BARR CREGG WIND FARM

Further Environmental Information 2016

Volumes 1 - 3

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Contents

BARR CREGG WIND FARM

Further Environmental Information 2016

Volume 1 - Non-Technical Summary

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Contents

Preface

This Further Environmental Information 2016 has been prepared in support of the planning application for the proposed Barr Cregg Wind Farm. The proposed wind farm is located in the townlands of Barr Cregg, Ballymaclanigan and Slaghtmanus, near Claudy in County Londonderry.

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
Grid Connection Assessment	Blackstaff Ecology David Steele Gahan & Long McCloy Consulting Paul Johnston Associates Shanti McAllister Landscape Planning & Design
Outline Habitat Restoration Management Plan	Blackstaff Ecology David Steele McCloy Consulting Paul Johnston Associates Ross Environmental Associates
Archaeology and Cultural Heritage Assessment - Figures	Shanti McAllister Landscape Planning & Design
Water Framework Directive Assessment	McCloy Consulting
Socio-Economics	Oxford Economics

An electronic version of the FEI 2016 and other details about the project can be viewed at www.barrcregg-windfarm.co.uk.

Reference copies of the full ES (2012), FEI (2014), FEI (2016) and planning application(s) may be viewed and or purchased during normal opening hours at the following location

Diamond Centre

630 Baranailt Road

Claudy

County Londonderry

BT47 4EA

028 7133 8005

Paper Copies of the NTS are available free of charge. The ES (2012), FEI (2014) and FEI (2016) are available free of charge on CD or in paper form at a cost of £50 each from the address above, or by contacting RES. Cheques should be made payable to Renewable Energy Systems Ltd.

Renewable Energy Systems Ltd

Williowbank Business Park

Willowbank Road

Millbrook

Larne

County Antrim

BT40 2SF

028 2844 0580

Context

Renewable Energy Systems hereafter referred to as 'RES', applied to DOE Planning Service for consent to construct a wind farm of seven wind turbines on land at Barr Cregg, approximately 4.5km north of Claudy and 9km south/southeast of Eglinton in the townland of Barr Cregg, County Londonderry. The planning application (Ref A/2012/0401/F) was submitted on 20th August 2012.

The application was subject to Environmental Impact Assessment (EIA) under the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2012. 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 the Planning Service to assess the environmental impacts, and these were reported in the Barr Cregg Wind Farm Environmental Statement (ES) which accompanied the planning application.

The proposal comprises the construction of seven turbines (each with an overall maximum height of 125 m above ground level) and associated infrastructure including a hardstanding pad at each turbine for crane erection, an upgraded site entrance, new and upgraded onsite access tracks, an onsite substation and control building, underground cables, two temporary monitoring masts, a permanent meteorological mast, a temporary construction compound, a temporary enabling works compound amd road widening and improvement works on sections of the transport route (road improvement works).

DOE Planning requested Further Environmental Information on 23rd October 2013 following consultation with statutory and non-statutory bodies. RES submitted FEI on 28th February 2014, which included 2 additional applications for an additional section of site access track and passing bays (A/2014/0112/F & A/2014/0114/F respectively). All consultation responses where received by Planning Service by January 2015. By April 2015, Planning Service had not reached a decision and all 3 planning applications (A/2012/0401/F, A/2014/0112/F & A/2014/0114/F) were passed to Derry & Strabane District Council as part of the Reform of Planning Administration.

In June 2015, Derry & Strabane DC Planning Department recommended that the main application for Barr Cregg Wind Farm (A/2012/0401/F &) be refused and following presentation to the planning committee on 1st July 2015, the application was refused and a decision notice issued on 21st July 2015. On 4th August 2015, Renewable Energy Systems Ltd submitted an appeal to the Planning Appeals Commission.

In October 2015 - Derry & Strabane DC Planning Department recommended that the planning applications for additional access track (A/2014/0112/F) and passing bays (A/2014/0114/F) be refused and was presented to the planning committee on 7th October 2015. On 6th November 2015, Renewable Energy Systems Ltd appealed the decision to the Planning Appeals Commission. A decision notice was issued on 28th November 2015.

This document is a 'non-technical' summary of the Further Environmental Information (2016) with detailed information being presented in the FEI (2016), FEI (2014) and ES (2012).

Further Environmental Information

The purpose of this FEI is to update and complement, where appropriate, the environmental information previously submitted. The FEI (2016) together with the FEI (2014) and ES (2012) will comprise the environmental information before the Planning Appeals Commission.

The information contained in the Further Environmental Information (2016) Volumes 1 – 3 has been produced to present up to date assessments as it was considered that revised assessments that include a greater level of detail would provide clarity for the Planning Appeals Commission. The decision of which assessments should be produced was based on the consultation responses received post submission of the FEI (2014), the content of the Derry & Strabane DC – Development Case Officer Report and other developments that have arisen since submission of FEI (2014).

The Applicant

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 more than 9,000 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 both onshore and offshore wind, solar, wave and tidal as well as enabling technologies such as energy storage and demand side management. RES has been developing wind farms in Ireland since the early 1990s.

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.

Project Description

Excepting the changes described herein, the elements of the proposed Barr Cregg Wind Farm remain as described in Chapter 3 of the Barr Cregg Wind Farm Environmental Statement (Aug 2012) and Further Environmental Information (Feb 2014) remain unchanged.

Alternative Infrastructure Layout

The Alternative Infrastructure Layout (Figure E), which was submitted as a separate planning application (A/2014/0112/F) with the FEI (2014) is now proposed as the layout.

The layout of the Alternative Infrastructure remains unchanged. However, to minimise the extent of construction working corridor, where at all possible and maintain hydrological links, the length of floated site access track has been increased. A new figure (enclosed) has been produced, Alternative Infrastructure Layout - Figure E (Rev A) which illustrates the increased lengths of floated site access track.

Supplementary / Additional Assessments

Grid Connection

Although a grid connection is a functionally necessary part of any wind farm project, it typically follows a completely separate consenting route. Normally the applicant seeking planning permission for the wind farm will be the developer, whereas the grid connection consent will normally be sought by the relevant owner of the local distribution or transmission network, in this case Northern Ireland Electricity Ltd.

The Best Practice Guidance to PPS 18 states that whilst the routing of such lines by 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 have included a potential grid connection assessment.

The grid connection will originate at Killymalaght substation on Killymalaght Road approximately 3 km to the south west of Newbuildings village and approximately 12.5 km to the west of the Barr Cregg Wind Farm (straight line distance). The proposed grid connection route will follow the tertiary road network heading north eastwards into Derry city along Killymalaght Road, Trench Road and Church Road where it will then join the A6 Glenshane Road for approximately 6.4 km. It will then re-join the tertiary road network at Ervey Road then Slaghtmanus Road before connecting to the wind farm substation.

The proposed route is approximately 19 km and an assessment of the likely significant environmental impacts of the proposed underground grid connection route has been undertaken under the following headings:

- Landscape and visual
- Ecology
- Ornithology
- Geology and the water environment
- Fisheries

- Cultural heritage and archaeology
- Noise
- Traffic and transport.

The aforementioned assessments have concluded that subject to mitigation there will be no significant residual impacts associated with connecting Barr Cregg Wind Farm to the local distribution or transmission network.

Water Framework Directive Assessment (WFD)

The hydrology update is simply the provision of a Water Framework Directive (WFD) assessment, intended to determine if specific components or activities related to the development of the Wind Farm will compromise the attainment of a WFD objective as required by the relevant River Basin Management Plan or result in the deterioration in the ecological status of any waterbodies in the vicinity of the site.

No WFD Assessment was submitted with the previous submissions as such documentation was not typically requested by the relevant consultees at the time of original submission. The reason for submission of this Assessment is to ensure that the planning application and supporting environmental information is robust and satisfies current obligations and best practice in relation to the water environment.

The WFD assessment summarises the proposed mitigation measures previously proposed in the original Environmental Statement and Further Environmental Information submissions specific to management of surface water from the developed site where it is intended to mitigate a perceived risk of deterioration in the ecological status of any affected waterbody

Three WFD designated surface watercourse and one groundwater catchment were identified, which could be affected by the proposed works involved in the construction of the wind farm; i.e. the Burntollet River (Loughermore), Burntollet River (Ness Wood), and the Claudy Groundwater body.

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 waterbodies.

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.

Following incorporation of site-wide general binding mitigation control measures, NIEA approved 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 proposed Barr Cregg Wind Farm.

Outline Habitat Restoration Management Plan (OHRMP)

NIEA: Natural Environment Division (NED) raised concerns regarding distinct areas of the wind farm footprint being (in their opinion) on active peat. NIEA:NED accept that the land has been drained and the condition of the peatland is degraded. In addition NIEA:NED were of the opinion that there was inadequate detail to provide advice on whether there is adequate compensation for impacts on priority habitat and species. Derry & Strabane DC, Development Management Officer Report shared this view.

The Outline Habitat Restoration and Management Plan describes and quantifies the habitat restoration and enhancement proposed for the Barr Cregg Wind Farm Development. Its overall purpose is to ensure that identified impacts of the development are appropriately mitigated and also that the development delivers overall habitat benefit.

The proposed development footprint lies in degraded and blanket bog and degraded heather moorland (assessed as not active due to ongoing agricultural land management) which are, nevertheless, classified as priority habitats in both the UK Biodiversity Action Plan and in Northern Ireland Habitat Action Plans. The focus of the OHMP is to provide methods for correct habitat restoration around the infrastructure footprint and to provide methods for and locations or habitat enhancement in areas of degraded blanket bog on land within the control of the applicant. Maps are provided to illustrate site conditions and management proposals.

This document starts with an outline of the relevant legal and policy framework. In order to make transparent how the significance of impacts on peatland habitats was assessed, a detailed description of Ecological Impact Assessment (EcIA) methodology is provided both in the text and in an accompanying Appendix. A brief description of habitat conditions on site is followed by an assessment of potential impacts of the development on these habitats. Methods for mitigation (including compensation) and habitat enhancement are described in detail and monitoring, personnel responsibilities and an outline schedule of activities are provided.

The land proposed for the Barr Cregg Wind Farm Development is in agricultural use. The land has been drained, some parts of the site have been cut for peat and the vegetation swards have been mown for sheep and cattle grazing. The land owners voluntarily opted into a Countryside Management Scheme (CMS) which sets a number of restrictions on land use, including: restricted stock grazing, no deepening or widening of drainage ditches and limited peat cutting and burning. The CMS for these lands ended on 13th May 2016 and therefore the land use restrictions no longer apply and there is currently no proposed replacement for the CMS.

Detailed site survey work, including new statistical analysis of the vegetation data, together with the use of the NIEA guidance, has shown that many areas of blanket bog habitat, particularly those mapped as M19 (Calluna vulgaris-Eriophorum vaginatum blanket mire) in the original Environmental Statement, are substantially degraded habitats and are not active blanket bog (as NIEA contend), due to on-going agricultural land management activities. They will remain inactive, and their condition will continue to decline, until the on-going damaging agricultural land management practices of ditch cleaning, peat cutting, mowing/flailing and stock grazing/trampling are removed. A photographic Appendix is provided to illustrate the degraded condition of blanket bog and heathland habitats at Barr Cregg compared to the same vegetation communities elsewhere that are in good conservation condition.

Prior to conducting the final EcIA (FEI 2014) a number of elements which are beneficial to degraded blanket bog habitats were incorporated into the design of the wind farm, including avoidance of areas of more valuable habitat, avoidance of areas of deeper peat, a reduction in size of crane pads and the use of floating track construction methods in various parts of the site to minimise effects on peat hydrology, to minimise the volume of peat excavated and to reduce carbon emissions. The use of floated access track has been increased, and in addition RES anticipates that the Construction Method Statement will include methods of construction designed to further mitigate the impacts of development.

Two potential impacts of the proposed development on peatlands at Barr Cregg are described and assessed. These are habitat loss and alteration of peat hydrology.

A comprehensive programme of mitigation (including compensation for habitat loss) and habitat enhancement is proposed. The compensation and enhancement elements include four main types of work to compensate for habitat loss and to provide overall habitat benefit: areas of ditch blocking to raise water table levels; reinstatement of a good heather sward in areas of the site where heather is lacking; creation of a heather-dominated community in areas which are currently semi-improved grassland; and overall controls on stock grazing to allow bog vegetation to recover.

In addition to vegetation benefits, the proposed habitat enhancement will be beneficial for peatland hydrology and for flood management in the downstream catchment, by retaining water on site and reducing the peak rate of surface water runoff. By reducing scouring and peat erosion, ditch blocking will also reduce suspended sediments and improve the quality in water draining to the Burntollet River and downstream catchments. There are also anticipated benefits for both terrestrial fauna and ornithology. Six breeding bird species, including Red and Amber-listed species and Northern Ireland priority species, will potentially benefit from more diverse structure of peatland swards, increasing heather dominance, and raising water table levels in degraded blanket bog.

It is assessed that excavation to construct the wind farm will, without mitigation, have a significant adverse effect on small areas of degraded blanket bog (assessed as not active due to ongoing agricultural land management). Mitigation by design, through a construction mitigation package, and through compensation for habitat loss, will reduce the level of impacts such that they will not be significant. In any event, counter balancing this impact is the applicant's proposal to enhance/improve substantial areas of blanket bog outside the development footprint but within lands under the applicant's control. The calculated loss of degraded blanket bog and heathland, for the lifetime of the development, due to the construction footprint, amounts to 2.68ha, which is approximately 8.4% of the area of blanket bog and heathland within the planning application boundary. The area of proposed habitat enhancement is approximately 11.92ha. Comparing the habitat loss to the habitat enhancement, the overall habitat betterment proposed is approximately 4.5 times more peatland habitat enhanced and restored than will be lost as a result of the development. If the area of habitat enhancement is separated out from that which 'compensates' for the area of habitat loss (ie 2.68ha), the area of proposed habitat enhancement that is over and above direct 'compensation' amounts to 5.24ha, which is approximately the area of 8 football pitches. In addition, a further 98.4ha of degraded blanket bog would benefit from reduced sheep grazing densities for the lifetime of the wind farm development.

In conclusion, the Barr Cregg Wind Farm Development will provide a valuable vehicle for delivering enhancement/improvement of degraded blanket bog and contributing to Northern Ireland's Habitat Action Plan (NIHAP) targets. In the absence of other funding for habitat management outside of designated sites, cooperation between the NIEA and other partners, including wind farm developers, is likely to be one of the very few ways in which existing degraded and fragmented blanket bog habitats in the uplands of Northern Ireland can be restored and enhanced, and one of the few ways that NIHAP targets can be achieved.

Socio – Economics

Derry & Strabane DC, Development Management Officer Report stated that there was a lack of clarity and supporting information to evidence the economic figures stated. A revised socioeconomic chapter is provided which provides a greater level of detail in order that the significant weight can be attached to the economic benefits that would accrue should this application be consented. The revised chapter supercedes Chapter 19 (ES 2012).

The socioeconomic assessment concluded that should the proposed development go ahead, it will deliver substantial benefits to the economies of Northern Ireland and Derry & Strabane, 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

The proposed development is estimated to result in a capital spend of approximately £21.53 million. Of this an estimated 7.77 million of construction phase spend will be realised in Northern Ireland. The 18 month construction phase is estimated to create or sustain between 64 and 91 direct job years[1] of employment, with associated direct wages of between £1.52 million and £2.15 million and direct Gross Value Added (GVA)[2] of £2.23 million - £3.14 million. The estimated total (direct, indirect and induced) benefits from the construction phase include the creation or sustainment of between 113 – 159 job years, £2.46 million - £3.48 million of wages and £4.13 million - £5.82 million of GVA for the Northern Ireland economy.

RES has committed to a community fund package of £5,000 per MW for the wind farm lifetime. This will be split by £2,000 per MW of a community fund, and £3,000 per MW into a Local Electricity Discount Scheme. The total package will therefore contribute £1.75 million over the lifespan of the project.

The operational phase of the development is estimated to create or sustain one direct job per year, 0.04m of direct wages and 0.22m of direct GVA per annum. Given that the operational lifetime of the proposed development will be 25 years, this equates to 25 direct jobs, £1.12m of direct wages and 5.62m if direct GVA.

The estimated total (direct, indirect and induced) benefits from the operational phase of the development include the creation or sustainment of six jobs per year and £0.15m of wages per annum. It will also add £0.53m to Northern Irelands GVA per annum. Over 25 years, this equates to 150 total jobs, £3.75 million of total wages and £13.25 million of total GVA.

The proposed development is estimated to increase rateable value by £238,000 per annum or £5.95m over the course of the project, based on current average rateable value of £17,000 per MW for similar properties in the valuation list. It should be noted that there is a difference between rateable value charged on which the above figures are based, and the business rates revenue collected by the local Councils and NI Assembly – allowing for regional and district rate poundages. By applying the Non-Domestic Rate Poundage for Derry & Strabane, the above rateable values would leave additional business rates revenue of £141,949 per annum and £3.55 million over the 25 year lifetime of the project.

[1] Job Years: Fore 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 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 jobs years of employment.

[2] 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.

Cultural Heritage

NIEA: HBU requested additional information in their consultation response of 18th August 2014 to determine if there would be a significant impact on the setting of the Lower Cumber Presbyterian Church (HB01/02/005) and the Former Post Office Glenshane Road (HB01/02/006). Derry & Strabane DC, Development Management Officer Report also stated that the based on the information submitted, they could not be satisfied with regard to Policy PPS 6: BH2. Whilst RES do not agree that further information is required to make the above assessment, two photomontages have been produced to illustrate the setting of the aforementioned listed buildings.

The two photomontages (Figure 11.4 & 11.5 (Volume 3)) clearly illustrate that there will be no visibility of the wind farm and therefore no significant impact on the setting of either listed building.

Conclusion

Refinements made as part of FEI (2014) significantly reduced the extent of the permanent and temporary land take, whilst minimising development on the least damaged areas of peatland. The proportion of onsite access track utilising floating road construction has subsequently been increased to further minimise impacts on damaged areas of peatland.

The overall planning application boundary of the wind farm site is 77.0 hectares (Ha). However, the actual wind farm infrastructure will occupy a much smaller part of the area (4.3 Ha). Therefore a maximum of approximately 5.6% of the land within the planning application boundary will be utilised by the development due to the relatively small footprints of the infrastructure and the wind farm design criteria applied in the design process.

Nearly 100 Ha of habitat management is proposed within land under the applicants control, comprising a combination of drain blocking, heather brash reseeding and reduced grazing for the 25 year lifetime of the wind farm. Therefore the extent of habitat management areas are >23 fold that of the proposed development.

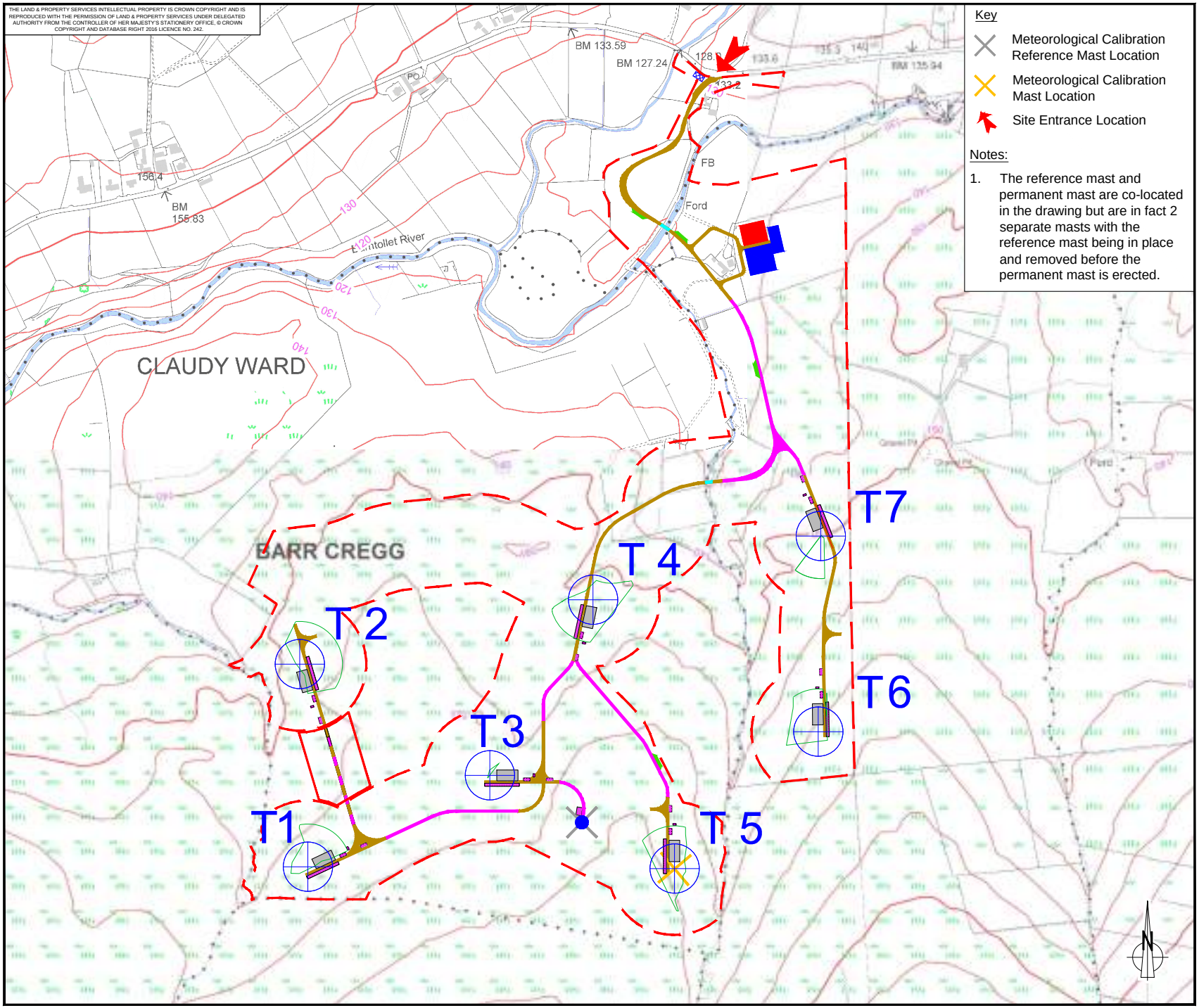
The proposed 14 MW wind farm is estimated to produce 46.6 GWh per year, which is enough electricity to meet the needs of 11,325 homes each year. This is the equivalent of 19.6 percent of the current (2016) housing stock of Derry and Strabane.

RES has committed to a community benefit package of £5,000 per MW. This will be split by £2,000 per MW of a community fund, and £3,000 per MW into a Local Discounted Electricity Scheme. The fund will therefore contribute £1.75m over the lifespan of the project.

The potential effects of the proposed Barr Cregg Wind Farm have been assessed in accordance with regulatory requirements and good practice. The ES (2012), FEI (2014) and FEI (2016) 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.

The Barr Cregg 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 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).



Key

- Meteorological Calibration Reference Mast Location
- Meteorological Calibration Mast Location
- Site Entrance Location

Notes:

1. The reference mast and permanent mast are co-located in the drawing but are in fact 2 separate masts with the reference mast being in place and removed before the permanent mast is erected.

BARR CREGG WIND FARM

FIGURE E-REVISION A

ALTERNATIVE INFRASTRUCTURE LAYOUT

Key

- Wind Turbine Location
- Micrositing Buffer (80m)
- Planning Application Boundary
- Planning Application Boundary (Planning Reference A/2014/0114/F)
- Site Tracks (New Excavated)
- Site Tracks (New Floated)
- Site Tracks (New Excavated on Floated)
- Control Building & Substation Compound
- Meteorological Mast Location (Permanent Lattice Type)
- Clear Span Watercourse Crossing
- Crane Hard Standing Area
  - Permanent
  - Temporary
- Temporary Passing Places & Turning Heads
- Temporary Construction Compound
- Temporary Enabling Works Compound

LAYOUT DWG	02381D0001-12	T-LAYOUT NO.	PNIRBRC034

DRAWING NUMBER 02381D1004-05

SCALE - 1:10,000 @ A4

FEI 2016

BARR CREGG WIND FARM

Further Environmental Information 2016

Volume 2 - Main Report & Appendices

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Contents

1 Introduction

Background

1.1 In August 2012, Renewable Energy Systems (RES) submitted an application (reference A/2012/0401/F) to DOE Planning Service, Northern Ireland for permission to erect a 7 turbine wind farm in the townlands of Barr Cregg, Ballymaclanigan and Slaughtmanus near Claudy, Co. Derry.

1.2 The application was subject to Environmental Impact Assessment (EIA) under the Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2012. 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 the Planning Service to assess the environmental impacts, and these were reported in the Barr Cregg Wind Farm Environmental Statement (ES) which accompanied the planning application.

1.3 DOE Planning requested Further Environmental Information on 23rd October 2013 following consultation with statutory and non-statutory bodies. RES submitted FEI on 28th February 2014, which included 2 additional applications for an additional section of site access track and passing bays (A/2014/0112/F & A/2014/0114/F respectively). All consultation responses where received by Planning Service by January 2015. By April 2015, Planning Service had not reached a decision and all 3 planning applications (A/2012/0401/F, A/2014/0112/F & A/2014/0114/F) were passed to Derry & Strabane District Council as part of the Reform of Planning Administration.

1.4 In June 2015, Derry & Strabane DC Planning Department recommended that the main application for Barr Cregg Wind Farm (A/2012/0401/F &) be refused and following presentation to the planning committee on 1st July 2015, the application was refused and a decision notice issued on 21st July 2015. On 4th August 2015, Renewable Energy Systems Ltd submitted an appeal to the Planning Appeals Commission.

1.5 In October 2015 - Derry & Strabane DC Planning Department recommended that the planning applications for additional access track (A/2014/0112/F) and passing bays (A/2014/0114/F) be refused and was presented to the planning committee on 7th October 2015. On 6th November 2015, Renewable Energy Systems Ltd appealed the decision to the Planning Appeals Commission. A decision notice was issued on 28th November 2015.

Purpose of the FEI

1.6 The purpose of this FEI is to update and complement, where appropriate, the environmental information previously submitted. The FEI (2016) together with the FEI (2014) and ES (2012) will comprise the environmental information before the Planning Appeals Commission.

1.7 This FEI (2016) is to be read in conjunction with the following documents and associated appendices:

- Environmental Statement (2012) except Socioeconomic Chapter which has been superceded by the Socioeconomic Chapter within FEI (2016);
- Further Environmental Information (2014) which provides addenda to the full chapters included within the ES (2012);

1.8 The information contained in the Further Environmental Information (2016) Volumes 1 – 3 has been produced to present up to date assessments as it was considered that revised assessments that include a greater level of detail would provide clarity for the Planning Appeals Commission. The decision of which assessments should be produced was based on the consultation responses received post submission of the FEI (2014), the content of the Derry & Strabane DC – Development Case Officer Report and other developments that have arisen since submission of FEI (2014).

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:

- **Chapter 1 - Introduction**: sets out the purpose of the FEI, provides detail of revised project and provides an overview of supplementary chapters.

1.11 **Supplementary Chapters** report the finding of each of the topics included within the FEI (2016). The topics are covered in the following structure:

- **Chapter 2 - Grid Connection Assessment;**
- **Chapter 3 - Water Framework Directive Assessment;**
- **Chapter 4 - Outline Habitat Restoration & Management Plan;**
- **Chapter 5 - Socioeconomics.**

Revised Proposal

The Project

1.13 Excepting the changes described herein, the elements of the proposed Barr Cregg Wind Farm remain as described in Chapter 3 of the Barr Cregg Wind Farm Environmental Statement (Aug 2012) and Further Environmental Information (2014).

1.14 The proposed project comprises the construction of up to seven turbines (each with an overall maximum height of 125.0 m above ground level) and associated infrastructure including a hard standing pad at each turbine for crane erection, an upgraded site entrance, new and upgraded onsite access tracks, an onsite substation and control building, underground cables, two temporary monitoring masts, a permanent meteorological mast, a temporary construction compound, a temporary enabling works compound and road widening and improvement works on sections of the transport route (road improvement works).

Alternative Infrastructure Layout

1.15 The Alternative Infrastructure Layout (Figure E), which was submitted as a separate planning application (A/2014/0112/F) with the FEI (2014) is now proposed as the layout.

1.16 The layout of the Alternative Infrastructure remains unchanged. However, to minimise the extent of construction working corridor where at all possible and maintain hydrological links, the length of floated site access track has been increased. A new figure has been produced, Alternative Infrastructure Layout (Figure E (Rev A) – Volume 3), which illustrates the increased lengths of floated site access track (See ES (2012) – Volume 2 – Figure 3.10 – Typical Access Track).

1.17 In addition to the originally proposed 497m of floating track (FEI, 2014), the current layout has additional lengths of floating track to the south of the proposed substation and between Turbines 1 and 2. Linking Turbines 1 and 2 with floated access track had previously been discounted due to the historic extraction of peat using a mechanical peat auger whereby ribbons of wet peat are extruded from below the surface, allowed to dry on the surface and then removed. This method of extraction has been a contributory factor in peat slides. Following further site investigations by RES Construction personnel, we are of the opinion that given the dry and compact nature of the peat in this location, shallow gradients and low peat slide risk highlighted within FEI (2014) that floating track design can be utilised in this location. The assessments contained herein have considered this section of track as both floating track and excavated track, should it be necessary for engineering reasons to construct the track using the latter method.

1.18 This amounts to a total length of floated track of 1487m, or 1310m, if the track between T1 & T2 is excavated track, resulting in a 813m / 990m increase in the length of floating track overall: a substantial benefit in terms of minimising excavated peat and CO2 emissions.

Supplementary / Additional Assessments

Grid Connection

1.19 Although a grid connection is a functionally necessary part of any wind farm project, it typically follows a completely separate consenting route. Normally the applicant seeking planning permission for the wind farm will be the developer, whereas the grid connection consent will normally be sought by the relevant owner of the local distribution or transmission network, in this case Northern Ireland Electricity Ltd.

1.20 The Best Practice Guidance to PPS 18 states that whilst the routing of such lines by 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 have included a potential grid connection assessment.

1.21 The grid connection will originate at Killymalaght substation on Killymalaght Road approximately 3 km to the south west of Newbuildings village and approximately 12.5 km to the west of the Barr Cregg Wind Farm (straight line distance). The proposed grid connection route will follow the tertiary road network heading north eastwards into Derry city along Killymalaght Road, Trench Road and Church Road where it will then join the A6 Glenshane Road for approximately 6.4 km. It will then re-join the tertiary road network at Ervey Road then Slaghtmanus Road before connecting to the wind farm substation.

1.22 The proposed route is approximately 19 km and an assessment of the likely significant environmental impacts of the proposed underground grid connection route has been undertaken under the following headings:

- Landscape and visual
- Ecology
- Ornithology
- Geology and the water environment
- Fisheries
- Cultural heritage and archaeology
- Noise
- Traffic and transport.

1.23 The aforementioned assessments have concluded that subject to mitigation there will be no significant residual impacts associated with connecting Barr Cregg Wind Farm to the local distribution or transmission network.

Water Framework Directive Assessment (WFD)

1.24 The hydrology update is simply the provision of a Water Framework Directive (WFD) assessment, intended to determine if specific components or activities related to the development of the Wind Farm will compromise the attainment of a WFD objective as required by the relevant River Basin Management Plan or result in the deterioration in the ecological status of any waterbodies in the vicinity of the site.

1.25 No WFD Assessment was submitted with the previous submissions as such documentation was not typically requested by the relevant consultees at the time of original submission. The reason for submission of this Assessment is to ensure that the planning application and supporting environmental information is robust and satisfies current obligations and best practice in relation to the water environment.

1.26 The WFD assessment summarises the proposed mitigation measures previously proposed in the original Environmental Statement and Further Environmental Information submissions specific to management of surface water from the developed site where it is intended to mitigate a perceived risk of deterioration in the ecological status of any affected waterbody

1.27 Three WFD designated surface watercourse and one groundwater catchment were identified, which could be affected by the proposed works involved in the construction of the wind farm; i.e. the Burntollet River (Loughermore), Burntollet River (Ness Wood), and the Claudy Groundwater body.

1.28 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 waterbodies.

1.29 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.

1.30 Following incorporation of site-wide general binding mitigation control measures, NIEA approved 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 proposed Barr Cregg Wind Farm.

Outline Habitat Restoration Management Plan (OHRMP)

1.31 NIEA: Natural Environment Division (NED) raised concerns regarding distinct areas of the wind farm footprint being (in their opinion) on active peat. NIEA:NED accept that the land has been drained and the condition of the peatland is degraded. In addition NIEA:NED were of the opinion that there was inadequate detail to provide advice on whether there is adequate compensation for impacts on priority habitat and species. Derry & Strabane DC, Development Management Officer Report shared this view.

1.32 The Outline Habitat Restoration and Management Plan describes and quantifies the habitat restoration and enhancement proposed for the Barr Cregg Wind Farm Development. Its overall purpose is to ensure that identified impacts of the development are appropriately mitigated and also that the development delivers overall habitat benefit.

1.33 The proposed development footprint lies in degraded blanket bog and degraded heather moorland (assessed as not active due to ongoing agricultural land management) which are, nevertheless, classified as priority habitats in both the UK Biodiversity Action Plan and in Northern Ireland Habitat Action Plans. The focus of the OHMP is to provide methods for correct habitat restoration around the infrastructure footprint and to provide methods for and locations for habitat enhancement in areas of degraded blanket bog on land within the control of the applicant. Maps are provided to illustrate site conditions and management proposals.

1.34 This document starts with an outline of the relevant legal and policy framework. In order to make transparent how the significance of impacts on peatland habitats was assessed, a detailed description of Ecological Impact Assessment (EcIA) methodology is provided both in the text and in an accompanying Appendix. A brief description of habitat conditions on site is followed by an assessment of potential impacts of the development on these habitats. Methods for mitigation (including compensation) and habitat enhancement are described in detail and monitoring, personnel responsibilities and an outline schedule of activities are provided.

1.35 The land proposed for the Barr Cregg Wind Farm Development is in agricultural use. The land has been drained, some parts of the site have been cut for peat and the vegetation swards have been mown for sheep and cattle grazing. The land owners voluntarily opted into a Countryside Management Scheme (CMS) which sets a number of restrictions on land use, including: restricted stock grazing, no deepening or widening of drainage ditches and limited peat cutting and burning. The CMS for these lands ended on 13th May 2016 and therefore the land use restrictions no longer apply and there is currently no proposed replacement for the CMS.

1.36 Detailed site survey work, including new statistical analysis of the vegetation data, together with the use of the NIEA guidance, has shown that many areas of blanket bog habitat, particularly those mapped as M19 (Calluna vulgaris-Eriophorum vaginatum blanket mire) in the original Environmental Statement, are substantially degraded habitats and are not active blanket bog (as NIEA contend), due to on-going agricultural land management activities. They will remain inactive, and their condition will continue to decline, until the on-going damaging agricultural land management practices of ditch cleaning, peat cutting, mowing/flailing and stock grazing/trampling are removed. A photographic Appendix is provided to illustrate the degraded condition of blanket bog and heathland habitats at Barr Cregg compared to the same vegetation communities elsewhere that are in good conservation condition.

1.37 Prior to conducting the final EcIA (FEI 2014) a number of elements which are beneficial to degraded blanket bog habitats were incorporated into the design of

the wind farm, including avoidance of areas of more valuable habitat, avoidance of areas of deeper peat, a reduction in size of crane pads and the use of floating track construction methods in various parts of the site to minimise effects on peat hydrology, to minimise the volume of peat excavated and to reduce carbon emissions. The use of floated access track has been increased, and in addition RES anticipates that the Construction Method Statement will include methods of construction designed to further mitigate the impacts of development.

1.38 Two potential impacts of the proposed development on peatlands at Barr Cregg are described and assessed. These are habitat loss and alteration of peat hydrology.

1.39 A comprehensive programme of mitigation (including compensation for habitat loss) and habitat enhancement is proposed. The compensation and enhancement elements include four main types of work to compensate for habitat loss and to provide overall habitat benefit, to include four main types of work: areas of ditch blocking to raise water table levels; reinstatement of a good heather sward in areas of the site where heather is lacking; creation of a heather-dominated community in areas which are currently semi-improved grassland; and overall controls on stock grazing to allow bog vegetation to recover.

1.40 In addition to vegetation benefits, the proposed habitat enhancement will be beneficial for peatland hydrology and for flood management in the downstream catchment, by retaining water on site and reducing the peak rate of surface water runoff. By reducing scouring and peat erosion, ditch blocking will also reduce suspended sediments and improve the quality in water draining to the Burntollet River and downstream catchments. There are also anticipated benefits for both terrestrial fauna and ornithology. Six breeding bird species, including Red and Amber-listed species and Northern Ireland priority species, will potentially benefit from more diverse structure of peatland swards, increasing heather dominance, and raising water table levels in degraded blanket bog.

1.41 It is assessed that excavation to construct the wind farm will, without mitigation, have a significant adverse effect on small areas of degraded blanket bog (assessed as not active due to ongoing agricultural land management). Mitigation by design, through a construction mitigation package, and through compensation for habitat loss, will reduce the level of impacts such that they will not be significant. In any event, counter balancing this impact is the applicant's proposal to enhance/improve substantial areas of blanket bog outside the development footprint but within lands under the applicant's control. The calculated loss of degraded blanket bog and heathland, for the lifetime of the development, due to the construction footprint, amounts to 2.68ha, which is approximately 8.4% of the area of blanket bog and heathland within the planning application boundary. The area of proposed habitat enhancement is approximately 11.92ha. Comparing the habitat loss to the habitat enhancement, the overall habitat betterment proposed is approximately 4.5 times more peatland habitat enhanced and restored than will be lost as a result of the development. If the area of habitat enhancement is separated out from that which 'compensates' for the area of habitat loss (ie 2.68ha), the area of proposed habitat enhancement that is over and above direct

'compensation' amounts to 5.24ha, which is approximately the area of 8 football pitches. In addition, a further 98.4ha of degraded blanket bog would benefit from reduced sheep grazing densities for the lifetime of the wind farm development.

1.42 In conclusion, the Barr Cregg Wind Farm Development will provide a valuable vehicle for delivering enhancement/improvement of degraded blanket bog and contributing to Northern Ireland's Habitat Action Plan (NIHAP) targets. In the absence of other funding for habitat management outside of designated sites, cooperation between the NIEA and other partners, including wind farm developers, is likely to be one of the very few ways in which existing degraded and fragmented blanket bog habitats in the uplands of Northern Ireland can be restored and enhanced, and one of the few ways that NIHAP targets can be achieved.

Socio – Economics

1.43 Derry & Strabane DC, Development Management Officer Report stated that there was a lack of clarity and supporting information to evidence the economic figures stated. A revised socioeconomic chapter is provided which provides a greater level of detail in order that the significant weight can be attached to the economic benefits that would accrue should this application be consented. The revised chapter supercedes Chapter 19 (ES 2012).

1.44 The socioeconomic assessment concluded that should the proposed development go ahead, it will deliver substantial benefits to the economies of Northern Ireland and Derry & Strabane, 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

1.45 The proposed development is estimated to result in a capital spend of approximately £21.53 million. Of this an estimated 7.77 million of construction phase spend will be realised in Northern Ireland. The 18 month construction phase is estimated to create or sustain between 64 and 91 direct job years[1] of employment, with associated direct wages of between £1.52 million and £2.15 million and direct Gross Value Added (GVA) [2] of £2.23 million - £3.14 million. The estimated total (direct, indirect and induced) benefits from the construction phase include the creation or sustainment of between 113 – 159 job years, £2.46 million - £3.48 million of wages and £4.13 million - £5.82 million of GVA for the Northern Ireland economy.

[1] Job Years: Fore 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 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 jobs years of employment.

[2] 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.

1.46 RES has committed to a community fund package of £5,000 per MW for the wind farm lifetime. This will be split by £2,000 per MW of a community fund, and £3,000 per MW into a Local Electricity Discount Scheme. The total package will therefore contribute £1.75 million over the lifespan of the project.

1.47 The operational phase of the development is estimated to create or sustain one direct job per year, 0.04m of direct wages and 0.22m of direct GVA per annum. Given that the operational lifetime of the proposed development will be 25 years, this equates to 25 direct jobs, £1.12m of direct wages and 5.62m if direct GVA.

1.48 The estimated total (direct, indirect and induced) benefits from the operational phase of the proposed Development includes the creation or sustainment of 6 jobs with associated wages of £0.15 million per year. This activity will add £0.53 million of GVA to the Northern Ireland economy each year. Over the 25 years of operation, this would support 147 total jobs, £3.81 million of wages and £13.32 million of GVA.

1.49 The proposed development is estimated to increase rateable value by £238,000 per annum or £5.95m over the course of the project, based on current average rateable value of £17,000 per MW for similar properties in the valuation list. It should be noted that there is a difference between rateable value charged on which the above figures are based, and the business rates revenue collected by the local Councils and NI Assembly – allowing for regional and district rate poundages. By applying the Non-Domestic Rate Poundage for Derry & Strabane, the above rateable values would leave additional business rates revenue of £141,949 per annum and £3.55 million over the 25 year lifetime of the project.

Cultural Heritage

1.50 NIEA: HBU requested additional information in their consultation response of 18th August 2014 to determine if there would be a significant impact on the setting of Lower Cumber Presbyterian Church (HB01/02/005) and the Former Post Office Glenshane Road (HB01/02/006). Derry & Strabane DC, Development Management Officer Report also stated that the based on the information submitted, they could not be satisfied with regard to Policy PPS 6: BH2. Whilst RES do not agree that further information is required to make the above assessment, two photomontages have been produced to illustrate the setting of the aforementioned listed buildings.

1.51 The two photomontages (Figure 11.4 & 11.5 - Volume 3) clearly illustrate that there will be no visibility of the wind farm and therefore no significant impact on the setting of either listed building.

Summary

1.52 Refinements made as part of FEI (2014) significantly reduced the extent of the permanent and temporary land take, whilst minimising development on the least damaged areas of peatland. The proportion of onsite access track utilising floating road construction has subsequently been increased to further minimise impacts on damaged areas of peatland.

1.53 The overall planning application boundary of the wind farm site is 77.0 hectares (Ha). However, the actual wind farm infrastructure will occupy a much smaller part of the area (4.3 Ha). Therefore a maximum of approximately 5.6% of the land within the planning application boundary will be utilised by the development due to the relatively small footprints of the infrastructure and the wind farm design criteria applied in the design process.

1.54 Nearly 100 Ha of habitat management is proposed within land under the applicants control, comprising a combination of drain blocking, heather brash reseeding and reduced grazing for the 25 year lifetime of the wind farm. Therefore the extent of habitat management areas are >23 fold that of the proposed development.

1.55 The proposed 14 MW wind farm is estimated to produce 46.6 GWh per year, which is enough electricity to meet the needs of 11,325 homes each year. This is the equivalent of 19.6 percent of the current (2016) housing stock of Derry and Strabane.

1.56 RES has committed to a community benefit package of £5,000 per MW. This will be split by £2,000 per MW of a community fund, and £3,000 per MW into a Local Discounted Electricity Scheme. The fund will therefore contribute £1.75m over the lifespan of the project.

1.57 The potential effects of the proposed Barr Cregg Wind Farm have been assessed in accordance with regulatory requirements and good practice. The ES (2012), FEI (2014) and FEI (2016) 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.

1.58 The Barr Cregg 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 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).

1.59 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 Barr Cregg Wind Farm is a suitable location for a wind farm development and that the ES (2012), FEI (2014) and FEI (2016) demonstrate that to be the case.

2 Grid Connection Assessment

Introduction

The Consenting Context

2.1 Although a grid connection is a functionally necessary part of any wind farm project, it typically follows a completely separate consenting route. Depending upon its scale and significance, consent for the wind farm is sought either from the relevant local council under the Planning Act (Northern Ireland) 2011 or from the Department of the Environmental under Section 26 of the Planning Act.

2.2 Normally the applicant seeking planning permission for the wind farm will be the developer, whereas the grid connection consent will normally be sought by the relevant owner of the local distribution or transmission network, in this case Northern Ireland Electricity Ltd.

2.3 The Best Practice Guidance to PPS 18 states that whilst the routing of such lines by 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.

2.4 This chapter contains the following:

- Appendix 2.1: Known archaeological monuments within 1 km of potential grid route

Potential Grid Connection

2.5 RES has submitted an application for a grid connection for the Proposed Wind Farm Development to NIE and is currently awaiting a response. Therefore the exact means of grid connection is unknown at the time of writing, However, a feasibility study undertaken by NIE for RES, proposed connection to the grid system at the existing Killymalaght Cluster Substation, and this assessment is based upon that being the point of connection.

2.6 The NIE feasibility study (September 2013) proposes connection to the grid system using a combination of overhead lines and underground cables. However RES have identified an entirely underground solution, which is keeping with more recently planned wind farm connections to cluster substations. The Proposed Wind Farm Development would be connected to the cluster substation by approximately 19 km of underground cable. The route would begin at the connection point within the Proposed Wind Farm Development, and thereafter would follow the public road corridor from the wind farm site entrance to the Killymalaght Cluster Substation, as shown in Figure 2.1: Potential Grid Connection (Volume 3).

2.7 For an underground cable connection the trench would be similar to those used on the main Proposed Wind Farm Development site, as shown in Environmental Statement (2012) - Volume 2 - Figure 3.15. The trench will be approximately 0.5 m – 0.75 m wide and 1.0 m deep and could run in the road side verges adjoining the carriageway, or within footways adjoining the carriageway, although it is also

possible that the cable would be laid within the carriageway itself. At 33 kV, underground cables are normally laid to a depth of 0.9 m. To lay this cable a trench is dug, bedding material, normally sand, is placed along the trench-base, the cable laid and then covered with more sand. The cables are then protected by a layer of protective plastic covers and then backfilled with subsoil and original topsoil and turfs.

2.8 For bridge crossings along the road, the cable could be laid within the bridge, if there is sufficient excavation depth, or otherwise via directional drilling under the watercourse.

2.9 The construction activities would include the following:

- Clearance of land (including vegetation strip as appropriate)
- Digging of trenches
- Backfilling of trenches and remediation.

2.10 The land should be reinstated as near as reasonably practicable to its original condition.

Potential Impacts

2.11 An assessment of the likely significant environmental impacts of the proposed underground grid connection route has been undertaken under the following headings:

- Landscape and visual
- Ecology
- Ornithology
- Geology and the water environment
- Fisheries
- Cultural heritage and archaeology
- Noise
- Traffic and transport.

Landscape and Visual

2.12 The grid connection will originate at Killymalaght substation on Killymalaght Road approximately 3 km to the south west of Newbuildings village and approximately 12.5 km to the west of the Proposed Wind Farm Development (straight line distance). The proposed grid connection route will follow the tertiary road network heading north eastwards into Derry city along Killymalaght Road, Trench Road and Church Road where it will then join the A6 Glenshane Road for approximately 6.4 km. It will then re-join the tertiary road network at Ervey Road then Slaghtmanus Road where it will meet the Proposed Wind Farm Development.

2.13 The tertiary road network in proximity to the Proposed Wind Farm Development is generally relatively narrow with narrow grass verges bordered by a combination of well-maintained thorn hedgerows and trees. The landscape to either side of the Slaghtmanus and Ervey Roads is characterised by pastoral fields, scattered rural residential properties and farmsteads. There is a slightly greater occurrence of

properties along Slaghtmanus Road than Ervey Road where properties tend to be slightly larger and more frequently located away from the road corridor. Ervey Road is narrower and has a more wooded character with some views into the wider landscape but often with views enclosed by roadside vegetation. Slaghtmanus Road is slightly wider and occupies a more elevated position from where there are more frequently occurring wide range views across the foreground agricultural landscape towards the uplands bordering the A6 road corridor and surrounding Derry city. Residential properties along Slaghtmanus Road are located both directly adjacent to the road corridor and on lanes leading from it. Farmland bordering the Slaghtmanus Road is in a more variable condition than along Ervey Road, with rough pasture including some some rush infested fields as well as pastoral fields.

2.14 Much of the tertiary road network at the start of the proposed grid connection route has a similar character to Ervey Road although it has few residential properties. The road corridors of Killymalaght Road and much of Church Road are narrow and enclosed by a high proportion of trees as well as hedgerows and views into the adjacent pastoral landscape are highly constrained for much of their length. Trench Road and the end of Church Road on the outskirts of Derry city are much wider with more frequent traffic and lower levels of tree cover. One section of Trench Road appears to have been widened fairly recently and hedgerows have been replaced with post and wire fencing. There are also more residential properties / suburban settlement in proximity to the road corridor. There are frequently more open views towards uplands in the east and south east as well as views towards Derry urban area.

2.15 The A6 is a busy road connecting Derry, Belfast and a number of settlements in between. This section of the grid connection route is part of the urban fringe of Derry city. It is also frequently in cutting and bordered by wooded embankments and stands of trees which often prevent long range views. Rising topography on the north eastern side of the road corridor also prevents long range views in this direction. There are more open views in a south westerly direction towards Slievekirk hill and wind farm.

2.16 There are no statutory landscape designations along the grid connection route. However, Ervey and Slaghtmanus Roads provide access from the A6 to two points of access to Ness Wood Country Park.

2.17 It is anticipated that there will be no disturbance to existing trees, hedgerows or adjacent fields but that there will be disturbance to grass verges adjacent to the road surface. Where the road corridor is particularly narrow it is possible that some existing hedgerows and trees may need to be trimmed back in order to allow sufficient working space for construction machinery .

2.18 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 landscape and visual effects occur;
- 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 the adjacent verges and should be cultivated where necessary and re-seeded with grass seed of an appropriate 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, where necessary, avoided in excessively wet or cold conditions in order to avoid compacting or otherwise damaging soil structure.

2.19 The start of the grid connection route will be located within Landscape Character Area 31 Burngibbah and Drumahoe, the A6 section of the route runs along the boundary between LCA 30 Sperrin Foothills and LCA 34 Loughermore Hills. The last part of the route on Ervey and Slaghtmanus Roads is also located with LCA 34.[1] The proposed works are not unlikely to result in any changes to the physical structure of existing landscape character elements, nor will they introduce a visible new element of landscape character because all cables will be undergrounded. Therefore, the LCAs are all deemed to be of low sensitivity to the proposed development. Providing the aforementioned measures are adopted, the magnitude of effects on landscape character will be negligible and the overall landscape effects are deemed to be Not Significant.

2.20 The primary visual receptors will be users of the local road network, and residents of urban edge housing areas who are generally deemed to be of low sensitivity. Residents of rural housing along the road network will occur in small numbers but will be present along many parts of the grid connection route. They are deemed to be of high sensitivity. Farmers on the adjacent upland grazing and pastoral fields are deemed to be of low sensitivity. There are unlikely to be significant views of the grid connection works beyond the immediately vicinity of the works.

2.21 There will be temporary disruption to the primary and tertiary road network during construction of the grid connection route which will be experienced by all visual receptors for a short period of time during which the magnitude of visual effects is deemed to be relatively high. However, the completed works will not be visible and the experience of visual receptors located along the grid connection route will be unchanged by its construction. Therefore, the overall magnitude of visual

[1] Sensitivity defined by the in the Northern Ireland Landscape Character Assessment, https://www.doeni.gov.uk/articles/landscape-character-northern-ireland

effects is also deemed to be negligible and the overall visual effects are deemed to be Not Significant.

Ecology

Habitats

2.22 This section considers the potential impacts of the proposed grid connection on the flora & fauna interests along the proposed route. Desk records were identified from the National Biodiversity Network (NBN) Gateway and NIEA database of designated sites. The route follows the public road (from the substation) and it is currently proposed to bury the cable under the public road for approximately 19 km from the Slaughtmanus Road to the Killymallaght Road.

2.23 The section alongside the public road was assessed as part of a desktop study in March 2016. This desk-based exercise was aimed at identifying the habitats and species found or likely to be found along the proposed grid connection route.

2.24 Between the Site boundary and Killymallaght Road the proposed grid connection option would be buried in the carriageway, or in the roadside verge, which primarily consists of rank semi-grassland with numerous adjacent hedgerows. The wider landscape is a mix of improved/semi-improved agricultural grassland along with pockets of broadleaved woodland (particularly along riverine corridors).

2.25 Mature trees, hedgerows and river crossings are the main areas of conservation value along the route of the proposed grid connection route. However, it is proposed to bury the cable in the roadside verge away from habitats of conservation value. Tree roots will be avoided by the use of British Standard BS5837: 2005 Trees in relation to Construction - Recommendations.

Fauna

2.26 Bats and otter occur in the vicinity of the section adjacent to the site boundary. However, the proposed site access track that the connection will follow has been designed to avoid these species.

2.27 There are National Biodiversity Network (NBN) records for Otter (100 m presence record) and hedgehog (100 m presence record) where the gird connection route travels along the Ervey Road (it is also close to the River Faughan & Tributaries SAC in this location). In addition to this, bats and badger are considered to be likely to occur in the area between the wind farm Site boundary and the Killymallaght Road, with numerous tributaries of the River Faughan and associated small watercourses providing good otter habitat and the habitats along the proposed route provide good habitat for bats and badgers that are considered likely to occur in the area.

2.28 The direct potential impacts on important ecological receptors are related to any potential habitat loss and disturbance of habitats as a result of activities to excavate a trench for an underground cable. Any trenching to lay an underground cable should involve immediate reinstatement of the low quality habitats found in the roadside verges. Therefore, the net habitat loss should be neutral.

2.29 The direct potential impacts on faunal receptors are related to habitat loss and disturbance of habitats as a result of activities to excavate a trench for an

underground cable. As well as the potential for direct disturbance to protected fauna from construction noise and associated activities themselves.

2.30 Any trenching to lay an underground cable would involve immediate reinstatement of the habitats. Therefore, the net habitat loss would be neutral.

2.31 Disturbance of habitats along the route also has the potential to result in indirect impacts on faunal species which inhabit those habitats and this could include otter, bat species, smooth newt, badger and hedgehog all of which have been recorded along or are considered likely to be present in close proximity to the route.

2.32 No operational impacts from normal operation of an underground connection are predicted. Should the cable be required to be excavated for maintenance this would result in habitat disturbance but this should be reinstated following works.

2.33 On the basis of the desk study undertaken the significance of the potential impacts is assessed to be low-negligible, however pre-construction mitigation measures are proposed below.

2.34 It is proposed that the construction contractor should adopt the following mitigation measures:

- 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 are 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.

2.35 Completion of a programme of ecological and ornithological mitigation works would offset the loss of the ecological resource that would occur as a result of the construction of the grid connection. Taking the proposed mitigation into account, no significant residual effects are anticipated to occur.

Ornithology

2.36 During the construction phase there is the possibility of disturbance to breeding birds along the route. No operational effects are predicted.

2.37 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.

2.38 With implementation of the proposed mitigation there should be no residual effects.

Geology & Water Environment

2.39 Potential direct effects of the proposed grid connection route are on water quality, water resource and flood risk to surface and groundwater in the affected sub-catchments. The nature of the development type would not be anticipated to have any potential for significant geological effect. Potential indirect effects on water dependant habitats are addressed separately within the ecology and peat sections.

Hydrogeology

2.40 The proposed grid connection route falls fully within the Claudy Groundwater Body (UKGBNI4NW003) which has a Water Framework Directive (WFD) water quality status of 'Good'. Characterisation of this groundwater body indicates it would have limited potential for significant abstraction. The bedrock aquifers underlying the route are classified as Bl(f) indicating limited potential productivity with predominantly fracture flow and low yields with shallow, local flow.

2.41 The proposed grid connection route is situated within areas classified as having a superficial aquifer; generally corresponding to the alluvium (sand and silt) deposits of the Burntollet, Faughan and Burngibbagh river valleys. The superficial aquifers result in an area of high groundwater vulnerability (class 4e). Groundwater vulnerability based on the uppermost aquifers in the remaining area surrounding the proposed route is also high (class 4-5).

2.42 The groundwater value would typically be dictated by it's use as a water supply source. A number of water supply datasets were queried in order to determine potential effects to private and public water supply sources. NIEA Drinking Water Inspectorate (DWI) and Derry City Council (now Derry Strabane Council) data showing abstractions within 1 km of the proposed Barr Cregg Wind Farm, and an NIEA Registered Private Water Supplies dataset available through Spatial NI were assessed.

2.43 The assessment indicates no abstractions from the above data sets are situated within 250 m (that being the screening distance advocated by NIEA) of the

proposed grid route as shown on Figure 2.2: Geology and Water Environment (Volume 3).

Hydrology

2.44 The proposed grid connection route lies wholly within the North Western River Basin District. The area containing the grid route drains to the Faughan River via 4 sub-catchments as follows:

3 % of the overall route drains to the Cullion Burn Catchment;
27 % of the overall route drains to the Burntollet River Catchment;
33 % of the overall route drains directly to the main Faughan River;
36 % of the overall route drains to the Burngibbagh Catchment.

2.45 Surface water quality where monitored in the affected catchments, based on 2014 NIEA waterbody WFD classifications, ranges in all instances from "Poor" to "Good" status. The Faughan River, Agivey River, Burngibbagh River and Burntollet River are designated as protected areas under the WFD due to the presence of economically significant fisheries

2.46 The route crosses approximately 508 m of 1% AEP fluvial floodplains as mapped by "strategic" type mapping on Flood Maps NI. Of this; c. 434 m is associated with flooding of water features within the Faughan Catchment, c. 51 m within the Burngibbagh Catchment, 15 m within the Cullion Catchment and c. 8 m within the Burntollet Catchment.

2.47 The route also crosses 1082 m of lands denoted as being liable to be affected by surface water flooding; some of which corresponds to fluvial floodplains. The nature of the proposed development (underground cable to a depth of 0.9 m) would have no effect on, and would not be affected by, flooding and floodplains from any source.

Water Feature Crossings

2.48 The development would have potential to directly affect the water environment where it came into contact with watercourses.

2.49 As part of the desk study potential watercourse crossings were assessed based on 1:2500 scale mapping and initial sensitivity was established based on contributing catchment size. No consideration was given to other water feature characteristics and no ground truthing was carried out. Surface water catchments and required watercourse / water feature crossing locations are identified on Figure 2.2: Geology and Water Environment (Volume 3).

2.50 The assessment concluded that the route would require 3 crossings of minor water features (watercourse tributaries, drains or other minor water features with contributing catchment < 0.25 km^2) and 10 crossings of significant watercourses (contributing catchment >0.25 km^2) as outlined below and shown Figure 2.2: Geology and Water Environment (Volume 3):

- Cullion Burn upstream of Slaughtmanus Lane;
- Crunkin Burn upstream of Slaughtmanus Road;
- no. Unnamed Faughan Tributarys along the Glenshane Road;

- Madam's Burn (Faughan Tributary) upstream of Glenshane Road;
- Main River Faughan upstream of Glenshane Road;
- Burngibbagh upstream of Glenshane Road;
- Unnamed Burngibbagh Tributary downstream of Trench Road;
- Trench Drain downstream of Trench Road;
- 2 no. Unnamed Burngibbagh Tributaries along Church Road.

Water Feature Crossings

2.51 Designated sites with sensitivities to the water environment and terrestrial sites of geological importance were assessed were identified:

- All watercourses draining the area adjacent to the proposed grid route eventually discharge to the River Faughan into the Foyle and Faughan Estuary a designated Ramsar, SPA and ASSI; situated greater than 10 km downstream of the proposed cable route;
- The grid connection route runs adjacent to and crosses the River Faughan; the river and tributaries are designated SAC and ASSI because of the physical features of the river and its associated riverine flora and fauna;
- There are no terrestrial sites of geological importance immediately adjacent to the grid connection route.

Summary of Effects

2.52 Effects associated with typical construction activities would be similar to those described in Barr Cregg Wind Farm Environmental Statement Volume 1, Chapters 12 (Geology and Hydrogeology Assessment) and 13 (Hydrology Assessment) and would be solely associated with the construction phase. No operational effects are anticipated.

Table 1: Summary of Hydrological Constraints and Effects

Baseline Characteristic / Summary Description		**Receptor**	**Unmitigated Potential Effect**	
Groundwater	Aquifers with low yield and local flow.	Groundwater quality and yield.	Reduced Groundwater Quality	Excavations resulting in release of sediments and use of mechanical plant with associated fuels and lubricants have the potential to effect water quality. PWS however are situated greater than 250 m from the proposed grid connection route and potential for short term slight deteriorations in water quality are limited.
			Reduced Groundwater Quantity	Shallow excavations associated with cable laying would not be anticipated to cause any change in groundwater flow routes.

Baseline Characteristic / Summary Description		Receptor	Unmitigated Potential Effect	
Surface Water	Floodplains.	Route within fluvial and surface water floodplains.	Flood Risk to the grid route	The cable route would by its nature (buried) be unaffected by flooding.
			Increased flood risk elsewhere	The cable route would by its nature (buried) have no effect on flooding by causing restrictions or disruption to flood flows.
	Waterbodies with WFD status of "Poor" to "Good".	13 No. water feature crossings.	Reduced water quality Changes to watercourse morphology	Excavations resulting in release of sediments and use of mechanical plant with associated fuels and lubricants have the potential to effect water quality. Methods would not typically be anticipated to cause requirement for any in-stream work or work that would directly affect watercourse morphology or cause potential for pollution of the watercourse. All watercourse crossings coincide with existing road crossings and culverts; the cable could be laid within carriageways and verges over the extent of the existing culvert structure, via directional drilling under the watercourse or built into road.
Protected Areas	Waterbodies protected for reasons of fisheries.	Cables would directly cross the Faughan River and Burngibbagh; designated as protected areas under the WFD due to presence of economically significant fisheries.	Reduced water quality Changes to watercourse morphology	Excavations resulting in release of sediments and use of mechanical plant with associated fuels and lubricants have the potential to effect water quality. Methods would not typically be anticipated to cause requirement for any in-stream work or work that would directly affect watercourse morphology or cause potential for pollution of the watercourse. All watercourse crossings coincide with existing road crossings and culverts; the cable could be laid within carriageways and verges over the extent of the existing culvert structure, via directional drilling under the watercourse or built into
	Designated Sites.	Cables would directly	Reduced water quality	

Baseline Characteristic / Summary Description		Receptor	Unmitigated Potential Effect	
		cross the River Faughan and tributaries SAC and ASSI designated for reasons of physical river features and riverine flora / fauna.	Changes to watercourse morphology	road.

Mitigation

2.53 Mitigation to address potential deterioration of water quality (due to excavations, runoff from the works, and use of oils fuels and lubricants) associated with the types of construction activities anticipated should be similarly addressed by the surface water management and pollution prevention measures stated in Barr Cregg Wind Farm Environmental Statement (2012) Chapter 13: Hydrology Assessment and FEI (2016) Chapter 3: Water Framework Directive Assessment.

Summary

Table 2: Potential environmental effects and proposed mitigation.

Topic	Construction Impacts	Operational Impacts	Mitigation	Residual Effects
Geology, Hydrology & Hydrogeology	Limited potential for short term slight deteriorations in water quality.	None	Surface water management and pollution prevention measures stated in Barr Cregg Wind Farm Environmental Statement (2012) Chapter 13: Hydrology Assessment and FEI (2016) Chapter 3: Water Framework Directive Assessment.	No significant impacts

Fisheries

2.54 Potential effects on water quality have been addressed above under Geology & the Water Environment. This sub-section considers watercourse crossings and the potential effects on fisheries interests.

2.55 The proposed underground grid route crosses seven watercourses between the proposed Barr Cregg Wind Farm Substation and the proposed Killymalaght cluster substation location, as detailed in the Geology and Water Environment section. Each of these channels forms part of the River Faughan catchment and each is in

one of four separate waterbodies as defined under the WFD, with ecological status and significant fish species noted in Table 1.

Table 3: WFD waterbody status and significant fish species present

Waterbody	Ecological status 2015	Significant fish species	Sensitivity
Cullion Burn	Good	Brown trout	High
Burntollet River (Ness Wood)	Moderate	Salmon, brown trout	Very High
River Faughan (Carnmoney)	Poor	Salmon, brown trout, eel, lamprey	Very High
Burngibbagh	Good	Salmon, brown trout, eel	High

2.56 Both River Faughan (Carnmoney) and Burntollet River (Ness Wood) are included in the River Faughan and Tributaries SAC which has Atlantic salmon listed as the main reason for designation. Although the Ecological status of these waterbodies is Poor and Moderate they are both significant in the context of fisheries, and should be regarded as of Very High due to the presence of salmon. The other two waterbodies are assessed as of High sensitivity due to their Good Ecological status.

2.57 It is proposed that installation of the cable will be within the existing bridge structure at all watercourse crossing locations provided there is sufficient excavation depth. If this cannot be achieved at specific locations, installation will be by directional drilling under the watercourse.

- Either approach to watercourse crossings will avoid any interference with the integrity of the stream channel and should therefore not result in any loss of or damage to aquatic habitats. The following mitigation measures will be applied: Construction processes will 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.
- If directional drilling is required at specific locations, pre-construction consultation with the Loughs Agency will be conducted to avoid any effects on fish passage or fish spawning beds – this may require scheduling of works outside of sensitive periods.

2.58 No operational effects are predicted. Implementation of the mitigation measures will ensure that there should be no residual effects.

Archaeology and Cultural Heritage

2.59 This section considers the potential impacts of the proposed grid connection options on the historic environment.

2.60 A detailed desktop survey was undertaken for the proposed grid connection route, extending to a 500m wide corridor either side of it. This entailed a review of the Sites and Monuments Records, the Industrial Archaeological Records, the Historic Buildings Archive, the Historic Gardens Register and the Defence Heritage Records, which are maintained by DOE:HED.

2.61 The identification of historic environment constraints is based solely upon the results of the desk-based assessment. No field survey was carried out at this stage of the assessment.

2.62 Figure 2.3 - Known Cultural Heritage (Volume 3) - shows the route of the proposed grid connection and the location of any cultural heritage resources within the search area.

Baseline

2.63 The desk top survey has identified two sites (2 & 7) of cultural heritage importance along the route of the proposed gird connection. The site IHR 1801 carries the Slaughtmanus Road over the Crunkin Burn. The bridge is first recorded on the 1st edition OS map of 1832. The site IHR 1787 carries the Glenshane Road over a tributary of the River Faughan. The bridge is first recorded on the 1st edition OS map of 1832.

2.64 Beyond the proposed grid connection route, the desk top survey identified a further 48 features of cultural heritage interest as shown on Figure 2.3 – Known Cultural Heritage (Volume 3). Appendix 2.1 contains details of these sites.

2.65 Prehistoric remains are identified at eight of the sites. These comprise of three standing stones (26, 32 and 41), three possible megalithic tombs (27, 28 and 29), a definite megalithic tomb (30), and a court tomb (31) which is a State Care monument.

2.66 Early Christian monuments are identified at one site which consists of a bullaun stone (35).

2.67 One site, an ecclesiastical site, relates to the 15th century (31) and a second relates to the 17th century and is a military entrenchment (37).

2.68 Thirty sites relate to the modern era and have been identified through the industrial heritage records historic buildings records, defence heritage records and historic gardens. These comprise of a number of bridges, mill sites, listed buildings, a 1940s refugee camp and two historic gardens.

2.69 The remaining sites are of uncertain date. They consist of an enclosure (38) and a landscape feature (36). Five sites which have since been identified as natural features were also recorded (33, 34, 36, 40, and 42).

Archaeological potential of the study area

2.70 The desk top survey has identified two features of cultural heritage interest along the proposed grid connection route. These are the bridge carrying the Slaughtmanus Road over the Crunkin Burn and the bridge carrying the Glenshane Road over a tributary of the River Faughan. A further 40 features were identified within a 500m search area ranging in date from prehistoric times up to the modern day. The number of features identified within the search area would suggest that the proposed grid connection route passes through an area of moderate cultural heritage interest. Taking into account that the proposed grid connection will be inserted into verges at the sides of existing roads, the probability of encountering

previously undiscovered sites of archaeological significance during construction work is considered to be very low.

Construction Impacts

2.71 The proposed grid route connection could have a direct impact upon the following cultural heritage resources:

- (2) IHR 1801- bridge
- (7) IHR 1787- bridge

2.72 These bridges are considered to be of local cultural heritage importance and any construction impact would be of negligible significance.

2.73 The likelihood of previously undiscovered sites of archaeological significance being located within the proposed grid connection route is considered to be very low. Should such deposits exist here they could be negatively impacted upon by the proposed construction works.

Operational Impacts

2.74 There will be no operational impacts on cultural heritage following the construction of the proposed grid connection.

Mitigation

2.75 If appropriate directional drilling to be considered at IHR 1801 and IHR 1787 to take the grid connection below the levels of the bridges.

Residual Effects

2.76 Following the implementation of the suggested mitigation measures, there will be no residual effects in relation to cultural heritage resources.

Noise

2.77 There are a number of residential properties located along, and within the vicinity of the potential underground grid connection route. The route is likely to be constructed along Killymalaght Road, Trench Road, Church Road, Glenshane Road (A6), Ervey Road and Slaghtmanus Road.

2.78 During the construction phase, noise generating plant would be used and it is likely that noise levels would temporarily increase at residential properties within the vicinity of the construction works along the grid connection route.

2.79 Construction activities with the potential to generate noise from grid connection construction are likely to include clearance of land, digging of trenches and backfilling of trenches and remediation.

2.80 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' . This legislation advices the use of British Standard BS 5228: Part 1:1997 as being suitable for giving guidance on appropriate methods for minimising noise from construction and open sites in Northern Ireland.

2.81 British Standard BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise' has been identified as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities.

2.82 In accordance with the ABC method of Annex E of BS 5228-1:2009, due to the relatively low levels of ambient noise along the proposed route, a Category A assessment would be appropriate. This category sets minimum LAeq criteria of: 65 dB(A) during weekdays (0700-1900) and Saturdays (0700-1300); below 55 dB(A) at evenings and weekends; and below 45 dB(A) for night-time (2300-0700) periods. The ABC method sets threshold noise levels for specific periods based on the ambient noise levels.

2.83 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.

2.84 There are many strategies to reduce construction noise by the limitation of activities. Any such measures should be considered adequate and the mitigation adopted should not be limited to the measures proposed.

2.85 With appropriate mitigation, if required, it is assessed that there be no residual significant effects during the construction phase.

2.86 There are no anticipated effects during the operational phase.

Traffic and Transport

2.87 The connection is approximately 19 km in plan length utilising a combination of primary (A6) and tertiary roads, with the majority of the proposed grid connection route located in rural areas.

2.88 It is likely that there will be temporary, local traffic disruptions for the duration of the underground cable installation works but traffic management will be utilised to minimise disruption. Temporary road closures may be required.

2.89 Any works within or adjacent to the road network will be subject to road opening licences, agreement(s) or permits.

2.90 No significant residual effects are anticipated to occur.

2.91 When installed, the underground cable will have no adverse effect upon traffic during the operational phase.

Table 4: Summary of Impacts provides a summary of the potential environmental effects and proposed mitigation.

Topic	Construction Impacts	Operational Impacts	Mitigation	Residual Effects
Landscape and visual	Disturbance to grass verges, cutting and potential removal	None	▪ Consideration should be given to the protection of established trees and hedgerows during cable	No significant impacts

Topic	Construction Impacts	Operational Impacts	Mitigation	Residual Effects
	where necessary of hedgerows and trees.		installation and where appropriate temporary fencing will 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 landscape and visual effects occur ▪ 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.	
Ecology	Damage to habitat in roadside verge. Indirect impacts due to habitat disturbance along the route on faunal species which inhabit those habitats, which could include otter, bat species, smooth newt, badger, hedgehog and common lizard all of which have been recorded along or in close proximity to the route.	None	▪ Tree roots should be protected by the implementation of BS5837:2005, where excavations will not be permitted inside the RPA (Root Protection Area). ▪ No spoil, vehicles, fuel, materials, temporary buildings or ancillary equipment should be stored inside the RPA. Existing ground levels within the RPA will not be raised or lowered. ▪ Pre-construction surveys to identify areas of sensitive habitat which should be avoided ▪ Pre-construction protected species surveys to identify species or features supporting species along the route and allow the preparation of appropriate mitigation ▪ Preparation of a construction method	No significant impacts

Topic	Construction Impacts	Operational Impacts	Mitigation	Residual Effects
			statement for the grid connection stating how impacts on protected species and habitats would be avoided ▪ The use of an ECoW (Ecological Clerk of Works) during construction to ensure that all of the above measures are properly implemented.	
Ornithology	Possibility of disturbance to breeding birds along the route.	None	▪ 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.	No residual impacts
Geology, Hydrology & Hydrogeology	Limited potential for short term slight deteriorations in water quality.	None	Surface water management and pollution prevention measures stated in Barr Cregg Wind Farm Environmental Statement (2012) Chapter 13: Hydrology Assessment and FEI (2016) Chapter 3: Water Framework Directive Assessment.	No significant impacts
Fisheries	Release of sediment or pollutants into watercourses near crossings.	None	▪ 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.	No significant impacts
	Directional drilling: Interruption of fish passage. Disturbance of fish spawning /	None	▪ Pre-construction consultation with Loughs Agency to avoid sensitive periods.	No significant impacts

Topic	Construction Impacts	Operational Impacts	Mitigation	Residual Effects
	spawning beds.			
Archaeology & Cultural Heritage	Potential impact on IHR 1878 bridge which carries the Drumbane Road over the Brockagh River. Very low potential for impacts on previously undiscovered sites of archaeological significance.	None	▪ Directional drilling should be considered at IHR 1878 to take the grid connection below the level of the bridge.	No residual effects
Noise	Potential short term noise increase at residential properties within the vicinity of the construction works along the grid connection route.	None	▪ Installation of acoustic barriers or the restriction of working hours per day could be considered, if required.	No residual impacts
Transport and Traffic	Temporary local traffic disruption for the duration of the cable laying, including some temporary road closures.	None	▪ Grid connection construction works should be undertaken in accordance with associated road opening licences, agreements or permits. ▪ A Traffic Management Plan including details of any temporary road closures should be agreed with Transport NI prior to the commencement of works to ensure any disruption during the underground cable works will be kept to a minimum.	No significant impacts

Appendix 2.1

Known archaeological monuments within 1 km of potential grid route

No.	SMR No.	Type	Date	Description
1	IHR1814	Bridge	20th Century	Carrying road over the Burntollet River: 1832 :- 1853: shown, 1907: shown, 1925: Listress Bridge
2	IHR1801	Bridge	19th Century	Carrying road over the Crunkin Burn: 1832: shown, 1854: Crunkin Br, 1907: shown, 1925:shown; Crunkin Bridge
3	IHR1815	Corn and Flax Mill	19th Century	1815:1 Corn & Flax Mills: 1832 : Mills, 1853: Corn & Flax Mill, 1907: 1925: Corn Mill 1815:2 - Millrace / Stream: 1832: Mill Stream, 1853 : Mill Stream, 1907, 1925 : Millrace
4	IHR1789	Flax Mill	19th Century	1789:1 - Flax Mill: 1832 : Flax Mill, 1854 : Flax Mill, 1907, 1925 1789:2 - Millrace (taken from the Island Burn): 1832: shown, 1854: shown,1907 :-----, 1925 :-----
5	IHR1785	Flax Holes	19th Century	1832 : Flax Holes, 1854 :-----, 1907 :-----, 1925 :-----
6	IHR1786	Flax Holes	19th Century	1832 : shown, 1854 : Liberty Br, 1907 : Liberty Br, 1925 : Liberty Br
7	IHR1787	Bridge	19th Century	Carrying road over a tributary of the River Faughan: 1832 : shown, 1854 : Liberty Br, 1907 : Liberty Br, 1925 : Liberty Br
8	IHR1788	Corn Mill	19th Century	1788:1 - Corn Mills: 1832 : extant ?, 1854 : Corn Mills, 1907 : Corn Mill, 1925 : Corn Mill 1788:2 - Millrace - deflected from a tributary of the River Faughan: 1832: shown, 1854 : shown, 1907:shown, 1925:shown 1788:3 - Mill Pond: 1832 :-----, 1854 : Mill Ponds, 1907 : Mill Ponds, 1925 : Mill Ponds
9	IHR1783	Bleaching Mill	19th Century	1832 : Bleaching Mill, 1854 : Bleaching Mill, 1907/1925 : large unidentified industrial building
10	IHR11177	Bridge	19th Century	No further details
11	IHR1782	Bleaching Green	19th Century	1832 : shown by symbol (max extent), 1854 : Bleach Green (not on E side of river), 1907 :-----, 1925 :-----
12	IHR1781	Beetling Mill	19th Century	1781:1 - Unspecified Mill - Beetling Mill & Drying House - Beetling Mill: 1832 : unspecified mill, 1854 : Beetling Mill & Drying House, 1907 : Beetling Mill, 1925 : Beetling Mill 1781:2 - Millrace - also serves IHR1782, 1783: 1832 : Millrace, 1854 : shown, 1907: Millrace, 1925 : Millrace 1781:3 - Drying House: 1832 :-----, 1854: Drying House, 1907 :-----, 1925 :-----
13	IHR1779	Flax Holes	19th Century	1832 : Flax Holes, 1854 :-----, 1907 :-----,

No.	SMR No.	Type	Date	Description
				1925 :-----
14	IHR1599	Flax Holes	19th Century	1832 :-----, 1856 : Flax Holes, 1907 : , 1964 :-----
15	IHR1597	Bridge	19th Century	Carrying road from Londonderry to Claudy over the Faughan River: 1832 : shown, 1856 : shown, 1907 : , 1964 : Drumahoe Br
16	IHR11101	Brewery	19th Century	No further details
17	IHR1596	Corn Mill	19th Century	1596:1 - Corn Mill - Corn Mill (disused): 1832 : building shown, 1856 : building shown, 1907 : , 1964 : Corn Mill (disused) 1596:2 - Millrace / Stream: 1832 : Mill Stream, 1856 : Mill Stream, 1907 : , 1964 : Millrace
18	IHR1595	Corn Mill	19th Century	1595:1 - Corn Mill: 1832 :-----, 1856 : Corn Mill, 1907 : , 1964 :----- 1595:2 - Mill Stream: 1832 : Mill Stream, 1856 : Mill Stream, 1907 : , 1964 : still obvious 1595:3 - Mill Pond: 1832 : shown, 1856 : shown, 1907 : , 1964 : shown ?
19	IHR1592	Mill site	18th Century	1592:1 - Mill - Mill (in ruins): 1832 : Mill, 1856 : Mill (in ruins), 1907 : , 1964 :----- 1592:2 – Millrace: 1832 : Millrace, 1856 : shown, 1907 : , 1964 :-----
20	IHR1776	Threshing Machine	19th Century	1831 :-----, 1856 : Thrashing Machine, 1907 :------, 1925 :-----
21	IHR1777	Flax Mill	19th Century	1777:1 - Flax Mill (in ruins): 1831 :-----, 1856 : Flax Mill (in ruins), 1907 :-----, 1925 :----- 1777:2 – Millrace: 1831 :-----, 1856 : shown ?, 1907 :-----, 1925 :-----
22	IHR1598		19th Century	1598:1 - Corn Mill: 1832 : building shown, 1856 : Corn Mill, 1907 : , 1954 : Corn Mills (disused) 1598:2 - Flour Mill: 1832 : building shown, 1856 : Flour Mill, 1907 : , 1964 :----- 1598:3 - Mill Stream: 1832 : Mill Stream, 1856 : Mill Stream, 1907 : , 1964 :-----
23	IHR1772	Quarry/lime kiln	19th Century	1831 : lime kiln in quarry, 1856 : quarry remains, no LK, 1907 : ditto, 1925 : Quarry
24	IHR1773		19th Century	1773:1 - Corn Mill - Scutch Mill: 1831 :-----, 1853 : Corn Mill, 1907 : Scutch Mill, 1925 : Scutch Mill 1773:2 - Millrace / stream: 1831 :-----, 1853 : shown, 1907 : Millrace, 1925 : Mill Stream 1773:3 - Mill Pond: 1831 :-----, 1853 : Mill Pond, 1907 : Mill Pond, 1925 : Mill Pond
25	LDY23:42	Field walls	Uncertain	The OS memoirs refer to ancient field walls in the this area. There are now no visible traces of these & they have presumably been destroyed by agriculture to a great extent. There are a few rough traces of walls in this small unreclaimed area, but these have been

No.	SMR No.	Type	Date	Description
				disturbed by peat cutting.
26	LDY23:43	Standing Stone	Prehistoric	This stone is shown by Davies at the end of a section of ancient field wall. This is the only stone remaining of the several noted in the area [Ldy 023:044, 045 & 046].
27	LDY23:44	Megalithic tomb	Prehistoric	A stone set on edge - possible remains of megalithic tomb. See also LDY 23:45,46. There are now no visible traces of this site.
28	LDY23:45	Megalithic tomb	Prehistoric	A stone set on edge - possible remains of megalithic tomb. See also LDY 23:45,46. There are now no visible traces of this site.
29	LDY23:46	Megalithic tomb	Prehistoric	A stone set on edge - possible remains of megalithic tomb. See also LDY 23:45,46. There are now no visible traces of this site.
30	LDY23:66	Megalithic tomb	Prehistoric	This site is described in the OS memoirs as a grave of "flags of a prodigious size set in the ground & on the top a flag stone of extraordinary dimensions believed to weigh 3-4 tons..." The site was knocked down by a gang looking for treasure in the C19th, who also dug up the interior & in 1831 the owner "removed all vesitges of the old monument then filled up the pit & brought it on level with the remainder of the field."
31	LDY23:07	Court Tomb	Neolithic	In rough ground with good views E-SE-S across a valley, the site is set on a sheltered platform with higher ground to N. The tomb is well preserved & faces E. It consists of 2 portal stones, a low sill stone, 2 large side stones & a backstone. A loose stone in the chamber is possible broken from the S portal. A possible capstone lies in from to the portals & a 2nd possible cap lies to NW. The N portal is 1.3m high & the S 1m (top broken). The gallery is 2.8m long & 0.95m wide. The side stones are 0.8m high & the backstone 1.1m. The possible capstone to E is 1.3m x 0.95m x 0.25m thick.
32	LDY23:59	Standing Stone	Prehistoric	The OS memoir relates that there are 17 large standing stones in this parish, one of which is in Ervey. There is no local knowledge of a standing stone in this townland. The land is high upland ground which has all been improved. It is possible that the stone may have come from the complex at Ldy 023:007. The field wall leading from the road to this site has some quite large stones in it.
33	LDY22:19	Natural feature	N/A	A small undesignated oval enclosure with trees shown on the 1854 OS 6"map E of a stream flowing into the R.Faughan was identified as a possible antiquity. Field inspection shows that this is a natural rocky knoll around 1.4m high & 20m in diam. with much bedrock visible. It is not an antiquity.

No.	SMR No.	Type	Date	Description
34	LDY22:18	Natural feature	N/A	The 1937 OS 6"map shows a sub-circular area of poorly drained land some 60m in diam. with a 2nd oval area of wet ground 25m to NW & these were identified as possible archaeological sites. However field inspection indicates that these are natural hollows within a silted drainage system, with the large hollow to SE partially filled with old field stones.
35	LDY14:17	Bullaun Stones	Early Christian	These 2 bullaun stones are not in situ. One is supposed to be in the wall of the "Cosy Inn" bar, but has been plastered over so it cannot be seen. The other was reported as nearby, but can not now be located
36	LDY22:17	Landscape feature	Uncertain	This enclosure consists of a hedge planted around the base of a natural mound, much of which has been subsequently quarried away. Several mature trees on the remaining portion of the mound suggest that it was planted as part of the landscaping associated with Ashbrook house.
37	LDY14:59	Military entrenchment	Possible 17th century	This site was recorded in the OS memoirs as "some entrenchements said to have been cast up by an English squadron in the wars of 1641. An old ruined barracks stands near the place, known by the name of Trench Hill". The site can not now be precisely located. There are 2 houses called the Trench in the townland & it is possible that they are on or near the site of the entrenchment. The location has very extensive views NW-SE.
38	LDY22:16	Enclosure	Uncertain	The 1856 OS 6"map shows a small convention marked "fort" on a SE-facing slope overlooking the Burnigibbagh river. The site lies on steeply sloping ground W of Holly Mount house with ground rising to a hill summit on the SW & falling to the river valley at E & S. Although the immediate location forms a slightly gently slope, there are no visible traces of an antiquity & the site is only differentiated from several other adjacent knolls by the 1856 fort designation. It is impossible to say if this was a genuine antiquity, now levelled, a landscaping or natural feature.
39	LDY22:04	Ecclesiastical site	Possible 15th century	This site consists of a rectangular walled graveyard. The interior falls slightly to E & contains numerous head-stones, with the church outline, aligned E-W, visible as a a raised irregular hummock with graves apparently along the lines of the walls & in the interior. It is approx. 18.7m x 5.7m internally, with an overgrown wall remnant at W, 0.45m high. The precise date & history of the church is unclear. It appears on the Raven maps of the early 1600s & may have

No.	SMR No.	Type	Date	Description
				been built around this time during the Plantation of the area. The absence of earlier documents or architectural remains makes it impossible to be certain when it was established, or if there was an earlier church on the site.
40	LDY22:15	Natural feature	N/A	The OS 6" map of 1856 shows an undesignated mound or platform on sloping ground which falls towards the Burngibbagh to S/SE & rises to N, but the feature is not shown on the earlier 1831 map or any subsequent editions. Field inspection shows that the location is an unlikely one for an antiquity. There are no visible remains of a mound or platform in the field. Given the steepness of the slope & the entirely natural appearance of surroundings it seems likely that this was a natural feature or a mapping error rather than an antiquity & several other small contoured sites shown on the map seem to share a similar origin.
41	LDY22:05	Standing stone	Prehistoric	On townland boundary with Warbleshinny. This standing stone is 1.25m high, 1.4m wide & 0.5m thick, set near the juntion of 2 field walls. Ground falls S to the Burngibbagh. The OS memoir description of the site suggests that this may be the remains of a megalithic tomb, "...a remarkable monument of that kind...the stones stand at present 4ft from the ground & are perfectly perpendicular". The entry continues that the occupying farmer broke all but one of the stones & that the ground had subsequently been disturbed by a "treasure seeker"..
42	LDY22:24	Natural feature	N/A	A small undesignated oval contoured feature shown on the 1854 OS 6"map was identified as a possible antiquity, but field inspection indicates that this is a natural feature set on sloping ground which falls to the Burnigibbagh river at E.
43	HB01/02/03	The Oaks, 227 Glenshane Road		No further details
44	HB01/06/05	Fort James, 15 Ardmore Road, Drumahoe	1860-79	This house was built post-1860 and both the 1830 and 1853 Ordnance Survey maps indicate that it was constructed on a greenfield site. A plaque inscribed 'J.A.M.S. 1862' remains in position as does an armorial stone set at low level into a wall. The initials stand for James A. M. Stevenson, the initiator of the house's construction and the year may represent the date of the laying of the foundation stone. The Valuation Revision Books, however, reveal that progress in building the house was slow. In 1864 the property makes its first entry with the house and offices receiving a valuation of £48. This

No.	SMR No.	Type	Date	Description
				appears to have been rather premature. A note from 1865 reads: 'This house in much the same state as when ex[amine]d last year – still unfinished inside and not occupied. I therefore leave out the value this year.' In April 1866 a further comment reads: 'This house is still unfinished but partly occupied – I enter it at a reduced valuation – to be examined when finally finished.' However, it was not until 1872 that a valuation of £27 was entered for the house and offices, still indicated as being unfinished. By 1901 the property had passed to James Stevenson, third son of Robert Stevenson, JP, of Ardkill, Co. Londonderry. A note in the Valuation Revision Books from 1904 states that he was resident in the house. Finally, in 1906, the word 'unfinished' was crossed out in the Valuation Revision Books and the valuation of the buildings was increased to £46. James Stevenson had married in New Zealand in 1895 Nina Sophia Nolan, fourth daughter of the late John B. Russell, Barrister-at-law. The 1911 census shows them living in Fort James with their son Colin, who had been born in Bavaria, and daughter Grace, born in County Londonderry (there was also a German-born domestic nurse). The House and Building Return of the 1911 census indicates that the house contained 12 or more rooms and had 10 windows in front. A photograph of the house was published in Belfast and the Province of Ulster in 1909. By 1921 James Stevenson had been replaced as occupier of the house by David R. Roberts. Stevenson himself died in Belfast in 1926. The property later became the Fort James Children's Home; a primary school was built on a site to its rear. Fort James later became a women's refuge run by Foyle Women's Aid. These changes of use resulted in various alterations to its structure. Repairs carried out in 1997 included the re-slating of the roof and the replacement of sashes and frames in a number of the windows. In 2009 further alterations and extensions were proposed, including landscaping and the creation of a new car park. In 2011 three new-build dwellings for supported living were proposed along with a new common room within the existing courtyard. Also proposed was the construction of a single-storey extension to the house, necessitating the partial demolition of the existing extension.
45	HB01/04/04	Graveyard, Clondermot	Uncertain	No further details
46	DHP155	Refugee Camp	1940s	No further details

No.	SMR No.	Type	Date	Description
47	L001	Ashbrook	17th Century	The demesne was established in the 17th century, the present house dating from 1686 (listed HB 1/6/6). There are fine, mature trees with glen side walks leading to the River Faughan, to which there is public access. This area was recently improved following a report by Dr Tim Edwards of UU, which emphasised the importance of this area as a public amenity. Tree planting is recorded in A Register of Trees in County Londonderry 1768-1911 for the years 1773 to 1776. The house is set in lawns with shrubs and trees a short distance away. The walled garden has not been cultivated in the last twenty years. Half was an orchard, separated from the rest by a beech hedge, which still exists.
48	L030	The Oaks	19th Century	The present house was remodelled in the 1860s (listed HB 1/2/3). There are no ornamental gardens today and the walled garden is not cultivated. The main interest in the site is the tree planting along the River Faughan, which are the remains of extensive early 19th century planting at this site and others in the vicinity, that was recorded in the Register of Trees for County Londonderry, 1768-1911.

3 Water Framework Directive Assessment

Introduction

Terms of Reference

3.1 RES Ltd has appointed McCloy Consulting Ltd to undertake a Water Framework Directive (WFD) Assessment for a planning application for Barr Cregg Wind Farm.

3.2 A number of existing assessments have identified affected waterbodies, fisheries, and other water users as follows, and should be referred to for a detailed appraisal of the site hydrology and hydrogeology as follows:

- Barr Cregg Environmental Statement Chapter 12: Geology and Hydrogeology Assessment,
- Barr Cregg Environmental Statement Chapter 13: Hydrology Assessment, and
- Barr Cregg Further Environmental Information, Chapter 13: Supplementary Hydrology Assessment.

3.3 No WFD Assessment was submitted with the previous submissions as such documentation was not typically requested by the relevant consultees at the time of original submission. The reason for submission of this Assessment is to ensure that the planning application and supporting environmental information is robust and satisfies current obligations and best practice in relation to the water environment.

3.4 This WFD Assessment is not an environmental impact assessment and does not supersede the assessments contained within the previous submissions, which remain valid. The purpose of this WFD assessment is to provide an overarching summary, drawing on existing baseline information established in the existing assessments, in order to demonstrate specifically that the proposed development does not compromise the specific objectives of the Water Framework Directive and the relevant River Basin Management Plan.

3.5 This Assessment introduces no new mitigation, but summarises the existing proposed mitigation measures previously put forward in the original Environmental Statement and Further Environmental Information submissions (and/or minor revisions to reflect changes to best practice in the intervening period since the original submission), and in particular to demonstrate how that mitigation would be applied to mitigate any short term adverse effect of habitat enhancement measures that are described in Chapter 4: Outline Habitat Restoration and Management Plan. The measures detailed have the specific aim of demonstrating that the initially perceived risk of deterioration in the ecological status of any affected waterbody can be satisfactorily mitigated.

Water Framework Directive

3.6 The EU Water Framework Directive (2000/60/EC) was established in law in Northern Ireland in December 2003 through:

- The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2003; and
- The Water Framework Directive (Classification, Priority Substances and Shellfish Waters) Regulations (Northern Ireland) 2015.

3.7 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.

River Basin Districts

3.8 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; the Second Cycle River Basin Management Plans were published in December 2015.

Local Management Areas

3.9 The RBMPs have been put into practice by a Local Management Area (LMA) Action Plans during the planning cycle from 2010 to 2015 and the latest cycle 2015-2021. 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.

Water Framework Directive Assessment

3.10 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 20121 which outlines how to carrying out a Water Framework Directive Assessment on EIA Developments.

3.11 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.

3.12 Each specific component of the proposal, 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.

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

[1] NIEA (2012) Carrying Out A Water Framework Directive (WFD) Assessment on EIA Developments. Available: http://www.doeni.gov.uk/niea/carrying_out_a_water_framework_directive_wfd_assessment_on_eia_developments-2.pdf [Accessed: 11/11/2015]

3.14 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.

Approach to the Assessment

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

- Stage I: Review of WFD Waterbody catchments, classifications and LMA Plans.
- Stage II: Assessment of the effect of the proposed development.
- Stage III: Proposed mitigation measures where key WFD objectives are not met.

Methodology

3.16 The Stage I methodology has been undertaken using a qualitative assessment based on experienced professional judgement. The study area includes the downstream river reaches affected by the proposal and the surface water catchments draining the proposal as defined by the relevant River Basin Management Plans, Local Management Areas and Catchment Stakeholder Groups

3.17 The Stage II assessment has been undertaken using a qualitative assessment based on professional judgement derived from extensive site experience for similar developments, and derives a conservative but realistic appraisal of the potentially detrimental effect of the development were no additional mitigation proposed.

3.18 The Stage III assessment identifies, based on qualitative assessment based on professional judgement, additional mitigating measures intended to reduce or prevent the residual significant hazards not fully mitigated by the design evolution and avoidance, sufficiently that there would be no anticipated deterioration in WFD water quality indicators.

STAGE I: WATERBODY IDENTIFICATION AND CLASSIFICATION

Approach

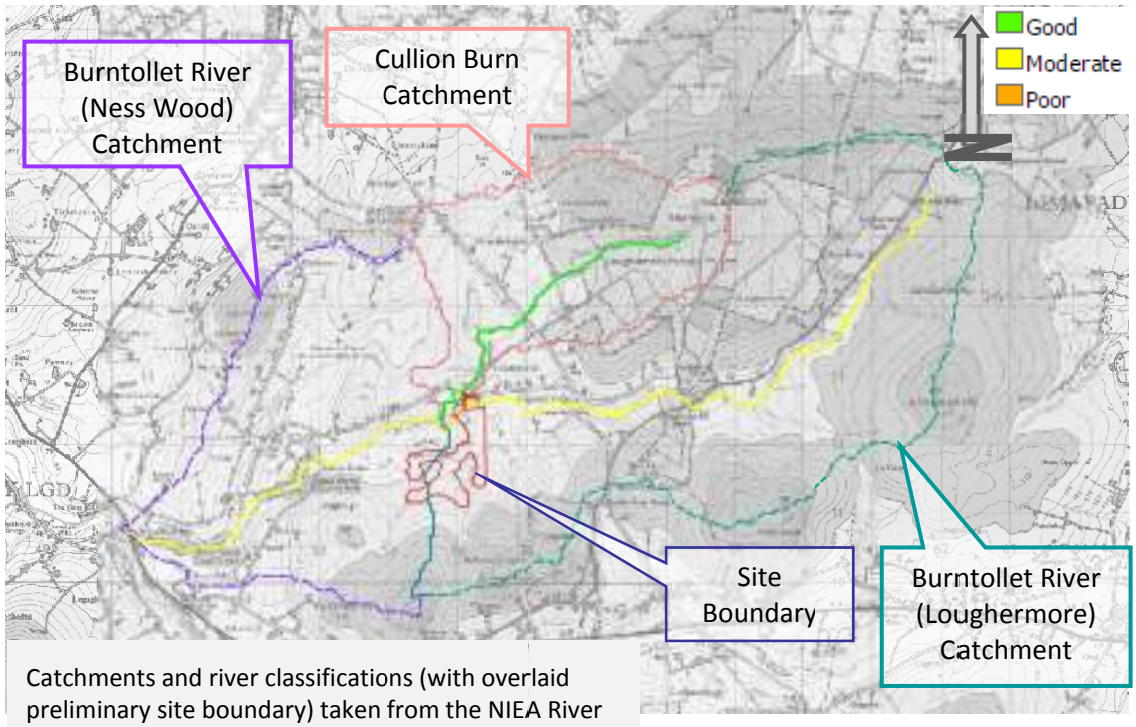
3.19 The first stage identifies those surface water and groundwater bodies with potential to be affected by the development and reviews any available WFD information to classify the waterbody including a review of the current WFD status, future status, identified environmental constraints and any existing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

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

Surface Waterbody Identification

3.21 The application site boundary considered as part of this assessment falls within the catchments of three surface waterbodies which form the overall catchment of the Burntollet River. These are the Burntollet River (Loughermore), Burntollet River (Ness Wood) and Cullion Burn (also referred to as Meenarnet Burn). Review of detailed topographic data confirms that no infrastructure proposed by the development lies within the catchment of the Cullion (Meenarnet) Burn and so that catchment is subsequently excluded from this assessment.

Figure 1: WFD Surface Waterbodies



Catchments and river classifications (with overlaid preliminary site boundary) taken from the NIEA River Basin Management Plan Interactive Map

Surface Waterbody Classification

3.22 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. As identified above; for purposes of classification under the WFD the Burntollet River (Loughermore) (UKGBNI1NW020204062) and Burntollet River (Ness Wood) (UKGBNI1NW020204035) are situated within the North Western River Basin District; part of the Faughan Local Management Area and the Lower Foyle Catchment Stakeholder Group.

3.23 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.

Surface Water Quality

3.24 The current Overall Status for the Burntollet River (Loughermore) is 'Moderate' with an objective to maintain 'Good' status through to 2021 and 2027. The Burntollet River is also a designated under the WFD Freshwater Fish Directive due to the presence of economically significant species. WFD results for each of the WFD waterbodies for 2015[2] are detailed within Table 1

Table 1: LMA Waterbody Classification 2015 Status

River Classification Element		Burntollet River (Loughermore)	Burntollet River (Ness Wood)
Overall Status		Moderate	Moderate
Confidence in Overall Status		High	High
Biological	Benthic Invertebrates	High	High
	Macrophytes	High	High
	Phytobenthos	High	Good
Chemical / Physio-chemical	Dissolved Oxygen	High	High
	pH	High	High
	Soluble Reactive Phosphate	Good	High
	Biological Oxygen Demand*	High	High
	Temperature*	High	High

[2] NIEA (2014) Reasons for status for the water bodies within the Faughan LMA. Available: https://www.doeni.gov.uk/sites/default/files/publications/doe/faughan-historical-status.pdf#page=3

River Classification Element		Burntollet River (Loughermore)	Burntollet River (Ness Wood)
Specific Pollutants	Ammonia	Good/High	Good/High
	Arsenic (dissolved)	Good/High	Good/High
	Chromium (dissolved)	Good/High	Good/High
	Iron (dissolved)	Moderate	Moderate
Hydro-morphology	Hydrological Regime	High	High
	Morphological conditions	Good	Good
Priority Substances	Cadmium (dissolved)	Good	Good
	Lead (dissolved)	Good	Good
	Nickel (dissolved)	Good	Good

Lower Bann Local Management Area Action Plan and Update[3]

3.25 The LMA Action Plan and Update states that many rivers (60 %) failed to achieve 'Good' status with the main pressures preventing 'Good' status being; abstraction and flow regulation, diffuse and point source pollution, organic enrichment, high levels of specific pollutants, changes to morphology (physical habitat) and invasion of alien species. The Burntollet River has been impacted by changes to morphology, however not significant enough to downgrade the overall status.

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

Catchment Wide Actions

- Encourage riparian zone management with an aim to improve biodiversity and minimise sedimentation through practical management measures on farms within the LMA.
- Raise awareness and promote the benefits of effective pollution control and farm nutrient and waste management.
- Provide advice on protected area designations to work towards improving the condition assessment of the 'Faughan and tributaries' Special Area of Conservation (SAC).
- Promote the NIEA Water Pollution Hotline through increased advertising, promotion and waterside signage throughout the LMA.
- Promote public participation by organising two Catchment Stakeholder Group meetings per year to provide an open forum for discussion on water management issues and encourage involvement in developing and implementing the LMA Action Plan.

[3] NIEA (2013) Faughan Local Management Area Action Plan and Update. Available: https://www.doeni.gov.uk/sites/default/files/publications/doe/water-information-faughan-local-management-area-action-plan-and-update-2013.pdf

Burntollet River Actions

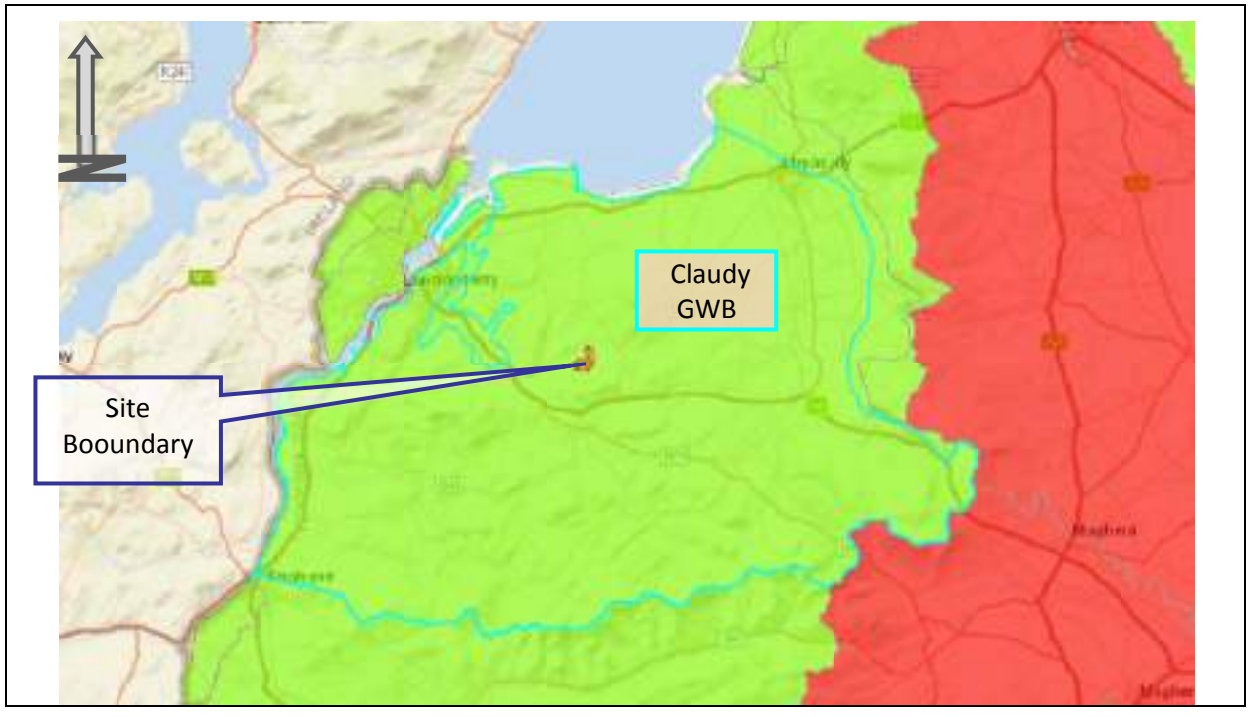
- Carry out a river walk to determine and address sources of organic pollution affecting the aquatic invertebrates.
- Carry out agricultural advisory site visits where necessary, as identified on river walk.
- Carry out monitoring and assessment of pesticides in this area.
- Carry out full RHAT assessment (River Hydromorphology Assessment Technique) to assess the hydromorphological classification and produce recommendations at a water body scale.

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

Groundwater Body Identification

3.28 The proposal is situated within the catchment of the Claudy Groundwater Body (UKGBNI4NW003), within the North Western River Basin District as shown on Figure 2.

Figure 2: WFD Groundwater Body



1.1

Groundwater Body Classification

3.29 This groundwater body is defined[4] by surface water catchments; with the body including the entire catchments of the Burndennett and Faughan Rivers, and a major part of the River Roe catchment. The body is mainly agricultural land with

4 NIEA (2012) Characterisation of groundwater bodies within Northern Ireland. Available: http://www.doeni.gov.uk/niea/characterisation-of-groundwater-bodies-northern-ireland-2012.pdf#page=4 [Accessed 11/11/2015]

the main urban centres of Londonderry (east), Limavady and Dungiven. It is noted that the information contained in the report is based on geological mapping at 1:250,000 scale; and therefore recommended as a background guide only.

3.30 The chemical composition of the natural waters is influenced by the Dalriadan bedrock with groundwater typically weakly mineralised calcium-bicarbonate type. Groundwater typically has a low (acidic) pH. Chloride levels may be elevated near the coast.

3.31 Characterisation of the waterbody in the vicinity of the site is summarised in Table 2

Table 2: Characterisation of Claudy Groundwater Body

Region	Geological Characteristics	Aquifer Type	
Land in vicinity of site boundary	Dalradian Bedrock	Bl (f)	Bedrock with limited potential for significant abstraction. Fracture flow dominant and short flow paths. Intergranular porosity negligible with flow restricted to upper weathered horizons and fractures.

Groundwater Body WFD Classifications

3.32 Following publication of the NIEA River Basin Management Plan in 2012 only an initial characterisation had been carried out for this groundwater body; the plan classified the overall status of the groundwater body as 'Good'. Second cycle results for the 2015-2021 period indicated water quality (quantitative, chemical, and overall) remained classified as 'Good'.

Groundwater Body WFD Objectives

3.33 The updated RBMP document "What We Plan to Achieve by 2021 and Beyond" [5] produced in December 2014 following the second cycle; highlights changes to original 2009-2015 WFD objectives. The RBMP now aims to achieve 'Good' status in the Claudy Groundwater Body by 2027.

Local Management Area Action Plans

3.34 The Faughan Action Plan and Update published in December 2013[6] 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

5 NIEA (2014) What We Plan to Achieve by 2021 and Beyond. Available: http://www.doeni.gov.uk/niea/what-we-plan-to-achieve-by-2021-and-beyond.pdf [Accessed 11/11/2015]
6 NIEA (2013) Faughan Local Management Area Action Plan and Update. Available: https://www.doeni.gov.uk/sites/default/files/publications/doe/water-information-faughan-local-management-area-action-plan-and-update-2013.pdf

STAGE II: ASSESSMENT OF PROPOSALS

Approach

3.35 The next stage undertaken identifies 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.

3.36 Obviously beneficial effects (such as improvements to bog hydrology associated with the proposals contained in Chapter 4: Outline Habitat Restoration and Management Plan) that would cause beneficial effects in relation to runoff rates and medium to long term runoff of sediment are not considered further.

Development Description

3.37 The proposed development consists of the following permanent infrastructure elements:

- 7 Turbines and associated crane pads
- 4347m of access track, 1487m of which will be floated
- Substation compound and control building
- Permanent meteorological mast
- A new clear span bridge over the Burntollet River with associated flood storage compensation works.
- A bottomless culvert to a watercourse and two closed culverts over an artificial drain.

3.38 In addition to the above, there will be temporary infrastructure, as follows:

- Construction compound
- Enabling works compound
- Crane pad hardstand
- A number of passing bays along the access track

Potential Effects

3.39 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

- Barr Cregg Environmental Statement Chapter 12: Geology and Hydrogeology
- Barr Cregg Environmental Statement Chapter 13: Hydrology Assessment, and
- Barr Cregg Further Environmental Information Chapter 13: Supplementary Hydrology Assessment,

Surface Water

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

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

Groundwater

3.41 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.

Site Specific Proposals Assessment

3.42 The following sections detail those areas where the proposed Barr Cregg wind farm has potential to affect the water environment, detailing the nature and extent of work required and potential for adverse impact.

3.43 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.

Potential Effect of Construction - Changes in Runoff and Flow Patterns

Description of the 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.
- Construction of a new bridge.

Potential Adverse Impacts

- Increased rate and volume of surface runoff, ponding and alterations to preferential flow routes, reduced surface permeability.
- Introducing structures in proximity to the river banks.

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 and changes to the river morphology have potential to affect the hydrological regime of the river.

Table 3: Potential Impact of Changes in Runoff and Flow Patterns on the Burntollet River

WATERCOURSE	Waterbody Name	Burntollet River (Loughermore)		Burntollet River (Ness Wood)	
	WFD Waterbody ID	UKGBNI1NW020204062		UKGBNI1NW020204035	
	Local Management Area	Faughan		Faughan	
	Status Objective 2021- 2027	Good Status		Good Status	
WFD CLASSIFICATION	WFD Element	Current Status	Assessed Change	Current Status	Assessed Change
	Benthic Invertebrates	High	Moderate	High	Moderate
	Phytobenthos	High	High	Good	Good
	Macrophytes	High	Moderate	High	Moderate
	Dissolved Oxygen	High	Moderate	High	Moderate
	pH	High	Moderate	High	Moderate
	Soluble Reactive Phosphate	Good	Moderate	High	Moderate
	Biological Oxygen Demand	High	Moderate	High	Moderate
	Temperature	High	Moderate	High	Moderate
	Ammonia	Good/High	Good/High	Good/High	Good/High
	Arsenic (dissolved)	Good/High	Good/High	Good/High	Good/High
	Chromium (dissolved)	Good/High	Good/High	Good/High	Good/High
	Iron (dissolved)	Moderate	Moderate	Moderate	Moderate
	Hydrological Regime	High	Moderate	High	Moderate
	Morphological conditions	Good	Moderate	Good	Moderate
	Cadmium (dissolved)	Good	Good	Good	Good
	Lead (dissolved)	Good	Good	Good	Good
	Nickel (dissolved)	Good	Good	Good	Good

Conclusion

Does the component comply with WFD Objectives 1, 2, 3 & 4?
YES – WITH MITIGATION (Refer to following Schedule B)

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

Description of the Proposed Works

- Excavations, ground disturbance, stripping of peat and mineral soils, temporary and permanent soil storage, and habitat improvement works requiring peat restoration will be required as part of the construction of the wind farm infrastructure.
- Excavations associated with the proposed Burntollet Bridge and its associated flood storage compensation work adjacent to the watercourse.
- 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 Adverse 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 fine 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.
- 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 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.

Table 4: Potential Impact of Silt / Suspended Solid Pollution on the Burntollet River

WATERCOURSE	Waterbody Name	Burntollet River (Loughermore)		Burntollet River (Ness Wood)	
	WFD Waterbody ID	UKGBNI1NW020204062		UKGBNI1NW020204035	
	Local Management Area	Faughan		Faughan	
	Status Objective 2021- 2027	Good Status		Good Status	
WFD CLASSIFICATION	WFD Element	Current Status	Assessed Change	Current Status	Assessed Change
	Benthic Invertebrates	High	Moderate	High	Moderate
	Phytobenthos	High	Moderate	Good	Moderate
	Macrophytes	High	Moderate	High	Moderate
	Dissolved Oxygen	High	Moderate	High	Moderate
	pH	High	Moderate	High	Moderate
	Soluble Reactive Phosphate	Good	Moderate	High	Moderate
	Biological Oxygen Demand	High	Moderate	High	Moderate
	Temperature	High	Moderate	High	Moderate
	Ammonia	Good/High	Good/High	Good/High	Good/High
	Arsenic (dissolved)	Good/High	Good/High	Good/High	Good/High
	Chromium (dissolved)	Good/High	Good/High	Good/High	Good/High
	Iron (dissolved)	Moderate	Moderate	Moderate	Moderate
	Hydrological Regime	High	Moderate	High	Moderate
	Morphological conditions	Good	Moderate	Good	Moderate
	Cadmium (dissolved)	Good	Good	Good	Good
	Lead (dissolved)	Good	Good	Good	Good
	Nickel (dissolved)	Good	Good	Good	Good

Conclusion

Does the component comply with WFD Objectives 1, 2, 3 & 4?
YES – WITH MITIGATION (Refer to following Schedule B)

Potential Effect of Construction - Chemical Pollution of Surface Waters

Description of the 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 Adverse Impacts

- There is the potential for chemicals to enter a watercourse through accidental spillage, improper transport and refuelling or inappropriate storage and disposal procedures.
- 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.
- Wastewater and associated coliforms discharged to subsoil irrigation or to the ground surface can percolate through to underlying aquifer and adversely affect water quality.

Table5: Potential Impact of Chemical Pollution on the Burntollet River

WATERCOURSE	Waterbody Name	Burntollet River (Loughermore)		Burntollet River (Ness Wood)	
	WFD Waterbody ID	UKGBNI1NW020204062		UKGBNI1NW020204035	
	Local Management Area	Faughan		Faughan	
	Status Objective 2021- 2027	Good Status		Good Status	
WFD CLASSIFICATION	WFD Element	Current Status	Assessed Change	Current Status	Assessed Change
	Benthic Invertebrates	High	Moderate	High	Moderate
	Phytobenthos	High	Moderate	Good	Moderate
	Macrophytes	High	Moderate	High	Moderate
	Dissolved Oxygen	High	Moderate	High	Moderate
	pH	High	Moderate	High	Moderate
	Soluble Reactive Phosphate	Good	Moderate	High	Moderate
	Biological Oxygen Demand	High	Moderate	High	Moderate
	Temperature	High	High	High	High
	Ammonia	Good/High	Moderate	Good/High	Moderate
	Arsenic (dissolved)	Good/High	Moderate	Good/High	Moderate
	Chromium (dissolved)	Good/High	Moderate	Good/High	Moderate
	Iron (dissolved)	Moderate	Poor	Moderate	Poor
	Hydrological Regime	High	High	High	High
	Morphological conditions	Good	Good	Good	Good
	Cadmium (dissolved)	Good	Moderate	Good	Moderate
	Lead (dissolved)	Good	Moderate	Good	Moderate
	Nickel (dissolved)	Good	Moderate	Good	Moderate

Conclusion

Does the component comply with WFD Objectives 1, 2, 3 & 4?
YES – WITH MITIGATION (Refer to following Schedule B)

Potential Effect of Construction - Chemical Pollution of Groundwater Bodies

Description of the 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, 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.
- 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.

Table 6: Potential Impact of Chemical Pollution to Claudy GWB

WATER BODY	Waterbody Name	Claudy	
	WFD Waterbody ID	UKGBNI4NW003	
	Local Management Area	North Western	
WFD CLASSIFICATION	WFD Element	Current Status	Assessed Change
	Chemical Status	Good	Moderate
Does the component comply with WFD Objectives 1, 2, 3 & 4?			
YES – WITH MITIGATION (Refer to following Schedule B)			

Potential Effect of Construction - Disturbance of Groundwater Aquifers and Aquifer Recharge

Description of the Proposed Works

- Installation of new temporary or permanent impermeable surfaces.

Potential Impacts

- 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.

Consequences

- Reduction permeable areas on the site can reduced the potential for groundwater recharge.

Table7: Potential Impact of Construction Disturbance of Aquifer / Aquifer Recharge to Claudy GWB

WATER BODY	Waterbody Name	Claudy	
	WFD Waterbody ID	UKGBNI4NW003	
	Local Management Area	North Western	
WFD CLASSIFICATION	WFD Element	Current Status	Assessed Change
	Chemical Status	Good	Moderate
Does the component comply with WFD Objectives 1, 2, 3 & 4?			
YES – WITH MITIGATION (Refer to following Schedule B)			

STAGE III: MITIGATING MEASURES

Approach

3.44 The following sections of this chapter detail the third stage of the assessment; the approach to implementation of specific mitigation measures to be applied at the site.

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

Introduction

3.46 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.

3.47 A number of assessments have identified affected waterbodies, fisheries, and other water users as follows, and should be referred to for a detailed appraisal of the site hydrology and hydrogeology:

- Barr Cregg Environmental Statement Chapter 12: Geology and Hydrogeology
- Barr Cregg Environmental Statement Chapter 13: Hydrology Assessment, and
- Barr Cregg Further Environmental Information Chapter 13: Supplementary Hydrology Assessment,

3.48 The 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 downstream designated sites and fisheries are protected.

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

3.50 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 Volume 3. 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.

3.51 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.

Precedence

3.52 The mitigation stated herein is intended to **supersede** the previous Barr Cregg Environmental Statement - **Technical Appendix 13.4: SuDS Design Statement and outline SuDS design for planning stage**; the mitigation stated adopts the principles of the previous design and incorporates site-specific measures identified in the previous design, while including improvements and changes in practice in the intervening period since the original submission.

Additional References

3.53 This document refers to and should be read in conjunction with the following:

- Barr Cregg Environmental Statement, in particular:
  - Chapter 07: Ecology Assessment;
  - Chapter 08: Fisheries Assessment;
  - Chapter 12: Geology and Hydrogeology Assessment;
  - Chapter 13: Hydrology Assessment;
  - Technical Appendix 12.2: Peat Hazard Slide Risk Assessment;
- Further Environmental Information, in particular:
  - Chapter 13: Supplementary Hydrology Assessment (hereafter referred to as the "Supplementary Hydrology Assessment").
  - Chapter 8: Fisheries Assessment Addendum

3.54 In addition; the following accompanying drawings included within Volume 3:

- Figures 3.1 to 3.5 - Preliminary SuDS General Arrangement (Planning Stage Drainage Layouts);
- Figures 3.6 to 3.12 - Preliminary SuDS Typical Details (Planning Stage Drainage Details).

RELEVANT GUIDANCE AND LEGISLATIVE REQUIREMENTS

Relevant Guidance and Legislative Requirements

3.55 It is proposed that all drainage relating to the 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:

National Legislation and 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;

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);
- Derry Area Plan (2011);
- Sustainable Development Strategy, "Everyone's Involved" (2010);

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);
- 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 C697 - The SuDS Manual (2007)
- 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 Pollution Prevention Guidance Notes (PPGs);
- PPG01 Understanding Your Environmental Responsibilities: Good Environmental Practice;
- PPG02 Above Ground Oil Storage Tanks;
- PPG03 Use and Design Of Oil Separators in Surface Water Drainage Systems;
- PPG04 Treatment and Disposal of Sewage where no Foul Sewer is Available;
- PPG05 Works and Maintenance in or near Water;
- PPG06 Working at Construction and Demolition-sites;
- PPG07 The Safe Operation of Refuelling Facilities;
- PPG18 Managing Fire, Water and Major Spillages;
- PPG20 Dewatering Underground Ducts and Chambers;
- PPG21 Pollution Incident Response Planning;
- PPG26 Drums and Intermediate Bulk Containers.

DRAINAGE DESIGN - DETAILED CONSIDERATIONS

Preamble

3.56 The following key considerations have been identified in the preliminary design of hydrology and drainage (including foul) for the site in order to ensure that Water Framework Directive objectives are met, and are intended to address the potential impacts identified in the Stage II Assessment of Proposals.

- 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 hard standing 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;
- Watercourse Buffer Zones.

3.57 Note that the infrastructure layout and associated SUDS design prepared for purposes of Planning is preliminary. 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.

3.58 Preliminary drainage layout is shown on accompanying drainage management drawings **Figure 3.1 – 3.5** within **Volume 3.**

Watercourses and Watercourse Crossings

Identification of Watercourse Crossings

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

- Two crossings of significant watercourses (Burntollet River and the Eastern Stream) are required to allow development, both of which which are considered significant in terms of fisheries potential.
- Two crossings of the Central Drain, an artificially excavated tributary of the Eastern Stream which has been determined to be of no fisheries potential.

3.60 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.

3.61 Works to watercourse crossings will be subject to authorisation by Rivers Agency as per Schedule 6 of the Drainage (Northern Ireland) Order 1973.

Design of Watercourse Crossings

3.62 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.

3.63 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);
- 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).

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

3.65 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 **Figure 3.9** included in **Volume 3**.

Burntollet Bridge

3.66 Specific provision has been made in the siting and design of the Burntollet River bridge. Hydrological / water quality input to the initial design and future input to the detailed design will ensure that:

- The crossing type is clear span with abutments set back from the bank and will avoid disruption to the stream bed and banks;
- The crossing directing is perpendicular to the stream direction, therefore minimising the length of stream affected;

- The crossing will allow min. 0.6m freeboard to the design flow / flood level (or as may be otherwise specified by Rivers Agency) and will for the passage of out-of-bank flood flows within the clear span;
- The crossing is located in an area where bank slopes are the shallowest available, thus reducing the potential for runoff to carry sediment into the watercourse.

3.67 A typical clear span bridge detail representing an outline design is shown on drawing **Figure 3.11** included in **Volume 3**.

Bottomless Culvert Crossings

3.68 Bottomless Culvert crossings will be utilised as directed by ES Chapter 8 – Fisheries Assessment and FEI Chapter 8 – Fisheries Assessment Addendum (hereafter termed "Fisheries Assessment") 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.

3.69 A bottomless culvert crossing detail representing an outline design is shown on drawing **Figure 3.11** included in **Volume 3.**

Culvert Crossings

3.70 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 by the site specific Fisheries Assessment. These crossings and other culverts for surface flood conveyance or similar, shall be piped culverts.

3.71 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 subsequently in this assessment.

3.72 A typical culvert representing an outline design is shown on drawing **Figure 3.12** included in **Volume 3.**

Preservation of Overland Flow Routes

3.73 Where appropriate, 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.

3.74 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:

- The requirements of **Chapter 4: Outline Habitat Restoration and Maintenance Plan** and the Ecological Clerk of Works;
- Terrain gradients lateral to the proposed access track;
- Terrain gradients longitudinal to the proposed track;
- Location of natural depressions and points of flow collection.

Water Feature Buffer Zones

3.75 Buffer zones to water features have been established for the Site within Further Environmental Information, **Chapter 13: Supplementary Hydrology Assessment.** Buffers and are shown on accompanying drainage management drawings **Figure 3.1 to 3.3** within **Volume 3.**

3.76 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.

3.77 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.

Temporary Drainage

Clean / Polluted Water Separation

3.78 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.

3.79 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.

3.80 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.

3.81 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.

3.82 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.

Track Drainage

Trackside Drainage

3.83 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.

3.84 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).

3.85 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.

3.86 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 (TV) (15 mm rainfall on drained area).

3.87 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.

3.88 Note that dirty water under track crossings and breakouts are to be maintained separate from clean water crossings.

3.89 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.

3.90 Typical trackside swale arrangements are shown on **Figures 3.1 to 3.5** and track drainage details are shown on **Figures 3.7 and 3.8** in **Volume 3.**

Drainage Grips

3.91 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.

3.92 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.

3.93 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.

Runoff Attenuation

3.94 Runoff from large hard standing areas such as the site compound, turbine hard standings, 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 hard standing areas, providing immediate attenuation "at source", with pass-forward flow rate reduced by filtration and temporary detention.

3.95 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.

3.96 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.

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

Management of Suspended Solids

3.98 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.

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

Check Dams

3.100 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.

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

3.102 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.

3.103 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.

3.104 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.

3.105 Typical swale check dam arrangements are shown on track drainage drawing **Figure 3.7** in **Volume 3.**

Settlement Ponds

3.106 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.

3.107 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.

3.108 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.

3.109 Typical settlement lagoon arrangements are shown on drawing **Figure 3.6** included in **Volume 3.**

Vegetative Filtration

3.110 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.

Dewatering and Washout Pits

3.111 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.

Temporary Spoil Management

3.112 The following shall apply to design of drainage for temporary and permanent spoil deposition 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.

Foul Drainage

3.113 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.

3.114 In the event that foul water from temporary compounds and permanent control buildings can be reliably treated on site to a sufficiently high effluent standard, treated effluent will be discharged to a surface watercourse or percolation soakaway designed and constructed in accordance with NIEA requirements, subject (in the case of disposal to groundwater) to satisfactory percolation test results.

3.115 In the event that treatment is not considered sufficiently reliable and in order to prevent the requirement for a discharge of treated effluent of poor quality to a watercourse or percolation to groundwater, foul water permanent control buildings will drain to a sealed GRP collector (cesspool) buried underground. The collector will be a sealed unit with no drainage outlet. The collector tank will have a level indicator and/or audible alarm to signal when emptying is required. The tank will be sized to require emptying once (max. twice) a year. 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.

3.116 Location of temporary and permanent collection tanks will be situated adjacent to site tracks in order to allow access by tanker for emptying of sludge and/or effluent.

CONSTRUCTION PHASE – DETAILED CONSIDERATIONS

3.117 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 / Planning Authority prior to construction.

3.118 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.

3.119 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 previously. 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.

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

Planning and Phasing of Drainage Works

Site-Wide Requirements

3.121 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 / hard standing 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.

3.122 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 hard standing 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 WTG 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.

3.123 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.

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

Timing of Works

3.125 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.

Use of Existing Burntollet Fords

3.126 Use of existing ford structures would be permissible only to allow access across the Burntollet for sufficient plant and machinery to allow construction of the new clear span structure or a temporary clear span crossing.

3.127 Where the fords are used, wheel wash facilities are to be provided for construction traffic to use prior to traversing the ford, in order to minimise potential for transport of silts and sediments into the river channel.

Specific Construction Phase Measures

Working in the Vicinity of Water / Buffer Zones

3.128 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.

3.129 Construction buffer zones to drainage features will be set as stated within the **Supplementary Hydrology Assessment** and are reproduced on the accompanying **Figures 3.1 to 3.5** within **Volume 3.**

3.130 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.

Watercourse Crossings

3.131 Residual risk to watercourses specific to the construction stage will be fully addressed in the Contractor's construction method statement and 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.

3.132 Additional particular considerations (dependant on the crossing type) are stated subsequently.

Bridge and Bottomless Culvert Crossings

3.133 Fisheries considerations shall be as per the guidance stated in Guidelines for Fisheries Protection during Development Works[7] 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 bridge footings shall be constructed from the bank; civil works within the stream bed will not be permitted.
- Channel and banks will be retained intact within the bottomless culvert.

Culvert Crossings

3.134 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.

[7] Loughs Agency (2011) Guidelines for Fisheries Protection during Development Works. Available: http://www.loughs-agency.org/fs/doc/publications/loughs-agency-guidelines-for-fisheries-protection-during-development-works.pdf [Accessed 11/11/2015]

- 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.

Flood Storage Compensation

3.135 Works required to compensate displaced flood volume require the excavation of ground in proximity to the Burntollet River in order to reduce ground levels to allow inundation in the event of an extreme flood. While this would not entail any works within the river channel, by definition compensation areas must be located in areas connected to existing floodplains in order to be effective in their intended function.

3.136 Compensation areas proposed at the site nominally lie within 5-10m of the river bank and are therefore unavoidably located within the 50m buffer applied to the Burntollet River. Flood storage works would not be permitted within the mapped boundary of the Faughan SAC at the site. Mitigation measures specific to this aspect of the development would include:

- Planning and phasing of work to construct the flood storage compensation (FSC) area earthworks to occur during a dry spell and period of low river flows. Planning would be informed by observed river levels, ongoing weather (rainfall) patterns and precipitation forecasts. No works to construct the FSC would be permitted during prolonged spells of wet weather or when flooding would reasonably be anticipated.

3.137 A specific detailed construction method statement would be prepared prior to undertaking the work to detail methods and sequencing of the work, and would include the following considerations as a minimum.

- Prior to undertaking excavations, Contractor to install a series (min. 2) of parallel silt fences or straw bales pinned to undisturbed ground between the works and the river bank, extending adjacent and beyond the riverside extent of the earthworks.
- Excavation of material and overburden (max depth of earthwork typically 1.0-1.2m based on outline design) by mechanical excavator, and profiling of the excavated surface to the required levels. Any shallow groundwater or rainfall runoff from excavations would be collected and either pumped or gravitated to a settlement feature for treatment.
- Excavated material to be transported outwith the watercourse buffer for temporary or permanent storage. Note that timescale for excavations of the type shown on our drawings would be anticipated to be no greater than 1-2 days.
- Replace stored turf over the re-profiled excavation.
- Remove silt fences / straw bales after completion of earthworks and after vegetation has fully re-established (with a view to trapping silts entrained in runoff from the earthworks).

3.138 In order to mitigate residual risk, works to construct the flood storage compensation area would be limited to occur outside the fish spawning season as defined by the Fisheries Assessment submitted with the Environmental Statement.

3.139 Measures to protect water quality during construction of FSC areas are shown on drawing FEI Figure 13-8, reproduced for ease of reference as **Figure 3.5** included in **Volume 3.**

Habitat Improvements - Harrowing

3.140 Habitat improvement (bog restoration) works on lower lying improved grasslands include potential for screefing off the surface turf and turn it over to expose the peat surface (this may not be required if these areas have been used for temporary peat storage during the construction phase). A possible method for turning over the surface turf would be to use a trailed, shallow mouldboard ploughshare, followed by light harrowing. Improvement works may be sited within the 50m buffer of a watercourse on the site.

3.141 Mitigation measures specific to this aspect of the development would include planning and phasing of work to occur during a dry spell and period of low river flows. Planning would be informed by observed river levels, ongoing weather (rainfall) patterns and precipitation forecasts.

3.142 A specific detailed construction method statement would be prepared prior to undertaking the work to detail methods and sequencing of the work, and would include the following considerations as a minimum.

- Prior to undertaking excavations, Contractor to install a series (min. 2) of parallel silt fences or straw bales pinned to undisturbed ground between the works and the river bank, extending adjacent and beyond the riverside extent of the earthworks.

- Remove silt fences / straw bales after completion of earthworks and after vegetation has fully re-established (with a view to trapping silts entrained in runoff from the earthworks).

3.143 In order to mitigate residual risk, works would be limited to occur outside the fish spawning season as defined by the Fisheries Assessment submitted with the Environmental Statement.

Drain Diversion

3.144 Works at Turbine 3 (T3) include the interception and diversion of the Central Drain in proximity to the turbine. Sequencing of diversion of the drain relative to civil works at the turbine location would be timed so that the drain was diverted and established prior to any main excavations commencing to build the turbine crane pad or foundation.

3.145 The proposed diversion channel would be constructed off-line and from the discharge point in an up gradient direction so that the channel remained dry. Water would not be permitted to enter the channel until all temporary and permanent scour protection had been placed. Permanent protection at channel bends would be formed out of rip rap or Reno mattress; temporary protection to the channel base and banks would be formed from biodegradable geotextile (jute / coir matting or similar) anchored to banks, lapped to prevent bypassing, and overlaid with imported rounded washed gravel to the stream bed.

3.146 Works to the diversion shall be restricted to those periods outside of the fish spawning season in accordance with commitments made in the project Environmental Statement. All works at the drain diversion shall be supervised by an Ecological Clerk of Works (ECoW) or equivalent, and would be timed taking cognisance of prevailing ground conditions and season in order to allow works to be undertaken during periods of low flows.

Turbine Bases and Crane Pads

3.147 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.

3.148 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.

Cable Trenches

3.149 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.
- 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.

Dewatering

3.150 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.

Use of Flocculant

3.151 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.

3.152 Where flocculant is preferred or required, due to the presence of extremely fine particles within clays or aggregates that cannot be effectively removed using filtration or settlement ponds, then its use 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.

3.153 Flocculant would generally be installed within an existing settlement pond in liquid form, or installed in solid form in a culvert with water allowed to flow around the flocculant block. Flocculant would be required to be removed immediately upon reduction of the observed pollution risk that prompted its use.

3.154 Typical location of flocculant dosing in conjunction with settlement lagoons is shown on **Figure 3.6** in **Volume 3.**

Excavated Track Drainage

3.155 Where an excavated type track construction is specified, all track runoff (polluted water) would be directed to flow to track-side drainage channels, to be installed as tracks are constructed.

3.156 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.

3.157 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 4: Outline Habitat Restoration and Maintenance Plan**.

3.158 Typical drainage installation for excavated tracks is shown on **Figure 3.7** in **Volume 3.**

Floated Track Drainage

3.159 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.

3.160 Track runoff will be directed over the edge of the track structure to discharge across existing vegetation to allow filtration / settlement of suspended solids.

3.161 Typical drainage installation for floated tracks is shown on drawing **Figure 3.8** in **Volume 3.**

MAINTENANCE

Construction Phase

3.162 The following is intended to inform the detailed drainage / SuDS maintenance manual for the construction phase.

3.163 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.

3.164 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.

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.

Settlement 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.

Operational Phase

3.165 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.

ASSESSMENT OF MITIGATION

Assessment of Mitigation against WFD Objectives

Table 8: Schedule B – Assessment of Specific Mitigation Against WFD Objectives

Scheme Component / Effect	Objective 1	Objective 2	Objective 3	Objective 4
	To prevent deterioration in the ecological status of the waterbody.	To prevent the introduction of impediments to the attainment of Good WFD status for the waterbody.	To ensure the attainment of the WFD objectives for the waterbody are not compromised.	To ensure the achievement of WFD objectives in other waterbodies within the same catchment are not permanently excluded or compromised.
	Describe mitigation required to meet objective 1:	Describe mitigation required to meet objective 2:	Describe mitigation required to meet objective 3:	Describe mitigation required to meet objective 4:
Changes in Runoff and Flow Patterns In relation to the surface water body.	Detailed previously and summarised as follows: • Track and hard standing runoff will be handled by sheet flow to trackside ditches or swales; • Tracks and hard standing areas are to be constructed from unbound aggregate and are not surfaced, thus helping to reduce runoff volumes; • Under track drainage will provide a means for flows to pass from upslope to downslope of tracks; • 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 bridges ,or culverts as appropriate; • 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.			

Silt / Suspended Solid pollution of surface water In relation to the surface water body.	Detailed previously 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 would be reinstated on slopes as early as possible. • 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 hard standing areas will be collected and attenuated before discharge to receiving drainage networks. • Specific mitigation will apply to works adjacent to watercourses such as construction of culverts, flood storage compensation, and drain diversions.
Chemical Pollution of surface water and groundwater In relation to the surface water body and groundwater body.	Detailed previously 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.

SUMMARY AND CONCLUSION

Assessment of Post-Construction WFD Status

3.166 Specific mitigation has been identified in Stage III that would address the potential deterioration of WFD indicators identified in Stage II, such that it is anticipated that the proposal could be developed without causing any adverse effect to any indicator and as such meet WFD Objectives 1 to 4.

3.167 The assessment correlates with and supplements similar findings within the relevant chapters of previous Environmental Statement and FEI which found that the development would cause no significant adverse effect to the water environment.

3.168 The post-construction assessment of WFD elements for the on-site WFD waterbodies are summarised in the following table.

Table 9: Summary of post-construction WFD Status – Burntollet River

WFD Element	Burntollet River (Loughermore)			Burntollet River (Ness Wood)		
	Current Status*	Assessed Post-Works Status - No Mitigation	Assessed Post-Works Status - With Mitigation	Current Status*	Assessed Post-Works Status - No Mitigation	Assessed Post-Works Status - With Mitigation
Benthic Invertebrates	High	Moderate	High	High	Moderate	High
Phytobenthos	High	Moderate	High	Good	Moderate	Good
Macrophytes	High	Moderate	High	High	Moderate	High
Dissolved Oxygen	High	Moderate	High	High	Moderate	High
pH	High	Moderate	High	High	Moderate	High
Soluble Reactive Phosphate	Good	Moderate	Good	High	Moderate	High
Biological Oxygen Demand	High	Moderate	High	High	Moderate	High
Temperature	High	Moderate	High	High	Moderate	High
Ammonia	Good/High	Moderate	Good/High	Good/High	Moderate	Good/High
Arsenic (dissolved)	Good/High	Moderate	Good/High	Good/High	Moderate	Good/High
Chromium (dissolved)	Good/High	Moderate	Good/High	Good/High	Moderate	Good/High
Iron (dissolved)	Moderate	Poor	Moderate	Moderate	Poor	Moderate
Hydrological Regime	High	Moderate	High	High	Moderate	High

WFD Element	Burntollet River (Loughermore)			Burntollet River (Ness Wood)		
	Current Status*	Assessed Post-Works Status - No Mitigation	Assessed Post-Works Status - With Mitigation	Current Status*	Assessed Post-Works Status - No Mitigation	Assessed Post-Works Status - With Mitigation
Morphological conditions	Good	Moderate	Good	Good	Moderate	Good
Cadmium (dissolved)	Good	Moderate	Good	Good	Moderate	Good
Lead (dissolved)	Good	Moderate	Good	Good	Moderate	Good
Nickel (dissolved)	Good	Moderate	Good	Good	Moderate	Good

Table 10: Summary of post-construction WFD Status – Claudy GWB

WFD Element	Current Status*	Assessed Post-Works Status - No Mitigation	Assessed Post-Works Status - With Mitigation
Chemical Status	Good	Moderate	Good

Summary

3.169 This Water Framework Assessment has been undertaken to determine the effects of the development of Barr Cregg Wind Farm on the ecological quality status of waterbodies potentially affected by construction activities associated with the development.

3.170 Three WFD designated surface watercourse and one groundwater catchment were identified, which could be affected by the proposed works involved in the construction of the wind farm; i.e. the Burntollet River (Loughermore), Burntollet River (Ness Wood), and the Claudy Groundwater body.

3.171 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 waterbodies.

3.172 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.

Conclusion

3.173 Following incorporation of site-wide general binding mitigation control measures, NIEA approved 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 proposed Barr Cregg Wind Farm.

4 Outline Habitat Restoration Management Plan

Introduction

Terms of Reference

4.1 The OHRMP has been produced collaboratively by a number of consultants due to the inter-relationships that exist between various environmental disciplines and the benefit of a holistic approach to habitat management and enhancement. The following consultants were appointed by RES Ltd:

- Ross Environmental Associates (Peatlands);
- Blackstaff Ecology (Ecology);
- Paul Johnstone Associates (Fisheries);
- McCloy Consulting (Hydrology);
- David Steele (Ornithology).

4.2 In addition the legal & policy section has been authored by Marcus Trinick QC and Carson McDowell Solicitors and deals exclusively with the legal and policy status of blanket bog so far as relevant to the proposed development.

Background

4.3 The purpose of this Outline Habitat Restoration and Management Plan is to describe and quantify the proposed habitat restoration and enhancement/improvement proposed as part of the mitigation package for the Barr Cregg Wind Farm.

Since the main part of the wind farm infrastructure footprint lies in degraded blanket bog and degraded heather moorland which are, nevertheless, classified by NIEA as Northern Ireland priority habitats in the Northern Ireland Habitat Action Plan, this Outline Habitat Restoration and Management Plan (OHRMP) focusses both on restoring vegetation around the construction footprint and on enhancing/improving the condition of degraded moorland and degraded blanket bog habitats. This topic, and particularly the condition, sensitivity, value and importance of the degraded blanket bog and heather moorland, and the approach to be taken to these habitats in this development context, are discussed in the section of this plan starting at paragraph 4.50. The legal and policy framework for this topic is discussed in the section starting at paragraph 4.5.

The Ecological Impact Assessment (EcIA) methodology approach provided by CIEEM (2016), has been adopted in this document. This approach scopes out, ahead of the impact assessment, insignificant impacts through modifications of the design of the development and through implementation of good working practices during construction. These elements of 'mitigation built into the design of the development' are noted below.

A number of elements which are beneficial to degraded blanket bog habitats have already been incorporated into the design of the wind farm and are described in the Peat Condition Report (submitted as part of the Further Environmental Information (FEI) in 2014). These include:

- All crane pads have been reduced in size;
- The layout has been designed to avoid areas of deeper peat;
- The layout has been redesigned (reorientation of turbines and crane pads, re-routing of access track) to avoid as much as possible areas of NI priority habitats, including areas of degraded blanket bog habitat;
- The route of the main access track to the south of proposed substation lies in the poorest area of degraded M19. The layout now completely avoids the area of blanket bog between turbines 4 and 2 reducing the overall length of access track.

In addition to the originally proposed 497m of floating track (FEI, 2014), the current layout has additional lengths of floating track between Turbines 1 and 2 and the main access track to south of proposed substation. This amounts to a total for the development of 1487m if the track between T1 & T2 is floated and 1310m if it were to be cut track, resulting in a 813m / 990m increase in the length of floating track overall: a substantial benefit in terms of minimising excavated peat and CO_2 emissions.

4.4 In addition to the above design modification to reduce adverse impacts, a number of good working practices will be implemented throughout the construction of the Barr Cregg wind farm which will prevent or minimise damage topeatland habitats of value. As a minimum, these will follow the guidelines provided in the Scottish Renewables et al. (2010) document: "*Good Practice During Windfarm Construction*". In order to prevent leaks or spillages of fuels or other materials, such as cement/concrete onto peatland vegetation, and to prevent the laydown of excavated or construction materials on peatland vegetation or in areas of deeper peat (>1m) in order to minimise the potential for peat slide, a programme of good practices will be implemented. In addition to good methods of construction and waste management, key good working practices which will ensure protection of valuable peatland vegetation habitats and the quality of water courses include as a minimum:

- Appointment of an independent and appropriately qualified Ecological Clerk of Works (ECoW) who is independent of the construction contractor and who not only understands both the ecological value of protected habitats and species as well as the importance of protecting the quality of water resources, but also has the responsibility and power within the construction team to influence decision making and implement protection and/or remediation practices as required during the entire construction period. The ECoW will oversee and advise on all matters relating to ecology, peatlands, hydrology and habitats;
- Instigation of strict access and egress routes as a 'working corridor' for all construction-related traffic, as well as marking out and implementation of strict

exclusion zones around valuable areas of peatland habitat and watercourse buffers. This will ensure that heavy plant does not traffic protected, vulnerable vegetation communities and that soft peaty buffer zones that shed to adjacent streams and watercourses are not compromised;

- Designated re-fuelling areas within controlled zones to ensure that there is no possibility that spillages and leaks could affect vegetation, peat or watercourses.
- Appropriate location and containment of all temporarily stored materials such that they don't impinge on valuable vegetation habitats or watercourse buffer zones.
- Implementation of a well-designed temporary construction phase drainage system and a Sustainable Drainage System (SuDS) to prevent peat erosion and to encourage retention on site of as much rainfall runoff as possible, thus assisting in the peatland re-wetting process. Regular inspections will be made of all SuDS elements and the construction phase drainage system throughout the construction period to ensure that they are fit for purpose and functional.

Legal and policy context

4.5 This section has been written by Marcus Trinick QC and Gary McGhee, Partner in Carson McDowell. It is included in this document for ease of future reference and explores the legal and policy status of blanket bog so far as relevant to the proposed development.

EU Habitats Directive 1992

4.6 Article 1 of the EU Habitats Directive 1992 defines certain natural habitat types by principal reference to their danger of disappearance in their natural range or because they have a small natural range for the reasons given in the Article. These habitat types are listed in Annex I to the Directive with 'priority natural habitat types' being accorded a distinct status.

4.7 Within Annex 1 is listed blanket bog and wet heathland, two habitat types found at Barr Cregg. Active blanket bog (for a definition of which see paragraph 4.42 of this plan) is accorded 'priority' status. This is justified in the Directive as follows: "*whereas, in view of the threats to certain types of natural habitat and certain species, it is necessary to define them as having priority in order to favour the early implementation of measures to conserve them*."

4.8 The EU Habitats Directive (and the corresponding Habitats Regulations) provide for the classification of areas containing Annex 1 habitats as Special Areas of Conservation. However, there is a process of selection of candidate SAC(s) and the area of the Barr Cregg site has not been selected for possible classification. This is not surprising given the degraded status of the blanket bog. Nevertheless the conservation of the biodiversity of blanket bog remains a general aim of the Habitats Directive (Article 2).

UK Biodiversity Action Plan and Northern Ireland Habitat Action Plans

4.9 The United Kingdom Biodiversity Action Plan (UK BAP) was published in 1994. For all habitats on the original priority habitats list, produced between 1995 and 1999, a Habitat Action Plan (HAP) was created. All types of blanket bog are included in the original list of UK priority habitats. Specific HAPs were created for Northern Ireland habitats.

4.10 Within both the UK BAP and the Northern Ireland Habitat Action Plan (NI HAP) the category "priority habitats" includes all blanket bog, including that which may have been damaged and degraded by activities such as drainage, burning, peat cutting and stock grazing.

4.11 In paragraph 118 of the NI HAP, it states: "*This plan encompasses all areas of blanket bog supporting semi-natural blanket bog vegetation, including intact surfaces, drained and cutover bog and whether or not it may be defined as 'active' (actively laying down peat). It excludes areas which no longer support such vegetation (except where the restoration of these areas is necessary for the protection and/or enhancement of adjacent bog)*."

4.12 The test to determine what blanket bog is and is not included as priority habitat in the NI HAP is whether the area still supports semi-natural vegetation typical of blanket bog. This is not defined in the NI HAP but is interpreted in this document (with reference to Barr Cregg) to mean the presence of species such as the following: *Calluna vulgaris, Sphagnum* species*, Eriophorum species, Trichophorum germanicum, Erica tetralix* and *Narthecium ossifragum*.

4.13 Although areas of damaged and degraded blanket bog at Barr Cregg are currently in agricultural use, they still support the above species in varying quantities, with little or no *Sphagnum* in many places. These degraded areas are therefore still assessed to be very poor examples of NI priority habitats.

4.14 For the purposes of what follows on policy in this section it is important to note that the definition of priority habitats in the NI HAP, drawn up within the framework of the Northern Ireland Biodiversity Strategy, is different from, and broader than, the definition in the EU Habitats Directive. Non-active blanket bog in Northern Ireland may be defined as priority habitat (subject to the matters discussed in the previous two paragraphs) whereas this would not be so under the Habitats Directive.

PPS2: Natural Habitats and Other Advice

4.15 PPS2 requires detailed consideration in the case of Barr Cregg for reasons given in the following paragraphs. However, attention needs to drawn potentially relevant advice in the Strategic Planning Policy Statement for Northern Ireland (SPPS) and PPS18. Paragraph 6.226 of the SPPS advises against any renewable energy development on active peatland. This advice is repeated in Policy RE1 within PPS18. These elements of advice are not engaged at Barr Cregg because the peat land or blanket bog which will be impacted by the proposed development are not

active, as recorded later in this document. The advice in the SPPS and within RE1 can be contrasted with the advice within policy NH5 within PPS2, as will become clear in the following discussion.

4.16 PPS2 sets out the policies of the Department of the Environment for the conservation, protection and enhancement of Northern Ireland's natural heritage. Before turning to the key policy applicable to the proposed Barr Cregg Wind Farm it is worth noting paragraph 1.6 of PPS2 which advises that environmental policy continues to be based on the precautionary principle. The principle is not engaged in this case on the basis of the definition of the precautionary principle within the Rio Declaration referenced in footnote 12 to paragraph 1.6 of PPS2, since there is no lack of full scientific certainty in the case of the impact of the development on blanket bog at Barr Cregg which could cause the principle to be engaged. This is not of course to say that a careful approach to blanket bog is not appropriate, as is evidenced by this Plan.

4.17 Noting what has already been said about the definition of priority habitats in the NI HAP reference is also made to paragraph 5.11 of PPS2 which sets matters in a general legal and policy context.

4.18 Policy NH5 within PPS2 is set out in full here so far as required in the circumstances at Barr Cregg because it does require discussion:

> *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*
> - *active peatland*
>
> *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 case, appropriate mitigation and/or compensatory measures will be required"*

4.19 The explanatory paragraphs 5.11-5.13 which are to be read with NH5 are little more than general context, and in particular give no advice on the application of policy NH5 in a development management context. In the quoted section of NH5 reference to active peatland is noted for completeness, although it is the category "priority habitats" which is really engaged in the case of Barr Cregg.

4.20 NH5 is a curiosity in some respects:

a. The first sentence of the policy is clearly not intended to incorporate a planning balance since that is explicit within the second paragraph. However, the word "unacceptable" implies some kind of planning balance. In the absence of this, "unacceptable" can only sensibly be interpreted as referring to an impact which would be unacceptable without the application of the balance.

b. The same point applies to the meaning of "unacceptable" in the second paragraph which, however, clearly allows for a planning balance.

c. There is no advice in NH5 or its explanatory paragraphs on what is meant by "unacceptable". And it is not for the Appellant to interpret the policy while trying to make sense of it. The ES and this Plan acknowledge that there will be adverse impacts on blanket bog as a result of the construction of the development. While some of these impacts may (subject to mitigation) be significant in EIA terms that does not make them unacceptable in terms of NH5 unless there is an undeclared and illogical equation between acceptability and significance. However, for the avoidance of doubt the Appellant places great weight in this case on its mitigation and enhancement measures discussed in the document as a whole and later in this section.

4.21 Applying NH5 in context it is first worth noting the advice of paragraph 5 of PPS2 that what is advised in NH5 "will prevail unless there is other overriding policy or material considerations that outweigh them and justify contrary decisions". In other words PPS2 envisages that even if a negative conclusion is drawn under NH5 there may still be room for some kind of overriding planning balance. However, the Appellant confesses to being a little confused by the approach evidenced in paragraph 5 and NH5.

4.22 The wording of NH5 makes it important to properly address the meaning of "mitigation", "compensatory measures" and (of great importance in the case of Barr Cregg) "habitat enhancement". It is the Appellant's view that the following basic definitions apply:

a. Mitigation can be applied during the design of the development, as has been done in the case of Barr Cregg and as is recorded elsewhere in this document. Additionally mitigation may be applied through best practice measures during construction, as is fully intended by the Appellant. Both design (embedded) and applied mitigation are relevant at Barr Cregg. However, an overriding point is that the purpose of mitigation is to restrict the impacts of the proposed development in the context of the environment as it was prior to construction works. It would not be right to expect an applicant for planning permission to apply mitigation which improved the environmental capital of the area. The requirement can only be to make good damage caused.

b. Compensatory measures are those measures which are intended to offset the impacts of development, and the main context of such measures may well be the Habitats Directive and appropriate assessment relating to designated European sites. This context is not relevant to Barr Cregg. It is the Appellant's view that what is proposed is not in breach of the advice in the first paragraph of policy NH5, assuming that the word "unacceptable" has no meaning other than "significant detriment". In the alternative the development would be compliant within NH5 on the basis of the planning balance set out in the second paragraph of the policy and accordingly the

appellant has proposed compensatory measures to offset any direct loss of habitats as a result of the proposed development.

c. The Appellant does propose very substantial habitat enhancement in the categories set out in Table 7 within this document. It must be emphasised that the measures proposed are not mitigation as just discussed, but seek to improve the environmental capital of the area independently of development impacts. Habitat enhancement measures are a benefit of the development which should be taken into account in the development management test set out in the second paragraph of NH5. This development management test is also reflected in paragraph 3.4 of the SPPS.

4.23 In seeking to address concerns raised by NIEA Natural Environment Division (NIEA NED) in their consultation response of 4th November 2014, the potential impact upon NI priority habitats has been quantified in detail to demonstrate both the permanent and temporary habitat loss, for the purposes of discussing mitigation. However, it is also important to quantify and illustrate the potential areas of habitat enhancement and management that could result in a significant improvement to the quality of NI priority habitats within the site and on lands within the control of the applicant over the lifetime of the wind farm. It is important to differentiate the mitigation of impacts of construction and works of enhancement, which can be regarded as a benefit of the project.

Current Habitat Conditions and Ecology at Barr Cregg

Site Conditions, Peatland and Habitat Conditions and Ecology

4.24 The proposed wind farm development site at Barr Cregg consists of gentle slopes at elevations between approximately 190 m AOD to 120m AOD, with areas of improved grassland in the north of the site and modified and degraded heather moorland and blanket bog vegetation communities in the southern, main, part of the site. Moorland and blanket bog communities have been classed in Chapter 7 of the Environmental Statement (ES) as modified versions of National Vegetation Classification (NVC) communities M19, M15 and M25.

4.25 Peat depths across the site are generally between 0.5-2m deep, with small pockets of peat up to 3m deep. The total area included within the Planning Application Boundary is 0.756 km2 (approximately 75.6 Ha).

4.26 The whole site drains to the Burntollet River, which runs adjacent to or parallel to the northern site boundary.

4.27 The River Faughan & Tributaries Site of Community Importance (SCI) and Area of Special Scientific Interest (ASSI) is located within the site of the proposed wind farm. Designation details are provided in Chapter 7 of the ES. The boundary of the SCI/ASSI in relation to the proposed wind farm is illustrated in Figure 7.1 of the Environmental Statement (August 2012).

4.28 The western part of the site (turbines 1-5) is subject to a DARD Countryside Management Scheme and there is evidence across the whole site of past peat cutting, installation of an extensive man-made drainage system and more

recently, the maintenance and cleaning out of existing drainage ditches, mowing and grazing by both sheep and cattle.

Land Management and Agri - Environmental Schemes

4.29 The land proposed for the Barr Cregg Wind Farm Development is in agricultural use. The land has been drained and the vegetation swards have been mown for sheep and cattle grazing.

4.30 The main feature of the site, apparent both on the ground and visible in aerial imagery, is the intensive drainage that can be seen across all parts of the site (see Figure 4.1 – Watercourse & Drainage Ditches). Most notably, the construction of 6,200 'gripps' (field drains 5m long, 18" wide at top, 12" deep & 9" wide at bottom) were installed in July 1969 in the western part of the site (turbines 1-5) under a Ministry of Agriculture – Agriculture Development Scheme (see Appendix 4.5). This was followed by the installation of the larger man-made drainage ditch through the middle of the site in the 1980's. Drainage is most notable in the areas of T1, T3, and between T1 and T2, in the valley south west of T4 and to the north west of T5. At the time of the site visit in February 2016, the majority of the larger drainage ditches had been maintained (cleaned out) (in compliance with landowners CMS prescription – see Appendix 4.3) and were flowing freely and actively draining the site.

4.31 The main locations of former peat cutting are in the areas around T2, T5, T6 and T7. These are all areas of historic manual peat cutting. Some exposed peat edges are still visible, but in the main these have now re-vegetated.

4.32 The area between T1 and T2 has been cut in the past using a mechanical 'sausage machine', whereby ribbons of wet peat are extruded from below the surface, allowed to dry on the surface and then removed. This methods causes the surface peat to dry out, become more dense and harden.

4.33 In several areas on site it is clear that mowing has been a regular and recent activity, as indicated by very short and stunted vegetation growth, linear patterns in vegetation regrowth (see Photographs 1, 2 and 3 in the Peat Condition Report, FEI 2014) and dry and compacted surface peat conditions, caused by trafficking.

4.34 Lands in the western part of the Barr Cregg site (around turbines 1-5) were subject to a Department of Agriculture and Rural Development (DARD) Countryside Management Scheme (CMS). The land management restrictions imposed under the CMS for each type of land are listed in Appendix 4.3. Improved grassland, unimproved grassland, rough moorland and wet heath are all covered by the agri-environment scheme.

4.35 There are management restrictions for each type of land under the CMS. However the following activities, that have the potential to restrict and or stop the accumulation of peat and render it inactive, are allowed:

- Unimproved Grassland
  - No Stock rate restrictions in fact unimproved grassland must be maintained by grazing.
  - A hay crop or light silage crop may be removed.

- Rough Moorland
  - Stock rate restriction of 0.75 livestock units per hectare all year.
  - Existing drainage systems can be maintained but not widened, deepened or extended.
  - Peat cutting is limited to 0.1Ha for domestic use.
- Wet Heath
  - Stock rate restriction as follows: sheep (0.25 livestock units per hectare – 1 March to 31 October) or
  - cattle (0.20 livestock units per hectare – 1 June to 31 August).
  - Existing drainage systems can be maintained but not widened, deepened or extended.
  - Peat cutting is limited to 0.1Ha for domestic use.
  - Burning requires written permission from DARD and cannot be carried out from 15 April to 31 August.

4.36 The DARD carried out a site inspection on the western portion of the site (Turbines 1 – 5) to check compliance under the Countryside Management Scheme (CMS) on 10th December 2013 following a referral from the Northern Ireland Environment Agency and to review land management practices on site. DARD confirmed that there were no breaches of the CMS.

4.37 The land owners voluntarily opted into the CMS which ended on the 13th May 2016. The restrictions noted below no longer apply to these lands. In addition, there is currently no proposed replacement for the CMS.

4.38 The lands to the east (ie around Turbines 6 and 7) were not part of the CMS and the restrictions noted below do not apply to these lands.

National Vegetation Classification Communities

4.39 NVC was devised as a method of describing and classifying British vegetation according to its plant species composition. The method of attributing vegetation communities to NVC is based on quadrat data recording the cover of all plant species and is usually carried out in the field by an experienced surveyor, based on professional experience. It can be, but is not usually, verified by using computer software such as TABLEFIT or MAVIS. It is extremely difficult to attribute degraded forms of habitat to an NVC class. Nevertheless, for Ecological Impact Assessment (EcIA) purposes, all efforts are made to attribute even degraded versions of vegetation communities to the NVC class they are assessed as being closest to. When computer software is used to verify NVC classes for degraded habitats such as those at Barr Cregg, the 'goodness of fit' can often be lower than 50%. 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. Since NVC class is one of the key indicators of whether blanket bog is 'active' or not, it is important to understand how degraded is the NVC community.

4.40 To test the goodness of fit of NVC classes at Barr Cregg in four areas of the proposed development footprint where the M19 blanket bog habitat is assessed to

be degraded, a series of quadrats were recorded in March 2016 and tested using MAVIS (Modular Analysis of Vegetation Information System). MAVIS is a program that analyses vegetation data using different types of classification systems, including the National Vegetation Classification (NVC). The results of the 'goodness of fit' test are provided in Appendix 4.6. The interpretation of MAVIS results and what they mean for the condition of NVC communities is provided in the section entitled "Condition of NVC Communities at Barr Cregg".

Assessment of 'Active' Blanket Bog at Barr Cregg

4.41 When assessing whether the blanket bog is 'active' or not, a number of different types of information are taken into account and policy issues relating to the consequences of this assessment are discussed in paragraphs 4.5 – 4.23. In addition to information about the NVC communities and the presence of particular plant species which are considered to be bog 'builders', such as bog cottons (*Eriophorum* spp) and *Sphagnum* mosses, the assessment of whether a site supports 'active' blanket peat includes an depends on (a) depth of peat (generally >0.5m), (b) hydrological conditions (generally an intact and functional acrotelm[1] and catotelm[2]), and (c) whether the peat has been excessively degraded or damaged such that semi-natural peatland vegetation (and hence the peat) is no longer growing.

4.42 In terms of precisely defining these habitats, the key reference document is the European Commission's Interpretation Manual of European Union Habitats. Blanket bogs are European priority habitats if they are 'active'. The manual defines active to mean "*still supporting a significant area of vegetation that is normally peat forming*". The term 'active', in relation to peatlands, therefore incorporates two main concepts –'peat forming' and 'significant area'.

4.43 At Barr Cregg, large parts of the blanket bog are degraded, particularly where drainage, mowing and sheep grazing is taking place. Many of the drainage ditches and gripps across blanket bog in the vicinity of turbines 1-5 have recently been maintained (cleaned out) to improve the drainage further.

4.44 In order to assess whether blanket bog is active or not, the NIEA produced an internal guidance note (NIEA 2012) which provides the following list of characteristics which are more likely to be found in active peatland:

- *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

[1] The **acrotelm** is the surface (aerated) layer of peat, above the fluctuating water table, in which live bog vegetation grows. It is normally fibrous, of low bulk density and highly permeable. Drainage causes this layer to dry out, shrink, crack and become compacted, causing it to lose its typical physical and hydrological characteristics and its ability to support characteristic bog plant species.

[2] The **catotelm** is the sub-surface (anaerobic) layer of peat below the water table, which is saturated, highly humified and physically often sludge-like in character.

- E. *vaginatum/ angustifolium* is present in significant quantities with some *Sphagnum*
- The typical range of blanket bog species is present as indicated within the interpretation manual
- There is a hummock and pool topography

4.45 The peat conditions at Barr Cregg are described in more detail below, but in terms of 'active' peat, only two partial indicators are present: the presence of *Eriophorum vaginatum* and some areas of peat that are deeper than 0.5m. Most importantly, there is a general absence of *Sphagnum* in many areas of degraded blanket bog. For example, *Sphagnum* is absent in the area mapped as M19 along the main access track to the south of the proposed substation.

4.46 NIEA also indicate that blanket bog is less likely to be 'active' if the following characteristics are present:

- None or very little *Sphagnum* is present
- A significant amount of non-typical bog community species is present as indicated within the interpretation manual e.g. soft rush
- There is a mosaic with acid grassland or dry heath
- Peat depth is less than 0.5m
- The surface is dry and / or the hydrology is severely affected by deep drains
- There are large areas of bare peat and / or algal mats

4.47 At Barr Cregg, *Sphagnum* mosses are not frequent and have low % cover in areas of NVC M19 and only very occasionally in areas of M15. These communities are described in more detail below.

4.48 The European Commission's (EC) interpretation of active peatland is "*a significant area of peat forming vegetation"* and therefore recognises the mosaic of habitats that can occur within blanket bog. An assessment of how intact is the peat hydrology is a key consideration in deciding whether the blanket bog is active or not. The NIEA state that "*If a survey finds small isolated pockets of active peat, such as in drains, then the unit would not be considered to be active. However if larger areas of active peat are identified with smaller areas of inactive peatland, this would indicate that the hydrological unit is mainly active. In these cases impacts to inactive areas could indirectly impact on adjacent active areas due to introduced hydrological changes. We will consider the unit to be classified as active*".

4.49 Taking all of the evidence and guidance into account, our assessment is that many areas of blanket bog habitat, mapped as M19 on the NVC map (reproduced as a combined Phase 1 habitat and NVC map in Figure 4.2), are not active, due to on-going agricultural land management activities. They will remain inactive until the on-going damaging agricultural land management practices of ditch cleaning, mowing/flailing and stock grazing/trampling are removed.

Condition of NVC communities at Barr Cregg

4.50 At Barr Cregg, the degraded blanket bog and moorland habitats were attributed to three NVC classes in Chapter 7 of the ES. These are:

- M15 *Trichophorum cespitosum-Erica tetralix* wet heath
- M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire
- M25 *Molinia caerulea-Potentilla erecta* mire

4.51 The NVC map, reproduced in Figure 4.1, shows the distribution of these heathland/peatland NVC communities which are classed as NI priority habitats in the NI HAP. The site was re-surveyed in September 2013 and vegetation communities were found at that time to be in poorer condition than at the time of the NVC survey in November 2011 and March 2012. This is almost certainly because the landowners have focused more on farming activities in the last few years and land management practices have degraded the peatland further. The current status and condition of these communities is described briefly below, with photographs of the current condition of peatland habitats illustrated in Appendix 4.2.

Blanket Bog

4.52 M19 and M25 communities listed above represent blanket bog habitats. Both habitats are widespread across the site and both have been substantially altered and degraded by drainage, mowing, stock grazing and a smaller area by mechanical peat cutting. The condition of these habitats has been described in Chapter 7 of the ES and in the Peat Condition Report which was submitted as part of the Further Environmental Information (FEI) in 2014. The following paragraphs briefly describe the condition of these habitats in February 2016.

M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire

4.53 Four parts of the proposed development footprint impinge on M19 vegetation. These are (a) the route of the main access track to the south of the proposed substation, (b) around Turbine 4, around Turbine 3, and along the track between Turbine 1 and Turbine2. Each is described below.

M19 at the main access

4.54 The M19 community at the main access was heavily flailed and surface vegetation severely damaged in Autumn 2013. This is illustrated in the Peat Condition Report (Appendix 7.1 - FEI 2014). Although flailing is a normal agricultural activity within the CMS for the site, the M19 community was assessed in Autumn 2013 as being inactive blanket bog, due to the severe degree of the damage and the excessively dry nature of the peat. It is likely that damage to the blanket bog was more severe than usual because flailing was carried out at the end of a very dry spell of summer weather in 2013 and further evaporation from the exposed bare peat resulted in irreversibly drying out the peat surface, making it hard and impervious in some places and dry and powdery and subject to wind erosion in others.

4.55 In February 2016, this community consists of recovering *Molinia caerulea* and *Eriophorum vaginatum* with occasional, very patchy *Calluna vulgaris*, occasional *Erica tetralix* and occasional *Narthecium ossifragum*. There are still significant areas of bare peat. This is illustrated in Photographs B1 and B2 in Appendix 4.2. To illustrate what good quality M19 vegetation looks like, compared to this community at Barr Cregg, comparative photographs are provided (Photographs A1 and A2) in Appendix 4.1. Photograph A2 shows a healthy *Calluna* and *Eriophorum* sward, representing good quality M19. Photograph A1 shows the route of the access track at Barr Cregg where the vegetation classed as M19 is dominated by *Molinia and Eriophorum,* with a paucity of *Calluna* and an absence of *Sphagnum* moss species.

4.56 On the basis of these observations, large parts of this community would not now be classified as M19 due, for example, to the paucity of *Calluna vulgaris* and the total absence of *Sphagnum* in the understory.

4.57 To test this M19 classification, a series of 20 quadrats were recorded in this area in March 2016 to determine, using MAVIS software, the 'goodness of fit' to the NVC class M19 that it had been attributed to in the Environmental Statement. The full results of this exercise are provided in Appendix 4.6.

4.58 The MAVIS results show that, on an individual basis, only three out of twenty quadrats indicated any similarity to an M19 community and those three that did showed only a 45.9 to 52.8% goodness of fit. When taken as a group of twenty quadrats, the M19 community was only the second best fit, with an aggregate goodness of fit of 57%. These poor goodness of fit results show that this area near the main access is a mixture of heathland and bog plant species, but the current vegetation and peatland conditions are too varied, due to past and present agricultural practices, to be attributed to any one NVC community.

4.59 These MAVIS results illustrate very well the difficulty in attributing an NVC class to a highly degraded vegetation community.

4.60 The route of the proposed access track lies in the lower part of the slope where the dominant vegetation is a mixture of *Molinia* and *Eriophorum* with a total absence of *Sphagnum*. See photographs B1 and B2 in Appendix 4.2 (which should be compared to Photograph A1 in Appendix 4.1 which shows good quality M19 vegetation).

4.61 The surface peat in this part of the site is compacted, hard and dry and not typical of an active acrotelm. Peat depth along this section of the access track varies from 0.25-1.3m. This range of peat depths appears to be due partly to heavy flailing of the vegetation and cutting off of surface vegetation in the past. This community at the main access is degraded blanket bog. Considering the damage to the acrotelm, the hard and compacted peat surface and the dominance of *Molinia* and *Eriophorum* rather than *Calluna* and *Sphagnum*, and the difficulty in attributing it to any one NVC community, this very poor and highly degraded M19 peatland community is not 'active' blanket bog, due to the on-going land management activities of flailing and drainage. Only if land

management practices are removed would this area of blanket bog, over time, become active again.

M19 at turbine 4

4.62 The M19 community at turbine 4 has been both drained and heavily grazed by sheep. This is illustrated in Photograph B3 in Appendix 4.2. This vegetation community was mapped as M19 (*Calluna vulgaris-Eriophorum vaginatum* blanket mire). It is dominated by *Eriophorum vaginatum* with severely stunted *Calluna* vulgaris and a limited presence of *Sphagnum* and again illustrates the difficulty in attributing NVC class to a highly degraded vegetation community.

4.63 To test this M19 classification, a series of 20 quadrats were recorded in this area in March 2016 to determine, using MAVIS software, the 'goodness of fit' to the NVC class M19 that it had been attributed to in the Environmental Statement. The full results of this exercise are provided in Appendix 4.6.

4.64 The MAVIS results show that, on an individual basis, eleven out of twenty quadrats did indicate some similarity to an M19 community, showing a 48.1% to 59.7% goodness of fit. When taken as a group of twenty quadrats, the M19 community was the best fit, but only with an aggregate goodness of fit of 64%. These poor goodness of fit results show that the micrositing area around T4 is a highly degraded form of M19 which has been damaged by drainage and sheep grazing.

4.65 Drainage ditches across the blanket bog south west of turbine 4 have been recently maintained (cleaned out)(see Photograph B4 in Appendix B). At the time of the site visit in February 2016, recently maintained (cleaned out) drains were flowing freely indicating that they were working well to further dry out the bog.

4.66 The surface peat at turbine 4 is also compacted, hard and dry and not typical of an active acrotelm. Peat depth at turbine 4 is >1m. This vegetation community at turbine 4 has the appearance of a dry heathland rather than bog. However it has been classed as, and MAVIS has confirmed it to be, a highly degraded form of M19 blanket bog. Considering the damage to the acrotelm, the paucity of *Sphagnum* and the poor and stunted condition of *Calluna* and other species, this peatland is not 'active' blanket bog, due to the on-going land management activities of drainage and sheep grazing. Only if land management practices are removed would this area of blanket bog, over time, become active again.

M19 at Turbine 3

4.67 The vegetation community within the microsite of turbine 3 has been mapped as M19 blanket bog. In this area, the convergence of drainage ditches and the fact that they have been recently maintained (cleaned out), combined with past mowing and current sheep grazing, has resulted in a compacted, hard and dried out surface peat, with stunted vegetation and a paucity of *Sphagnum*.

4.68 To test the goodness of fit to the M19 NVC classification, a series of 20 quadrats were recorded in this area in March 2016 and tested using MAVIS software. The full results of this exercise are provided in Appendix 4.6.

4.69 The MAVIS results show that, on an individual basis, sixteen out of twenty quadrats indicated a similarity to an M19 community, with a 45.19 to 67.6% goodness of fit. When taken as a group of twenty quadrats, the M19 community was the best fit, with an aggregate goodness of fit of 65.02%. These poor goodness of fit results show that the micrositing area around turbine 3 is correctly classified as M19 but that the current vegetation conditions are very poor, due to past and present agricultural practices, indicating a highly degraded M19 NVC community.

4.70 The surface peat at turbine 3 is compacted, hard and dry and not typical of an active acrotelm. Peat depth at turbine 3 is >1m. The vegetation community at turbine 3 has the appearance of a dry heathland, not blanket bog. However it has been classed as, and MAVIS has confirmed it to be, a highly degraded form of M19 blanket bog. Considering the damage to the acrotelm and the poor and stunted condition of *Calluna* and other species, the peatland in this area is not 'active' blanket bog, due to the on-going land management activities of drainage, mowing and sheep grazing. Only if land management practices are removed would this area of blanket bog, over time, become active again.

M19 between Turbines 1 and 2

4.71 The vegetation between Turbines 1 and 2 has been mapped as M25 blanket bog nearest to Turbine 1, grading into M19 blanket bog around Turbine 2. In this area, past mechanical peat cutting by 'sausage machine' has caused the peat surface to become dry, dense and hardened. This part of the site has also been intensely drained (Figure 4.1), with drainage ditches recently maintained (cleaned out). These effects, combined with past mowing and current sheep grazing, has resulted in a compacted, hard and dried out surface peat, with stunted vegetation and a paucity of *Sphagnum*.

4.72 To test the goodness of fit to the M19 or M25 NVC classifications, a series of 20 quadrats were recorded in this area in March 2016 and tested using MAVIS software. The full results of this exercise are provided in Appendix 4.6.

4.73 The MAVIS results show that, on an individual basis, fifteen out of twenty quadrats indicated a similarity to an M19 community, with a 42.91 to 61.61% goodness of fit. The goodness of fit to M19 was lowest closer to Turbine 1 and became higher towards Turbine 2. When taken as a group of twenty quadrats, the M19 community was the best fit, with an aggregate goodness of fit of 64.89%. The NVC mapping in the ES Figure 7.5 indicated that M25 (*Molinia caerulea* mire) was present around T1, grading into M19 towards T2. The MAVIS analysis showed no similarity to M25 anywhere along the track between these two turbines.

4.74 The poor M19 goodness of fit results show that the NVC community around T1 was incorrectly classified as M25 and that the whole of the stretch of track between T1 and T2 should have been classed as degraded M19 community. The current vegetation conditions in this part of the site are very poor, due to past mechanical peat cutting and present agricultural practices, indicating a highly degraded M19 NVC community.

4.75 The surface peat between T1 and T2 is compacted, very hard and dry and not typical of an active acrotelm. Peat depth along this route is >1m throughout. Considering the damage to the acrotelm and the poor and stunted condition of *Calluna* and other species, the peatland in this area is not 'active' blanket bog, due to past mechanical peat cutting and the on-going land management activities of drainage, mowing and sheep grazing. Only if land management practices are removed would this area of blanket bog, over time, become active again.

M25 *Molinia caerulea-Potentilla erecta* mire

4.76 Although the area around T1 was mapped as M25 in the ES, the MAVIS results above have shown it to be more accurately described as highly degraded M19 blanket bog. The whole area of blanket bog east and north of turbine 1 has a series of parallel, curving drainage ditches (see Figure 4.1) which have been recently been maintained (cleaned out). All drainage ditches were flowing freely at the time of the February 2016 site visit, indicating that they are still drying out this area of degraded blanket bog. Photograph A5 in Appendix 4.1 illustrates an area of short, grazed, species-poor M25 sward at Barr Cregg, compared to Photograph A6 which shows a good quality M25 habitat.

Wet Heath

4.77 Areas of wet heath (M15 *Trichophorum cespitosum-Erica tetralix* wet heath) at Barr Cregg have been both drained and grazed by sheep, resulting in very short sward height and a degraded, species-poor community which has a high abundance of *Eriophorum vaginatum* and a lack of *Sphagnum*. In all areas, the drainage ditches have recently been maintained (cleaned out), further drying out this degraded wet heath community. Photograph A3 in Appendix 4.1 illustrates the short, grazed, species-poor sward, compared to Photograph A4 which shows a good quality M15 sward.

Summary of Existing Peatland Degradation

4.78 Although the site has been subject to past manual peat cutting, particularly in the east around turbines 6 and 7, and past mechanical peat cutting (in the area between T1 and T2) the main land management practices which have damaged and are currently degrading both blanket bog and heathland habitats within the Barr Cregg site are drainage, mowing and flailing, and stock grazing, trampling and dunging.

4.79 The effects of these practices were discussed in the Peat Conditions Report (Appendix 7.1 - FEI, 2014). The site visit in February 2016 indicated that peatland habitats are still subject to the same land management practices (that are in compliance with CMS prescriptions where applicable).

Artificial Drainage

4.80 The most damaging of the three land management practices has been drainage, since many drainage ditches across the site have recently been maintained (cleaned out), as can be seen in the example locations below:

Plate 1. Drainage ditches at T3 cleaned out

Plate 2 Main S-N drainage ditch cleaned out, with spoil spread to the side

Plate 3. Recently cleaned drainage ditch at T4

Plate 4. Cleaned out drainage ditches east of T3

4.81 The effects that past and present drainage and past and present mowing has had on large areas of the site are to (a) dry out the peat and (b) compress surface layers so that these areas of bog now have hard, compacted surfaces which prevent infiltration and prevent the re-wetting of dried out peat by rainfall, and natural infiltration.

4.82 One of the main proposals in this OHRMP for habitat enhancement and improvement is to block up, and in some places infill, cleaned out drainage ditches in order to pond up water and to cause water table levels to rise back to the levels which were present prior to artificial drainage.

Mowing and Flailing

4.83 The second most damaging land management activity has been regular mowing and in one location near the main access, severe flailing which removed the surface vegetation. Apart from the effect this has had on compressing surface peat layers through trafficking with heavy plant, the main damaging effect has been to skim off surface turf and expose bare peat where vegetation is removed.

4.84 One aim of the OHRMP is to reinstate moorland vegetation, primarily by overseeding with heather, in areas along the access track at the main access where highly degraded M19 vegetation lacks a heather component in the sward.

Stock grazing, trampling and dunging

4.85 Sheep and cattle grazing occur across most of the site. Evidence of surface damage through trampling and cropping of vegetation is seen across the site.

4.86 Since the current CMS ended on the 13th May 2016, the OHRMP aims to work with the landowner in order to continue, over the lifetime of the development, stock grazing restrictions in line with CMS guidelines for blanket bog within the land under the control of the developer. This is discussed in the 'Habitat Enhancement' section of this OHRMP and would reduce the stocking density by a factor of ten over the lifetime of the development.

Conclusions

4.87 In many parts of the site, agricultural land management practices, which were permitted under the landowner's CMS, have nevertheless led to degradation of the majority of the blanket bog at the Barr Cregg site. The main forms of damage are: (a) lowering of the water table level by drainage causing the surface peat to dry out; (b) hardening and compaction of the surface peat caused by drying out and vehicle trafficking across the surface for mowing of the sward or past mechanical peat cutting; (c) grazing by sheep and to a lesser extent cattle. Dry and hardened peat surfaces, and denser surface peat are indications that the normally spongy and wet surface acrotelm of the blanket bog is no longer functioning. This has led to much slower and poorer growth of bog vegetation and in some places, the absence of the main bog forming species – Sphagnum mosses, which require wet acrotelm conditions to grow.

4.88 When the acrotelm has been compromised in this way, the blanket bog is no longer active, due to on-going agricultural land management practices. Only if these land management practices are removed would these areas of blanket bog, over time, become active again.

Brief Description of the Proposed Development

4.89 The proposed development consists of the following permanent infrastructure elements (footprint dimensions for each is provided in Table 3):

- 7 Turbines and associated crane pads
- 4347m of access track (typically 5m wide with approximately 2m verges either side),between 1310m - 1487m of which will be floated (typically 5m wide, with a 1m batter either side)
- Substation compound and control building
- Permanent meteorological mast
- Two bridges crossing watercourses

4.90 In addition to the above, there will be temporary infrastructure, as follows:

- Construction compound
- Enabling works compound
- Crane pad hardstand
- A number of passing bays along the access track

4.91 The total permanent footprint of the development infrastructure will be approximately 36,605m^2. The total temporary footprint during the construction phase of the development including verges / batters will be approximately 24,379m^2. A breakdown of the permanent and temporary footprint areas is provided in Table 3.

Assessment of Potential Impacts on Peatlands

Mitigation built into the design of the wind farm

4.93 A description of 'mitigation built into the design of the wind farm' has been described in the introduction to this document. For impact assessment purposes, CIEEM (2016) guidance recommends that after mitigation built into the design of the development has been taken into account, all insignificant impacts should be scoped out. Only potentially significant impacts are described below, together with mitigation measures.

Types of potential impacts during construction

4.94 The construction of the wind farm is likely to result in two potentially significant adverse impacts on the degraded peatland habitats their associated peat within the Planning Application boundary. These impacts are listed below.

- **Land take** - a direct adverse impact on both degraded blanket bog and heathland (despite being degraded, both are, nevertheless, classified as UKBAP/NIHAP priority habitats).
- **Alteration of peat hydrology** – a potential indirect adverse impact on blanket bog habitat.

4.95 Each of these impacts is briefly discussed below.

4.96 Although this is a Habitat Management Plan, some explanation of the environmental impact assessment (EIA) is provided here for clarity and in order to explain the terminology used.

4.97 Appendix 4.7 provides a description of the EIA process and definitions for impact magnitude, value and sensitivity of the ecological receptor/receiving environment, and significance of impacts. The definitions include relevant hydrology and peatland examples to assist in understanding how the definitions are applied.

4.98 The definitions of receptor value and sensitivity are of key importance in understanding how the EIA is applied to peatland habitats, particularly degraded forms of blanket bog. It is important to note that the value and sensitivity of blanket bog as an ecological receptor must be assessed separately.

4.99 The EIA methodology used in this document properly draws a distinction between the value and sensitivity of blanket bog habitat and Appendix 4.7 more fully records the methodology which has been used. Based on this approach, and on the surveys which have been carried out, the following approach to receptor value and sensitivity has been adopted to the blanket bog on the application site

- Blanket bog habitat within the wind farm infrastructure footprint cannot be categorised as being of *very* high value because it is degraded, not intact and is not therefore active.
- Nevertheless, the Applicant recognises that the blanket bog habitat within the site deserves to be addressed as habitat of high value because of its status recorded in Annex 1 of the Habitats Directive and because of the approach taken

to priority habitats within the NI HAP (and, as per the CIEEM (2016) guidance, noting the potential to restore the degraded habitats at Barr Cregg).

- Nevertheless the sensitivity of the blanket bog habitat to the development proposed is assessed as medium because of the habitat's degraded status and its correspondingly lower sensitivity to the impact of development. This is discussed and explained in more detail in paragraphs 4.100 - 4.103 and Table 1 below.
- Recognising the high value which should be attributed to blanket bog habitat, the Applicant properly proposes the appropriate mitigation of construction impacts. Again, recognising the inherent value of blanket bog, the Applicant proposes extensive habitat enhancement measures so as to improve the longer term environmental capital of the site.

4.100 Assessing the sensitivity of blanket bog to further impacts requires an understanding of (a) the health of the vegetation, (b) peat hydrology, particularly the intactness and function of the acrotelm and (c) peat structure, composition, density and 'strength'.

4.101 The sensitivity of a receptor incorporates the ecological concepts of 'stability' and 'resilience'. In simple terms, if an ecological receptor (eg a habitat) is stable, it is resistant to small short-lived disturbances. If it is resilient, it is capable of 'bouncing back' and retaining its functional and organisational structure after a perturbation. These concepts are very useful in assessing how a blanket bog would respond to a disturbance such as excavation.

4.102 In intact, 'active' blanket bog, the act of excavating a ditch or pit causes the water within the functioning acrotelm to drain into the excavation: the peat is 'dewatered'. This can also cause the peat to slump into the excavation since the peat has little strength, depending on its floristic composition, moisture content, density and degree of humification. Thus intact, active blanket bog would be described as being of very highly or highly sensitive to excavation (as a construction activity) because dewatering and slumping would completely change the acrotelm and hence would alter the blanket bog vegetation and habitat. Whether sensitivity is high or very high depends entirely on (a) the type of blanket bog (active bog pool communities dominated by *Sphagnum* species being by far the most sensitive and active *Calluna* and *Molinia* blanket mires being somewhat less sensitive because they are drier and denser), (b) how wet the peat is and (c) whether there has been any previous damaging activities, such as drainage. The 'active', intact blanket bog would be described as having little resilience to the change in hydrology.

4.103 In degraded blanket bog, such as that at Barr Cregg, where the acrotelm has already been damaged and the peat surface is dry, hard and dense, the peat's sensitivity to further damage has been reduced. The sensitivity of this kind of blanket bog at Barr Cregg is assessed as being medium, since the acrotelm has already been substantially altered, vegetation has already been changed (both vegetation composition and stature) and the density of surface peat has been increased. Rainfall infiltation into the hardened peat surface is impeded and throughflow characteristics altered. The peat hydrology and the acrotelm

conditions are already damaged and, because the dried out peat is now less sensitive to change, further damage, through, for example, excavation, would be unlikely to change to peat's density and hydrology much further. However, it has been shown in many restoration projects that ditch blocking can successfully rewet and return blanket bog to its former 'active' state and this potential for restoration should also be a consideration in assessing the sensitivity of degraded peatland.

4.104 A summary of examples is provided in Table 1 below to show how the value and sensitivity of blanket bog receptors have been assessed in this document These descriptions are *examples* and the final, site-specific, impact assessment will always be based on professional judgement.

Table 1a. Example definition of the *value* of blanket bog habitat receptors

Receptor value	Blanket bog habitat condition/description
Very high	EU Priority Habitat – both Designated Site e.g. SAC and not designated Intact, 'active' blanket bog. Healthy flourishing bog vegetation, dominated by *Sphagnum* (bog pool communities), also including blanket bogs and mires with frequent to abundant *Sphagnum* and abundant associated species such as *Calluna, Eriophorum, Trichophorum and Molinia*.
High	UK and NI Priority Habitats All areas of blanket bog supporting semi natural blanket bog vegetation including intact surfaces, drained and cutover bog whether or not it may be defined as 'active' (actively laying down peat). Habitats still dominated by vegetation species typical of blanket bog, including *Sphagnum, Calluna, Eriophorum, Trichophorum* and *Molinia*.
Medium/Low	Blanket Bog that no longer supports semi natural blanket bog vegetation. Areas which were formerly blanket bog (the have peat substrates) but can no longer be considered as blanket bog due to the extent of agricultural practices, including drainage which, over time, have changed the vegetation to communities dominated by grasses and rush.

Table 1b. Example definitions of the *sensitivity* of blanket bog habitat receptors

Receptor sensitivity	Condition of peat and peat hydrology
Very high	Deep peat, usually >1m deep but could be >0.5m deep, 'active', intact and functioning acrotelm and catotelm, typical of bog pool communities, dominated by *Sphagnum* species that is not damaged by agricultural or other anthropogenic practices.
High	Deep peat, >0.5m deep, damaged acrotelm but water table level recovering and reduced dryness and density of acrotelmic peat. Damaging activities (drainage, peat cutting, mowing etc) have been removed and visible hydrological and vegetation recovery is in progress.
Medium	Acrotelm seriously damaged – dried out and compacted, due to drainage and use of vehicles, no longer spongy and wet. The sensitivity of the peatland receptor has already been substantially reduced and further damage, through, for example, excavation, would be unlikely to alter the sensitivity much further. Damaging activities (drainage, peat cutting, mowing etc) are still being carried out.
Low	Shallow peat, <0.5m deep. Not classified as blanket bog or areas of peatland that have been extensively eroded such that there is no remaining vegetation.

Habitats Impacted by the Development (quantification of direct habitat loss)

4.105 The construction of seven turbines and associated crane hardstandings and access tracks will have a direct impact on degraded blanket bog and degraded heathland habitats at Barr Cregg. Due to ongoing agricultural management of both blanket bog and heathland and their degraded condition, these habitats are considered to be ecological receptors of high value, not *very* high value since agricultural drainage and repeated mowing of the sward, and, between T1 and T2, past mechanical peat cutting, have altered the acrotelm in such a way that surface peat hydrology has been compromised, the peat has become dry, hard and dense, resulting in the general loss of *Sphagnum* moss species. The growth and resultant stature of Ericoid species is stunted as a result of repeated mowing.

4.106 Table 2 below describes the habitat type and condition at the location of each turbine.

Table 2. Habitat type and condition at the location of each turbine

Turbine	Habitat type	Habitat condition
T1	M25 *Molinia caerulea-Potentilla erecta* mire	Degraded: Drainage ditches recently cleaned out and flowing freely, previously mowed, sheep grazed. Peat surface compacted, dry and hard. Short cropped vegetation sward.
T2	M15 *Trichophorum cespitosum-Erica tetralix* wet heath	Degraded: Previously mowed, sheep grazed. Peat surface compacted, dry and hard. Short cropped vegetation sward.
T3	M25 *Molinia caerulea-Potentilla erecta* mire	Degraded: Drainage ditches recently cleaned out, previously mowed, sheep grazed. Peat surface compacted and hard. Short cropped vegetation sward.
T4	M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire	Degraded: Drainage ditches recently cleaned out to both north and south. Vegetation sheep grazed and the sward is very short and stunted.
T5	M15 *Trichophorum cespitosum-Erica tetralix* wet heath	Degraded: Previously mowed, sheep grazed. Peat surface compacted, dry and hard. Short cropped vegetation sward.
T6	M15 *Trichophorum cespitosum-Erica tetralix* wet heath	Shallow surface peat layer (<25cm), *Molinia* dominant with Ericoid sps only sub-dominant. Light sheep grazing.
T7	M15 *Trichophorum cespitosum-Erica tetralix* wet heath	Regenerating sward in area of historic peat cutting. Beginning to revert to scrub with gorse and birch encroaching.

4.107 These areas of degraded blanket bog as assessed to be ecological receptors of medium sensitivity because the acrotelm in each case has been substantially changed by drying out and compaction and agricultural practices of drainage, mowing and grazing are still being carried out. The acrotelm will not be as sensitive to excavation since the infiltration and throughflow characteristics of dry, dense and compacted peat are very different from those of intact, wet and soft, spongy peat.

4.108 Table 3 shows the areas of M19, M25 and M15 habitat that will be directly impacted by the turbine/crane pad footprints.

Table 3. Areas of temporary and permanent habitat loss

Habitat Type	Temporary* Loss (m^2)	Permanent Loss (m^2)	Combined Loss (m^2)
M19	2805	6377.5	9182.5
M25	7549	10674	18223
M15	5563	9627	15190
SI Grassland	8462	9927	18389
Total	**24379**	**36605.5**	**60984.5**

* Temporary habitat loss has been calculated using a 5m batter around all crane hardstands, 2m wide verges along all stretches of cut access track and 1m batter along stretches of floated track, plus the area of the construction and enabling compounds.

4.109 Overall approximately 6378m^2 of permanent land take will be in degraded M19 blanket bog, 10,674m^2 will be in degraded M25 mire and 9627m^2 will be in degraded M15 wet heathland. The breakdown of habitat loss per element of infrastructure footprint is provided in Appendix 4.4.

4.110 The longest section of access track (an area of 8010m^2) will be in semi-improved grassland, compared to 4791m^2 in M19, 5944m^2 in M15 and 6982m^2 in M25 degraded peatland habitats.

4.111 All other infrastructure (substation and control building, construction compound, enabling compound) will be located in semi-improved grassland.

4.112 Land take associated with turbines, crane hardstandings and new access tracks will be for the lifetime of the development, which will be for a minimum of 25 years.

4.113 Permanent (for 25 years) land take of degraded blanket bog which is in poor condition will be a direct, adverse impact on a habitat of high value and medium sensitivity. The magnitude of the impact is assessed as being low to medium, since the footprint of the development is calculated to result in the loss of approximately 2.4% of degraded M19 blanket bog habitat, 8.1% of degraded wet heath habitat and 6.1% of degraded M25 bog habitat within the Planning Application Boundary (see Table 4). Since this is an impact of low to medium magnitude on habitat receptors of high value and medium sensitivity, this impact is assessed as being of moderate significance. Note that the peatland habitat receptors are not assessed as being of very high value since they are already degraded. As a matter of good practice provision is proposed for the mitigation of impacts as well as extensive habitat enhancement.

Table 4. Land take (habitat loss) for the lifetime of the development

NVC class	Total area within Planning Application boundary (m^2)	Total area of development footprint (m^2)	% habitat loss
Degraded M19	265,216	6377.5	2.40%
Degraded M25)	132,171	10,674	8.08%
Degraded M15	157,985	9627	6.09%
Total peatland habitat	555,372	26,678.5	8.40%

Alteration of peat hydrology

4.114 Where excavation, as part of the construction works, takes place in deep peat, there is the potential that the hydrology of adjacent peat may be altered. At Barr Cregg, the depth of peat across the blanket bog part of the site (ie where peat exists as opposed to improved and semi-improved grassland on mineral soils) ranges from 0.2 to 3.3m.

4.115 The wind farm layout has been designed so that no turbines are located in areas of deeper peat. Floating road methods of access track construction will be used in any area where the peat depth is approximately 0.5m deep (in order to minimise excavation of peat). These locations are indicated in Figure 4.2. This, together with the fact that the degraded peatlands in these areas are already drained and dried out, means that there is no potential or only very limited potential for a small, localised dewatering/drainage impact on peat hydrology in any area of deeper peat. At Barr Cregg this impact is considered to be of minor significance.

4.116 Since there has been mechanical peat cutting in the area between T1 and T2 in the past, it may be necessary for engineering reasons to construct the access track between these two turbines as a cut track, not a floated track. If this is required, there is the potential for an adverse, indirect impact on peat hydrology in this area. Preliminary peat depth probing to inform the peat slide risk assessment indicated that the peat depth along this section of track is over 1m deep, with one location between T1 and T2 up to 2.4m deep. In addition, there is a series of parallel drainage ditches across the blanket bog in this area, crossing the route of the track perpendicularly (see Figure 4.1). Since the blanket bog in this part of the site is already degraded and the acrotelm damaged, if a cut track design is used along this stretch of track there would be the potential for some dewatering of adjacent peat on either side of the track. The sensitivity of the bog to excavation and dewatering is less than that of intact, active bog because drainage and peat cutting has already caused a degree of dewatering and compaction of the peat. Given the already damaged condition of the peat, it is assessed that this indirect impact on adjacent peat would result in a low magnitude effect, possibly extending up to 10m from the track, on a receptor (degraded blanket bog) of high value but medium sensitivity. This effect would likely cause a long term change in the biodiversity and health of bog vegetation in this small, 10m zone adjacent to the track. This would result in an adverse impact of minor to moderate significance without the implementation of further mitigation.

4.117 Since one of the main activities that has damaged blanket bog across Barr Cregg in the past is artificial drainage of blanket bog, this OHRMP provides details of peatland habitat enhancement within lands under the control of the developer to reinstate peatland hydrology, through ditch blocking, in degraded blanket bog and wet heathland.

Proposed Habitat Restoration and Habitat Enhancement

Introduction

4.118 *Habitat restoration* is used for restoring areas of vegetation that have been damaged by wind farm construction activities such as the restoration of vegetation along access track verges and hardstandings. *Habitat enhancement* is used for activities that are designed to improve the quality of existing degraded habitats on land that is within the control of the developer, and generally provides habitat benefit over and above that which would be considered as compensation. Habitat enhancement targets the blanket bog communities that have been degraded or damaged by land management activities. At Barr Cregg, these activities are: drainage, mowing/flailing and stock grazing/trampling. Both habitat restoration and Habitat enhancement measures at Barr Cregg are discussed in this outline Habitat Restoration and Management Plan.

4.119 This section of the OHRMP is divided into nine sections: (i) evidence of the success of peatland restoration and enhancement from around the UK, (ii) methods of habitat restoration within the construction footprint, (iii) habitat enhancement on lands within the control of the developer, (iv) working with landowners to improve land management, (v) assessment of overall habitat betterment, (vi) other ecological benefits of habitat enhancement, including ornithology, (vii) verification of the status of badger (viii) fisheries habitat management, and (ix) hydrological benefits of habitat enhancement.

Evidence of the success of blanket bog and heathland habitat restoration (example projects from around the UK including NI)

4.120 At Barr Cregg the aim will be to restore and enhance areas of both degraded blanket bog and degraded wet heathland. This section therefore addresses both types of habitat. It is salient to note here that M15 communities are described as 'wet heathland' in the EU Habitats Directive. However, where these communities occur on peat deposits exceeding 0.5m depth they are, for the purposes of this OHRMP, considered to be blanket bog.

4.121 Many blanket bog restorations projects have been undertaken successfully across the UK, including projects in Scotland, the North York Moors and the Peak District National Parks, lands disturbed in order to bury pipelines or electricity cables, as well as road construction, and the construction of power stations and oil terminals. A successful Northern Ireland example has been implemented at the Garron Plateau by the RSPB et al. (2012). The Northern Ireland Peatlands and Uplands Biodiversity Delivery Group (2010) has also produced excellent "*Guidelines for Peatland Restoration*" which are specifically suitable for Northern Ireland conditions.

4.122 Examples of successful peatland and blanket bog restoration programmes include: Department of the Environment for Northern Ireland (DOE-NI) (2010) for restored aggregate sites, wind farms, former commercial peat extraction and ex-forestry sites in Northern Ireland; and ADAS (2004) for restoration and conservation

management of peatlands across the UK. In addition, Natural England has published "*A review of techniques for monitoring the success of peatland restoration*" (Bonnett, et al., 2009) which reviews a wide range of peatland restoration objectives (which include vegetation reinstatement and carbon sequestration) and appropriate ways to assess success (Bonnett et al 2011).

4.123 Ditch blocking to rewet drained blanket bogs has been extensively examined and success reported (eg Penny Anderson; Adrian Armstrong et al. (2010), particularly in relation to raising water table levels and improving carbon storage. Best practice has been assessed and cost-effective methods of ditch blocking recommended (Armstrong et al. 2009).

4.124 The techniques used for blanket bog restoration are well understood by botanists and regulators alike, these methods are likely to succeed, and are no longer considered controversial.

4.125 Across the UK there is also a wealth of experience and published evidence of the efficacy and success of a range of heathland restoration methods and programmes. The EAU (1988) "*Heathland Restoration: A Handbook of Techniques*" is the seminal text providing tested methodologies for restoring heathland habitats in many different kinds of situations. Scottish Natural Heritage (1996a) Information and Advisory Note Number 44: "*Heather re-establishment on mechanically-disturbed areas"* and Putwain and Rae (1988) also provide guidance on methods of heather restoration and re-establishment. Similar methods have been used successfully by The Moorland Association across the UK.

4.126 One of the most important parts of a successful habitat restoration/enhancement programme is to state clearly *a priori* what are the objectives of the work. Without a clear statement of the aims and objectives it is impossible to set up criteria for monitoring by which to judge the success of the work. This OHRMP therefore starts by stating the aims and objectives of both restoration (around the construction footprint) and habitat enhancement elsewhere.

Restoration of vegetation around the development footprint after construction

4.127 In all areas where vegetation is stripped ahead of the construction of access tracks, turbine bases, crane pads, and cabling for the Barr Cregg Wind Farm, there is the need to restore vegetation after the construction activities have been completed. The prime aim of the restoration of vegetation within the wind farm footprint is to re-vegetate bare soil and peaty surface soils to stabilise them, prevent erosion and to reinstate peatland vegetation. A secondary aim is to restore the heather-dominated vegetation that was present prior to construction.

Methods of peatland vegetation restoration

4.128 There are five main methods of restoring the peatland vegetation cover, particularly heather (e.g. EAU, 1988; SNH, 1996a) around the construction footprint:

- Re-turfing with intact blocks of soil and plant cover, including whole heather plants, saved at the time of turf stripping.
- Using "topsoil" with its intact heather seedbank.
- Direct seeding with harvested heather capsules, litter or cut brash material.
- Nursery production of heather seedlings and planting-out.
- Establishing grass cover and relying on natural colonisation of heather to follow.

4.129 The intention at Barr Cregg will be twofold: (a) re-turfing with intact turves stripped ahead of construction, which will be a mixture of semi-improved grassland pasture, wet heath and blanket bog (see the Phase 2 vegetation and NVC map Figure 4.2), and, if required, (b) to enhance restored heathland areas by overseeding any bare peat areas and re-turved heathland areas with locally collected heather seed. The decision on where overseeding of re-turved heathland areas might provide useful enhancement will be made by the Ecological Clerk of Works (ECoW) once the initial turf replacement has been completed.

4.130 Removal and replacement of turf is usually the best option for restoring bare areas around construction developments. This method permits restoration of a near full range of plant community species and possibly elements of the invertebrate fauna. It may also produce more rapid results as it largely involves vegetative regrowth of established plants. All the other methods rely on seedling germination and establishment.

4.131 Four main activities will be carried out to ensure that the restoration is effective and that vegetation is restored as quickly as possible. These are:

- Careful stripping of vegetation turves;
- Storage of intact turves close to their point of origin for as short a period of time as possible;
- Careful reinstatement of turves, with additional heather seeding where suitable; and
- Monitoring of reinstated vegetation.

4.132 Each activity is described in more detail below. Monitoring is described in the section entitled “Monitoring of restored / enhanced areas of peatland”.

Careful stripping of vegetation turf

4.133 Ahead of the construction of turbine bases and cut sections of access tracks, the vegetation will be stripped in intact turves, ideally in large sections using plant such as the bucket of a JCB or digger. The turves should be large in area (ideally around 0.5m x 0.5m) and as deep as the surface soil organic horizon, but not less than 30cm to ensure that the turves stay moist and intact during handling and storage. This will also assist their successful reinstatement. To ensure careful work, it is recommended that an experienced driver is used for this task and that all drivers are trained to meet this requirement.

4.134 For the excavation of cable trenches, a turf stripping and peat excavation technique should be agreed in advance with the contractor so that sections of cable trench (e.g. 400-500m sections) are excavated, laid and restored as quickly

as possible and that the cable trench is not left open across the site and restored in one activity. This will allow the most rapid reinstatement of peatland (and other) vegetation and will prevent drying out of both the stored turves and areas of vegetation adjacent to the trench.

Storage of intact turves

4.135 Stripped turves should be stored as close to their point of origin and for as short a period of time as possible. In the case of turbine bases this is likely to be of the order of weeks, but for cable trenches it should be in the order of days.

4.136 Locations chosen for the storage of peaty vegetation turves should be located away from any areas of valuable peatland vegetation (NVC M19, M25 or M15 within the Barr Cregg Planning Application boundary), as agreed by the ECoW, and should be contained so that (a) turf stripped from areas of degraded blanket bog or degraded heathland is stored vegetation side up, (b) turves stripped from areas of semi-improved grassland or rush pasture are stored no greater than one layer high and (c) no soil erosion can runoff the storage area. Turves from grassland areas can be stacked two layers high. Turf storage areas should be managed so that the turves can be deposited and lifted with minimal impact on underlying vegetation.

4.137 To ensure good conservation and to retain moisture status of turves during storage, particularly in dry weather when desiccation can occur rapidly, they will be covered or they may require periodic watering, as determined by the ECoW, if storage includes any longer spells of hot, sunny and windy weather.

Restoration using stored turves

4.138 The aim will be to restore all construction areas to their original vegetation type using stored turves initially stripped from these areas.

4.139 Where the access track is constructed as a 'cut' track, a methodology shall be agreed with the contractor to design the access track verges and the cable trench in such a way as to minimize the disturbance of stripped vegetation and excavated peat. This could be a single vegetation stripping and storage exercise, or a two-stage process. The single stage approach would involve vegetation restoration on the road verge and over the cable trench as a single process after all the construction work has been completed. A two stage approach would start by constructing the track, followed by restoration of the track verges, then a second process at a slight distance from, but parallel to, the track, would involve excavation of the cable trenches followed by rapid vegetation restoration. The latter two-step process, with the cable trench at an approximate 10m distance from the track, has been shown to speed up the process of vegetation restoration over cable trenches since vegetation re-colonises the restored trench from both sides.

4.140 Restoration around batters of turbine bases, crane hardstandings and sections of cut access track will be achieved by (a) ensuring sufficiently shallow batter gradients to prevent peat erosion, (b) careful levelling and firming of subsoil to the correct density to minimise the risk of uneven settlement, and (c) by careful replacement of turves, butted close together and well tamped into place, so that they will not easily erode. Any unavoidable gaps should be filled with loose peat

and well tamped. The quality of restored areas will be checked by the ECoW immediately after completion to confirm that turf reinstatement has been carried out correctly. Subsequent checks and monitoring of restored areas is described in the section entitled "Monitoring of restored / enhanced areas of peatland".

4.141 Should there be a requirement to dress batters with stored peat in addition to peat turves; the stored peat will be replaced first in a layer, typically of approximately 0.3-0.5m and well tamped into place and leveled in order to reduce the potential for peat erosion. Peat turves will then be carefully placed on top, closely butted, and further tamped into place. The peat and turf replacement process will be carried out as one activity and in no case will any replaced loose peat be left as an exposed layer without turf cover, unless under the guidance of the on-site ECoW. In such cases, revegetation of bare peat will be according to the methods to reseed using heather brash or seed, outlined in 4.143 to 4.152 below.

4.142 Restoration of cable trenches will be completed as soon as sections of trench, 400-500m long, are completed and back-filled. To ensure successful restoration of vegetation along cable trenches, and to ensure that trenches do not become routes of preferential flow for drainage waters, trenches will be designed with cross dams and back-filling and re-turfing will take place immediately after cables have been laid. Appropriate scale plant (such as a JCB) will be used for these activities to minimize as much as possible the trafficking of adjacent peat.

Restoring vegetation using heather seed

4.143 Heather seed is very small and can be produced in great abundance. Heather seed does not ripen until about October, depending on weather conditions. Germination requires light, warmth and moisture, so seed collected in the autumn is best sown in the spring. In the uplands most germination usually occurs in the second half of the summer. If conditions are unsuitable, seed will remain dormant and can persist in the seedbank for decades although viability varies greatly according to site conditions.

4.144 In order to use locally-sourced heather seed for revegetating areas of bare peat and enhancing re-turved areas the Proposed Wind Farm Development, a programme of heather mowing, ideally using a forage harvester, or alternatively a heather vacuuming technique (if appropriate equipment is available) will be conducted on suitable areas of heather moorland in the southern part of the Site. Where heather is cut to generate brash for seeding, this will have the dual benefits of (a) regenerating areas of old and leggy heather in the donor areas and (b) providing seed for reseeding restoration areas. This activity will require a number of component tasks, which will be developed further post-determination and will be managed by the ECoW. Likely tasks will include but will not necessarily be limited to:

- inspection of all areas of heather moorland in the south of the Site to identify and select suitable donor locations for heather seed. Likely areas suitable for cutting will be accessible and will display signs of mature and 'old age' heather stands in

need of regeneration. Likely areas suitable for heather seed collection will be mature, healthy stands showing good flowering characteristics;

- plan a heather cutting programme according to the methods outlined in guidance provided by DARD (2005, 2010) and SNH (1996b). The programme will include designs for maximising edges of cut blocks, equipment to be used and timescales to be adopted, including justification. In addition, plan a heather seed collection programme;
- plan suitable storage facilities for both heather brash and heather seed so that harvested materials can be suitably conserved until it is deployed in restoration works; and
- if there are any bare patches in restored areas within the Planning Application Boundary, implement heather seed spreading on a location-by location basis, as indicated in the final version of this HMP and as directed by the ECoW.

Methods of heather cutting and seeding

Heather cutting

4.145 A number of possible methods can be used for cutting heather, including the use of a tractor drawn flail, heather swipe or a forage harvester. Choice of equipment will primarily depend on (a) the quality of the donor site (i.e. age and structure of the heather), (b) general topography and micro-topography of the site (particularly the gradient and presence of rocks, hummocks, hollows, drains or pools) and (c) access. According to the guidance provided in DARD (2005) Section 12, heather flailing must not be carried out during the period 15 April to 31 August to protect ground-nesting birds.

4.146 Cutting/flailing heather will encourage regeneration of old heather stands and will generate brash which will be used to reseed areas of bare and restored peat. To ensure that areas of flailed heather look as natural as possible and to provide a useful habitat for ground nesting birds, the edges of cut areas will be left as irregular as possible. Cut heather brash will be removed, bailed/bagged (depending on method of cutting) and transported to the locations designated for storage or seeding.

Season of heather cutting

4.147 Heather cutting can be carried out either in autumn/early winter or late winter/spring. At Barr Cregg it is proposed that cutting in late autumn is likely to be best for collection of brash and seed which will be stored for future use in re-seeding peat restoration areas of the wind farm construction footprint. Seed bearing shoots cut during October to mid-January can be used for heather restoration (see SNH (1996a) Heather Re-establishment on Mechanically Disturbed Areas). A double-chop forage harvester probably produces the best material but a single-chop type is also suitable. Depending on the amount of seed carried by the donor stand there should be enough material to treat an area from one to three times the size of the donor area. This will allow pre-planning of the extent of heather cutting required for the anticipated restoration activities.

Vacuum seed collection

4.148 As an alternative to heather cutting, it may be possible (if suitable equipment is available) to use a vacuum seed harvesting technique.

4.149 A garden vacuum with a two-stroke engine or an industrial vacuum cleaner with a generator can permit the collection of around 100 - 250 kg of heather litter plus seed per day. The seed-litter material may be collected in winter and stored or sown at once. Alternatively, it may be collected in early summer when, being vernalised, a proportion of the seed will germinate as soon as it is sown provided seedbed and germination conditions are suitable. If collected when dry the material can be safely stored in dry, airy conditions without need of further drying.

Seeding method

(a) Cut/flailed heather

4.150 Heather reseeding using cut brash should take place in late spring (late April to May) to allow warmth and moisture conditions of early summer to optimise germination. The cut heather should be spread thinly so that the soil surface is not obscured but adequate seed is available. Recommended application rates (EAU, 1988) of heather litter/brash are between 1000 -1500 kg/ha[1] in order to supply a minimum of 300-500 germinable seeds per m^2. The size of the donor area to be cut will depend on the density and productivity of the donor heather. (Reported examples of coverage range from less than the size of the donor site up to three times larger (SNH, 1996a)). It is claimed that the stem material helps to stabilise small scale soil movement and improves humidity at the soil surface but an alternative view is that the litter becomes mobile in wind and can damage or bury seedlings. Laying sapling or mature heather brash over the reseeded area may be used to reduce this risk.

(b) Heather seed/litter obtained by vacuuming

4.151 As above, heather reseeding should take place in late spring (late April to May) to allow warmth and moisture conditions of early summer to optimise germination. The decision on application rates depends on seed abundance in the donor litter. Northern Ireland's Peatlands and Uplands Biodiversity Delivery Group (2010) recommends an application rate of 200 g/m^2.

Protection of restored areas

4.152 Restored areas require some degree of protection against livestock grazing, where present, for at least the first three years. Within priority habitat areas, the ECoW will determine which method of protection will be most suitable. Possible methods will include: (a) exclusion fencing (if permitted, such that it doesn't create predator posts), (b) use of heather brash or other brash to secure applied seed and protect seedling growth, or (c) a programme of restricted sheep grazing until restored vegetation has sufficiently established.

Habitat enhancement on lands within the control of the developer

Introduction

4.153 A number of agricultural land management practices have damaged and caused the degradation of both blanket bog and heathland habitats at Barr Cregg. In addition to preventing the occurrence of these damaging management practices in the future, there are a number of habitat enhancement and improvement activities that can be implemented as part of the OHRMP.

4.154 The Proposed Barr Cregg Wind Farm Development provides a good opportunity to work with the current landowners to manage areas of blanket bog and wet heathland within the Site so as to return it to good conservation status for at least the lifetime of the Proposed Wind Farm Development which is predicted to be at least 25 years.

4.155 Four main types of habitat enhancement and improvement are proposed:

- **Ditch blocking**. Areas of both degraded blanket bog habitat (M19 and M25) and areas of degraded wet heathland (M15) are targeted for ditch blocking and infilling of gripps to reinstate higher water table levels which would have been present before artificial drainage. (Areas C and D in Figure 4.3.)
- **Reinstatement of M19 community**. Area of degraded M19 at the main access that has been particularly badly damaged through vegetation flailing, together compaction caused by heavy vehicle trafficking, is targeted for reinstatement of a Calluna sward and the recreation of an M19 community. (Area E in Figure 4.3.)
- **Creation of M19 vegetation** in two areas that were converted to semi-improved grassland. (Areas A and B in Figure 4.3)
- **Control stock grazing**. Working with landowners to improve general land management and grazing regimes, particularly within areas of NI priority habitat.

Ditch blocking and infilling`

4.156 There are many locations across the Barr Cregg site, both within the Planning Application boundary and in adjacent land that is under the control of the developer, where drainage ditches and gripps have been recently maintained (see for example, Plates 1-4 in 4.80 of this OHRMP). There is excellent scope to block and infill these ditches and gripps in order to raise water table levels back to where they were before drainage.

4.157 Proposed locations for ditch infilling and ditch blocking are indicated as Areas C and D in Figure 4.3. The purpose of ditch blocking is to raise the water table level initially in the vicinity of each ditch or gripp but over time, across whole units of blanket bog. Ditches would first be blocked to pond back water and halt runoff then back-filled using the overturned furrow turf that still exists adjacent to each ditch, to recreate the original, wetter bog surface. Where there is no overturned furrow, infilling of gripps and ditches will be achieved using excavated peat from the construction of turbine bases and crane pads.

4.158 Raising water table levels is the necessary first step to encourage the regeneration of bog species, such as Sphagnum mosses.

Methodology of ditch blocking

4.159 Ditch blocking has been shown in numerous studies to be a highly effective method of raising water tables as a pre-cursor to blanket bog restoration. See, for example, Armstrong et al (2009) who review the results of 32 ditch blocking programmes in England and Scotland and also provide a drain-blocking best practice guide which advises on methodology. Typical methods for ditch blocking involves the use of plastic or wooden piling, often accompanied by infilling/backfilling the blocked ditch with peat or heather bales. In some places, for example areas where drainage ditches intercept mineral substrate below, stone dams have been used.

4.160 DOE-NI (2010) guidelines recommend using either highly decomposed peat or plastic sheet piling. Peat turves are often the most widely used method for damming drainage ditches, since turves are available on site and the method is cheap. However this type of dam has also resulted in the highest incidence of dam failure if not installed correctly. Where turves are used, an escape route for water should be created from the dam pool so that water can diffuse over the peat slope rather than flow around the dam and back into the drain.

4.161 Plastic piling is the most widely recommended method for ditch blocking, particularly where there is sufficient peat below the ditch in which to secure the piling. At the Proposed Barr Cregg Wind Farm Development, it is recommended that plastic piling is used as the most simple and effective method, in addition to backfilling ditches and gripps with peat turf. The spacing between dams will be determined by the slope of the land, the width of the ditch and the rate of water flow. Figure 4.3 shows *indicative* locations of ditch dams in Areas C and D. No general rule can be provided on whether dams should be regularly spaced or whether spacing should be determined by the gradient of the slope and its microtopography.

4.162 On the Site, the exact location of dams in Areas C and D which are generally relatively flat areas, will be assessed and determined by the ECoW, in consultation with the peat hydrology expert. In general, the spacing between dams should exhibit a 'top to toe' effect whereby the raised water table stretches from one dam up to the next one upslope.

4.163 There will be a number of key requirements of the construction contractor during ditch blocking and dam construction, including:

- planning access and egress routes to minimise as much as possible the compaction of peat around drainage ditches;
- use of plant with low ground bearing tyres to reduce compaction around the construction areas;
- careful overturning of turf or overturned peat 'ribbons', so as to cause as little disturbance to the ditch banks as possible and to leave original underlying bankside vegetation intact; and
- peat must be tamped and keyed into the bottom and sides of the drain and dam to avoid undercutting or leakage.

4.164 A conservative estimate of the total area of bog over which ditch blocking will raise water table levels is approximately 59,354m^2 (just under 6ha (the approximate area of 8 football pitches)) (Areas C and D combined).

4.165 Monitoring the success of ditch blocking to raise water table levels within the peat adjacent to the ditches is important. One of the simplest methods available for monitoring water table levels are WALRAGS (WAter Level RAnge GaugeS) which monitor the upper and lower (minimum and maximum) water table levels by means of a floating indicator which raises and lowers a magnet on a water level scale. These can be read manually at pre-determined intervals. The locations of insertion of WALRAGS must be carefully chosen to allow an understanding of the geographical extent that the water table level has been raised. At Bar Cregg, monthly reading of WALRAGS before dam insertion and afterwards for a period of at least a year will provide seasonal evidence of whether the dams are working to raise water table levels and the spatial extent of water level raising. Monitoring water table levels before ditch blocking is important in order to provide a baseline from which to measure the success of water table raising.

Heather mowing and collection of brash/seed

4.166 To the south of the Site, within lands under the control of the developer, there are areas of mature and old age heather that would benefit from mowing to rejuvenate the sward. These areas will also act as donor area of heather brash and heather seed for re-seeding and over-seeding other habitat enhancement areas within the site. The area labelled Area F in Figure 4.3 outlines a gentle slope with a sward of mature heather.

4.167 Under the guidance of the ECoW, smaller areas within Area F will be selected for mowing. This will involve an inspection of Area F to select the best and most easily accessible areas as donor locations for collection of heather brash and/or heather seed for re-seeding elsewhere. These areas will display signs of mature and 'old age' heather stands in need of regenerating and displaying good seed production.

4.168 Ahead of peatland habitat restoration works elsewhere at Barr Cregg (eg in Areas A, B and E in Figure 3), The ECoW will plan and supervise a heather mowing programme in the areas identified above according to the methods outlined in guidance provided by DARD (2005, 2010) and SNH (1996b) and described briefly in 4.143 to 4.152. The programme will include details of equipment to be used and timescales to be adopted. In addition, the ECoW will plan a heather brash/heather seed collection programme.

4.169 Suitable storage facilities for both heather brash and heather seed will also be planned so that harvested materials can be suitably conserved and protected from wet conditions until they are deployed in restoration works.

4.170 Since only patchy heather mowing will take place in Area F in order to create an uneven heather sward structure and to create uneven 'edges' for birds (see the section entitled "Benefits of Habitat Enhancement for Ornithology"), a conservative estimate of the area of M19 habitat enhancement in this part of the site is 50% of Area F (24,182m^2), ie approximately 12,091m^2 (1.21ha).

Heather overseeding area of poor M19

4.171 Close to the main access, on either side of the proposed new access track, the habitat mapped as degraded M19 was very seriously damaged by flailing and screefing off[3] of surface vegetation in 2013. This area is labeled Area E in Figure 4.3. Area E is now dominated by *Molinia* with *Eriophorum vaginatum* and is particularly poor in *Calluna*.

4.172 The aim of habitat enhancement in this part of the site is to overseed with either heather seed or heather brash collected from the south of the site. Prior to overseeding, the surface of the peatland will be slightly roughened with a trailed harrow, sufficient to expose areas of bare peat, but the vegetation turf will not be removed or overturned. The trailed harrow will be pulled by a tractor with pressure bearing tyres.

4.173 Heather seed or brash will be spread by hand to ensure that roughened areas of bare peat are adequately covered. The aim in this part of the site will be to encourage the regeneration of patchy heather with the anticipation that once established, *Calluna* will naturally spread through the sward to form either a heathland or blanket bog community.

4.174 An estimate of the area of M19 habitat enhanced around the main access track is approximately 32,840m^2 (3.28ha).

4.175 Monitoring of reseeded areas is described in the section entitled "Monitoring of restored / enhanced areas of peatland".

Recreation of a heather sward and M19 community in areas of semi-improved grassland

4.176 Two semi-improved grassland fields near the main access in the north of the Site are ideal locations for re-instating a heather-dominated vegetation sward and eventually the recreation of an M19 blanket bog/wet heathland community. These fields are labelled as Areas A and B in Figure 4.3. The parts of Areas A and B have been identified as a possible location for temporary storage of peat during the construction phase. These areas will be recreated as heather sward and M19 community after temporary peat storage has been removed and re-placed around the construction footprint to restore verges and batters.

4.177 The substrate beneath the existing grass cover in both areas is peat, with depths of around 1-1.5m. The intention in these two fields will be to screef off the surface turf and turn it over, burying the surface grassland vegetation and surface soil seedbank, and exposing the peat surface (this may not be required if these areas have been used for temporary peat storage during the construction phase). A possible method for turning over the surface turf would be to use a trailed, shallow mouldboard ploughshare, followed by light harrowing. The ECoW will determine whether light harrowing of the surface is required after temporary peat storage in order to break up and aerate the surface peat prior to seeding.

4.178 Once the overturned surface peat has been exposed and harrowed, heather seed or heather brash will be sown by hand to prevent further compaction of the newly

[3] Screefing is the cutting off of a very thin surface layer of turf.

exposed peat surface and to ensure a good and complete cover across these two areas.

4.179 Heather reseeding should take place in late spring (late April to May) to allow warmth and moisture conditions of early summer to optimise germination.

4.180 Assuming that sowing is carried out in Spring, artificial watering may be required at sowing and throughout the first six months after sowing (during summer and possibly also autumn) to ensure that surface peat and vegetation conditions are maintained suitably wet for germination and seedling establishment.

4.181 The decision on application rates depends on seed abundance in the donor litter. Reported examples are in the range 10-120 g/m^2 (SNH, 1996a). An application rate near the upper end of this range would be advisable. If heather seeding is used, the ECoW will determine whether seeded areas need to be protected by cut brash or sapling brash to maintain humic conditions and to prevent disturbance of seed by wind.

4.182 Whether seeding is carried out using heather brash or heather seed, the ECoW will inspect re-seeded conditions regularly to ensure (a) that heather seed and/or heather brash has not been eroded or removed and remains *in situ*, (b) surface moisture conditions are adequate for seed germination and seedling establishment. Should warm and/or windy weather conditions dry out surface peat, the ECoW will prescribe light watering and will ensure that watering does not cause erosion or seed removal.

4.183 The total area of habitat enhancement of the two semi-improved grassland fields in Areas A and B is approximately 14,871m^2 (1.49ha).

4.184 Monitoring of reseeded areas is described in the section entitled "Monitoring of restored / enhanced areas of peatland".

Reinstatement of semi-improved grassland after temporary storage of peat

4.185 Indicative locations for temporary storage of excavated peat (see Figure 4.4 have been intentionally located in areas of semi-improved grassland, in order to avoid more valuable areas of NI priority habitat. Once the stored peat has been removed these areas will be reseeded to reinstate semi-improved grassland. The seed source and seed mixture will be agreed I advance with NIEA, but is likely to be similar to the following specification, suitable for acid soils, supplied by a reputable UK seed supplier:

%	Latin name	Common name
14	*Agrostis capillaris*	Common Bent
1	*Anthoxanthum odoratum*	Sweet Vernal-grass (w)
24	*Cynosurus cristatus*	Crested Dogstail
15	*Festuca ovina*	Sheep's Fescue (w)
16	*Festuca rubra*	Slender-creeping Red-fescue

4.186 Alternatively, areas of semi-improved acid grassland elsewhere within the land under the control of the Developer, will be mown to collect grass seed suitable for sowing.

4.187 A sowing rate of between 20-30 kg/ha has been shown to produce good germination and establishment results.

Protection of restored and enhanced areas of peatland

4.188 All habitat restored and enhanced areas will be protected against sheep grazing for at least the first three years. Restrictions on grazing will be agreed with the landowner until restored vegetation has sufficiently established. Proposed grazing regimes are indicated in Figure 4.5 which indicates stock grazing exclusion timescales and subsequent grazing levels across the site post-construction.

Working with landowners to improve land management

4.189 Paragraphs 4.29–4.38 of this report describes the DARD CMS agri-environment scheme which permits certain types of agricultural activities to take place within the proposed Barr Cregg Wind Farm boundary and on other adjacent areas of land which are within the control of the Developer.

4.190 Paragraphs 4.50-4.77 of this report describe the main reasons why both blanket bog and wet heathland habitats within the Site are already damaged and degraded. On-going agricultural practices, including maintaining (cleaning out) of drainage ditches and gripps, mowing and flailing of heather swards and grazing of stock (both sheep and cattle), have dried out blanket bog and wet heathland, compacted and compressed surface peat and damaged or destroyed the acrotelm in many parts of the site.

4.191 Should the proposed Barr Cregg Wind Farm Development be permitted it will provide an excellent opportunity to work with landowners, both in the west of the site (as of 13th May 2016 lands are no longer subject to a CMS) and in the east of the site (lands never subject to a CMS) to improve the status of areas of degraded peatland habitats. This will include agreements between the Applicant and landowners to include:

- ditch and gripp blocking and infilling;
- patchwork mowing of old age and mature heather stands in more environmentally friendly ways and only when these stands are considered to be mature to old age, not annually. The purpose of this will be (a) to develop, over time, a greater variety of sward statures and diversities and (b) to generate heather brash and seed which will be used to re-seed and over-seed species poor degraded areas of blanket bog and wet heathland;
- protecting areas of restored and enhanced habitat for the first three years after restoration works, until the swards are well established; and
- implementing and maintaining appropriate grazing regimes according to the DARD (2005) CMS manual for blanket bog and wet heathland. The CMS permits a stocking rate restriction of 0.75 livestock units per hectare all year on rough moorland and a stock rate of sheep (0.25 livestock units per hectare – 1 March to 31 October) or cattle (0.20 livestock units per hectare – 1 June to 31 August) on wet heathland. The proposed stocking rates which would be implemented as part of the HMP for the wind farm (taken from DARD (2005) CMS Table 2), would be

the rate applicable for blanket bog which would be as much as ten times less than the current rate (0.075 livestock units (sheep only) per hectare – 1 March to 31 October). Over the period of the wind farm lifetime (25 years) it is assessed that a ten times reduction in grazing density would result in a very significant improvement of sward structure and biodiversity of degraded blanket bog.

4.192 The Developer will work with landowners over the lifetime of the proposed wind farm development, which is anticipated to be in the order of 25 years, to provide long term continuity of these management practices.

4.193 Detailed records will be kept of initial habitat condition, current and historical stocking densities will be compiled and maintained throughout the operational life of these proposals. Grazing prescriptions for each habitat compartment will then be produced in accordance with the DARD (2005) CMS guidelines.

4.194 These proposals recognise that at correct stocking densities, grazing may control and reduce incidences of grasses that can out-compete more beneficial species such as heather. Well managed grazing can therefore help to increase species diversity.

4.195 In addition it is noted that many characteristic peatland fauna require a range of community structures (tall vegetation, short vegetation, bare ground) and grazing is the most effective tool for achieving this, therefore a variety of associated benefits arise. Birds (for which many peatland sites are protected under UK and European law) benefit from a range of structural diversity and the increase in insect prey (see the section below entitled "Benefits of Habitat Enhancement to Ornithology".

4.196 Sheep grazing will be completely excluded from the three peatland blocks that have been targeted for habitat enhancement (Areas A, B and E) during the construction phase and for the first three years after re-seeding/over-seeding. Elsewhere within the land control boundary, a programme of restricted sheep grazing will be agreed with landowners. The areas where sheep management will be implemented are indicated in Figure 4.5.

4.197 These proposals recognise that at much reduced stocking densities, grazing may control and reduce incidences of grasses that can out-compete more beneficial species such as heather. Well managed grazing can therefore help to increase species diversity.

Benefits of Habitat Enhancement for Ornithology

4.198 The proposed habitat enhancement measures would be beneficial for six breeding bird species that are recorded from the site and surrounding 500m buffer area[4]. These species are snipe, skylark, meadow pipit, stonechat, grasshopper warbler and reed bunting. One of these species (meadow pipit) is a Red-listed species of conservation concern in Ireland and three species (snipe, skylark and stonechat) are Amber-listed species of conservation concern[5]. Four of these species are also

[4] Barr Cregg Wind Farm Baseline Bird Surveys

[5] Colhoun, K &Cummins, S Birds of Conservation Concern in Ireland 2014-2019 Irish Birds Volume 9, No. 4

Northern Ireland Priority Species[6]. For an additional two species (kestrel and cuckoo) there is at least a possibility that the proposed measures would be beneficial. One of these additional species (kestrel) is an Amber-listed species of conservation concern and one species (cuckoo) is a Northern Ireland Priority Species. The proposed enhancement measures and the bird species for which they would be of beneficial are summarized in Table 5. The conservation status of the relevant bird species is summarized in Table 6.

Table 5: Summary of Value of Proposed Habitat Enhancement Measures for Breeding Birds

Proposed Habitat Enhancement Measures	Breeding Bird Species for which Proposed Measure would be Beneficial	Additional Bird Species for which Proposed Measure may be Beneficial
Diversifying structure of *Calluna* sward and creating irregular sward edges (Area F)	Skylark, meadow pipit, stonechat, reed bunting	Kestrel, cuckoo
Diversifying *Molinia*-dominated blanket bog (Area E)	Skylark, meadow pipit, snipe	Kestrel, cuckoo
Creating more *Calluna*-dominated heathland where there is currently semi-improved grassland (Areas A and B)	Skylark, meadow pipit, stonechat, grasshopper warbler, reed bunting	Kestrel, cuckoo
Raising water table levels in wet bog and heath (Areas C and D)	Snipe, skylark, meadow pipit	Kestrel, cuckoo

Table 6: Summary of Conservation Status of Relevant Bird Species

Bird Species	Conservation Status	Remarks
Snipe	Amber-listed	NIEA Priority Species
Kestrel	Amber-listed	
Cuckoo	Green-listed	NIEA Priority Species
Skylark	Amber-listed	NIEA Priority Species
Meadow pipit	Red-listed	
Stonechat	Amber-listed	
Grasshopper warbler	Green-listed	NIEA Priority Species
Reed bunting	Green-listed	NIEA Priority Species

[6] Northern Ireland Environment Agency Northern Ireland Priority Species List (March 2010)

4.199 Diversifying the structure of *Calluna* sward and creating irregular sward edges (Area F) would be beneficial for skylarks, meadow pipits, stonechats and reed buntings. All of these species favour a mosaic of better-vegetated areas (in which to nest and shelter) and more open areas and edges (in which to feed). These conditions would be enhanced by the proposed measure.

4.200 Diversifying the *Molinia*-dominated blanket bog (Area E) would be beneficial for skylarks, meadow pipits and snipe. All of these species utilize this habitat type and diversifying the floristic diversity would be expected to improve both the feeding conditions and nesting opportunities for these species.

4.201 Creating more *Calluna*-dominated heathland where there is currently semi-improved grassland (Areas A and B) would be beneficial for skylarks, meadow pipits, stonechats, grasshopper warblers and reed buntings. All of these species utilize this habitat type and providing an additional area of this habitat (where there is currently semi-improved grassland) would provide additional nesting and feeding areas for these species.

4.202 Raising the water table levels in wet bog and heath (Areas C and D) would be particularly beneficial for snipe and also beneficial for skylarks and meadow pipits. Snipe require soft ground in which to feed and therefore raising the water table levels would be beneficial for this species. Skylarks and meadow pipits do not particularly require soft ground but would benefit from improved feeding opportunities because a raised water level would improve the general condition of the wet bog / heath habitat.

4.203 All of the proposed habitat enhancement measures could possibly be beneficial for kestrels by way of improving foraging conditions for this species – diversification of the existing habitats, creation of additional habitat and raising water table levels would be expected to increase abundance of kestrel prey species such as frogs, small mammals, invertebrates and small birds/ nestlings. It is unlikely that increased foraging conditions for kestrels would give rise to a significant increase in collision risk for this species – benefits for kestrels would be via increased foraging success, not necessarily by increased foraging activity (foraging activity per se is more likely to be affected by the proximity of nest sites). The same enhancement measures that benefit meadow pipits could also be beneficial for cuckoos, as this species is a brood-parasite (laying its eggs in the nests of other birds) and the meadow pipit is one of the principal host-species in north-west Europe , probably almost exclusively so in upland habitats in Northern Ireland (D Steele personal observations).

Assessment of Habitat Betterment (habitat enhancement vs habitat loss)

4.204 Five different types of habitat enhancement/improvement are proposed in this OHRMP. These, and the areas proposed for habitat enhancement, are summarised in Table 7.

Table 7. Summary of types and areas of habitat enhancement

Area	Habitat Enhancement for the lifetime of the project	Area (m²)
A+B	Recreate *Calluna*-dominated heathland in area of semi-improved grassland	14,871
C+D	Block and infill drainage ditches and gripps to raise water table levels	59,354
E	Overseed with *Calluna* to improve degraded in species-poor area of former M19 blanket bog	32,840
F	Mow patches of over-mature *Calluna* to create a heterogeneous sward structure and to create edge diversity for birds.	12,091
Total habitat enhanced		**119,156**
Stock management - specified locations across the whole Site	Reduced and carefully managed stocking density of 0.075 livestock units (sheep only) per hectare, from 1 March to 31 October) over the majority of the site (this is illustrated in Figure 4.4).	984,000

4.205 The areas proposed for habitat enhancement are a mixture of degraded M19, M15 and M25 NVC communities. In areas C and D it is difficult to separate out the exact areas of each of these communities that will be improved. The calculation of proposed habitat 'betterment' (ie the amount of enhanced habitat vs the amount of habitat lost to the development footprint over its lifetime) therefore has been based on the sum of all three habitats (M19, M15 and M25).

4.206 The area of NI priority habitat that will be lost for the lifetime of the development due to the footprint of the infrastructure is 26,679m^2 (2.68ha) (see Tables 3 and 4). The area of habitat enhancement is approximately 119,156m^2 (11.92ha). The overall habitat betterment proposed is approximately 4.5 times more peatland habitat enhanced and restored than will be lost as a result of the development.

4.207 If, in relation to PPS2 NH5, it is helpful to separate out the area of habitat enhancement that 'compensates' for the area of habitat loss (ie 2.68ha), the area of proposed habitat enhancement that is over and above direct 'compensation' amounts to 5.24ha.

4.208 Should it be necessary for engineering reasons to construct the access track between Turbine 1 and Turbine 2 using a cut track methodology, with its associated small indirect impact on adjacent degraded blanket bog, this indirect impact – amounting to 190m x 20m in extent (ie 3800m^2), added to the permanent

direct impact (26, 679m^2), results in an impacted habitat of 30,479m^2. Since the area of enhanced habitat is 119,156m^2, this would mean that the overall betterment would be slightly reduced to times 3.9. Irrespective of the amount of quantified betterment, the proposed habitat enhancement appropriately and sufficiently reduces the significance of the residual impact in relation to T1 and T2.

4.209 In addition, a further 984,000m^2 (98.4ha) of degraded blanket bog would benefit from reduced sheep grazing densities for the lifetime of the wind farm development. The main value of reduced sheep stocking densities will be reduced grazing of sensitive bog species, less trampling and creation of paths through blanket bog, particularly in very fragile wet winter conditions and reduced dunging in sensitive areas of acidic peat bog.

Habitat Management Over the Lifetime of the Development

4.210 The HMP for the Barr Cregg Wind Farm, including land management agreements with landowners, will operate over the lifetime of the development, which is planned to be 25 years. Monitoring will be carried out by an independent, suitably qualified Ecologist. After each phase of monitoring, results will be reported to both Mid Ulster District Council and NIEA. Monitoring is described in the section entitled "Monitoring of restored / enhanced areas of peatland".

Other Ecological Benefits of Habitat Enhancement & Management

4.211 Many characteristic peatland fauna require a range of community structures (tall vegetation, short vegetation, bare ground). In a variety of peatland and grassland habitats carefully controlled and managed grazing is the most effective tool for achieving this. Birds (for which many heathland sites are protected under UK and European law) benefit from a range of structural diversity and the increase in insect prey

Other Ecological Management - Badger

4.212 In their consultation response of the 4 November 2014 NIEA comment:

4.213 "*The proposed relocation of the central drain presented within the FEI brings the works closer to badger sett 5. This has not been considered within the FEI. We consider that a licence will be required for works on the drainage channel near this sett entrance. We are content with the amendment in relation to badger sett 1 near turbine 4.*"

4.214 In an effort to consider the NIEA response a further site visit to investigate the location of badger sett 5 (in relation to the proposed drain diversion) was undertaken on the 5th August 2015. No sett had been noted within 50 m of the proposed drain diversion during works to inform the (2014) FEI, therefore the original badger survey data from 2011 was reviewed and the co-ordinates of badger sett 5 obtained.

4.215 The area around coordinates IC 54745 11466 was thoroughly search for 50 m in all directions. No badger sett could be found and no obvious badger field signs were noted. The only thing found was an obscured and completed collapsed (single

entrance) tunnel; which was so old and in such poor condition that it could not be determined what species had originally excavated it. No spoil heap was present, no bedding and the tunnel only extended 30 cm before being blocked by collapsed earth. There was insufficient evidence of any recent use (by any species) to even necessitate the deployment of the camera trap (which had been carried to site on the day in an effort to ascertain the status of the sett under investigation (see Plate 5 below)).

Plate 5 – The collapsed tunnel at 54745 11466 (bottom of post) with gloves and trail camera for scale.

Plate 6 – A close-up of the collapsed tunnel entrance showing grass and the lack of obvious signs of any recent use of the tunnel/burrow/den/sett.

Plate 7 – The area surrounding the location of badger sett 5 was searched and no other obvious entrance tunnels could be located.

4.216 A second site visit was undertaken on the 22nd April 2016 by Seán Meehan to assess the sett at 54745 11466. Seán was on site to record vegetation quadrats and was asked to look at the location as second opinion. No sett was noted and nothing has changed since the earlier (5th August 2015) site visit. Therefore, as no sett is present in the location outlined, no NIEA Wildlife Licence will be required and the drain diversion will have no impact on the local badger population.

Fisheries Habitat Management

4.217 Habitat restoration with regard to fisheries focuses on the Barr Cregg (Eastern) stream which flows north through the application area to join with the Burntollet River approximately 80m downstream of where the proposed main site access track will cross the river.

4.218 This is a good trout nursery stream with abundant spawning gravel deposits, good riffle habitats and occasional pools. Stream width ranges from 0.5 to 1.0 m at the southern edge of the proposed site to 1 to 2 m at the downstream (northern) end.

4.219 There are no natural barriers to fish in the lower section of stream and good densities of juvenile trout were found at survey sites extending up to the area of the proposed stream crossing. Beyond this point stream gradient increases and the substrate becomes predominantly bedrock – fish densities are likely to be much reduced.

4.220 The stream could be enhanced as a trout spawning and nursery area through some basic habitat management measures to improve fish access and general productivity. These measures can be summarised as follows and full details are set out in the attachments:

- Removal of dead branches and fallen trees obstructing the channel and potentially causing bank erosion;
- Removal of excessive growth of bankside vegetation to admit more light to stimulate productivity of stream biota in general;

- Removal of blockages to fish passage – fallen trees, branches and general waste materials;
- Removal of redundant fences in danger of falling into the channel;
- Re-location of short lengths of fencing to a minimum of 1m distance back from top of the bank;
- Replacement of improvised suspended gates where fencing crosses the channel – currently in bad condition and in danger of obstructing the channel;
- Minor bank repairs through rock revetment.

4.221 The stream flows over a course of approximately 640m through the north-eastern section of the application area to its confluence with the Burntollet River. Most of these proposed measures focus on the lower 260m of the stream.

Hydrological Benefits of Habitat Enhancement

4.222 The proposed habitat enhancement measures would be anticipated to have a beneficial effect in relation to site hydrology and water quality in the medium to long term. Blocking of drainage gripps and ditches that would otherwise accelerate runoff from the site would serve to reduce the peak rate of surface water runoff from the site, and contribute to flood management in the downstream catchment. Similarly, blocking of those ditches and gripps would eliminate pathways for scoured sediments and suspended solids that would otherwise drain to the Burntollet and downstream catchments, resulting in a beneficial effect to water quality.

Indicative Schedule of Habitat Restoration and Enhancement Activities

4.223 The timing of many of the OHRMP activities is crucial for success. Table 8 below provides indicative timings for implementation of the main elements of the habitat restoration and enhancement programme.

Table 8. Indicative schedule of habitat restoration and enhancement management activities and timescales

Phase of Development	Activity	Timescale
Pre-Construction or early Construction	Consult with the NIEA to agree suitable locations, within the lands under the control of the developer (eg Area F), for harvesting of local heather brash or seed.	April to October
	Harvesting local heather brash	Avoid mid-March to end August. Ideal time is October.
	Collect local heather seed	Ideally October
Construction	Peat/vegetation stripping and temporary storage in areas of wind farm construction	According to construction plan
On-going Construction and Post-Construction	Peat/vegetation restoration by replacing stripped turves in areas of wind farm construction	As soon after stripping as possible, ideally within a few days (cable trenches) or weeks (e.g. turbine bases and crane pads)
	Vegetation restoration by over-seeding turfed areas of any bare peat areas if required within the farm construction footprint.	Ideally late spring (late April to May)
	First inspection of restored vegetation on crane pad batters,	Ideally August – September

	road verges and cable trenches (confirmation of appropriate restoration conditions achieved)	after construction has been completed.
	Heather re-seeding in areas identified for habitat enhancement (Areas A, B and E). The order of activities would be: • Area E: Lightly harrow roughen surface and to reduce existing compaction and rutting • Areas A and B: shallow plough to turn over surface turf and expose bare peat surface. • Broadcast collected heather brash and/or seed	Ideally late spring (late April to May)
	Implement ditch blocking on selected ditches in Areas C and D. The sequence of works will be: • Inspect indicated ditches for suitability • Insert plastic pile dams as per guidance (e.g. Armstrong et al., 2009) • Backfill selected drains using overturned furrow turves.	Summer months when peat surfaces are drier and water table levels lowest.
Post-Construction and Operation	Monitoring of restored habitats and vegetation communities within the Site	Annually for the first four years, then in years 7 and 10.
Before and after construction	Monitoring of WALRAGS in areas of ditch blocking.	A minimum of one year before dam insertion and one to three years after.
Landowner grazing measures	Implement appropriate DARD CMS grazing regimes.	Post-construction

Overall Assessment of the Impacts and Benefits of the Project

4.224 This section provides an overall assessment of the impacts and proposed benefits of the Barr Cregg Wind Farm Development.

4.225 It has been assessed that unless current agricultural practices cease, the degraded blanket bog habitats that are currently not active, as shown through (a) statistical analysis of the vegetation present, and (b) visual inspection of the dried out, hardened and compacted surfaces where the acrotelm is no longer functioning, will continue to be degraded.

4.226 Degraded areas of blanket bog are present across the entire site which is under the control of the applicant, not just within the proposed development footprint.

4.227 While it is assessed that excavation to construct the wind farm will cause an adverse effect on small areas of degraded blanket bog, counter balancing this impact is the applicant's proposal to enhance and improve substantial areas of blanket bog outside the development footprint but within lands under the applicant's control. Part of this habitat enhancement provides direct compensation for loss of peatland habitat within the construction footprint. The remaining habitat enhancement provides a positive benefit as a result of the development.

4.228 Taking into account the initial degraded condition of the blanket bog and heathland habitats at Barr Cregg, it is assessed that implementation of measures described in the OHMP will, despite construction of the wind farm, result in an overall substantial habitat benefit, compared to the current condition of the site. The Barr Cregg development will, through implementation of the OHMP, improve

the site's natural capital and will provide a large area of substantially improved peatland habitat for birds, wildlife and fisheries.

Monitoring of restored / enhanced areas of peatland

Introduction

4.229 To confirm that habitat restoration and enhancement has been successful, all areas of restored vegetation should be monitored post-restoration, monitoring results reported and any criteria failures identified and corrective actions implemented.

4.230 The process emphasises the importance of stating clearly the objectives of habitat restoration or enhancement activities at the outset.

Habitat restoration areas

4.231 In restored areas within the application site, the objective is to re-vegetate bare soil and peat surfaces to stabilise them, prevent erosion and to reinstate peatland vegetation, with the opportunity of restoring better quality and more valuable peatland vegetation communities long term than were present before construction. Thus, the criteria by which the success of *habitat restoration* is judged will be threefold:

- Is the restored area stable? Criteria for assessment will include: presence of surface cracks in peat, evidence of peat slippage, percentage of bare soil/peat exposed.
- Has vegetation re-established and if so, what percentage vegetation cover is there and do any areas of bare soil/peat remain? The main aim will be to achieve 100% vegetation cover within 5 years of restoration
- Has a suitable vegetation composition been restored? This will be a longer term aim and assessment criteria will include species biodiversity and composition. The target will be to reinstate the same NVC community that was present prior to construction.

Habitat enhanced/improved areas

4.232 In habitat enhanced areas within the application site, the objectives are a little different. In Areas C and D where ditch blocking is proposed, the aims and objectives, as well as the inspections and monitoring are described in 4.118 to 4.126).

4.233 In habitat enhancement areas which will be re-seeded and overseeded (Areas A, B and E), the initial aim is to re-establish a peatland sward that is dominated by heather. A longer term aim would be that these areas would eventually develop into an M19 NVC community, given suitable peat hydrological conditions. Over the lifetime of the proposed wind farm development, the aim will be to restore better

quality and more valuable peatland vegetation communities in these areas than were present before construction.

4.234 Thus, the criteria by which the success of *habitat enhancement in Area E* is judged will be as follows:

- Has *Calluna* re-established and if so, what percentage *Calluna* cover is there and do any areas of bare soil/peat remain? This will be compared to % cover prior to habitat enhancement.
- What is the % cover of (a) bare peat, (b) *Calluna* and (c) other heathland or blanket bog indicator species such as *Eriophorum vaginatum, R. angustifolium*, *Erica tetralix*, *Narthecium ossifragum* and, lastly, *Sphagnum* species.
- Has a suitable vegetation composition been restored? This will be a longer term aim and assessment criteria will include species biodiversity and composition. The target will be to reinstate NVC M19 community.

4.235 The criteria by which the success of habitat recreation in Areas A and B is judged will be as follows:

- Has *Calluna* re-established and if so, what percentage *Calluna* cover is there and do any areas of bare soil/peat remain? Has peat erosion occurred?
- What is the % cover of other heathland or blanket bog indicator species such as *Eriophorum vaginatum, E. angustifolium, Molinia caerulea, Erica tetralix, Narthecium ossifragum* and, lastly, *Sphagnum* species.
- As for Area E, the overall aim will be to reinstate NVC M19 community. So the final questions will be to determine whether the vegetation surface is stable whether a suitable vegetation composition been restored? As for Area E, this will be a longer term aim and assessment criteria will include species biodiversity and composition.

Timing of inspections/monitoring

4.236 Visual inspections of restored areas within the application site will be carried out biannually during the first two years after restoration to check for potential soil erosion or movement and degradation of replaced turves. Vegetation monitoring will be carried out in years 1, 3, 5 and 10 after restoration. Monitoring will involve the following:

Soil/surface peat assessment

- An assessment of the physical state of the topsoil/surface peat with regard to:
- Percentage bare soil or peat not covered by vegetation;
- Moisture status (qualitative);
- Intactness (e.g. presence of visible cracking in surface peat; and
- General stability (e.g. presence of peat erosion).

Vegetation assessment

- An assessment of the composition and condition of the restored vegetation, including:

- Percentage of surface covered by vegetation;
- Full plant species list, using DAFOR assessment;
- Photograph of at least one GPS-located 10m x 10m quadrat for each restored location monitored;
- Estimated NVC class (but full NVC DOMIN cover assessment not required).

Monitoring/inspection of hydrological conditions

4.237 A combination of visual inspections and the use of regularly monitored WALRAGS will be used (see 4.165).

4.238 Bi-annually visual inspections will be made of blocked and infilled ditches and gripps for the first two years after construction (assuming that ditches are blocked at the time of construction or immediately after).

4.239 It is proposed that WALRAGS are inserted in four locations – two in Area C and two in Area D. These locations will be monitored bimonthly for 12 months prior to ditch blocking, then bimonthly for two years after blocking. These results will determine whether ditch and gripp blocking has been successful in raising the water table more generally across Areas C and D.

4.240 It is not proposed that detailed quadrat monitoring of vegetation is carried out in Areas C and D, but a biannual inspection and list of all plant species present will be recorded at the same time as vegetation monitoring of Areas A, B and E.

Monitoring reporting and action plan

4.241 The outcome of each visual inspection will be a brief note to confirm status of all restored areas and to indicate any locations where restoration requires further remedial action. If remedial action is required, activities and appropriate methods should be formulated and implemented. Monitoring reports will be sent to both Derry & Strabane District Council and NIEA.

Personnel Roles and Responsibilities

Personnel roles and responsibilities during the construction phase

4.242 The implementation of the HMP will require certain key responsibilities to be assigned to defined roles. The following roles are key to the success of the HMP:

4.243 Key roles in the effective delivery of the HMP lie with the Construction Contractor's Site Environmental Engineer who will be assisted by the ECoW for the Proposed Development.

4.244 The Site Environmental Engineer and the ECoW will supervise and provide quality control on soil, peat and vegetation stripping, temporary stockpiling and vegetation restoration aspects of work. The Site Environmental Engineer and the ECoW will have a key role in ensuring that the control measure methodologies described in this HMP are correctly implemented.

4.245 The ECoW will be responsible for carrying out *in situ* inspections of temporary turf storage/stockpiling areas and vegetation conditions in restored areas.

4.246 The ECoW will be responsible for carrying out and reporting on monitoring after habitat restoration and vegetation enhancement activities have been completed.

4.247 The ECoW will provide the valuable link between the development team and liaison with the regulatory authorities with regard to compliance.

Training for construction personnel during the construction phase

4.248 To ensure that all site personnel understand the need for protection of valued habitats, both blanket bog and wet heathland, a series of toolbox talks will be provided by the ECoW for all construction personnel. These talks will include topics such as why the UK and Northern Ireland value these habitats, and how well planned construction methods and carefully implemented vegetation stripping and reinstatement can make all the difference in assuring the successful restoration of temporarily impacted habitats.

Conclusions

4.249 The proposed site of the Barr Cregg Wind Farm Development consists of areas of degraded blanket bog, degraded wet heathland and semi-improved and improved grassland. Although degraded, the blanket bog and wet heath habitats are still classified as NI priority habitats.

4.250 The land has been subject to a range of agricultural land management practices, including artificial drainage to permit mowing and stock (primarily sheep) grazing. The land in the west of the site (turbines 1-5) was the subject of a DARD CMS which set a number of restrictions on land use, including: restricted stock grazing, no deepening or widening of drainage ditches and limited peat cutting and burning. The CMS for these lands expired on 13th May 2016 and therefore the land use restrictions no longer apply and there is currently no proposed replacement for the CMS.

4.251 This OHRMP has been produced to describe and quantify the proposed habitat enhancement and improvement which will accompany the wind farm development. Its overall purpose is to ensure that identified impacts of the development are appropriately and sufficiently mitigated. In particular, the OHRMP aims to provide compensationary habitat improvement that sufficiently offsets the impact of loss of degraded NI priority habitats.

4.252 Four different types of habitat enhancement/improvement are proposed at Barr Cregg: (a) diversifying the structure of mature *Calluna* swards and creating irregular sward edges, (b) raising water table levels in blanket bog and wet heath, (c) diversifying *Molinia*-dominated blanket bog and (d) creating more *Calluna*-dominated heathland habitat where there is currently semi-improved grassland. In addition to those activities, the developer will work with landowners as their DARD CMS agreement has finished in order to manage stock grazing densities and the timing of grazing to prevent further degradation of peatland habitats through grazing, trampling and dunging.

4.253 The total area which will be enhanced by activities (a) to (d) above is 119,156m^2 (11.92ha (an area of approximately 17 football pitches)).

4.254 Excluding the habitat betterment that will result from improved stock management and reduced grazing densities for the 25 year lifetime of the development, the proposed area of peatland enhancement is approximately 4.5 times more than the area of NI priority habitat with will be lost to the development.

4.255 Managing sheep grazing and reducing stocking densities to 0.075 LU/ha across the majority of the site (approximately 984,000m^2 (98.4ha (an area of approximately 147 football pitches)) over the 25 year lifetime of the development would represent a ten-fold reduction in grazing pressure and would result in a very significant improvement of sward structure and biodiversity of degraded blanket bog

4.256 Should the Barr Cregg Wind Farm Development be permitted, there will be the opportunity to work with the landowner to manage the land in a manner that

promotes the reinstatement of improved blanket bog habitat conditions. Preventing agricultural practices that have a deleterious effect on NI priority habitats is the first and most important step in restoring blanket bog to good conservation condition.

4.257 The Barr Cregg Wind Farm Development will provide a valuable vehicle for delivering enhancement/improvement of degraded blanket bog and wet heath habitat and contributing to Northern Ireland's Habitat Action Plan (NIHAP) targets. In the absence of other funding for habitat management outside of designated sites, cooperation between the NIEA and other partners, including wind farm developers, is likely to be one of the very few ways in which existing degraded and fragmented blanket bog habitats in the uplands of Northern Ireland can be restored and enhanced, and one of the few ways that NIHAP targets can be achieved.

References

ADAS (2004) Restoration and Management of Blanket Mires, Upland Management Technical Guideline No. 4, DEFRA (Department for Environment, Food and Rural Affairs) contract BD1234.

Armstrong, A., J. Holden, P. Kay, B. Francis, M. Foulger, S. Gledhill, A.T. McDonald, A. Walker (2009) The impact of peatland drain-blocking on dissolved organic carbon loss and discolouration of water; results from a national survey. Journal of Hydrology 381 (2010) 112–120.

Armstrong, A., J. Holden, P. Kay, M. Foulger, S. Gledhill, A.T. McDonald, A. Walker (2010) Drain-blocking techniques on blanket peat: A framework for best practice. Journal of Environmental Management, 90 (2009) 3512–3519.

Bonnett, S.A.F, Ross, S., Linstead, C and Maltby, E. (2009) A review of techniques for monitoring the success of peatland restoration. University of Liverpool. Natural England Commissioned Reports, Number 086.

Bonnett, S.A.F, Linstead, C, Maltby, E., and Ross, S. (2011) Guidelines for Monitoring Peatland Restoration. Natural England Technical Information Note TIN097. First edition 2 September 2011.

CIEEM (Chartered Institute of Ecology and Environmetnal Management) (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater and Coastal. January, 2016.

DARD (Department of Agriculture and Rural Development) (2005) Agri-environment Scheme Management Plan. Advisory notes.

DARD (Department of Agriculture and Rural Development) (2010) Heather Moorland. Countryside Management Publications.

EAU (Environmental Advisory Unit, University of Liverpool) (1988). Heathland Restoration: A Handbook of Techniques. British Gas, Southampton (Comprehensive and authoritative).

Putwain, P.D. and Rae, P.A.S. (1988) Heathland Restoration: a handbook of techniques. Environmental Advisory Unit, Liverpool University & British Gas, Southampton.

Northern Ireland Peatlands and Uplands Biodiversity Delivery Group (2010) Guidelines for Peatland Restoration.
http://www.qpani.org/documents/PeatlandRestorationguidelinesfinal.pdf

RSPB, NIEA and NI Water (2011) Rebuilding the Countryside. The Garron Plateau : an example of blanket bog restoration and management in Northern Ireland.
http://www.rspb.org.uk/Images/Blanket_Bog_sm_tcm9-335643.pdf

Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency and Forestry Commission Scotland (2010) Good Practice During Windfarm Construction. Version 1, October 2010.

SNH (Scottish Natural Heritage) (1996a) Heather Re-establishment on Mechanically Disturbed Areas. Information Advisory Note No 44.

SNH (Scottish Natural Heritage) (1996b) Cutting of heather as an alternative to muirburn. Information Advisory Note No 58.

Appendices

Appendix 4.1 - Photographs comparing degraded condition of NVC communities at Barr Cregg with example NVC communities in good condition.

1. M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire

Barr Cregg

Photograph A1. Habitat mapped as M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire along the main access track to the south of the proposed substation. Note dominance of *Molinia caerulea*, *Eriophorum vaginatum* and *Trichophorum cespitosum* and the paucity of *Calluna vulgaris,* with *zero Sphagnum*.

Comparative Good quality habitat

Photograph A2. Example of *Calluna vulgaris-Eriophorum vaginatum* blanket mire in good condition. A good quanity M19 consists of a shaggy, purple-brown and dark-green, tussocky sward of *Calluna vulgaris* and *Eriophorum vaginatum,* with occasional *E. angustifolium,* and a deep rich-red-gold ground cover of *Sphagnum capillifolium, S. subnitens* with pleurocarpous mosses such as *Hylocomium splendens, Pleurozium schreberi, Hypnum jutlandicum, Rhytidiadelphus loreus and Plagiothecium undulatum.*

M15 *Trichophorum cespitosum-Erica tetralix* **wet heath**

Barr Cregg

Photograph A3. M15 *Trichophorum cespitosum-Erica tetralix* wet heath along the route between turnbines 3 and 1. Note cropped sward and the dominance of *Eriophorum vaginatum* and *Trichophorum cespitosum* and the paucity of *Calluna vulgaris,* with *zero Sphagnum*. The drainage ditches in this area have also been recentlycleaned out, further drying out the peat.

Comparative Good quality habitat

Photograph A4. Good quality M15 (*Trichophorum cespitosum-Erica tetralix* wet heath) are usually vast, ochre-brown tracts of moorland consisting of mixtures of *Calluna vulgaris, Erica tetralix, Trichophorum cespitosum* and *Molinia caerulea*, with occasional upright shoots of *Narthecium ossifragum* and *Eriophorum angustifolium*.

M25 Molinia caerulea-Potentilla erecta mire

Barr Cregg

Photograph A5. M25 *Molinia caerulea-Potentilla erecta* mire at the Barr Cregg. Note the cropped and damaged sward due to stock trampling, grazing and dunging. Absence of any Sphagnum species. Drainage ditches in many of the areas of M25 at Barr Cregg have also been recently cleaned out, further drying out this blanket bog community.

Comparative Good quality habitat

Photograph A6. Example of *M25 Molinia caerulea-Potentilla erecta mire* in good condition. A good quality M25 consists of tall dense tussocks of Molinia caerulea, with long leaves blown into waves by the wind and rain. The habitat can be diverse on a fine scale, with different species, particularly Sphagna, growing on the ground in between the tussocks.

Appendix 4.2. NVC communities at Barr Cregg, February 2016.

Photograph B1. The vegetation community at the site entrance which was mapped as M19 (*Calluna vulgaris-Eriophorum vaginatum* blanket mire). Note the dominance of *Eriophorum vaginatum* and *Molinia caerulea*, the paucity of *Calluna vulgaris* and the total lack of *Sphagnum*.

Photograph B2. The vegetation community at the site entrance, mapped as M19 (Calluna vulgaris-*Eriophorum vaginatum* blanket mire). Note the dominance of *Eriophorum vaginatum* with *Narthecium ossifragum* and the lack of *Calluna vulgaris* or *Sphagnum*.

Photograph B3. The vegetation community at turbine 4, looking north east. This vegetation was mapped as M19 (*Calluna vulgaris-Eriophorum vaginatum* blanket mire). Note the series of drains recently cleaned out, the dominance of *Eriophorum vaginatum with severely stunted Calluna vulgaris* in the foreground. There is a total lack of *Sphagnum*.

Photograph B4. The vegetation community north of turbine 4, with recently cleaned out drainage ditch. This vegetation was mapped as M19 (*Calluna vulgaris-Eriophorum vaginatum* blanket mire). Note the dominance of *Eriophorum vaginatum with some Molinia caerulea* and the absence of *Calluna vulgaris* and *Sphagnum*.

Photograph B5. The vegetation community east of turbine 1, with recently cleaned out drainage ditch. This community is a species poor M25 *Molinia caerulea-Potentilla erecta* mire.

Appendix 4.3. Countryside Management Scheme Restrictions

The following restrictions apply to land management taking place under the DARD Countryside Management Scheme (CMS).

Unimproved Grassland

- Annual nitrogen applications must not exceed 125kg per hectare;
- Unimproved grassland must be maintained by grazing. A hay crop or light silage crop may be removed;
- No cultivations, ploughing or reseeding are permitted;
- New or improved drainage systems must not be installed;
- Rush control must be carried out where rushes cover more than one third of the area. Rushes must be controlled by cutting or weed wiping preferably between 15 July and 15 March leaving 10% uncut/not wiped;
- No applications of pesticides or herbicides are permitted except by weedwiper or by spot spraying to control rushes or noxious weeds.
- The spread of scrub/trees must be controlled.
- Supplementary feeders must be rotated to avoid excessive poaching.
- No poaching.

Rough Moorland

- Stock rate restriction of 0.75Lu per hectare all year;
- No cultivation, fertilization, liming drainage, dumping or mineral extraction is permitted;
- No application of slurry, farmyard manure, herbicides, insecticides, sheep dip, fungicides, sewage sludge, basic slag, poultry litter or any other material is permitted;
- Existing drainage systems can be maintained but not widened, deepened or extended;
- Supplementary feeding is permitted on rough moorland grazing. All feeding sites must be regularly moved to prevent trampling and overgrazing damage. Care must be taken to avoid damage by vehicles.
- Supplementary feeders or troughs should be placed on lanes or other hard surfaces within rough moorland grazing and at least 10m away from watercourses.
- Peat cutting is limited to 0.1Ha for domestic use. Mechanised peat cutting is not permitted.
- New fencing is not permitted without permission of DARD.
- Trees must not be planted on rough moorland grazing.
- The spread of scrub / trees must be controlled.
- No poaching.

Wet Heath

- No grazing from 1 November to 28/29 February on all heather moorland types. However within the grazing period, the stocking density and length of grazing will vary depending on the heather moorland type and whether sheep (0.25Lu per hectare – 1 March to 31 October) or cattle (0.20Lu per hectare – 1 June to 31 August) are used.
- No cultivation, fertilization, liming drainage, dumping or mineral extraction is permitted;
- No application of slurry, farmyard manure, herbicides, insecticides, sheep dip, fungicides, sewage sludge, basic slag, poultry litter or any other material is permitted;
- Existing drainage systems can be maintained but not widened, deepened or extended;

- Supplementary feeding sites, temporary silage clamps and storage areas fro big bale silage or hay are not permitted on heather moorland.
- Peat cutting is limited to 0.1Ha for domestic use. Mechanised peat cutting is not permitted.
- New fencing is not permitted without permission of DARD.
- Trees must not be planted on heather moorland.
- No poaching
- Burning requires written permission from DARD and cannot be carried out from 15 April to 31 August.

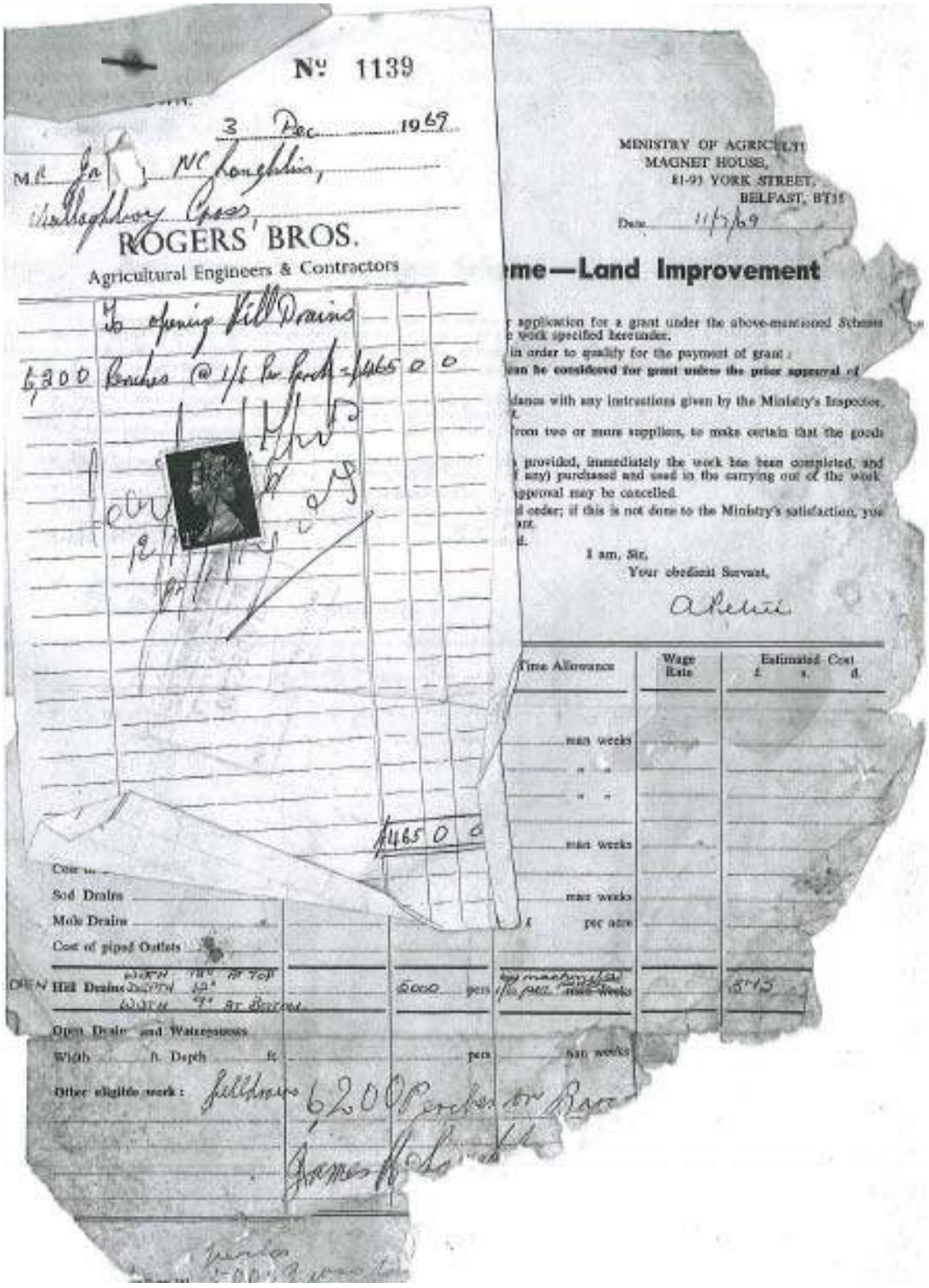
Appendix 4.4. Areas of Habitats Impacted by the Development

Infrastructure Type	Habitat Type	Temporary Loss (m²)	Permanent Loss (m²)	Combined Loss (m²)
Access Track	M19	1072	1340	2412
Access Track	M15	3330	3648.5	6978.5
Access Track	M25	3036	4014	7050
Access Track	SI Grassland	4376	6712	11088
Floated Track	M15	0	2296	2296
Floated Track	M25	0	3066	3066
Floated Track	M19	0	3626	3626
Floated Track	SI Grassland	0	1421	1421
Passing Bays (Temp)	M19	224	0	224
Passing Bays Cont…	M15	5	0	5
Passing Bays Cont…	M25	112	0	112
Passing Bays	SI Grassland	386	0	386
Hardstanding Area (T1)	M25	0	1295.5	1295.5
Hardstanding Area (T2)	M15	0	898	898
T2 Continued…	M19	0	69	69
Hardstanding Area (T3)	M25	0	1193.5	1193.5
T3 Continued…	M19	0	14	14
Hardstanding Area (T4)	M19	0	1235.5	1235.5
T4 Continued…	M15	0	60	60
Hardstanding Area (T5)	M15	0	1180.5	1180.5
T5 Continued…	M19	0	93	93
T5 Continued…	M25	0	22	22
Hardstanding Area (T6)	M15	0	1295.5	1295.5
Hardstanding Area (T7)	M15	0	1295.5	1295.5
Temporary Contruction Compound	SI Grassland	3500	0	3500
Temporary Enabling Works	SI Grassland	200	0	200
Substation Compound & Control Building	SI Grassland	0	1794	1794
Permanent Met Mast	M25	0	36	36
Temporary Met Mast Hardstanding	M25	150	0	150
Temporary Crane Hardstanding		495.5	0	495.5

Infrastructure	Dimensions
Temporary Construction Compound	20m x 50m
	50m x 50m
Temporary Enabling Works	10m x 20m
Control Building & Substation	39m x 46m

Track Type	Approx Length (m)
Excavated Track	2860
Floated Track	1487
Total track	4347

Appendix 4.5. Ministry of Agriculture Documentation July1969



№ 1139

3 Dec 1969

ROGERS' BROS.
Agricultural Engineers & Contractors

To opening Hill Drains
6300 Banks @ 1/6 Per Perch = £465 0 0

£465 0 0

MINISTRY OF AGRICULTURE
MAGNET HOUSE,
81-93 YORK STREET,
BELFAST, BT15

Date 11/12/69

me—Land Improvement

application for a grant under the above-mentioned Scheme
work specified hereunder.
in order to qualify for the payment of grant:
can be considered for grant unless the prior approval of
dance with any instructions given by the Ministry's Inspector.
from two or more suppliers, to make certain that the goods
provided, immediately the work has been completed, and
any) purchased and used in the carrying out of the work
approval may be cancelled.
order; if this is not done to the Ministry's satisfaction, you
art.
d.

I am, Sir,
Your obedient Servant,

	Time Allowance	Wage Rate	Estimated Cost £ s. d.
	man weeks		
	man weeks		
Sod Drains	man weeks		
Mole Drains		per acre	
Cost of piped Outlets			
Hill Drains	6000 perch	per man weeks	£465
Open Drains and Watercourses			
Width ft. Depth ft.	per	man weeks	

Other eligible work: fillDrains 6,300 Perches @ 1/6 Per Perch

Appendix 4.6. Results of MAVIS 'goodness of fit' studies of NVC communities at three locations within the site.

Four locations which NIEA had identified as 'active' blanket bog within the Barr Cregg site were chosen for more detailed study in March 2016. All four sites are assessed by the applicant as being highly degraded and not active blanket bog at the present time. The three locations are:

- The area of M19 on either side of the main access track to south of proposed substation;
- The area around turbine 4 (mapped as M19);
- The area around turbine 3 (mapped as M19);
- The area between T1 & T2.

In each area, 20 quadrats were recorded using the DOMIN scale and analysed using the MAVIS (Modular Analysis of Vegetation Information System) software. The purpose of the work was to determine the 'goodness of fit' to an NVC community – and to show how degraded and unlike any good quality NVC community these areas are.

When computer software is used to verify NVC classes for degraded habitats such as those at Barr Cregg, the 'goodness of fit' can often be lower than 50%. 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. Since NVC class is one of the key indicators of whether blanket bog is 'active' or not, it is important to understand how degraded is the NVC community.

Results of MAVIS study around the access track to south of substation

Site: Barr Cregg, Co. Derry, Date: 17.03.2016, Study area: Access Track, Recorder: Sean Meehan

Quadrat (2m x 2m) Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Bare peat (% cover)	0	30	5	20	0	5	2	2	2	5	0	5	15	0	5	0	0	0	0	0
Peat depth (m)	0.35	0.45	1.2	0.2	0.9	1.2	1	1	0.55	1.3	1	1	0.9	0.75	0.8	0.55	1	0.3	0.25	1
Species (% cover)																				
Calluna vulgaris		15	10	30	10	1	2	5	10	5	5	5	5	5	15	5	1	5	10	2
Erica tetralix				5	2	1	2	1	5	5	2		2	5	5	5		5	5	
Eriophorum vaginatum	1		10			10	15	5	20	30	30	5	35	5	5	5	40	5	5	2
Eriophorum angustifolium			2				2		1	5						2		10		
Trichophorum germanicum				10			2	10	5	2	1	5	2	5	10	10	5	20	5	
Narthecium ossifragum			2			5	15	<1	15	1		10	5		5			15		
Agrostis spp.	40	10			5	5	1	10			5	1	5	1	5	5	15		10	10
Nardus stricta	5							5		2		2	5	2	15	10			5	
Deschampsia flexuosa	5									2		2	5	2	10			10	10	10
Molinia caerulea	10	15	60	15	60	35	45	40	40	35	50	50	30	35	30	30	30	15	40	80
Sphagnum capillifolium		1														2				
Sphagnum fallax		1																		
Sphagnum palustre			1																	
Hypnum jutlandicum				1				1						2	5	1			5	
Pleurozium schreberi	10			1				1				2		2	5	5			2	5
Campopylous introflexous	2				2							2	1			2				
Polytrichum commune			2			10	5			1		2				1			2	
Rhytidiadelphus spp.	30	25			20							5		15	5	10			30	

Quadrat (2m x 2m) Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Other non Sphagnum bryophytes		15	10	10	20	30	10	10	10	15	15		10	10			10	15		
Juncus effusus	20					5	2	5	5	5		10		10		10		2		
Juncus squarrosus		5		10		2								2				1	5	
Juncus acutiflorus						2	2	5		5								2		2
Potentilla erecta	2						1	1	1		1					2	2			
Ulex spp.	10																		1	
Vaccinium myrtillus															2	2			2	<1
Cladonia portentosa		1	<1	<1				1				1	2	1			1		2	
Carex echinata						1		1	1					1				<1		
Other Carex spp.						1		1		1		1			1			<1		

NVC Classification (highest % fit) per quadrat following MAVIS software analysis

Quadrat	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
NVC classification (per MAVIS software)	U2b	H9e	M21b	M16a	H2c	M16a	M17a	M15c	M17a	M17	M15c	M15d	M17	M19a	M19a	M19a	M15c	M17	M15d	U2b
% fit (per MAVIS analysis)	39.29	32.26	41.75	52.33	42.07	39.79	52.67	47.03	55.32	52.84	51.12	41.74	43.94	45.91	51.71	52.83	40.9	50.96	44.84	51.11

Top ten NVC classifications of all twenty quadrats combined along access route

:ation AVIS e)	M15d	M19a	M15	M17c	M17	M15c	M15b	M16a	M17b	M16
er MAVIS e)	57.68	57.02	56.36	55.45	54.09	53.98	53.66	52.63	52.3	50.3

Results of MAVIS study at Turbine 4 microsite

Site: Barr Cregg, Co. Derry, Date: 18.03.2016, Study area: Turbine 4 microsite, Recorder: Sean Meehan

Quadrat (2m x 2m) Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Bare peat (% cover)	10	2	5	10	5	2	2	0	20	5	5	2	0	5	5	2	5	2	2	30
Peat depth (m)	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1
Species (% cover)																				
Calluna vulgaris	25	35	15	10	30	40	5		10	10	15		15	10	15	10	20	5	10	10
Erica tetralix	15	20	10	10	15		2	2	10	15	15	5		15	10		15	5		15
Eriophorum vaginatum	25	10	25	20	20	5	2	10	10	15	10	5	10	5	10	10	10	10	10	15
Eriophorum angustifolium									2					5						
Trichophorum germanicum	15	10	1	5	20	5	20	15	15	10	10	20	15	20	10	10	15	15	10	10
Narthecium ossifragum	2	2						2			1			15			2	1	2	
Agrostis spp.							10			1			5		5	10				
Nardus stricta		10	5		5	5	10	20	5	10	10	20	15	5	10	15	10	10	10	10
Deschampsia flexuosa		10	20	20	20		10	10	10		15	5	5		10	10	5		10	
Molinia caerulea	2	1		25	20	30	40	30	10	25	10	40	40	15	35	40		15	25	20
Sphagnum capillifolium	5	10	10	2	1		2		5	1	5	5		15			5	5		1
Sphagnum fallax									5		5									
Sphagnum spp.			10					15					10			2		5	10	
Sphagnum palustre											2									
Hypnum jutlandicum			5		2			5	5	5	10	2		2	5	5	10	5		5
Pleurozium schreberi			1									2	1						2	
Campylopus introflexus		5	5									1			2		2			
Polytrichum commune			2	1	1	1			2	2			5			5		2	2	2
Rhytidiadelphus spp.			5					5			2	5	10			15		15	10	

Quadrat (2m x 2m) Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Other non *Sphagnum* bryophytes	10	15	1	15	5		10													
Dicranum scoparium	2					2	2					1			2					
Plagiothecium undulatum	5	5				10					2	5		5						
Thuidium tamarascinum										2		2								2
Juncus acutiflorus									1											
Juncus squarrosus		2	1		5	1				1	1	2		5	2	2	2	2		1
Juncus effusus				2					1					2	2			2		
Vaccinium myrtillus			1				1			2	2	1			5			2	1	2
Cladonia portentosa						1			1					1	1	2	1			
Carex echinata														1						
Succisa pratensis										1										1
Myrica gale																	2	2	1	
Galium saxatile			<1													2				
Potentilla erecta	<1								2	1		2	1	2		1	2	2	2	1
Other *Carex* spp.												1			1					

NVC Classification (highest % fit) per quadrat following MAVIS software analysis

Quadrat	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NVC classification (per MAVIS software)	M19a	M15c	M19a	M19a	M19a	M19a	M19a	M17	M19a	M17c	M17	M19a	U2b	M17	M19a	M15d	M17	M19a	M17	M19a
% fit (per MAVIS analysis)	59.73	50.14	48.92	54.61	54.19	48.1	53.08	43.19	52.45	48.53	53.77	58.54	43.44	54.44	48.62	44.59	58.68	58.71	57.26	54.68

Top ten NVC classifications of all twenty quadrats combined within microsite area of Turbine 4

NVC classification (per MAVIS software)	M19a	M15d	M17c	M15	M17	M15c	M17b	M15b	M16a	M19
% fit (per MAVIS software)	64.18	64.13	63.42	58.79	57.97	57.49	55.16	53.81	50.3	49.4

Results of MAVIS study at Turbine 3 microsite

Site: Barr Cregg, Co. Derry, Date: 24.03.2016, Study area: Turbine 3 microsite, Recorder: Sean Meehan

Quadrat (2m x 2m) Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Bare peat (% cover)	5	5	2	5	2	30	10	10	35	15	35	10	2	5	5	10	10	10	5	5
Peat depth (m)	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1
Species (% cover)																				
Calluna vulgaris	2	2	5	5	10	10	15	25	20	20	10	25	20	20	25	15	10	20	10	25
Erica tetralix	2		1	2	2	10	15	10	5	5	2	5	10	10	10	5	5	10	5	10
Eriophorum vaginatum	2		1	5	2	5	15		5	15	2	20	15	15	10	10	5	10	15	15
Eriophorum angustifolium				1		2				2			5					2		5
Trichophorum germanicum				5	5	10	10	10	10	15	15	10	10	10	10	10	5	5	15	10
Narthecium ossifragum					1	2						2		2	5	2		1	5	2
Agrostis spp.	15	5	5	5	2			1					2			1	5	5		
Nardus stricta				2	1	5	15	10	10	15	15	15	10	5		5		5	5	5
Deschampsia flexuosa	5	5	5	5	5				5	5	5	5	2	5	5	10	5	5	5	5
Molinia caerulea	60	70	65	60	60	5		10	5	2		2		5	5	5	45	5	5	
Sphagnum capillifolium		1	1		2	10	10	10	5	5	5	10	10	15	10	10	5	10	10	
Sphagnum fallax					1	5	5	2	2	2					5			2	5	
Sphagnum spp.					1				1											
Sphagnum palustre								2					2					1	2	
Hypnum jutlandicum						5	10	10	2	5	5	2	5	5	5	5		5	5	5
Pleurozium schreberi					1			2		2				2						1
Campylopus introflexus											1									
Polytrichum commune	5	2	1	1	2	1						1			2	2	2			2
Rhytidiadelphus spp.																	5			5
Other non *Sphagnum*	5	2	5	5	5		10				10	10								5

Quadrat (2m x 2m) Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
bryophytes																				
Dicranum scoparium		1		2			2			2							1			2
Plagiothecium undulatum				2		2	10	2		5		2	5	5	5	2			5	2
Juncus acutiflorus		1	2																	
Juncus squarrosus	1			2		1						1	1				2		1	
Juncus effusus	5	5	10		5												5		2	
Vaccinium myrtillus													2			2		2		
Cladonia portentosa											1	1	1	1		1		1		1
Myrica gale	2	2																	1	
Potentilla erecta		1		1		1	2	2				2	2		2			1		2
Ulex spp.																	2			
Other *Carex* spp.				1															1	1

NVC Classification (highest % fit) per quadrat following MAVIS software analysis

Quadrat	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NVC classification (per MAVIS software)	U2b	M15d	M19a	M19a	M17a	M19	M19a	M19a	M19a	M19a	M19a	M17c	M19a	M19a	M19a	M19a	M19a	M19a	M19a	M19a
% fit (per MAVIS analysis)	40	39.16	46.9	53.11	49.43	62.11	55.43	54.49	50.88	67.63	48.74	56.42	58.71	61.61	59.7	58.7	45.19	60.33	52.94	60.38

Top ten NVC classifications of all twenty quadrats combined within microsite area of Turbine 3

NVC classification (per MAVIS software)	M19a	M17c	M15d	M17	M15	M17b	M15b	M15c	M16	M17a
% fit (per MAVIS software)	65.02	59.51	59	58.76	52.49	56.84	54.89	54.74	50.99	50.46

Results of MAVIS study along access track between Turbine 1 and Turbine 2

Site: Barr Cregg, Co. Derry, Date: 20.04.2016, Study area: track between T1 and T2, Recorder: Sean Meehan

Quadrat (2m x 2m) Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Bare peat (% cover)	0	0	0	20	10	15	0	15	5	10	25	10	15	2	2	1	5	10	2	10
Peat depth (m)	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1
Species (% cover)																				
Calluna vulgaris				10					5	2		10	15	20	20	20	15	15	10	15
Erica tetralix	5	5	5	5	5		15	5	5	10	5	5	10	10	5	10	5	5	10	10
Eriophorum vaginatum	30	5	5	10	15	5	20		25	10	15	25	15	25	25	25	35	30	10	20
Eriophorum angustifolium					1															
Trichophorum germanicum								1	2			1		2	2	5	5	5	10	2
Narthecium ossifragum																	1			1
Agrostis spp.						1					2			2			1			5
Nardus stricta			2			5		2												1
Deschampsia flexuosa	10		2			5	15					5	2	2	5	2	5	5	10	5
Molinia caerulea	35	50	50		50	20		20	2	2	2	2	2	2	5		5	5	15	5
Sphagnum capillifolium	10		5		5		15	2				5	10	10	5	10		5	5	5
Sphagnum spp.			5			15	10		40	50	15	10	5	15	5	10	10	5	5	5
Sphagnum palustre								10							5					
Hypnaceous species	15	20	20	65	15	15	20	15	5	20	10	10	10	10	15	10	10		10	10
Pleurozium schreberi							1		1						1				1	
Campylopus introflexus						2				2										
Polytrichum commune								2		1		5					1		10	2
Plagiothecum undulatum					1				1						1					
Dicranum scoparium		1					2													
Rhytidiadelphus loreus		30	10	5	2			15	10			10	10	5	10	15		5	10	5

Quadrat (2m x 2m) Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Juncus effusus													2			2		2	10	
Juncus squarrosus																1		2		
Potentilla erecta	2				1	1	1	1	1			1	1				1	1	2	
Vaccinium myrtillus			1								2		1			1	1		1	
Cladonia portentosa														1		1		1		1
Luzula multiflora								1												
Polygala serpyllifolia																	1			
Other *Carex* spp.																		1		
Brash / Leaf litter (% cover)	10	5	10	10	5	20	5	15	2		20	2	2				2	5		2

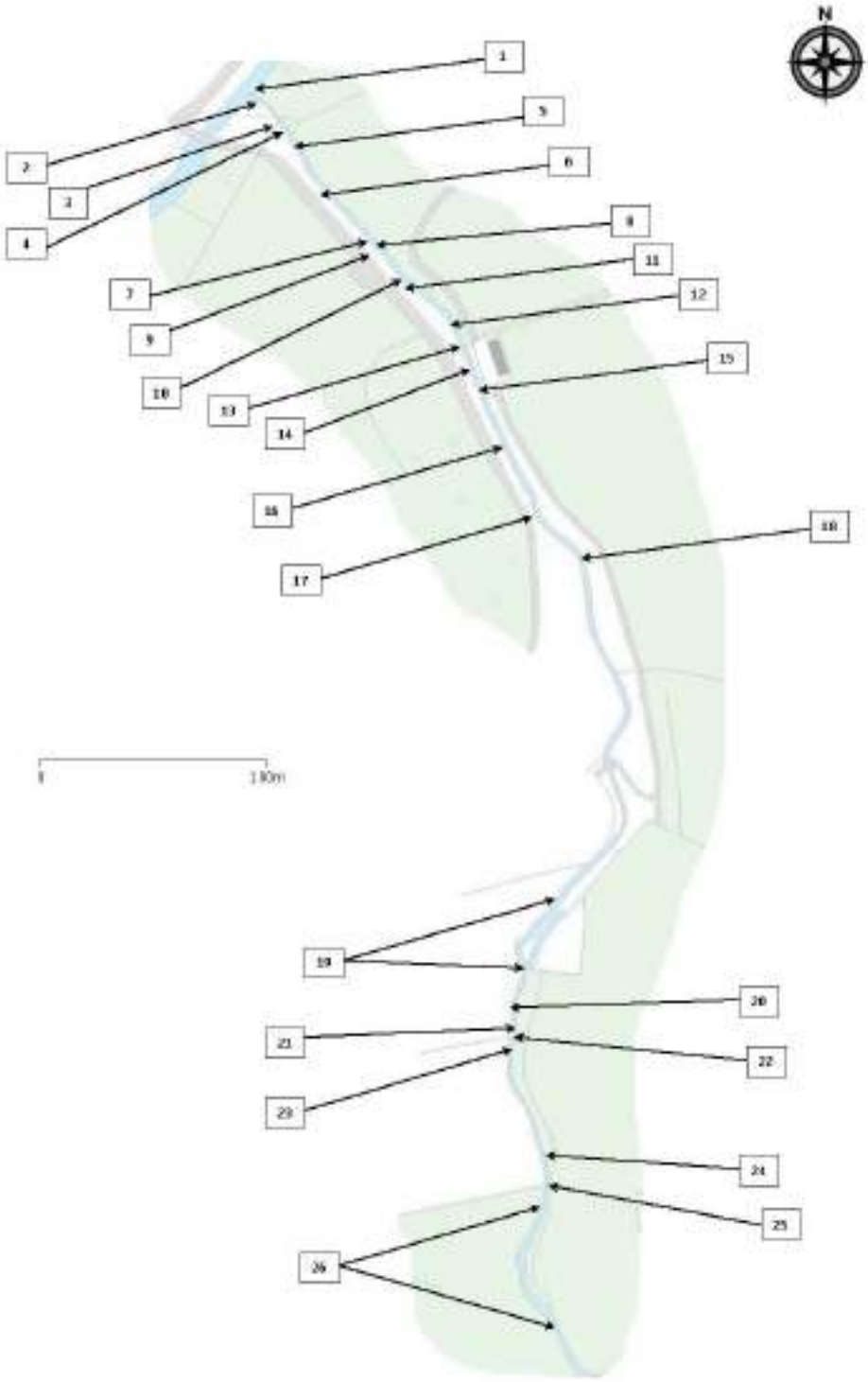
NVC Classification (highest % fit) per quadrat following MAVIS software analysis

Quadrat	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NVC classification (per MAVIS software)	M15c	M19a	M19a	H2c	M19a	M15c	M19a	M15c	M19a	M19a	M19a	M19a	M19a	M19a	M19a	M19a	M17	M19a	M19a	M19a
% fit (per MAVIS analysis)	44.82	43.21	47.42	45.77	53.05	34.72	49.51	47.49	52.5	42.91	37.18	56.21	51.52	51.89	61.61	53.58	55.41	49.66	59.38	53.11

Top ten NVC classifications of all twenty quadrats combined along the track between T1 and T2

NVC classification (per MAVIS software)	M19a	M15d	M15	M17c	M17	M15c	M17b	M19	M15b	H12a
% fit (per MAVIS software)	64.89	58.98	56.6	56.3	55.84	55.31	52.73	51.62	51.03	50.28

Appendix 4.7. Fisheries – Location of Stream Measures and Enhancement



Item	Easting	Northing	Specification	Photo
1	255013	412362	Remove fallen tree from left bank of Burntollet River immediately upstream of stream outlet – retain root structure in bank	
2	255014	412353	Remove dead branches and associated vegetation from stream channel	
3	255019	412345	Stream channel obstructed – remove fallen tree (right bank) from channel and cut back tree on left bank	
4	255024	412340	Remove tree from left bank and cut back tree on right bank	

5	255032	412333	Remove tree from left bank	
6	255042	412315	Remove trailing brambles and dead branches in this reach	
7	255062	412294	Remove tree from right bank (almost completely dead)	
8	255065	412290	Cut back tree on right bank	

9	255062	412290	Remove approx 20m of fence on left bank close to channel and re-erect in line with main fence line approx 3m back from bank	
10	255075	412275	Remove 25m of redundant fence falling into stream; cut back and remove dead scrub from both banks	
11	255075	412275	Install new suspended stock-proof gate	
12	255079	412252	Cut back and remove dead branches etc	

13	255108	412256	Install new suspended stock-proof gate	
14	255079	412252	Cut back and remove dead branches etc	
15	255111	412222	Install new suspended stock-proof gate	
16	255132	412202	Remove lower branches overhanging channel	

17	255140	412171	Remove approx 10m of redundant fence and tree from left bank – both at risk of falling into channel	
18	255156	412152	Carry out rock revetment of short section (approx 8m) of right bank top prevent further erosion	
19	255150	411997	Cut back and remove branches from channel and overhanging from bank	
	255133	411970		

20	255129	411945	Remove collapsed fence from left bank and re-erect 1m back for bank edge	
21	255131	411940	Cut back tree on right bank	
22	255131	411933	Install new suspended stock-proof gate	
23	255130	411926	Remove tree obstructing channel	

24	255144	411876	Remove live and dead material obstructing channel	
25	245141	411865	Install new suspended stock-proof gate	
26	255145	411804	Stream flows through “glen” with many aged trees and collapsed branches – general thinning would be of benefit	

Appendix 4.8. Generic Methodology and Definitions for Peatland Environmental Impact Assessment (EIA)

EIA Methodology

There is no generally accepted methodology for assessing impacts on peat hydrology, peatland habitats and vegetation communities. The method used here is based on approaches recommended by CIEEM (2016) and derived from more general environmental impact assessment (EIA) methodology, citing specific examples to illustrate the EIA terminology used. In this EIA the term 'effect' is used synonymously with 'impact'.

The impact assessment methodology used in this EcIA involves five clear steps which are described below. This methodology is subject to the application of law, policy and the approach to mitigation discussed in the legal and policy section of this document.

1. Describing the impact
2. Assessing the magnitude of impact and the value and sensitivity of the receiving environment
3. Determining the degree of significance of the impact based on the frozen design for the development which includes changes to the layout and other features which have been evolved as a result of the baseline environmental and ecological studies. These included changes are described as 'mitigation included in the design of the development' by CIEEM (2016)
4. Where required, proposing appropriate mitigation measures to reduce impacts
5. Re-assessing residual impacts after mitigation.

Each identified impact is first described, then its significance rated. The description provides a qualification of the impact in the context of the Site. It is considered that the methodology used here is in line with good practice followed in other environmental disciplines and provides a robust evaluation.

Impact Description

The following criteria are considered when describing each impact:
Nature of impact – negative (adverse) or positive (beneficial), direct or indirect, reversible or irreversible;
Spatial extent: localised (within a few meters), widespread (over a whole catchment);
Temporal extent: short term (few days), medium term (months) long term (years); reversible or permanent.

Assessing the Degree of Significance of the Impact

The rating of an impact is the assessment of its degree of significance. The significance of an impact is a direct combination of:
The magnitude of change of the impact (both spatial and temporal), which includes an assessment of the probability of occurrence of the impact;
The value and sensitivity of the receptor or receiving environment.

Assessing the Magnitude of Impact and the Value and Sensitivity of the Receiving Environment

Magnitude of the Impact

The scale or magnitude of an impact is a measure of the spatial or temporal extent of the effect, such as whether an effect is localised or widespread and whether the effect is of short duration or is long term or permanent. An example of a permanent impact is land take, where an area of existing habitat and associated vegetation community is lost. Guidelines for the assessment of impact magnitude are provided in Table 1 below.

Table 1: Guidelines for the Assessment of Impact Magnitude

Magnitude	Guidelines
Low	Noticeable changes for less than two years (i.e. temporary/reversible), significant changes for less than six months, or barely discernible changes for any length of time, over a small area, such as 20 m on either side of an access track, to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.
Medium	Noticeable but not significant changes for more than two years or significant changes for more than six months but less than two years, over a partial area, such as 50 m on either side of an access track, to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact will possibly occur.
High	Significant, permanent/irreversible changes, over the majority of the development area, to key characteristics or features of the particular environmental aspect's character or distinctiveness for more than two years. Impact certain or likely to occur.
Very High	Very significant, permanent/irreversible changes, over the whole development area and beyond (i.e. off site), to key characteristics or features of the particular environmental aspect's character or distinctiveness for more than two years. Impact certain or likely to occur.

Receptor Value and Sensitivity

The value and sensitivity of the receptor will be a function of a variety of factors, such as biodiversity value, social/community value and economic value. The *value* or potential value of a resource or feature can be determined within a defined geographical context. For example, the following hierarchy is recommended by IEEM (2006) with respect to ecological receptors, including priority habitats such as peatland vegetation communities:

international
UK
national (i.e. England/Northern Ireland/Scotland/Wales)
regional
county (or metropolitan - e.g. London)
district (or unitary authority, city, or borough)
local or parish and
within zone of influence only (which might be the project site or a larger area).

The *sensitivity* of the receiving environment is the degree of resilience that the environment has either to resist change or to bounce back from change. In relation topeatlands and their hydrology, the sensitivity of the habitat is determined both by (a) the resilience of its eco-hydrology (i.e. how resistant to change is moisture absorption, retention and throughflow, the physical flow or rate of flow of water through the peat) and (b) the resilience of peatland plants (i.e. how capable are plants of resisting changes to their moisture regime (flooding or drying out) and how capable are they of regenerating naturally if they are damaged).

If a peatland habitat has been degraded, for example if the acrotelm of a blanket bog has been dried out through drainage or it has been compacted and hardened through mechanical peat cutting, the sensitivity of the peatland receptor will have been substantially reduced. The peat hydrology and the acrotelm conditions are already damaged and, because the dried out peat is now less sensitive to change, further damage, through, for example, excavation, would be unlikely to change to peat's density and hydrology further.

In order to help define the level of receptor 'Value and Sensitivity', the following guidance, shown in Table 2, has been adopted for the purposes of this EIA. It is based loosely on the example given in Scottish Natural Heritage (2005). Some examples of sensitivity in the context of eco-hydrology, peat and peatland vegetation communities are also provided in the table below:

Table 2: Guidelines for the Assessment of Receptor Value and Sensitivity
(More specific examples of value and sensitivity for blanket bog receptors are provided in Tables 1a and 1b in the text).

Value and Sensitivity	Guidelines
Low	Feature/receptor characteristics do not make a significant contribution to the character or distinctiveness locally. Feature/receptor not designated. Feature receptor identified as being generally tolerant of the proposed change (i.e. of low sensitivity). Feature/receptor possesses low biodiversity, social/community value and/or economic value. Feature/receptor is common. Eco-hydrology examples include a natural resource or habitat which is either already degraded and damaged (e.g. a eutrophic lake, a river contaminated with industrial effluents, an area of derelict or contaminated land; an intensively drained agricultural field), or is resistant to changes in hydrology (quantity or quality of water), such as a very large water body, urban environment with a high proportion of hard surfaces, improved, species-poor, improved grasslands).
Medium	Feature/receptor only possess characteristics which are locally significant. Feature/receptor not designated or only designated at a local level. Feature/receptor identified as having some tolerance of the proposed change subject to design and mitigation etc . i.e. is only moderately sensitive. Feature/receptor possesses moderate biodiversity, social/community value and/or economic value. Feature/receptor is relatively common. Eco-hydrology examples include receiving natural resource or habitat which is only moderately resistant to changes in hydrology (quantity or quality of water), such as a large lake or river (the size and quality of the water body providing a degree of 'buffering' of any hydrological changes), wetlands such as reedbeds whose plants can adapt to changes in hydrology or habitats of only moderate value, such as agriculturally drained and managed rushy pasture; degraded

Value and Sensitivity	Guidelines
	semi-natural grasslands or scrub woodland, or already degraded and agriculturally-managed peatlands which have lost their typical, semi-natural bog vegetation.
High	Feature/receptor possesses key characteristics which contribute partially to the distinctiveness, and character of the site/receptor (e.g. complementary features of nationally important sites, including ASSIs) and receptor is identified as having low capacity to accommodate proposed form of change (i.e. is highly sensitive). Feature receptor possesses substantial biodiversity, social/community value and/or economic value. Feature/receptor is uncommon. Eco-hydrology examples include: a receiving natural resource or habitat which is valuable as a water resource e.g. a large water body or large river used for recreational fishing or for visual/amenity value and habitats which are vulnerable to changes in hydrological conditions (quantity or quality of water), such as large oligotrophic water bodies (lochs), neutral to alkaline mires, flushes and wetlands, damaged/degraded blanket peat and mires.
Very High	Feature/receptor possesses key characteristics which contribute significantly to the distinctiveness, rarity and character of the site/receptor (e.g. designated features of international/national designation/importance such as SACs, SPAs, Ramsar sites, SSSIs, etc) and receptor is identified as having very low capacity to accommodate proposed form of change (i.e. is very highly sensitive). Feature/receptor possesses very significant biodiversity, social/community value and/or economic value. Feature/receptor is extremely rare. Eco-hydrology examples include: receiving natural resource or habitat which is valuable as a water resource e.g. for drinking or bathing water), and habitats which are very vulnerable to changes in hydrological conditions (quantity or quality of water), such as salmonid fisheries, small oligotrophic water bodies (lochs and streams), intact, undamaged, acidic blanket bog (active) and raised bogs (active), particularly those with bog pools.

Where there is assessed to be a difference in value and sensitivity of a receptor it is good practice to use the worst case scenario and use the higher of the two assessments, either receptor value or sensitivity, as the overall assessment to be used in determining the final level of significance.

Impact Probability

With respect to the probability or likelihood of an impact occurring, the broad definitions identified in Table 3 have been applied. The probability of an impact occurring has been included in the overall assessment of impact magnitude provided in Table 1 above.

Table 3: Definitions for Assessing the Probability and Likelihood of an Impact

Descriptor	Description
Unlikely	Do not expect it to happen, but it is possible
Possible	May occur
Likely	Will probably occur
Certain	Very likely to occur

Impact Significance Rating

Four ratings of impact significance are derived using the above Impact Assessment Matrix (IAM), these being Negligible, Minor, Moderate and Major. They are a direct result of the assessment of impact magnitude (which includes an assessment of probability of occurrence) and receptor value and sensitivity. Example definitions of these four ratings are provided below in Table 4 below with examples to illustrate how impact magnitude and receptor value and sensitivity combine as the assessment criteria.

Table 4: Guidelines for the Definition of Impact Significance

Impact significance rating	Guidance Description with Examples
Negligible	An impact, which has an 'unlikely' probability of occurrence, could affect an area only temporarily and locally, and affects a receptor of low or medium value and sensitivity, such as a receptor which is already damaged or degraded or a receptor which is resistant to change. An impact, which has only very low potential to cause a change to surface or groundwater hydrology. Eco-hydrology examples include: impact to a canalised, already contaminated, urban stream; clay soils with species-poor, improved neutral grassland. An impact which is reversible in the short-term (several days).
Minor	An impact which has a possible chance of occurring and has only limited potential to temporarily and locally alter a receptor of low to medium value or low to medium sensitivity (e.g. an impact to an already eutrophic pond, a large, fast flowing, high discharge river, mature woodland on freely draining soils, neutral to alkaline wetland; agriculturally managed or drained peatland which no longer has typical bog vegetation or recently cutover peatland). An impact, which has a low potential to cause a change to surface or groundwater hydrology. An impact that is reversible in the short to medium-term (e.g. several weeks).
Moderate	An impact, which has a 'likely' chance of occurrence and/or has the potential to alter a moderately sensitive receptor (e.g. mesotrophic lake, mature reedbed; damaged/degraded blanket bog or heathland) over the short or medium term. The effect could extend wider than the immediate local area. An impact which causes a change to surface or groundwater hydrology such that water conditions are altered for several weeks. Reversible in the medium-term (several weeks to months).
Major	An impact, which has a 'certain' chance of occurrence and/or has the potential to completely alter a sensitive receptor (e.g. a salmonid river, an oligotrophic loch or an area of intact, undamaged, 'active' acidic blanket peat or acidic raised bog). An impact which causes a change to surface or groundwater hydrology such that water conditions are altered lasting effects over several weeks/months. Examples might include: flow of water in a river completely interrupted for a several days, ponding/flooding of water over an area of normally un-inundated land for several weeks, sediment discharge/deposition or other contamination (e.g. oil spill) into an upland, clear-water river over a period of several days, diversion of water away from a wet peat mire, inducing drought and damage to moisture-loving plant communities for several weeks to months. Possibility of medium to long-term effect, possibly reversible, but if so, only over several months or longer. Could be irreversible.

While the Impact Assessment Matrix provided in Table 5 below gives guidance on the assessment of impact significance, each impact and its receptor is unique and professional judgement is used throughout the assessment process.

Table 5: Significance of Impacts on Peat and Peatland Vegetation Communities

Impact Magnitude	Value and/or Sensitivity of Receptor			
	Low	**Medium**	**High**	**Very High**
Low	Negligible#	Negligible#	Minor#	Moderate#
Medium	Negligible#	Minor#	Moderate#	Major#
High	Minor#	Moderate#	Major#	Major#
Very High	Moderate#	Major#	Major#	Major#

The rating of the impact is the most important step in the EIA process since it is this rating, which is used to assess whether mitigation should be implemented and also to determine whether mitigation measures have reduced the impact to an insignificant level. In all cases, the above matrix is used for guidance only and professional judgement is used for each unique, site-specific combination of receptor value and sensitivity, together with impact spatial and temporal magnitude.

For the purposes of this EIA, only those impacts which are assessed as being of potentially greater than minor adverse significance have been initially considered as Significant in EIA terms. As a matter of good practice mitigation measures are proposed for all those impacts which are assessed as Significant. The aim of mitigation measures is to reduce all identified impacts as far as is reasonably possible and in this case, to a rating of minor or lower.

Mitigation Measures

The preferred hierarchy of mitigation is prevention first, then minimisation (eg CIEEM, 2016).
prevention: avoid, relocate, modify the design;
minimisation: modify location, modify design, alter technology, reduce size and scale of development.

Assessment of Residual Impacts

The next step in the EIA process is the assessment of the residual impacts after the implementation (where necessary) of the proposed mitigation measures. Residual impacts are rated in accordance with the definitions provided in Tables 4 and 5. Residual impacts assessed as being of minor or negligible are considered to be insignificant.

Enhancement

According to CIEEM (2016), once the above types of mitigation measures have been applied and the significance of residual impacts assessed, there is the opportunity to identify appropriate compensation measures to offset significant residual effects and to identify opportunities for ecological enhancement.

Cumulative ***Impact Assessment***

The Planning (EIA) Regulations (Northern Ireland) require that the likely cumulative impacts of a proposed development are assessed. Cumulative impacts are those that result from incremental changes caused by other developments, plans or projects together with the proposed development or developments. The Institute of Environmental Management and Assessment (IEMA) defines cumulative impacts as:

> *"…the impacts on the environment which result from incremental impacts of the action when added to other past, present and reasonably foreseeable future actions…"*

Cumulative impacts can be broadly defined as additive or interactive. Additive impacts are those in which change in an environmental parameter (receptor) may be added to (or subtracted from) another change. Many small effects on one sensitive receptor could add up to a significant overall effect even if individually they are insignificant. Typically, additive impacts occur when different facets or activities within a project or between projects act upon the same environmental receptor (e.g. the additive impact of noise from a number of different sources (e.g. heavy plant, piling and traffic on a single residential receptor). Interactive impacts are again assessed in relation to a receptor, but here the impact is caused by the interactions of effects from different activities even if individually these effects are insignificant (e.g. the interaction of noise disturbance and light pollution on bat foraging). Cumulative impacts can also have an effect in terms of the overall temporal impact, scale of impact and/or spatial impact.

Appendix 4.9 - Information to Inform a Habitat Regulations Assessment

Introduction

1. Blackstaff Ecology Ltd was commissioned by Renewable Energy Systems (RES) to provide information to inform a Habitat Regulations Assessment (HRA) for a proposed wind farm at Barr Cregg, near Claudy, County Derry.

2. A HRA is required where a project may give rise to 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). Part of the River Faughan & Tributaries Special Area of Conservation (SAC) is located within the Planning Application Boundary of the proposed wind farm indicated by a red line boundary as illustrated on Figure 4.1 – Volume 3 (FEI 2016).

3. A HRA is undertaken by the Competent Authority that takes the decision on the project, in this appeal the Commissioner to whom the decision has been delegated. The Commissioner will take account of all the evidence in the ES (2012), FEI (2014) and FEI (2016) described below, and responses on consultation relating to these documents The Commissioner will also have regard to any evidence at the likely informal hearing into the appeal and to the views of NIEA, whom he or she must consult for the purposes of the HRA. The ES and FEI together with the following information (to inform a HRA) have been compiled to present the information required for NIEA to undertake a revised HRA.

4. A HRA was completed by NIEA on the 17th June 2014; to cover the possibility that permission might be granted locally. However not only is the scheme at appeal but updated to include a second tranche of FEI (2016) and an updated Information to Inform a HRA (which considers the contents of the second round of FEI) has been provided for the project.

Current Layout (Alternative Infrastructure Layout)

Amendments Description

5. The developer refined the proposed development of the site within FEI (2014) and the changes can be summarised as follows:

- Reduced crane pads from 40m x 30m to 40m x 20m and reduced extent of temporary infrastructure;
- Re-orientated T4 crane pad
- Reduced size of junction to south of T4;
- Moved access track to T5 east;
- Re-orientated T5 crane pad;
- T5 turning head moved north of crane pad;
- Moved access track to T3 west;
- Re-orientated T3 crane pad;
- Permanent meteorological mast moved southeast of T3;
- Re-orientated T2 crane pad.

6. A secondary planning application submitted as part of the FEI (2014) created the potential for a section of track from T1 to T2 (hereafter termed Alternative Infrastructure Layout) as follows:

- Omission of junction to north of T4 and access track between T4 & T2, and new access track from adjacent to T1 to T2;
- T2 crane pad relocated.

7. A third planning application was also submitted to include the addition of:

- Passing bays along the turbine access route.

8. The Alternative Infrastructure Layout (Figure E), which was submitted with the FEI (2014) and included a separate planning application (A/2014/0112/F) is now proposed as the layout. The layout of the Alternative Infrastructure remains unchanged. However, to minimise the extent of construction working corridor where at all possible and maintain hydrological links, the length of floated site access track has been increased. A new figure has been produced, Alternative Infrastructure Layout (Figure E (Rev A) – Volume 3)

Further Environmental Information (2016)

9. In addition to the aforementioned change, the information contained in the Further Environmental Information (2016) Volumes 1 – 3 has been produced to present up to date assessments as it was considered that revised assessments that include a greater level of detail would provide clarity for the Planning Appeals Commission. The decision of which assessments should be produced was based on the consultation responses received post submission of the FEI (2014), the content of the Derry & Strabane DC – Development Case Officer Report and other developments that have arisen since submission of FEI (2014).

Grid Connection Assessment

10. An assessment has been undertaken of the potential grid connection to the site which assesses approximately 19 km of underground cable from the site to the substation at Killymallaght, Newbuildings, Co. Derry.

Water Framework Directive Assessment

11. An assessment has been undertaken to provide an overarching summary, drawing on existing baseline information established in the existing assessments, in order to demonstrate specifically that the proposed development does not compromise the specific objectives of the Water Framework Directive and the relevant River Basin Management Plan.

Outline Habitat Restoration & Management Plan

12. The developer has compiled a detailed (outline) HRMP (Habitat Restoration & Management Plan) in order to demonstrate that the measures proposed can be effectively delivered in order to adequately compensate for the loss of Priority Habitat as a result of the development and ensure an overall 'No Net Loss' as a result of the Development.

Habitat Regulations Assessment

13. HRA consists of a four staged approach (EC 2002[1]) consisting of a 'Test of Likely Significance' and if necessary an 'Appropriate Assessment'.

- **Stage One:** *Screening* **or** '*Test of Likely Significance*' - the process which identifies the likely impacts upon a Natura 2000 site of a project or plan, either

[1] European Commission (2002) *Assessment of plans & projects significantly affecting Natura 2000 sites, Methodological guidance on the provisions of Article6 (3) & (4) of the Habitats Directive 92/43/EEC*, Office of the Official Publications of the European Communities, Luxembourg.

alone or in combination with other projects or plans, and considers whether these impacts are likely to be significant;

- **Stage Two: Appropriate Assessment -** the consideration of the impact on the integrity of the Natura 2000 site of the project or plan, either alone or in combination with other projects or plans, with respect to the site's structure and function and its conservation objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts;
- **Stage Three: Assessment of Alternative Solutions** - the process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site;
- **Stage Four: Assessment Where Adverse Impacts Remain -** an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

Description of the Project

14. The Planning Application Boundary associated with the proposed wind farm is approximately 77.0 ha. The proposed wind farm would result in the permanent land take of approximately 3.73 ha to accommodate the permanent infrastructure footprint and a temporary land take of approximately 2.36 ha to accommodate the temporary infrastructure footprint (including grading). The total permanent and temporary development footprint is 6.09 ha (excluding construction working areas).

15. The Planning Application Boundary includes approximately 243 m of the Burntollet River which is designated as part of the River Faughan & Tributaries SAC; ~561 m of a minor tributary of the Burntollet River to the south-east; and ~306 m of a minor tributary of the Burntollet River along the south-west boundary of the site.

16. The proposed wind farm would result in minimal permanent land take (within the boundary of the River Faughan & Tributaries SAC), as the bridge abutments lie outside (but adjacent) the boundary of the SAC. However, the clear-span bridge will completely span the Burntollet River (& also the SAC), this will inevitably create an area of permanent shade across 30m2 - 50 m2 of riverbed.

17. The proposed wind farm would result in construction, operation (and eventual decommissioning) of seven wind turbines (overall height 125 m; hub height 80 m; rotor diameter 90 m) and associated infrastructure including installation of two permanent clear-span bridges and four culverts; earthworks, excavation and foundation works associated with the construction of infrastructure; storage and management of spoil during construction; the installation and management of surface water drainage during construction; the management of surface water and foul water drainage during operation; and the removal of above ground infrastructure and reinstatement during decommissioning.

18. These activities have the potential to cause peat slide, accidental leaks or spillage and release of pollutants such as sediment, silt, concrete, fuel, oils, chemicals or other waste material that in the absence of appropriate mitigation measures would result in point source pollution causing significant adverse effects on the designated sites, their qualifying features and conservation objectives.

19. Construction access to the site would be via the newly installed clear-span bridge which would be put in place prior to any on-site construction works. It is anticipated that

construction would last approximately 12-18 months. The proposed wind farm would be operational for a period of 25 years.

20. The Proposed Wind Farm Development would be connected to the cluster substation by approximately 19 km of underground cable. The route would begin at the connection point within the Proposed Wind Farm Development, and thereafter would follow the public road corridor from the wind farm site entrance to the indicative cluster location, as shown in Figure 2.1: Potential Grid Connection (Volume 3).

Grid Connection

21. For an underground cable connection the trench would be similar to those used on the main wind farm site itself. The trench will be approximately 0.5 m – 0.75 m wide and 1.0 m deep and could run in the road side verges adjoining the carriageway, or within footways adjoining the carriageway, although it is also possible that the cable would be laid within the carriageway itself. At 33 kV, underground cables are normally laid to a depth of 0.9 m. To lay this cable a trench is dug, bedding material, normally sand, is placed along the trench-base, the cable laid and then covered with more sand. The cables are then protected by a layer of protective plastic covers and then backfilled with subsoil and original topsoil and turfs.

22. For bridge crossings along the road, the cable could be laid within the bridge, if there is sufficient excavation depth, or otherwise via directional drilling under the watercourse.

23. The construction activities would include the following:

- Clearance of land (including vegetation strip as appropriate)
- Digging of trenches
- Backfilling of trenches and remediation.
- The land should be reinstated as near as reasonably practicable to its original condition.

Description of Natura 2000 Site

24. Part of the River Faughan & Tributaries Special Area of Conservation (SAC) is located within the site of the proposed wind farm. The boundary of the SAC in relation to the proposed wind farm is illustrated on Figure 4.1.

25. The site was confirmed as a SAC on the 20/09/12 and its current status is as an SAC[2] (Site Code UK0030361). The SAC is 293.27 ha in extent and 62.03 km in length. Table 1 below describes the qualifying features for the designation of the SAC and a summary of the conservation objectives.

26. 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 habitat 'Old sessile oak woodland with *Ilex* and *Blechnum* in the British Isles' and the Annex II species otter. Other species present include sea lamprey *Petromyzon marinus*, brook lamprey *Lampetra planeri* & river lamprey *Lampetra fluviatilis*. Table 1 below describes the qualifying features for the designation of the Natura 2000 site.

2 http://jncc.defra.gov.uk/ProtectedSites/SACselection/sac.asp?EUCode=UK0030361

Table 1: River Faughan & Tributaries SAC Qualifying Features & Conservation Objectives.

Qualifying Feature	Representativity[1]	Relative Surface[2]	Conservation Status[3]	Global Assessment[4]	Description
91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	C	C	**B**	C	59.6% National Cover
	Population[5]	**Isolation[6]**	**Conservation[7]**	**Global[8]**	
1106 Atlantic Salmon	C	C	**B**	B	Resident Population
1355 Otter	C	C	**B**	C	Common
1095 1099 1096 Lamprey spp.	D	**-**	-	-	Present

[1] Degree of representativity of the habitat type; A Excellent, B Good, C Significant, D Non-Significant
[2] Area of the site covered by the natural habitat type in relation to the total area covered by that natural habitat type within the national territory; A 100≥ p >15%, B 15≥ p >2%, C2≥ p > 0%
[3] Degree of conservation of the structure and functions of the natural habitat type, concerned including restoration possibilities; A Excellent, B Good, C Average/Reduced
[4] Global assessment of the value of the site for conservation of the natural habitat type concerned; A Excellent, B Good, C Significant
[5] Size & density of the population of the species present on the site in relation to the populations present within national territory; A 100% ≥ p >15%, B 15% ≥ p >2%, C 2% ≥ p > 0%, D Non-Significant
[6] Degree of isolation of the population present on the site in relation to the natural range of the species; A isolated/almost isolated, B not-isolated, but on margins of area of distribution, C not-isolated within extended distribution range
[7] Degree of conservation of the features of the habitat which are important for the species concerned and possibilities for restoration; A Excellent, B Good, C Average/Reduced
[8] Global assessment of the value of the site for conservation of the species concerned; A Excellent, B Good, C Significant

Conservation Objectives	
91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	Maintain & where feasible expand the extent of existing oak woodland but not at the expense of other SAC features (There are areas of degraded heath, wetland & damp grassland which have the potential to develop into oak woodland).
	Maintain & enhance oak woodland species diversity & structural diversity.
	Maintain the diversity & quality of habitats associated with the oak woodland, e.g. fen, swamp, grasslands, scrub, especially where these exhibit natural transition to oak woodland
	Seek nature conservation management over adjacent forested areas outside the ASSI where there may be potential for woodland rehabilitation.
	Seek nature conservation management over suitable areas immediately outside the ASSI where there may be potential for woodland expansion.
1106 Atlantic Salmon	Maintain & if possible expand existing population numbers & distribution (preferably through natural recruitment) & improve age structure of population.
	Maintain & if possible enhance the extent & quality of suitable salmon habitat - particularly the chemical & biological quality of the water & the condition of the river channel & substrate.
1355 Otter	Maintain & if possible increase population numbers & distribution.
	Maintain the extent & quality of suitable otter habitat, in particular the chemical & biological quality of the water & all associated wetland habitats.

Impacts on Natura 2000 Site

27. The proposed project is not directly connected with or necessary to the management of the Natura 2000 site.

28. The likely significance of effects of the proposed project on the Natura 2000 site and its conservation objectives have been assessed taking into account the source-pathway-receptor model. The source is defined as the individual elements of the proposed project that have the potential to impact on the Natura 2000 site, its qualifying features and its conservation objectives. The pathway is defined as the means or route by which a source can migrate to the receptor. The receptor is defined as the Natura 2000 site and its

qualifying features. Each element can exist independently however a potential impact is created where there is a linkage between the source, pathway and receptor.

Likely Significance of Effects on Qualifying Features & Conservation Objectives

Atlantic Salmon

29. The presence of Atlantic salmon is the primary reason for site selection. Salmon require clean, well-oxygenated river gravel for spawning, good water quality, a substrate consisting of coarse boulder, cobble and pebble for juvenile fry and parr, an abundant food supply and unimpeded access to and from the sea (JNCC 2007[3]). The overall conservation status of Atlantic salmon in the UK is Unfavourable-Inadequate (JNCC 2007[3]). The overall grading of B indicates good conservation status within the Natura 2000 site (JNCC 2011[2]).

30. The waterfall at Ness Wood Country Park, ~1.6 km downstream of the site, provides a significant barrier to migrating fish species and no salmon were recorded in the Burntollet River upstream of the waterfall. There is a potential link between source, pathway and receptor during construction, operation and decommissioning. Elements of the proposed wind farm as described above in paragraphs 11-17 have in the absence of appropriate mitigation measures the potential to have significant adverse effects on the water quality downstream which is a key component in the conservation status of salmon. Salmon are particularly susceptible to deteriorating water quality due to sedimentation. Suspended solids can physically choke fish, disrupt feeding behaviour, smother salmon eggs and disrupt or prevent alevin emergence reducing the fitness of fry and parr and their ability to cope with natural pressures (Hendry & Crag-Hine 2003[4]). The significance of effects would be greater during the salmon spawning season which extends from October to March.

Oak Woods

31. The habitat type 'old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' is a qualifying feature, but is not the primary reason for site selection. The habitat is characterised as woodland dominated by a mixture of oak *Quercus* spp. and birch *Betula* spp. The overall conservation status of oak woods in the UK is Bad but Improving (JNCC 2007[3]). The overall grading of B indicates good conservation status within the Natura 2000 site (JNCC 2011[2]).

32. Habitat conforming to the Annex I habitat type is fragmented occurring at Ness Wood and Ervey Wood along the Burntollet River, Bonds Glen Wood along Bonds Glen and along the valley sides of the River Faughan and the Glanrandel River (NIEA 2011[5]). The proposed wind farm at its nearest point is 1.3 km from Ness Wood which contains this habitat type. There is no identified pathway between source and receptor during construction, operation or decommissioning.

Otter

33. Otter is a qualifying feature, but is not the primary reason for site selection. Otter requires good water quality, suitable shelter for resting and breeding and an abundant food supply dominated by fish (Chanin 2003[6]). The overall conservation status of otter in the UK is Favourable (JNCC 2007[3]). The overall grading of B indicates good conservation status within the Natura 2000 site (JNCC 2011[2]).

[3] Joint Nature Conservation Committee (2007) *Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006*, Peterborough, JNCC, viewed on 30 March 2011, Available from: <http://www.jncc.gov.uk/article17>.
[4] Hendry, K. & Cragg-Hine, D (2003) *Ecology of the Altantic Salmon, Conserving Natura 2000 Rivers, Ecology Series No. 7*, English Nature, Peterborough.
[5] Northern Ireland Environment Agency (2011) Draft ASSI Conservation Objectives River Faughan And Tributaries, NIEA, Belfast.
[6] Chanin, P. (2003) *Ecology of the European Otter, Conserving Natura 2000 Rivers Ecology Series No. 10*, English Nature, Peterborough.

34. There is a potential link between source, pathway and receptor during construction, operation and decommissioning of the proposed wind farm. Elements of the proposed wind farm as describe above in **paragraphs 14-20** have in the absence of appropriate mitigation measures the potential to have an adverse effect on water quality that could lead to a reduction in fish populations therefore impacting on the conservation status of otter.

Likely Significance of Effects on Integrity of Natura 2000 Site

35. The primary effect associated with the proposed wind farm is a potential change in the water quality of watercourses within the Natura 2000 site during construction, operation and decommissioning. Maintaining water quality is the most important factor required for the specific structure and function of the site. It is a key indicator of conservation status and is an important factor for the conservation status of the qualifying features.

36. Changes in the chemical and biological water quality of watercourses can be used as an indicator to evaluate the condition of the Natura 2000 site and its qualifying features taking into account the conservation objectives. Good water quality is necessary for the long-term maintenance of the Natura 2000 site.

37. In the absence of appropriate mitigation measures, deterioration of water quality during construction, operation or decommissioning of the proposed wind farm has the potential to effect the integrity of the Natura 2000 site and its water dependant qualifying features affecting their conservation status and resulting in adverse effects on the distribution and abundance of species populations.

In-Combination Effects with Other Projects

38. There are currently a number of impacts occurring within the Natura 2000 site that have an influence on its conservation and management. The primary effects relevant to the proposed project include deterioration of water quality within the catchment of the Natura 2000 site from point-source pollution including urban and industrial centres; point-source pollution from development including existing and consented 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 causing cumulative adverse effects on water dependant qualifying features, affecting their conservation status, and the overall integrity of the Natura 2000 site.

Stage One: Information to Inform Screening or Test of Likely Significance

Table 2: Screening Matrix	
Name of Project or Plan. gBarr Cregg Wind Farm (7	Barr Cregg Wind Farm (7 turbines). Additional access track. Passing bays.
Project reference *(Planning ref. etc.):*	A/2012/0401/F A/2014/0114/F A/2014/0112/F
NIEA File number:	CB 19666 CB 21232 CB 21225

Name and location of Natura 2000 site.	River Faughan & Tributaries SAC
Natura 2000 site features: (refer to JNCC website)	River Faughan and Tributaries designated an ASSI in May 2008 because area is of special scientific interest because of the physical features of the river and its associated riverine flora and fauna. It was recommended at the same time (May 2008) as a SAC, which remains its current status. N2K features: Salmon *Salmon salar* Otter *Lutra lutra* Upland *Oak Wood*
Brief description of the project or plan • **Size and scale;** • **Land-take;** • **Distance from Natura 2000 site or key features of the site;** • **Resource requirements (water abstraction etc);** • **Emission (disposal to land, water or air);** • **Excavation requirements;** • **Transportation requirements;** • **Duration of construction, operation, de-commissioning etc;** • **Other.**	RES UK & Ireland Ltd would like to undertake construction of a proposed wind farm consisting of seven wind turbines with associated infrastructure at Barr Cregg, County Derry. The layout of the proposed project can be found on **Figure 4.1**. The proposed project is not directly connected with or necessary to the management of the Natura 2000 site. Size and scale – Overall planning application boundary 77 ha actual wind farm infrastructure will occupy only 4.31 ha. Land-take Minimal. The clear span bridge required for access will necessitate excavations for the abutments and foundations. Distance from Natura 2000 site or key features of the site The proposed site traverses the boundary of the River Faughan & Tributaries SAC. A clear span bridge will be employed for the proposed access. Resource requirements (water abstraction etc) None Emission (disposal to land, water or air) The entire site drains indirectly or directly to Burntollet River, which is main tributary within the River Faughan catchment and part of the SAC designation. Excavation requirements Excavations required for the 7 turbines foundations, crane pads, access lanes and all associated infrastructure (incl. underground grid connection (19 km)). Flood compensation measures and clear span bridge works will result in significant excavation works. Transportation requirements New site tracks will be constructed, upgrade of the main access point. Duration of construction, operation, de-commissioning etc The construction phase will take approximately 12-18 months from starting on site to commissioning the wind turbines and electrical system. The turbines will have a minimum operational life of 25 years.

Is the proposal directly connected with or necessary to management of the site for conservation of N2K features? If yes proceed no further.	No
Brief description of the Natura 2000 site	The River Faughan & Tributaries SAC is located within the site of the proposed wind farm. The boundary of the SAC in relation to the proposed wind farm is illustrated in **Figure 4.1.** 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 habitat 'Old sessile oak woodland with *Ilex* and *Blechnum* in the British Isles' and the Annex II species otter. Other species present include sea lamprey *Petromyzon marinus*, brook lamprey *Lampetra planeri* & river lamprey *Lampetra fluviatilis*.
Assessment Criteria	
Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the Natura 2000 site.	• **Proposed Project** The proposed wind farm would involve construction of seven wind turbines (overall height 125 m; hub height 80 m; rotor diameter 90 m) and associated infrastructure including upgraded site entrance; new and upgraded site access tracks; two clear span bridges and four culverts; turbine foundations, transformers and crane hard standings; a substation and control building; a temporary construction compound; a temporary enabling works compound; underground cables; two temporary monitoring masts; a permanent meteorological mast; and road widening and improvement works on sections of the transport route; and an 19 km underground grid connection. These activities have the potential to cause peat slide, accidental leaks or spillage and release of pollutants such as sediment, silt, concrete, fuel, oils, chemicals or other waste material that would result in point source pollution causing significant adverse effects on the designated sites, their qualifying features and conservation objectives. • **In Combination with Other Projects** There are currently a number of impacts occurring within the Natura 2000 site that have an influence on its conservation and management including pollution from urban and industrial centres, existing (and consented) wind farm developments, commercial forestry and farming.
Describe any likely direct, indirect or secondary impacts of the project (either alone or in combination with other plans or projects) on the Natura 2000 site by virtue of: • Size and scale; • Land-take; • Distance from Natura 2000 site or key features of the site; • Resource requirements (water abstraction etc);	• **Proposed Project** The Planning Application Boundary associated with the proposed wind farm is approximately 77.0 ha. The proposed wind farm would result in the permanent land take of approximately 3.73 ha to accommodate the permanent infrastructure footprint and a temporary land take of approximately 2.36 ha to accommodate the temporary infrastructure footprint (including grading). The total permanent and temporary development footprint is 6.09 ha (excluding construction working areas). The proposed wind farm would result in minimal permanent land take (within the boundary of the River Faughan & Tributaries SAC), as the bridge abutments lie outside (but adjacent) the boundary of the SAC. However, the clear-span bridge will completely span the Burntollet River (& also the SAC), this will

• Emission (disposal to land, water or air); • Excavation requirements; • Transportation requirements; • Duration of construction, operation, de-commissioning etc;	inevitably create an area of permanent shade across $30m^2$ - 50 m^2 of riverbed. The proposed wind farm would result in the permanent land take of a minimal area of land situated within the boundary of the River Faughan & Tributaries SAC to accommodate the excavated abutment and foundations of a clear-span bridge which would completely span the Burntollet River. The Planning Application Boundary includes approximately 180 m of the Burntollet River which is designated as part of the River Faughan & Tributaries SAC; ~620 m of a minor tributary of the Burntollet River to the south-east; and ~365 m of a minor tributary of the Burntollet River along the south-west boundary of the site. The proposed wind farm would result in construction, operation and decommissioning activities including installation of two permanent clear-span bridges and four culverts; earthworks, excavation and foundation works associated with the construction of infrastructure; storage and management of spoil during construction; the installation and management of surface water drainage during construction; the management of surface water and foul water drainage during operation; and the removal of above ground infrastructure and reinstatement during decommissioning. • **In Combination with Other Projects** The primary effects relevant to the proposed project include deterioration of water quality within the catchment of the Natura 2000 site from point-source pollution including urban and industrial centres; point-source pollution from development including existing (and consented) 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 causing cumulative adverse effects on water dependent qualifying features, affecting their conservation status, and the overall integrity of the Natura 2000 site.
Describe any likely changes to the site arising as a result of : • Reduction of habitat area: • Disturbance to key species; • Habitat or species fragmentation; • Reduction in species density; • Changes in key indicators of conservation value (water quality etc).	The primary effect associated with the proposed wind farm is a potential change in the water quality of watercourses hydrologically linked to the Natura 2000 site. Water quality is the single most important factor for the conservation status of the Natura 2000 qualifying features. Poor water quality and increased sedimentation can have significant influences on these qualifying features and can result in population declines. Salmon in particular are susceptible to deteriorating water quality due to sedimentation. Suspended solids can physically choke fish, disrupt feeding behaviour, smother salmonid eggs and disrupt or prevent alevin emergence reducing the fitness of fry and parr and their ability to cope with natural pressures (Hendry & Cragg-Hine 2003). Pollution can also have a major impact of lamprey; smothering spawning gravels and nursery silt habitat and making the watercourse unsuitable for ammocoetes (Maitland 2003 & Goodwin 2009). The significance of effects on salmon and lamprey would be greater during the spawning season. A decline in fish populations has the potential to impact on the otter population.

Describe any likely impacts on the Natura 2000 site as a whole in terms of: • Interference with the key relationships that define the structure of the site; • Interference with key relationships that define the function of the site.	Water quality is an important factor in the specific structure and function of the Natura 2000 site and an indicator of conservation value. Good water quality is necessary for the long-term maintenance of the Natura 2000 site. Deterioration of water quality has the potential to affect the conservation status of the qualifying features impacting on the distribution and abundance of species populations.
Provide indicators of significance as a result of the identification of effects set out above in terms of: • Loss • Fragmentation • Disruption • Disturbance; • Change to key elements of the site (e.g. water quality etc).	Water quality is a key indicator of the conservation status of the Natura 2000 site and is an important factor for the conservation status of the qualifying features. Changes in the chemical and biological water quality of the watercourses can be used as an indicator to evaluate the condition of the Natura 2000 sites and their qualifying features taking into account the conservation objectives.
Describe from the above those elements of the project or plan, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts are not known.	The proposed project has the potential to have a significant effect on the water quality of the Natura 2000 site in combination with other projects. Therefore the finding of the Stage 1 – Test of Likely Significance is **Significant.** A Stage 2 Appropriate Assessment is therefore required to be completed.

Natura 2OOO Feature: Mention all features	**Describe any likely direct or indirect effects to the N2K features arising as a result of:** • **loss;** • **reduction of habitat area;** • **disturbance;** • **habitat or species fragmentation;** • **reduction in species density;** • **changes in key indicators of conservation value (e.g. water quality, climate change).**	***Effect Significant/Not Significant? Why?**
Atlantic Salmon *Salmo Salar* **-**	General Construction, operation and decommissioning works	**Potentially significant –** In the absence of mitigation sediment laden runoff could potentially enter nearby watercourses which could ultimately impact upon the Salmon population and indirectly Otter population structure through interference with key components of their ecology.

		Disruption of the salmon population structure through alteration and disruption of required salmon habitat.
	New Access track between T1 and T2	**Potentially significant –** In the absence of mitigation sediment laden runoff could potentially enter nearby watercourses which could ultimately impact upon the Salmon population and indirectly Otter population structure through interference with key components of their ecology. Disruption of the salmon population structure through alteration and disruption of required salmon habitat.
	Works at both natural and man-made watercourses	**Potentially significant –** In the absence of mitigation sediment laden runoff could potentially enter nearby watercourses which could ultimately impact upon the Salmon population and indirectly Otter population structure through interference with key components of their ecology. Disruption of the salmon population structure through alteration and disruption of required salmon habitat.
	Storage of spoil	**Potentially significant –** In the absence of mitigation sediment laden runoff could potentially enter nearby watercourses which could ultimately impact upon the Salmon population and indirectly Otter population structure through interference with key components of their ecology. Disruption of the salmon population structure through alteration and disruption of required salmon habitat.
	Passing bays	**Potentially significant –** In the absence of mitigation sediment laden runoff could potentially enter nearby watercourses which could ultimately impact upon the Salmon population and indirectly Otter population structure through interference with key components of their ecology.

		Disruption of the salmon population structure through alteration and disruption of required salmon habitat.
	Peat Slide	**Potentially significant –** In the absence of mitigation sediment laden runoff could potentially enter nearby watercourses which could ultimately impact upon the Salmon population and indirectly Otter population structure through interference with key components of their ecology. Disruption of the salmon population structure through alteration and disruption of required salmon habitat.
Otter *Lutra lutra*		**Potentially significant** The main impact on the Otter population is if there is a significant reduction in water quality thereby reducing the quantity of fish available.
Upland Oak Woodlands	Not present	N/A

Only mitigation measures designed within the application can be considered at this stage. Any conditions that NIEA would impose must be assessed through the appropriate assessment stage.

Describe any potential effects on the Natura 2000 site as a whole in terms of: interference with the key relationships that define the structure or function of the site	**Effect considered significant/non-significant: Finding of No significant effects Matrix**
In river works and works adjacent to designation & Direct impact on otter population.	**Potentially significant**
Provide details of any other projects or plans that together with the project or plan being assessed could (directly or indirectly) affect the site.	**Provide details of any likely in-combination effects and quantify their significance -**
A/2012/0401/F, Barr Cregg wind farm (7 turbines), A/2014/0114/F, additional access track between T1 & T2, A/2014/0112/F, passing bays & (Underground) grid connection route	These proposals have been assessed together as they are all components of the same project.

Is the potential scale or magnitude of any effect likely to be significant?	
Alone?	**Yes☒ No☐**
In-combination with other projects of plans?	**Yes☒ No☐**

List of Agencies Consulted: Provide contact name and telephone or email address.	

Above consultee response.	

Conclusion: Is the proposal likely to have a significant effect on an N2K site?	**Yes**☒ **No**☐
IT HAS BEEN DETERMINED THAT THE PROPOSAL COULD POTENTIALLY HAVE A SIGNIFICANT EFFECT ON THE CONSERVATION OBJECTIVES AND/OR THE INTEGRITY OF THE SAC; THEREFORE A STAGE 2 APPROPRIATE ASSESSMENT IS REQUIRED.	

Stage 2: Appropriate Assessment Report

Table 3: Assessment of Effects of the Project or Plan on the Integrity of the Site	
Describe the elements of the project or plan (alone or in combination with other projects or plans) that are likely to give rise to significant effects on the site (from screening assessment)	The construction of the wind farm requires the central drain (near T3) is diverted; that watercourses adjacent to the passing bays require protection by temporary works or diversions; excavation of a flood compensation area is required and a new bridge over the SAC is to be installed. A 19 km cable route grid connection from the wind farm to the nearest substation is also required to be undergrounded. Sections of the work are in proximity to the SAC. Therefore, mitigation measures are needed to ensure that there are no adverse effects on the integrity of the River Faughan & Tributaries SAC.
Set out the Conservation objectives of the site	See Annex 1 of the report.
Describe how the project or plan will affect key species, key habitats and the integrity of the site (determined by structure and function and conservation objectives). Acknowledge uncertainties and any gaps in information.	As a result of the direct hydrological link the SAC there is the potential for the Natura 2000 selection features to be adversely affected through a degradation of the water quality. This may result from construction of the windfarm, associated infrastructure and passing bays leading to contaminated runoff entering the drainage system present i.e. the road side ditches/wind farm track drainage systems (during construction, operation & decommissioning).
Describe what mitigation measures are to be introduced to avoid or reduce the adverse effects on the integrity of the site. **Acknowledge uncertainties and any gaps in information**	Mitigation measures are outlined in Table 4 (below). ***The mitigation that has been identified and applied to ensure no adverse effect on the integrity of the SAC is considered to be straightforward and integral to the specifications of the wind farm project. It is also clearly achievable, sure to succeed and as such meets the precautionary nature of the HRA process.***

Table 4: Summary of Mitigation to Minimise Significance of Effect on Designated Nature Conservation Sites

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
Environmental Impact Assessment All mitigation measures detailed in the EIA would be implemented during construction, operation and decommissioning works. Mitigation measures in relation to the Natura 2000 site can be found in the following sections of the ES; Chapter **7: Ecology Assessment, Chapter 8: Fisheries Assessment, Chapter 12: Geology & Hydrogeology Assessment and Chapter 13: Hydrology Assessment.**	The mitigation measures as set out in the EIA have been designed to avoid and reduce impacts on water quality which is a key indicator of the conservation status of the water dependant qualifying features and is an important factor for the structure and function of the Natura 2000 site.	The mitigation measures set out in the EIA would be incorporated with the Construction & Decommissioning Method Statement (CDMS) and its relevant procedures would be implemented by the Contractor and Sub- Contractors as part of the requirements of the construction contract.	Certain/Near Certain Mitigation Measures can be assured through planning conditions.	Construction Site Manager (CSM) – The CSM would be responsible for the implementation of the CDMS which would include all of the mitigation measures set out in the EIA. See Construction & Decommissioning Method Statement (below) for full details of proposed monitoring.
Peatslide Hazard & Risk Assessment A copy of the Assessment can be found in Appendix 12.2 of the ES (2012). All mitigation measures detailed in the Assessment would be implemented during construction and operation works.	There is a low risk of peat slide at all turbine locations and on-site access track locations. There would be no storage of spoil within a 50m buffer of a main watercourse and within a 20m buffer zone of a minor watercourse or existing drainage ditches. Spoil storage would be kept to a minimum, temporarily covered and stored in designated bunded areas. Cut-off drains would be installed to direct excess water around these areas. Emergency Plan – Details the procedures to be undertaken in the event of an incident that could cause pollution on to a watercourse during construction or operation.	The Construction & Decommissioning Method Statement (CDMS) as described below and its relevant procedures would be implemented by the Contractor and Sub- Contractors as part of the requirements of the construction contract.	Certain/Near Certain Mitigation Measures can be assured through planning conditions.	Construction Site Manager – The CSM will be responsible for completing regular environmental audits of the site and monitoring the construction activities.
Drainage Management (SuDS) Design Statement	Surface water run-off would not be allowed to discharge directly into watercourses.	SuDS will be implemented by the Contractor and Sub-Contractors as part of the requirements of the	Certain/Near Certain Mitigation Measures can be	A Suitably Qualified Consultant would be appointed to undertake regular site inspections to ensure

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
Surface water management would be undertaken in accordance with SuDS. A copy of the Design Statement can be found in Appendix 13.4 of the ES (2012) The Design Statement is incorporated into the WFD (Water Framework Directive) Assessment (FEI (2016) Chapter 3. All mitigation measures detailed in the WFD would be implemented during construction and operation works.	A 50 m exclusion zone would be maintained to all main watercourses and a 10 m exclusion zone to significant artificial land drainage. SuDS would be constructed at source with the use of swales, check dams and settlement ponds prior to or at the same time as construction of the access roads to provide a surface water management system. Clear-span bridges would be used across the Burntollet River and tributaries of the Burntollet River. All other watercourse crossings would be designed on a bespoke basis during the post consent design stage in accordance with best practice guidance.	construction contract.	assured through planning conditions. The SuDS proposed replicates that installed for similar wind farms in Northern Ireland. It has been demonstrated that silt and sediment can be managed in a controlled way, stored at source and collected within the drainage system.	the implementation of the SuDS. Construction Site Manager – would undertake monitoring of SuDS throughout construction to inform regular maintenance. Operational and maintenance staff would undertake monitoring of SuDS post-construction.
(SuDS) Design Statement for Works At Turbine 3 Surface water management would be undertaken in accordance with SuDS. The Design Statement can be found in Chapter 13 FEI (2014) and is similarly incorporated within the WFD Assessment - Chapter 3 - FEI (2016) All mitigation measures detailed in the Design Statement would be implemented during construction and operation works.	Collect all contaminated runoff and groundwater from the area of works and direct it to a primary treatment/ settlement lagoon with a sufficient surface overflow rate to allow settlement of the maximum anticipated concentration of silt for the design water quality event. A secondary lagoon or off-line temporary containerised system for flocculant dosing would be provided where clay-range particles were observed for which conventional settlement is inadequate. The existing artificially excavated channel of the Central Drain in the vicinity of T3 would be intercepted and diverted. The diverted alignment has been designed to go around the area affected by works in order to give sufficient working area to allow a	SuDS will be implemented by the Contractor and Sub-Contractors as part of the requirements of the construction contract. All works at the drain diversion shall be supervised by an Ecological Clerk of Works (ECoW) or equivalent	Certain/Near Certain Mitigation Measures can be assured through planning conditions. Runoff control and treatment design drawings and supporting calculations demonstrating that the design arrangement proposed is sufficiently robust such that no adverse effect materially affecting the designated site downstream would be anticipated are included in Appendix .13-1 and 13-2 of the FEI. All the above mitigation measures would avoid and reduce adverse effects on the integrity of the designated sites	A Suitably Qualified Consultant would be appointed to undertake regular site inspections to ensure the implementation of the SuDS. Operational and maintenance staff would undertake monitoring of SuDS post-construction.

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
	minimum 20m riparian buffer between the works and channel. The design includes provision of scour protection (rip rap or similar) at bends and provision of temporary scour protection in the form of biodegradable geotextile liners to the excavated channel in order to minimise washout of silt during the period of establishing the channel. The proposed diversion channel would be constructed off-line and from the discharge point in an up gradient direction so that the channel remained dry. Water would not be permitted to enter the channel until all temporary and permanent scour protection had been placed. Permanent protection at channel bends would be formed out of rip rap or Reno mattress; temporary protection to the channel base and banks would be formed from biodegradable geotextile (jute / coir matting or similar) anchored to banks, lapped to prevent bypassing, and overlaid with imported rounded washed gravel to the stream bed The execution of the works will be undertaken during periods of low river flows. Works to the diversion shall be restricted to those periods outside of the fish spawning season (October to March Inclusive).		and on their water dependant qualifying features.	

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
Further Environmental Information All mitigation measures detailed in the FEI will be implemented during construction, operation and decommissioning works. Mitigation measures in relation to the Natura 2000 site can be found in the following sections and associated appendicesas follows: **FEI (2014);** Chapter 7: Ecology Assessment, Chapter 8: Fisheries Assessment, Chapter 13: Hydrology Assessment. **FEI (2016);** Chapter 2: Grid Connection Assessment, Chapter 3: WFD Assessment, Chapter 4: OHRMP.	The mitigation measures as set out in the FEI have been designed to avoid and reduce impacts on water quality which is a key indicator of the conservation status of the water dependant qualifying features and is an important factor for the structure and function of the Natura 2000 site.	The mitigation measures set out in the FEI will be incorporated with the Construction & Decommissioning Method Statement (CDMS) and its relevant procedures would be implemented by the Contractor and Sub- Contractors as part of the requirements of the construction contract.	Certain/Near Certain Mitigation Measures can be assured through planning conditions.	Construction Site Manager (CSM) – The CSM would be responsible for the implementation of the CDMS which would include all of the mitigation measures set out. See (below) for full details of proposed monitoring.
Design Statement for Works at the proposed Burntollet Bridge Surface water management would be undertaken in accordance with SuDS. A copy of the Design Statement can be found in Chapter 13 FEI (2014)and is similarly incorporated within the WFD Assessment within Chapter 3 - FEI (2016) All mitigation measures detailed in the WFD would be implemented during construction and operation works.	Works to construct the proposed Burntollet Bridge would unavoidably be located in proximity to the Burntollet River. While the structure has been designed to avoid any requirement for work within the river channel, the works would require excavations for bridge abutments in close (<5m) proximity to river bank. Such excavations would have potential to cause risk to water quality due to runoff from exposed excavated clay surfaces in proximity to the river. Works to construct bridge abutments and foundations would be phased to occur during a dry spell and period of low river flows. Planning would be informed by observed river levels, ongoing weather	This mitigation will be implemented by the Contractor and Sub-Contractors as part of the requirements of the construction contract. All works at the Burntollet River crossing will be supervised by an Ecological Clerk of Works (ECoW) or equivalent	Certain/Near Certain Mitigation Measures can be assured through planning conditions. All of the mitigation measures described would avoid and reduce adverse effects on the integrity of the designated site and on their water dependant qualifying features.	A Suitably Qualified Consultant would be appointed to undertake regular site inspections to ensure the implementation of the measures described.

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
	(rainfall) patterns and precipitation forecasts. Prior to undertaking excavations, Contractor to install a series of parallel silt fences or straw bales pinned to undisturbed ground between the excavations and the river bank, extending adjacent and beyond the riverside extent of the earthworks. Any shallow groundwater or rainfall runoff from excavations would be collected and pumped to a settlement feature for treatment, while any excavated spoil would be removed for temporary or permanent storage outwith the water buffer zone. Silt fences or straw bales would be removed only on completion of the works and following establishment of vegetation between the abutment and river bank.			
Design Statement for Works at FSC (Flood Storage Compensation) Areas Surface water management would be undertaken in accordance with SuDS. A copy of the Design Statement can be found in Chapter 13 FEI (2014) and is similarly incorporated within the WFD Assessment within Chapter 3 - FEI (2016) All mitigation measures detailed in the WFD would be implemented during construction and operation works.	Flood storage works would not be permitted within the mapped boundary of the Faughan SAC at the site. Phasing of earthworks to occur during a dry spell and period of low river flows. Planning would be informed by observed river levels, ongoing weather (rainfall) patterns and precipitation forecasts. No works to construct the FSC would be permitted during prolonged spells of wet weather or when flooding would reasonably be anticipated. The design of the FSC area will ensure that the width will not exceed approximately 15m in order that all work could be undertaken by a long-reach excavator from the land-side of the	SuDS will be implemented by the Contractor and Sub-Contractors as part of the requirements of the construction contract. All works at the FSC areas hall be supervised by an Ecological Clerk of Works (ECoW) or equivalent	Certain/Near Certain Mitigation Measures can be assured through planning conditions. Runoff control and treatment design drawings and supporting calculations demonstrating that the design arrangement proposed is sufficiently robust such that no adverse effect materially affecting the designated site downstream would be anticipated are included in Appendix .13-1 and 13-2 of the FEI. All the above mitigation	A Suitably Qualified Consultant would be appointed to undertake regular site inspections to ensure the implementation of the SuDS. Operational and maintenance staff would undertake monitoring of SuDS post-construction.

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
	excavation, thus reducing the requirement for trafficking or plant movement in close proximity to the boundary of the SAC. Prior to undertaking excavations, Contractor to install a series (min. 2) of parallel silt fences or straw bales pinned to undisturbed ground between the works and the river bank, extending adjacent and beyond the riverside extent of the earthworks. Excavation of material and overburden (max depth of earthwork typically 1.0-1.2m based on outline design) by mechanical excavator, and profiling of the excavated surface to the required levels. Excavated material to be transported outwith the watercourse buffer for temporary or permanent storage. Note that timescale for excavations of the type shown on our drawings would be anticipated to be no greater than 1-2 days. Replace stored turf over the re-profiled excavation. Remove silt fences / straw bales after completion of earthworks and after vegetation has fully re-established (with a view to trapping silts entrained in runoff from the earthworks). The execution of the works will be undertaken during periods of low river flows. Works to the diversion shall be restricted to those periods outside of the fish spawning season (October to March Inclusive).		measures would avoid and reduce adverse effects on the integrity of the designated sites and on their water dependant qualifying features.	

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
Construction & Decommissioning Method Statement A Method Statement would be produced during the post consent design stage as is established practice. The proposed construction works relating to the **Passing Bays** shall be carried out between 1st June and 31st October.	The CDMS would control the implementation of construction and decommissioning works to avoid and reduce impacts on the environment and the qualifying features of the Natura 2000 site. It will be approved by DOE Planning Service prior to project commencement. Environmental Requirements of Subcontractors – Would detail the environmental management measures that must be adopted by contractors during construction. The Spoil Management Plan (SMP) will detail spoil storage and management during construction. Emergency Procedure in Event of Contaminant Spill – Would detail procedures to be undertaken in the event of an incident that could cause pollution on site during construction or operation. Water Quality Monitoring Procedure – Would detail monitoring programme to periodically monitor water quality and aquatic habitat of watercourses pre-construction, during construction and post-construction. All the above mitigation measures would avoid and reduce adverse effects on the integrity of the designated sites and on their water dependant qualifying features.	The CDMS and its relevant procedures would be implemented by the Contractor and Sub- Contractors as part of the requirements of the construction contract.	Certain/Near Certain The production of a CDMS can be assured through planning condition.	Construction Site Manager –The CSM would be responsible for the implementation of the CDMS, completing regular environmental audits of the site and monitoring the activities of Sub-Contractors. Ecological Clerk of Works – Due to the ecological sensitivity of the site, an ecologist would be appointed to undertake regular site visits and would also be available on call throughout construction. A Suitably Qualified Consultant would be appointed to undertake water quality monitoring throughout construction. The monitoring as detailed above would ensure that proposed mitigation measures are implemented and work effectively. In the event of mitigation failure any issues would be identified and remedial measures implemented immediately.
Outline Habitat Restoration & Management Plan – (Habitat Improvements; Harrowing) Surface water management would be undertaken in accordance with	Habitat improvement (bog restoration) works on lower lying improved grasslands include potential for screefing off the surface turf and turn it over to expose the peat surface (this may not be	CMS & SuDS will be implemented by the Contractor and Sub-Contractors as part of the requirements of the construction contract.	Certain/Near Certain Mitigation Measures can be assured through planning conditions.	A Suitably Qualified Consultant would be appointed to undertake regular site inspections to ensure the implementation of the CMS.

List of mitigation measures to be introduced.	Explain how the mitigation measures will avoid/reduce the adverse effects on the integrity of the site.	Provide evidence of how mitigation measures will be implemented and by whom.	Provide evidence of the degree of confidence in the likely success of mitigation measures.	Explain the proposed monitoring scheme and how any mitigation failure will be addressed.
SuDS. The Design Statement is incorporated within the WFD Assessment within Chapter 3 – FEI (2016) All mitigation measures detailed in the WFD would be implemented during construction and operation works.	required if these areas have been used for temporary peat storage during the construction phase). A possible method for turning over the surface turf would be to use a trailed, shallow mouldboard ploughshare, followed by light harrowing. Improvement works may be sited within the 50m buffer of a watercourse on the site. Mitigation measures specific to this aspect of the development would include planning and phasing of work to occur during a dry spell and period of low-river flows. Planning would be informed by observed river levels, ongoing weather (rainfall) patterns and precipitation forecasts. In order to mitigate residual risk, works would be limited to occur outside the fish spawning season as defined by the Fisheries Assessment submitted with the Environmental Statement.	All works at the FSC areas hall be supervised by an Ecological Clerk of Works (ECoW) or equivalent. A specific detailed construction method statement would be prepared prior to undertaking the work to detail methods and sequencing of the work, and would include the following considerations as a minimum. • Prior to undertaking excavations, Contractor to install a series (min. 2) of parallel silt fences or straw bales pinned to undisturbed ground between the works and the river bank, extending adjacent and beyond the riverside extent of the earthworks. • Remove silt fences / straw bales after completion of earthworks and after vegetation has fully re-established (with a view to trapping silts entrained in runoff from the earthworks).	Runoff control and treatment design drawings and supporting calculations demonstrating that the design arrangement proposed is sufficiently robust such that no adverse effect materially affecting the designated site downstream would be anticipated are included in Appendix .13-1 and 13-2 of the FEI. All the above mitigation measures would avoid and reduce adverse effects on the integrity of the designated sites and on their water dependant qualifying features.	Operational and maintenance staff would undertake monitoring of CMS post-construction.

Table 5: Data collected to carry out the assessment

Who carried out the assessment?	Cormac Loughran
Sources of data	Environmental Statement Further Environmental Information
Level of assessment completed	Stage 2 - Appropriate Assessment
Where can the full results of the assessment be accessed and viewed?	In this report
Results	RES have undertaken a (Shadow) Habitats Regulations Assessment (HRA) on the proposed development to Stage 2 Appropriate Assessment. ***The HRA has concluded that there will be no adverse effects on the integrity of the site provided that the mitigation outlined and described in Table 4 is implemented as detailed in the ES, FEI and associated project documentation.***

Conclusion

41. The detailed design of the proposed wind farm has evolved throughout the EIA process (including the FEI) and has taken into consideration constraints that have been identified and highlighted as part of baseline environmental surveys. A significant number of detailed mitigation measures have been incorporated into the design of the proposed wind farm in order to avoid any adverse effects on the Natura 2000 site.

42. The **Supplementary Hydrology Assessment** (**Chapter 13 – FEI**) concludes; In accordance with the methodology of assessing the significance of the effect of the development outlined in the original Environmental Statement generally as per the methodology derived from The Institute of Environmental Management and Assessment (IEMA) guidance, following incorporation of the mitigation outlined the proposed development would not have potential to cause any significant adverse effect, with particular consideration to the highly sensitive Burntollet River within the Faughan SAC.

43. In addition to the Supplementary Hydrological Assessment, a **Water Framework Directive Assessment** was also undertaken as part of the second round of FEI in order to provide an overarching summary of the mitigating measures proposed and determine the effects of the development of the Wind Farm on the ecological quality status of waterbodies potentially affected by construction activities associated with the development.

44. In this assessment consideration was given to the design and mitigation measures which have already been incorporated into the scheme; and further mitigation measures were outlined where required and general pollution prevention measures were presented.

45. In concluding the WFD assessment (and following incorporation of site-wide general binding mitigation control measures, NIEA approved 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 proposed Wind Farm.

46. The project design evolution and the implementation of the mitigation measures as set out in the EIA and FEI are sufficient to determine that the proposed Wind Farm at Barr Cregg would have **No Significant Effects** on the qualifying features, conservation objectives or integrity of the River Faughan & Tributaries SAC.

47. The implementation of the mitigation measures set out in the EIA (& FEI) would further ensure that the proposed wind farm does not contribute to any **cumulative impact** on designated nature conservation sites.

Annex 1

Description

The River Faughan & Tributaries ASSI was designated on 9 May 2008 and includes the River Faughan and its tributaries the Burntollet River, Bonds Glen and the Glenrandal River (and its tributary the Inver River). In total, the area encompasses approximately 60km of watercourse and is notable for the physical diversity and naturalness of the banks and channels, especially in the upper reaches, and the richness and naturalness of its plant and animal communities, in particular the population of Atlantic Salmon *Salmo salar*, which is of international importance and the widespread and common occurrence of Otter *Lutra lutra* in the catchment. The valley sides of River Faughan and its tributaries are partly covered by Upland Oak Woodland which although fragmented is in total in excess of 50ha.

The site was designated as an SAC during August 2008 on account of its Annex I habitats including Old sessile oak woods with Ilex and Blechnum in the British Isles and its Annex II species including Atlantic salmon *Salmo salar* and otter *Lutra lutra*.

N2K Selection Features

River Faughan & Tributaries SAC

Feature Type	Feature	Size/ extent/ pop~
Species	Salmon *Salmo salar*	**1,000 -10,000**
Species	Otter *Lutra lutra*	**Common**
Habitat	Upland Oak Wood	**96ha**

Conservation Objectives for N2K Features

River Faughan and Tributaries SAC

Feature	Objective
Atlantic salmon *Salmo salar*	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.
Otter *Lutra lutra*	Maintain and if possible increase population numbers and distribution.
	Maintain the extent and quality of suitable Otter habitat, in particular the chemical and biological quality of the water and all associated wetland habitats
Upland Oak Woodlands	Maintain and where feasible expand the extent of existing oak woodland but not at the expense of other features. (There are areas of degraded heath, wetland and damp grassland which have the potential to develop into Oak woodland)
	Maintain and enhance Oak woodland species diversity and structural diversity.

	Maintain the diversity and quality of habitats associated with the Oak woodland, e.g. fen, swamp, grasslands, scrub, especially where these exhibit natural transition to Oak woodland
	Seek nature conservation management over adjacent forested areas outside the ASSI where there may be potential for woodland rehabilitation.
	Seek nature conservation management over suitable areas immediately outside the ASSI where there may be potential for woodland expansion.

SAC Features Condition Assessment

River Faughan & Tributaries SAC

A baseline assessment was carried out during 2008 and concluded the following:

The River Faughan and Tributaries was surveyed by Mott MacDonald on behalf of NIEA in 2008. The site was found to be relatively natural in character and bordered along much of its length by a semi-continuous mixed woodland fringe. The channel is geomorphologically diverse with sections of exposed bedrock interrupted by numerous natural features associated with a dynamic river system, including cobble dominated bars and eroding banks. A natural flow regime is present which, in places, is characterised by cobble riffle-bedrock and riffle-pool sequences. Water quality is generally good, although some evidence of nutrient enrichment and siltation exists in the lower catchment.
Whilst many sections of the catchment are considered to be of good conservation value and demonstrate a fair degree of naturalness, several target features failed to comply with the guideline standards for a Favourable Condition status.

Much of the river is dominated by a non-vascular flora, and whilst small populations of *Callitriche*
brutia var. hamulata and other taxa considered indicative of the Callitricho-Batrachion "association", such as *Myriophyllum* spp. and *Fontinalis antipyretica* occur in places on the catchment, there appears to be no justification for considering the River Faughan and tributaries as an example of a 'watercourse of plain to montane levels with *Ranunculiion fluitantis* and Callitricho-Batrachion vegetation'.

Without comparison to other rivers in the region it is not possible to assess the relative conservation value of the River Faughan and the tributaries surveyed. Whilst the catchment has unquestionably been subject to some modification, particularly in the lower reaches and is not considered to be of the
Callitricho-Batrachion type, in absolute terms, it appears to be in good condition and supports a reasonably diverse non-vascular flora which can, in sections, be considered of high conservation value.

Conservation Objectives for Additional ASSI selection features

River Faughan & Tributaries ASSI

Feature	Objective
Earth Science – Dalradian series	Maintain extent and quality of exposure, together with access to the feature subject to natural processes.

5 Socioeconomics

Introduction

Background to the Study

5.1 RES commissioned Oxford Economics in March 2016 to undertake a socioeconomic impact report of the proposed Barr Cregg Wind Farm within the Derry and Strabane District Council area.

5.2 This report presents estimates relating to the direct, indirect and induced benefits that could be generated. It also provides a brief discussion of the unquantifiable benefits associated with a development of this type and scale, and the current macroeconomic and socioeconomic environments.

The proposed Wind Farm Development

5.3 The proposed Wind Farm Development is located approximately 4.5 km north of Claudy in the Derry and Strabane District Council area. The wind farm will have a capacity of at least 14 megawatt (MW), consisting of 7 turbines, with a planned operational lifespan of 25 years. It is anticipated that the electricity generated will be exported to the grid.

5.4 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.

Structure of the Report

5.5 This section of the report is structured as follows:

- Firstly, the estimated quantifiable benefits of the construction and on-going phases of the proposed Wind Farm Development are presented– concentrating on employment, gross value added (GVA)[1] and wages. An assessment of potential fiscal and environmental benefits are also included;
- Secondly, an overview of the pertinent socio-economic conditions present both at the regional and local level is provided;
- Thirdly, a detailed analysis concerning links with tourism and visitor perceptions; and
- Finally, we set out our overall conclusions in respect to the proposed Wind Farm Development at Barr Cregg.

[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.

Caveat

5.6 This report provides a review of potential economic impacts. It quantifies these impacts in fiscal terms and reviews the benefits of the proposed Wind Farm Development in terms of the outlook for the local economy.

5.7 Specific information related to the proposed Wind Farm Development was provided where possible by RES. The estimates of the benefits are based on a mix of this information, published data and reasonable assumptions.

5.8 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.

5.9 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 Wind Farm Development is granted full planning permission and has been built, the economic environment may look different. The estimates of direct, indirect and induced employment, GVA and wages take no account of any potential slowdown or growth in the global and UK economies. Instead, the analysis assumes all facilities contained in the proposed Wind Farm 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.

5.10 There is no analysis within the report focusing on how the proposed Wind Farm Development would impact on income distribution and deprivation levels in the area. This is very difficult to model and is outside of the scope of this piece of work.

5.11 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" 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 Renewable UK and the Department of Energy and Climate Change (DECC)[2] and on behalf of NIRIG, IWEA and RenewableUK[3] for

[2] http://www.renewableuk.com/en/publications/reports.cfm/BiGGAR

[3] http://www.ni-rig.org/wp-content/uploads/2012/07/FINAL-WEB-Northern IrelandRIG-REPORT.pdf

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.

5.12 Our modelling does not factor in industry support mechanisms.

Glossary of Definitions

5.13 **Backward linkages**: Backward linkages refer to the channels through which money, materials or information flows between a company and its suppliers, creating a network of economic interdependence. In terms of this study, it refers to the fact that the construction phase of the proposed Wind Farm 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.

5.14 **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).

5.15 **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 full-time equivalents (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.

5.16 **Gross value added (GVA):** 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.

5.17 **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. Our input-output model is used to measure the indirect impact from the development.

5.18 **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. This helps to support jobs in the industries that supply these purchases including in a range of service industries such as retail. Our input-output model is used to measure the induced impact from the development.

5.19 **Jobs:** Any references to the employment benefits from the on-going phase once the proposed Wind Farm Development becomes operational are expressed in terms of "jobs" per annum. As noted above, these jobs are full-time equivalent in nature.

5.20 **Job years:** Any references to the employment benefits from the construction phase of the proposed Wind Farm 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 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. 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.

5.21 **Nominal prices:** Nominal prices are those which reflect the current situation and do not make adjustments to reflect seasonality or inflation.

5.22 **Real prices (2012 prices):** Real prices refer to values that have been adjusted from nominal values 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, 2012 is the base year as it is consistent with the base/reference year used within UK ONS National Accounts: the Blue Book.

Quantifiable Benefits

5.23 This section analyses the estimated quantifiable benefits of the construction and operational phases of the proposed Wind Farm Development - concentrating on employment, GVA and wages, as well as assessing fiscal and further benefits.

Economic impact of the Construction Phase

5.24 The benefits associated with the construction phase of the proposed Wind Farm 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 more conservative levels are calculated using full-time job year equivalent figures provided by RES, based on previous projects they have carried out. Higher limits are reflective of the method Oxford Economics normally apply to projects of this type where such detailed job information is unable to be provided by the client. In this case, we use the spend figures by type of activity (grid connection, civils, professional etc.) and apportion that spend to the closest matching broad sector of the economy. This approach is the best possible one using the available data (most notably, the UK input-output table, published by ONS, used to calculate the indirect and induced benefits, only publishes information for the construction sector as a whole). That being said, Oxford Economics believe the best approach was to provide a range of benefits for the construction phase.

Method 1: Expenditure approach gives higher estimates

5.25 The proposed Wind Farm Development is estimated to result in a capital spend of approximately £21.53 million in nominal prices. This figure is based on information provided by RES. Approximately five percent of the estimated £13.52 million turbine cost value is likely to be included as part of the construction phase costs, through the use of local haulage companies and crane companies. The total

construction phase spend realisable within Northern Ireland for the purposes of this analysis, including all other construction costs, is £7.77 million (in nominal prices). This regional/total spend split (£7.77m/£21.53m) seems to be comparable with that observed in reports carried out by BiGGAR Economics on behalf of Renewable UK and DECC and Deloitte.[4] The split between construction related spend and professional services related spend is assumed to be £6.09m and £1.68m respectively. For the purposes of our modelling, we have converted all this expenditure information into 2012 real prices, to keep it consistent with our model inputs and national accounts publications.[5]

5.26 The construction phase of the proposed Wind Farm is scheduled to commence in Q2 2018 and last 18 months, reaching completion and then being connected to the grid by the end of 2019. The analysis therefore assumes a constant spend per quarter, leading to 33.3 percent of total spend being realised in 2018 and the remaining 66.6 percent in 2019.

5.27 This method's construction impacts are calculated using 2018 and 2019 GVA and productivity estimates, alongside wage forecasts based on the most recently published wage data (i.e. 2015).

Method 2: Lower estimates using job posts approach

5.28 RES also provided Oxford Economics with job figures based on a nine turbine project with a 24 month construction programme. We pro-rated the job figures based on the 7 turbines in the proposed Wind Farm Development, adjusted for the 18 month construction period of Barr Cregg, and used the same construction/professional split as in in Method 1. These job figures are outlined in Table 5.1).

[4] http://www.iwea.com/contentFiles/Documents%20for%20Download/Publications/IWEA%20Policy%20Documents/2009_06_Jobs_and_Investment_in_Irish_Wind_Energy.pdf?uid=1245084750778

[5] The construction phase and operational phase benefits within this section are expressed in real/constant prices with a 2012 base year – this is because 2012 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 2012 data has been used – we have used the latest available data and the relevant forecast year in every case – 2012 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.

Table 5.1: Job year information provided by RES and pro-rated for proposed Wind Farm Development

Job years	9 turbine project	7 turbine project (Barr Cregg)
Construction	86	50
Professional	24	14
Total	**110**	**64**

Source: RES

Direct construction phase impacts

5.29 The proposed Wind Farm Development's 18 month construction phase is estimated to create or sustain between 64–91 direct job years of employment, 50–73 of which are involved with construction related activities and the remaining 14–18 job years account for development related activities (Table 5.2).

5.30 This direct construction phase employment would be likely to create or sustain between £1.52-£2.15m of additional direct wages in the Northern Ireland economy. Furthermore, the investment is estimated to directly contribute between £2.23-£3.14m to regional direct GVA.

5.31 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[6] which discusses jobs that are destroyed though shifting of jobs from one industry to another). However, a U.S. based study[7] 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."

5.32 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 Wind Farm 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 as a result 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[8] focused on energy demand in Northern Ireland and factored in changes relating to renewables policy. The report suggested that energy demand

[6] http://www.ukerc.ac.uk/support/tiki-download_file.php?fileId=2691

[7] 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.

[8] http://www.sibni.org/a_strategic_energy_scenario_planning_model_for_northern_ireland_-_final_report.pdf

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 that both renewables and fossil fuels will be needed to meet the energy needs of Northern Ireland.

Table 5.2: Direct benefits from the construction phase

Direct benefits	Job years	Wages (£2012m)	GVA (£2012m)
Construction related	50 - 73	£1.18 - £1.70	£1.62 - £2.35
Professional services related	14 - 18	£0.34 - £0.45	£0.61 - £0.79
Total	**64 - 91**	**£1.52 - £2.15**	**£2.23 - £3.14**

Source: Oxford Economics
Note: May not add due to rounding

Indirect and induced construction phase impacts

5.33 The supply chain (or indirect) impacts arising from the construction related activity have been estimated using the latest 2010 UK input-output tables (published by ONS). Minor adjustments have been made to the UK input-output tables to account for the size of imports (i.e. the import propensities[9]) in a devolved region like Northern Ireland, as the area will require more imported products than the UK as whole. The wind turbines, and a small proportion of the BOP and development costs will be sourced from outside Northern Ireland and hence the associated benefits will accrue to that location and are not included in the indirect estimates.

5.34 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 2.7 and 2.3 for the UK and Northern Ireland respectively, this means that for every £1 of direct output by the sector, an additional £1.70 and £1.30 is created in the wider UK or Northern Ireland economy, respectively.

5.35 Indirect GVA resulting from the proposed Development is therefore estimated to be approximately £1.39-£1.97m, creating or sustaining an estimated 33-47 job years of employment, with associated wages of between £0.74-£1.04m (Table 5.3).

[9] Indirect GVA was scaled back in most sectors to account for Northern Ireland companies' greater propensity to import products. The rationale behind this adjustment is based on comparing imports across geographies. The construction sector in the UK imports 6.8% of its supply chain on average, showing that it can source most of what it needs internally. However devolved regions like Scotland and Northern Ireland have a greater need to import their products.

Table 5.3: Total benefits from the construction phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2012m)	GVA (£2012m)
Direct	64 - 91	£1.52 - £2.15	£2.23 - £3.14
Indirect	33 - 47	£0.74 - £1.04	£1.39 - £1.97
Induced	15 - 21	£0.20 - £0.28	£0.51 - £0.72
Total	**113 - 159**	**£2.46 - £3.48**	**£4.13 - £5.82**

Source: Oxford Economics
Note: May not add due to rounding

5.36 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 15-21 job years alongside £0.20-£0.28m of wages. The majority of sectors within the regional economy are expected to experience some degree of benefit (Table 5.4).

5.37 It is worth noting that the modelling has estimated the construction phase benefits for the proposed Wind Farm Development at a Northern Ireland level. An exact amount attributable to the Derry and Strabane District Council area is more difficult to identify and therefore 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 have informed Oxford Economics that their previous projects have 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. This means that the vast majority of the direct and indirect benefits are likely to be realised within Northern Ireland, with Derry and Strabane enjoying some uplift at the local level. Finally, it is likely that a sizeable proportion of the induced benefits would be realised locally (with this proportion rising the more direct and indirect jobs are within the local economy).

5.38 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)[10] , and on behalf of NIRIG, IWEA and RenewableUK, for Northern Ireland specifically[11]. In most cases, the benefits were of a similar magnitude.

5.39 The aforementioned BiGGAR Economics report backs up the scale of benefits that can be experienced locally, citing the: "…many local economies throughout the UK

[10] http://www.renewableuk.com/en/publications/reports.cfm/BiGGAR

[11] http://www.ni-rig.org/wp-content/uploads/2012/07/FINAL-WEB-NIRIG-REPORT.pdf

over the last few years, which have experienced significant direct, supply chain and wider economic benefits from onshore deployment."

Table 5.4: Total sectoral benefits from the construction phase

Total (direct, indirect and induced) benefits	Job years	Wages (£2012m)	GVA (£2012m)
Agriculture, forestry and fishing	0	£0.00 - £0.00	£0.00 - £0.00
Mining and quarrying	0	£0.00 - £0.00	£0.00 - £0.01
Manufacturing	4 - 6	£0.10 - £0.14	£0.24 - £0.35
Electricity, gas, steam	0	£0.00 - £0.00	£0.02 - £0.02
Water supply; sewerage and waste	0	£0.00 - £0.00	£0.00 - £0.00
Construction	59 - 86	£1.39 - £2.01	£1.92 - £2.77
Wholesale and retail	10 - 15	£0.16 - £0.22	£0.42 - £0.60
Transportation and storage	1 - 2	£0.03 - £0.05	£0.06 - £0.09
Accommodation and food	3 - 5	£0.03 - £0.04	£0.06 - £0.08
Information and communication	1	£0.03 - £0.04	£0.07 - £0.09
Financial and insurance activities	1 - 2	£0.04 - £0.05	£0.09 - £0.13
Real estate activities	0	£0.00 - £0.00	£0.02 - £0.02
Professional, scientific, and technical	19 - 26	£0.48 - £0.63	£0.84 - £1.12
Administrative and support	7 - 10	£0.11 - £0.15	£0.18 - £0.26
Public administration and defence	2	£0.04 - £0.06	£0.09 - £0.12
Education	1	£0.01 - £0.02	£0.02 - £0.03
Health and social work	0	£0.00 - £0.00	£0.00 - £0.00
Arts, entertainment and recreation	1 - 2	£0.02 - £0.03	£0.03 - £0.05
Other service activities	2	£0.02 - £0.02	£0.06 - £0.09
Total	**113 - 159**	**£2.46 - £3.48**	**£4.13 - £5.82**

Source: Oxford Economics
Note: May not add due to rounding

Economic impact of the operational phase

5.40 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 constructed by Oxford Economics which uses an input-output framework, standard economic underpinnings, published data and few clearly documented reasonable working assumptions.

Direct operational impacts

5.41 Following the 18 month construction phase the developments grid connection is estimated to take place in Q4 2019. The operational phase estimates have therefore used Oxford Economics' 2019 forecasts of both GVA and productivity. Additional earnings/wages have been estimated using typical salary levels for workers of this kind from other wind farm economic impact studies we have

undertaken (£44,645 for engineers/technicians/site managers). The benefits are expressed both in per annum terms, and as a summation for the assumed life of the project (i.e. given this is 25 years, total benefits for the project life simply multiply the annual benefits by a factor of 25). As such, the summed benefits assume 2019 productivities for each year of the forecast period.

5.42 The proposed Wind Farm Development is likely to sustain one direct FTE job per annum, in the capacity of an asset manager (Table 5.5).[12]

5.43 The total direct wage of the 1 direct worker each year is estimated to be £0.04 million per year. After applying productivity estimates, this on-going direct employment is expected to generate £0.22 million of GVA per annum. Given the 25 year lifetime of the development, this equates to 25 direct job years of employment, £1.12 million of direct wages and £5.62 million of direct GVA over the entirety of the operational phase.

Table 5.5: Direct annual benefits from the operational phase

Direct benefits	Jobs	Wages (£2012m)	GVA (£2012m)
Site manager	1	£0.04	£0.22
Total	**1**	**£0.04**	**£0.22**

Source: Oxford Economics
Note: May not add due to rounding

Indirect and induced operational impacts

5.44 The electricity industry plays a significant role in enabling other parts of the economy to be more productive. The sector itself is the most productive sector in Northern Ireland. The electricity industry generates much higher output per worker than the UK average, reflecting high levels of investment and highlights the impact of improving technology on productivity in the sector.

5.45 Using the UK input-output tables to identify the supply chain spending, it is estimated that the proposed Wind Farm Development is likely to create or sustain a further 4 indirect jobs in the Northern Ireland economy each year, with wages and GVA of £0.28m and £0.10m per annum respectively (Table 5.6).

[12] 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 6.47 – 6.52.

Table 5.6: Total annual benefits from the operational phase

Total (direct, indirect and induced) benefits	Jobs	Wages (£2012m)	GVA (£2012m)
Direct	1	£0.04	£0.22
Indirect	4	£0.10	£0.28
Induced	1	£0.01	£0.03
Total	**6**	**£0.15**	**£0.53**

Source: Oxford Economics
Note: May not add due to rounding

5.46 Furthermore, the combined additional wages of those in direct and indirect employment will result in induced activities as wages are spent on products and services in the local and regional economies. These wages are estimated to create or sustain a further 1 job in the economy as a whole, which is likely to be in the wholesale & retail sector. This jobs is estimated to induce £0.01m in additional wages and generate GVA of £0.03m per annum (see Table 5.7).

Table 5.7: Total annual sectoral benefits from the operational phase

Total (direct, indirect and induced) sectoral benefits	Jobs	Wages (£2012m)	GVA (£2012m)
Agriculture, forestry and fishing	0	£0.00	£0.00
Mining and quarrying	0	£0.00	£0.01
Manufacturing	1	£0.01	£0.04
Electricity, gas, steam	1	£0.06	£0.34
Water supply; sewerage and waste	0	£0.00	£0.00
Construction	0	£0.01	£0.01
Wholesale and retail	1	£0.01	£0.03
Transportation and storage	0	£0.00	£0.01
Accommodation and food	0	£0.00	£0.00
Information and communication	0	£0.01	£0.01
Financial and insurance activities	0	£0.01	£0.03
Real estate activities	0	£0.00	£0.00
Professional, scientific, and technical	1	£0.01	£0.02
Administrative and support	1	£0.01	£0.02
Public administration and defence	0	£0.00	£0.00
Education	0	£0.00	£0.00
Health and social work	0	£0.00	£0.00
Arts, entertainment and recreation	0	£0.00	£0.00
Other service activities	0	£0.00	£0.00
Total	**6**	**£0.15**	**£0.53**

Source: Oxford Economics
Note: May not add due to rounding

The exclusion of displacement from this study

5.47 The benefits from the construction phase of the proposed Wind Farm Development were gross estimates with zero job displacement applied. A detailed assessment of displacement is a large undertaking with very few examples of studies that have tried to estimate this type of displacement. While we did consider the merits of putting a displacement/relocation of jobs rate into our modelling calculations (as we have done with other economic impact studies we have undertaken), in our judgment the most robust course of action was to exclude any displacement assumptions given the niche type of project in question and for the reasons described below.

5.48 We did not use a job displacement rate in the construction estimates given the significant spare capacity in the construction sector. The most recent Northern Ireland Construction Bulletin notes[13]:

"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 the construction sector. The current levels of construction output are approximately 37% lower than the levels reported in the quarter 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."

5.49 This has been reflected in the level of construction sector employment in Northern Ireland. The construction sector suffered the largest amount of recessionary job losses of any sector. A large share of the unemployment on-flows (those starting to register for unemployment benefits) following the recession were construction workers in manual trade roles. The UK and Northern Ireland are finally out of recession, and demand from commercial and residential property is now beginning to pick up. Job levels are likely to remain below the peak not just over the short to medium-term. 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.

5.50 Oxford Economics' estimates for the benefits from the on-going operational phase consider only activity from the proposed Wind Farm Development. Had the development displaced a site already in use for other activities such as farming or quarrying, then adjustments could have been made to the economic impact model.

[13] https://www.detini.gov.uk/publications/construction-output-statistics-q3-2015

RES has informed Oxford Economics that the proposed Wind Farm Development will not displace any current or future economic activity on the site. Factoring in job displacement rate assumptions to the on-going phase rather than the construction phase merits slightly more consideration, though ultimately a decision was reached not to factor in a displacement assumption given the niche type of project we are considering here, and given that the number of on-going jobs is small in volume and specialised in nature.

5.51 Given the likely low levels of displacement and the uncertainty, in our judgment the most robust course of action was to exclude any displacement assumptions altogether from should different underlying displacement data be made available though we suspect the resulting estimates will be close to the numbers we present in this report. Our economic impact model has been developed to include displacement.

Increased tax revenues and benefit savings

5.52 As part of this analysis it is assumed that approximately 40 percent of total wages would be paid to the Treasury through the channels of taxation. This takes into account not only income tax, but value added tax through the purchase of goods and services by those in direct, indirect and induced employment.

5.53 During the construction period of the proposed Wind Farm Development, tax receipts are likely to reach between £0.98-£1.39m (including direct, indirect and induced wage impacts). The operational phase is estimated to generate approximately £0.06 million in additional tax receipts each year of operation (Table 5.8). Over the 25 year lifetime of the Development this would equate to £1.52 million in additional tax revenue.

Table 5.8: Annual tax revenues arising from the proposed Development

Tax revenue (over entire construction phase; per annum of on-going phase)	Wages (£2012m)	Tax revenue (£2012m)
Construction phase	£2.46 - £3.48	£0.98 - £1.39
Operational phase	£0.15	£0.06
Total	**£2.61 - £3.63**	**£1.04 - £1.45**

Source: Oxford Economics
Note: May not add due to rounding

5.54 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 would reduce benefit payments. While the Proposed Wind Farm 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. Take for example the "wholesale and retail" job (created through operational indirect and induced impacts) in Table 5.7. In reality, this net additional job may require a worker moving from another retail job. However, someone will need to replace this person in their old job, so that, somewhere down the line, someone will need to come off the ranks of the unemployed to take up a job. We take the point that the job vacancy may not always be re-filled by the existing company losing the individual (hence the use of the wording create or sustain in this report), but it would be our view that this may suggest that company was operating inefficiently before and could have done without that individual in the first place, and now is operating from a lower cost base and is more competitive. Furthermore, the modelling assumes "vertical" movement of labour – i.e. that individuals are assumed only to move jobs if their new position is at least as well paid or more senior.

5.55 Currently, unemployment benefit varies between £57.90 and £114.85 per week. Using these lower and upper levels, we estimate between £0.34-£0.95m of savings will be made during the construction phase of the proposed Wind Farm Development (Table 5.9).

Table 5.9: Annual benefits saving arising from the construction phase

Construction phase	Unemployment savings (£2012m)	
	Upper	Lower
Direct	£0.38 - £0.54	£0.19 - £0.27
Indirect	£0.20 - £0.28	£0.10 - £0.14
Induced	£0.09 - £0.13	£0.05 - £0.06
Total	**£0.67 - £0.95**	**£0.34 - £0.48**

Source: Oxford Economics
Note: May not add due to rounding

5.56 Similarly, the on-going benefits are estimated to provide unemployment savings of between £0.02-£0.04m each year (Table 5.10), or £0.45-£0.90m over the 25 year project horizon.

Table 5.10: Annual benefits saving arising from the operational phase

On-going phase	Unemployment savings (£2012m)	
	Upper	Lower
Direct	£0.01	£0.00
Indirect	£0.02	£0.01
Induced	£0.01	£0.00
Total	**£0.04**	**£0.02**

Source: Oxford Economics
Note: May not add due to rounding

Other quantifiable benefits of the proposed Wind Farm Development

Rates, community fund and land rentals contributions

5.57 Wind farms in Northern Ireland are assigned a rateable value charged of £17,000 per megawatt per annum, based on the current average rateable value of similar properties in the valuation list. Using the current rateable value and given that the proposed Wind Farm Development will have a total capacity of 14 MW, this means a figure of £238,000 in rates payments to the government annually, or approximately £5.95m over the course of the project. 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[14] for Derry and Strabane District Council indicate non-domestic poundage rates of 59.6p for every £1, of which 31.9p is a regional rate paid to the Northern Ireland Assembly, and 27.8p of which is a district rate paid to the local Council. By applying the Non-Domestic Rate Poundage for Derry and Strabane, the above rateable values would leave additional business rates revenue of £141,949 per annum and £3.55 million over the 25 year lifetime of the project. In every case, 46.6% of the totals would be attributable to the local Council (Derry and Strabane District Council) and the remaining 53.4% would be realised by the Northern Ireland Assembly.

5.58 RES has committed to a community benefit package of £5,000 per MW. This will be split by £2,000 per MW of a community fund, and £3,000 per MW into a Local Discounted Electricity Scheme. The fund will therefore contribute £1.75m over the lifespan of the project. Given the likelihood, and the weighting direction in Policy RE 1, the benefits from the proposal are a material consideration and should be given substantial significant weight. Furthermore, the leasing of land for the wind farm has been agreed for a 27 year period. PPS 18 acknowledges that landowner rents are supportive of the Northern Ireland economy and provide "opportunities for rural diversification".

5.59 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.

5.60 Over the lifetime of the project, the community fund, rates, taxes and land rental will collectively amount to approximately £11.6 million.

[14] https://www.dfpni.gov.uk/articles/poundages-2015-2016

Energy and Environmental benefits

5.61 The proposed Wind Farm Development is a 14 MW wind farm consisting of 7 x 2 MW turbines. The amount of electricity that could be produced by the proposed Wind Farm Development is estimated at 46.6 GWh per year, which is enough electricity to meet the needs of 11,325 homes each year. This is the equivalent of 19.6 percent of the current (2016) housing stock of Derry and Strabane[15]. This level of electricity production equates to 0.2 percent and 3.2 percent of the January 2016 UK and Northern Ireland onshore wind farm levels respectively. Given the UK target to source 110 TWh of electricity from renewable sources[16], the proposed Wind Farm Development would in turn contribute towards this obligation. Factoring in Northern Ireland's elevated 40% target, and given that it only obtains 19.9 percent of its electricity from renewable sources, the proposed Wind Farm Development would increase this percentage to 20.5 percent (thereby taking it to over half of the 40 percent target)[17]. Given that this is a rolling target, continued and regular progression towards this level remains necessary.

5.62 The proposed Wind Farm Development is also estimated to reduce CO_2 emissions by 20,039 tonnes each year. This is the equivalent of 15,237 newly registered cars[18]. In terms of targets set, Northern Ireland has set itself the target of bringing emissions down to 18,746ktCO_2e by 2025[19]. Current levels of emissions as of 2013 were 22,379 ktCO2e[20] - which was actually a 6.7% rise on the 2012 figure. This means that 3,633 ktCO_2e of reductions must be found over nine years. The proposed Wind Farm Development will contribute 0.6 percent of this amount. It should be noted that these contributions will be reached quickly given the timeframes associated with the grid-connection (anticipated before 2020) – a relatively early connection like this should be particularly attractive to the decision-maker when striking the planning balance.

5.63 A similar roadmap has been drawn up for Northern Ireland by DECC which is currently out to consultation with key stakeholders in the energy sector.

5.64 Clearly there exists a broad range of potential benefits presented by the proposed Wind Farm Development. These benefits are becoming increasingly relevant when considering the merits of future developments. Indeed, the recent Cloghinarney Wind Farm appeal decision noted "that it is appropriate to attach significant weight to these considerations (net environmental, economic and social benefits) in

[15] Oxford Economics Internal Model Suite

[16] http://www.detini.gov.uk/energy_statistics.htm

[17] Assuming no other electricity generation.

[18] https://www.gov.uk/government/publications/new-car-carbon-dioxide-emissions

[19] Northern Ireland Action Plan on Greenhouse Gas emissions – http://www.doeni.gov.uk/northern_ireland_action_plan_on_greenhouse_gas_emissions_reductions.pdf

[20] http://naei.defra.gov.uk/reports/reports?report_id=810

determining whether planning permission should be granted" (Planning Appeals Commission, App ref: G/2011/0155/F, Paragraph 13).

Socioeconomic Context

Global challenges remain

5.65 The global economy has shown consistent levels of growth in recent years, however performance has varied significantly between countries. We expect the UK's growth to weaken slightly throughout 2016 before improving over the medium term. Overall, we forecast that the UK's economy will outperform that of most advanced economies on average between 2016 and 2019.

5.66 Risks to global prospects remain present, however. Weaker growth in the Chinese economy is likely to have implications for global trade and markets. Although growth in the Eurozone has improved lately, the economic area continues to struggle with relatively high levels of sovereign debt. Equally, the possibility of the UK leaving the EU (Brexit) is likely to result in increasing uncertainty and weakened investor confidence over the short to medium term.

5.67 Due to a number of global factors, oil prices have fallen to levels last seen in 2004. Although this has provided a temporary boost to consumer's disposable income, negative consequences result from prices being strongly influenced by weak global demand and weakened investment in new oil deposits. Oxford Economics forecasts that world oil prices will begin a gradual recovery over the next number of years.

Jobs losses slow to recover

5.68 Following the recession, Northern Ireland was the most heavily impacted region within the UK in employment terms. Between 2008 and 2012 the total employment level contracted by 8 percent (over 66,000 jobs). In addition, the region's labour market recovery is likely to continue to be drawn out. Our outlook suggests the pre-recession jobs peak is unlikely to be recovered before 2024.

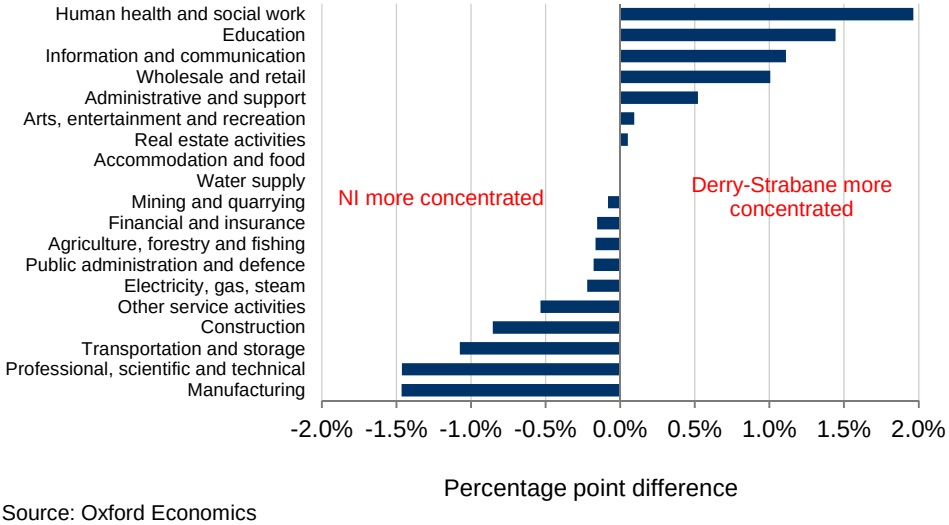
5.69 The Derry and Strabane Council area has struggled with relatively weak employment growth dating before the downturn. Between 2000 and 2008, employment growth in the Council area was the second weakest in Northern Ireland, over 5 percentage points lower than the average.

5.70 Derry and Strabane's employment growth is expected to match the regional annual average of 0.3 percent over the next decade. Further job losses during this time are likely to be limited to the public administration and manufacturing sectors, collectively losing 800 jobs. Employment in the administration and support sector is to create around 600 jobs over the next decade.

5.71 Derry and Strabane's employment structure goes some way to explain these forecasts. The Council area was relatively less exposed to construction and the heavy job losses it suffered during the recession. Relative to the rest of the regional 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. However, future growth in the local economy is restrained by the limited growth predicted from these areas of the economy.

Figure 5.1: Sectoral concentration of employment, Derry City and Strabane vs. Northern Ireland, 2015



Source: Oxford Economics

Employment measures among the weakest in the region

5.72 Working age economic activity rates within Derry and Strabane are the lowest in Northern Ireland. NISRA estimates show that only two-thirds of working age residents were economically active (employed or unemployed but seeking work) in 2014. This was 6 percentage points lower than the regional average of 72.7 percent that year.

5.73 Equally, unemployment is a prominent concern for Derry and Strabane's economy. We estimate that 48 percent of the resident population aged 16 plus were in employment in 2015, the weakest of the local Council areas. In addition the claimant count measure of the unemployment rate was the highest in Northern Ireland at 6.9 percent, significantly higher than the regional average of 3.7 percent.

5.74 High levels of inactivity and weak employment growth have contributed to strong net out migration from the local area. We estimate that Derry City and Strabane's population has been the weakest growing in Northern Ireland between 2008 and 2015. Cumulative net-out migration over these years was estimated at 5,500—the largest net outflow of any District Council in the region.

5.75 The gap between Derry and Strabane's resident and workplace based wages widened for a short period between 2005 and 2015, suggesting that the local economy's higher value jobs attracted commuters from outside the Council area. Relatively low inflation and weak employment growth has restrained wage growth throughout the recovery period. We expect strong growth in Derry and Strabane's

resident wages over the next decade, broadly matching the regional annual average growth rate of 3.5 percent.

Skill levels among the lowest in Northern Ireland

5.76 Skills and educational attainment are increasingly important to an individual's employability prospects in the modern services driven, "skills hungry" economy. The latest labour market statistics published by NISRA show that, in terms of the working age population, the Derry and Strabane Council area had the second highest proportion with no qualifications.

5.77 Arguably the Council area performs even less well in terms of attainment of higher level skills. The proportion of Derry and Strabane's working age residents attaining the equivalent of the degree level qualification or above was the lowest of Northern Ireland's 11 Council areas in 2014. Only 22.1 percent of residents aged between 16 and 64 were educated to this higher level. This share was 6 percentage points lower than the Northern Ireland average.

5.78 Derry and Strabane's is among the worst performing areas in terms of qualification attainment—both at the higher and lowest ends of the educational spectrum. 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 alongside below average skill levels are likely to contribute to economic inactivity and social exclusion within the local community.

5.79 The local economy has a history of economic challenges which have been further exposed by the last recession. The relatively weak employment outlook is unlikely to address current problems faced within the local labour market. Therefore investment and development opportunities in the area should be encouraged in order to promote opportunities and boost economic growth prospects.

Links with Tourism

Existing global studies

5.80 Existing studies into the attitudes of visitors, tourists and tourism organisations towards wind farms in the UK (discussed later in this section) suggests that the renewable energy source has its own tourism pull. Independent UK studies have shown that the adverse effects of wind farms on tourism are negligible, and there is a growing body of evidence to suggest that wind farms can become tourist attractions in their own right.

5.81 In terms of effects on tourism, there is an element of subjectivity of opinion on this matter on account of differing opinions as to the wind turbine's contribution or effect on a view or setting. While no recent research is available for Northern Ireland, independent research released by Visit Scotland in April 2012 shows wind

turbines do not affect the choice of eight in ten tourists to visit Scotland and most people do not feel wind turbines spoil the countryside[21].

5.82 This survey backed up a previous study undertaken in 2008 by the Scottish Government to ascertain the impact of wind turbine development on tourism.

5.83 Scottish tourism relies heavily on its beautiful landscapes, so the Government wanted to understand whether there was any justification to the claim that wind turbines harmed tourism in Scotland. The study provides a definite conclusion that wind turbine development does not harm tourism. On this basis, there are still strict policies on the sensitive siting of wind turbines in Scotland but this works alongside an ambitious economic growth targets set down by the Scottish Government. There is a strong argument that wind turbines can be seen as features of interest in a landscape and be a key factor in a view becoming much more interesting and photographed following their introduction[22].

5.84 A more recent study by the University of Edinburgh found that wind farms had no economic benefit, either positive or negative, on local tourism. It further found that when combined with a visitor attraction, numbers may increase[23].

5.85 In 2007, as an expert witness at a public enquiry for a proposed wind farm in Devon, the same author said:

"The vast majority of tourists we surveyed in North Devon (87%) stated that the presence of a wind farm would neither encourage nor discourage them from visiting. Of the remaining 13%, slightly more would be encouraged to visit because of the presence of a wind farm. The majority of North Devon respondents thought that the wind farm would have no overall impact on the quality of their experience.

5.86 "Indeed, slightly more tourists felt that the wind farm would have a positive impact on their experience than felt it would have a negative impact and the majority of tourists actually thought wind farms could be tourist attractions in their own right."

5.87 A study for the Welsh government published in February 2014[24] concluded that, in areas where wind farms have had an established presence for a number of years (Powys, Anglesey and the South Wales Valleys), there was no evidence of significant impacts on tourism to date. The report cited local studies which show that the majority of visitors to those areas have either a positive or indifferent stance on the wind farms' presence. It was suggested that this was an indirect consequence of planning policy which focuses development away from Wales's key natural assets and visitor attractions.

[21] http://www.visitscotland.org/research_and_statistics/tourism_topics/wind_farms.aspx

[22] http://www.scotland.gov.uk/Publications/2008/03/07113554/0

[23] Aitchison, Cara, 2012. Tourism Impact of Wind Farms, Submitted to Renewables Inquiry Scottish Government, April 2012.

[24] http://wales.gov.uk/docs/desh/publications/140404economic-impacts-of-wind-farms-on-tourism-en.pdf

5.88 Whitelee Wind Farm, Europe's largest wind farm located in Scotland, attracted almost 250,000 visitors between becoming operational in 2009 and June 2012[25].

5.89 A 2003 survey by Leeds Metropolitan University found that the vast majority of tourism organisations reported no adverse effect on their business from the presence of a wind farm in their vicinity, nor did they anticipate any effect associated with a new wind farm proposal.[26] The survey found that:

- 87% of visitors/tourists and 88% of tourism organisations felt positive towards wind farms; and
- 75% said that increases in the number of turbines in the next few years would not have any effect on them visiting in the future.
- "It has been found that "twice as many respondents would return to an area because of the presence of a wind farm than the number that would stay away."

5.90 Wind turbines can be viewed as symbols of sustainable development and valued for producing clean energy. It is perhaps this attitude which lends itself to the notion of wind turbines being part of modern heritage. Windmills, the predecessors of modern wind turbines, were also contested when introduced to the European landscape around the 12th century. In countries like Holland, windmills have increasingly become a visual part of the nation's heritage.

5.91 However, some anecdotal evidence suggests that wind turbines are unlikely to be a major tourism draw in their own right, especially since they are now increasingly part of the cultivated landscape in many countries. In some cases, they diversify the attraction base of a destination, like Cap Chat in the Gaspé Peninsula, where a visitor centre showcases the highest vertical-axis wind turbine in the world. Similar interpretation centres worldwide offer guided tours - for example in Denmark there are boat tours to see the offshore wind farms at Middelgrunden near Copenhagen.

5.92 RES has carried out an on-going annual programme of wind farm schools open days, in addition to visits for community groups and professional bodies. Between 1995 and 2014 there were over 29,000 visitors to RES wind farms in Northern Ireland and Donegal.

A Focus Closer to Home

5.93 There is a lack of critical mass of literature focusing on the impact of wind farms on tourism in Northern Ireland. The Northern Ireland Tourism Board (NITB) final draft report of August 2011 called "Windfarms and Off Shore Windfarms" concludes that "the impact of wind farm development on tourism may not be as severe a threat as thought by the tourism industry, as tourists on the whole seem generally positive or neutral to the prospect of wind farm development" though it does make reference to a small segment who still object to such developments and that future perceptions must be monitored. The results showed that only 5% of domestic

[25] http://www.bbc.co.uk/news/uk-scotland-scotland-business-18525763

[26] http://www.helensburghrenewables.co.uk/wp-uploads/2013/02/ReUK-Tourism.pdf

tourists and 3% of tourists to Northern Ireland from the Republic of Ireland would avoid returning to areas that had wind farms. Indeed 52% of domestic tourists and 48% of tourists from Republic of Ireland stated that they would be happy to visit an area that has wind farms.

5.94 Overall, this shows a very positive tourist attitude towards wind farm development. The report suggests that any potential disruption by wind farms may be mitigated by leveraging them as a tourist amenity.

5.95 A survey was carried out for Fáilte Ireland[27] entitled "Visitor Attitudes on the Environment – Wind Farms" investigating the impacts of wind farms on tourism on the island of Ireland. This survey found that two thirds of tourists surveyed claim that potentially greater numbers of wind farms would have no impact or would positively impact a return visit to the island of Ireland. The survey results suggest that in landscapes other than those of national scenic importance, development of wind farms can have a positive impact in terms of the visitor's perception of the Irish and Northern Irish landscape and of the Republic of Ireland's/Northern Ireland's commitment to renewable energy. Visual impacts if negative are undermined by the positive effects of renewable energy and the drive to reduce carbon footprints.

5.96 The report entitled "Attitudes towards the development of wind farms in Ireland" conducted by Sustainable Energy Ireland[28] was Ireland's first independent study into the public's attitude to the development of wind energy and the integration of wind farms on the Irish landscape. The study indicates that the overall attitude to wind farms is almost entirely positive. More than eight out of ten believe wind energy to be a very or fairly good thing. The study highlights that wind farms are seen in a positive light compared to other utility-type structures that could be built on the landscape. Encouragingly, the study highlights that two-thirds of Irish adults are either very or fairly favourable to having a wind farm built in their locality, with little evidence of a "Not In My Back Yard" effect.

5.97 The Best Practice Guidance to PPS 18 acknowledges that wind energy developments can co-exist and enhance tourism and leisure interests. A prime example of this co-existence is highlighted in the Dunmore Wind Farm appeal (PAC Ref: 2009/A0037), which was subsequently approved. The Commissioner's report states: "…'Wind farms – Impact on Tourism and Public Perceptions' illustrates that there is no evidence to suggest that wind farms deter tourists, indeed, many wind farms are themselves a tourist attraction and are often sign posted. The site can be promoted as tourist/education destination as a means of encouraging additional visitors to the

[27] http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Visitor-Attitudes-on-the-Environment.pdf?ext=.pdf

[28] http://www.sei.ie/uploadedfiles/RenewableEnergy/Attitudestowardswind.pdf

area to support the local economy." (p12, paragraph 5.21 of the Commissioner's Report)[29].

5.98 NITB have incorporated the Rigged Hill Wind Farm into the Ulster Way walking route. Tourist facilities have also been installed at the 29 turbine Altahullion Wind Farm, Co. Derry and this wind farm is actively promoted by NITB and the local District Council as a tourism attraction. There are directional signs to the site off the A6, with car parking, an information board and access to the visitor turbine. Altahullion Wind farm is also listed as a point of interest on an 18 mile section of the National Cycle Route No. 93 from Park to Limavady. The Bessy Bell Wind Farm is also actively promoted as a site of interest on the South Sperrins Scenic Driving Route in the Sperrins Tourism brochure 2012. Causeway Coast and Glens council and the former Ballymoney Borough Council included guided walks around Gruig Wind Farm in County Antrim as part of their countryside events programme.

Conclusions

5.99 As noted in the publication prepared for the Isle of Anglesey County Council by The Tourism Company in February 2012 entitled "The impact of wind turbines on tourism – a literature review"[30], preferences and attitudes towards modern wind farms are likely to evolve over time as people become accustomed to their presence, albeit unlikely that they will appeal to everyone in the future.

5.100 In summary, in most places, a variety of legislative and planning tools help minimise the social and environmental impact of wind farms. Further research would be required in order to establish preferences with regard to visiting places and choosing accommodations. In this context, it might also be worthwhile to independently assess the effects of wind farms on tourism at a local level in Northern Ireland.

5.101 Nonetheless, based on the aforementioned independent studies, it would appear that the majority of people are favourably disposed towards the generation of renewable electricity by wind turbines and to the presence of wind farms. Evidence would further suggest that such disposition becomes more favourable when the wind farms became operational (i.e. people becoming used to them.)

[29] http://applications.pacni.gov.uk/reports/27745R.pdf, page 12, paragraph 5.21.

[30] http://www.anglesey.gov.uk/Journals/2012/10/30/the-impact-of-wind-turbines-on-tourism.pdf

Conclusions

5.102 Both in economic and environmental terms, the proposed Wind Farm Development will offer substantial benefits to the local area and the region as a whole. Significant job creation and economic activity will result throughout its construction, with a strong likelihood of local labour involvement. Throughout the construction and operational phases, there be will increased tax and business rates revenue payable to central, regional and local government. The development will also contribute to relevant renewable energy targets both in Northern Ireland and the UK.

5.103 Investment of this type 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.

5.104 Funding for such developments are usually project specific and involve a considerable amount of sunk costs—therefore if it does not take place, the benefits are unlikely to be realised elsewhere in the Northern Ireland economy. Likewise, the potential catalytic benefits will be lost for further investment in the area. A study carried out by fDi intelligence[31] 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 5 years, which will increase demand for R&D investment. Northern Ireland should be able to compete for R&D investment in renewable energy. However, in the same way as approving the project may cause positive catalytic benefits for further investment, refusing it may send out a bad message to future investors.

5.105 The proposed Wind Farm Development is estimated to involve a capital spend of £21.53 million. Of this total, £7.77 million will be realised within the Northern Ireland economy. The projected 18 month construction phase is estimated to create or sustain 113-159 total (direct, indirect and induced) job years of employment, £2.46-£3.48m of wages and £4.13-£5.82m of GVA to the Northern Ireland economy.

5.106 The proposed Wind Farm Development is expected to create or sustain the equivalent of 25 direct jobs, £1.12 million of direct wages and £5.62 million of direct GVA over its lifespan.

5.107 The estimated total (direct, indirect and induced) benefits from the operational phase of the proposed Development includes the creation or sustainment of 6 jobs with associated wages of £0.15 million per year. This activity will add £0.53 million of GVA to the Northern Ireland economy each year. Over the 25 years of operation, this would support 147 total jobs, £3.81 million of wages and £13.32 million of GVA.

5.108 Over the Development's construction phase the UK Exchequer is estimated to benefit from increased tax revenue and benefits saving of £1.33-£2.35m. In addition to this,

[31] http://www.detini.gov.uk/attracting_fdi_executive_summary.pdf

each year of operation is likely to yield a further £0.08-£0.10m of increased tax revenue and benefit savings. Over the 25 year project life, some £1.97-£2.42m would be realised in raised revenue and benefits savings.

5.109 Based on rateable values of £17,000 per MW—we calculate that the proposed Wind Farm Development will increase rateable value by £238,000 each year, or by £5.95m over the project horizon. From these values business rates are calculated and collected for local Councils and the Northern Ireland Assembly. By applying Derry and Strabane District Council non-domestic poundage rates, we estimate additional business rates of £141,949 each year and £3.55m over the 25 year lifetime of the project.

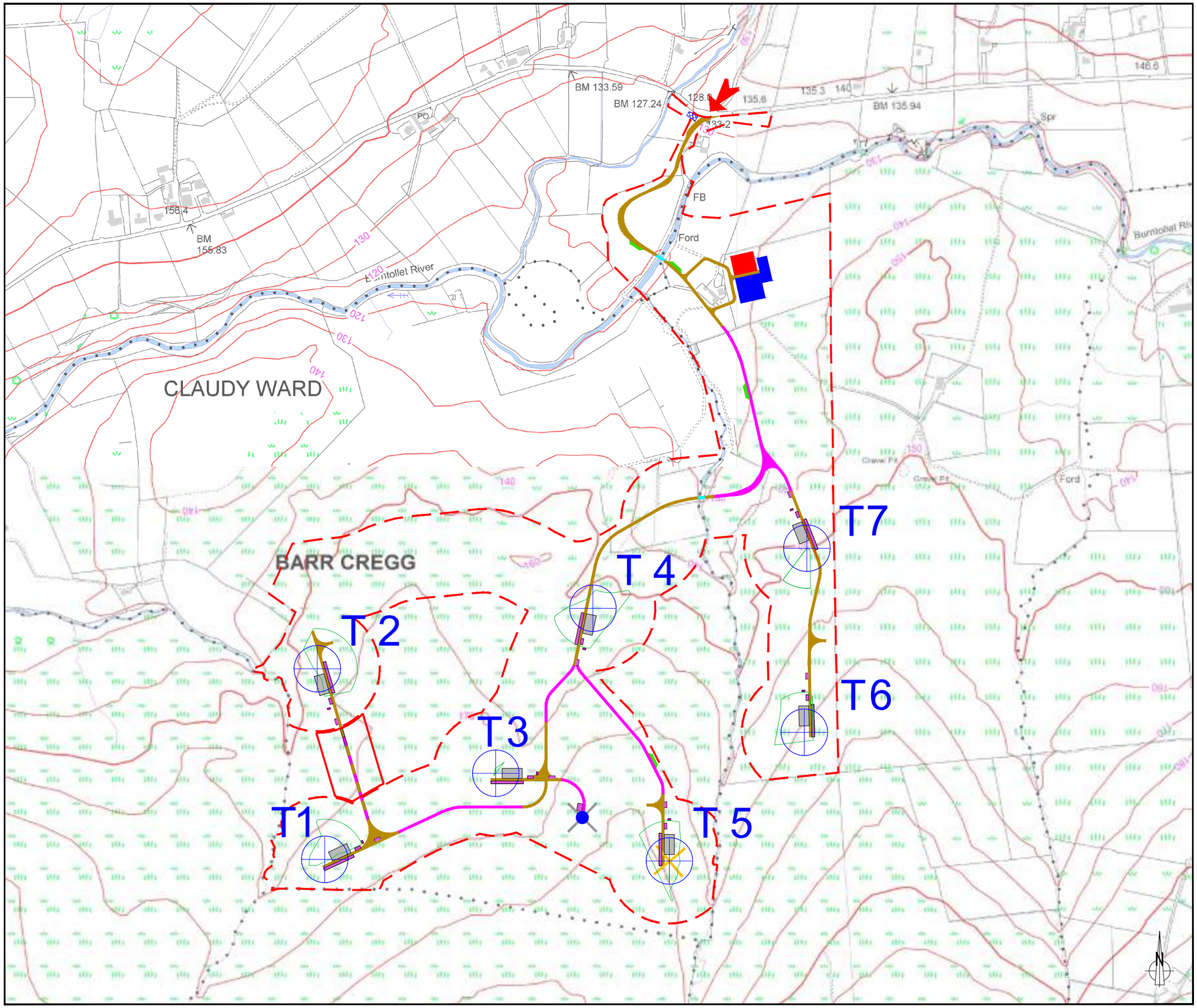
BARR CREGG WIND FARM

Further Environmental Information 2016

Volume 3 - Figures

res
powering change

Figures



res

BARR CREGG WIND FARM

FIGURE E - REVISION A

ALTERNATIVE INFRASTRUCTURE LAYOUT

Key

- Wind Turbine Location
- Micrositing Buffer (80m)
- Planning Application Boundary
- Planning Application Boundary (Planning Reference A/2014/0114/F)
- Site Tracks (New Excavated)
- Site Tracks (New Floated)
- Site Tracks (New Excavated on Floated)
- Control Building & Substation Compound
- Meteorological Mast Location (Permanent Lattice Type)
- Clear Span Watercourse Crossing
- Crane Hard Standing Area
  - Permanent
  - Temporary
- Temporary Passing Places & Turning Heads
- Temporary Construction Compound
- Temporary Enabling Works Compound
- Meteorological Calibration Reference Mast Location
- Meteorological Calibration Mast Location
- Site Entrance Location

Notes:

1. The reference mast and permanent mast are co-located in the drawing but are in fact 2 separate masts with the reference mast being in place and removed before the permanent mast is erected.

LAYOUT DWG	T-LAYOUT NO.
02381D0001-12	pNIRbrc034

DRAWING NUMBER

02381D1004-05

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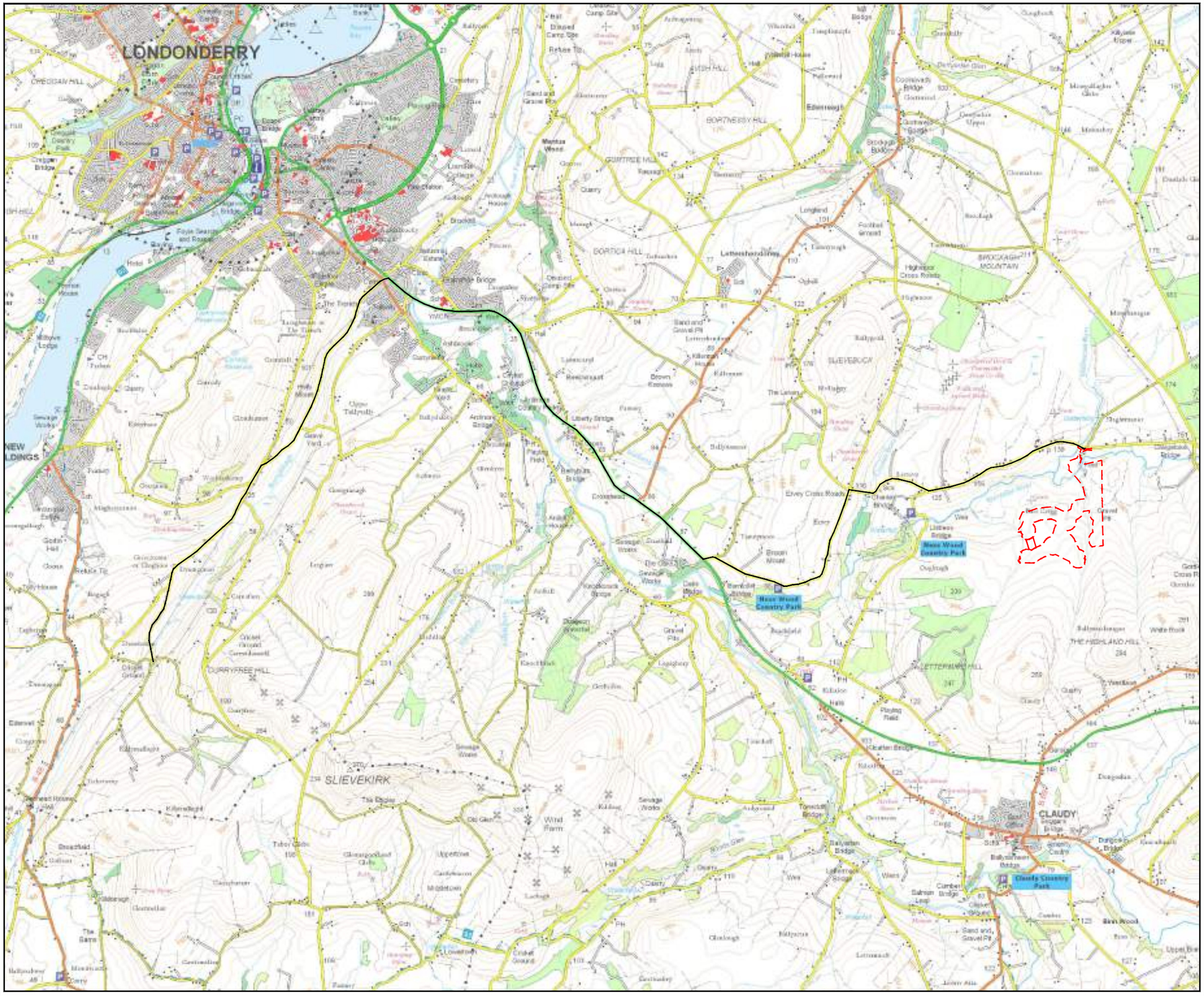
FEI 2016



BARR CREGG WIND FARM

FIGURE 2.1

POTENTIAL GRID CONNECTION ROUTE

KEY:

- PLANNING APPLICATION BOUNDARY
- GRID CONNECTION ROUTE

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

DRAWING NUMBER

02381D2245-01

SCALE - 1:50,000 @ A3

FEI 2016

242500 245000 247500 250000 252500 255000

417500 415000 412500 410000 407500

N

PROPOSED BARR CREGG WIND FARM GRID CONNECTION ROUTE

FIGURE 2.2

GEOLOGY & WATER ENVIRONMENT

Infrastructure

- Barr Cregg Wind Farm Planning Application Boundary
- Grid Connection Route

Water Features

- Watercourse

Watercourse Crossings

- Minor Crossing
- Significant Crossing

Abstractions

- Abstraction
- 250m water supply screening area

Rivers Agency Floodmap (NI)

- Grid Route within Fluvial 1% AEP Floodplain
- Grid Route within Surface Water Floodplain

DRAWING NUMBER
02381D2245-01

SCALE - AS SHOWN

FEI 2016

McCloy Consulting
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52 Mallusk Enterprise Park
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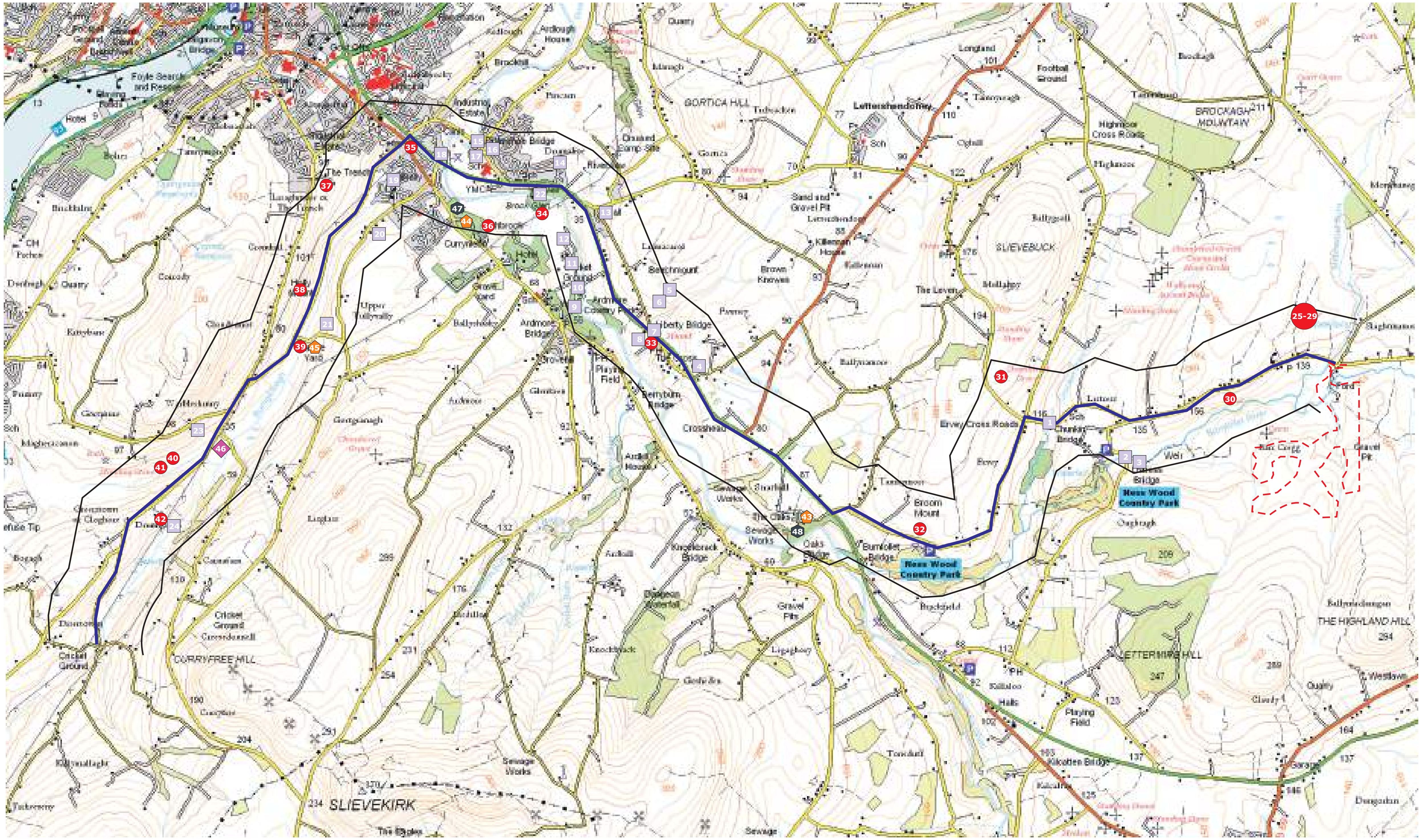
0 1 2 3 4 5 km



BARR CREGG WIND FARM

FIGURE 2.3

KNOWN CULTURAL HERITAGE FEATURES WITHIN 500M OF PROPOSED GRID CONNECTION ROUTE

- PLANNING APPLICATION BOUNDARY
- GRID CONNECTION ROUTE
- ARCHAEOLOGICAL SITES
- INDUSTRIAL HERITAGE SITE
- HISTORIC BUILDING
- DEFENCE HERITAGE SITE
- HISTORIC GARDEN

gahanandlong archaeological services

N/A

0 2km

FEI 2016

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UNDER-TRACK DRAINAGE CROSSINGS PROVIDED TO SIMILARLY ALLOW CONVEYANCE OF EXTREME OUT-OF-BANK FLOODING OF THE BURNTOLLET RIVER

ROADSIDE SWALES C/W CHECKDAMS AT SPECIFIED CENTRES AS PER TYPICAL DETAIL DRAWING

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

PROPOSED EXCAVATED FLOOD STORAGE COMPENSATION AREAS; REFER TO DRAWINGS WFD-04 FOR DETAIL

EXCAVATION DEWATERING FROM BRIDGE FOOTINGS TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

PROPOSED MAIN CLEAR SPAN BRIDGE (SPAN CIRCA. 20m) TO BURNTOLLET RIVER TO COMPLY WITH THE DESIGN REQUIREMENTS OF THE PROJECT FLOOD RISK ASSESSMENT – REFER TO DRAWING WFD-03 FOR TYPICAL DETAIL

CONTROL BUILDING / SUBSTATION

TEMP. COMPOUND

PROPOSED SETTLEMENT PONDS TO LOCATIONS WHERE A SIGNIFICANT DISCHARGE IS PROPOSED TO A MAIN WATERCOURSE

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

OUTFLOW FROM SWALES TO DISCHARGE VIA CHECK DAM AND STILLING BASIN. FLOWS TO BE DISTRIBUTED OVER UNBROKEN GROUND

PIPED CROSSING TO BE PROVIDED FOR CUT-OFF DRAIN

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

FLOW

LAYOUT PART 1A
1:2500

INDICATIVE DESIGN

N

OUTFLOW FROM SWALES TO DISCHARGE VIA CHECK DAM AND STILLING BASIN. FLOWS TO BE DISTRIBUTED OVER UNBROKEN GROUND

ROADSIDE SWALES C/W CHECKDAMS AT SPECIFIED CENTRES AS PER TYPICAL DETAIL DRAWING

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

SETTLEMENT / ATTENUATION POND PROVIDED AT MAJOR EXCAVATIONS AND HARDSTANDINGS UPSTREAM OF DISCHARGE OVERLAND

EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

PIPED CROSSING TO BE PROVIDED FOR CUT-OFF DRAIN

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

ROADSIDE SWALES C/W CHECKDAMS AT SPECIFIED CENTRES AS PER TYPICAL DETAIL DRAWING

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

PIPED CROSSING TO BE PROVIDED FOR CUT-OFF DRAIN

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

SETTLEMENT / ATTENUATION POND PROVIDED AT MAJOR EXCAVATIONS AND HARDSTANDINGS UPSTREAM OF DISCHARGE OVERLAND

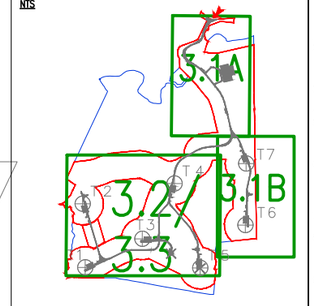
EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

FLOW

LAYOUT PART 1B
1:2500

KEY PLAN
NTS



PRECEDENCE

1. Drawing supercedes previous FEI FIGURE 13.4 and ES Appendix 13.4, DWG_01.

NOTES

2. Drainage layout shown is indicative for Planning purposes only and is intended to be developed post-consent. Drainage features shown are subject to change dependant on detailed infrastructure design and local topography.
3. Location of crossings, swales, breakouts, ponds etc is indicative only for purposes of preliminary planning drawing layout.
4. Pipe sizes to be confirmed at detailed design stage.
5. 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 and geotextile barriers at the problem areas.
6. 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.
7. Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving water courses.
8. 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 watercourses.
9. Batters of swales to have a slope of between 1:1½ – 1:2 depending upon depth of swale and will be left as cut to re-vegetate with local species.
10. Roadside swales to be shallow with moderate gradients to prevent scouring. In steep areas check dams have been designated to reduce flow rate and provide source control silt containment. Where necessary these have been designated in conjunction with settlement ponds and/or cross drains.
11. Slopes of the swale to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer from excavations to be stored locally and used to line slopes and base of swale. Vegetative layer to be placed into swale after construction of the swale.
12. Where reseeding is required, Grass seed mix shall use locally sourced mix based upon the surrounding habitat. To achieve the required local biodiversity, the seed mix and planting regime shall be agreed with appointed ecologist.
13. Areas stripped of vegetation should be kept to a minimum.
14. 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.
15. 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 removed and replaced.
16. 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.
17. 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).

SuDS KEY

- Floated track balancing crossdrain
- Undertrack drainage (Construction Runoff)
- Undertrack drainage (Natural Runoff)
- Watercourse crossing
- Drainage Swale / Indicative Breakout & Check Dam
- Natural Runoff Cut-off Ditch
- Silt Fence
- Settlement Pond
- Temporary Washout Pit
- 50m Buffer to Watercourse / 20m Buffer to Drain

MAP KEY

- Site Boundary
- Watercourse
- Drain
- Ephemperal Ditch/ Field Drain
- Faughan & Tributaries SAC
- Natural Overland Flow Directions
- Habitat Enhancement Area
- Habitat Improvement – Permanent Drain Blocking

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
Alternative Layout 02381D1004-04

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR WFD ASSESSMENT SUBMISSION
1	VR	DKS	27/04/2016	FOR WFD ASSESSMENT SUBMISSION

STATUS
FOR WFD ASSESSMENT

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52 Mallusk Enterprise Park
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BT36 4GN

PROJECT
PROPOSED WIND FARM AT BARR CREGG. CO. DERRY

CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS) FOR WFD ASSESSMENT
SITE DRAINAGE PLAN

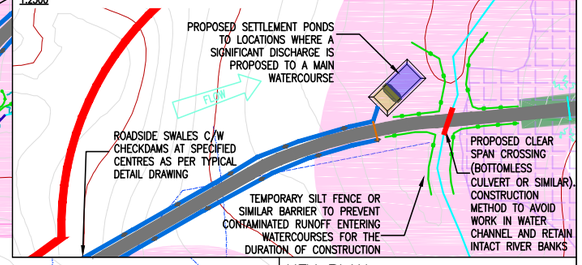
SCALE	ORIGINAL SIZE
1:2500	A3

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115-21	WFD	FIG 3.1	2

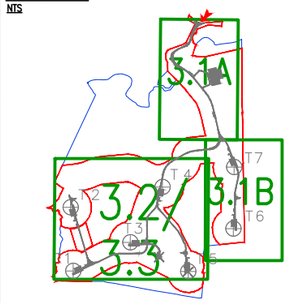
N

FOR CONTINUATION SEE EASTERN STREAM CROSSING DETAIL

EASTERN STREAM CROSSING
1:2500



KEY PLAN
NTS



TEMPORARY SILT FENCE OR SIMILAR BARRIER TO PREVENT CONTAMINATED RUNOFF ENTERING WATERCOURSES FOR THE DURATION OF CONSTRUCTION

PROPOSED CROSSING (PIPE OR BOX CULVERT OR SIMILAR) TO BE INSTALLED

TEMPORARY BARRIER FROM STRAW BALES OR SIMILAR TO PROVIDE ADDITIONAL FILTER TO RUNOFF FROM MAIN EXCAVATIONS IN PROXIMITY TO WATER BUFFERS.

SETTLEMENT / ATTENUATION POND PROVIDED AT MAJOR EXCAVATIONS AND HARDSTANDINGS UPSTREAM OF DISCHARGE OVERLAND

EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

EXISTING PEAT DRAINAGE TO BE BLOCKED FOR HABITAT ENHANCEMENT

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

SETTLEMENT / ATTENUATION POND PROVIDED AT MAJOR EXCAVATIONS AND HARDSTANDINGS UPSTREAM OF DISCHARGE OVERLAND

TEMPORARY SILT FENCE OR SIMILAR BARRIER TO PREVENT CONTAMINATED RUNOFF ENTERING WATERCOURSES FOR THE DURATION OF CONSTRUCTION

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

EXISTING PEAT DRAINAGE TO BE BLOCKED FOR HABITAT ENHANCEMENT

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

SETTLEMENT PONDS TO TREAT RUNOFF IN VICINITY OF T3 – REFER TO DRAWING WFD-10

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

TEMPORARY SILT FENCE OR SIMILAR BARRIER TO PREVENT CONTAMINATED RUNOFF ENTERING WATERCOURSES FOR THE DURATION OF CONSTRUCTION

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

TEMPORARY SILT FENCE OR SIMILAR BARRIER TO PREVENT CONTAMINATED RUNOFF ENTERING WATERCOURSES FOR THE DURATION OF CONSTRUCTION

DIVERSION TO EXISTING ARTIFICIAL DRAIN – REFER TO DRAWING WFD-03

PIPED CROSSING TO BE PROVIDED FOR CUT-OFF DRAIN

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

PROPOSED CROSSING (PIPE OR BOX CULVERT OR SIMILAR) TO BE INSTALLED

REFER TO DRAWING WFD-03 FOR DRAINAGE WORKS AT T3

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

ROADSIDE SWALES C/W CHECKDAMS AT SPECIFIED CENTRES AS PER TYPICAL DETAIL DRAWING

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

FLOATED-TYPE TRACK DENOTED WITH HATCH AS SHOWN

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

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PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

INDICATIVE DESIGN

PRECEDENCE

1. Drawing supercedes previous FEI FIGURE 13.6 and ES Appendix 13.4, DWG_01.

NOTES

2. Drainage layout shown is indicative for Planning purposes only and is intended to be developed post-consent. Drainage features shown are subject to change dependant on detailed infrastructure design and local topography.
3. Location of crossings, swales, breakouts, ponds etc is indicative only for purposes of preliminary planning drawing layout.
4. Pipe sizes to be confirmed at detailed design stage.
5. 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 and geotextile barriers at the problem areas.
6. 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.
7. Suitable prevention measures should be in place at all times to prevent the conveyance of silts to receiving water courses.
8. 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 watercourses.
9. Batters of swales to have a slope of between 1:1½ – 1:2 depending upon depth of swale and will be left as cut to re-vegetate with local species.
10. Roadside swales to be shallow with moderate gradients to prevent scouring. In steep areas check dams have been designated to reduce flow rate and provide source control silt containment. Where necessary these have been designated in conjunction with settlement ponds and/or cross drains.
11. Slopes of the swale to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer from excavations to be stored locally and used to line slopes and base of swale. Vegetative layer to be placed into swale after construction of the swale.
12. Where reseeding is required, Grass seed mix shall use locally sourced mix based upon the surrounding habitat. To achieve the required local biodiversity, the seed mix and planting regime shall be agreed with appointed ecologist.
13. Areas stripped of vegetation should be kept to a minimum.
14. 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.
15. 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 removed and replaced.
16. 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.
17. 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).

SuDS KEY

- Floated track balancing crossdrain
- Undertrack drainage (Construction Runoff)
- Undertrack drainage (Natural Runoff)
- Watercourse crossing
- Drainage Swale / Indicative Breakout & Check Dam
- Natural Runoff Cut-off Ditch
- Silt Fence
- Settlement Pond
- Temporary Washout Pit
- 50m Buffer to Watercourse / 20m Buffer to Drain

MAP KEY

- Site Boundary
- Watercourse
- Drain
- Ephemperal Ditch / Field Drain
- Redundant Ephemeral Ditch / Field Drain
- Natural Overland Flow Directions
- Habitat Enhancement Area
- Habitat Improvement – Permanent Drain Blocking

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
Alternative Layout 02381D1004-04

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR WFD ASSESSMENT SUBMISSION
1	VR	DKS	27/04/2016	FOR WFD ASSESSMENT SUBMISSION

STATUS: FOR WFD ASSESSMENT

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PROJECT: PROPOSED WIND FARM AT BARR CREGG. CO. DERRY

CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) FOR WFD ASSESSMENT SITE DRAINAGE PLAN

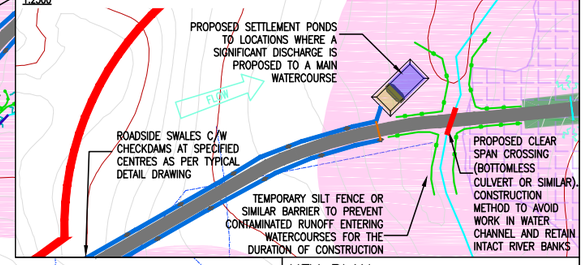
SCALE	ORIGINAL SIZE
1:2500	A3

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115-21	WFD	FIG 3.2	2

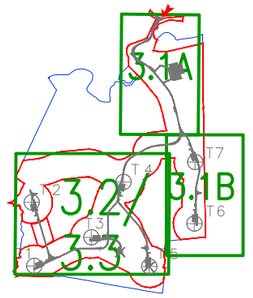
N

FOR CONTINUATION SEE EASTERN STREAM CROSSING DETAIL

EASTERN STREAM CROSSING
1:2500



KEY PLAN
NTS



TEMPORARY SILT FENCE OR SIMILAR BARRIER TO PREVENT CONTAMINATED RUNOFF ENTERING WATERCOURSES FOR THE DURATION OF CONSTRUCTION

PROPOSED CROSSING (PIPE OR BOX CULVERT OR SIMILAR) TO BE INSTALLED

TEMPORARY BARRIER FROM STRAW BALES OR SIMILAR TO PROVIDE ADDITIONAL FILTER TO RUNOFF FROM MAIN EXCAVATIONS IN PROXIMITY TO WATER BUFFERS.

SETTLEMENT / ATTENUATION POND PROVIDED AT MAJOR EXCAVATIONS AND HARDSTANDINGS UPSTREAM OF DISCHARGE OVERLAND

EXCAVATION DEWATERING TO BE PUMPED TO TEMPORARY STILLING POND. WATER TO BE RETURNED TO SITE DRAINAGE SYSTEM

PROPOSED CUTOFF DRAIN TO DIVERT SURFACE WATER AWAY FROM TRACK EXCAVATION

EXISTING PEAT DRAINAGE TO BE BLOCKED FOR HABITAT ENHANCEMENT

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

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SETTLEMENT PONDS TO TREAT RUNOFF IN VICINITY OF T3 – REFER TO DRAWING WFD-10

FLOW BALANCING CROSS DRAINS TO BE PROVIDED AT REGULAR FREQUENCY THROUGH FLOATED-TYPE TRACKS TO PRESERVE PEAT HYDROLOGY

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EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

DIVERSION TO EXISTING ARTIFICIAL DRAIN – REFER TO DRAWING WFD-03

PIPED CROSSING TO BE PROVIDED FOR CUT-OFF DRAIN

PROPOSED CROSSING (PIPE OR BOX CULVERT OR SIMILAR) TO BE INSTALLED

REFER TO DRAWING WFD-03 FOR DRAINAGE WORKS AT T3

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

OUTFLOW FROM SWALES TO DISCHARGE VIA CHECK DAM AND STILLING BASIN. FLOWS TO BE DISTRIBUTED OVER UNBROKEN GROUND

NO IMPORTING OF SPOIL TO DENOTED WATER BUFFER ZONES FOR TEMPORARY OR PERMANENT STOCKPILING

ROADSIDE SWALES C/W CHECKDAMS AT SPECIFIED CENTRES AS PER TYPICAL DETAIL DRAWING

EXISTING PEAT DRAINAGE TO BE TEMPORARILY BLOCKED USING AGGREGATE OR CLAY PLUGS FOR THE DURATION OF CONSTRUCTION WORKS (SHOWN INDICATIVE)

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INDICATIVE DESIGN

PRECEDENCE

1. Drawing supercedes previous FEI FIGURE 13.6 and ES Appendix 13.4, DWG_01.

NOTES

2. Drainage layout shown is indicative for Planning purposes only and is intended to be developed post-consent. Drainage features shown are subject to change dependant on detailed infrastructure design and local topography.
3. Location of crossings, swales, breakouts, ponds etc is indicative only for purposes of preliminary planning drawing layout.
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10. Roadside swales to be shallow with moderate gradients to prevent scouring. In steep areas check dams have been designated to reduce flow rate and provide source control silt containment. Where necessary these have been designated in conjunction with settlement ponds and/or cross drains.
11. Slopes of the swale to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer from excavations to be stored locally and used to line slopes and base of swale. Vegetative layer to be placed into swale after construction of the swale.
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SuDS KEY

- Floated track balancing crossdrain
- Undertrack drainage (Construction Runoff)
- Undertrack drainage (Natural Runoff)
- Watercourse crossing
- Drainage Swale / Indicative Breakout & Check Dam
- Natural Runoff Cut-off Ditch
- Silt Fence
- Settlement Pond
- Temporary Washout Pit
- 50m Buffer to Watercourse / 20m Buffer to Drain

MAP KEY

- Site Boundary
- Watercourse
- Drain
- Ephemperal Ditch / Field Drain
- Redundant Ephemeral Ditch / Field Drain
- Natural Overland Flow Directions
- Habitat Enhancement Area
- Habitat Improvement – Permanent Drain Blocking

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
Alternative Layout 02381D1004-04

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR WFD ASSESSMENT SUBMISSION
1	VR	DKS	27/04/2016	FOR WFD ASSESSMENT SUBMISSION

STATUS: FOR WFD ASSESSMENT

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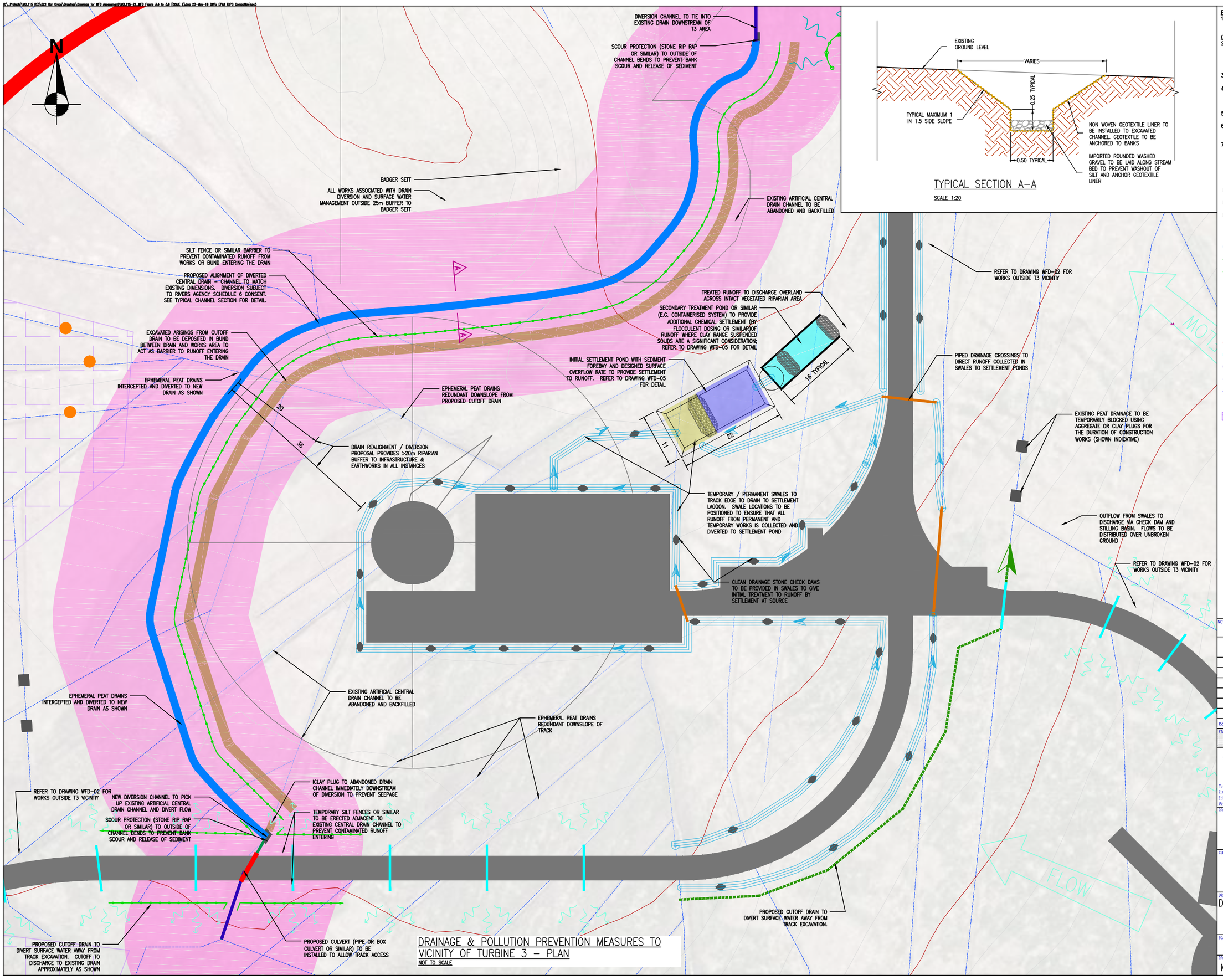
PROJECT: PROPOSED WIND FARM AT BARR CREGG. CO. DERRY

CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) FOR WFD ASSESSMENT
SITE DRAINAGE PLAN (ALTERNATIVE T1-T2 LAYOUT)

SCALE	ORIGINAL SIZE
1:2500	A3

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115-21	WFD	FIG 3.3	2



DRAINAGE & POLLUTION PREVENTION MEASURES TO VICINITY OF TURBINE 3 – PLAN

NOT TO SCALE

TYPICAL SECTION A–A

SCALE 1:20

PRECEDENCE

1. DRAWING SUPERCEDES PREVIOUS FEI FIGURE 13.7.

CONSTRUCTION METHODOLOGY

2. THE WATERCOURSE CHANNEL ALIGNMENT HAS BEEN DESIGNED TO MAXIMISE THE DISTANCE BETWEEN SOURCES OF POLLUTION IN ORDER TO PROVIDE THE GREATEST POSSIBLE RIPARIAN BUFFER ZONE IN LIEU OF OTHER FIXED CONSTRAINTS.
3. SCOUR PROTECTION (RIP RAP OR SIMILAR) IS TO BE PROVIDED AT BENDS AS SHOWN.
4. TEMPORARY SCOUR PROTECTION (GEOTEXTILE LINER) IS TO BE PROVIDED TO THE EXCAVATED CHANNEL TO MINIMISE WASHOUT OF SILTS. TEMPORARY MEASURES CAN BE REMOVED WHEN CHANNEL IS VEGETATED.
5. NEW CHANNEL IS TO BE EXCAVATED FROM THE LOW POINT IN AN UPGRADIENT DIRECTION I.E. FROM NORTH TO SOUTH.
6. WATER WILL NOT BE PERMITTED TO ENTER THE NEW CHANNEL UNTIL ALL TEMP. AND PERM. SCOUR PROTECTION HAS BEEN INSTALLED.
7. IMPORTED ROUNDED WASHED GRAVEL TO BE PLACED IN THE CHANNEL BED TO MINIMISE WASHOUT OF SILTS AND ANCHOR GEOTEXTILE.

SuDS KEY

- Floated track balancing crossdrain
- Undertrack drainage (Construction Runoff)
- Undertrack drainage (Natural Runoff)
- Watercourse crossing
- Drainage Swale / Indicative Breakout & Check Dam
- Natural Runoff Cut-off Ditch
- Silt Fence
- Settlement Pond
- Temporary Washout Pit
- 50m Buffer to Watercourse / 20m Buffer to Drain

MAP KEY

- Site Boundary
- Watercourse
- Drain
- Ephemperal Ditch / Field Drain
- Redundant Ephemeral Ditch / Field Drain
- Natural Overland Flow Directions
- Habitat Enhancement Area
- Habitat Improvement – Permanent Drain Blocking

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
Alternative Layout 02381D1004-04

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
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BT36 4GN

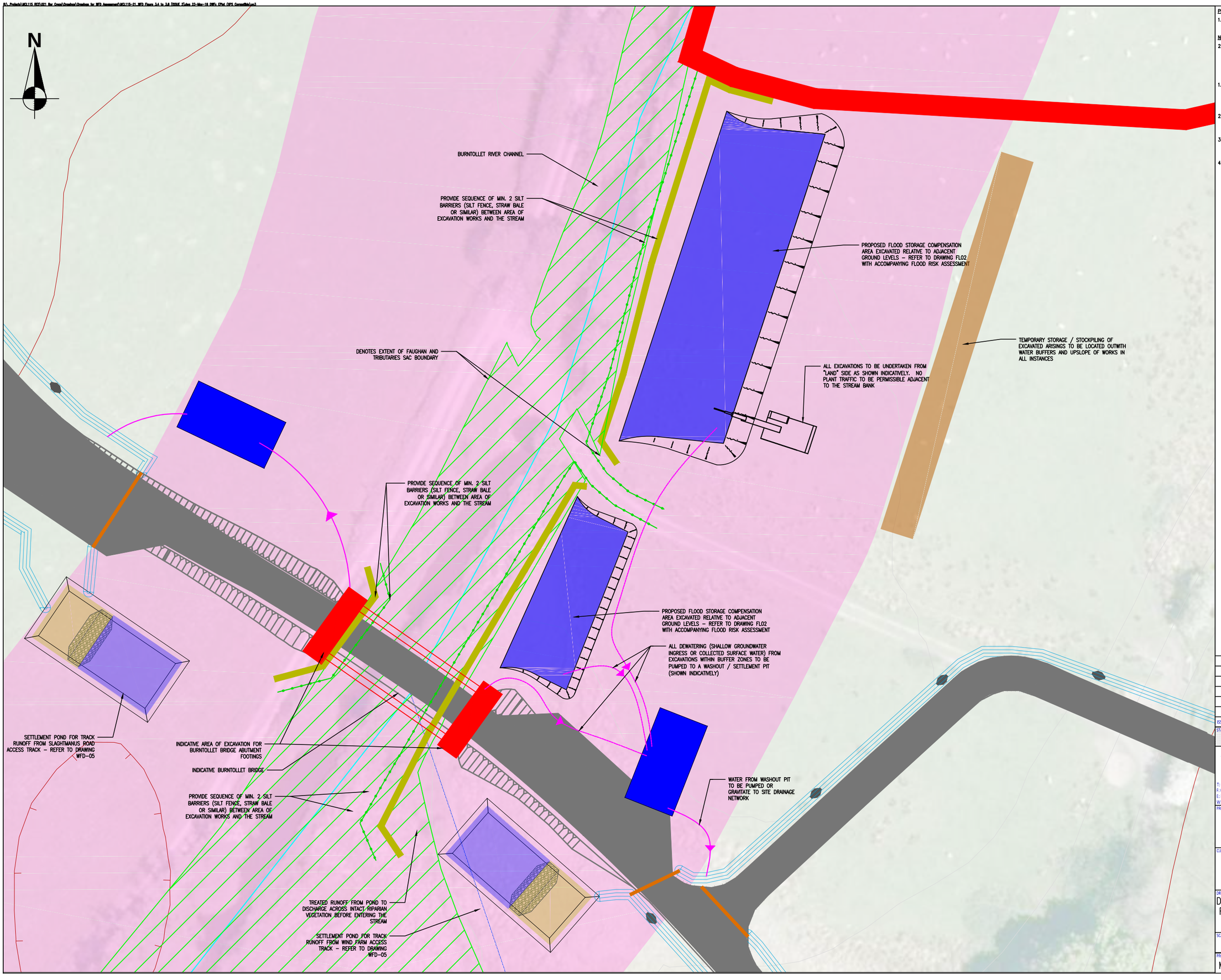
PROJECT: PROPOSED WIND FARM AT BARR CREGG. CO. DERRY

CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) FOR WFD DRAINAGE AT T3 & VICINITY PRELIMINARY LAYOUT FOR PLANNING

SCALE	ORIGINAL SIZE
AS SHOWN	A3

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115-21	WFD	FIG 3.4	1



PRECEDENCE

1. DRAWING SUPERCEDES PREVIOUS FEI FIGURE 13.8.

NOTES

2. PRIOR TO UNDERTAKING EXCAVATIONS, CONTRACTOR TO INSTALL A SERIES (MIN. 2) OF PARALLEL SILT FENCES OR STRAW BALES PINNED TO UNDISTURBED GROUND BETWEEN THE WORKS AND THE RIVER BANK, EXTENDING ADJACENT AND BEYOND THE RIVERSIDE EXTENT OF THE EARTHWORKS.
1. EXCAVATION OF MATERIAL AND OVERBURDEN (MAX DEPTH OF EARTHWORK TYPICALLY 1.0–1.2M BASED ON OUTLINE DESIGN) TO BE BY MECHANICAL EXCAVATOR TO SUIT THE REQUIRED PROFILE AND LEVELS.
2. EXCAVATED MATERIAL TO BE TRANSPORTED OUTWITH THE WATERCOURSE BUFFER FOR TEMPORARY OR PERMANENT STORAGE. REPLACE STORED TURF OVER THE RE-PROFILED EXCAVATION.
3. SILT FENCES / STRAW BALES TO REMAIN AFTER COMPLETION OF EARTHWORKS UNTIL VEGETATION HAS FULLY RE-ESTABLISHED ON THE AREA OF WORKS.
4. WORKS TO CONSTRUCT THE FLOOD STORAGE COMPENSATION AREA WOULD BE LIMITED TO OCCUR OUTSIDE THE FISH SPAWNING SEASON AS DEFINED BY THE FISHERIES ASSESSMENT SUBMITTED WITH THE ENVIRONMENTAL STATEMENT.

SuDS KEY

- Floated track balancing crossdrain
- Undertrack drainage (Construction Runoff)
- Undertrack drainage (Natural Runoff)
- Watercourse crossing
- Drainage Swale / Indicative Breakout & Check Dam
- Natural Runoff Cut-off Ditch
- Silt Fence
- Settlement Pond
- Temporary Washout Pit
- 50m Buffer to Watercourse / 20m Buffer to Drain

MAP KEY

- Site Boundary
- Watercourse
- Drain
- Ephemperal Ditch/ Field Drain
- Faughan & Tributaries SAC
- Natural Overland Flow Directions
- Habitat Enhancement Area
- Habitat Improvement – Permanent Drain Blocking

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
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PROJECT: PROPOSED WIND FARM AT BARR CREGG. CO. DERRY

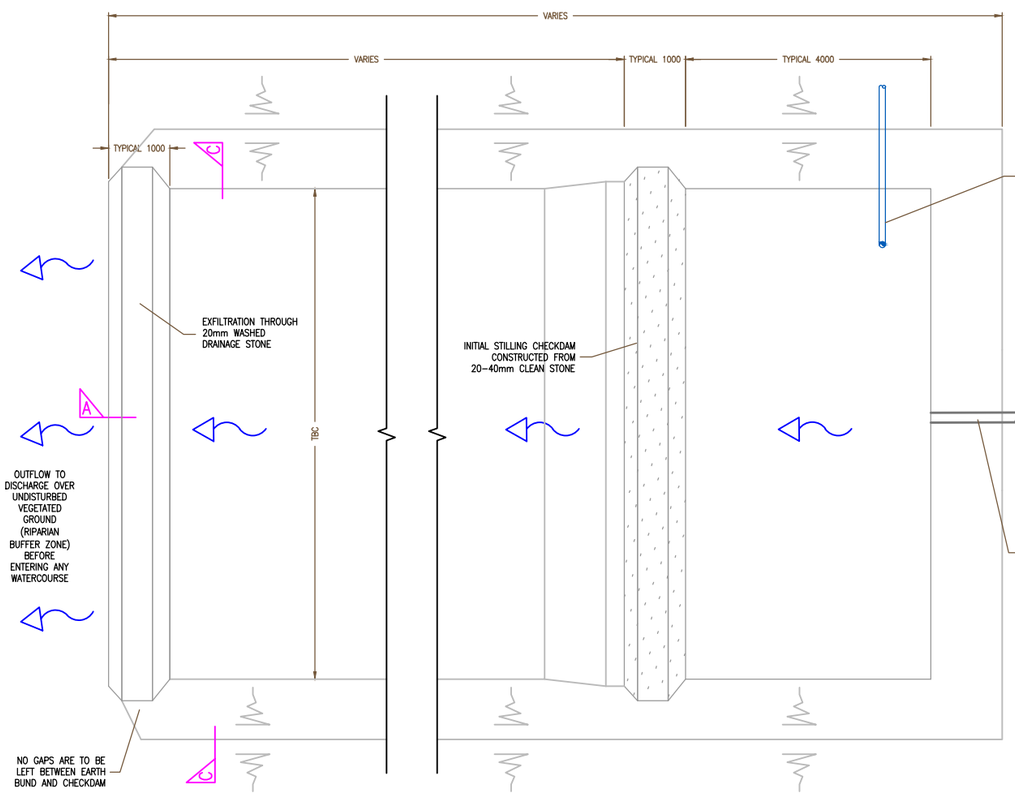
CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) FOR WFD FLOOD STORAGE COMPENSATION WORKS PRELIMINARY LAYOUT FOR PLANNING

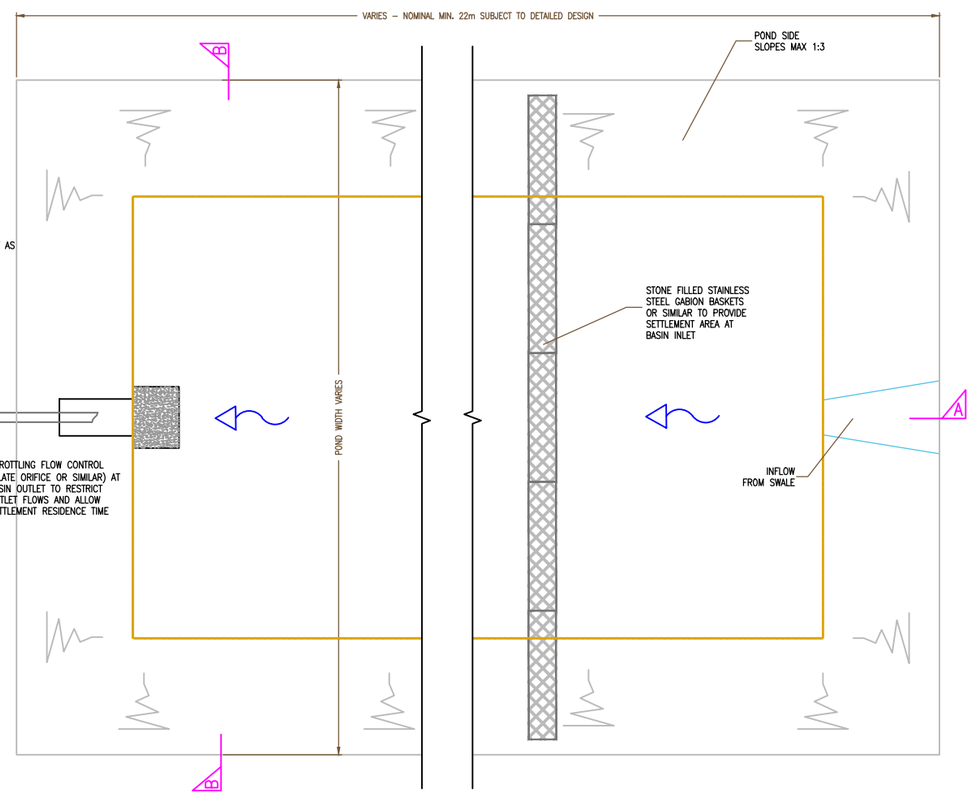
SCALE	ORIGINAL SIZE
1:500	A3

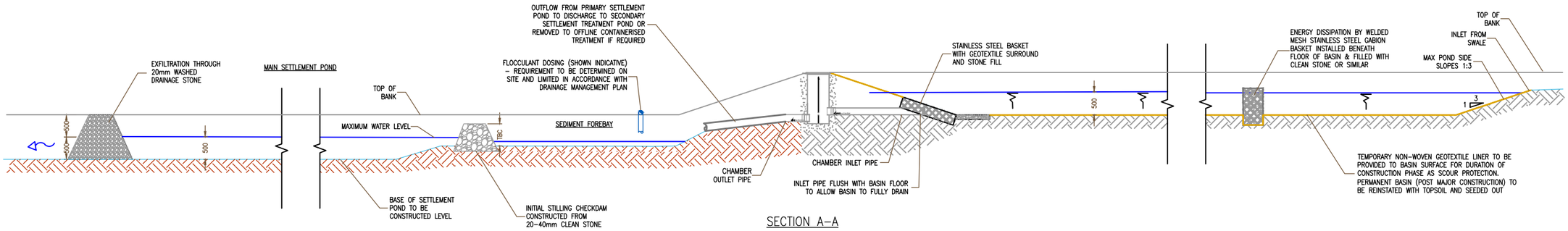
PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115–21	WFD	FIG 3.5	1

SECONDARY SETTLEMENT (IF REQUIRED BY DETAILED DESIGN)

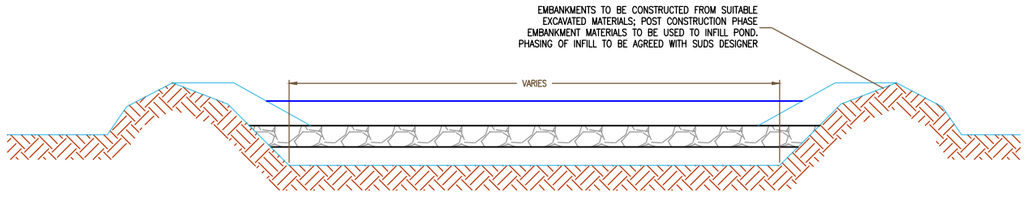


PRIMARY SETTLEMENT

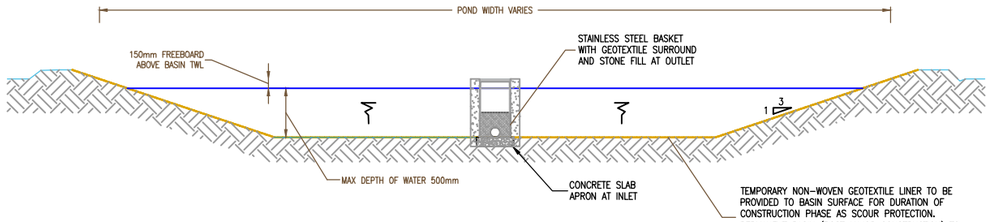




SECTION A–A



SECTION C–C



SECTION B–B

INDICATIVE DESIGN

PRECEDENCE

1. DRAWING SUPERCEDES PREVIOUS FEI FIGURE 13.9 AND ES APPENDIX 13.4, DWG_04.

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
1	VR	DKS	27/04/2016	FOR INFORMATION / APPROVAL

STATUS: FOR WFD ASSESSMENT

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PROJECT: PROPOSED WIND FARM AT BARR CREGG. CO. DERRY

CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) FOR WFD RUNOFF SETTLEMENT & SECONDARY TREATMENT PRELIMINARY DETAILS FOR PLANNING

SCALE	ORIGINAL SIZE
1:100	A3

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115–21	WFD	FIG 3.6	1

SUMP TO BE FORMED AT PIPE INLET. EXPOSED PIPE BEDDING AROUND PIPE TO BE SEALED WITH COMPACTED PEAT OR SIMILAR TO PREVENT SCOUR / WASHOUT

CLEAN WATER CROSS DRAIN (MIN. 450ø OR AS PER DETAILED LAYOUT DESIGN) TO BE PROVIDED AT EXISTING DRIPS, DRAINAGE CHANNELS AND ALL NATURAL OR ARTIFICIALLY CREATED LOW POINTS WHERE WATER IS LIKELY TO GATHER.

FLOW DIRECTION

DISTANCE VARIES TYPICALLY 10–40m CENTRES (AS PER DETAILED LAYOUT)

ROAD ALIGNMENT LONGITUDINAL FALL

SIDECAST SPOIL

DRAINAGE SWALE (CONSTRUCTION RUNOFF)

CLEAN WATER CUTOFF DRAINAGE PLACED AT UPSLOPE SIDE (AS PER SITE SPECIFIC ARRANGEMENT)

STONE FILTRATION CHECKDAMS TO BE LOCATED DOWNSTREAM OF CROSS DRAINS AND ELSEWHERE AS SHOWN ON DETAILED SuDS GENERAL ARRANGEMENT LAYOUTS. FREQUENCY TYPICALLY 10–40m CENTRES

NEW ACCESS TRACK – DETAILS AS PER ROAD DESIGNERS SPECIFICATION

SILT COLLECTION SUMP AT CROSSDRAIN ON UPSTREAM SIDE

VARIES

FALL OF EXISTING TERRAIN

IMPERMEABLE DAM (COMPACTED EXCAVATED SOIL OR SIMILAR) TO BE PLACED IMMEDIATELY DOWNSTREAM OF BREAKOUT CHANNEL / SPILLWAY TO ENSURE REDIRECTION OF FLOWS TO BREAKOUT CHANNEL

FORM HEADWALL / SCOUR PROTECTION AT PIPE OUTLET USING STACKED LARGE (300MM+) STONE

TEMPORARY SILT FENCE (AS PER SEPERATE DETAIL DRAWING) TO BE INSTALLED AS ADDITIONAL MEASURE DURING CONSTRUCTION PHASE AS REQUIRED WHERE RISK OF POLLUTION IS OBSERVED AT CROSSING OUTLET

DRAINAGE SWALE (CONTAMINATED WATER)

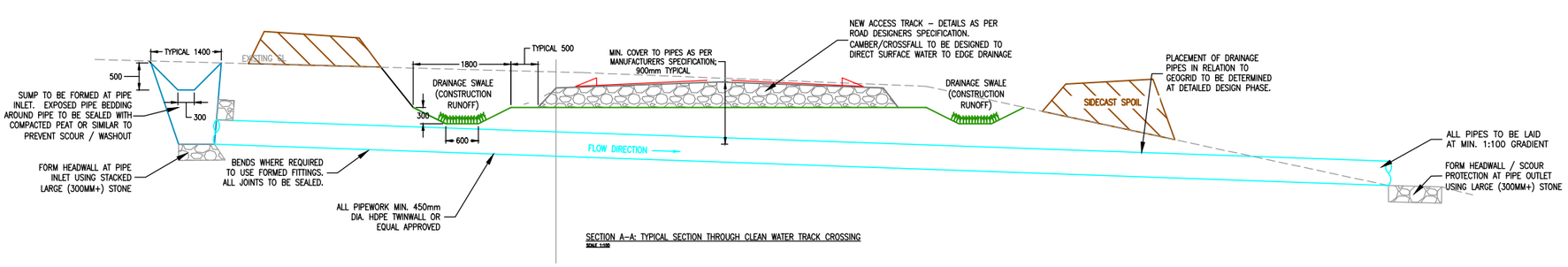
FORM SUMP/SETTLEMENT BASIN AT OUTLET

TEMPORARY SILT FENCE (AS PER SEPERATE DETAIL DRAWING) TO BE INSTALLED AS ADDITIONAL MEASURE DURING CONSTRUCTION PHASE AS REQUIRED WHERE RISK OF POLLUTION IS OBSERVED AT SWALE OUTLET

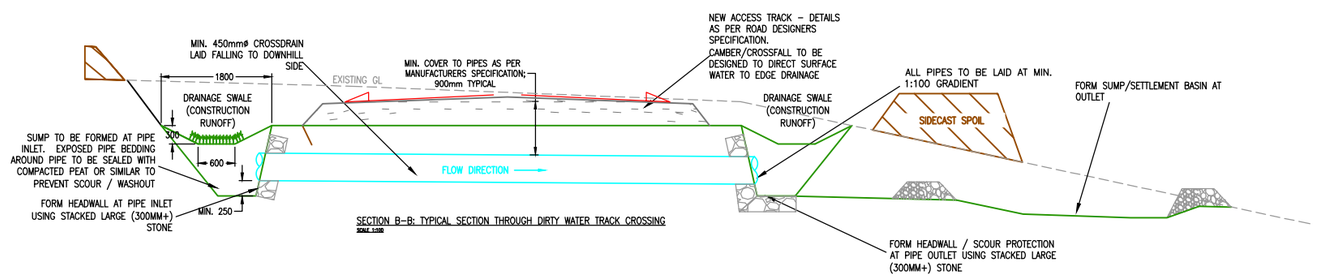
UNDISTURBED VEGETATED AREA

FLOWS TO BE DISPERSED OVERLAND

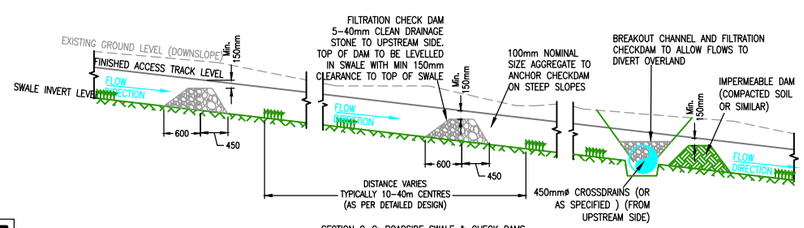
PLAN OF TRACKSIDE DRAINAGE – ROAD SECTIONS IN CUT
SCALE 1:500



SECTION A–A: TYPICAL SECTION THROUGH CLEAN WATER TRACK CROSSING
SCALE 1:100



SECTION B–B: TYPICAL SECTION THROUGH DIRTY WATER TRACK CROSSING
SCALE 1:100



SECTION C–C: ROADSIDE SWALE & CHECK DAMS
SCALE 1:100

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

PRECEDENCE

1. DRAWING SUPERCEDES PREVIOUS ES APPENDIX 13.4, DWG_02.

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR INFORMATION
1	VR	DKS	15/04/2016	ORIGINAL – FOR INFORMATION

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PROJECT: PROPOSED WINDFARM AT BARR CREGG, CO. DERRY

CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS EXCAVATED FOUNDATION (CUT) TRACK

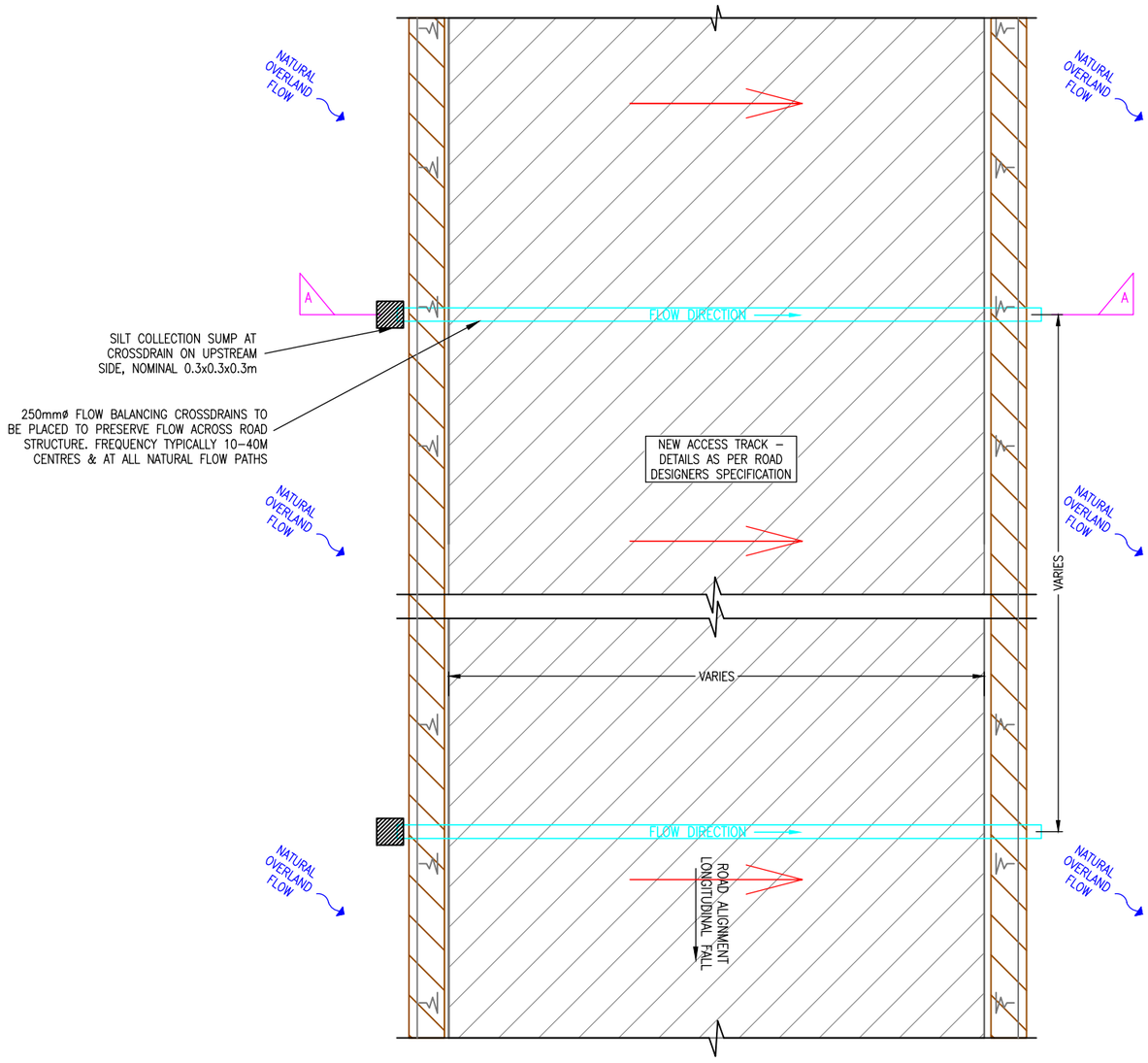
SCALE	ORIGINAL SIZE
AS SHOWN	A3

DRAWN	CHECKED	DATE
VR	DKS	23/05/2016

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115–21	WFD	FIG 3.7	2

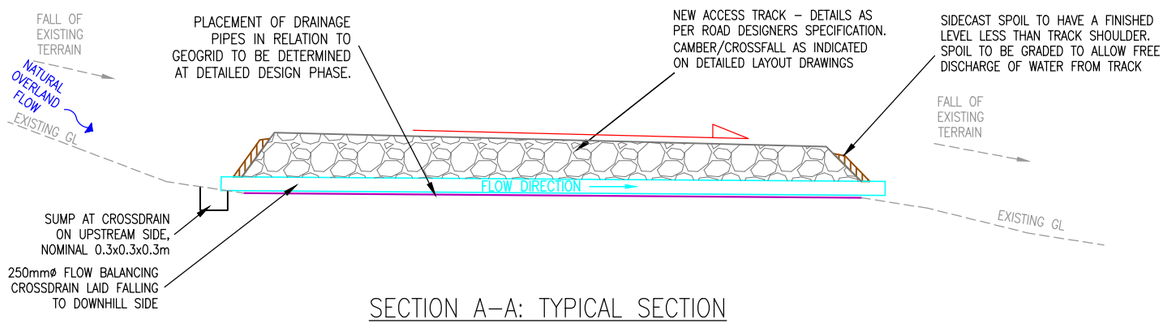
PRECEDENCE

1. DRAWING SUPERCEDES PREVIOUS ES APPENDIX 13.4, DWG_03.



PLAN OF ROADSIDE DRAINAGE – FLOATED ROAD SECTIONS

SCALE 1:100



SECTION A–A: TYPICAL SECTION

SCALE 1:100

INDICATIVE DESIGN

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR INFORMATION
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PROJECT: PROPOSED WINDFARM AT BARR CREGG, CO. DERRY

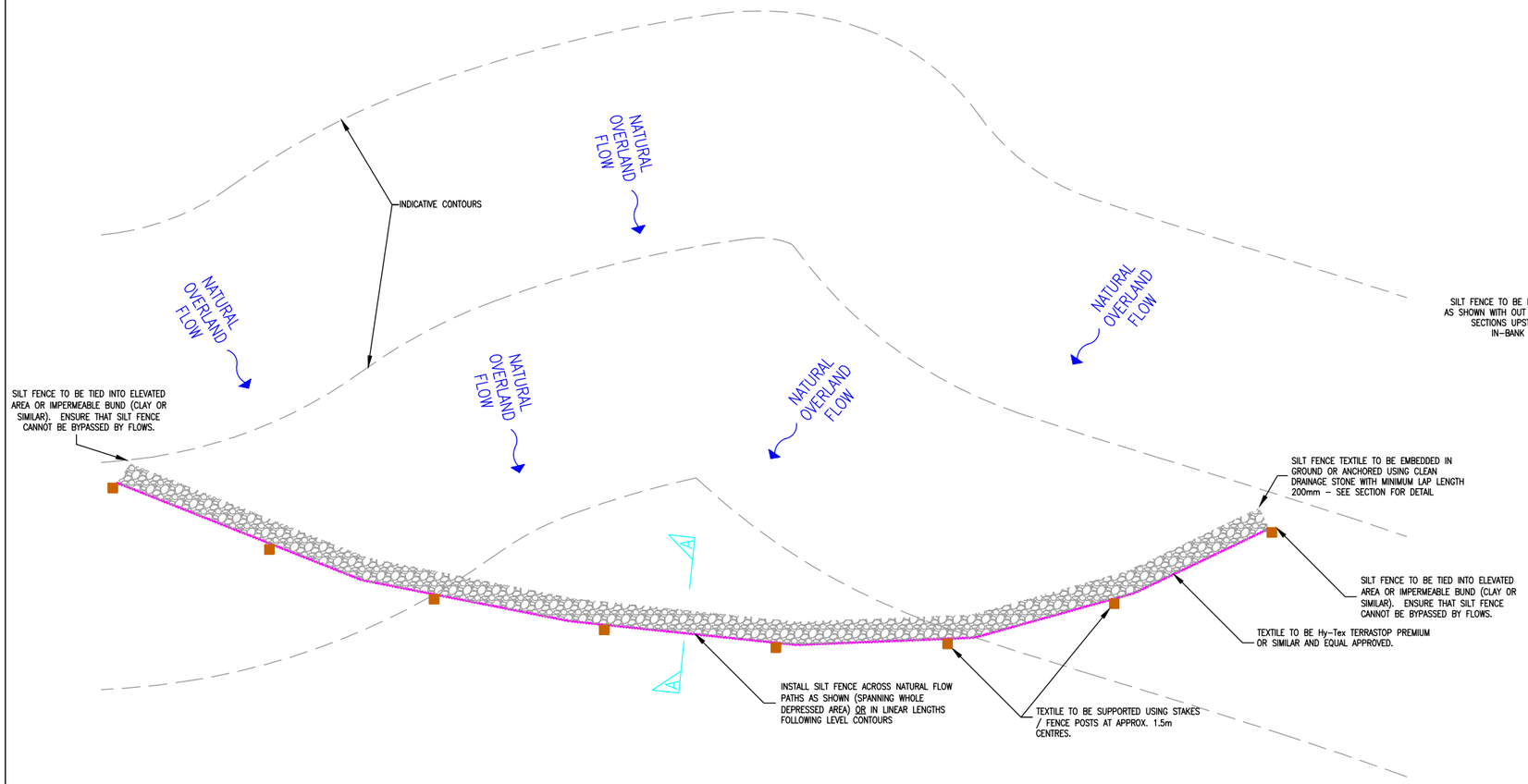
CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS DRAINAGE AT FLOATED TRACK

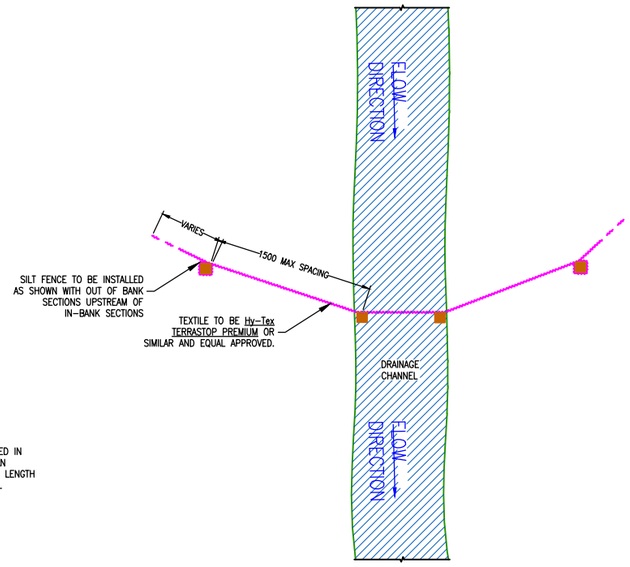
SCALE	ORIGINAL SIZE
AS SHOWN	A3

DRAWN	CHECKED	DATE
VR	DKS	23/05/2016

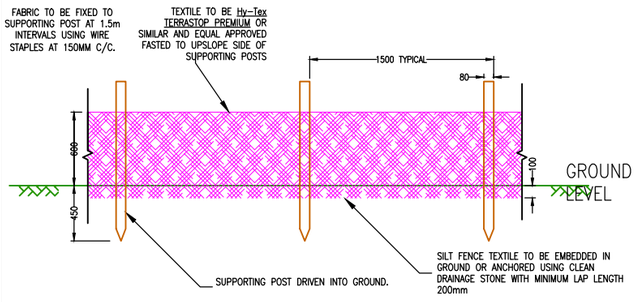
PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115–21	WFD	FIG 3.8	2



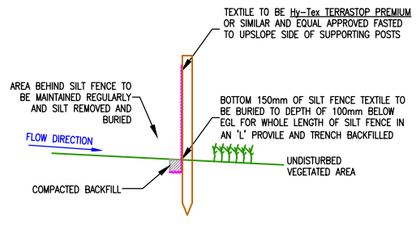
TYPICAL OVERLAND SILT FENCE PLAN
SCALE 1:50



TYPICAL CHANNEL SILT FENCE PLAN
SCALE 1:50

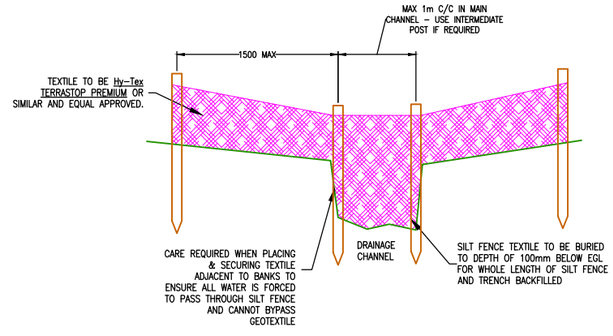


ELEVATION
SCALE 1:50



SECTION A–A
BURIED TYPE OPTION
SCALE 1:50

EXAMPLE OF CHANNEL SILT FENCE INSTALLATION
NTS



TYPICAL CHANNEL SILT FENCE ELEVATION
SCALE 1:50

INDICATIVE DESIGN

PRECEDENCE
1. DRAWING SUPERCEDES PREVIOUS ES APPENDIX 13.4, DWG_05.

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR INFORMATION
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PROJECT: PROPOSED WINDFARM AT BARR CREGG, CO. DERRY

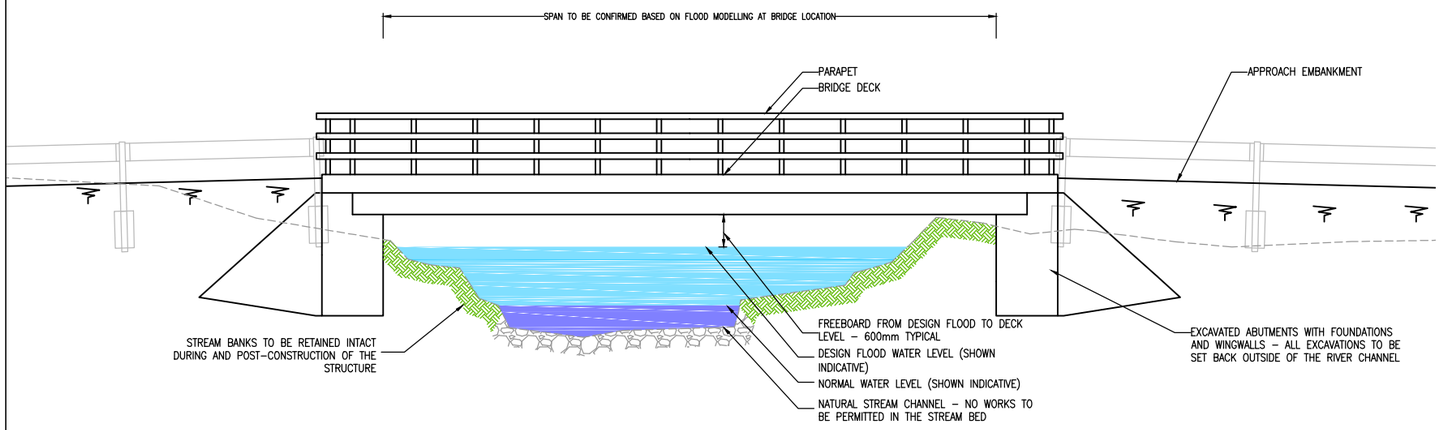
CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS)
INDICATIVE TYPICAL DETAILS
SILT FENCE

SCALE	ORIGINAL SIZE
AS SHOWN	A3

DRAWN	CHECKED	DATE
VR	DKS	23/05/2016

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115–21	WFD	FIG 3.9	2

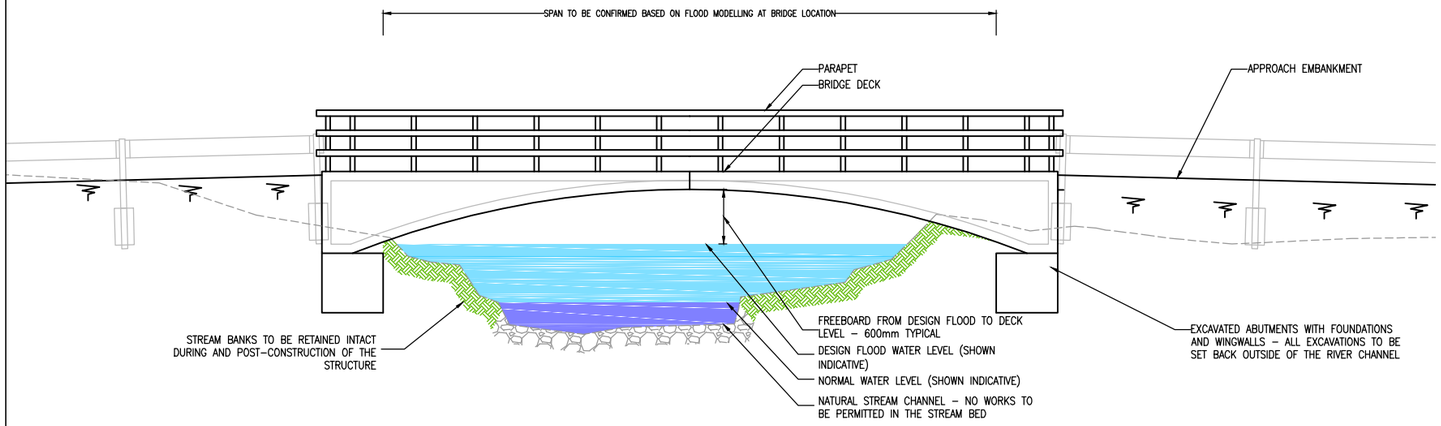


TYPICAL CLEAR SPAN BRIDGE – BEAM/DECK OPTION

SCALE 1:100

EXAMPLE CLEAR SPAN BRIDGE – BEAM/DECK OPTION

NTS



TYPICAL CLEAR SPAN BRIDGE – PRECAST SEGMENTED ARCH OPTION

SCALE 1:100

EXAMPLE CLEAR SPAN BRIDGE – PRECAST SEGMENTED ARCH OPTION

NTS

INDICATIVE DESIGN

INDICATIVE DESIGN

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR INFORMATION
1	VR	DKS	15/04/2016	ORIGINAL – FOR INFORMATION

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PROJECT: PROPOSED WINDFARM AT BARR CREGG, CO. DERRY

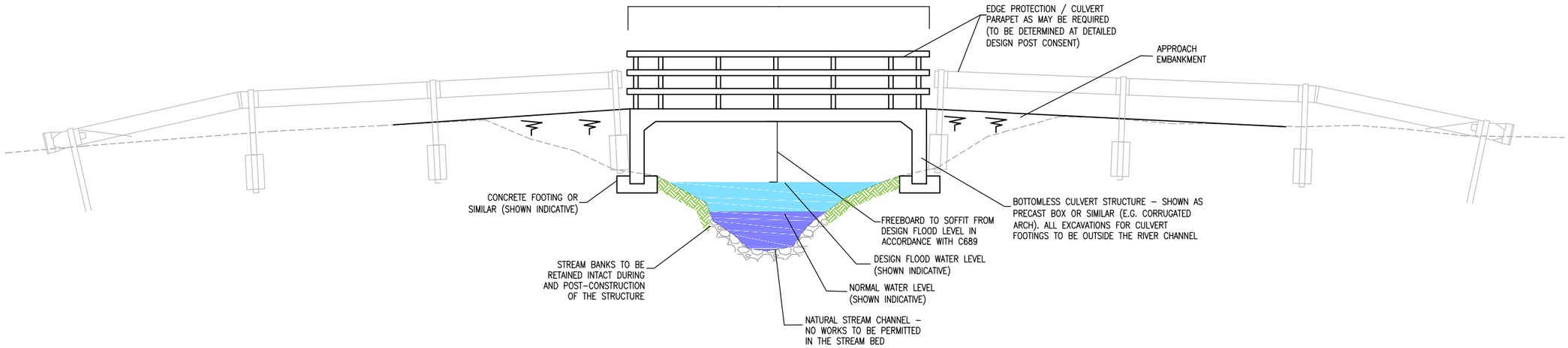
CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS BURNTOLLET BRIDGE

SCALE	ORIGINAL SIZE
AS SHOWN	A3

DRAWN	CHECKED	DATE
VR	DKS	23/05/2016

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115-21	WFD	FIG 3.10	2



TYPICAL BOTTOMLESS CULVERT WATERCROSSING

NTS

INDICATIVE DESIGN

NOTE: THIS DRAWING IS BASED ON 3RD PARTY INFRASTRUCTURE / PROPOSAL DRAWING:
N/A

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR INFORMATION
1	VR	DKS	15/04/2016	ORIGINAL – FOR INFORMATION

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PROJECT
PROPOSED WINDFARM AT BARR CREGG, CO. DERRY

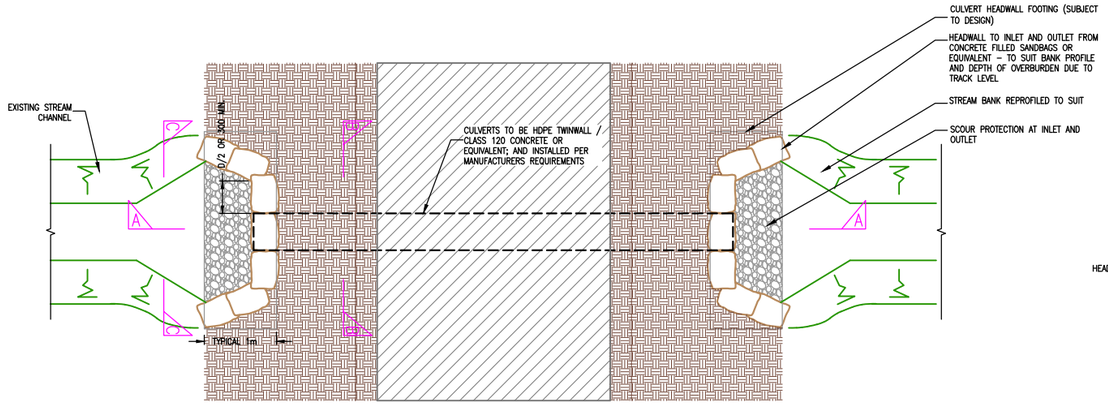
CLIENT
res

DRAWING TITLE
DRAINAGE MANAGEMENT (SuDS)
INDICATIVE TYPICAL DETAILS
BOTTOMLESS CULVERT

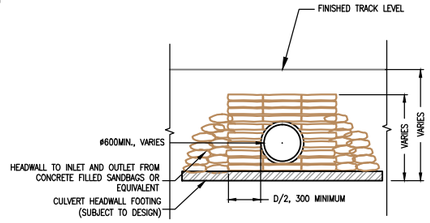
SCALE	ORIGINAL SIZE
AS SHOWN	A1

DRAWN	CHECKED	DATE
VR	DKS	23/05/2016

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115-21	WFD	FIG 3.11	2



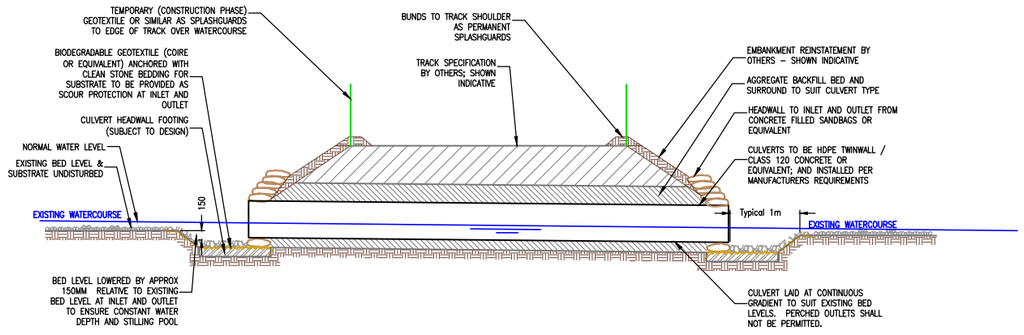
PLAN
SCALE
1:100



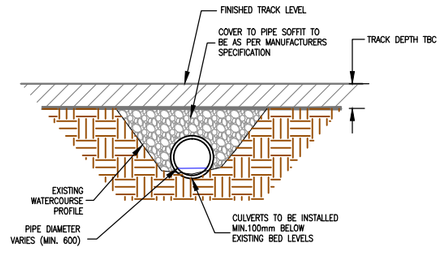
ELEVATION C–C (WITH HEADWALL)
1:100

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 1:100



SECTION B–B
SCALE 1:100

INDICATIVE DESIGN

ISSUE	DRN	APP	DATE	NOTES / DESCRIPTION
2	VR	DKS	23/05/2016	FOR INFORMATION
1	VR	DKS	15/04/2016	ORIGINAL – FOR INFORMATION

STATUS: FOR WFD ASSESSMENT

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PROJECT: PROPOSED WINDFARM AT BARR CREGG, CO. DERRY

CLIENT: res

DRAWING TITLE: DRAINAGE MANAGEMENT (SuDS) INDICATIVE TYPICAL DETAILS PIPED CULVERTS

SCALE	ORIGINAL SIZE
AS SHOWN	A3

DRAWN	CHECKED	DATE
VR	DKS	23/05/2016

PROJECT No.	PURPOSE	DRAWING No.	ISSUE NO.
MCL115–21	WFD	FIG 3.12	2

KEY

- PLANNING APPLICATION BOUNDARY
- LAND UNDER APPLICANT CONTROL
- TURBINE LOCATION
- PERMANENT CRANE HARDSTANDING AREA
- TEMPORARY CRANE HARDSTANDING AREA
- MICROSITING
- CUT OR FLOATED TRACK
- FLOATED TRACK
- EXCAVATED TRACK
- TEMPORARY PASSING BAY
- WATERCOURSE CROSSING
- PERMANENT METEOROLOGICAL MAST LOCATION
- METEOROLOGICAL CALIBRATION MAST LOCATION
- MINOR EPHEMERAL LAND DRAINAGE
- SIGNIFICANT WATERCOURSE
- MAIN DRAIN
- CONTROL BUILDING & SUBSTATION COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND
- SPECIAL AREA OF CONSERVATION (SAC)

SURVEYORS

Blackstaff Ecology

DRAWING NUMBER

COORDS: TM65 IRISH GRID

PURPOSE: FEI 2016

SCALE

ORIGINAL PLOT SIZE: A3

PROJECT TITLE

BARR CREGG
WIND FARM

FIGURE 4.1
WATERCOURSES
AND DRAINAGE DITCHES

CLIENT

res

T1
T2
T3
T4
T5
T6
T7

0 250
METRES

KEY

- PLANNING APPLICATION BOUNDARY
- LAND UNDER APPLICANT CONTROL
- TURBINE LOCATION
- PERMANENT CRANE HARDSTANDING AREA
- TEMPORARY CRANE HARDSTANDING AREA
- MICROSITING
- CUT OR FLOATED TRACK
- FLOATED TRACK
- EXCAVATED TRACK
- TEMPORARY PASSING BAY
- WATERCOURSE CROSSING
- PERMANENT METEOROLOGICAL MAST LOCATION
- METEOROLOGICAL CALIBRATION MAST LOCATION
- SIGNIFICANT WATERCOURSE
- M15
- M19
- M25
- WET NEUTRAL GRASSLAND
- MARSHY GRASSLAND
- SCRUB
- BROADLEAVED PLANTATION WOODLAND
- SI SEMI IMPROVED GRASSLAND
- I IMPROVED GRASSLAND
- SPECIES RICH HEDGE WITH TREES
- SPECIES POOR INTACT HEDGE
- SPECIES POOR GAPPY HEDGE
- CONTROL BUILDING & SUBSTATION COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND

SURVEYORS: Blackstaff Ecology

DRAWING NUMBER:

COORDS: TM65 IRISH GRID

PURPOSE: FEI 2016

SCALE:

ORIGINAL PLOT SIZE: A3

PROJECT TITLE:

BARR CREGG
WIND FARM

FIGURE 4.2
PHASE 2 VEGETATION

CLIENT: res

0 250
METRES

Enhancement Area Measurements (m^2)	
AREA A	4153
AREA B	10718
AREA C	34398
AREA D	24956
AREA E	32840
AREA F	24182

Area E

Area A

Area B

Area C

Area D

Area F

N

0 250

METRES

KEY

- PLANNING APPLICATION BOUNDARY
- LAND UNDER APPLICANT CONTROL
- TURBINE LOCATION
- PERMANENT CRANE HARDSTANDING AREA
- TEMPORARY CRANE HARDSTANDING AREA
- MICROSITING
- CUT OR FLOATED TRACK
- FLOATED TRACK
- EXCAVATED TRACK
- TEMPORARY PASSING BAY
- WATERCOURSE CROSSING
- PERMANENT METEOROLOGICAL MAST LOCATION
- METEOROLOGICAL CALIBRATION MAST LOCATION
- MINOR EPHEMERAL LAND DRAINAGE
- MAIN DRAIN
- SIGNIFICANT WATERCOURSE
- INDICATIVE LOCATION OF DITCH DAMMING
- AREA RE-WETTED THROUGH DITCH BLOCKING (C & D)
- AREA A & B
- AREA E
- AREA F
- CONTROL BUILDING & SUBSTATION COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND

SURVEYORS

Blackstaff Ecology

DRAWING NUMBER

COORDS: TM65 IRISH GRID

PURPOSE: FEI 2016

SCALE

ORIGINAL PLOT SIZE: A3

PROJECT TITLE

BARR CREGG
WIND FARM

FIGURE 4.3
HABITAT ENHANCEMENT

CLIENT

res

N

KEY

- PLANNING APPLICATION BOUNDARY
- LAND UNDER APPLICANT CONTROL
- POTENTIAL SPOIL DEPOSITION AREA
- HYDROLOGICAL BUFFER
- TURBINE LOCATION
- PERMANENT CRANE HARDSTANDING AREA
- TEMPORARY CRANE HARDSTANDING AREA
- MICROSITING
- CUT OR FLOATED TRACK
- FLOATED TRACK
- EXCAVATED TRACK
- PERMANENT METEOROLOGICAL MAST LOCATION
- METEOROLOGICAL CALIBRATION MAST LOCATION
- TEMPORARY PASSING BAY
- WATERCOURSE CROSSING
- SIGNIFICANT WATERCOURSE
- MAIN DRAIN
- CONTROL BUILDING & SUBSTATION COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND

0 250

METRES

SURVEYORS

Blackstaff Ecology

DRAWING NUMBER

COORDS TM65 IRISH GRID

PURPOSE FEI 2016

SCALE

ORIGINAL PLOT SIZE A3

PROJECT TITLE

BARR CREGG
WIND FARM

FIGURE 4.4
POTENTIAL(TEMPORARY) SPOIL STORAGE AREAS

CLIENT

res

N

KEY

- PLANNING APPLICATION BOUNDARY
- LAND UNDER APPLICANT CONTROL
- TURBINE LOCATION
- PERMANENT CRANE HARDSTANDING AREA
- TEMPORARY CRANE HARDSTANDING AREA
- MICROSITING
- CUT OR FLOATED TRACK
- FLOATED TRACK
- EXCAVATED TRACK
- TEMPORARY PASSING BAY
- WATERCOURSE CROSSING
- PERMANENT METEOROLOGICAL MAST LOCATION
- METEOROLOGICAL CALIBRATION MAST LOCATION
- SIGNIFICANT WATERCOURSE
- 0.075 LU (FROM YEAR 0) (22.1Ha)
- 2 YEAR EXCLUSION 0.075 LU (YEAR 3 ONWARDS) (63.2Ha)
- 5 YEAR EXCLUSION 0.075 LU (YEAR 4 ONWARDS) (13.1Ha)
- CONTROL BUILDING & SUBSTATION COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND

0 250

METRES

SURVEYORS Blackstaff Ecology

DRAWING NUMBER

COORDS TM65 IRISH GRID

PURPOSE FEI 2016

SCALE

ORIGINAL PLOT SIZE A3

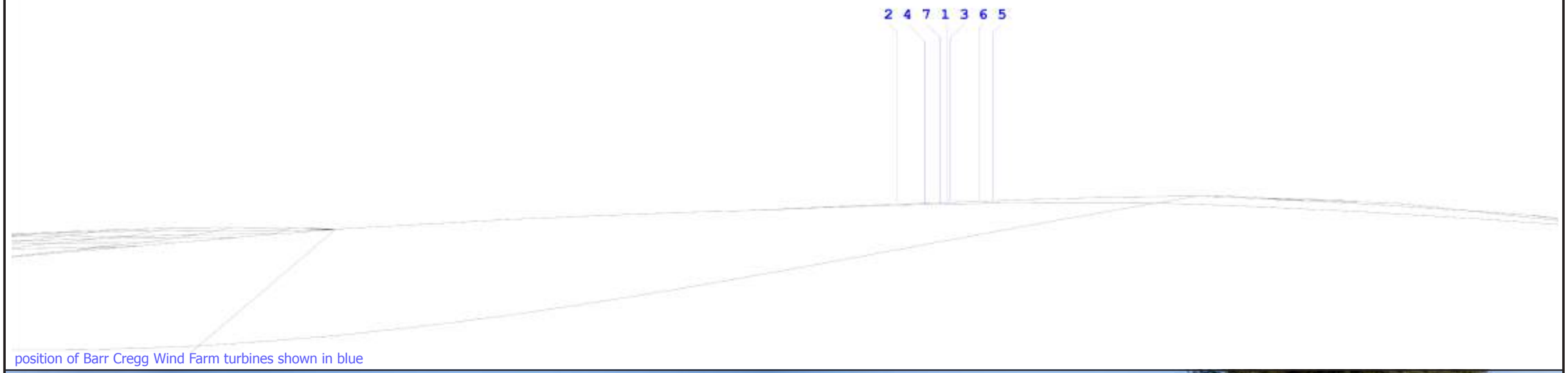
PROJECT TITLE

BARR CREGG
WIND FARM

FIGURE 4.5
GRAZING PRESCRIPTIONS

CLIENT

res



position of Barr Cregg Wind Farm turbines shown in blue

Shanti McAllister
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FEI 2016

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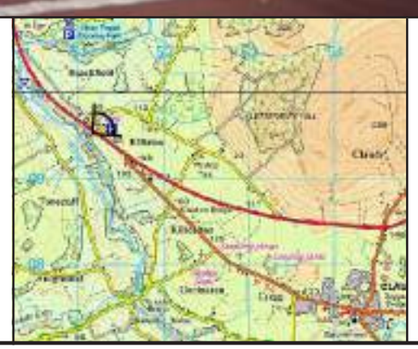
BARR CREGG WIND FARM

FIGURE 11.4

SETTING OF LISTED BUILDINGS HB/01/02/05 LOWER CUMBER PRESBYTERIAN CHURCH, GLENSHANE ROAD AND HB/01/02/06 FORMER POST OFFICE, GLENSHANE ROAD

Easting:	251252
Northing:	409443
Bearing:	60.50 °
Approx. Included Angle:	160 °
Approx. distance to nearest turbine:	3.59 km

View this image flat at a comfortable arm's length



res

SMc/ 11 001 03/ SMcDwgs/ Fig11.4_OldPO_RevC_190516.indd; Layout Dwg 10; Turbine Layout No. pNIRbrc034

road corridor on left hand side of setting of listed building

road corridor on right hand side of setting of listed building

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FIGURE 11.5

SSETTING OF LISTED BUILDINGS HB/01/02/05 LOWER CUMBER PRESBYTERIAN CHURCH, GLENSHANE ROAD AND HB/01/02/06 FORMER POST OFFICE, GLENSHANE ROAD

Easting:	251252
Northing:	409443
Bearing:	60.50 °
Approx. Included Angle:	160 °
Approx. distance to nearest turbine:	3.59 km

View this image flat at a comfortable arm's length