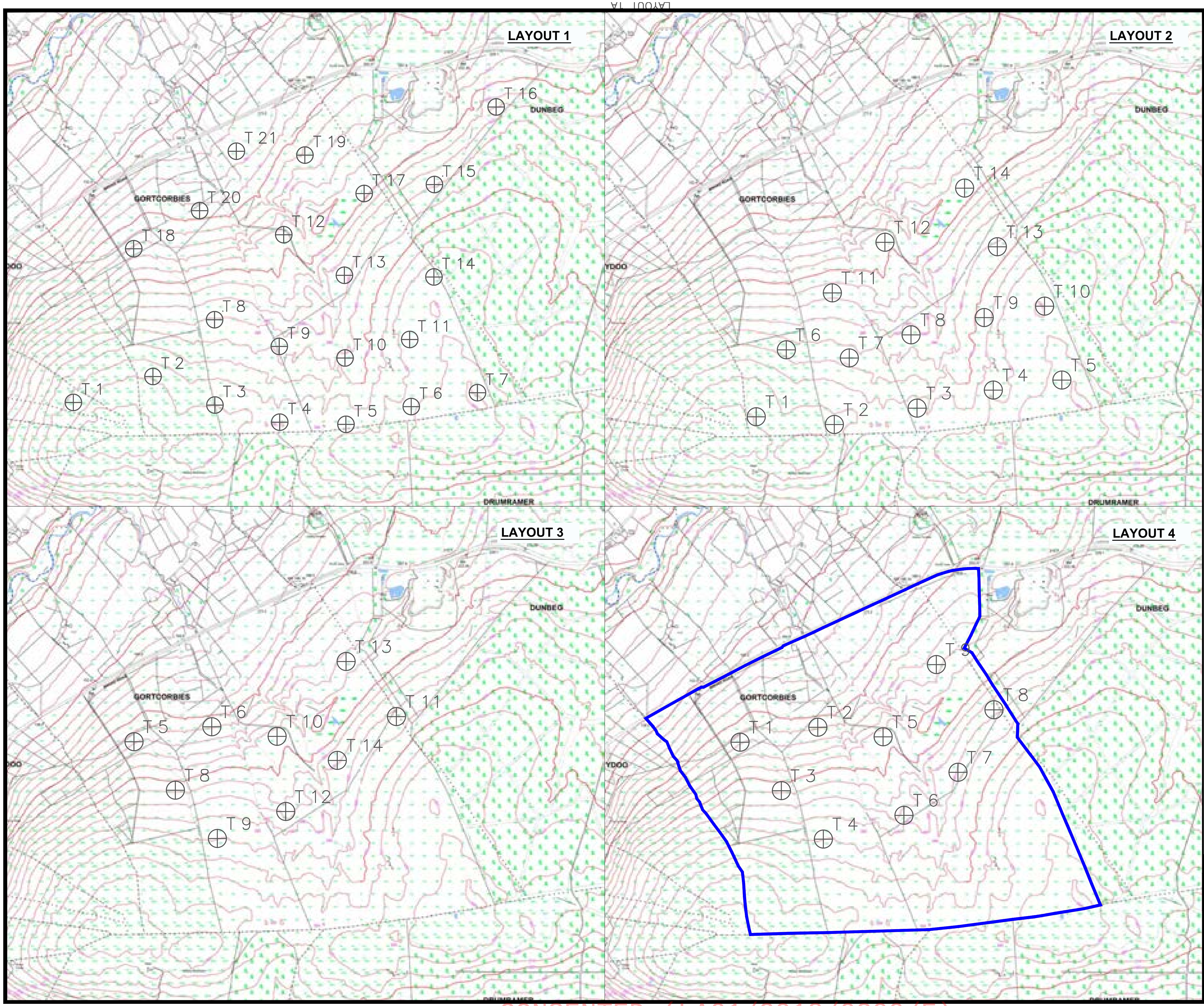
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

3

Design Evolution & Alternatives

CONSENTED (LA01/2018/0200/F)



res

DUNBEG SOUTH
WIND FARM

FIGURE 3.1

TURBINE LAYOUT
EVOLUTION

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

T x Turbine Location

Site Boundary

LAYOUT 1A – pNIRssl008
21 turbines x 90 m rotor diameter

LAYOUT 1B– pNIRdbx012
14 turbines x 100 m rotor diameter

LAYOUT 1C– pNIRdbx024
9 turbines x 100 m rotor diameter

LAYOUT 1D– pNIRdbx028
9 turbines x 100 m rotor diameter

LAYOUT DWG N/A	T-LAYOUT NO. AS SHOWN

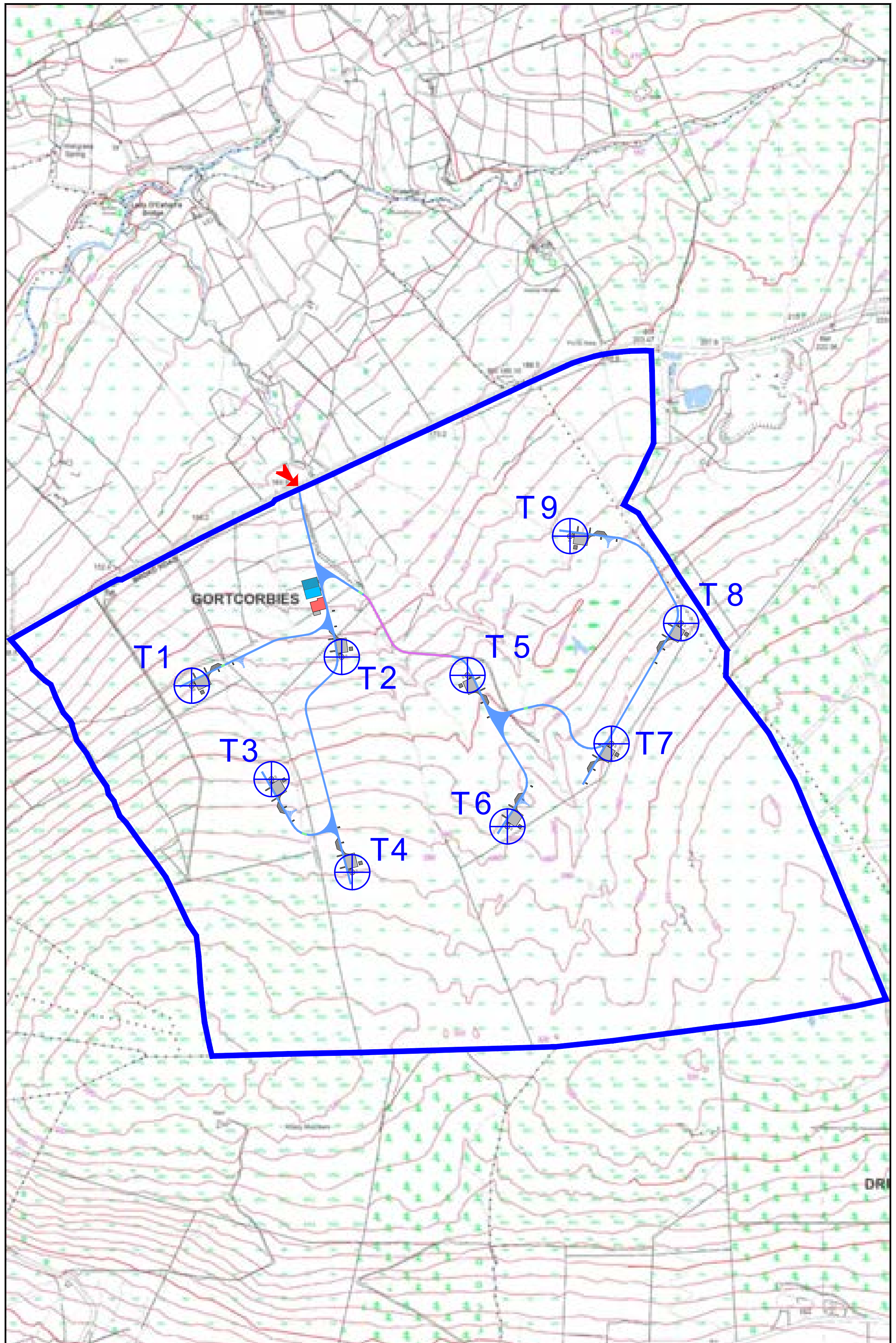
DRAWING NUMBER
03219D0002-01

SCALE - 1:20,000

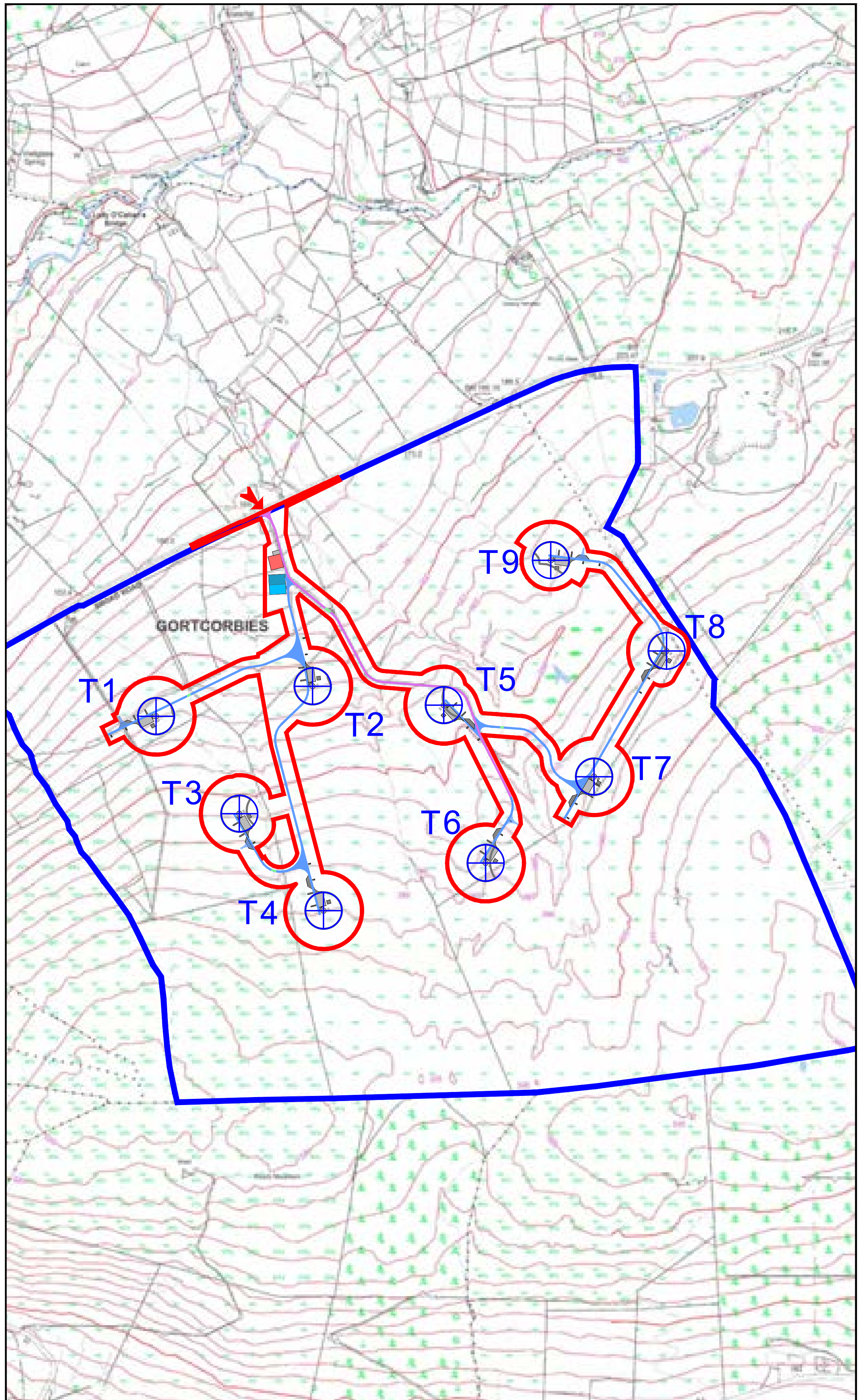
ENVIRONMENTAL STATEMENT 2017
FOR PLANNING

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DESIGN 1 (03219D1001-01)
(PNIRdbx028)
SCALE 1:15,000



DESIGN 2 (03219D1001-02)
(PNIRdbx028)
SCALE 1:15,000

DUNBEG SOUTH WIND FARM

FIGURE 3.2

INFRASTRUCTURE DESIGN EVOLUTION

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- LAND UNDER APPLICANT CONTROL
- WIND TURBINE LOCATION
- TURBINE MICROSITING
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
  - ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMENANT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028

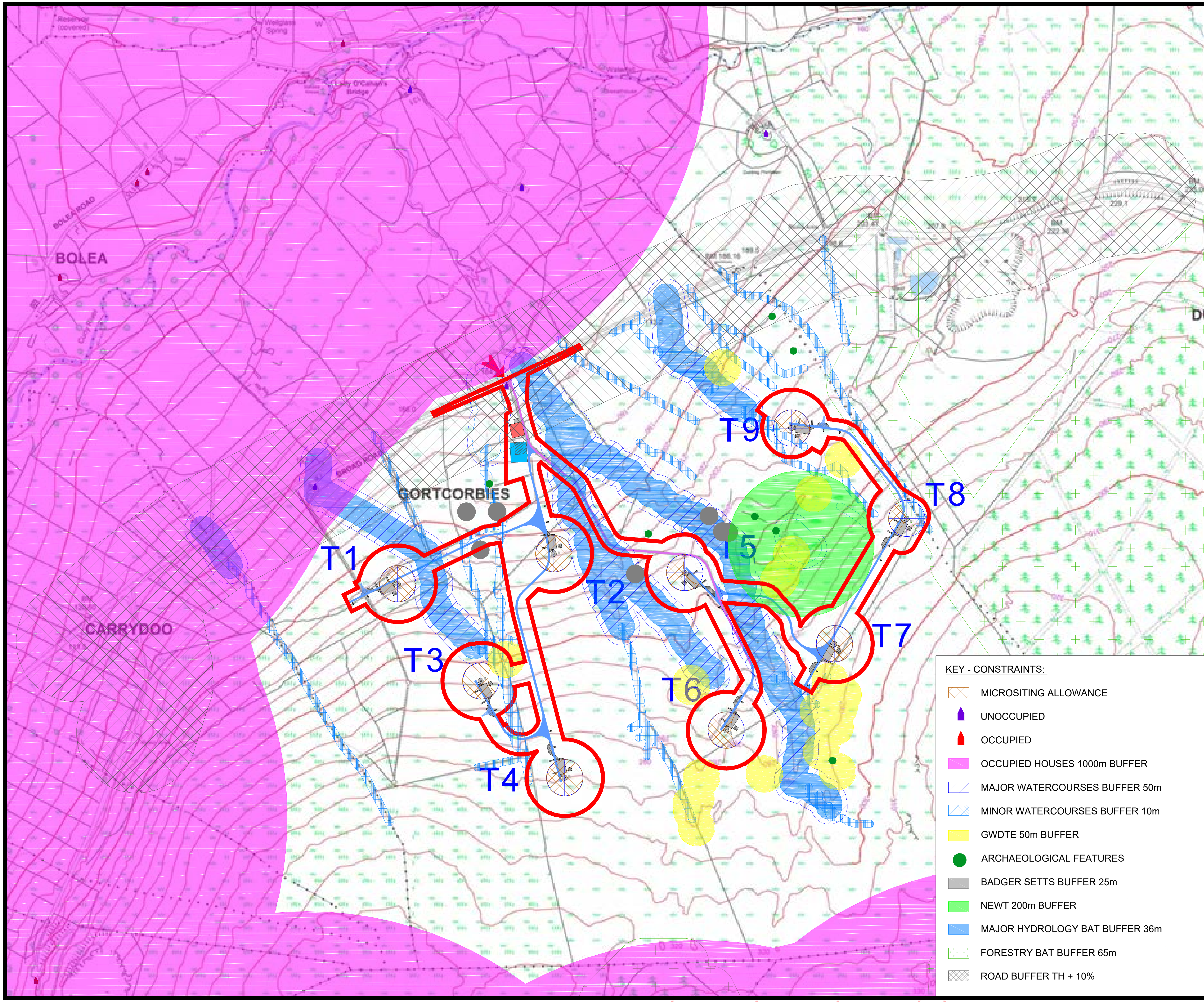
DRAWING NUMBER 03219D1001-02

SCALE - 1:15,000 @ A3

ENVIRONMENTAL STATEMENT 2017

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 3.3

COMBINED CONSTRAINTS & INFRASTRUCTURE

THE LAND & PROPERTY SERVICES INTELLECTUAL PROPERTY IS CROWN COPYRIGHT AND IS REPRODUCED WITH THE PERMISSION OF LAND & PROPERTY SERVICES UNDER DELEGATED AUTHORITY FROM THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE, © CROWN COPYRIGHT AND DATABASE RIGHT 2017 LICENCE NO. 242.

KEY - INFRASTRUCTURE:

- PLANNING APPLICATION BOUNDARY (INSIDE OF LINE DENOTES BOUNDARY)
- WIND TURBINE LOCATION
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA: PERMANENT, TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- ENERGY STORAGE AREA
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG 03219D0001-06	T-LAYOUT NO. PNIRdbx028
DRAWING NUMBER 03219D2237-01	
SCALE - 1:10,000 @ A3	
ENVIRONMENTAL STATEMENT 2017	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

CONSENTED (LA01/2018/0200/F)

4

Landscape & Visual

CONSENTED (LA01/2018/0200/F)

PURPOSE AND UNDERSTANDING OF THESE FIGURES:

These Figures must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

These map-based Figures provide information on the baseline conditions within the 30 km Study Area that has been used for this Landscape and Visual Impact Assessment. They must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the LVIA that is described in Technical Appendix 4.2.

For ease of reference, the Reverse Zone of Theoretical Visibility (ZTV) is shown on Figures 4.1 – 4.4. The blue shaded areas indicate parts of the Study Area which would experience no visibility of the Development. The same is illustrated in Figure 4.8: Reverse ZTV and the means of understanding ZTV diagrams are further explained in relation to Figures 4.6 – 4.10.

Figure 4.1 collates key information from other LVIA Figures. It was presented to the County Council during the scoping stage of the LVIA to provide an overview of the key landscape and visual characteristics of the Study Area. More detailed information on the baseline conditions in the Study Area are provided on the other Figures in this section.

Figure 4.2 illustrates the location of statutory landscape designations defined by planning policy and Development Plans. These provide evidence of the value placed on various parts of the Study Area for landscape and/ or visual characteristics and which may be subject to particular development control or planning policies. Non-statutory classifications, such as tourist routes and visitor attractions within the Study Area are also mapped on Figure 4.2. These give an indication of the wider value of the Study Area to society although these classifications may not equate to any statutory protection.

Landscape Character Areas are presented separately on Figure 4.3. These are defined by a published Landscape Character Assessment for Northern Ireland which defines areas of distinct, recognisable or common character. LCAs are further analysed by site survey and, where they are not deemed to be of relevance to this Development, this is indicated on Figure 4.3.

Figure 4.4 illustrates the location of Provisional Viewpoints that were used to gain an initial understanding of the visual characteristics of the Development within the Study Area. It also illustrates the location of final Viewpoints that were chosen to provide a representative sample of viewers (receptors) and types of views of the Development across the Study Area and, most importantly, to demonstrate potential views of the Development rather than to show the screening effect of landscape features. A full and detailed description of the viewpoint selection process is provided in Technical Appendix 4.4 and should be referred to in conjunction with this Figure.

Figure 4.5 illustrates the locations of other wind farms and single turbines that are considered to form the 'Cumulative Baseline' for this LVIA which comprises existing, consented and proposed (in-planning) wind farms which are likely to be visible from the selected Viewpoints (see Figures 4.15 – 4.41. Existing and consented single turbines within a 5 km radius of the Development and with a tip height of 50m or more are also included in the cumulative baseline. A full description of the Cumulative Baseline is provided in Technical Appendix 4.5.

res

DUNBEG SOUTH WIND FARM

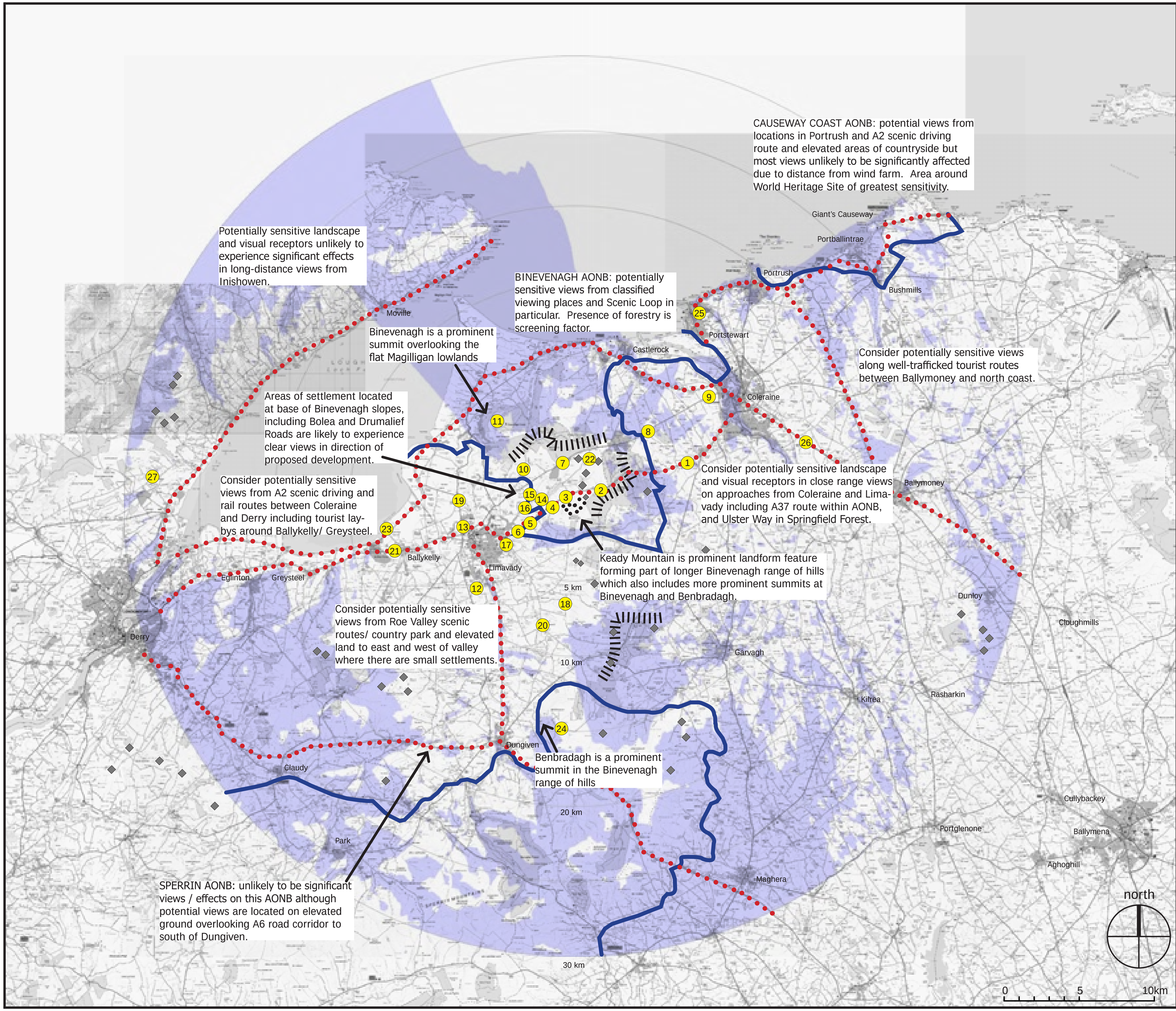
FIGURES 4.1 - 4.5

BASELINE ASSESSMENT FIGURES

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4.1

LVIA STUDY AREA ANALYSIS

KEY

- Dunbeg South proposed turbines
- Viewpoint locations (see Figure 4.3 for more detail)
- Zone of Theoretical Visibility: blue shading indicates areas with no visibility. (see Figures 4.5 - 4.7 for more detail)
- Areas of Outstanding Natural Beauty
- Scenic drives, rights of way and cycle routes (see Figure 4.2 for more detail)
- Forestry screening potential views from some directions
- Locations of other wind farms (see Figure 4.5 for more detail)

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

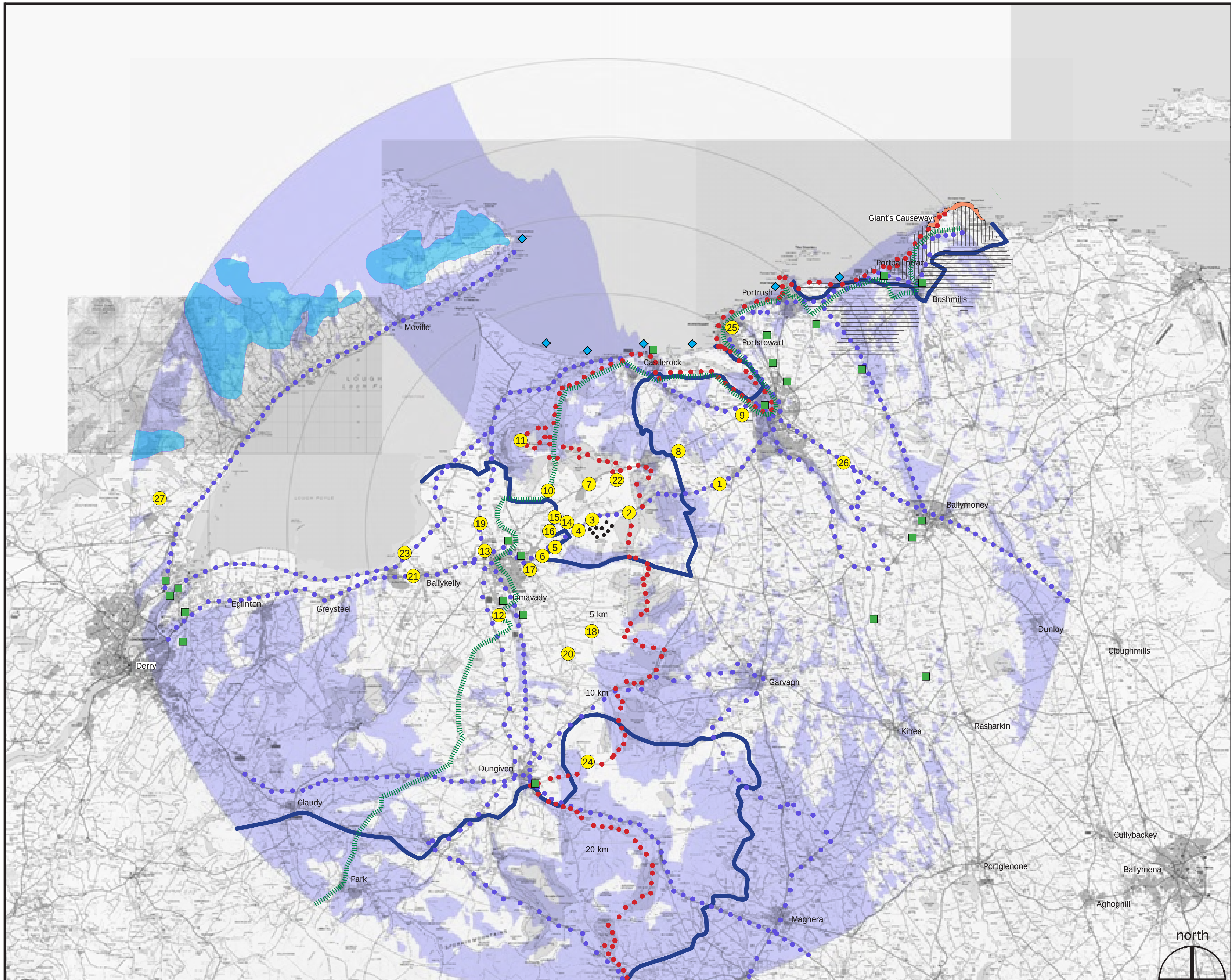
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	1:250,000 @ A3	E

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.1 RevE 211117.indd

CONSENTED (LA01/2018/0200/F)



NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

DUNBEG SOUTH WIND FARM

FIGURE 4.2

LANDSCAPE DESIGNATIONS AND CLASSIFICATIONS

KEY

Dunbeg South proposed turbines

15 Viewpoint locations (see Figure 4.3 for more detail)

Reverse Zone of Theoretical Visibility (see Figure 4.7 for more detail)

STATUTORY DESIGNATIONS

World Heritage Site & Landscape Setting

Areas of Outstanding Natural Beauty

Registered Parks, Gardens and Demesnes

Areas of Especially High Scenic Amenity (Co. Donegal)

NON-STATUTORY CLASSIFICATIONS

Scenic drives /Rights of Way / National Cycle Network

Blue Flag Beach

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m;
hub height 100 m; rotor diameter 99.8 m

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

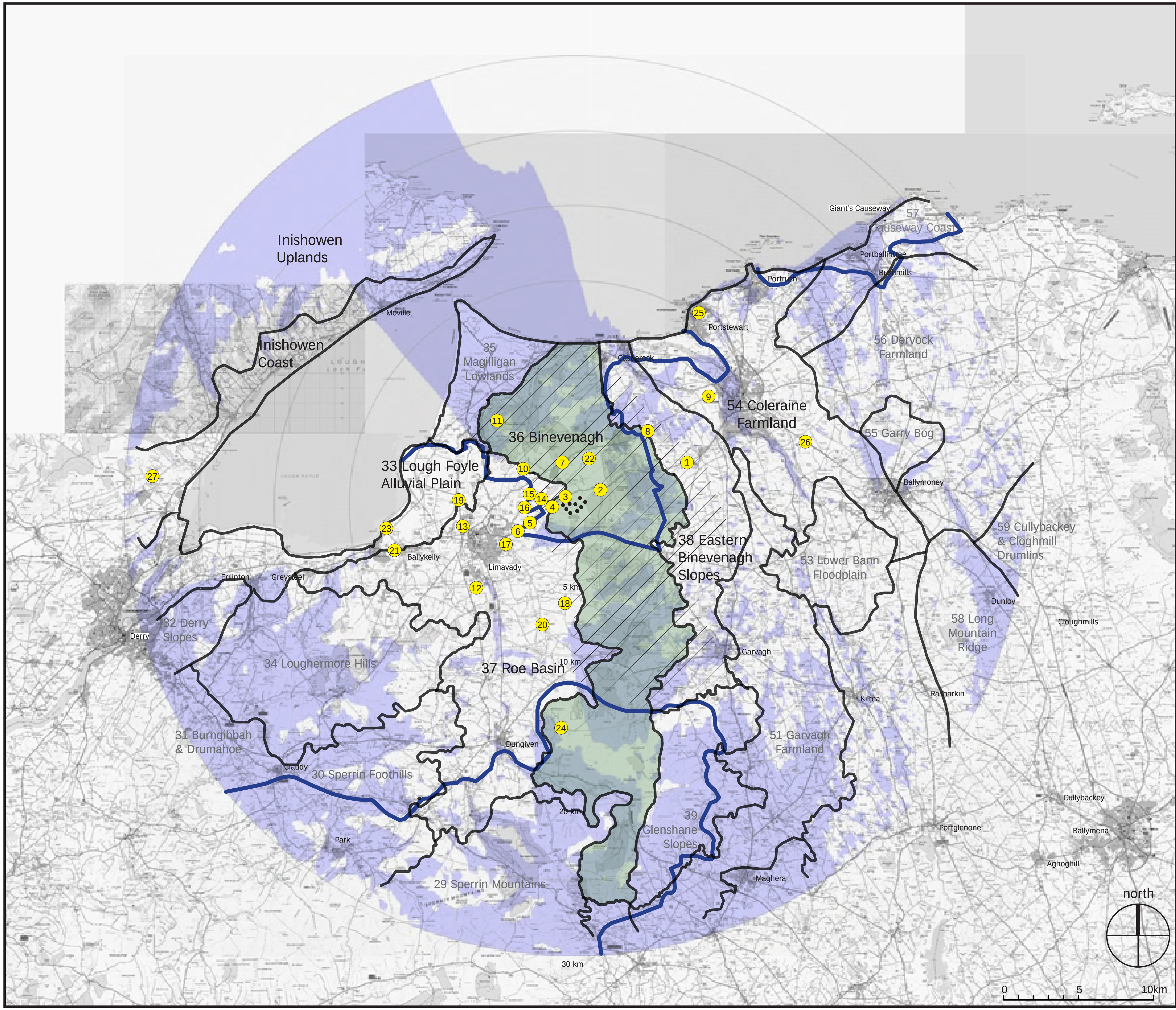
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	1:250,000 @ A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.2 RevC_051217.indd

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4.3

LANDSCAPE CHARACTER AREAS

KEY

- Dunbeg South proposed turbines
- 15 Viewpoint locations (see Figure 4.3 for more detail)
- Reverse Zone of Theoretical Visibility (see Figure 4.7 for more detail)
- Areas of Outstanding Natural Beauty
- Landscape Character Area boundaries (LCA 36 shaded green)
- 36 36 LCA number and title (those not analysed in detail in LVIA shown in grey font)
- Regional Landscape Character Area 10: Binevenagh Ridge

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	1:250,000 @ A3	B

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.3 RevB 051217.indd

CONSENTED (LA01/2018/0200/F)

INSET: FINAL VIEWPOINT CATEGORIES

A — **Category A: Views from primary and secondary transport routes, including tourist routes**

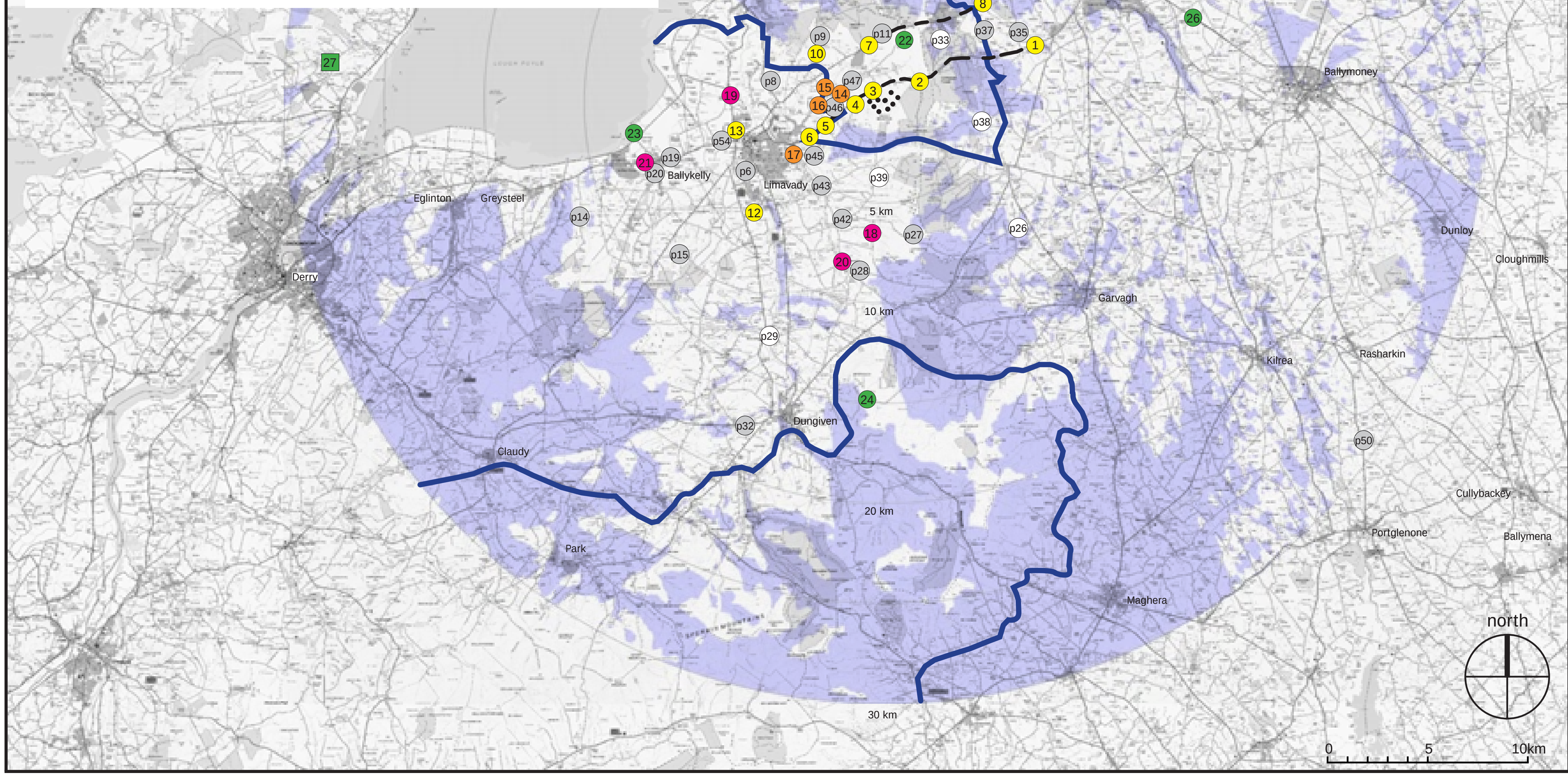
- A1 Viewpoints 1 - 6: Views from the A37 road corridor between Coleraine and Limavady.
- A2 Viewpoints 7 -9: Views from the secondary B201 road corridor between Coleraine and Limavady.
- A3 Viewpoints 10 and 11: Views from the Binevenagh Scenic Drive.
- A4 Viewpoints 12 and 13: Views from the Roe Valley and Causeway Coast Scenic Routes to the west of the Development.

B — **Category B Viewpoints 14 - 17: Views from residential properties and rural settlement within 5 km of the Development.**

C — **Category C: Views from residential properties and settlements within 5 - 15 km of the Development**

- C1 Viewpoints 18 and 19: Views from rural residential properties and settlements between 5 – 15 km from the Development.
- C2 Viewpoints 20 and 21: Views from settlements between 5 – 15 km from the Development.

D — **Category D Viewpoints 22 - 27: Views illustrating the wider landscape setting and visibility of the Development in the context of the adjacent Dunbeg cluster of wind farms.**



DUNBEG SOUTH WIND FARM

FIGURE 4.4

VIEWPOINT SELECTION

KEY

- Dunbeg South proposed turbines
- Shortlisted viewpoints within 25 km: photomontages produced (see 'INSET' & Figures 4.15 - 4.40)
- Shortlisted viewpoint beyond 25 km: wireline produced (see Figure 4.41)
- Preliminary viewpoints not shortlisted (see Chapter 4 LVIA for reasoning)
- Preliminary viewpoints not shortlisted due to absence of view (see Chapter 4 LVIA for details)
- Area of Outstanding Natural Beauty
- Zone of Theoretical Visibility: blue shading indicates areas with no visibility. (see Figures 4.6 - 4.8 for more detail)

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

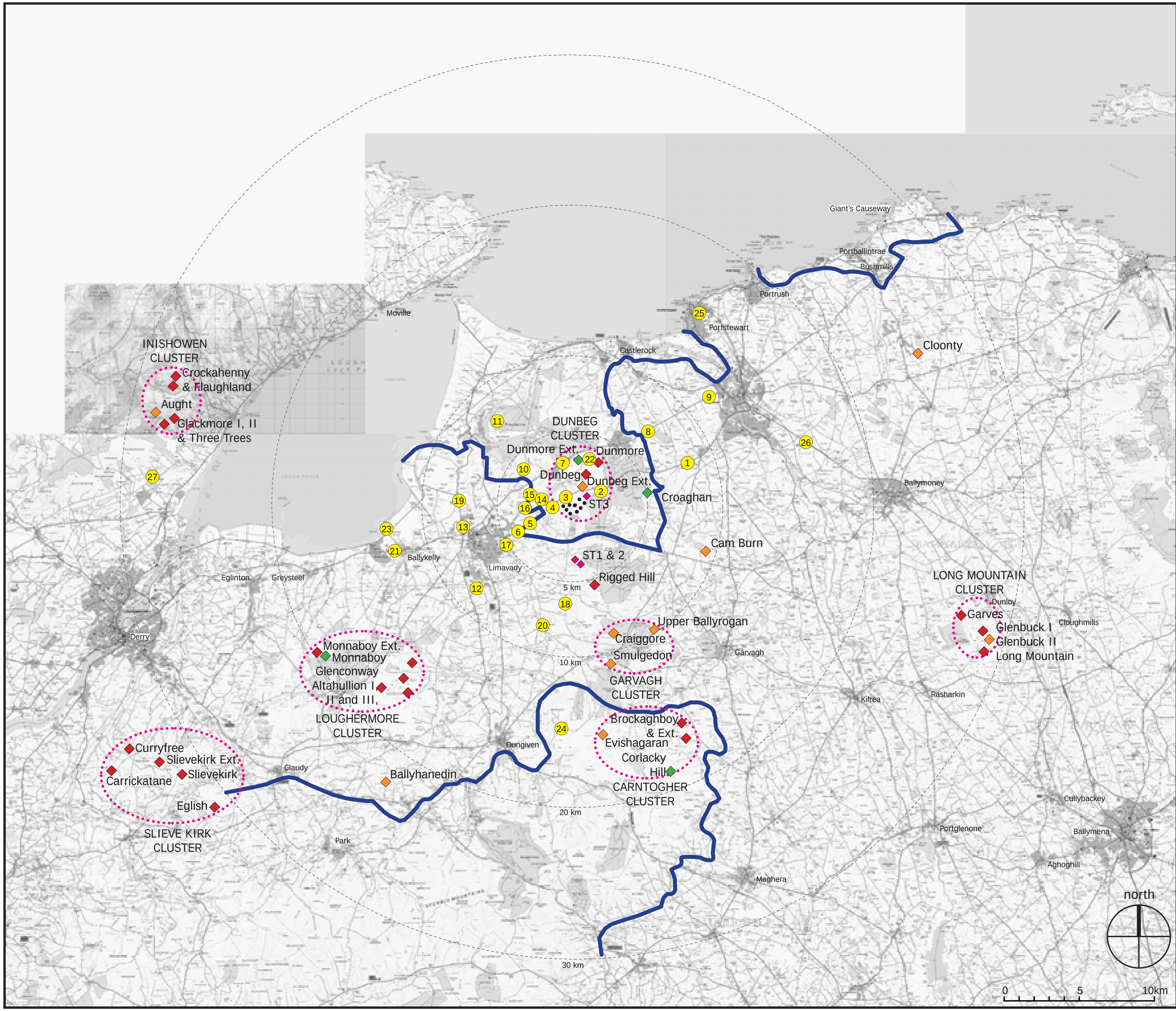
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	1:250,000 @ A3	F

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.4 RevF_051217.indd

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4.5

CUMULATIVE BASELINE

KEY

- Dunbeg South proposed turbines
- 15 Viewpoint locations
- Existing wind farms within a 30 - 40 km radius of Dunbeg South
- Consented wind farms within a 30 - 40 km radius of Dunbeg South
- Proposed wind farms within a 30 - 40 km radius of Dunbeg South
- Existing and consented single turbines within 5 km radius, >50 m tip height
- Areas of Outstanding Natural Beauty

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	1:250,000 @ A3	E

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.5 RevE 051217.indd

CONSENTED (LA01/2018/0200/F)

PURPOSE AND UNDERSTANDING OF THESE FIGURES:

These map-based Figures provide information on the baseline conditions within the 30 km Study Area that has been used for this Landscape and Visual Impact Assessment. They must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the LVIA that is described in Technical Appendix 4.2.

A Zone of Theoretical Visibility (ZTV) is a map-based diagram showing where the Development and other wind farms in the Cumulative Baseline would theoretically be visible from within the Study Area. They are created using computer-generated contour data and are useful in providing an initial indication of visibility within the Study Area that allows for more detailed assessment in the field. They do not illustrate actual visibility because they do not take account of above-ground features such as vegetation or buildings, or contour variations between 50 m intervals. A number of ZTV scenarios are assessed in this LVIA and categories of theoretical visibility are indicated using different colours, for example, areas with theoretical visibility of all the proposed turbines would be indicated by one colour, and areas with visibility of lesser numbers of turbines would be indicated by contrasting colours. The coverage of these areas is expressed as a percentage of the overall Study Area.

ZTV diagrams are based on the visibility of the turbine blade tips unless otherwise stated. Blade tip visibility means that any area where the tip of the blade is theoretically visible is indicated on the diagram. This approach is in accordance with the SNH recommendation to err on the side of over-representation of potential effects. A Reverse ZTV diagram is used as a clear means of illustrating the parts of the Study Area where no turbines would be visible.

DUNBEG SOUTH WIND FARM

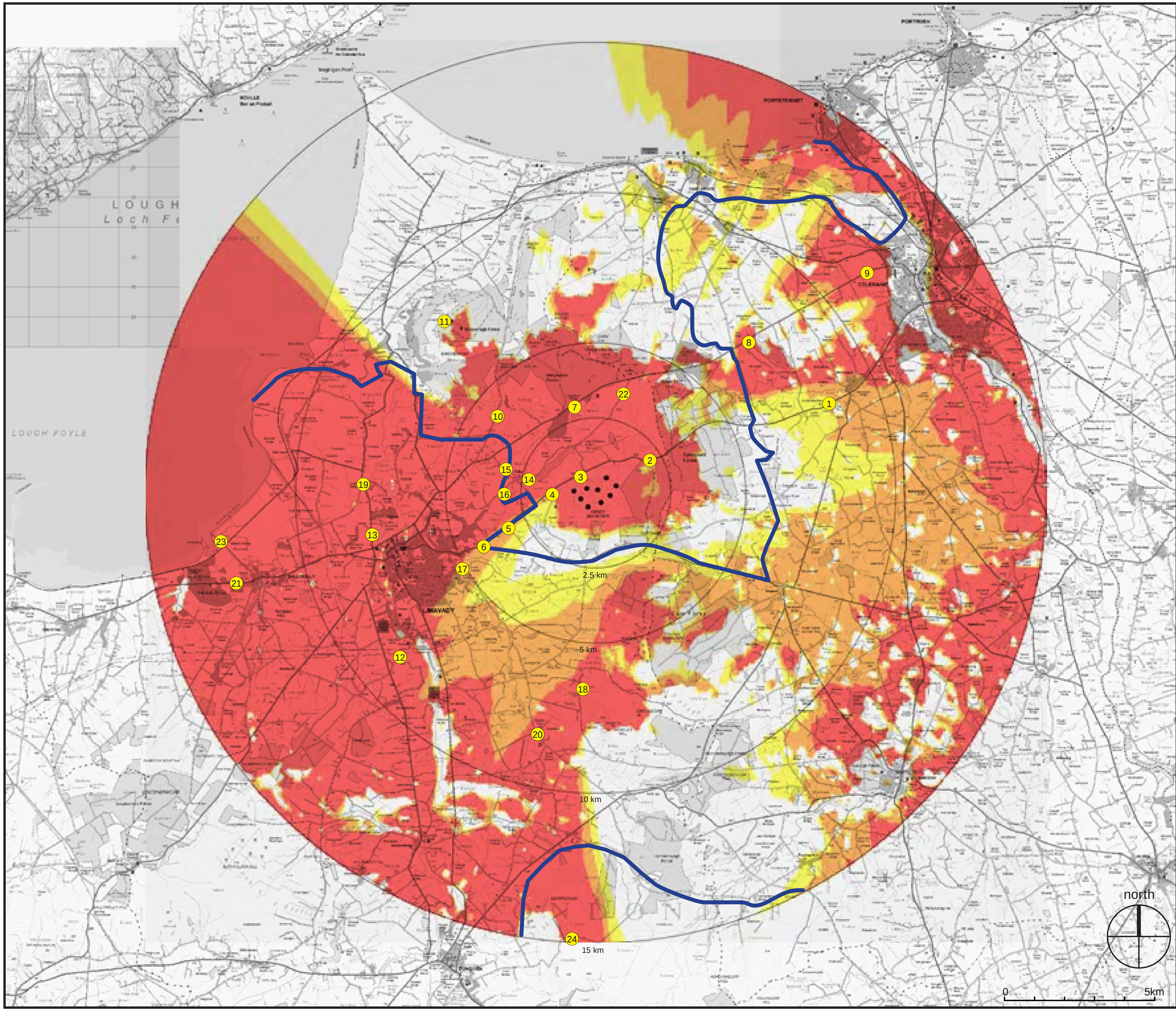
FIGURES 4.6 - 4.10

ZONE OF THEORETICAL VISIBILITY DIAGRAMS

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4.6

ZONE OF THEORETICAL VISIBILITY
15 KM RADIUS, BLADE TIP

KEY

Dunbeg South proposed turbines

Viewpoint location

Theoretical visibility of 1 - 3 turbines 8.42 %

Theoretical visibility of 4 - 6 turbines 14.19 %

Theoretical visibility of 7 - 9 turbines 45.05 %

Total area within 15 km with theoretical visibility of at least 1 blade tip: 67.66 %

Parts of Study Area with no visibility of the Development are unshaded: 32.34 %

Area of Outstanding Natural Beauty

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design

info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

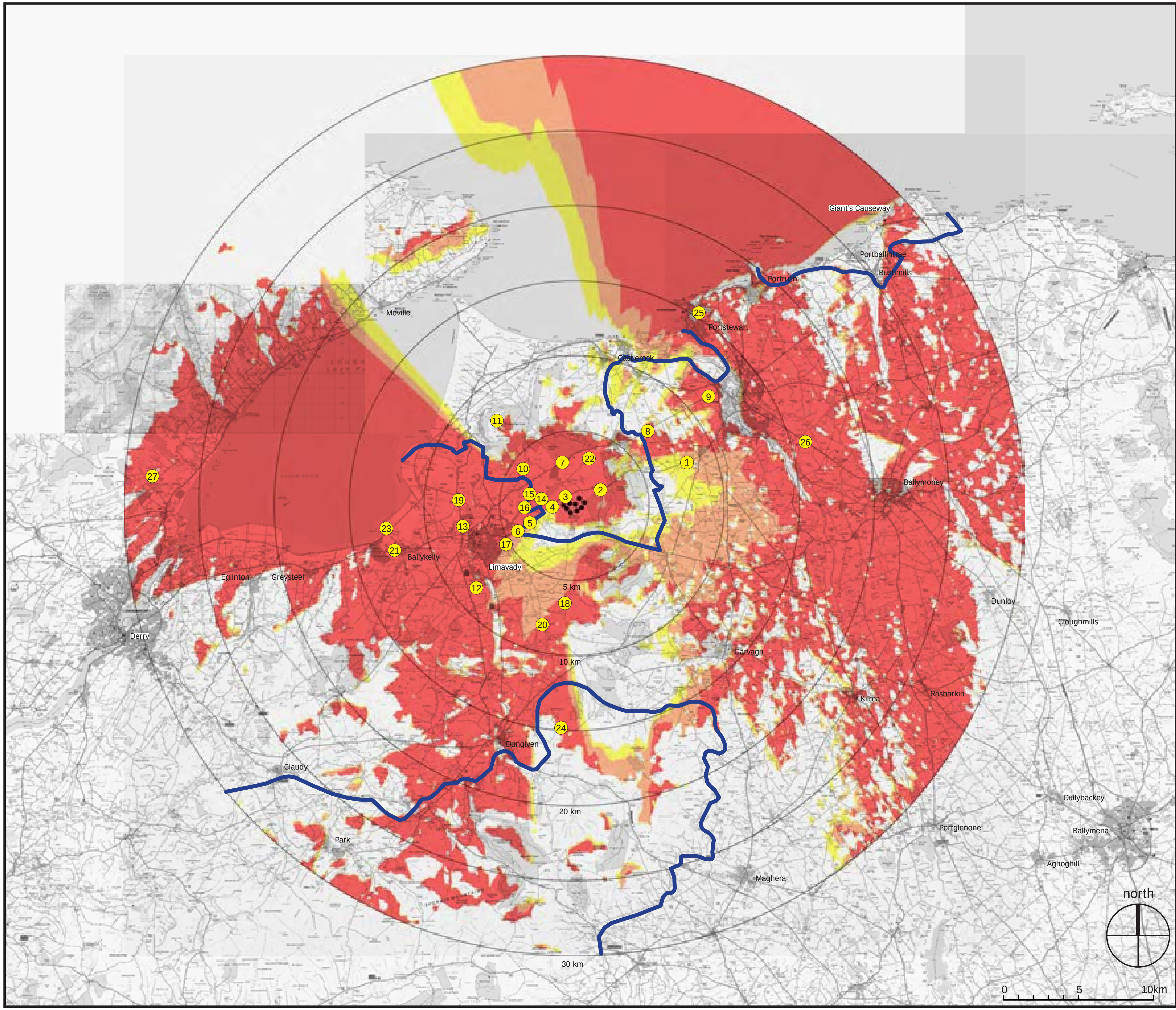
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	1:125,000 @ A3	D

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.6 Rev D 211117.indd

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4.7

ZONE OF THEORETICAL VISIBILITY 30 KM RADIUS, BLADE TIP

KEY

Dunbeg South proposed turbines

Viewpoint location

Theoretical visibility of 1 - 3 turbines 4.85 %

Theoretical visibility of 4 - 6 turbines 7.14 %

Theoretical visibility of 7 - 9 turbines 46.19 %

Total area within 30 km with theoretical visibility of at least 1 blade tip: 58.18 %

Parts of Study Area with no visibility of the Development are unshaded: 41.82 %

Area of Outstanding Natural Beauty

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

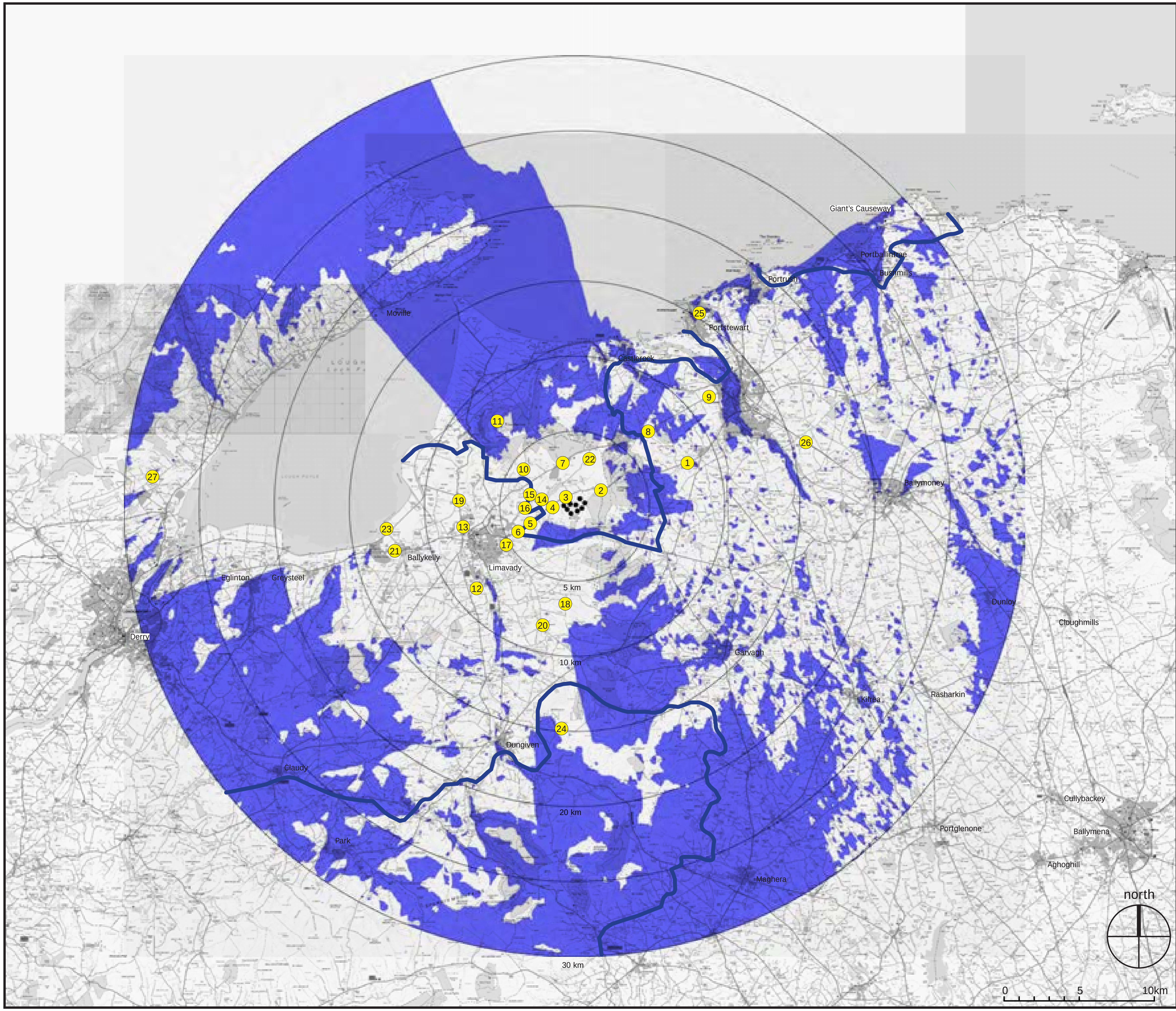
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	1:250,000 @ A3	D

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.7 Rev D 211117.indd

CONSENTED (LA01/2018/0200/F)



DUNBEG SOUTH WIND FARM

FIGURE 4.8

REVERSE ZONE OF THEORETICAL VISIBILITY 30 KM RADIUS, BLADE TIP

KEY

- Dunbeg South proposed turbines
- 15 Viewpoint location
- No theoretical visibility of Development 41.82 %
- Area of Outstanding Natural Beauty

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

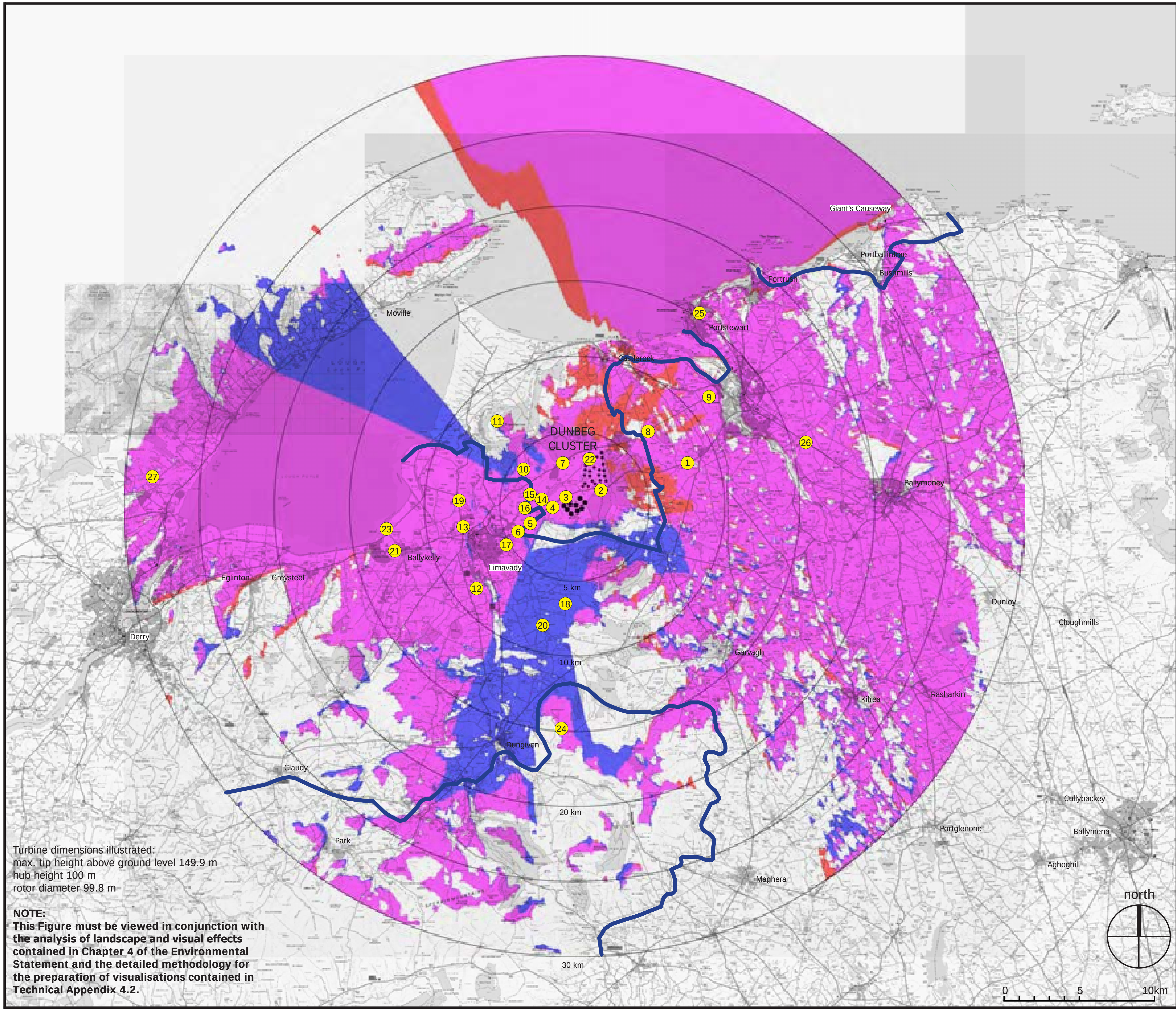
LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	1:250,000 @ A3	B

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

CONSENTED (LA01/2018/0200/F)



Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

DUNBEG SOUTH WIND FARM

FIGURE 4.9

CUMULATIVE ZONE OF THEORETICAL VISIBILITY WITH DUNBEG CLUSTER 30 KM RADIUS, BLADE TIP

KEY

- Dunbeg South proposed turbines
- Viewpoint location
- Theoretical visibility of Dunbeg cluster of wind farms* where Development is not visible 3.26 %
- Theoretical visibility of the Development where there is already visibility of Dunbeg cluster* 49.53 %

Total area within 30 km with theoretical visibility of Dunbeg cluster: 52.79 %
*cluster includes Dunbeg; Dunmore; Dunbeg Extension & Dunmore Extension

- Additional theoretical visibility of Development where there is no visibility of Dunbeg cluster: 8.65 %

Total area within 30 km with theoretical visibility of Development: 58.18 %

- Parts of Study Area with no visibility of the Development or cluster are unshaded: 38.56 %
- Area of Outstanding Natural Beauty

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

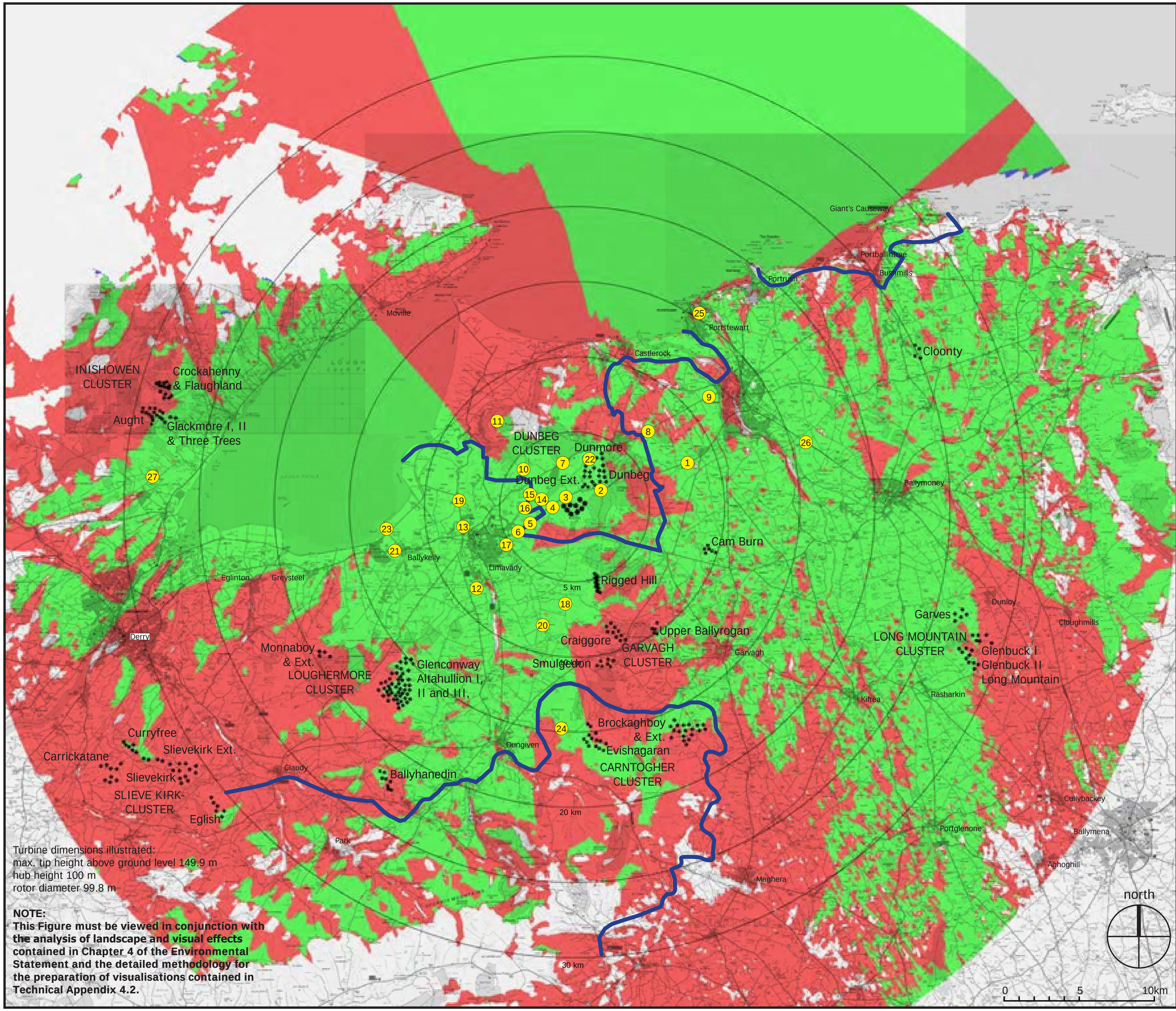
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	1:250,000 @ A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.9 RevC 051217.indd

CONSENTED (LA01/2018/0200/F)



Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.

res

DUNBEG SOUTH WIND FARM

FIGURE 4.10

CUMULATIVE ZTV EXISTING & CONSENTED WIND FARMS, 40 KM RADIUS, BLADE TIP

KEY

- Dunbeg South proposed turbines
- Existing / Consented Turbines
- 15 Viewpoint location
- Theoretical visibility of existing and consented wind farms where Development is not visible 38.69 %
- Theoretical visibility of Development where there is already visibility of other wind farms 48.10 %
- Total area within 40 km with theoretical visibility of other wind farms 86.79 %
- Additional theoretical visibility of Development where there is no visibility of other wind farms 0.05 %
- Total area within 40 km with theoretical visibility of Development: 48.15 %
- Parts of Study Area with no visibility of the Development or cluster are unshaded: 13.16 %
- Area of Outstanding Natural Beauty

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	1:250,000 @ A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.10 RevC 051217.indd

CONSENTED (LA01/2018/0200/F)

PURPOSE AND UNDERSTANDING OF THESE FIGURES:

These Figures are intended to accompany the detailed description of the iterative design process that has formed an integral part of this LVIA (refer to Chapter 4 starting at paragraph 4.53). They must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the LVIA that is described in Technical Appendix 4.2.

A number of turbine layouts were considered during the early stages of the project and, through a careful analysis of the constraints and opportunities presented by the site location and the characteristics of the Development itself, the 9-turbine option that is presented in the EIA is the result of this iterative design process. A comparative ZTV and a series of wireline diagrams are included in these Figures to illustrate the relocation and reduction in the number of proposed turbines in order to achieve a final 9-turbine layout that is deemed to be acceptable in LVIA terms.

res

DUNBEG SOUTH WIND FARM

FIGURES 4.11 - 4.14

VISUALISATIONS OF COMPARATIVE TURBINE LAYOUTS

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

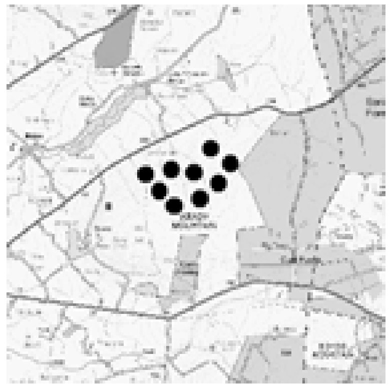
LANDSCAPE AND VISUAL IMPACT ASSESSMENT

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Figure Dividers.indd

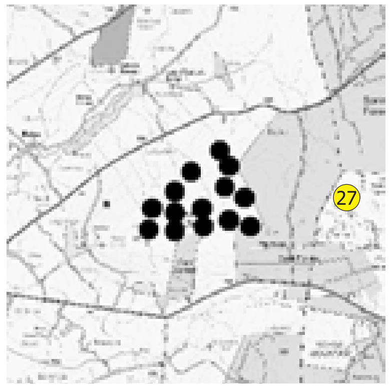
CONSENTED (LA01/2018/0200/F)

INSET: COMPARATIVE LAYOUTS

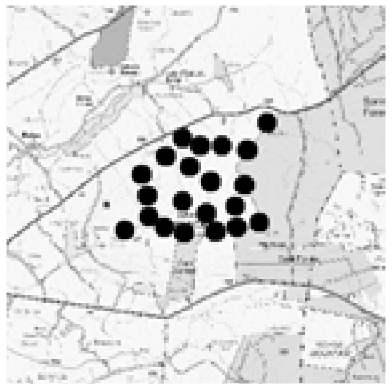
9 TURBINE LAYOUT



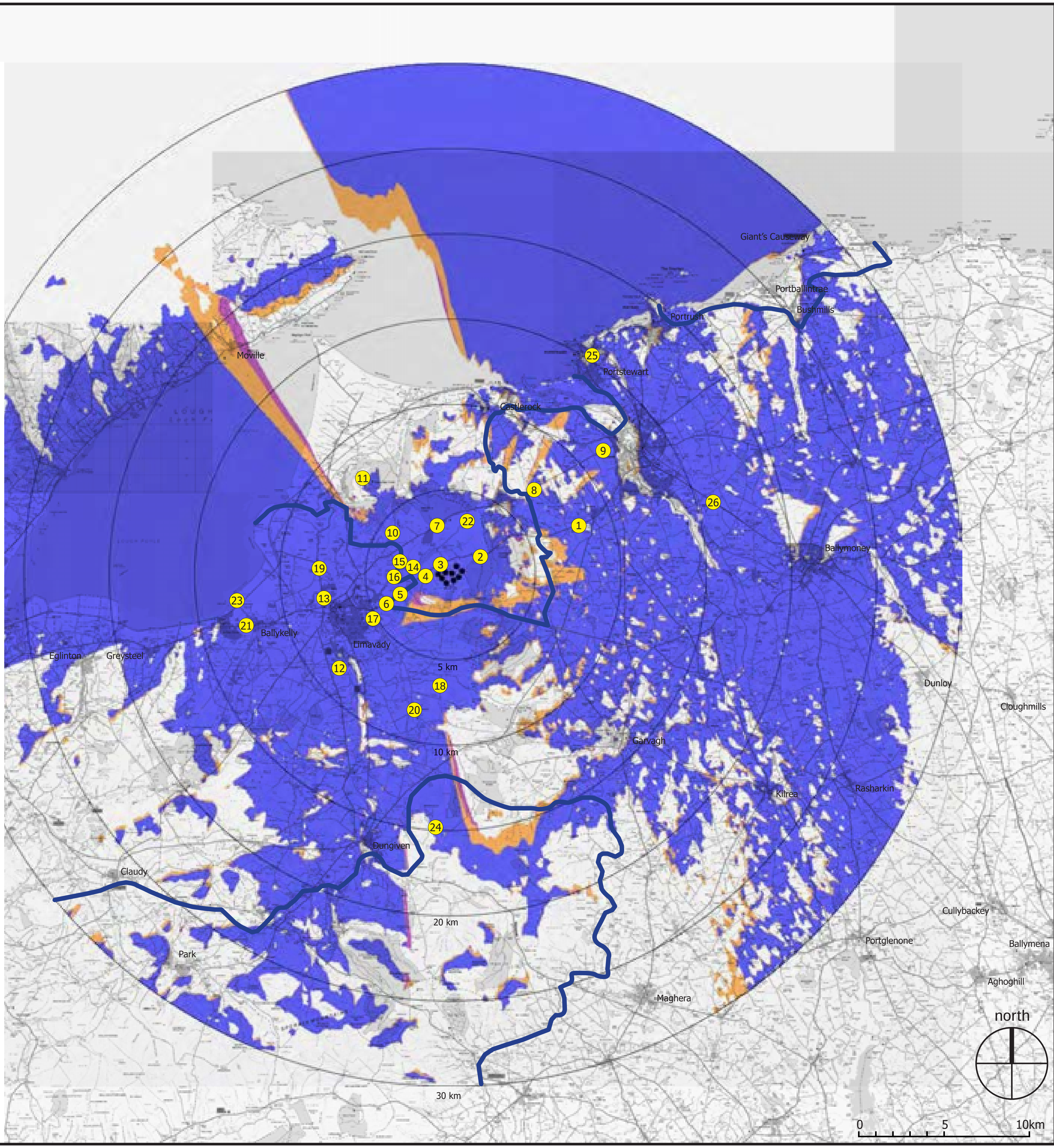
14 TURBINE LAYOUT



21 TURBINE LAYOUT



NOTE:
This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2.



DUNBEG SOUTH WIND FARM

FIGURE 4.11

COMPARATIVE ZTV, FINAL & FEASIBILITY STAGE LAYOUTS 30 KM RADIUS, BLADE TIP

KEY

- Dunbeg South proposed turbines final 9-turbine layout
- 15 Viewpoint location
- Theoretical visibility of 9 turbine layout 58.18 %
- 0% visibility of final layout in parts of the Study Area where the preliminary layouts would not be visible
- Additional theoretical visibility of 14 turbine layout. Total visibility of layout is 62.10 %
- Additional theoretical visibility of 21 turbine layout. Total visibility of layout is 62.01 %
- Parts of Study Area with no visibility of the Development are unshaded: 37.49 %
- Area of Outstanding Natural Beauty

Turbine dimensions illustrated:
max. tip height above ground level 149.9 m
hub height 100 m
rotor diameter 99.8 m

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

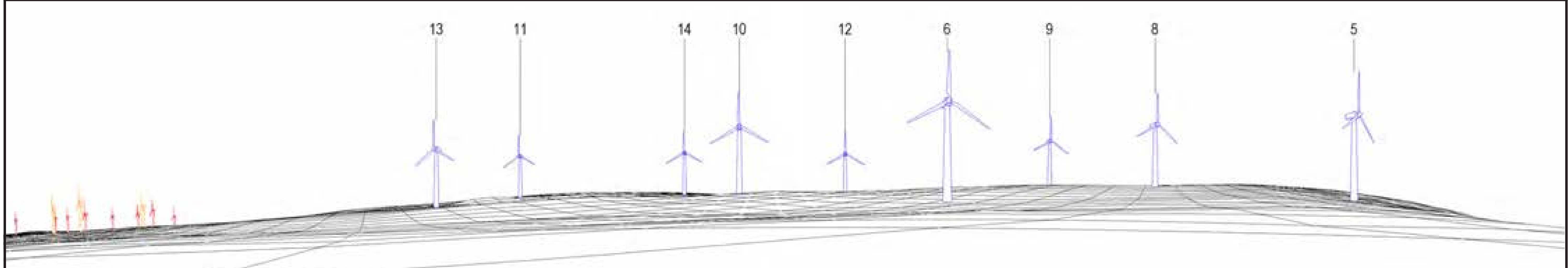
DRAWN / APPROVED:	DATE:	SCALE & PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	1:250,000 @ A3	B

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

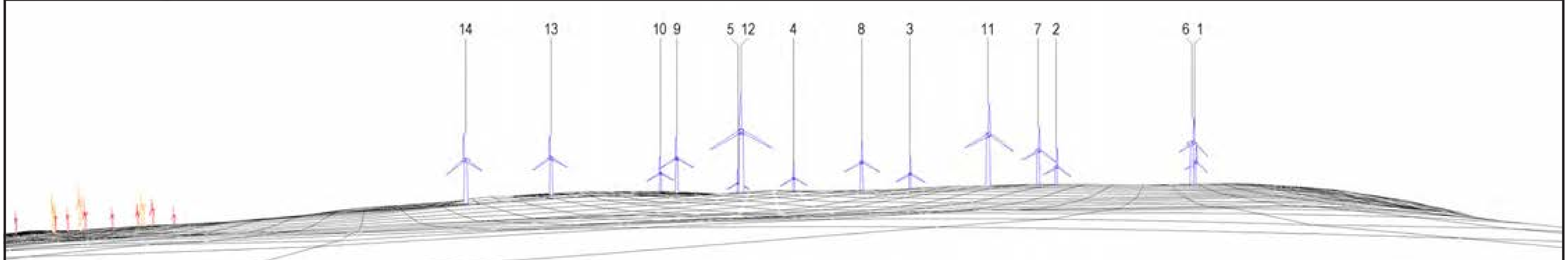
This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242

SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.11 RevB 211117.indd

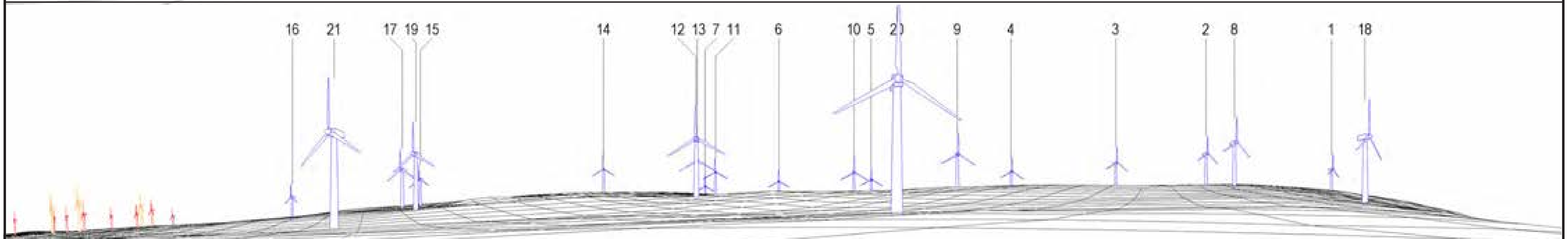
CONSENTED (LA01/2018/0200/F)



Final 9 turbine layout (99.8 m rotor diameter; 100 m hub; 149.9 m blade tip height)



Feasibility Stage: 14 turbine layout (99.8 m rotor diameter; 85 m & 100 m hub; 134.9 m - 149.9 m blade tip height)



Feasibility Stage: 21 turbine layout (90 m rotor diameter; 80 m hub; 125 m blade tip height)

Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

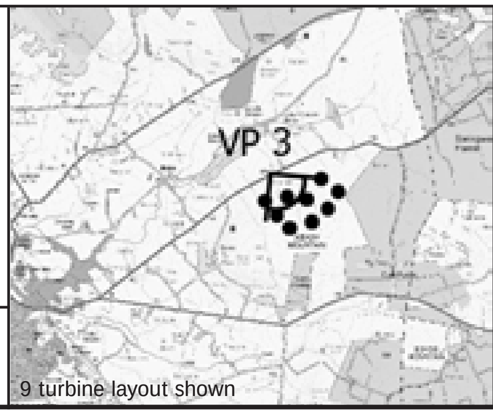
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.12 VP 3 Comparative_RevC 051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.12

COMPARATIVE WIRELINES FOR VIEWPOINT 3 : A37 NEAR DUNBEG WIND FARM, BROAD ROAD UPPER

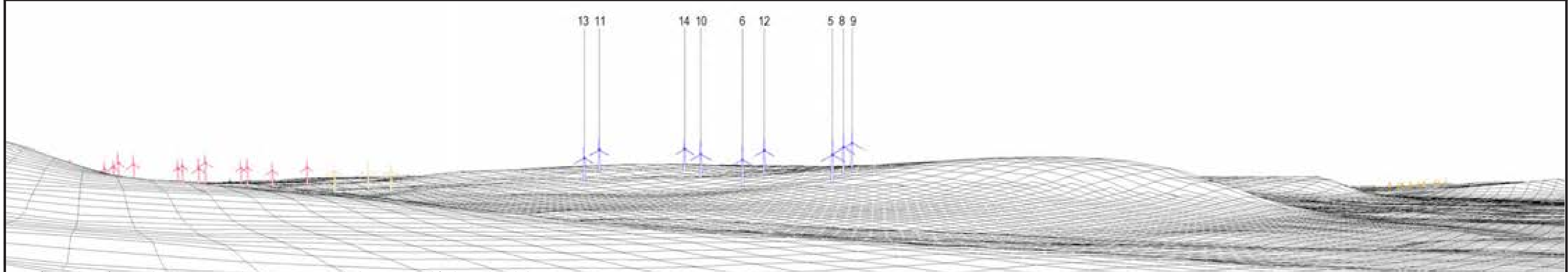
Easting:	273244
Northing:	425742
Elevation A.O.D	168 m
Bearing:	131.42 °
Approx. Included Angle:	180 °
Approx. distance to nearest turbine in final 9t layout:	0.46 km to T1



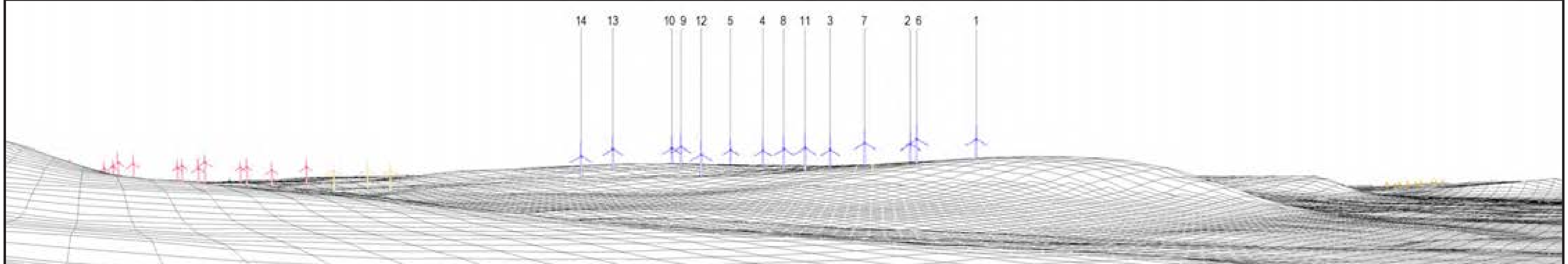
9 turbine layout shown

NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

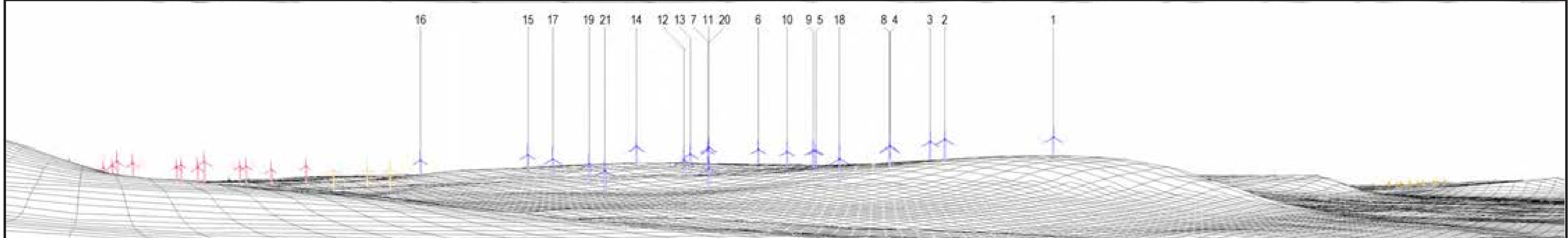
CONSENTED (LA01/2018/0200/F)



Final 9 turbine layout (99.8 m rotor diameter; 100 m hub; 149.9 m blade tip height)



Feasibility Stage: 14 turbine layout (99.8 m rotor diameter; 85 m & 100 m hub; 134.9 m - 149.9 m blade tip height)



Feasibility Stage: 21 turbine layout (90 m rotor diameter; 80 m hub; 125 m blade tip height)

Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

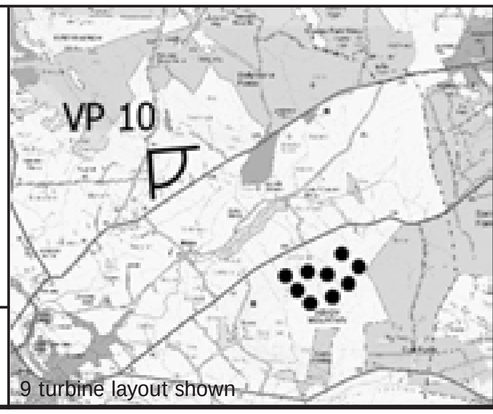
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.13 VP 10 Comparative_RevC 051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.13

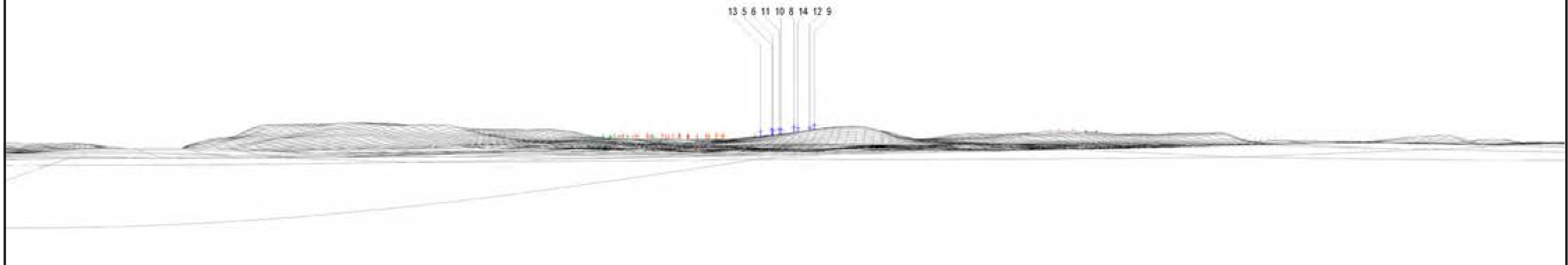
COMPARATIVE WIRELINES FOR VIEWPOINT 10 : BINEVENAGH SCENIC DRIVE NEAR LISNAGRIB

Easting:	270487
Northing:	427688
Elevation A.O.D	168 m
Bearing:	128.67 °
Approx. Included Angle:	180 °
Approx. distance to nearest turbine in final 9t layout:	359 km to T1

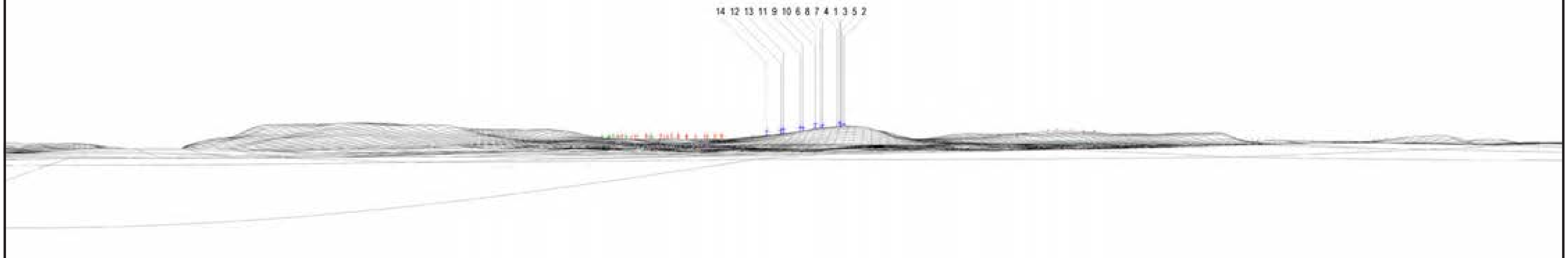


NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

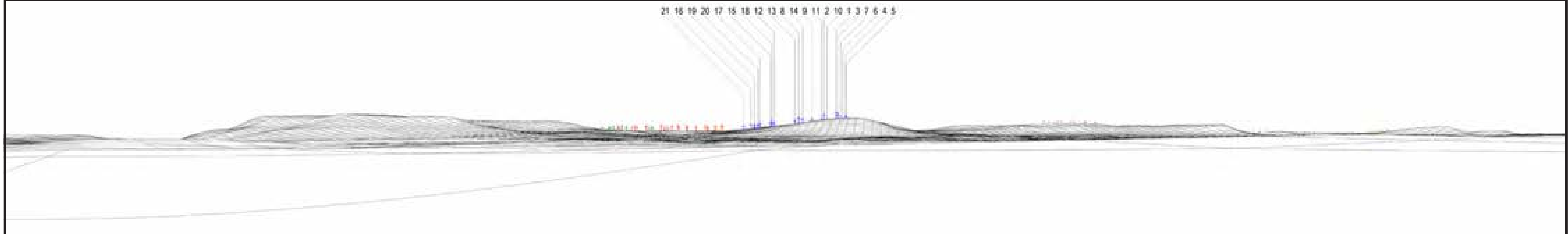
CONSENTED (LA01/2018/0200/F)



Final 9 turbine layout (99.8 m rotor diameter; 100 m hub; 149.9 m blade tip height)



Feasibility Stage: 14 turbine layout (99.8 m rotor diameter; 85 m & 100 m hub; 134.9 m - 149.9 m blade tip height)



Feasibility Stage: 21 turbine layout (90 m rotor diameter; 80 m hub; 125 m blade tip height)

Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

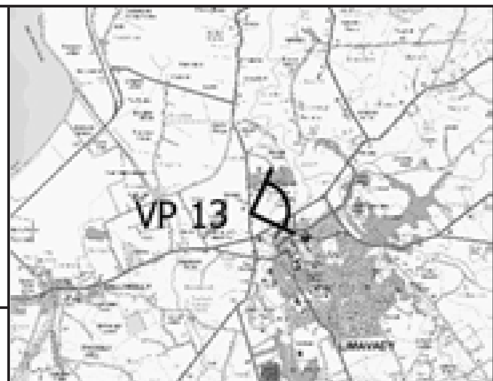
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.14 VP 13 Comparative_RevC 051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.14

COMPARATIVE WIRELINES FOR VIEWPOINT 13: A2 SCENIC ROUTE NEAR SEACOAST ROAD GARDEN CENTRE

Easting:	266355
Northing:	423789
Elevation A.O.D	22 m
Bearing:	76.46 °
Approx. Included Angle:	180 °
Approx. distance to nearest turbine in final 9t layout:	6.90 km to T1



9 turbine layout shown

NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)

PURPOSE AND UNDERSTANDING OF THESE FIGURES:

These Figures are intended to accompany the detailed written descriptions of the final 27 Viewpoints that have been included to represent views of the Development from various parts of the Study Area. They include computer-generated wirelines and photomontages. The purpose of these is to help the assessor establish what the Development's visual effect might be by providing a 'snapshot' of what the Development would look like within the landscape. They should always be viewed in conjunction with the LVIA report which provides a detailed written assessment of visual effects, as well as a visit to all of the viewpoints in appropriate weather conditions. Wirelines are not intended to be visually representative images but they are generally accepted as an illustrative digital imaging tool. They provide a good indication of the location of turbines within the landscape and their relationship with the Cumulative Baseline of other wind farms in the Study Area. If these limitations are recognised, visualisations can be accepted as adequate representations for the purpose of the LVIA. The methodology for producing these visualisations is described in detail in Technical Appendix 4.2. The methodology conforms to the best practice guidance documents listed in Technical Appendix 4.1.

These Figures must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the LVIA that is described in Technical Appendix 4.2. Detailed descriptions of the final Viewpoints are an integral part of the Visual Impact Assessment section of Chapter 4, LVIA. Viewpoint locations are shown on Figure 4.4 and all other map-based Figures for ease of reference.

On the wireline diagrams the turbine blades are displayed at an angle of 0º, i.e. the uppermost blade is always shown pointing directly upwards, in order to demonstrate the highest possible level of visibility. All cumulative wind farms, including any which may appear within the view but which are located beyond the field of view that it is possible to illustrate on A3-sized figures, are also labelled on the wireline. However, only existing wind farms and single turbines are shown on the photomontages (i.e. those that are already present within the Study Area). This is in accordance with best practice guidance.

In many scenarios wind farms are visible as elements of wide angle views which can only be appreciated if viewers turn their heads from side to side or move through the landscape. Wirelines and photomontages show the turbines in accurate proportion to other visual elements. However, the overall scale of the view is reduced by the practical need to illustrate the view on a single sheet of paper that allows as many people as possible to have fair and easy access to the published Environmental Statement. Features that are of note in wider views, but which are beyond the angle that can be illustrated in the viewpoint figures, such as other wind farms, are included in the detailed written descriptions of viewpoints in the LVIA report.

Visualisations are prepared in accordance with the SNH best practice guidance as far as practical and SNH's best practice guidance recommends that the following information on the limitations of visualisations is included in all LVIA methodologies:

"Visualisations of wind farms have a number of limitations which you should be aware of when using them to form a judgement on a wind farm proposal. These include:

- A visualisation can never show exactly what the wind farm will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image;
- The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate;
- A static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move;
- The viewpoints illustrated are representative of views in the area, but cannot represent visibility at all locations;
- To form the best impression of the impacts of the wind farm proposal these images are best viewed at the viewpoint location shown;
- The images must be printed at the right size to be viewed properly (The visualisations in this LVIA are 130 mm x 42 mm at A3); You should hold the images flat at a comfortable arm's length. If viewing these images on a wall or board at an exhibition, you should stand at arm's length from the image presented to gain the best impression.
- It is preferable to view printed images rather than view images on screen. If you do view images on screen you should do so using a normal PC screen with the image enlarged to the full screen height to give a realistic impression. Do not use a tablet or other device with a smaller screen to view the visualisations described in this guidance."

res

DUNBEG SOUTH WIND FARM

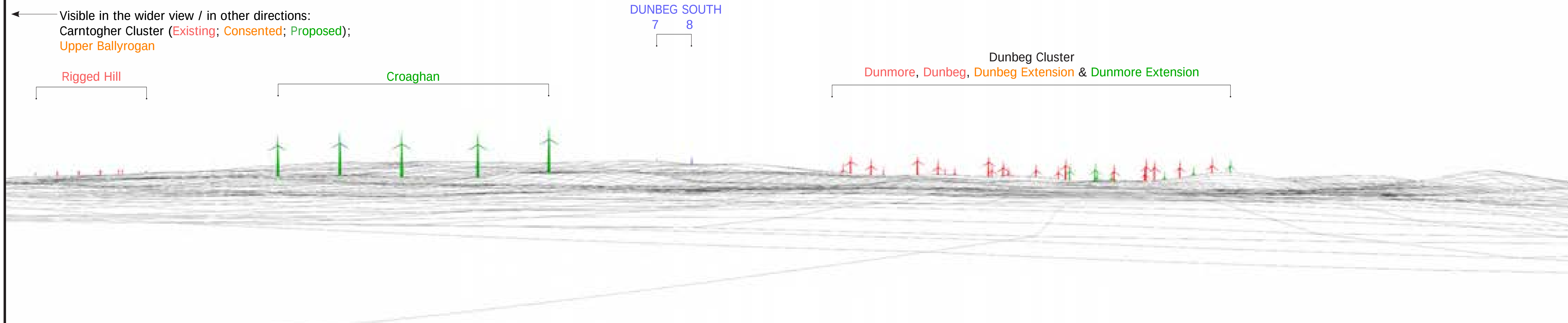
FIGURES 4.15 - 4.41

VIEWPOINT VISUALISATION FIGURES

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

CONSENTED (LA01/2018/0200/F)



Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	A3	B

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

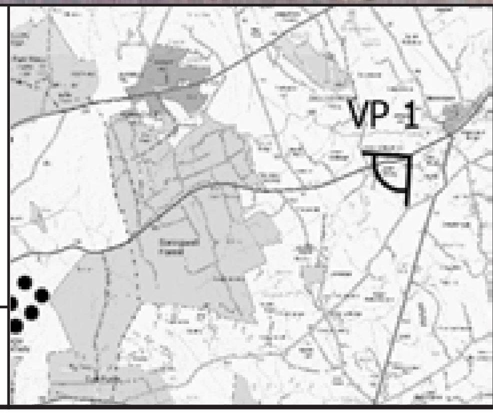
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.15_VP1_RevB_21117.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.15

VIEWPOINT 1: A37 NEAR MACOSQUIN

Easting:	281603
Northing:	428108
Elevation A.O.D	89 m
Bearing:	249.29 °
Approx. Included Angle:	75 °
Approx. distance to nearest turbine:	7.56 km to T8



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)

Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	A3	B

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

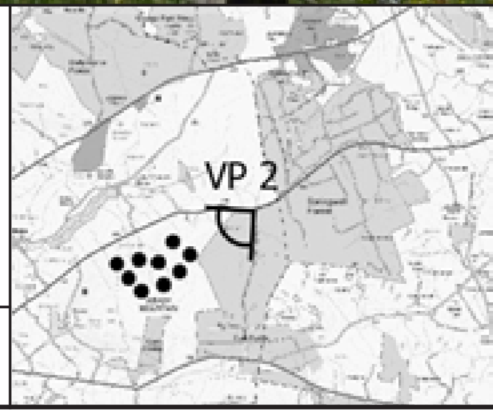
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.16 VP2 RevB_21117.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.16

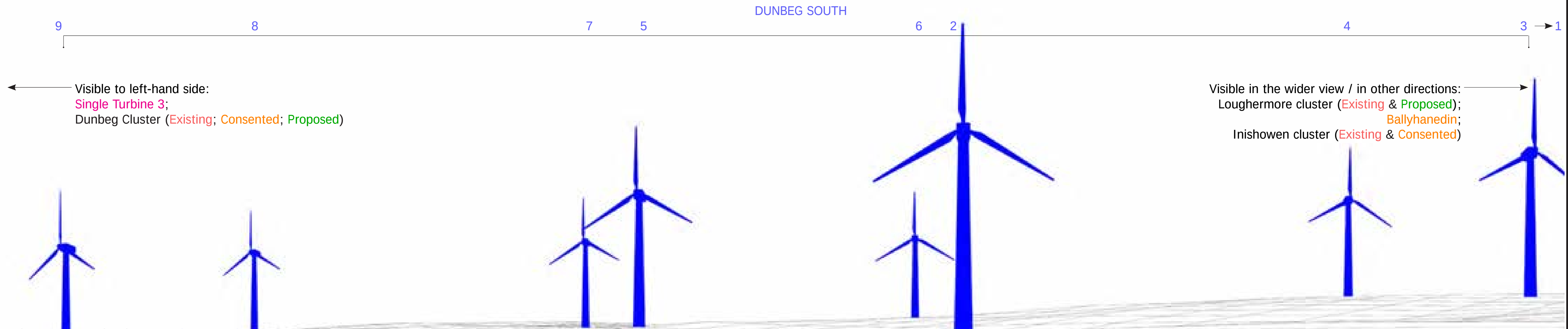
VIEWPOINT 2:
A37, PARKING LAYBY NEAR DUNBEG WIND FARM

Easting:	275677
Northing:	426261
Elevation A.O.D	247 m
Bearing:	242.00 °
Approx. Included Angle:	80 °
Approx. distance to nearest turbine:	1.39 km to T8



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)



Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

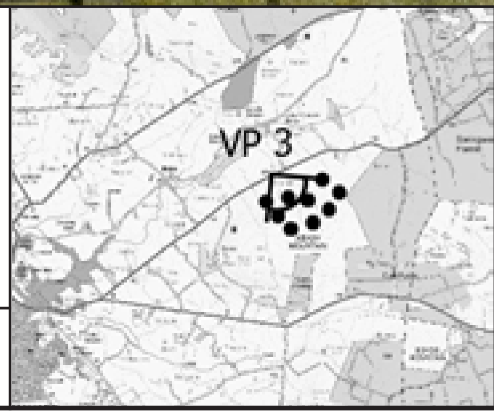
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.17 VP3 RevC_051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.17

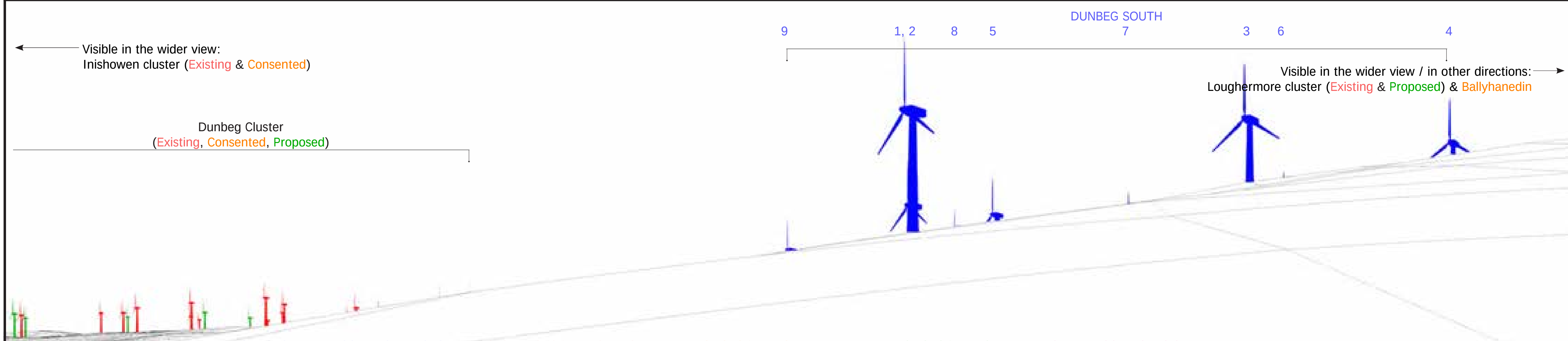
VIEWPOINT 3: A37 NEAR DUNBEG WIND FARM, BROAD ROAD UPPER

Easting:	273244
Northing:	425742
Elevation A.O.D	168 m
Bearing:	131.42 °
Approx. Included Angle:	90 °
Approx. distance to nearest turbine:	0.46 km to T1



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)



Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

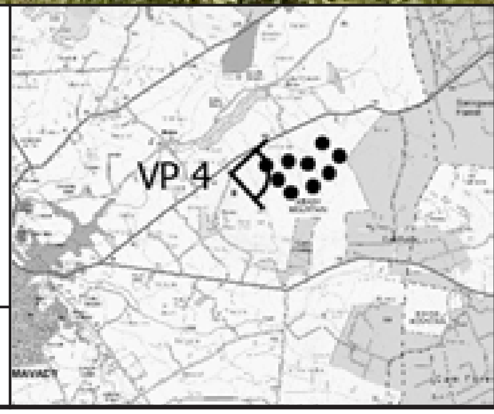
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.18 VP4 RevC_051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.18

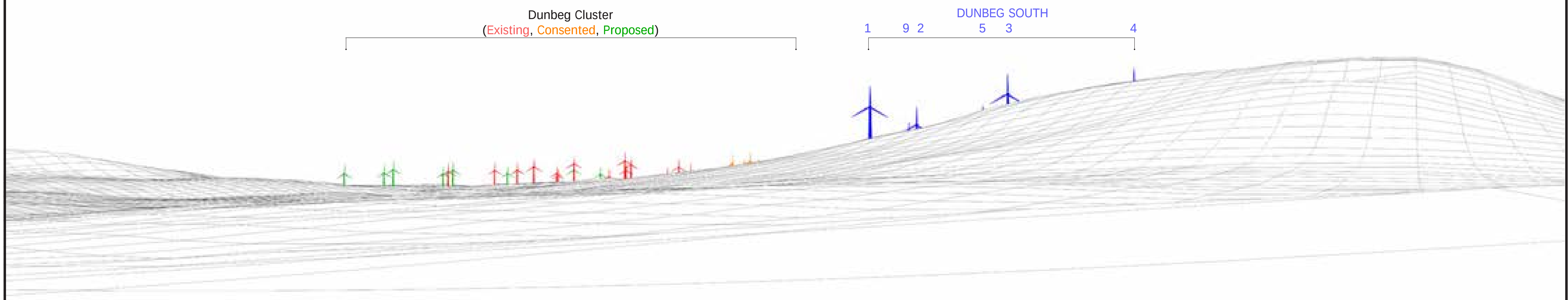
VIEWPOINT 4: KEADY MOUNTAIN NEAR A37

Easting:	272380
Northing:	425103
Elevation A.O.D	147 m
Bearing:	86.77 °
Approx. Included Angle:	80 °
Approx. distance to nearest turbine:	0.79 km to T1



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)



Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Nov. 2017	A3	A

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

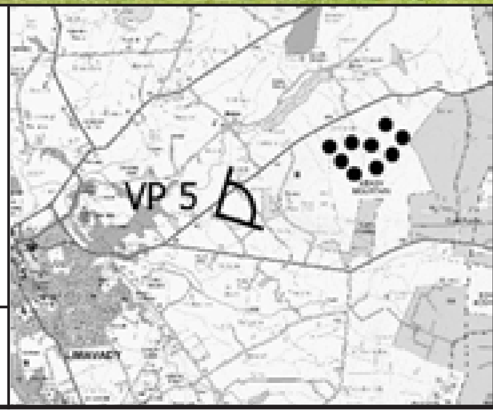
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.19 VP5 RevA_01117.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.19

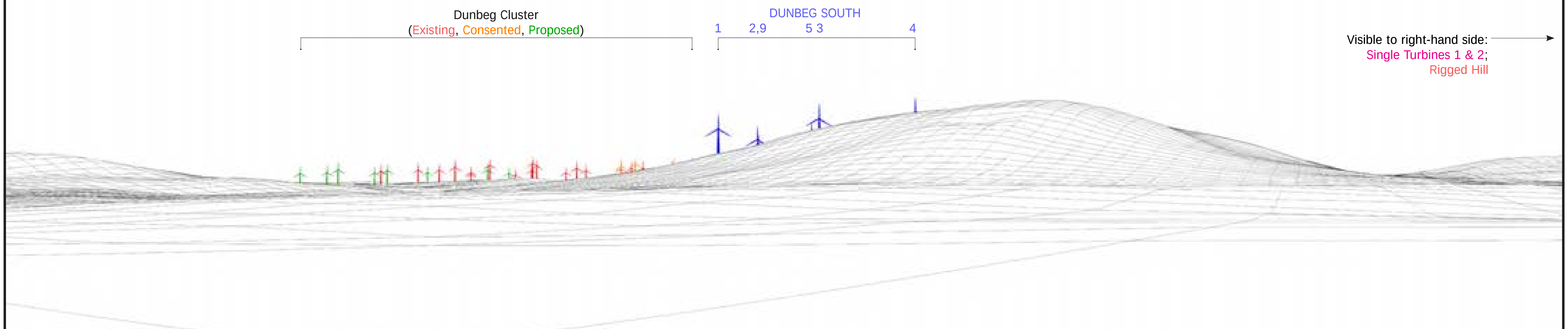
VIEWPOINT 5: GORTGARN ROAD NEAR JUNCTION WITH A37, BROAD ROAD MIDDLE

Easting:	270833
Northing:	424005
Elevation A.O.D	52 m
Bearing:	62.75 °
Approx. Included Angle:	75 °
Approx. distance to nearest turbine:	2.63 km to T1



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)



Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

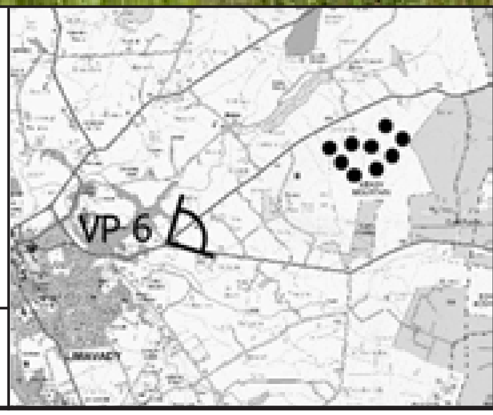
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.20 VP6 RevC_051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.20

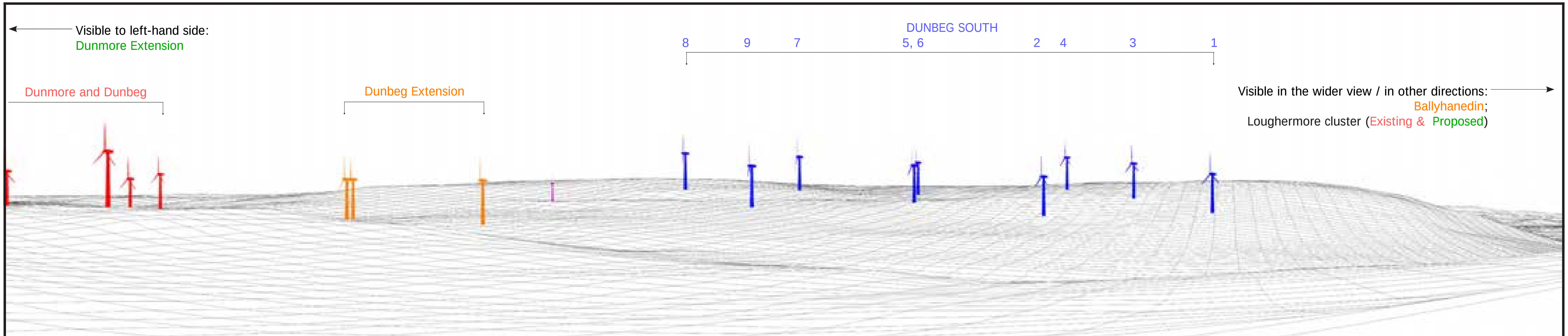
VIEWPOINT 6:
A37 LAYBY, BROAD ROAD LOWER

Easting:	269992
Northing:	423391
Elevation A.O.D	37 m
Bearing:	65.18 °
Approx. Included Angle:	75 °
Approx. distance to nearest turbine:	3.67 km to T1



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)



Where present in view: Dunbeg South Wind Farm turbines shown in blue; Existing wind farms in red; Consented wind farms in orange; Proposed wind farms in green; Single turbines in pink

Turbine dimensions shown for the Development: max. tip height above ground level 149.9 m; hub height 100 m; rotor diameter 99.8 m

This material is based upon Ordnance Survey digital data © Crown Copyright 2017 and is reproduced with the permission of Land and Property Services under delegated authority from the Controller of Her Majesty's Stationery Office. All rights reserved. Licence No. 242.

Shanti McAllister
landscape planning and design
info@shantimcallister.co.uk www.shantimcallister.co.uk

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

DRAWN / APPROVED:	DATE:	PRINT SIZE:	REVISION:
SMc / GM	Dec. 2017	A3	C

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

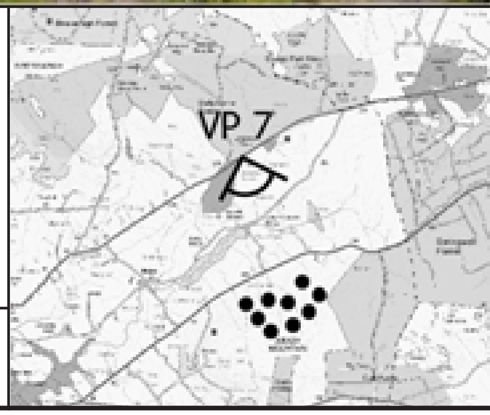
SMc/ 15 029 02/ SMcDwgs/ DBS_LVIA Fig 4.21 VP7 RevC_051217.indd

DUNBEG SOUTH WIND FARM

FIGURE 4.21

VIEWPOINT 7: WINDYHILL ROAD WEST

Easting:	273119
Northing:	428091
Elevation A.O.D	192 m
Bearing:	164.50 °
Approx. Included Angle:	75 °
Approx. distance to nearest turbine:	2.65 km to T9



NOTE: This Figure must be viewed in conjunction with the analysis of landscape and visual effects contained in Chapter 4 of the Environmental Statement and the detailed methodology for the preparation of visualisations contained in Technical Appendix 4.2, in particular the paragraphs referencing Scottish Natural Heritage Guidance regarding the limitations of visualisations.

CONSENTED (LA01/2018/0200/F)