REFERENCE DOCUMENTS for PROPOSED LARGER TURBINES AND MET MASTS AT UPPERCHURCH WINDFARM for EIAR 2021 and AA 2021

REFERENCE DOCUMENT 29 of 36

This document contains the following:

UWF Replacement Forestry

- **2018 UWF Replacement Forestry EIA Report - Volume C4: EIAR Appendices (Part 2 of 3)**
  - Appendix 8.1 – Detailed Biodiversity Data and Supplementary Information
  - Appendix 9.1 – No Appendix for Chapter 9
  - Appendix 10.1 – Trial Hole Investigations
  - Appendix 10.2 – Borehole Investigations
  - Appendix 10.3 – Peat Stability Assessment
  - Appendix 10.4 – Consented Upperchurch Windfarm Site Investigations
  - Appendix 10.5 – Geophysical Survey Report

Reference

Upperchurch Windfarm Replacement Forestry (UWF Replacement Forestry)

UWF Replacement Forestry EIA Report (EIAR)

VOLUME C4: EIAR APPENDICES

(Part 2 of 3)

EIA Report Authors:

Inis

HYDRO ENVIRONMENTAL SERVICES

tli GROUP

RPS

macroworks

EY DKM

awnconsulting

AiBridges Total Communications Solutions ...bridging the divide

Malachy Walsh and Partners Engineering and Environmental Consultants

NRB consulting engineers

KILKENNY ARCHAEOLOGY Archaeological Consultants

Compliance Engineering Ireland Ltd. Test & Certification Solutions

EIAR Coordinator:

ECOPOWER

February 2018

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A8-1 Appendix to Chapter 8: Biodiversity

Appendix 8.1: Detailed Biodiversity Data and Supplementary Information

The data and descriptions in this appendix have informed Chapter 8: Biodiversity of the EIA Report.

The information presented in this Appendix 8.1 is outlined below and the relevant element(s) of the Whole UWF Project are also identified.

Appendix 8.1 Section	**Section Heading**	**Relevant Individual Project Element**
A8-1.1	Guidance Documents and Criteria	UWF Grid Connection UWF Related Works UWF Replacement Forestry Upperchurch Windfarm UWF Other Activities
A8-1.2	Baseline Information - Scoping and Consultation - Desktop review - Field work - Survey results - Policy context	
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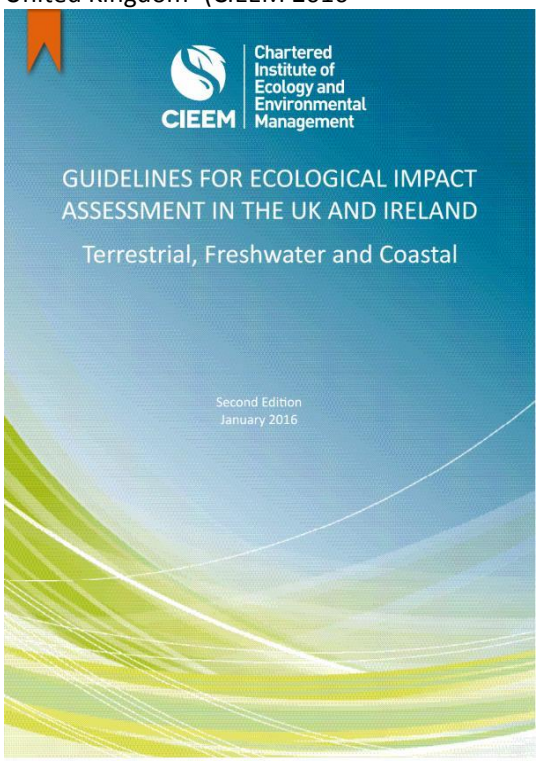
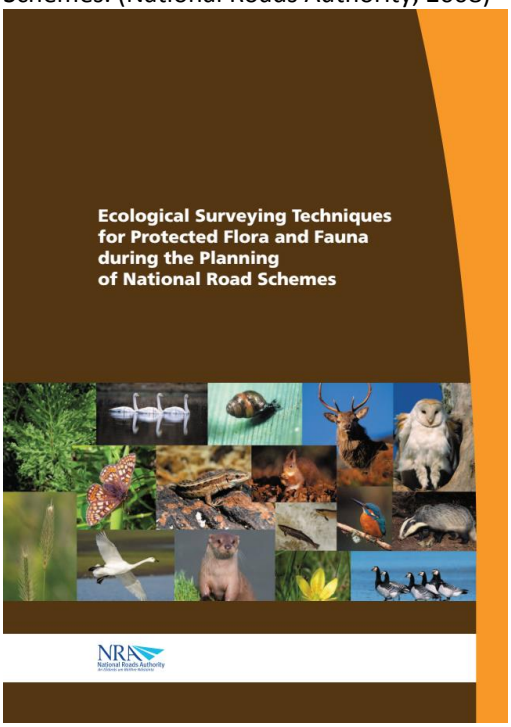
A8-1.1 Guidance Documents and Criteria

The following publications were used for specific guidance and criteria for the Biodiversity Chapter. Front cover sheets of these publications are presented where accessible.

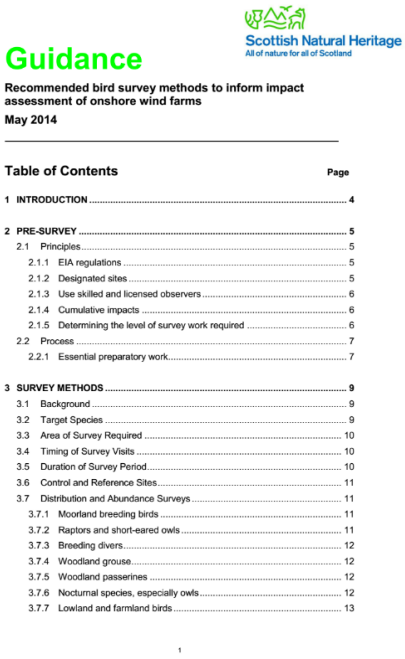
Guidelines for Ecological Impact Assessment in the United Kingdom- (CIEEM 2016



Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. (National Roads Authority, 2008)



Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms. (Scottish Natural Heritage, 2014)



Scottish Natural Heritage
All of nature for all of Scotland

Guidance

Recommended bird survey methods to inform impact assessment of onshore wind farms

May 2014

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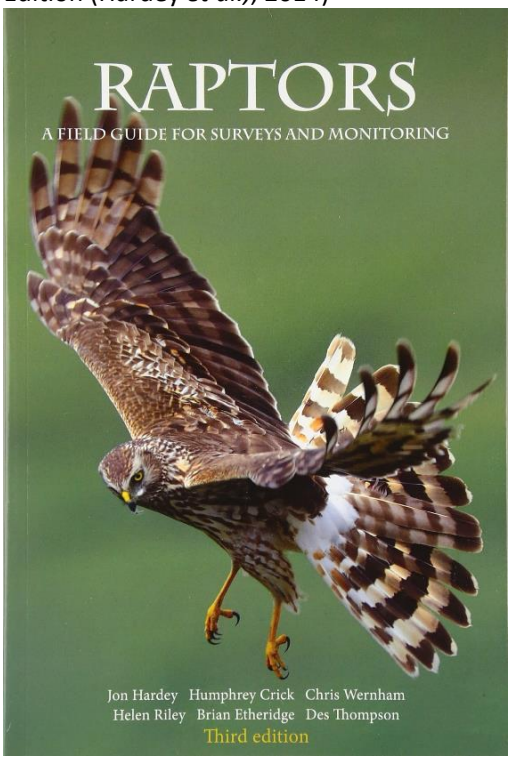
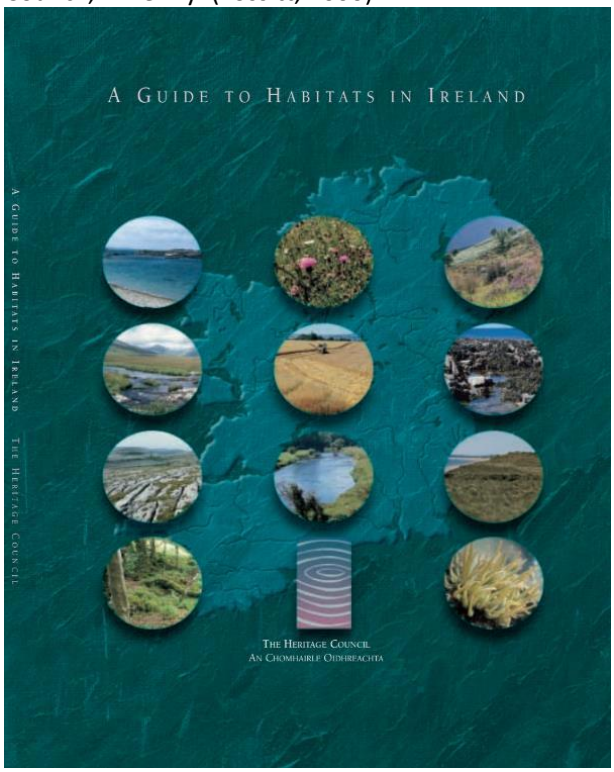
Raptors: A Field Guide for surveys and Monitoring, third Edition (Hardey *et al.*,, 2014)



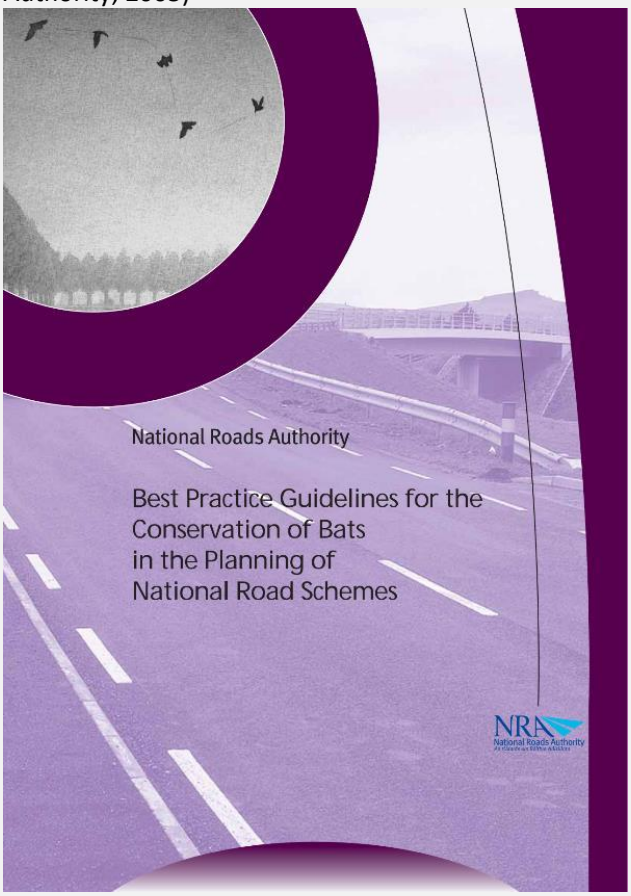
A Guide to The Habitats of Ireland. The Heritage Council, Kilkenny. (Fossitt, 2000)



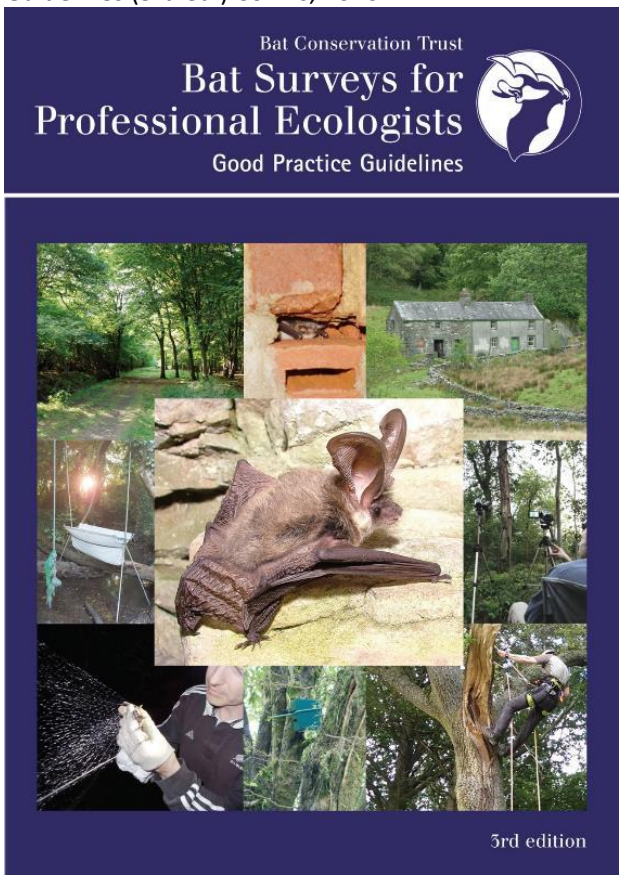
Best Practice Guidance for Habitat Survey and Mapping (Smith *et al.,* 2011)

Guidelines for the Treatment of Bats During the Construction of National Road Schemes (National Roads Authority, 2005)

Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (National Roads Authority, 2005)



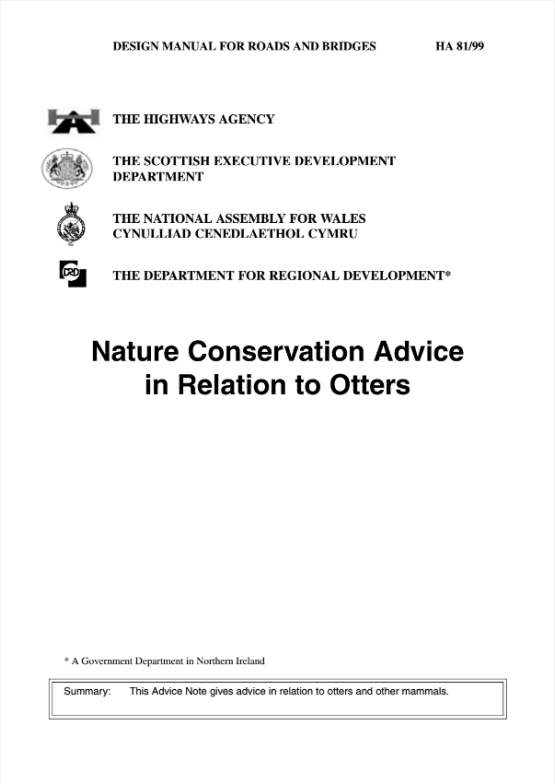
Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd ed.) Collins, 2016



Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes (National Roads Authority, 2005)

Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes (National Roads Authority, 2006)

The Good Roads Guide New Roads Nature Conservation Advice in Relation to Otters (Highways Agency, 1999, HA 81/99)



DESIGN MANUAL FOR ROADS AND BRIDGES HA 81/99

THE HIGHWAYS AGENCY

THE SCOTTISH EXECUTIVE DEVELOPMENT DEPARTMENT

THE NATIONAL ASSEMBLY FOR WALES
CYNULLIAD CENEDLAETHOL CYMRU

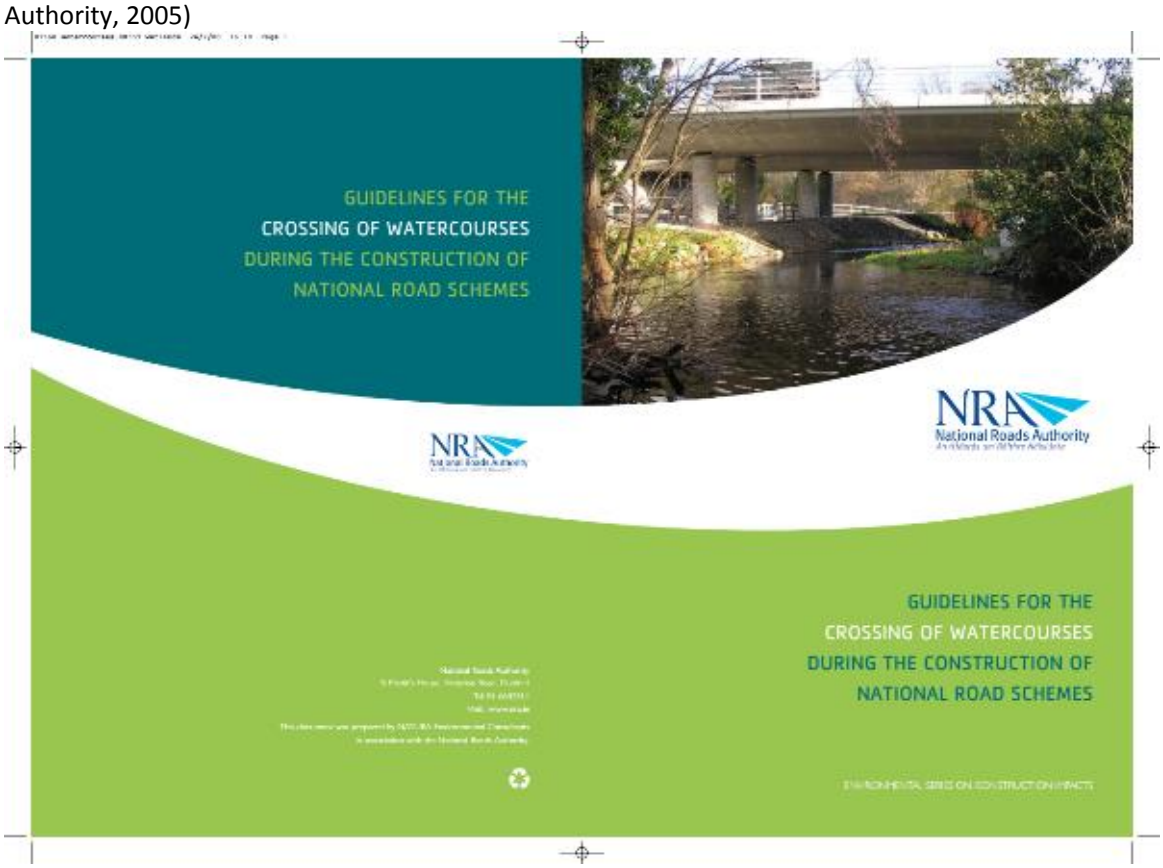
THE DEPARTMENT FOR REGIONAL DEVELOPMENT*

Nature Conservation Advice in Relation to Otters

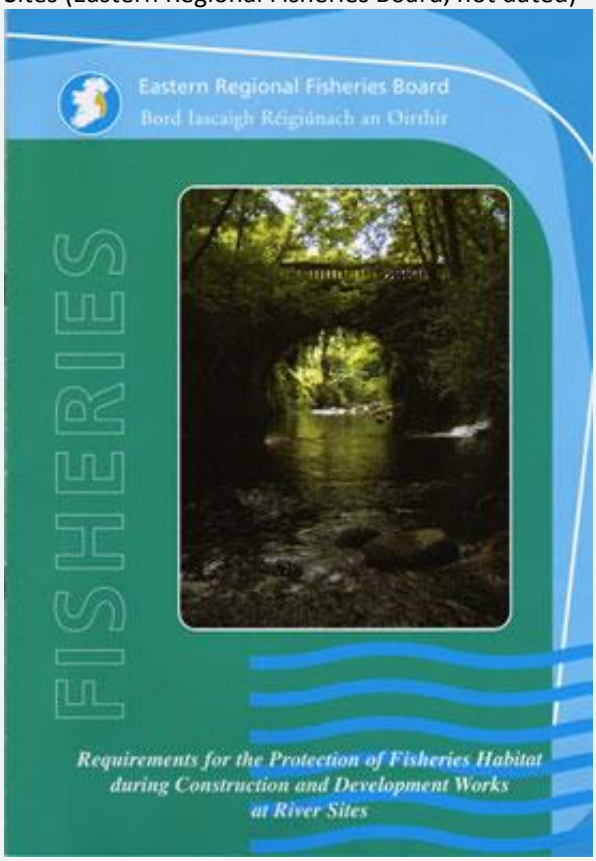
* A Government Department in Northern Ireland

Summary: This Advice Note gives advice in relation to otters and other mammals.

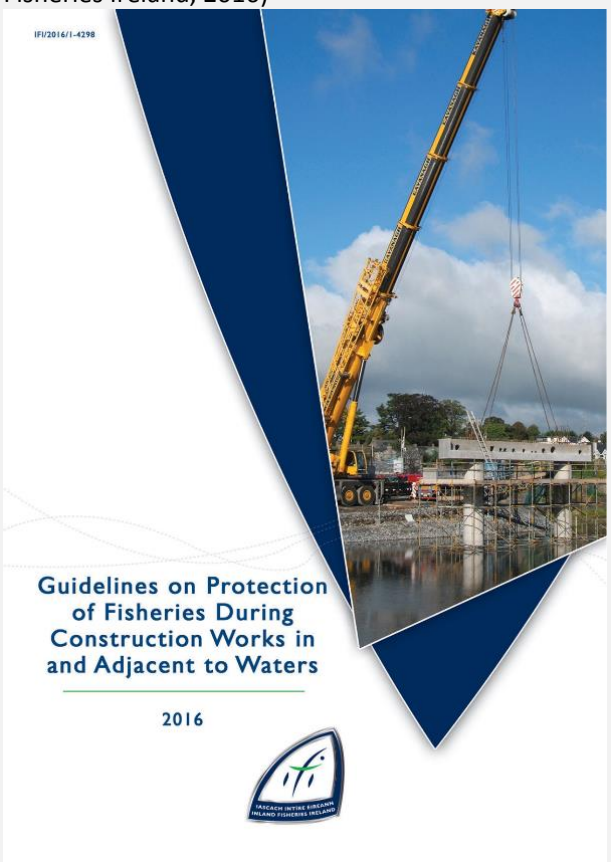
Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (National Roads Authority, 2005)

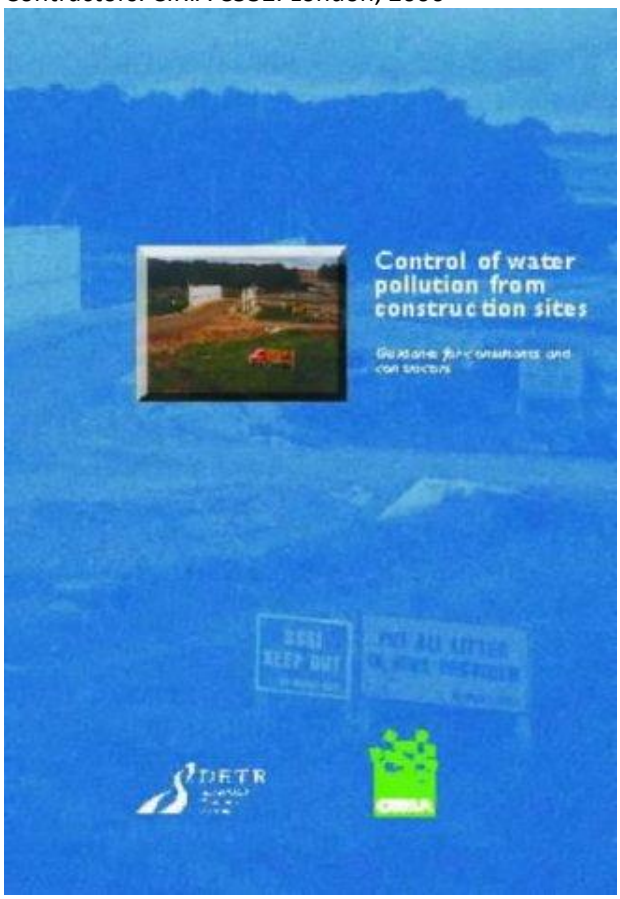
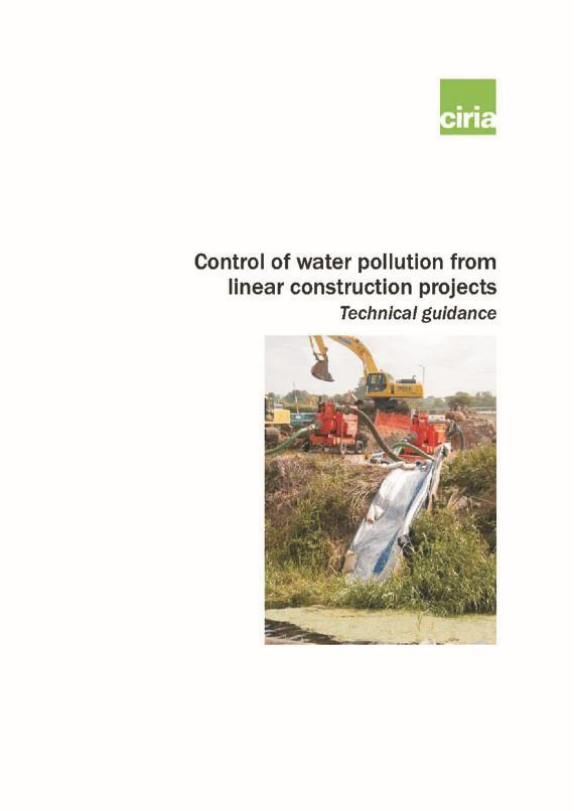


Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites (Eastern Regional Fisheries Board, not dated)



Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016)



CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006 	CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006) 
Water Framework Directive (2000/60/EC).	UK Pollution Prevention Guidelines (PPG).

A8-1.2 Baseline Information

A8-1.2.1 Scoping and Consultation

Consultation (including in relation to scoping) with statutory consultees and other relevant bodies commenced in August 2015. A full list of consultees and a complete chronology of the consultation undertaken is provided hereunder. Further information on scoping is available in Chapter 3 Scoping and Consultation.

Table 1 Chronology of formal Biodiversity related consultation both issued to and received from statutory and non- statutory environmental agencies and organisations

Date	Project Element	Consultees	Action
31/08/15	Mountphilips Substation	DAU NPWS IFI	Posted initial Mountphilips consultation documents to DAU (the Manager), NPWS (Jervis Good) and IFI (Michael Fitzsimons and Frank O'Donoghue).
09/02/16	UWF Grid Connection	DAU NPWS IFI	Posted initial UWF Grid Connection consultation documents to DAU (the Manager), NPWS (Jervis Good) and IFI (Michael Fitzsimons and Frank O'Donoghue).
16/02/16	Mountphilips Substation	DAU NPWS IFI	Posted supplementary Mountphilips consultation documents to DAU (the Manager), NPWS (Jervis Good) and IFI (Michael Fitzsimons and Frank O'Donoghue)
22/02/16	Upperchurch Grid Route/Mountphilips Substation	IFI EDL	Initial consultation meeting between IFI (Michael Fitzsimons and Frank O'Donoghue), INIS (Howard Williams and Sarah Ingham) and Ecopower Developments Ltd (Julie Brett) at the IFI offices in Limerick. Minutes recorded by Sarah Ingham and sent to EDL.
24/02/16	Upperchurch Grid Route/Mountphilips Substation	IFI	Verbal communication from Mr Michael Fitzsimons that IFI were very satisfied with the detailed plans being prepared for all watercourse crossings by Ecopower Developments Ltd. Mr Fitzsimons stressed that Ecopower Developments Ltd/Inis had put a lot of work into site specific mitigation which he was confident would protect all watercourses comprehensively during the construction stage.
24/02/16	Upperchurch Grid Route/Mountphilips Substation	NPWS EDL	Initial consultation meeting between NPWS (Jervis Good and Stefan Jones), INIS (Howard Williams and Sarah Ingham) and EDL (Julie Brett) at the NPWS offices in Blackrock, Cork. Minutes recorded by Sarah Ingham and sent to Ecopower Developments Ltd and NPWS.
29/04/16	Upperchurch Grid Route/Mountphilips Substation	BWI BCI	Posted (by registered post) initial UWF Grid Connection consultation documents to BWI and BCI.

Date	Project Element	Consultees	Action
29/04/16	Upperchurch Grid Route/Mountphilips Substation	DAU NPWS IFI	Posted (by registered post) project amendment consultation documents re changes to UWF Grid Connection route and Mountphilips Switching Station access route to DAU (the Manager), NPWS (Jervis Good) and IFI (Michael Fitzsimons and Frank O'Donoghue).
11/05/16	Upperchurch Grid Route/Mountphilips Substation	Tipperary Co. Co.	Posted (by registered post) initial UWF Grid Connection consultation documents to the Environment Officer and the Heritage Officer, Tipperary Co. Co.
11/05/16	Upperchurch Grid Route/Mountphilips Substation	DAU	Telecon between Sarah Ingham (INIS) and Michael Murphy (DAU) in which Mr. Murphy confirmed receipt of all documentation by both email and post and of his forwarding of same to Dr Jervis Good for review. He advised that there is currently a backlog in Dr Good's work load and that he would formally respond in due course.
19/05/16	Upperchurch Grid Route/Mountphilips Substation	IFI	Onsite meeting between Mr Howard Williams (INIS) and Mr Michael Fitzsimons (IFI) to inspect potential impacts of proposed watercourse crossing methodologies on the aquatic ecology of a number of watercourses along the grid connection route.
26/05/16	Upperchurch Grid Route/Mountphilips Substation	IFI	Formal written response received from Mr Fitzsimons in respect of the onsite meeting, outlining his professional opinions and recommendations regarding particular watercourses crossing methods. IFI concludes from this meeting that all crossings are possible during the open season but that more detailed methodologies should be drafted prior to work commencing.
23/06/16	Upperchurch Grid Route/Mountphilips Substation	NPWS	Meeting between Howard Williams (INIS) and Pat Foley (NPWS Regional Manager) at hotel in Limerick. Consultation documentation supplied to Mr Foley outlining all ecological survey work conducted, the results to date and what further pre-planning survey work we proposed to provide to ensure a comprehensive Ecology assessment for the entire project.
28/10/16	Upperchurch Grid Route/Mountphilips Substation	DAU/NPWS	Received formal response letter from DAU stating that based on the documentation submitted by Inis, *"the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs has no further observations regarding nature conservation considerations"*.

Date	Project Element	Consultees	Action
20/01/17	Upperchurch Grid Route/Mountphilips Substation	NPWS	Onsite meeting between Ms Aine Lynch (NPWS, CR), Ms Julie Brett (EDL) and Howard Williams (INIS). Mr Williams outlined to Ms. Lynch the ecological receptors covered by the surveys, the actual survey effort completed for each of the ecological receptors for the project to date. Mr. Williams also presented the survey effort outstanding and planned for the future of the project prior to the submission of the planning application. In addition to this information, provisional results of all surveys to date were presented to Ms. Lynch by way of GIS mapping of the locations of all ecological receptors/ecologically sensitive areas recorded relative to the location of the Whole Windfarm Project.
27/01/17	Upperchurch Grid Route/Mountphilips Substation	NPWS	Further to this meeting, Ms. Lynch held a telephone consultation with Mr. Williams on Friday 27th January 2017 during which she confirmed that she had subsequently relayed all details of the meeting to Dr Jervis Good, Regional Ecologist.
06/06/17	UWF Related Works, Counties Tipperary and Limerick	DAU NPWS IFI BWI BCI	Scoping document outlining up-to-date project amendments, ecological surveys to date, a brief synopsis of ecological survey results to date, in addition to an overview of potential impacts resulting from the proposed project.
27/7/2017	Whole UWF Project	NPWS	Watercourse crossings, biosecurity, marsh fritillary, drainage at Bleanbeg Bog, forestry felling and replanting as well as proposed mitigation measures for bats and hen harrier foraging habitats.
23/8/2017	Whole UWF Project	IFI	Conference Call between Mr. Howard Williams, Mr. C. Cullen (INIS) and Mr Michael Fitzsimons (IFI) in respect of watercourse evaluations in terms of fisheries importance and proposed crossing methods. Further to the call Mr. Fitzsimons confirmed via email that a review and discussion of proposed crossings had taken place. Mr. Fitzsimons also confirmed that the proposed crossing methodologies are in line with the methodologies discussed during the scoping inspection carried out with Howard Williams.
27/08/17	Whole UWF Project	NPWS	Information meeting between Dr. Jervis Good (NPWS, Divisional Ecologist), and Mr. Howard

Date	Project Element	Consultees	Action
			Williams (INIS). This meeting provided an update of the project for NPWS staff and a discussion on each receptor within the project study area.
13/12/2017	Whole UWF Project	NPWS	Project Overview. Final formal meeting with NPWS. Attendees were Mr Pat Foley (NPWS Deputy Regional Manager), Ms Julie Brett (Ecopower) and Mr Howard Williams and Chris Cullen (Inis). Mr Williams gave a full project overview to Mr Foley. Mr Foley acknowledged this and stated that he would pass on any pertinent details to Dr Good.

Official Consultation Response from IFI (Mr. Michael Fitzsimons, Senior Fisheries Environmental Officer, May 2016)

Mr Howard Williams,
Inís Environmental Consultants Ltd.,
Suite 18, Shannon Commercial Properties,
Information Age Park,
Gort Road,
Ennis, County Clare.

Iascach Intíre Éireann
Inland Fisheries Ireland

27 May, 2016.

Re-Proposed Crossing Methodologies to be used by Ecopower in respect of the UpperChurch Grid Connection Project.

Dear Mr Williams.
I refer to our site inspections on 19 May, 2016 in respect to the above. A number of photographs were taken in relation to the different types of crossing. The photographs, reproduced below are accompanied with recommendations as to the type of crossing methodology that should be employed.

The fundamental driver is to minimise disruption of the aquatic habitat and the immediate riparian habitat. In terms of the aquatic habitat the main potential impact is the generation of silt. This is particularly the case in "open cut" crossings and it could be a knock-on effect on bands of spawning gravel and small fish in particular.

Currently the open season, in waters of "fisheries importance", for in-stream works has been reduced to July, August and September. This is a very tight window. Where it is applicable it is therefore desirable to get infrastructure in place during the open season. This of course does not apply to directional drilling operations it can be done at any time as they are unlikely to interfere with surface waters. The main item with directional drilling is the safe disposal of water which has been used as a lubricant and is carrying significant quantities of silt and debris.

The details in relation to the specific crossings that were inspected are as follows.

Photo 1. 34 W. This is U/S an old farm bridge using two 600 mm approx. concrete pipes. These pipes are too small. There woody debris on the upstream side and the apparent erosion of riverbank indicate that significant blockage of the pipes has occurred. If this bridge is being replaced IFI recommends that a box culvert should be the first choice alternatively large diameter pipes 1.2 m – 1.5 m should provide sufficient conveyance. Generally fisheries recommend between 300mm and 500mm embedment. In a small stream such as we have here probably 300

If the existing bridge is being replaced this would be an ideal location to either divert the channel off from the right bank or, depending on weather conditions, to have a pump over facility. In the event

IIE Luimneach, Páirc Gnó Cill Dhéagláin, Bóthar an Duga, Luimneach.
IFI Limerick, Ashbourne Business Park, Dock Road, Limerick.
+ 353 (0)61 300238 - limerick@fisheriesireland.ie - www.fisheriesireland.ie

of a pump over sandbags, containing washed sand could be used to form a dam to divert water into a prepared temporary channel. Alternatively a pump over system could be established. At all times a suitable splash plate should be in position downstream to ensure that energy dispersal from the waterjet is assured.

If a diversion channel is put in the channel should be lined with Teram, pinned to the banks, and a layer of crushed rock or round washed stone on the bed. There may be a requirement for electro-fishing of the area in between the sandbag dams upstream and downstream. The necessity for this can be determined on site. Prior to closing off the temporary bypass channel electro-fishing should take place so as to remove any fish in the temporary channel.

Photo 2. W34.
It is possible to discern the two relatively small diameter pipes currently used at this bridge. The section of concrete block wall in the left foreground is close to a state of collapse. On completion of the bridge or the directional drilling it would be desirable to use some small rock armour to delineate and tighten the river. It should be done both upstream and downstream

Photo 3. W35a.

This is a photo taken at W35a. This is on the right-hand side of an old bridle path (as you head north). There is very little flow here and no fisheries interest. A pump over and open cut operation would be ideal at this location. It would appear that no particular mitigation measures are required. Equally a directional drilling to go under this watercourse, the bridle path and watercourse W35 on the far side would be ideal.

Photo 4. W35.
This is the small watercourse to the left of the bridle path. There is gravel eminently suitable for trout spawning. At higher flows small trout would spawn in this River and juveniles might still be present.

If an open cut was proposed the area will need to be checked for the presence of fish which would need to be removed.

Directional drilling should not cause any problems and can be done at any season.

Photo 4. W36.
This is a larger watercourse circa 2 m in width. It is anticipated that directional drilling would take place at or beside the clump briars at this location on the left bank.
The woodland area would probably easily absorb soiled water from the directional drilling operation. The discharge would need to be monitored to ensure that direct discharges at another location do not take place.
Directional drilling can be done at any time
Dry gravel bank.

If flow levels are low and this season for in stream crossings is still open it should be possible to carry out an open cut and pump over. Ideally the backfill should be tamped to within say 8 inches of the bed level. It should then be filled over with river gravel and the dry bank of gravel shown on the right-hand side would be very suitable. The gravel can be removed down to 6 inches above water level at this location.

3

Photo 5. W34a.
This is a small watercourse that was identified as we were leaving this area.

It appears that there is a small amount of flow on the left-hand channel. The flow is seasonal. There is evidence of erosion under the pipes.
IFI recommend that after the cable is laid that the bed is backfilled with crushed rock to a point level with the lowest pipe.

It may also be necessary to put small amount of light cobble as rock armour against the clay banks on either side.
If this bridge is being replaced a 900mm diam. pipe would be the minimum requirement.

Photo 6. W33.
This is a directional drilling site going through bed rock under the Mulkear River.
On the left bank exposed fractured bedrock could be observed. This may be limestone or it could be a mudstone.

It is anticipated that this riffle area is being caused by bedrock.
The long pool upstream of this riffle is likely to be an important salmon resting area. It would be important to try and have this directional drilling completed before the run of salmon. Noise and vibration could disturb these fish.

Photo 6 a. W33.
This is a clearer photo showing the fractured bedrock on the left bank and the Riffle caused by the bed rock

4

Photos 7 & 8. W32.

These two photographs show a shallow watercourse with very sandy bottom. It is unlikely that this particular watercourse is of fisheries importance. However, applying the precautionary principle an inspection preferably using an electro-fishing gear should be undertaken.

It is likely that this would be crossed using an open cut method. At the location of the cut on both banks but particularly on the high left-hand bank rock armor should be bedded back into the exposed cut and along the foot of the bank upstream and downstream.

Yellow line shows typical open cut direction. Lower sections of the bank should be rock armoured especially as the soil is friable in this area.

Red arrows indicate placement of rock armor upstream and downstream

Conclusion.
The open cut options discussed will be time-dependent in terms of the open season for in stream works. The main thrust of the discussions centred on the prevention of pollution particularly from silt. Also the feasibility of the various options at the different crossing points was discussed. The selection of crossing points was typical of those to be found along the route.

IFI considers that all the crossings are possible during the open season. And directional drilling will facilitate crossing under any watercourse at any time. Main drawback will be the disposal of soiled water used for lubrication and grit removal from the drill line.

More detailed methodologies can be drafted prior to work commencing. Should you require further clarification on any point please do not hesitate to contact me.

Yours sincerely

Michael Fitzsimons

Michael Fitzsimons
pgDip, MSc, LLB(*Hons*), MCIWEM, C.WEM.
Senior Fisheries Environment Officer.

5

Official Consultation Response from DAU (Mr. Michael Murphy, October 2016)

An Roinn Ealaíon, Oidhreachta,
Gnóthaí Réigiúnacha, Tuaithe agus Gaeltachta

Department of Arts, Heritage,
Regional, Rural and Gaeltacht Affairs

28 October 2016 **Our Ref:** G Pre00048/2016

Mr Howard Williams,
INIS Environmental Consultants Ltd
Suite 11
Shannon Commercial Properties
Information Age Park
Gort Road
Ennis
County Clare

Re: Pre-planning notification Reg. Ref. No. G Pre00048/2016 by Inis Environmental Consultants: Preparation of an Ecology report etc for proposed grid connection at Mountphillips, Co Tipperary

A Chara,

I refer to your pre-planning enquiry in relation to the preparation of an ecology report etc for the proposed grid connection at Mountphillips, Co Tipperary

I can confirm that those documents submitted were assessed by NPWS and that following your meeting with Divisional Staff of NPWS that the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs has no further observations regarding nature conservation considerations.

These recommendations are based on the papers submitted to this Department on a pre-planning basis and are made without prejudice to any decision the Minister may take upon sight of a formal planning application.

Is mise le meas,

Michael Murphy

Michael Murphy,
Development Applications Unit
Tel: (053) 911 7516

A8-1.2.2 Desktop Review

A desktop review was conducted to inform scoping and identify features of ecological importance. The desktop review also included an appraisal of all sites designated for nature conservation under International and National legislation within a 15km radius of the Whole UWF Project. This enabled identification of any *possibly* significant impacts on habitats, flora and fauna, either terrestrial and/or aquatic, likely to arise from the construction and operation of the Whole UWF Project. Potential sites of conservation interest were identified by an examination of Ordnance Survey (OSI) mapping (1:50,000 scale), NPWS maps browser and detailed aerial photography (Bing maps).

Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Natural Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs) and records of protected species in the vicinity of the Whole UWF Project were identified. This information was obtained by accessing the website of the National Parks and Wildlife Service (NPWS) of the Department of the Environment, Heritage and Local Government.

A data request was also sent to NPWS GIS division for a full inventory of all protected and rare species recorded within pertinent 10km squares overlapping the Whole UWF Project. This data is presented in Table 2.

The database of the National Biodiversity Data Centre was also consulted to assess the presence of rare plant and faunal species and records of protected species reported within the primary 10km squares in which the Whole UWF Project is located. This data is presented in Table 3 to Table 8.

Due to the conditions of the data request with regard to the presentation of sensitive data as defined (https://www.npws.ie/sites/default/files/general/npws-sensitive-species.pdf), not all records are presented. In addition, the spatial resolution of each record is presented at 10 km scale in line with the condition that "data are provided on the understanding that users will not use the information to the detriment of individual species or habitats, biodiversity or the environment in general."

Information on water quality of the relevant watercourses was obtained from the EPA website and Chapter 11 Water.

Tables are presented overleaf in respect of the 10km grid squares within which the UWF Grid Connection, the Upperchurch Windfarm (UWF), UWF Related Works, UWF Replacement Forestry and elements of the UWF Other Activities (HA21-HA23) are located. Remaining elements of the UWF Other Activities (HA1-HA20) are located entirely on public roads. Plate 1, overleaf illustrates the 10km squares selected for review.

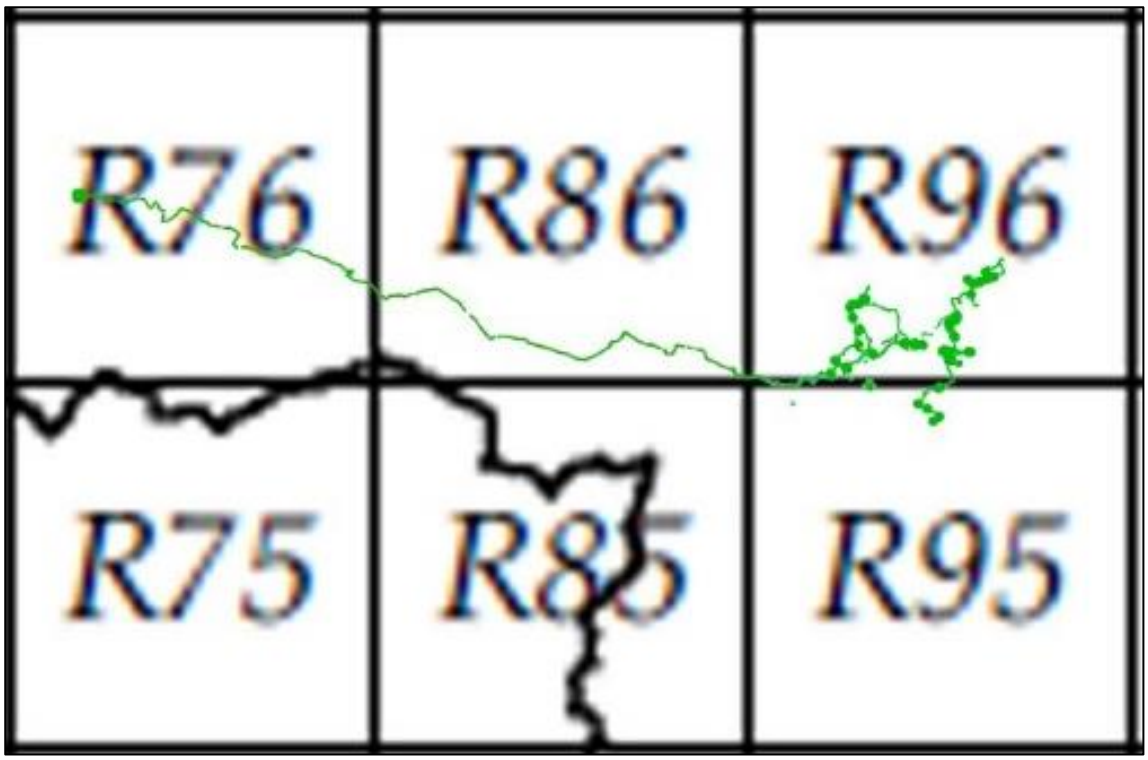


Plate 1: 10km squares selected for desktop review

Table 2 Records of legally protected and rare species, excluding sensitive species, held by the National Parks and Wildlife Service (https://www.npws.ie/maps-and-data/open-data-policy, 22/04/2016)

10 km Grid Square	Scientific Name	Common Name	Date of last record
R76	*Cephaloziella stellulifera*	Heath Threadwort	06/05/2008
R76	*Dama dama*	Fallow Deer	2004 - 2005
R76	*Eurodryas aurinia*	Marsh Fritillary	19/09/2004
R76	*Lampetra fluviatilis*	River Lamprey	Unknown
R76	*Lepus timidus subsp. hibernicus*	Irish Hare	2006 - 2007
R76	*Lutra lutra*	Otter	30/05/1980
R76	*Martes martes*	Pine Marten	2005 - 2006
R76	*Meles meles*	Badger	13/02/2007
R76	*Mustela erminea subsp. hibernica*	Irish Stoat	1969
R76	*Petromyzon marinus*	Sea Lamprey	Unknown
R76	*Rana temporaria*	Common Frog	19/02/2006
R76	*Sorex minutus*	Eurasian Pygmy Shrew	July 1970
R85	*Amblystegium fluviatile*	Brook-side Feather-moss	28/06/2005
R85	*Dama dama*	Fallow Deer	2004 - 2005
R85	*Entosthodon fascicularis*	Hasselquist's Hyssop	28/06/2005
R85	*Lutra lutra*	Otter	02/09/2010
R85	*Martes martes*	Pine Marten	2005 - 2006
R85	*Meles meles*	Badger	15/02/1991
R85	*Mustela erminea subsp. hibernica*	Irish Stoat	01/06/2005
R85	*Philonotis caespitosa*	Tufted Apple-moss	28/06/2005
R85	*Rana temporaria*	Common Frog	03/05/2011
R85	*Sciurus vulgaris*	Red Squirrel	15/02/1991
R86	*Cladonia portentosa*	Reindeer Moss	26/08/2003
R86	*Dama dama*	Fallow Deer	2004 - 2005
R86	*Lepus timidus subsp. hibernicus*	Irish Hare	24/09/1990
R86	*Lutra lutra*	Otter	20/09/2010
R86	*Meles meles*	Badger	24/09/1990
R86	*Rana temporaria*	Common Frog	23/02/2011

REFERENCE DOCUMENTS

10 km Grid Square	Scientific Name	Common Name	Date of last record
R86	*Sphagnum subnitens*	Lustrous Bog-moss	11/06/2005
R95	*Austropotamobius pallipes*	Freshwater Crayfish	07/06/2006
R95	*Dama dama*	Fallow Deer	2004 - 2005
R95	*Lepus timidus subsp. hibernicus*	Irish Hare	28/02/1990
R95	*Lutra lutra*	Otter	20/10/2010
R95	*Meles meles*	Badger	28/02/1990
R96	*Austropotamobius pallipes*	Freshwater Crayfish	03/09/2008
R96	*Bromus racemosus*	Smooth Brome	1969
R96	*Cladonia portentosa*	Reindeer Moss	Unknown
R96	*Dama dama*	Fallow Deer	2004 - 2005
R96	*Lepus timidus subsp. hibernicus*	Irish Hare	08/05/1990
R96	*Lutra lutra*	Otter	30/08/2010
R96	*Meles meles*	Badger	08/05/1990
R96	*Rana temporaria*	Common Frog	13/04/2006
R96	*Sorex minutus*	Eurasian Pygmy Shrew	May 1969

REFERENCE DOCUMENTS

Table 3 Records of legally protected mammal species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

10 km Grid Square	Scientific name	Common name	Record count	Date of last record	EU HD Annex II	EU HD Annex IV	EU HD Annex V	Wildlife Acts
R76	*Lutra lutra*	European Otter	5	30/05/1980	X	X		X
R76	*Martes martes*	Pine Marten	5	21/05/2014			X	X
R76	*Meles meles*	Eurasian Badger	72	17/02/2011				X
R76	*Myotis daubentonii*	Daubenton's Bat	26	23/08/2014		X		X
R76	*Nyctalus leisleri*	Lesser Noctule	1	09/10/2009		X		X
R76	*Pipistrellus pipistrellus sensu lato*	Pipistrelle	2	09/10/2009		X		X
R76	*Pipistrellus pygmaeus*	Soprano Pipistrelle	3	09/10/2009		X		X
R76	*Sciurus vulgaris*	Eurasian Red Squirrel	6	29/12/2015				X
R76	*Sorex minutus*	Eurasian Pygmy Shrew	1	31/07/1970				X
R86	*Lutra lutra*	European Otter	8	20/09/2010	X	X		X
R86	*Myotis daubentonii*	Daubenton's Bat	23	28/08/2009		X		X
R86	*Myotis nattereri*	Natterer's Bat	1	28/10/2011		X		X
R86	*Nyctalus leisleri*	Lesser Noctule	1	28/06/2008		X		X
R86	*Pipistrellus pipistrellus sensu lato*	Pipistrelle	1	28/06/2008		X		X
R86	*Pipistrellus pygmaeus*	Soprano Pipistrelle	1	28/06/2008		X		X
R86	*Martes martes*	Pine Marten	5	21/05/2014			X	X
R86	*Cervus elaphus*	Red Deer	1	31/12/2008				X
R86	*Meles meles*	Eurasian Badger	51	19/03/2009				X
R86	*Sciurus vulgaris*	Eurasian Red Squirrel	2	12/04/2011				X
R95	*Lutra lutra*	European Otter	8	20/08/2012	X	X		X
R95	*Martes martes*	Pine Marten	2	17/07/2009			X	X
R95	*Meles meles*	Eurasian Badger	75	19/05/2009				X
R95	*Myotis daubentonii*	Daubenton's Bat	1	08/08/2009		X		X
R95	*Nyctalus leisleri*	Lesser Noctule	1	08/08/2009		X		X
R95	*Pipistrellus pipistrellus sensu lato*	Pipistrelle	1	08/08/2009		X		X

REFERENCE DOCUMENTS

10 km Grid Square	Scientific name	Common name	Record count	Date of last record	EU HD Annex II	EU HD Annex IV	EU HD Annex V	Wildlife Acts
R95	*Pipistrellus pygmaeus*	Soprano Pipistrelle	2	08/08/2009		X		X
R95	*Sciurus vulgaris*	Eurasian Red Squirrel	2	03/04/2015				X
R96	*Lutra lutra*	European Otter	6	30/08/2010	X	X		X
R96	*Myotis daubentonii*	Daubenton's Bat	1	08/08/2009		X		X
R96	*Nyctalus leisleri*	Lesser Noctule	1	08/08/2009		X		X
R96	*Pipistrellus pipistrellus sensu lato*	Pipistrelle	2	08/08/2009		X		X
R96	*Pipistrellus pygmaeus*	Soprano Pipistrelle	2	08/08/2009		X		X
R96	*Plecotus auritus*	Brown Long-eared Bat	1	08/08/2009		X		X
R96	*Martes martes*	Pine Marten	4	28/05/2014			X	X
R96	*Erinaceus europaeus*	West European Hedgehog	1	12/08/2012				X
R96	*Meles meles*	Eurasian Badger	67	16/09/2008				X
R96	*Sciurus vulgaris*	Eurasian Red Squirrel	3	03/06/2015				X

REFERENCE DOCUMENTS

Table 4 Records of legally protected bird species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

Grid square	Scientific name	Common name	Record count	Date of last record	EU BD Annex I	EU BD Annex II	EU BD Annex III	Wildlife Acts
R76	*Alauda arvensis*	Sky Lark	11	19/04/2014				X
R76	*Alcedo atthis*	Common Kingfisher	7	31/12/2011	X			X
R76	*Anas platyrhynchos*	Mallard	16	31/12/2011		X	X	X
R76	*Anser anser*	Greylag Goose	6	31/12/2011		X	X	X
R76	*Apus apus*	Common Swift	1	31/07/1972				X
R76	*Carduelis cannabina*	Common Linnet	8	31/12/2011				X
R76	*Circus cyaneus*	Hen Harrier	8	31/12/2011	X			X
R76	*Columba oenas*	Stock Pigeon	1	31/07/1972				X
R76	*Columba palumbus*	Common Wood Pigeon	32	31/12/2011		X	X	X
R76	*Crex crex*	Corn Crake	2	31/07/1991	X			X
R76	*Cygnus olor*	Mute Swan	2	31/12/2011				X
R76	*Delichon urbicum*	House Martin	7	31/12/2011				X
R76	*Emberiza citrinella*	Yellowhammer	1	31/07/1972				X
R76	*Falco columbarius*	Merlin	1	07/01/2014	X			X
R76	*Falco tinnunculus*	Common Kestrel	14	31/12/2011				X
R76	*Gallinago gallinago*	Common Snipe	9	31/12/2011		X	X	X
R76	*Hirundo rustica*	Barn Swallow	17	31/12/2011				X
R76	*Lagopus lagopus*	Red Grouse	5	31/12/2011		X	X	X
R76	*Larus canus*	Mew Gull	2	31/12/2011				X
R76	*Larus ridibundus*	Black-headed Gull	7	31/12/2011				X
R76	*Locustella naevia*	Common Grasshopper Warbler	6	31/12/2011				X
R76	*Muscicapa striata*	Spotted Flycatcher	11	31/12/2011				X
R76	*Numenius arquata*	Eurasian Curlew	7	31/12/2011		X		X
R76	*Passer domesticus*	House Sparrow	20	31/12/2011				X
R76	*Phalacrocorax carbo*	Great Cormorant	3	31/12/2011				X
R76	*Phasianus colchicus*	Common Pheasant	16	31/12/2011		X	X	X
R76	*Pluvialis apricaria*	European Golden Plover	2	31/12/2011	X	X	X	X
R76	*Riparia riparia*	Sand Martin	5	31/12/2011				X

REFERENCE DOCUMENTS

Grid square	Scientific name	Common name	Record count	Date of last record	EU BD Annex I	EU BD Annex II	EU BD Annex III	Wildlife Acts
R76	*Scolopax rusticola*	Eurasian Woodcock	1	31/07/1972		X	X	X
R76	*Sturnus vulgaris*	Common Starling	24	31/12/2011				X
R76	*Tyto alba*	Barn Owl	2	31/12/2011				X
R76	*Vanellus vanellus*	Northern Lapwing	3	31/12/2011		X		X
R86	*Falco peregrinus*	Peregrine Falcon	3	31/12/2011	X			X
R86	*Circus cyaneus*	Hen Harrier	5	31/12/2011	X			X
R86	*Falco columbarius*	Merlin	4	31/12/2011	X			X
R86	*Anas platyrhynchos*	Mallard	3	31/12/2011		X	X	X
R86	*Columba palumbus*	Common Wood Pigeon	14	31/12/2011		X	X	X
R86	*Phasianus colchicus*	Common Pheasant	11	31/12/2011		X	X	X
R86	*Lagopus lagopus*	Red Grouse	8	07/01/2016		X	X	X
R86	*Anas crecca*	Eurasian Teal	1	31/07/1972		X	X	X
R86	*Lymnocryptes minimus*	Jack Snipe	2	31/12/2011				
R86	*Gallinago gallinago*	Common Snipe	10	31/12/2011		X	X	X
R86	*Scolopax rusticola*	Eurasian Woodcock	3	31/07/1991		X	X	X
R86	*Numenius arquata*	Eurasian Curlew	5	31/12/2011				
R86	*Alauda arvensis*	Sky Lark	11	31/12/2011				X
R86	*Carduelis cannabina*	Common Linnet	9	31/12/2011				X
R86	*Delichon urbicum*	House Martin	6	31/07/1991				X
R86	*Falco tinnunculus*	Common Kestrel	11	31/12/2011				X
R86	*Hirundo rustica*	Barn Swallow	9	31/12/2011				X
R86	*Locustella naevia*	Common Grasshopper Warbler	2	31/12/2011				X
R86	*Muscicapa striata*	Spotted Flycatcher	4	31/12/2011				X
R86	*Passer domesticus*	House Sparrow	14	31/12/2011				X
R86	*Riparia riparia*	Sand Martin	1	31/12/2011				X
R86	*Sturnus vulgaris*	Common Starling	14	31/12/2011				X
R86	*Emberiza citrinella*	Yellowhammer	4	31/07/1991				X
R95	*Alauda arvensis*	Sky Lark	6	31/12/2011				X

REFERENCE DOCUMENTS

Grid square	Scientific name	Common name	Record count	Date of last record	EU BD Annex I	EU BD Annex II	EU BD Annex III	Wildlife Acts
R95	*Alcedo atthis*	Common Kingfisher	1	31/07/1972	X			X
R95	*Anas platyrhynchos*	Mallard	7	31/12/2011		X	X	X
R95	*Apus apus*	Common Swift	7	31/07/1991				X
R95	*Carduelis cannabina*	Common Linnet	11	31/12/2011				X
R95	*Circus cyaneus*	Hen Harrier	7	31/12/2011	X			X
R95	*Columba oenas*	Stock Pigeon	3	31/07/1991				X
R95	*Columba palumbus*	Common Wood Pigeon	17	31/12/2011		X	X	X
R95	*Crex crex*	Corn Crake	1	31/07/1972	X			X
R95	*Delichon urbicum*	House Martin	7	31/12/2011				X
R95	*Emberiza citrinella*	Yellowhammer	1	31/07/1972				X
R95	*Falco peregrinus*	Peregrine Falcon	1	28/07/2012				X
R95	*Falco tinnunculus*	Common Kestrel	8	31/12/2011				X
R95	*Gallinago gallinago*	Common Snipe	7	31/12/2011		X	X	X
R95	*Hirundo rustica*	Barn Swallow	13	31/12/2011				X
R95	*Lagopus lagopus*	Red Grouse	1	31/07/1972		X	X	X
R95	*Larus argentatus*	Herring Gull	2	31/07/1991				X
R95	*Larus ridibundus*	Black-headed Gull	1	31/12/2011				X
R95	*Locustella naevia*	Common Grasshopper Warbler	1	31/07/1972				X
R95	*Muscicapa striata*	Spotted Flycatcher	5	31/12/2011				X
R95	*Numenius arquata*	Eurasian Curlew	1	31/07/1972		X		X
R95	*Passer domesticus*	House Sparrow	7	31/12/2011				X
R95	*Phasianus colchicus*	Common Pheasant	13	31/12/2011		X	X	X
R95	*Riparia riparia*	Sand Martin	3	31/07/1991				X
R95	*Scolopax rusticola*	Eurasian Woodcock	1	31/07/1972		X	X	X
R95	*Sturnus vulgaris*	Common Starling	11	31/12/2011				X
R95	*Vanellus vanellus*	Northern Lapwing	2	31/07/1991		X		X
R96	*Alcedo atthis*	Common Kingfisher	2	31/07/1991	X			X
R96	*Circus cyaneus*	Hen Harrier	11	18/04/2015	X			X
R96	*Falco columbarius*	Merlin	2	31/07/1991	X			X

REFERENCE DOCUMENTS

Grid square	Scientific name	Common name	Record count	Date of last record	EU BD Annex I	EU BD Annex II	EU BD Annex III	Wildlife Acts
R96	*Crex crex*	Corn Crake	1	31/07/1972	X			X
R96	*Columba livia*	Rock Pigeon	4	31/12/2011		X		X
R96	*Anas platyrhynchos*	Mallard	3	31/07/1991		X	X	X
R96	*Columba palumbus*	Common Wood Pigeon	24	31/12/2011		X	X	X
R96	*Phasianus colchicus*	Common Pheasant	14	31/12/2011		X	X	X
R96	*Lagopus lagopus*	Red Grouse	4	31/07/1991		X	X	X
R96	*Fulica atra*	Common Coot	1	31/07/1972		X	X	X
R96	*Gallinago gallinago*	Common Snipe	9	31/12/2011		X	X	X
R96	*Numenius arquata*	Eurasian Curlew	7	31/12/2011		X		X
R96	*Vanellus vanellus*	Northern Lapwing	2	31/07/1991		X		X
R96	*Alauda arvensis*	Sky Lark	13	31/12/2011				X
R96	*Carduelis cannabina*	Common Linnet	15	31/12/2011				X
R96	*Columba oenas*	Stock Pigeon	1	31/07/1972				X
R96	*Delichon urbicum*	House Martin	12	31/12/2011				X
R96	*Falco tinnunculus*	Common Kestrel	14	31/12/2011				X
R96	*Hirundo rustica*	Barn Swallow	17	31/12/2011				X
R96	*Larus canus*	Mew Gull	3	31/07/1991				X
R96	*Locustella naevia*	Common Grasshopper Warbler	3	31/12/2011				X
R96	*Muscicapa striata*	Spotted Flycatcher	5	31/12/2011				X
R96	*Oenanthe oenanthe*	Northern Wheatear	2	31/07/1991				X
R96	*Passer domesticus*	House Sparrow	22	31/12/2011				X
R96	*Riparia riparia*	Sand Martin	3	31/12/2011				X
R96	*Sturnus vulgaris*	Common Starling	19	31/12/2011				X
R96	*Tachybaptus ruficollis*	Little Grebe	1	31/07/1972				X
R96	*Emberiza citrinella*	Yellowhammer	3	31/07/1991				X
R96	*Larus argentatus*	Herring Gull	2	31/12/2011				X
R96	*Larus ridibundus*	Black-headed Gull	8	31/12/2011				X

REFERENCE DOCUMENTS

Table 5 Records of legally protected amphibian species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

Grid square	Scientific name	Common name	Record count	Date of last record	EU HD Annex V	Wildlife Acts
R76	*Rana temporaria*	Common Frog	9	19/02/2006	X	X
R86	*Rana temporaria*	Common Frog	1	26/03/2006	X	X
R96	*Rana temporaria*	Common Frog	12	01/05/2006	X	X

Table 6 Records of legally protected butterfly species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

Grid square	Scientific name	Common name	Record count	Date of last record	ED HD Annex II
R76	*Euphydryas aurinia*	Marsh Fritillary	6	31/12/1984	X
R86	*Euphydryas aurinia*	Marsh Fritillary	1	31/12/2010	X
R95	*Euphydryas aurinia*	Marsh Fritillary	7	31/12/2010	X

Table 7 Records of legally protected bryophyte species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

Grid square	Scientific name	Common name	Record count	Date of last record	EU HD Annex IV
R86	*Leucobryum glaucum*	Large White-moss	1	21/08/1979	IV

Table 8 Records of legally protected crustacean species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

Grid square	Scientific name	Common name	Record count	Date of last record	EU HD Annex II	Wildlife Acts
R95	*Austropotamobius pallipes*	Freshwater White-clawed Crayfish	6	07/06/2006	X	X
R96	*Austropotamobius pallipes*	Freshwater White-clawed Crayfish	8	03/09/2008	X	X

REFERENCE DOCUMENTS

Table 9 Records of non-native invasive species held by the National Biodiversity Data Centre (www.biodiversityireland.ie, 20/04/2016)

Grid square	Species group	Scientific name	Common name	Record count	Date of last record	Medium Impact	High Impact	Wildlife Acts
R76	Flowering plant	Acer pseudoplatanus	Sycamore	1	21/10/2008	X		
R76	Flowering plant	Gunnera tinctoria	Giant-rhubarb	1	17/09/2008		X	
R76	Flowering plant	Heracleum mantegazzianum	Giant Hogweed	4	31/05/2009		X	
R76	Terrestrial mammal	Cervus nippon	Sika Deer	1	12/01/2009		X	X
R76	Terrestrial mammal	Dama dama	Fallow Deer	6	30/04/2009			
R76	Terrestrial mammal	Mustela vison	American Mink	1	01/06/2015		X	
R76	Terrestrial mammal	Myodes glareolus	Bank Vole	2	17/11/2010	X		
R76	Terrestrial mammal	Oryctolagus cuniculus	European Rabbit	1	06/04/1990	X		
R76	Terrestrial mammal	Sciurus carolinensis	Eastern Grey Squirrel	1	31/12/2001		X	
R86	Flowering plant	Fallopia japonica	Japanese Knotweed	1	28/06/2014		X	
R86	Flowering plant	Heracleum mantegazzianum	Giant Hogweed	1	18/09/2008		X	
R86	Flowering plant	Impatiens glandulifera	Indian Balsam	1	17/09/2008		X	
R86	Terrestrial mammal	Sciurus carolinensis	Eastern Grey Squirrel	1	31/12/2001		X	
R86	Terrestrial mammal	Dama dama	Fallow Deer	11	28/11/2011		X	X
R86	Terrestrial mammal	Oryctolagus cuniculus	European Rabbit	1	24/09/1990	X		
R95	Conifer	Pseudotsuga menziesii	Douglas Fir	1	04/09/2007	X		
R95	Flowering plant	Acer pseudoplatanus	Sycamore	2	24/09/2007	X		
R95	Flowering plant	Fallopia japonica	Japanese Knotweed	2	22/04/2010		X	
R95	Flowering plant	Heracleum mantegazzianum	Giant Hogweed	1	04/09/2007		X	
R95	Flowering plant	Leycesteria formosa	Himalayan Honeysuckle	1	04/09/2007	X		

REFERENCE DOCUMENTS

Grid square	Species group	Scientific name	Common name	Record count	Date of last record	Medium Impact	High Impact	Wildlife Acts
R95	Flowering plant	Prunus laurocerasus	Cherry Laurel	1	24/09/2007		X	
R95	Flowering plant	Quercus rubra	Red Oak	1	04/09/2007	X		
R95	Mollusc	Cornu aspersum	Common Garden Snail	1	19/07/1971	X		
R95	Terrestrial mammal	Crocidura russula	Greater White-toothed Shrew	3	24/08/2012	X		
R95	Terrestrial mammal	Dama dama	Fallow Deer	2	31/12/2008		X	X
R95	Terrestrial mammal	Myodes glareolus	Bank Vole	1	24/08/2012	X		
R95	Terrestrial mammal	Oryctolagus cuniculus	European Rabbit	1	28/02/1990	X		
R96	Flowering plant	Acer pseudoplatanus	Sycamore	4	22/09/2008	X		
R96	Mollusc	Cornu aspersum	Common Garden Snail	3	19/09/1977	X		
R96	Mollusc	Potamopyrgus antipodarum	Jenkins' Spire Snail	1	19/09/1977	X		
R96	Mollusc	Tandonia sowerbyi	Keeled Slug	1	19/09/1977	X		
R96	Terrestrial mammal	Cervus nippon	Sika Deer	1	11/09/2013		X	X
R96	Terrestrial mammal	Dama dama	Fallow Deer	2	25/10/2011		X	X
R96	Terrestrial mammal	Crocidura russula	Greater White-toothed Shrew	1	14/11/2010	X		
R96	Terrestrial mammal	Myodes glareolus	Bank Vole	1	14/11/2010	X		
R96	Terrestrial mammal	Oryctolagus cuniculus	European Rabbit	1	08/05/1990	X		

REFERENCE DOCUMENTS

A8-1.2.2.1 Bats

National landscape suitability maps for Irish bat species (Lundy *et al.,* 2010) were reviewed using the Map Viewer of the National Biodiversity Data Centre. The suitability index for the 'all bats combined' layer varies across the Whole UWF Project; areas of high suitability are found in the environs of Mountphilips at the western extremity of the UWF Grid Connection, moderate suitability and low suitability along the centre of the UWF Grid Connection route and finally moderate suitability within the environs of UWF Related Works, UWF Replacement Forestry and the Upperchurch Windfarm. Overall, the landscape suitability follows a consistent west to east pattern of decreasing suitability for all species, which roughly corresponds with the changes in altitude.

With regard to the UWF Other Activities, areas comprising very high suitability are to be found at the western end of the Whole UWF Project near Foynes and Limerick. Further elements of UWF Other Activities near Thurles are in areas of high suitability, while the haulage route between Thurles and Limerick crosses areas of moderate and high suitability. Due to the small scale of works for the UWF Other Activities (predominantly street furniture removal), no source pathway linkages were identified for Bats, and these locations were therefore excluded from further desktop review.

Records of known bat roosts within 10km of the UWF Grid Connection were obtained from the Bat Conservation Ireland database on the 5th September 2016. Eighteen roosts were identified, but all were located more than 5km from the UWF Grid Connection; most were from the banks of the River Shannon, and a small number were from the towns of Murroe (Glenstal Abbey), Ballyvoureen and Silvermines in County Tipperary. This study zone also includes the UWF Related Works, UWF Replacement Forestry and Upperchurch Windfarm Locations.

There were a number of activity records of Daubenton's bat, common pipistrelle, soprano pipistrelle and Leisler's bat within 10km of the Whole UWF Project, with a few records of Natterer's bat and brown long-eared bat. Project Elements 1-4 are located just outside the geographical range of the lesser horseshoe bat, as the closest desktop records of this species were at Annacotty, Co. Limerick and Doonass, Co. Clare, approximately 8-10km to the west of the UWF Grid Connection.

Landscape suitability in respect of Bats as available from the above cited source is illustrated overleaf in Plate 2.

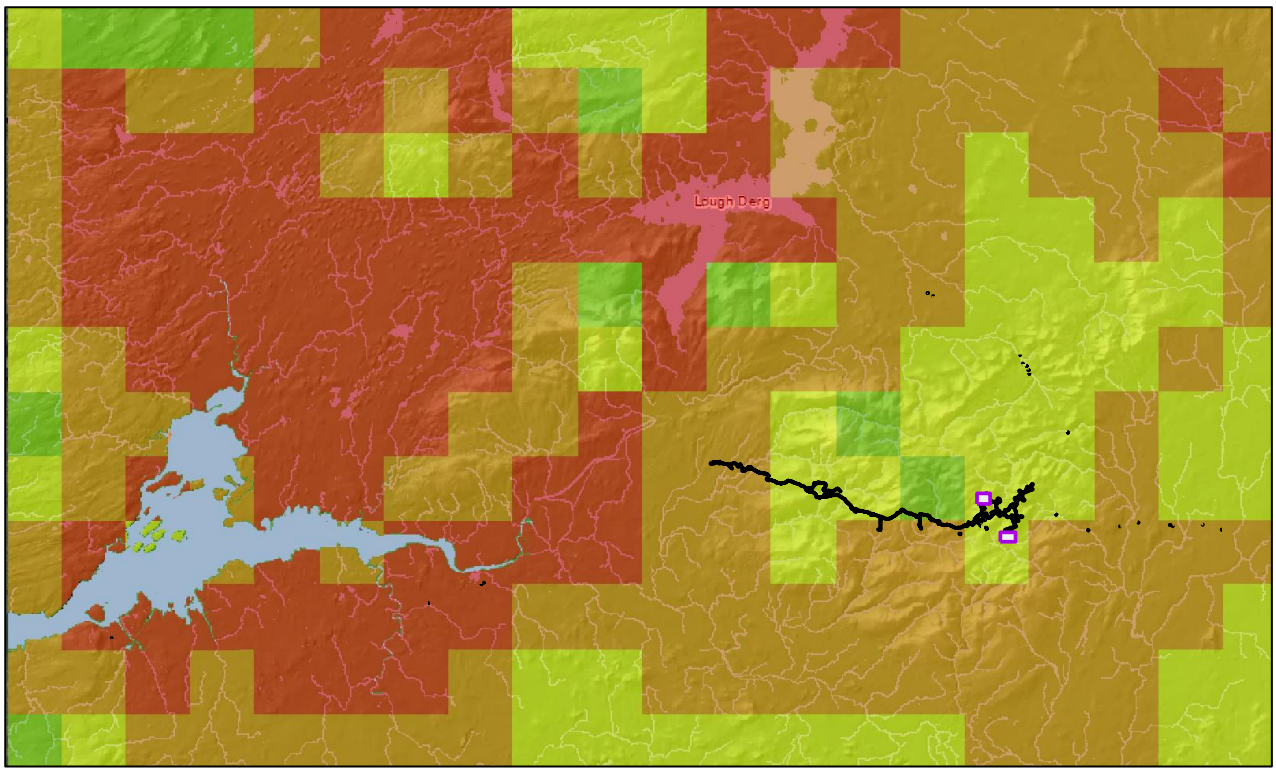


Plate 2: Bat Suitability Areas as per National Bat Suitability Landscape Mapping
(Those areas shown in red have the highest habitat suitability index, and those in green, the lowest suitability index. However, squares highlighted as less favourable may still have local areas of abundance).

A8-1.2.3 Fieldwork

A8-1.2.3.1 Fieldwalking (Scoping)

An initial scoping visit was conducted by INIS ecologists Mr. Howard Williams CEnv MCIEEM MRSB CBiol MIFM, Ms. Sarah Ingham MSc ACIEEM and Mr. Domhnall Finch MSc GradCIEEM on December 8th 2015, in collaboration with the Ecopower Developments Ltd project design team and other sub consultants. The entire route of the UWF Grid Connection was travelled by the team as part of this scoping exercise. The purpose of this visit was to gain an on-site overview of the UWF Grid Connection, as well as an opportunity for the specialists of the disciplines in ecology, hydrology and archaeology to consult with one another and with the developer's design team to ensure the least intrusive route would be applied for this project.

A8-1.2.3.2 Habitat Surveys

Existing habitat information was reviewed to identify potentially sensitive habitats following a data request made to the NPWS. A further walkover of the UWF Grid Connection in January 2016 also allowed potentially sensitive areas to be identified prior to commencing habitat surveys.

All habitat surveys undertaken for the Whole UWF Project followed best practice guidance (Smith *et al.*, 2011) and utilised the habitat classification presented in Fossitt (2000). All habitats within a 50-m buffer of work locations were surveyed and classified to level 3. All surveys were carried out in good weather with no constraints.

Table 10 Dates of habitat surveys undertaken on all elements of the Whole UWF Project during 2016 and 2017.

Project Element	2016	2017	2018
UWF Grid Connection	11th to 13th January 22nd and 23rd March 6th April 7th June 15th August 2nd September 22nd September	5th and 6th April 3rd August	
UWF Other Activities		24th and 25th June	17th, 18th and 19th January
UWF Related Works		13th July	
UWF Replacement Forestry		6th September	

With regard to previous habitat surveys within the Upperchurch Windfarm (Ecopower Developments Ltd., 2013), the methodology also followed best practice guidance (Smith *et al.*, 2011) and utilised the habitat classification presented in Fossitt (2000). The results of Habitat surveys are presented in Section 8.2.3.5.

A8-1.2.3.3 Hen Harrier

Following scoping and formal consultation with NPWS as described, it was established that, based on likely sensitivities, and source-pathways linkages in respect of disturbance and displacement, the primary objective of Hen Harrier surveys should be to identify all Hen Harrier breeding and winter roosting sites in suitable habitat within a 2km radius of proposed works (i.e. any likely source stimulus in terms of disturbance or displacement –with the distance of 2km being the radius stipulated by SNH guidance). This approach was formulated in consultations with NPWS and is supported in SNH guidance. By virtue of the prior appraisal of Upperchurch Windfarm, breeding occupancy and presence of winter roosts has already been established for those areas of habitat within and proximal to the Upperchurch Windfarm, which includes the UWF Related Works, and elements of the UWF Other Activities. Remaining elements of the UWF Other Activities were scoped out for further appraisal in terms of impact pathways on breeding or winter roosting Hen Harrier, due to distance from Hen Harrier habitat, location on public roads and the minimal nature of works involved (e.g. the lifting and re-instatement of street furniture). The proposed telecom relay pole at Knockmaroe was scoped out as a source-impact-pathway for collision mortality as there are no records of Hen Harrier collision and/or mortality with structures of this size and nature. As no breeding habitat is present at the Mountphilips substation location, then this was scoped out as a likely source of disturbance/displacement to breeding birds, in addition the distance to nearest Hen Harrier habitat and absence of records of collision mortality with buildings/structures such as sub-stations imply collision mortality is not a risk. UWF Replacement Forestry was also scoped out as no breeding or winter roosting habitat is present. Survey effort therefore was concentrated on the UWF Grid Connection, in particular areas of high habitat suitability (as per SNH Guidance) within 2km, and which by default coincide with the SPA designation present.

Accordingly, the methodology selected was that published by SNH in respect of breeding raptor surveys (Hardey *et al.,* 2013), which describes the survey techniques to establish breeding occupancy by Hen Harrier. This method corresponds to that utilized to date in National Surveys for the species in the republic (e.g. Ruddock *et al.,* 2012, 2015) and also research into the species (Irwin *et al.,* 2015 and Wilson *et al.,* 2015).

Existing records of Hen Harrier usage of the area, dating back to 2003, were collated to establish suitable nesting or roosting habitat. Satellite imagery was additionally reviewed to identify areas of potentially suitable breeding habitat. NPWS Conservation Rangers and local bird experts with knowledge of existing and historical Hen Harrier nest record locations were consulted for further information.

For breeding season surveys to establish nesting attempts, 12 vantage points were ground-truthed (for visibility) and fixed. These vantage points were used during the 2016 (March to June inclusive) and 2017 (March to August inclusive) breeding seasons. Additional effort in the months of July and August was added to surveys in 2017 as some nesting attempts occurred later than the previous year.

For winter roost surveys 7 of the preceding 12 vantage points were employed during the winter 2016/17 period. The rationale for decreasing the number of VPs from 12 in the breeding period to 7 during the winter period was based on the requirement to focus survey efforts on suitable roosting habitat within the study area – of which there is less. Additional Survey effect was carried out in September, October and November 2017.

In terms of collision mortality there are no source impact pathways identified as effects from the telecom relay pole (part of UWF Related Works) are scoped out and the windfarm is already consented; similarly the substation element of the UWF Grid Connection is not considered to pose a collision risk with remaining elements of the UWF Grid Connection at ground level or below.

Although therefore not a formal flight activity survey to inform a collision risk model; as an approach to standardise effort, each VP received six hours of survey effort per month as per Best Practice (SNH, 2014).

Results of Hen Harrier surveys are presented in Section 8.2.3.2.

Breeding Season Vantage Points

All observations were restricted to hours of daylight (range 06.45-20.35). All 12 vantage points focused on suitable nesting habitat and historical nest locations within 2km of the UWF Grid Connection.

The grid references for VP locations (ITM) are presented in Table 11.

Locations of Vantage points are included in **Figures CG 8.6, RW 8.6, RF 8.6 and CE 8.6 of Volume C3 EIA Report Figures.**

Table 11 Fixed vantage point locations (UWF Grid Connection)

Vantage Point	ITM Grid Reference
1	590503 E 659845 N
2	590263 E 663064 N
3	588454 E 657845 N
4	585164 E 659385 N
5	584216 E 660366 N
6	584744 E 661484 N
7	583015 E 662754 N
8	580275 E 661364 N
9	580495 E 662744 N
10	579726 E 664434 N
11	576626 E 664763 N
12	575976 E 662474 N

Winter Roost Vantage Points

Winter surveys were stratified to coincide with dawn and dusk periods, as per Best Practice guidance (SNH, 2014 and guidance for the Irish Winter Hen Harrier Roost Survey (IWHHRS) from O'Donoghue, 2010), to establish the locations of communal roosts. Dawn surveys commenced one hour before sunrise and continued for two hours after (range of earliest start to latest finish: 06.10-11.00) and dusk surveys commenced two hours prior to sunset and continued for one hour after (range of earliest start to latest finish: 13.58-20.30). Grid references of vantage points utilised as provided in Table 12.

Table 12 Fixed vantage points selected for winter roost surveys (UWF Grid Connection)

Vantage Point	ITM Grid Reference
2	590263 E 663064 N
3	588454 E 657845 N
5	584216 E 660366 N
6	584744 E 661484 N
10	579726 E 664434 N
11	576626 E 664763 N
12	575976 E 662474 N

Data Recorded During Vantage Point Surveys

For each vantage point watch (both breeding and winter period) the following parameters were recorded:

- Vantage Point number;
- Date of watch;
- Watch period;
- Weather conditions including visibility, wind-force and direction and precipitation;
- Notes – any notes on other birds of prey or potentially disturbing activity etc.

When a Hen Harrier was observed, the following information was recorded:

- Sighting number during that watch;
- Time of sighting;
- Sex of Hen Harrier;
- Approximate height of flight (in meters);
- Habitat over which bird was flying – see Table 13 for habitat codes used;
- The activity of the bird – see Table 14 for activity codes used;
- The duration of the activity;
- Notes – any more information on behaviour of bird(s), nesting location estimates, roosting location estimates.

Table 13 Habitat codes recorded during VP watches

Code	Habitats
G	Grazing
RG	Rough Grazing
HB	Heath or bog
DE	Deciduous woodland or scrub
GO	Gorse
CF	Clear fell
NF2	New forestry plantation trees 20-30cm high
NF3	New forestry plantation trees c 1m high
NF4	New forestry plantation trees > 2m high
2nd F1/F2	Second rotation forestry plantation trees 20-30cm high
2nd F3	Second rotation forestry plantation trees c 1m high
2nd F4	Second rotation forestry plantation trees > 2m high
F	Post thicket forestry

Table 14 Activity and behaviour codes recorded during watches

Code	Behaviour or activity
S	Soaring
D	Displaying
H	Hunting
Fl	Flying
C	Circling
P	Perching

Table 15 Details of timing, duration and weather conditions for vantage point surveys undertaken during the breeding season in 2016

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	11/03/2016	GP	None	8	10	1	SW	10	09:10	12:10	10800
1	15/03/2016	GP	None	2	10	2	E	10	13:40	16:40	10800
2	15/03/2016	GP	None	2	10	3	E	9	10:30	13:30	10800
2	21/03/2016	GP	None	8	5	1	NW	11	14:30	17:30	10800
3	11/03/2016	GP	None	8	10	2	SW	13	13:15	16:15	10800
3	13/03/2016	GP	None	8	10	1	SE	13	15:15	18:15	10800
4	12/03/2016	GP	None	6	10	2	S	10	08:15	11:15	10800
4	21/03/2016	GP	None	8	5	1	NW	9	11:30	14:30	10800
4	21/03/2016	GP	None	8	5	1	NW	9	11:30	14:30	10800
5	12/03/2016	GP	Light	8	10	2	S	11	11:30	14:30	10800
5	13/03/2016	GP	None	7	10	2	SE	15	12:00	15:00	10800
6	12/03/2016	GP	None	8	10	2	S	12	14:35	17:35	10800
6	21/03/2016	GP	Mist	8	2	1	NW	8	08:00	11:00	10800
6	21/03/2016	GP	None	8	2	0	NW	8	08:00	11:00	10800
6	21/03/2016	GP	None	8	2	0	NW	8	08:00	11:00	10800
6	21/03/2016	GP	None	8	2	0	NW	8	08:00	11:00	10800
6	21/03/2016	GP	None	8	2	0	NW	8	08:00	11:00	10800
7	13/03/2016	GP	None	8	10	2	SE	9	08:45	11:45	10800
7	14/03/2016	GP	None	2	10	2	E	14	14:40	17:40	10800
8	15/03/2016	RMD	None	7	5	1	SE	10	15:30	18:30	10800
8	16/03/2016	RMD	None	5	2	1	SE	7	09:30	12:30	10800
9	16/03/2016	RMD	None	8	2	1	SE	11	12:30	18:30	21600
9	16/03/2016	RMD	None	8	2	1	SE	11	12:30	18:30	21600
10	14/03/2016	RMD	None	0	5	3	E	5	07:45	14:15	21600
11	15/03/2016	GP	None	1	5	1	SE	8	09:30	15:30	21600
12	14/03/2016	RMD	None	0	5	1	SE	10	11:00	17:00	21600
12	14/03/2016	RMD	None	0	5	1	SE	10	11:00	17:00	21600
1	04/04/2016	GP	light	6	5	1	SW	12	09:45	12:45	10800
1	04/04/2016	GP	none	6	5	1	SW	12	09:45	12:45	10800
1	04/04/2016	GP	none	6	5	1	SW	12	09:45	12:45	10800
1	04/04/2016	GP	none	6	5	1	SW	12	09:45	12:45	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	21/04/2016	GP	none	7	10	1	E	12	10:10	13:10	10800
2	07/04/2016	GP	none	3	10	1	NW	9	07:15	10:50	16800
2	07/04/2016	GP	none	3	10	1	NW	9	07:15	10:50	16800
2	07/04/2016	GP	none	3	10	1	NW	9	07:15	10:50	16800
2	07/04/2016	GP	none	3	10	1	NW	9	07:15	10:50	16800
2	07/04/2016	GP	none	3	10	1	NW	9	07:15	10:50	16800
2	07/04/2016	GP	none	3	10	1	NW	9	07:15	10:50	16800
2	09/04/2016	GP	light	4	10	1	SE	12	14:00	17:00	10800
2	09/04/2016	GP	none	4	10	1	SE	12	14:00	17:00	10800
2	09/04/2016	GP	none	4	10	1	SE	12	14:00	17:00	10800
3	08/04/2016	GP	light	6	5	3	SW	9	07:15	10:50	16800
3	04/04/2016	GP	light	7	5	1	SW	15	13:45	16:45	10800
4	05/04/2016	GP	light	6	10	1	W	11	11:30	17:30	21600
4	05/04/2016	GP	light	6	10	1	W	11	11:30	17:30	21600
5	05/04/2016	GP	light	8	2	1	W	10	08:15	11:15	10800
5	05/04/2016	GP	none	8	2	1	W	10	08:15	11:15	10800
5	05/04/2016	GP	none	8	2	1	W	10	08:15	11:15	10800
5	05/04/2016	GP	none	8	2	1	W	10	08:15	11:15	10800
5	17/04/2016	GP	none	6	10	2	SW	10	10:35	13:35	10800
6	06/04/2016	GP	showers	8	5	4	SW	9	08:15	11:15	10800
6	07/04/2016	GP	light	6	5	3	W	13	14:20	17:20	10800
6	07/04/2016	GP	light	6	5	3	W	13	14:20	17:20	10800
6	07/04/2016	GP	light	6	5	3	W	13	14:20	17:20	10800
6	25/04/2016	GP	none	3	10	3	NW	14	16:40	19:40	10800
6	25/04/2016	GP	none	3	10	3	NW	14	16:40	19:40	10800
6	25/04/2016	GP	none	3	10	3	NW	14	16:40	19:40	10800
6	25/04/2016	GP	none	3	10	3	NW	14	16:40	19:40	10800
7	07/04/2016	GP	light	8	5	3	W	11	11:10	14:10	10800
7	25/04/2016	GP	light	8	10	3	N	12	09:15	12:15	10800
8	06/04/2016	RMD	showers	8	8	2	W	6	12:35	18:35	21600
9	06/04/2016	RMD	showers	8	8	2	W	7	09:30	12:30	10800
9	07/04/2016	RMD	showers	8	10	1	NW	7	09:30	12:30	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
10	17/04/2016	RMD	none	5	10	2	SW	10	14:00	17:30	12600
10	25/04/2016	RMD	none	8	10	3	NW	12	13:30	16:30	10800
11	05/04/2016	GP	showers	7	10	1	SW	7	10:15	16:15	21600
12	04/04/2016	RMD	showers	7	3	1	S	9	11:30	17:30	21600
12	04/04/2016	RMD	showers	7	3	1	S	9	11:30	17:30	21600
12	04/04/2016	RMD	showers	7	3	1	S	9	11:30	17:30	21600
12	04/04/2016	RMD	showers	7	3	1	S	9	11:30	17:30	21600
12	04/04/2016	RMD	showers	7	3	1	S	9	11:30	17:30	21600
1	06/05/2016	GP	none	3	10	1	N	15	11:30	14:30	10800
1	10/05/2016	GP	mist	8	2	1	E	12	09:50	12:50	10800
2	06/05/2016	GP	none	4	10	1	N	10	08:15	11:15	10800
2	06/05/2016	GP	none	4	10	1	N	10	08:15	11:15	10800
2	18/05/2016	GP	mist	6	10	1	N	12	10:00	13:00	10800
3	04/05/2016	GP	none	8	10	3	S	11	14:00	17:00	10800
3	06/05/2016	GP	none	1	10	1	N	17	14:45	17:45	10800
4	04/05/2016	GP	none	8	10	3	S	11	07:30	10:30	10800
4	19/05/2016	GP	none	4	10	3	W	15	12:40	15:40	10800
5	04/05/2016	GP	none	8	10	3	S	11	10:45	13:45	10800
5	12/05/2016	GP	mist	8	1	2	NE	12	08:30	11:30	10800
6	05/05/2016	GP	none	7	10	1	S	15	15:10	18:10	10800
6	13/05/2016	GP	none	1	10	2	NE	15	13:20	16:20	10800
6	13/05/2016	GP	none	1	10	2	NE	15	13:20	16:20	10800
7	05/05/2016	GP	none	7	10	2	S	11	12:00	15:00	10800
7	19/05/2016	GP	showers	7	10	3	W	10	08:30	12:30	10800
8	20/05/2016	RMD	showers	8	10	1	SE	12	10:15	16:15	10800
9	13/05/2016	RMD	none	0	16	1	NE	13	09:30	15:30	10800
9	13/05/2016	RMD	none	0	16	1	NE	13	09:30	15:30	10800
10	05/05/2016	RMD	none	1	10	3	S	10	07:25	10:30	10800
10	05/05/2016	RMD	none	1	10	3	S	10	07:25	10:30	10800
10	05/05/2016	RMD	none	1	10	3	S	10	07:25	10:30	10800
10	05/05/2016	RMD	none	1	10	3	S	10	07:25	10:30	10800
10	13/05/2016	RMD	none	0	10	2	NE	13	08:15	12:15	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
10	13/05/2016	RMD	none	0	10	2	NE	13	08:15	12:15	10800
11	09/05/2016	GP	showers	8	16	1	NE	17	09:30	15:30	21600
12	11/05/2016	RMD	none	8	5	1	NE	13	09:30	15:30	21600
1	07/06/2016	GP	none	7	5	2	SW	17	14:30	16:30	10800
1	09/06/2016	GP	none	7	10	1	SW	16	08:40	11:40	10800
2	09/06/2016	GP	none	8	10	1	SW	17	15:00	18:00	10800
2	09/06/2016	GP	none	8	10	1	SW	17	15:00	18:00	10800
2	15/06/2016	GP	none	7	10	2	NW	14	07:50	10:50	10800
2	15/06/2016	GP	none	7	10	2	NW	14	07:50	10:50	10800
2	15/06/2016	GP	none	7	10	2	NW	14	07:50	10:50	10800
2	15/06/2016	GP	none	7	10	2	NW	14	07:50	10:50	10800
3	07/06/2016	GP	none	7	5	1	SW	17	10:10	13:10	10800
3	15/06/2016	GP	light	7	10	2	NW	15	11:00	14:00	10800
4	08/06/2016	GP	none	8	5	1	E	13	09:15	12:15	10800
4	13/06/2016	GP	light	7	5	3	W	15	15:00	18:00	10800
5	03/06/2016	GP	none	3	10	1	E	15	10:15	13:15	10800
5	13/06/2016	GP	light	1	10	1	W	14	08:40	11:40	10800
6	11/06/2016	GP	none	8	10	1	SW	15	10:00	13:00	10800
6	13/06/2016	GP	none	7	10	1	W	13	11:45	14:45	10800
6	13/06/2016	GP	light	7	10	1	W	13	11:45	14:45	10800
7	03/06/2016	GP	none	5	10	1	E	19	13:30	16:30	10800
7	08/06/2016	GP	none	8	5	1	E	13	12:30	15:30	10800
8	10/06/2016	RMD	light	8	4	1	NE	15	09:20	15:20	21600
9	03/06/2016	RMD	none	2	16	1	SE	16	10:30	16:30	10800
10	11/06/2016	RMD	none	7	10	2	SE	18	13:45	16:45	10800
10	11/06/2016	RMD	none	7	10	2	SE	18	13:45	16:45	10800
10	17/06/2016	RMD	none	8	10	2	NW	13	08:00	12:00	14400
11	09/06/2016	GP	none	7	16	1	SE	15	09:30	15:30	21600
12	08/06/2016	RMD	none	8	16	1	SE	17	09:30	15:30	21600
12	08/06/2016	RMD	none	8	16	1	SE	17	09:30	15:30	21600
12	08/06/2016	RMD	none	8	16	1	SE	17	09:30	15:30	21600

REFERENCE DOCUMENTS

Table 16 Details of timing, duration and weather conditions for vantage point surveys undertaken during the non-breeding season in 2016/2017.

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	13/09/2016	GP	Misty	5/8	2	F2	NW	9	06:10	08:30	10800
10	13/09/2016	GP	None	5/8	2	F1	NW	10	18:00	20:30	10800
10	13/09/2016	GP	None	5/8	2	F1	NW	10	18:00	20:30	10800
4	14/09/2016	GP	None	1/2	2	F3	NW	10	06:30	09:30	10800
3	15/09/2016	GP	None	3/8	2	F1	S	14	17:20	20:20	10800
5	16/09/2016	GP	None	5/8	2	F1	W	11	06:30	09:30	10800
6	16/09/2016	GP	None	1/2	2	F2	W	12	17:30	20:30	10800
6	16/09/2016	GP	None	1/2	2	F2	W	12	17:30	20:30	10800
2	17/09/2016	GP	Misty	1/2	2	F1	SW	10	06:30	09:30	10800
2	17/09/2016	GP	None	8/8	2	F1	S	14	17:30	20:30	10800
10	18/09/2016	GP	Misty	8/8	1	F3	S	13	06:10	09:10	10800
5	18/09/2016	GP	None	3/8	2	F1	W	14	17:15	20:15	10800
6	19/09/2016	GP	None	8/8	2	F1	W	10	06:15	09:15	10800
1	19/09/2016	GP	None	8/8	2	F1	W	11	17:10	20:10	10800
3	20/09/2016	GP	None	8/8	1	F1	SW	10	06:15	09:15	10800
4	20/09/2016	GP	None	8/8	2	F1	W	12	17:00	20:00	10800
4	20/09/2016	GP	None	8/8	2	F1	W	12	17:00	20:00	10800
12	20/09/2016	TG	None	8/8	10	F1	SE	11	06:40	09:40	10800
12	20/09/2016	TG	None	8/8	15	F1	SE	14	17:15	20:15	10800
11	21/09/2016	TG	Misty	8/8	5	F2	SE	11	06:42	09:42	10800
11	21/09/2016	TG	None	3/4	15	F1	SE	10	17:13	20:13	10800
7	22/09/2016	TG	None	1/2	15	F1	SE	5	06:45	09:45	10800
7	22/09/2016	TG	Light	8/8	1	F1	SE	12	17:11	20:11	10800
8	27/09/2016	TG	None	8/8	1	F1	SW	11	06:55	09:55	10800
8	27/09/2016	TG	None	3/4	3	F1	SW	11	16:54	19:54	10800
9	28/09/2016	TG	None	8/8	5	F1	S	12	06:57	09:57	10800
9	28/09/2016	TG	Heavy Showers	3/4	1	F1	S	14	16:52	19:52	10800
1	15/10/2016	GP	Misty	3/4	2	F1	SE	4	07:30	10:30	10800
10	15/10/2016	GP	None	7/8	5	F1	NW	10	16:00	19:00	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
10	15/10/2016	GP	None	7/8	5	F1	NW	10	16:00	19:00	10800
10	15/10/2016	GP	None	7/8	5	F1	NW	10	16:00	19:00	10800
5	16/10/2016	GP	Light	8/8	1	F3	S	8	07:15	10:15	10800
2	16/10/2016	GP	Light	8/8	5	F2	S	10	16:15	19:15	10800
7	17/10/2016	GP	Light	5/8	5	F2	SW	11	16:10	19:10	10800
4	18/10/2016	GP	None	1/4	2	F1	SW	6	07:30	10:30	10800
3	18/10/2016	GP	Light	1/2	2	F1	NW	8	16:00	19:05	10800
6	19/10/2016	GP	None	8/8	2	F1	NW	7	07:30	10:30	10800
1	20/10/2016	GP	None	8/8	5	F1	E	8	07:10	10:10	10800
6	20/10/2016	GP	None	7/8	2	F1	E	10	16:00	19:00	10800
7	21/10/2016	GP	None	8/8	2	F1	SE	7	07:00	10:00	10800
5	21/10/2016	GP	None	7/8	5	F1	SE	10	16:15	19:00	10800
4	22/10/2016	GP	None	5/8	5	F1	E	10	16:00	19:00	10800
10	24/10/2016	GP	None	1/8	2	F1	NE	5	07:30	10:30	10800
10	24/10/2016	GP	None	1/8	2	F1	NE	5	07:30	10:30	10800
10	24/10/2016	GP	None	1/8	2	F1	NE	5	07:30	10:30	10800
11	24/10/2016	RMD	None	5/8	15	F1	NE	12	15:52	18:52	10800
11	24/10/2016	RMD	None	5/8	15	F1	NE	12	15:52	18:52	10800
3	25/10/2016	GP	None	3/8	1	F1	NE	4	07:30	10:30	10800
11	25/10/2016	RMD	None	3/4	5	F1	SE	3	07:45	10:45	10800
12	25/10/2016	RMD	None	7/8	9	F1	N	11	15:50	18:50	10800
12	26/10/2016	RMD	None	8/8	15	F1	S	11	07:45	10:45	10800
8	26/10/2016	RMD	Light	8/8	4	F1	SW	13	15:42	18:42	10800
8	27/10/2016	RMD	Misty	8/8	10	F1	SW	11	07:45	10:45	10800
9	27/10/2016	RMD	None	8/8	15	F1	SE	16	15:40	18:40	10800
9	28/10/2016	RMD	Misty	8/8	4	F1	SW	12	07:50	10:50	10800
2	29/10/2016	GP	None	3/8	2	F1	SE	11	15:45	18:45	10800
9	20/11/2016	GP	None	3/8	1	F1	NE	5	14:15	17:15	10800
5	21/11/2016	GP	None	8/8	5	F1	NE	0	07:30	10:30	10800
6	21/11/2016	GP	None	7/8	5	F3	NE	2	14:10	17:10	10800
8	22/11/2016	GP	None	1/4	5	F3	NW	4	07:30	10:30	10800
3	22/11/2016	GP	None	3/8	10	F1	NE	2	14:00	17:10	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
9	23/11/2016	GP	None	0/8	5	F1	NE	5	07:30	14:30	10800
4	23/11/2016	GP	None	1/4	5	F2	NE	5	14:10	17:10	10800
6	24/11/2016	GP	None	0/8	5	F1	NE	0	07:30	10:30	10800
8	25/11/2016	GP	None	1/4	5	F1	E	5	14:10	17:10	10800
4	28/11/2016	GP	None	8/8	5	F1	E	6	07:30	10:30	10800
5	28/11/2016	GP	None	8/8	5	F1	E	5	14:10	17:10	10800
1	28/11/2016	SI	None	8/8	5	F1	E	6	07:19	10:19	10800
1	28/11/2016	SI	None	8/8	5	F1	E	8	13:58	16:58	10800
12	28/11/2016	JD	None	8/8	10	F1	NE	6	07:15	10:19	10800
12	28/11/2016	JD	None	8/8	10	F1	NW	6	14:25	17:25	10800
2	29/11/2016	SI	None	7/8	10	F1	SE	4	07:21	10:21	10800
2	29/11/2016	SI	None	7/8	10	F1	SE	4	14:00	17:10	10800
11	29/11/2016	JD	None	1/4	15	F1	E	6	07:20	10:20	10800
11	29/11/2016	JD	None	1/8	15	F3	SE	6	14:20	17:25	10800
11	29/11/2016	JD	None	1/8	15	F4	SE	6	14:20	17:25	10800
11	29/11/2016	JD	None	1/8	15	F5	SE	6	14:20	17:25	10800
3	30/11/2016	GP	None	0/8	5	F1	E	0	07:30	10:30	10800
7	30/11/2016	SI	None	3/4	10	F1	E	3	07:25	10:25	10800
7	30/11/2016	SI	None	3/4	10	F1	E	3	14:00	17:00	10800
10	30/11/2016	JD	None	0/8	15	F1	E	3	07:20	10:20	10800
10	30/11/2016	JD	None	0/8	15	F1	E	6	14:30	17:30	10800
2	15/12/2016	SI	None	1/8	10	F1	NW	8	07:43	10:45	10800
2	15/12/2016	SI	None	1/8	10	F1	NW	8	14:30	17:30	10800
12	16/12/2016	RMD	None	8/8	15	F1	NW	5	08:00	11:00	10800
5	16/12/2016	RMD	None	0/8	15	F1	NW	8	14:00	17:00	10800
11	19/12/2016	RMD	None	8/8	<1	F1	NW	8	08:00	11:00	10800
6	19/12/2016	RMD	None	1/4	20	F1	NW	8	14:00	17:00	10800
6	20/12/2016	RMD	None	1/2	15	F1	SE	0	08:00	11:00	10800
12	20/12/2016	RMD	Constant	8/8	4	F1	SE	5	14:00	17:00	10800
5	21/12/2016	RMD	Light	8/8	15	F1	SW	5	08:00	11:00	10800
10	21/12/2016	RMD	Light	5/8	15	F1	SW	6	14:00	17:00	10800
10	22/12/2016	RMD	None	3/8	5	F1	SW	5	08:00	11:00	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
11	22/12/2016	RMD	Single shower	7/8	15	F1	SW	8	14:00	17:00	10800
11	22/12/2016	RMD	Single shower	7/8	15	F1	SW	8	14:00	17:00	10800
11	22/12/2016	RMD	Single shower	7/8	15	F1	SW	8	14:00	17:00	10800
Casual	23/12/2016	RMD	Heavy Showers	5/8	10	F3	SW	11	14:10	14:10	Casual
11	17/01/2017	RMD	Misty	8/8	3	F1	SW	8	08:00	11:00	10800
11	17/01/2017	RMD	None	8/8	15	F1	SW	10	14:30	17:30	10800
12	18/01/2017	RMD	None	8/8	15	F1	SE	8	08:00	11:00	10800
5	18/01/2017	RMD	Single shower	8/8	15	F1	S	8	14:30	17:30	10800
5	19/01/2017	RMD	None	1/8	15	F1	SE	2	08:00	11:00	10800
12	19/01/2017	RMD	None	0/8	15	F1	SE	11	14:30	17:30	10800
6	25/01/2017	RMD	Occasional showers	8/8	15	F3	SE	8	07:50	10:50	10800
10	25/01/2017	RMD	None	7/8	15	F3	SE	9	14:45	17:45	10800
10	27/01/2017	RMD	Heavy Showers	8/8	5	F1	SE	6	07:50	10:50	10800
3	27/01/2017	RMD	None	5/8	15	F1	SW	8	14:45	17:45	10800
2	29/01/2017	MD	Light	8/8	6	F1	E	6	07:35	10:35	10800
2	29/01/2017	MD	Light	8/8	5	F1	SE	4	14:45	17:45	10800
3	31/01/2017	RMD	Light	8/8	4	F1	SW	4	07:40	10:40	10800
6	31/01/2017	RMD	None	3/4	10	F1	SE	10	14:45	17:45	10800
11	08/02/2017	GP	None	7/8	5	F2	S	7	15:10	18:10	10800
11	08/02/2017	GP	None	7/8	5	F2	S	7	15:10	18:10	10800
12	09/02/2017	GP	None	8/8	2	F2	E	5	15:10	18:10	10800
2	10/02/2017	GP	None	8/8	2	F1	E	1	07:30	10:30	10800
5	10/02/2017	GP	None	8/8	5	F2	E	3	15:10	18:10	10800
6	11/02/2017	GP	None	1/8	5	F1	NE	0	07:30	10:30	10800
3	12/02/2017	GP	None	8/8	1	F2	NE	3	15:15	18:15	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
3	12/02/2017	GP	None	8/8	1	F2	NE	3	15:15	18:15	10800
3	12/02/2017	GP	None	8/8	1	F2	NE	3	15:15	18:15	10800
5	13/02/2017	GP	Misty	8/8	1	F3	E	5	07:15	10:15	10800
10	14/02/2017	GP	None	5/8	5	F2	SE	10	15:15	18:15	10800
10	14/02/2017	GP	None	5/8	5	F2	SE	10	15:15	18:15	10800
10	14/02/2017	GP	None	5/8	5	F2	SE	10	15:15	18:15	10800
3	15/02/2017	GP	Light	7/8	2	F2	SW	6	07:15	10:15	10800
11	16/02/2017	GP	Light	8/8	1	F1	SW	7	07:15	10:15	10800
11	16/02/2017	GP	Light	8/8	1	F1	SW	7	07:15	10:15	10800
6	16/02/2017	GP	None	8/8	2	F1	SW	7	15:20	18:20	10800
12	22/02/2017	GP	Misty	8/8	<1	F1	SW	9	07:00	10:00	10800
2	23/02/2017	GP	None	1/4	5	F2	NW	8	15:30	18:30	10800
10	24/02/2017	GP	Misty	7/8	<1	F2	SW	5	07:00	10:00	10800

REFERENCE DOCUMENTS

Table 17 Details of timing, duration and weather conditions for vantage point surveys undertaken during the breeding season in 2017.

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
3	12/03/2017	GP	None	1/2	10	F3	W	11	13:00	16:00	10800
9	13/03/2017	RMD	None	7/8	8	F2	SW	9	09:30	15:30	21600
12	13/03/2017	RMD	None	8/8	10	F1	SW	14	15:50	16:50	3600
12	14/03/2017	RMD	Misty	8/8	2	F1	SW	12	09:40	13:40	14400
11	14/03/2017	RMD	None	3/8	16	F1	W	13	14:00	16:00	7200
12	14/03/2017	RMD	None	5/8	16	F1	SE	11	16:10	17:10	3600
3	14/03/2017	GP	None	1/2	10	F3	W	11	13:10	16:10	10800
3	14/03/2017	GP	None	1/2	10	F3	W	11	13:10	16:10	10800
11	15/03/2017	RMD	None	1/4	16	F1	SE	11	09:35	13:35	14400
10	15/03/2017	RMD	None	8/8	16	F1	SE	11	14:00	17:00	10800
1	15/03/2017	GP	None	0/8	10	F2	SW	7	08:15	14:15	21600
8	16/03/2017	RMD	Light	8/8	5	F2	SW	6	09:40	15:40	21600
8	16/03/2017	RMD	Light	8/8	5	F2	SW	6	09:40	15:40	21600
5	16/03/2017	RMD	None	1/4	20	F1	NW	9	15:50	16:50	3600
5	21/03/2017	RMD	Light	1/2	16	F1	SW	1	10:00	15:00	18000
6	21/03/2017	RMD	Light	8/8	16	F1	SW	5	15:15	17:15	7200
6	21/03/2017	RMD	Light	8/8	16	F1	SW	5	15:15	17:15	7200
6	22/03/2017	RMD	None	8/8	15	F2	N	2	09:50	13:50	14400
10	22/03/2017	RMD	Light	7/8	15	F1	N	5	14:15	17:15	10800
7	23/03/2017	RMD	Misty	8/8	15	F1	N	5	09:40	15:40	21600
2	24/03/2017	GP	None	0/8	10	F1	NE	5	07:15	10:15	10800
4	24/03/2017	GP	None	0/8	10	F2	NE	9	10:30	16:30	21600
2	27/03/2017	GP	None	1/8	5	F1	E	8	07:15	10:15	10800
2	27/03/2017	GP	None	1/8	5	F1	E	8	07:15	10:15	10800
3	05/04/2017	GP	None	8/8	10	F1	NW	10	08:15	11:15	10800
8	05/04/2017	GP	None	8/8	10	F1	NW	10	13:30	16:30	10800
2	06/04/2017	GP	None	8/8	5	F1	NW	8	07:00	10:00	10800
2	06/04/2017	GP	None	8/8	5	F1		16	07:00	10:00	10800
10	08/04/2017	GP	None	8/8	5	F3	S	16	10:20	16:20	21600
10	08/04/2017	GP	None	8/8	5	F3	S	16	10:20	16:20	21600
7	09/04/2017	GP	None	8/8	5	F1	NW	8	07:45	10:45	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
4	09/04/2017	GP	None	8/8	5	F1	NW	10	10:50	13:50	10800
1	10/04/2017	GP	None	8/8	5	F2	NW	8	08:45	11:45	10800
5	10/04/2017	GP	None	7/8	10	F2	NW	10	12:00	15:00	10800
5	10/04/2017	GP	None	7/8	10	F2	NW	10	12:00	15:00	10800
5	10/04/2017	GP	None	7/8	10	F2	NW	10	12:00	15:00	10800
5	10/04/2017	GP	None	7/8	10	F2	NW	10	12:00	15:00	10800
5	10/04/2017	GP	None	7/8	10	F2	NW	10	12:00	15:00	10800
5	10/04/2017	GP	None	7/8	10	F2	NW	10	12:00	15:00	10800
7	10/04/2017	GP	None	1/2	10	F2	NW	12	15:10	18:10	10800
2	11/04/2017	GP	None	8/8	10	F2	NW	7	07:45	10:45	10800
1	12/04/2017	GP	None	8/8	2	F2	NW	9	07:45	10:45	10800
6	12/04/2017	GP	Light	1/4	1	F2	NW	8	11:00	14:00	10800
6	12/04/2017	GP	Light	1/4	1	F2	NW	8	11:00	14:00	10800
6	12/04/2017	GP	Light	1/4	1	F2	NW	8	11:00	14:00	10800
3	17/04/2017	GP	None	8/8	10	F1	NW	9	09:40	12:40	10800
5	17/04/2017	GP	None	8/8	10	F1	NW	9	13:00	16:00	10800
8	18/04/2017	GP	None	8/8	10	F1	NW	10	08:00	11:00	10800
8	18/04/2017	GP	None	8/8	10	F1	NW	10	08:00	11:00	10800
9	18/04/2017	GP	None	7/8	10	F1	S	12	11:00	17:00	21600
6	19/04/2017	GP	None	7/8	5	F1	SW	13	10:45	13:45	10800
6	19/04/2017	GP	None	7/8	5	F1	SW	13	10:45	13:45	10800
4	19/04/2017	GP	None	7/8	5	F1	SW	14	14:00	16:30	10800
12	22/04/2017	GP	None	1/4	5	F1	NE	8	08:30	11:30	10800
12	22/04/2017	GP	None	1/4	5	F1	NE	8	08:30	11:30	10800
11	22/04/2017	GP	None	8/8	10	F1	NE	13	12:30	15:30	10800
11	22/04/2017	GP	None	8/8	10	F1	NE	13	12:30	15:30	10800
11	22/04/2017	GP	None	8/8	10	F1	NE	13	12:30	15:30	10800
11	22/04/2017	GP	None	8/8	10	F1	NE	13	12:30	15:30	10800
12	27/04/2017	GP	None	8/8	10	F2	NW	9	09:50	12:50	10800
12	27/04/2017	GP	None	8/8	10	F2	NW	9	09:50	12:50	10800
12	27/04/2017	GP	None	8/8	10	F2	NW	9	09:50	12:50	10800
11	27/04/2017	GP	None	5/8	10	F2	NW	11	13:00	16:00	10800
11	27/04/2017	GP	None	5/8	10	F2	NW	11	13:00	16:00	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	05/05/2017	GP	None	3/8	10	F2	E	13	11:30	14:30	10800
2	05/05/2017	GP	None	3/8	10	F3	E	14	14:40	17:40	10800
2	05/05/2017	GP	None	3/8	10	F3	E	14	14:40	17:40	10800
2	05/05/2017	GP	None	3/8	10	F3	E	14	14:40	17:40	10800
6	06/05/2017	GP	None	8/8	5	F3	E	10	14:30	17:30	10800
6	06/05/2017	GP	None	8/8	5	F3	E	10	14:30	17:30	10800
1	08/05/2017	GP	None	0/8	10	F1	E	11	06:45	09:45	10800
4	08/05/2017	GP	None	0/8	5	F1	E	17	09:50	12:50	10800
3	08/05/2017	GP	None	3/8	5	F2	NE	18	13:30	16:30	10800
3	08/05/2017	GP	None	3/8	5	F2	NE	18	13:30	16:30	10800
5	09/05/2017	GP	None	0/8	10	F1	SE	8	08:00	11:00	10800
4	09/05/2017	GP	None	3/8	5	F1	E	9	11:30	14:30	10800
3	18/05/2017	GP	None	5/8	10	F1	SW	9	09:10	12:10	10800
5	18/05/2017	GP	None	1/2	10	F2	SW	14	13:30	16:30	10800
8	19/05/2017	KOC	Light	7/8	15	F3	SW	12	10:40	13:40	10800
8	19/05/2017	KOC	Light	7/8	5	F3	SW	12	14:10	17:10	10800
2	20/05/2017	GP	None	7/8	10	F3	S	13	10:15	13:15	10800
6	20/05/2017	GP	None	1/2	10	F3	S	13	13:45	16:45	10800
6	20/05/2017	GP	None	1/2	10	F3	S	13	13:45	16:45	10800
9	22/05/2017	KOC	None	3/4	20	F3	SW	15	11:10	14:10	10800
9	22/05/2017	KOC	None	3/4	20	F3	SW	15	11:10	14:10	10800
9	22/05/2017	KOC	None	3/4	20	F3	SW	15	11:10	14:10	10800
9	22/05/2017	KOC	None	3/4	20	F3	SW	15	11:10	14:10	10800
9	22/05/2017	KOC	None	3/4	20	F3	SW	17	14:40	17:40	10800
	22/05/2017	KOC	None	3/4	20	F3	SW	17	17:56	17:56	
7	22/05/2017	KOC	None	7/8	15	F3	SW	15	18:45	20:15	4800
7	23/05/2017	KOC	None	8/8	10	F3	W	15	09:50	11:20	4800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
10	23/05/2017	KOC	None	8/8	10	F3	W	15	12:00	15:00	10800
	23/05/2017	KOC	None	8/8	10	F3	W	15	15:12	15:12	
10	23/05/2017	KOC	None	5/8	10	F4	W	15	15:30	18:30	10800
10	23/05/2017	KOC	None	5/8	10	F4	W	15	15:30	18:30	10800
10	23/05/2017	KOC	None	5/8	10	F4	W	15	15:30	18:30	10800
10	23/05/2017	KOC	None	5/8	10	F4	W	15	15:30	18:30	10800
10	23/05/2017	KOC	None	5/8	10	F4	W	15	15:30	18:30	10800
10	23/05/2017	KOC	None	5/8	10	F4	W	15	15:30	18:30	10800
11	24/05/2017	GP	None	8/8	2	F1	S	16	11:00	14:00	10800
11	24/05/2017	GP	None	8/8	2	F1	S	16	11:00	14:00	10800
12	24/05/2017	GP	None	3/8	2	F1	S	20	14:30	17:30	10800
12	24/05/2017	GP	None	3/8	2	F1	S	20	14:30	17:30	10800
12	24/05/2017	GP	None	3/8	2	F1	S	20	14:30	17:30	10800
7	24/05/2017	KOC	None	5/8	10	F2	SW	18	10:50	13:50	10800
7	24/05/2017	KOC	None	5/8	10	F2	SW	18	10:50	13:50	10800
11	26/05/2017	GP	None	8/8	10	F2	SE	17	08:00	11:00	10800
12	26/05/2017	GP	None	7/8	2	F2	SE	21	11:30	14:30	10800
1	16/06/2017	GP	Misty	8/8	2	F1	W	13	08:00	11:00	10800
3	16/06/2017	GP	None	8/8	5	F1	W	16	12:30	18:30	21600
4	17/06/2017	GP	None	0/8	10	F2	SW	16	09:00	12:00	10800
1	17/06/2017	GP	None	1/4	10	F1	SW	22	13:30	16:30	10800
2	18/06/2017	GP	None	0/8	10	F1	SW	15	08:30	12:30	14400
2	18/06/2017	GP	None	0/8	10	F1	SW	15	08:30	12:30	14400
4	19/06/2017	GP	None	3/8	10	F1	NE	17	08:00	11:00	10800
4	19/06/2017	GP	None	3/8	10	F1	NE	17	08:00	11:00	10800
10	19/06/2017	GP	None	1/2	5	F1	NE	22	12:30	15:30	10800
10	19/06/2017	GP	None	1/2	5	F1	NE	22	12:30	15:30	10800
10	19/06/2017	GP	None	1/2	5	F1	NE	22	12:30	15:30	10800
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
5	19/06/2017	JD	None	1/4	10	F1	SE	20	10:15	16:45	21600
2	20/06/2017	GP	None	1/2	10	F1	NE	15	08:00	11:00	10800
11	20/06/2017	JD	None	0/8	10	F1	S	21	10:30	17:00	21600
11	20/06/2017	JD	None	0/8	10	F1	S	21	10:30	17:00	21600
11	20/06/2017	JD	None	0/8	10	F1	S	21	10:30	17:00	21600
10	21/06/2017	GP	None	7/8	5	F1	S	18	08:20	12:30	14400
10	21/06/2017	GP	None	7/8	5	F1	S	18	08:20	12:30	14400
10	21/06/2017	GP	None	7/8	5	F1	S	18	08:20	12:30	14400
12	21/06/2017	JD	None	8/8	10	F1	SW	23	10:30	17:00	21600
8	25/06/2017	KOC	None	7/8	15	F3	W	16	14:05	17:05	10800
8	25/06/2017	KOC	None	8/8	10	F2	NW	15	17:35	20:35	10800
6	26/06/2017	KOC	None	8/8	15	F2	SE	15	09:15	12:15	10800
6	26/06/2017	KOC	None	8/8	15	F2	SE	15	09:15	12:15	10800
6	26/06/2017	KOC	Misty	8/8	5	F2	SE	14	12:45	15:45	10800
7	26/06/2017	KOC	Misty	8/8	3	F3	SE	14	16:15	17:15	3600
9	27/06/2017	KOC	None	7/8	15	F3	S	18	10:40	13:40	10800
9	27/06/2017	KOC	None	3/4	15	F3	S	18	14:10	17:10	10800
7	28/06/2017	KOC	None	8/8	15	F2	NW	17	11:50	14:50	10800
7	28/06/2017	KOC	None	8/8	15	F2	NW	16	15:25	17:25	7200
1	14/07/2017	GP	None	7/8	10	F2	W	12	07:50	13:30	21600

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
3	14/07/2017	GP	None	1/2	10	F2	W	20	14:30	17:30	10800
3	16/07/2017	GP	None	1/2	10	F1	NW	14	09:00	12:00	10800
5	16/07/2017	GP	None	7/8	10	F1	NW	17	12:15	15:15	10800
2	17/07/2017	GP	None	1/8	10	F1	SE	14	07:10	10:10	10800
2	17/07/2017	GP	None	1/8	10	F1	SE	14	07:10	10:10	10800
4	17/07/2017	GP	None	0/8	10	F1	SE	20	10:30	16:30	21600
2	20/07/2017	GP	Occasional showers	3/4	5	F2	SW	11	08:30	11:30	10800
5	24/07/2017	GP	None	1/4	10	F1	NW	15	08:30	11:30	10800
5	24/07/2017	GP	None	1/4	10	F1	NW	15	08:30	11:30	10800
5	24/07/2017	GP	None	1/4	10	F1	NW	15	08:30	11:30	10800
1	04/08/2017	RMD	Light	1/2	5	F1	W	15	10:50	16:50	21600
11	10/08/2017	RMD	None	8/8	10	F1	W	14	11:00	14:00	10800
12	10/08/2017	RMD	None	8/8	10	F1	W	15	14:15	16:15	7200
11	17/08/2017	RMD	None	3/4	5	F1	SW	17	10:00	13:00	10800
12	17/08/2017	RMD	Occasional showers	3/4	5	F1	SW	17	13:15	17:15	14400
2	07/08/2017	KOC	Dry	7/8	15	F3	W	16	12:15	15:15	10800
3	08/08/2017	KOC	Occasional showers	3/4	10	F2	N	12	12:00	15:00	10800
10	09/08/2017	GP	none	6/8	10	F3	N	14	08:15	14:15	21600
6	09/08/2017	GP	none	2/8	10	F2	NW	18	14:45	17:45	10800
8	10/08/2017	GP	none	8/8	5	F2	SW	13	09:30	12:30	10800
9	10/08/2017	GP	none	5/8	10	F2	SW	17	13:00	16:00	10800
7	11/08/2017	GP	none	7/8	5	F2	NW	15	08:00	14:00	21600
5	11/08/2017	GP	none	4/8	10	F2	NW	17	14:30	17:30	10800
4	15/08/2017	GP	Occasional showers	7/8	10	F2	SW	12	07:15	10:15	10800
5	15/08/2017	GP	Occasional showers	6/8	10	F2	SW	15	10:30	13:30	10800
6	15/08/2017	GP	none	4/8	10	F2	SW	16	14:00	17:00	10800
4	17/08/2017	GP	Occasional showers	7/8	10	F2	S	14	07:30	10:30	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
8	17/08/2017	GP	Occasional showers	7/8	10	F2	S	15	11:00	14:30	10800
9	17/08/2017	GP	Occasional showers	6/8	10	F3	SW	18	15:00	18:00	10800

Table 18 Details of timing, duration and weather conditions for vantage point surveys undertaken during the non-breeding season in 2017/2018 (September 2017 to February 2018 inclusive).

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	05/09/2017	GP	Light drizzle	8/8	2	F1	W	13	10:20	13:20	10800
2	05/09/2017	GP	dry	3/4	10	F2	SW	16	14:00	17:00	10800
4	06/09/2017	GP	dry	1/2	5	F2	W	12	08:30	11:30	10800
3	06/09/2017	GP	dry	7/8	2	F2	W	14	12:00	15:00	10800
1	06/09/2017	GP	dry	8/8	2	F2	SW	15	15:15	18:15	10800
3	07/09/2017	GP	Light drizzle	8/8	5	F3	W	14	14:30	17:30	10800
5	08/09/2017	GP	Occasional showers	1/2	10	F2	W	13	09:10	12:10	10800
4	08/09/2017	GP	Occasional showers	7/8	5	F2	W	14	12:30	15:30	10800
5	13/09/2017	GP	Occasional showers	1/2	10	F3	W	9	10:00	13:00	10800
2	13/09/2017	GP	Occasional showers	7/8	10	F2	W	11	13:30	16:30	10800
7	11/09/2017	RMD	Occasional showers	8/8	20	F2	W	13	11:05	17:05	21600
7	11/09/2017	RMD	Occasional showers	8/8	20	F2	W	13	11:05:00	17:05	21600
7	11/09/2017	RMD	Occasional showers	8/8	20	F2	W	13	11:05	17:05	21600

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
7	11/09/2017	RMD	Occasional showers	8/8	20	F2	W	13	11:05	17:05	21600
8	12/09/2017	RMD	Light	5/8	15	F2	S	11	10:10	16:10	21600
10	04/09/2017	OOG	None	8/8	2	F2	S	16	13:30	15:30	7200
9	05/09/2017	OOG	None	5/8	10	F1	SW	18	10:00	13:00	10800
11	05/09/2017	OOG	None	5/8	10	F2	SW	19	13:50	16:50	10800
11	06/09/2017	OOG	None	5/8	5	F1	W	17	09:50	12:50	10800
9	06/09/2017	OOG	None	5/8	5	F2	SW	19	13:50	16:50	10800
12	07/09/2017	OOG	Light	8/8	2	F2	W	14	09:45	12:45	10800
12	07/09/2017	OOG	None	7/8	5	F2	W	15	13:15	16:15	10800
6	11/09/2017	OOG	None	3/4	5	F2	W	13	11:20	17:20	21600
10	12/09/2017	OOG	None	5/8	5	F2	S	15	11:30	17:30	21600
1	12/10/17	GP	dry	6/8	10	F1	SW	7	07:30	10:30	10800
2	12/10/17	GP	dry	5/8	10	F3	SW	12	11:00	14:00	10800
4	13/10/17	GP	dry	8/8	5	F2	SW	16	08:10	11:10	10800
5	13/10/17	GP	dry	8/8	2	F2	SW	17	12:30	15:30	10800
3	14/10/17	GP	dry	8/8	2	F3	SE	15	16:20	19:20	10800
1	17/10/17	GP	dry	3/8	10	F1	SW	11	11:15	14:15	10800
3	18/10/17	GP	dry	8/8	10	F2	E	9	10:00	13:00	10800
4	20/10/17	GP	dry	8/8	5	F1	SW	6	10:10	13:10	10800
2	22/10/17	GP	dry	8/8	5	F2	SW	10	10:00	13:00	10800
5	23/10/17	GP	Occasional showers	7/8	5	F1	S	13	13:00	16:00	10800
6	23/10/17	GP	dry	8/8	2	F1	SW	14	16:15	19:15	10800
6	25/10/17	GP	dry	8/8	5	F1	SW	13	16:15	19:15	10800
7	14/10/17	HW	dry	8/8	2	F3	SE	15	8:00	14:00	21600
8	17/10/17	HW	dry	3/8	10	F1	SW	11	8:00	14:00	21600
9	18/10/17	HW	dry	8/8	10	F2	E	9	9:00	15:00	21600
10	20/10/17	HW	dry	8/8	5	F1	SW	6	9:00	15:00	21600
11	22/10/17	HW	dry	8/8	5	F2	SW	10	9:00	15:00	21600
17	23/10/17	HW	Occasional showers	7/8	5	F1	S	13	9:00	15:00	21600
10	07/11/2017	GP	dry	3/8	5	F2	W	5	07:00	13:00	21600

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
11	07/11/2017	GP	Occasional showers	5/8	2	F2	W	6	14:30	17:30	10800
11	07/11/2017	GP	Occasional showers	5/8	2	F2	W	6	14:30	17:30	10800
1	08/11/2017	GP	Occasional showers	4/8	5	F1	SW	4	07:00	13:00	21600
2	09/11/2017	GP	dry	2/8	10	F1	NW	9	11:30	17:30	21600
6	13/11/2017	GP	drizzle	8/8	5	F1	SW	7	11:15	17:15	21600
3	15/11/2017	GP	misty	8/8	2	F1	SE	7	07:15	13:15	21600
11	16/11/2017	GP	dry	1/8	10	F1	NW	8	14:15	17:15	10800
11	16/11/2017	GP	dry	1/8	10	F1	NW	8	14:15	17:15	10800
5	22/11/2017	KOC	Occasional showers	8/8	4	F1	NE	11	10:00	13:00	10800
5	22/11/2017	KOC	Dry	8/8	5	F1	N	10	10:00	13:00	10800
4	22/11/2017	KOC	Light	8/8	2	F2	N	7	13:30	16:30	10800
4	23/11/2017	KOC	None	1/8	15	F3	W	5	10:00	13:00	10800
4	23/11/2017	KOC	None	3/8	10	F3	W	6	10:00	13:00	10800
4	23/11/2017	KOC	None	3/8	10	F3	W	6	10:00	13:00	10800
4	23/11/2017	KOC	None	3/8	10	F3	W	6	10:00	13:00	10800
5	23/11/2017	KOC	None	3/4	15	F2	W	6	13:30	16:30	10800
5	23/11/2017	KOC	None	7/8	15	F2	W	6	13:30	16:30	10800
5	23/11/2017	KOC	None	7/8	15	F2	W	6	13:30	16:30	10800
5	23/11/2017	KOC	None	3/4	15	F2	W	6	13:30	16:30	10800
5	23/11/2017	KOC	None	3/4	8	F1	W	4	13:30	16:30	10800
7	28/11/2017	OOG	None	5/8	5	F2	N	6	03:00	05:00	7200
8	29/11/2017	OOG	None	1/4	2	F1	N	1	07:15	09:15	7200
9	29/11/2017	OOG	None	3/4	2	F1	N	5	15:00	17:30	7200
9	30/11/2017	OOG	None	7/8	2	F1	NW	3	07:15	09:15	7200
8	28/11/2017	SD	None	5/8	4	F3	N	4	15:00	17:00	7200
12	30/11/2017	SD	None	1/4	3	F3	N	2	07:00	09:14	7200
7	29/11/2017	SD	None	1/4	4	F3	N	3	07:00	09:15	7200
12	29/11/2017	SD	None	1/4	3	F3	N	4	15:12	17:12	7200
12	05/12/2017	OOG	None	8/8	5	F1	S	8	09:05	15:05	21600

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
11	05/12/2017	OOG	None	7/8	2	F1	S	10	15:20	17:20	7200
11	06/12/2017	OOG	Heavy Showers	8/8	2	F1	S	10	07:30	09:30	7200
5	06/12/2017	OOG	Misty	8/8	2	F1	S	10	10:05	16:05	21600
5	06/12/2017	OOG	Misty	8/8	2	F1	S	10	10:05	16:05	21600
1	01/12/2017	GP	dry	1/8	10	F1	NW	3	11:00	17:00	21600
6	03/12/2017	GP	dry	7/8	10	F1	W	7	10:30	13:30	10800
10	03/12/2017	GP	dry	6/8	10	F1	W	8	14:00	17:00	10800
10	03/12/2017	GP	dry	6/8	10	F1	W	8	14:00	17:00	10800
4	05/12/2017	GP	dry	8/8	10	F1	SW	8	11:00	17:00	21600
3	07/12/2017	GP	dry	4/8	5	F1	W	5	11:00	17:00	21600
10	09/12/2017	GP	dry	8/8	10	F1	SW	4	09:00	12:00	10800
6	09/12/2017	GP	dry	8/8	10	F1	SW	4	14:00	17:00	10800
2	21/12/2017	GP	Occasional showers	8/8	1	F1	SW	10	11:00	17:00	21600
8	06/12/2017	SD	Light	8/8	2	F4	SW	8	08:30	16:30	21600
8	06/12/2017	SD	Light	8/8	2	F4	SW	8	08:30	16:30	21600
8	06/12/2017	SD	Light	8/8	2	F4	SW	8	08:30	16:30	21600
8	06/12/2017	SD	Light	8/8	2	F4	SW	8	08:30	16:30	21600
8	06/12/2017	SD	Light	8/8	2	F4	SW	8	08:30	16:30	21600
8	06/12/2017	SD	Light	8/8	2	F4	SW	8	08:30	16:30	21600
7	07/12/2017	SD	Dry	1/8	3	F1	NW	4	08:30	16:30	21600
7	07/12/2017	SD	Dry	1/8	3	F1	NW	4	08:30	16:30	21600
7	07/12/2017	SD	Dry	1/8	3	F1	NW	4	08:30	16:30	21600
9	08/12/2017	SD	Dry	1/8	4	F1	NW	1	08:30	16:30	21600
9	08/12/2017	SD	Dry	1/8	4	F1	NW	1	08:30	16:30	21600
9	08/12/2017	SD	Dry	1/8	4	F1	NW	1	08:30	16:30	21600
9	08/12/2017	SD	Dry	1/8	4	F1	NW	1	08:30	16:30	21600
12	02/01/2018	SD	Light	8/8	2	F3	SW	8	10:00	16:00	21600
9	03/01/2018	SD	Light	8/8	1	F4	SW	6	09:00	15:00	21600
7	04/01/2018	SD	Light	8/8	2	F3	SW	5	09:00	15:00	21600
2	05/01/2018	SD	None	5/8	3	F1	SW	2	09:00	15:00	21600
5	02/01/2018	OOG	Misty	7/8	2	F1	W	9	10:15	16:15	21600

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	03/01/2018	OOG	Misty	3/4	3	F4	W	5	09:40	15:40	21600
1	03/01/2018	OOG	Misty	3/4	3	F4	W	5	09:40	15:40	21600
8	15/01/2018	OOG	Heavy Showers	7/8	4	F2	W	8	10:05	16:05	21600
4	19/01/2018	OOG	snow showers	7/8	2	F2	W	4	10:05	16:05	21600
4	19/01/2018	OOG	snow showers	7/8	2	F2	W	4	10:05	10:05	21600
3	03/01/2018	GP	Occasional showers	8/8	1	F4	W	6	11:00	17:00	21600
6	05/01/2018	GP	Occasional showers	3/4	5	F2	SW	5	11:00	17:00	21600
10	06/01/2018	GP	dry	3/8	10	F2	NE	4	09:30	12:30	10800
11	06/01/2018	GP	dry	1/2	10	F2	NE	4	14:00	17:00	10800
11	06/01/2018	GP	dry	1/2	10	F2	NE	4	14:00	17:00	10800
11	06/01/2018	GP	dry	1/2	10	F2	NE	4	14:00	17:00	10800
11	06/01/2018	GP	dry	1/2	10	F2	NE	4	14:00	17:00	10800
11	06/01/2018	GP	dry	1/2	10	F2	NE	4	14:00	17:00	10800
10	22/01/2018	GP	dry	7/8	2	F1	SW	6	10:30	13:30	10800
11	22/01/2018	GP	dry	7/8	2	F1	SW	7	14:30	17:30	10800
11	22/01/2018	GP	dry	7/8	2	F1	SW	7	14:30	17:30	10800
11	22/01/2018	GP	dry	7/8	2	F1	SW	7	14:30	17:30	10800
3	01/02/2018	GP	Occasional showers	1/2	10	F3	NW	5	12:00	18:00	21600
6	02/02/2018	GP	dry	1/2	10	F1	NW	3	07:30	13:30	21600
10	04/02/2018	GP	dry	0	10	F1	NW	1	07:30	13:30	21600
11	04/02/2018	GP	dry	1/2	10	F2	NE	6	15:00	18:00	10800
11	04/02/2018	GP	dry	1/2	10	F2	NE	6	15:00	18:00	10800
11	04/02/2018	GP	dry	1/2	10	F2	NE	6	15:00	18:00	10800
11	06/02/2018	GP	dry	1/2	10	F2	NW	3	10:00	13:00	10800
5	02/02/2018	OOG	None	1/4	10	F1	W	6	10:40	16:40	21600
12	05/02/2018	OOG	None	3/4	10	F2	SE	4	10:10	16:10	21600
4	06/02/2018	OOG	None	1/8	10	F2	NW	1	09:50	12:50	10800

REFERENCE DOCUMENTS

VP Name	Date	Observer	Rain	Cloud 0/8 = no cloud 8/8 = fully overcast	Visibility (km)	Wind Speed (Bft)	Wind Direction	Temp (Deg C)	Start Time	End Time	Duration of survey (s)
1	06/02/2018	OOG	None	7/8	10	F2	N	3	13:05	16:05	10800
1	06/02/2018	OOG	None	7/8	10	F2	N	3	13:05	16:05	10800
1	06/02/2018	OOG	None	7/8	10	F2	N	3	13:05	16:05	10800
4	07/02/2018	OOG	Light	8/8	5	F1	SW	0	10:00	13:00	10800
1	07/02/2018	OOG	Light	8/8	5	F1	SW	4	13:30	16:30	10800
8	01/02/2018	SD	None	3/4	10	F1	NW	3	09:30	16:00	21600
8	01/02/2018	SD	None	3/4	10	F1	NW	3	09:30	16:00	21600
8	01/02/2018	SD	None	3/4	10	F1	NW	3	09:30	16:00	21600
8	01/02/2018	SD	None	3/4	10	F1	NW	3	09:30	16:00	21600
8	01/02/2018	SD	None	3/4	10	F1	NW	3	09:30	16:00	21600
8	01/02/2018	SD	None	3/4	10	F1	NW	3	09:30	16:00	21600
9	02/02/2018	SD	None	1/8	10	F1	NW	2	10:00	16:00	21600
7	05/02/2018	SD	None	1/2	10	F1	SE	2	10:30	16:30	21600
2	06/02/2018	SD	None	1/4	10	F1	SE	1	10:30	16:30	21600
2	06/02/2018	SD	None	1/4	10	F1	SE	1	10:30	16:30	21600
2	06/02/2018	SD	None	1/4	10	F1	SE	1	10:30	16:30	21600
2	06/02/2018	SD	None	1/4	10	F1	SE	1	10:30	16:30	21600

REFERENCE DOCUMENTS

A8-1.2.3.4 Aquatic Ecology

Following a comprehensive desktop review to identify watercourses along the UWF Grid Connection, various field surveys took place.

A watercourse characteristics survey of crossing locations along the UWF Grid Connection route (by INIS Ecologists and members of the HES team) was carried out visually on the 17th, 18th and 26th of January 2017 during which the following parameters were recorded at each watercourse crossing point:

- *Grid coordinates of the crossing point;*
- *Watercourse feature i.e. drain, stream or river;*
- *Crossing type e.g. existing culvert, new crossing;*
- *Channel width and depth (m);*
- *Substrate type - listing substrate fractions in order of dominance i.e. large rocks, cobble, gravel, sand, mud, etc.*
- *Target notes where necessary on additional fisheries -influencing variables such as extent of riffle and glide/Bank stability.*

For additional information see Chapter 11: Water and relevant Appendices.

Surveys of watercourse crossing locations located on haulage routes associated with the UWF Grid Connection were carried out on the 7th and 8th June, 2017. Surveys of watercourse crossings pertaining to UWF Related Works were carried out on 17th of July, 2017. There are no watercourse crossings for the UWF Replacement Forestry whilst confirmatory surveys of a number of watercourses associated with the Upperchurch Windfarm were undertaken on the 9th and 13th September 2017. These surveys included biological sampling (Q-values) and fisheries assessments for watercourses draining the Upperchurch Windfarm at or in close proximity to the following locations: WW31; WW32; WW2, in addition to 4 locations previously identified in studies for Upperchurch Windfarm (MWP6; MWP2; MWP3; MWP4). The character of watercourses within the study area, including tributaries and main stem channel evaluations were completed for the upper reaches of the Clodiagh and Owenbeg Rivers.

Evaluations of any watercourses pertinent to UWF Other Activities were carried out visually in conjunction with site visits on 25th of July, 2017 however no watercourse crossings are proposed for this project element.

Watercourses have previously been characterised into 4 classes; see Section 11.2.6.1 of Chapter 11 Water.

Following the above broad characterisations, and using a combination of the following Best Practice we evaluated each watercourse crossing for fisheries and assigned a fisheries importance rating of Optimal, Sub-Optimal or Poor. We note that instances of marginal fisheries value (typically between Sub-Optimal and Poor) were subsumed into the Sub-Optimal category to allow for more robust evaluation of effects. Best Practice literature utilised was as follows:

- Barbour, M.T. and Stribling, J.B. (1991) Use of Habitat Assessment in Evaluating the Biological Integrity of Stream Communities. In: Methods in Stream Ecology (Eds. Hauer, F.R. and Lamberti, G.A. Academic Press.
- Kelly & King (2001) A review of the ecology and distribution of three lamprey species, Lampetra fluviatilis (L.), Lampetra planeri (Bloch), and Petromyzon marinus (L.): A context for conservation and biodiversity considerations in Ireland. Biology and the Environment. 101B(3):165-185.

- Kennedy, GJA & Strange, CD (1986) The effects of intra- and inter-specific competition on the distribution of stocked juvenile Atlantic salmon, Salmo salar L., in relation to depth and gradient in an upland trout, Salmo trutta L., stream. J. Fish. Biol., 29(2):199-214.
- Greenberg, L.A. and Dahl, J. 1998. Effect of habitat type on growth and diet of brown trout (Salmo trutta L.) in stream enclosures. Fisheries Management & Ecology 5: 331-348.
- Hatfield, T. & Bruce, J. (2000) Predicting Salmonid Habitat–Flow Relationships for Streams from Western North America. North American Journal of Fisheries Management 20:1005–1015, 2000
- O'Grady, M.F., Curtin, J (1993) The Enhancement of drained salmonid rivers in Ireland. A bioengineering perspective. Hydroecol. Appl., 5(2):7-26.

Watercourse Characterisations and equivalent fisheries Evaluations (following Best Practice) in addition to selected photographs of rivers and their habitats are presented in illustrative plates in Section 8.2.3.3.

A8-1.2.3.5 Bats

Scoping of surveys

The key sensitivities of bats are the destruction or disturbance of their roosting places, and the modification of their commuting routes and foraging habitats. During the day, bats roost in man-made structures (typically houses, farm buildings and bridges), mature trees and caves. They may suffer direct effects due to the destruction or modification of their roosts (e.g. the demolition of a house or felling of a tree), or indirect effects due to disturbance of the area surrounding a roost (e.g. illumination of exit / entry points, or removal of surrounding vegetation). They are most sensitive to effects during their maternity and hibernation periods, which are from May to August and November to March, respectively. During the night, bats 'commute' from their roosts to a suitable feeding area (which may be several kilometres from their roost), and spend most of the night foraging for insect prey. They typically favour linear habitat features (e.g. hedgerows and forest edges) for commuting and foraging, and usually avoid brightly-lit areas.

Survey aims

The aims of the bat surveys were to:

- Assess the bat roost suitability of buildings and mature trees that will be directly affected by the Whole UWF Project
- Identify any significant bat roosts (particularly maternity and hibernation roosts) in the vicinity of the Whole UWF Project
- Identify any important commuting routes / feeding areas along hedgerows, treelines or other linear features that will be severed or otherwise modified by the Whole UWF Project.

Preliminary evaluation

A Preliminary Ecological Appraisal was carried out for all buildings within 150m of the Whole UWF Project, using the approach outlined in Section 4.3 of Collins (2016). All buildings were assigned a suitability category of negligible, low, moderate or high suitability, based on the age and condition of structural features used by roosting bats (e.g. roof tiles, attic spaces, soffit / fascia boards, walls).

A preliminary ground-level inspection was carried out for all mature trees within 50m of the Whole UWF Project, using a high-powered torch and binoculars (Steiner SkyHawk 3.0 10x42). The aim of the ground-level inspection was to identify any potential roost features (cavities or crevices on trunks or limbs) and evidence of bats (e.g. droppings, fur-oil stains at access points). Coniferous trees within plantations were not inspected, because they are rarely large enough to have any features suitable for bats, and because it is standard forestry practice to remove any trees that have obvious signs of damage and disease; as a result, trees within plantations typically have negligible suitability for bats.

Visual inspections were also carried out for bridges within 150m of the Whole UWF Project material haul routes, using the methods outlined in Collins (2016) and Billington & Norman (1997). Although bridges were eventually scoped out of the impact assessment, the surveys were carried out before it had been confirmed that no bridge strengthening / modifications were required and were thus pre-cautionary in nature. All watercourse crossings along local roads and overlapping material haulage routes (i.e. excluding national and regional roads) were characterised by type (e.g. culvert, bridge), building materials (e.g. concrete, stone), dimensions, condition, and the presence of obvious cracks and crevices, and were assigned a roost suitability category as outlined above. Records of bat roosts and bat activity within 10km of the Whole UWF Project were obtained from Bat Conservation Ireland.

Surveys of potential roosts

Follow-up surveys were carried out for all features of high or moderate roost suitability that were considered to be at risk of direct or indirect effects, subject to the approval of landowners. In most cases this included a preliminary roost appraisal and a presence / absence survey, as defined in Collins (2016). Where evidence of bats was found, roost characterisation surveys (Collins, 2016) were carried out. If droppings were found but could not be identified, samples were collected and sent for DNA analysis at the Department of Chemical and Life Sciences at the Waterford Institute of Technology.

Presence / absence surveys and roost characterisation surveys involved a manual detector survey at dusk and dawn using an EM3+ bat detector (Wildlife Acoustics); this is a high-specification modern bat detector that is fit for purpose. The surveyor focussed on the building / feature for the majority of the survey period, but if no bats were observed entering the structure at dawn then the observer took the opportunity to track passing bats to other roosts in the surrounding area (i.e. a back-tracking survey, Collins 2016).

Four buildings of moderate or high suitability in the vicinity of the UWF Grid Connection were surveyed on multiple occasions in order to cover the maternity period (July / August 2016), the mating season (September / October 2016) and the hibernation period (December 2016). Five additional buildings in the vicinity of UWF Related Works were surveyed in July/August 2017 to cover the maternity period.

Evaluation of foraging areas / commuting routes

Surveys using automated detectors

Bat activity surveys were carried out at out at 27 locations, comprising 21 initially-proposed temporary compounds or set down locations, and 6 treelines / hedgerows with high suitability as bat foraging / commuting habitat.. Surveys were undertaken using automated Anabat Express bat detectors (Titley Scientific, purchased in 2015-16); these are high-specification modern bat detectors that are fit for purpose. External microphones were mounted on canes at a height of approximately 1.5m in order to obtain 'clean' recordings that were not affected by surrounding vegetation.

One detector was placed in each location for two nights in the mid-summer period (June – August 2016) and two nights in the autumn season (September / October 2016). Night length ranged from 7.15 hours in late June to 12.45 hours in early October, giving a total survey effort of approx. 35-40 hours at each sampling point. We consider that this survey effort was sufficient to provide a good representation of bat activity during their most active periods, that it was proportionate to the potential effects of the Whole UWF Project (as discussed in Section 2.2.5 of Collins (2016) and included sampling of bat activity within the zone of effect for both the UWF Grid Connection and UWF Related Works

Surveys were carried out during suitable weather conditions, i.e. minimum temperatures above 10°C, average winds of less than 4m/s and little or no rainfall. There was wet weather or high winds on some of the survey nights in September, so the survey was extended until two nights of suitable conditions were obtained.

Species identification and interpretation of data

Sonograms from Anabat Express detectors were obtained in the 'zero-crossing' format and viewed using AnalookW software (Corben 2014). Species were identified with reference to British Bat Calls: A Guide to Species Identification (Russ 2012) based primarily on frequency and call shape, but also with reference to call slope for *Myotis* spp. Social calls were classified as unidentified bats unless they closely matched the examples provided in Russ (2012).

It is acknowledged that *Myotis* spp. can have very similar calls, and that the classification of sonograms can be imprecise, so all Myotis records in this document should be considered as conferre records, i.e. *Myotis* cf *daubentonii*. There can also be overlaps in call frequency between *Pipistrellus* spp. - calls with a CF component at 50 kHz may be either soprano pipistrelle or common pipistrelle, while calls at 40 kHz may be either common pipistrelle or Nathusius' pipistrelles – but in most cases, it is possible to determine the species based on call characteristics and/or other calls immediately before or after the recording. If a bat pass could not be confidently identified to species level it was recorded as an unidentified bat, or identified only to genus level (e.g. *Myotis* spp.).

Calculation and comparison of bat activity indices

In order to standardise bat activity between the mid-summer and autumn survey periods, results are displayed as a 'Bat Activity Index', which is the total number of bat passes divided by the number of hours per night (Hundt, 2012). This was calculated from sunset to sunrise, using publicly-available data from www.timeanddate.com.

At present there is not a standard system to categorise bat activity as low, moderate or high, because the results vary depending on the species involved and the location of the site. For the purposes of this report we use a bespoke system to discuss and compare levels of bat activity at the site, as outlined in the Table 19. This approach uses standardised terms (e.g. occasional, frequent) to categorise bat activity indices within certain ranges; the average time interval between passes is also provided to give a more-intuitive interpretation of the terms.

Table 19 Characterisation of Bat Activity Indices

Bat Activity Index	Average interval between calls	Terms of characterisation
<2	> 30 minutes	Negligible
2 - 12	5 – 30 minutes	Occasional
12 – 60	1 – 5 minutes	Frequent
>60	< 1 minute	Near-constant

Valuation of ecological features and assessment of impacts

Impacts were assessed using the Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2016) and Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2017). Reference was also made to Wray *et al.,* (2010) with regards to the evaluation of roosts and commuting routes / foraging areas.

Results of Bat Surveys are presented in Section 8.2.3.4.

A8-1.2.3.6 Non-Volant Mammals

Surveys for all legally protected non-volant mammal species were undertaken within a 50m buffer of the UWF Grid Connection, with the exception of otter as detailed below. The main survey was undertaken on 8th – 11th March 2016. Additional surveys were undertaken on 29th August 2016, 29th September 2016 and 5th/6th April 2017. Mammal surveys of UWF Related Works, UWF Replacement Forestry and UWF Other Activities overlapped dates of Habitat Surveys as described in Section 8.2.2.1.

Otters

Otter surveys followed the NRA *Guidelines for Treatment of Otters During Construction of National Road Schemes* (NRA, 2006), which state that, although there are no seasonal constraints for otter surveys, any dense vegetation (especially in summer) can reduce success in the identification of otter holts or couches. Hence these surveys were scheduled for winter months 2016/17 in order to optimize detection of otters within the study area.

Guidance on the extent of the study area for otters was taken from the *British Highways Agency's Nature Conservation Advice in Relation to Otters HA8199* (Highways Agency, 1999) which dictates a linear search of 300m upstream and downstream of each watercourse crossing is undertaken.

Badgers

According to the NRA *Guidelines for the Treatment of Badgers Prior to Construction of National Road Schemes* (NRA, 2005), survey of setts within 50m of the proposed works location is required. Badger surveys are significantly constrained by vegetative cover and season, and are best conducted from November to April (NRA, 2005). In accordance with NRA guidance, all areas were systematically searched for setts and all hedgerows and boundaries were checked comprehensively by Inis ecologists. Badger territorial activity is high from mid-January to March and surveys at this time are most efficient in identification of badger paths, latrines and feeding signs.

Other Mammals

The following field signs of all mammals were recorded during non-volant mammal surveys within the study area:

- Well-used pathways;
- Prints/tracks;
- Scat/spraints/droppings;
- Signs of feeding (foraged pine cones, badger snuffle holes)
- Places of shelter and features or areas likely to be of particular value as foraging resources (NRA 2004).

Photographs and detailed notes were also recorded for each feature and mapped using ArcGIS 10.4.

A8-1.2.3.7 General Birds

The receiving environment for Whole UWF Project includes typical upland habitats in the Irish context in addition to an improved agricultural landscape.

Breeding Bird Surveys

Breeding season bird transects were carried out during May/June 2016 and April/June 2017 at seven transects along the UWF Grid Connection (Table 20).

Table 20 Details of breeding bird transects undertaken along transects 1 to 7 during the breeding season of 2016 and 2017.

Year	Visit Number	Dates
2016	1 (Early season)	8th, 11th, 12th and 13th May
	2 (Late season)	8th, 9th and 11th June
2017	1 (Early season)	5th, 6th, 7th and 27th April
	2 (Late season)	19th, 20th, 21st and 22nd June

The number of transects was defined using Best Practice guidance from Birdwatch Ireland i.e.:

$\sqrt{n} + 1$, where n = total length of the line (31km). Therefore, $\sqrt{31.7} + 1 = 6.6km$ of transects;

Note: The calculation of numbers of transects required is based on a larger length of 31km as oppose to the actual length of 28km, to account for any variation or changes during the iterative design process. A cautionary approach was taken.

Therefore, 7 no. 1 km transects were completed.

Data was recorded using standard Countryside Bird Survey (CBS) methodology (Birdwatch Ireland, 2012). The conservation status of each species recorded during the field surveys was assessed using the Birds of Conservation Concern in Ireland list (BoCCI) (Colhoun and Cummins, 2013) in addition to relevant national or international legal designations.

Available data on breeding birds within the EIS documentation for the Upperchurch Windfarm was reviewed within the context of overlap with the locations of UWF Related Works, UWF Replacement Forestry and UWF Other Activities. Due to the continuity and overlap of habitat types present throughout the respective elements, a sufficient representative sample of breeding birds is considered to have been achieved through both the results of the current study and previously conducted studies for the Upperchurch Windfarm.

Winter Bird Surveys

Bird transects were also carried out on the same seven transects during the non-breeding season of 2016/17 (Table 21) and 2017/18 (Table 22). The utilised methodology included walked transects and short watches from suitable vantage points to record bird species within the study area during the non-breeding season.

Table 21 Details of bird surveys undertaken along transects 1 to 7 during the non-breeding season of 2016/17.

Month	Dates
November 2016	28th, 29th and 30th
December 2016	15th, 16th, 17th and 23rd
January 2017	19th and 20th
February 2017	22nd and 23rd

Table 22 Details of bird surveys undertaken along transects 1 to 7 during the non-breeding season of 2017/18. (November 2017 to February 2018)

Month	Dates
November 2017	28th and 29th
December 2017	
January 2018	3rd, 10th, 11th and 12th
February 2018	3rd, 5th, 8th

Red Grouse Surveys

Tape playback counts were undertaken on the 23rd and 30th March 2017, under licence from NPWS, on suitable habitat on the UWF Grid Connection following the methodology outlined in Bibby *et al.,* (2000) and Cummins *et al.,* (2010).

The tape lure play-back method involves walking a transect line across the site while playing the call of a male Red Grouse every 250m and recording the territorial response calls of any male Red Grouse present within earshot of the transect line. The grid coordinates of any responding birds are recorded together with any associated behaviour. If the responding bird could not be visually located but could be aurally heard, the approximate location of the bird was recorded and plotted on a map. This is standard and the most effective method used to detect the presence of red grouse onsite prior to the breeding season.

In addition to the tape lure method, any evidence of red grouse including feathers and droppings, were noted and mapped. If droppings were encountered they were recorded as fresh roost sites (pair or single), old roost sites (pair or single) or dropping sites (fresh or old). These details are the primary indicators in determining active pairs of red grouse accurately within the study plot.

Analysis of fresh dropping sites should be carried out to show the rough extent of territories and the number of red grouse within the territory [i.e. paired (two roosts) or unpaired (single roosts) males]. It is necessary to establish whether droppings are old or fresh to eliminate any pre-pair formation locations.

Roost sites comprise of a heap of droppings. A pair roost will consist of two heaps of droppings spaced up to one meter apart (occasionally 1-3 meters apart). Roosts are the most likely to have the 'soft droppings', a

different type of dropping excreted from the grouses two blind guts. This means that there will be two 'soft droppings' per bird, these are classic indicators of fresh roosts (Murray and Bridge, 1997).

Merlin Surveys

Breeding Merlin surveys were undertaken across four months throughout the breeding season (April - July 2017) in suitable habitat at Bleanbeg Bog (identified as the most likely habitat to hold breeding birds based on scoping) with four-week intervals between surveys (Table 23).

Table 23 Dates on which Merlin surveys were carried out at Bleanbeg Bog during the breeding season of 2017.

Visit No.	Date
1	27th April
2	30th May
3	22nd June
4	31st July

Prior to the first visit, all areas identified as unsuitable for breeding Merlin (open water, urban areas, farmland, enclosed pastures and areas above 700m) were excluded from the target search area. The remaining habitat was walked using parallel transects 120m apart and intensively searched for evidence of Merlin. Features such as suitable nest sites (old corvid nests) and suitable perches (posts, hummocks, boulders, remnant peat stands and root mats) were noted and the grid reference recorded.

Recorded information/evidence (if found) was defined in the form of secondary Merlin evidence (whitewash, pellets, feathers), prey remains (feather spots, moth wings, prey remains etc.), nests (possible or occupied) and direct observations (calling birds, displaying birds, hunting birds, inter-specific aggression etc.).

Locations of collected evidence (if any) or observations (if any) are recorded for subsequent visits and prey remains and pellets were collected, placed in a bag and labelled with the date, site and location (for subsequent analysis). Observations of additional raptor species such as Kestrel, Sparrowhawk or Buzzard were noted as well as other noteworthy species such as Golden Plover, Curlew, etc.

The following four criteria are to be used for classifying territory status as per the most recent pilot survey Lusby *et al.,* (2011:

- **Unoccupied:** No fresh signs, sightings or calls recorded or fresh signs recorded on a single visit.
- **Occupied:** At least one Merlin seen or heard or fresh signs of occupation (pluckings, pellets, droppings or Merlin feathers) found on at least two occasions separated by at least one week;
- **Breeding Attempt:** Courtship display (food pass between male and female), copulation, adults entering or leaving a nest, eggs or eggshells found, young seen or heard, adults repeatedly alarm calling;
- **Successful breeding attempt:** At least one young fledged or young capable of flight when last seen.

Constraint: Due to the presence of a pair of breeding Hen Harrier proximal to the survey areas, surveys following April avoided parts of Bleanbeg Bog so as to avoid any undue disturbance to an Annex I species.

Kingfisher Surveys

Kingfisher surveys following the methodology presented in National Roads Authority (2008) was undertaken on the 8-11th March 2016. Watercourse crossings were evaluated for any evidence of nest holes within 300m of crossing locations (in tandem with Otter surveys). In each case banks were inspected for evidence of Kingfisher, and general suitability of banks in proximity to crossing locations for nesting Kingfisher. Target notes were made on suitable nesting banks, and any observed nest holes.

Results of Bird Surveys are presented in Section 8.2.3.6

A8-1.2.3.8 Amphibians and Reptiles

Amphibians and reptiles occurring within the UWF Grid Connection, UWF Related Works, UWF Replacement Forestry and UWF Other Activities were recorded during the course of all site walkovers for habitat, mammal and bird surveys.

Results are presented in Section 8.2.3.8.

A8-1.2.3.9 Marsh Fritillary

Suitable habitats, determined by the presence of Devil's Bit Scabious (*Succisa pratensis*) as well as an evaluation of vegetation height and structure, aspect and scrub cover, were identified in along the UWF Grid Connection during the Phase I habitat survey.

These habitats were revisited in 4th and 22nd September 2016 to undertake larval web searches. Survey timings were planned to meet the requirements of best practice guidance (NRA, 2009). The surveys involved a walked search of all suitable habitats. Weather conditions during the surveys were overcast, dry and warm. The locations of larval webs were recorded using a Garmin eTrex 10 GPS/GNSS handheld receiver and mapped using ArcGIS 10.4.

A follow up detailed habitat survey and evaluation of suitable Marsh Fritillary habitat was undertaken on 5th/6th April 2017 to delineate the suitable micro-habitats within the UWF Grid Connection which were known to contain larval webs from the 2016 survey. The extents of suitable micro-habitats were recorded using detailed aerial photography and Garmin eTrex 10 GPS/GNSS handheld receiver. Larval webs and the grid coordinates of scattered groups of basking/foraging larvae were also recorded during this survey. This habitat survey was undertaken in overcast, dry and warm conditions.

The Upperchurch Windfarm does include potential Marsh Fritillary habitat located at; a) the environs of T21 at Grousehall; and b) the environs of T2, T3 and T4 at Shevry. Due to their potential to possibly contain larval webbing these sites were visited on 6th September 2017 to confirm the baseline environment. In the interest of clarity both the consented turbine footprint and described works area for turbine establishment and erection were surveyed. No other Marsh Fritillary habitat overlaps the Whole UWF Project.

Results are presented in Section 8.2.3.9.

A8-1.2.4 Survey Results

A8-1.2.4.1 Designated European Sites

The following 23 European or Natura 2000 Sites have been identified within 15km of the construction area boundaries which includes all haul routes to be used during construction:

1. *Anglesey Road SAC (Site Code: 002125)*
2. *Askeaton Fen Complex SAC (Site Code: 002279)*
3. *Barrigone SAC (Site Code: 000432)*
4. *Bolingbrook Hill SAC (Site Code: 002124)*
5. *Clare Glen SAC (Site Code: 000930)*
6. *Curraghchase Woods SAC (Site Code: 000174)*
7. *Glenomra Wood SAC (Site Code: 001013)*
8. *Glenstal Wood SAC (Site code: 001432)*
9. *Keeper Hill SAC (Site Code: 001197)*
10. *Kilduff, Devilsbit Mountain SAC (Site Code: 000934)*
11. *Lough Derg (Shannon) SPA (Site Code: 004058)*
12. *Lough Derg, North-East Shore SAC (Site Code: 002241)*
13. *Lower River Shannon SAC (Site Code: 002165)*
14. *Lower River Suir SAC (Site Code: 002137)*
15. *Philipston Marsh SAC (Site Code: 001847)*
16. *Ratty River Cave SAC (Site Code: 002316)*
17. *River Shannon and River Fergus Estuaries SPA (Site Code: 004077)*
18. *Silvermine Mountain SAC (Site Code: 000939)*
19. *Silvermine Mountain West SAC (Site Code: 002258)*
20. *Slieve Bernagh SAC (Site Code: 002312)*
21. *Slievefelim to Silvermines SPA (Site Code: 001179)*
22. *Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161)*
23. *Tory Hill SAC (Site Code: 000439)*

A8-1.2.4.2 Designated National Sites

The following 8 NHAs have been identified within 15km of the Whole UWF Project:

1. *Bleanbeg Bog NHA (Site Code: 002450)*
2. *Grageen Fen and Bog NHA (Site Code: 002186)*
3. *Mauherslieve Bog NHA (Site Code: 002385)*
4. *Woodcock Hill Bog NHA (Site Code: 002402)*
5. *Moyreen Bog NHA (Site Code: 002361)*
6. *Carrigkerry Bogs NHA (Site Code: 002399)*
7. *Scohaboy Bog NHA (Site Code: 000937)*
8. *Gortacullin Bog NHA (Site Code: 002401)*

The following 60 pNHAs have been identified within 15km of the Whole UWF Project:

- *Inner Shannon Estuary - South Shore (Site Code: 000435)*
- *Cabragh Wetlands (Site Code: 001934)*
- *Fergus Estuary and Inner Shannon, North Shore (Site Code: 002048)*
- *Killavalla Wood (Site Code: 001178)*
- *Loughmore Common Turlough (Site Code: 000438)*
- *Keeper Hill (Site Code: 001197)*
- *Derrygareen Heath (Site Code: 000931)*
- *Sturamus Island (Site Code: 001436)*
- *Barrigone (Site Code: 000432)*
- *Bilboa And Gortnageragh River Valleys (Site Code: 001851)*
- *Knockalisheen Marsh (Site Code: 002001)*
- *Clare Glen (Site Code: 00930)*
- *Cahiracon Wood (Site Code: 001000)*
- *Dromore and Bleach Loughs (Site Code: 001030)*
- *Nenagh River Gorge (Site Code: 001133)*
- *Glenstal Wood (Site Code: 001432)*
- *Aughnaglanny Valley (Site Code: 000948)*
- *Garrannon Wood (Site Code: 001012)*
- *Silvermine Mountains (Site Code: 000939)*
- *Killough Hill (Site Code: 000959)*
- *Lough Ourna (Site Code: 000650)*
- *Ormond's Mill, Loughmoe, Templemore (Site Code: 002066)*
- *Adare Woodlands (Site Code: 000429)*
- *Knockanavar Wood (Site Code: 000961)*

- *Inchinsquillib and Dowlings Woods (Site Code: 000956)*
- *Lough Derg (Site Code: 000011)*
- *Kilduff, Devilsbit Mountain (Site Code: 000934)*
- *Castleconnell (Domestic Dwelling, Occupied) (Site Code: 000433)*
- *Ballyvorheen Bog (Site Code: 001849)*
- *Gortglass Lough (Site Code: 0001015)*
- *Curraghchase Woods (Site Code: 000174)*
- *Cloonsnaghta Lough (Site Code: 0001004)*
- *Cloonlara House (Site Code: 000028)*
- *Dromsallagh Bog (Site Code: 001850)*
- *Tory Hill (Site Code: 000439)*
- *Ballymorrisheen Marsh (Site Code: 001425)*
- *Ardagh Church, Newcastlewest (Disused) (Site Code: 000430)*
- *Willsborough Esker (Site Code: 000943)*
- *Clareen Lough (Site Code: 000929)*
- *Ballintemple Bog (Site Code: 000882)*
- *Glenomra Wood (Site Code: 001013)*
- *Templemore Wood (Site Code: 000942)*
- *Clonderalaw Bay (Site Code: 000027)*
- *Paradise House (Ballynacally) (Site Code: 000062)*
- *Derrygeeha Lough (Site Code: 000050)*
- *Gorteennamrock (Site Code: 001433)*
- *Kilbeg Marsh (Site Code: 001848)*
- *Cappagh Fen (Site Code: 001429)*
- *Glenastar Wood (Site Code: 001431)*
- *Dundrum (Site Code: 002096)*
- *Skoolhill (Site Code: 001996)*
- *Ballinvirick Marsh (Site Code: 001427)*
- *Philipston Marsh (Site Code: 001847)*
- *Ardmayle Pond (Site Code: 000945)*
- *Annacarty Wetlands (Site Code: 000639)*
- *Fort Fergus (Ballynacally) (Site Code: 000035)*
- *Dundrum Sanctuary (Site Code: 000950)*
- *Castle Lake (Site Code: 000239)*
- *Laffansbridge (Site Code: 000965)*
- *Ballyneill Marsh (Site Code: 001846)*

Table 24 Proposed Natural Heritage Areas (pNHAs) within 15km of the Whole UWF Project.

Site name and code	Distance from *
Inner Shannon Estuary - South Shore (Site Code: 000435)	0 m – UWF Other Activities, Haul Route location HA3 and HA4 located within pNHA boundary
Cabragh Wetlands (Site Code: 001934)	510 m north of UWF Other Activities, Haul Route location HA14
Fergus Estuary and Inner Shannon, North Shore (Site Code: 002048)	1.1 km north of UWF Other Activities, Haul Route HA4
Killavalla Wood (Site Code: 001178)	1.2 km west of UWF Other Activities, Haul Route location HA8
Loughmore Common Turlough (Site Code: 000438)	2.0 km south of UWF Other Activities, Haul Route location HA3
Keeper Hill (Site Code: 001197)	2.1 km north of UWF Grid Connection, Access Road AR4
Derrygareen Heath (Site Code: 000931)	2.2 km south of UWF Grid Connection
Sturamus Island (Site Code: 001436)	2.4 km north of UWF Other Activities, Haul Route location HA1
Barrigone (Site Code: 000432)	3.2 km east of Other Activities, Haul Route location HA1
Bilboa And Gortnageragh River Valleys (Site Code: 001851)	3.3 km south of UWF Grid Connection, Access Road AR9
Knockalisheen Marsh (Site Code: 002001)	4.2 km northeast of UWF Other Activities, Haul Route HA4
Clare Glen (Site Code: 00930)	4.2 km south of UWF Grid Connection
Cahiracon Wood (Site Code: 001000)	4.4 km northwest of UWF Other Activities, Haul Route location HA1
Dromore and Bleach Loughs (Site Code: 001030)	4.9 km west of UWF Other Activities, Haul Route location HA2
Nenagh River Gorge (Site Code: 001133)	5.3 km north of UWF Grid Connection
Glenstal Wood (Site Code: 001432)	5.6 km south of UWF Grid Connection
Aughnaglanny Valley (Site Code: 000948)	6.3 km south of UWF Grid Connection
Garrannon Wood (Site Code: 001012)	7.2 km northwest of UWF Other Activities, Haul Route location HA3
Silvermine Mountains (Site Code: 000939)	7.3 km north of UWF Grid Connection, Access Road AR4
Killough Hill (Site Code: 000959)	7.6 km south of UWF Other Activities, Haul Route location HA14
Lough Ourna (Site Code: 000650)	7.8 km north of UWF Other Activities, Haul Route location HA5
Ormond's Mill, Loughmoe, Templemore (Site Code: 002066)	8.0 km south of UWF Other Activities, Haul Route location HA14

Site name and code	Distance from *
Adare Woodlands (Site Code: 000429)	8.0 km south of UWF Other Activities, Haul Route location HA2
Knockanavar Wood (Site Code: 000961)	8.3 km south of UWF Grid Connection, Access Road AR9
Inchinsquillib and Dowlings Woods (Site Code: 000956)	8.5 km south of UWF Related Works, turning circle in Christmas tree farm
Lough Derg (Site Code: 000011)	8.6 km northwest of UWF Grid Connection
Kilduff, Devilsbit Mountain (Site Code: 000934)	8.9 km northeast of UWF Other Activities, Haul Route location HA12
Castleconnell (Domestic Dwelling, Occupied) (Site Code: 000433)	8.9 km southwest of UWF Grid Connection
Ballyvorheen Bog (Site Code: 001849)	9.0 km south of UWF Grid Connection
Gortglass Lough (Site Code: 0001015)	9.3 km north of UWF Other Activities, Haul Route location HA1
Curraghchase Woods (Site Code: 000174)	9.3 km west of UWF Other Activities, Haul Route location HA2
Cloonsnaghta Lough (Site Code: 0001004)	9.4 km northwest of UWF Other Activities Haul Route location HA1
Cloonlara House (Site Code: 000028)	9.5 km northeast of UWF Other Activities Haul Route location HA4
Dromsallagh Bog (Site Code: 001850)	9.8 km south of UWF Grid Connection
Tory Hill (Site Code: 000439)	10.3 km of UWF Other Activities, Haul Route location HA2
Ballymorrisheen Marsh (Site Code: 001425)	10.7 km southeast of UWF Other Activities, Haul Route location HA1
Ardagh Church, Newcastlewest (Disused) (Site Code: 000430)	10.9 km south of UWF Other Activities, Haul Route location HA1
Willsborough Esker (Site Code: 000943)	11.0 km north of UWF Other Activities, Haul Route location HA5
Clareen Lough (Site Code: 000929)	11.0 km northwest of UWF Other Activities, Haul Route location HA5
Ballintemple Bog (Site Code: 000882)	11.1 km northeast of UWF Other Activities, Haul Route location HA6
Glenomra Wood (Site Code: 001013)	11.5 km west of UWF Grid Connection
Templemore Wood (Site Code: 000942)	11.6 km northeast of UWF Other Activities, Haul Route location HA12
Clonderalaw Bay (Site Code: 000027)	11.6 km west of UWF Other Activities, Haul Route location HA1

Site name and code	Distance from *
Paradise House (Ballynacally) (Site Code: 000062)	11.7 km north of UWF Other Activities, Haul Route location HA1
Derrygeeha Lough (Site Code: 000050)	11.7 km northwest of UWF Other Activities, Haul Route location HA1
Gorteennamrock (Site Code: 001433)	12.0 km east of UWF Other Activities, Haul Route location HA1
Kilbeg Marsh (Site Code: 001848)	12.5 km south of UWF Grid Connection, Access Road AR10
Cappagh Fen (Site Code: 001429)	12.5 km southeast of UWF Other Activities, Haul Route location HA1
Glenastar Wood (Site Code: 001431)	12.6 km south of UWF Other Activities, Haul Route location HA1
Dundrum (Site Code: 002096)	12.6 km south of UWF Grid Connection
Skoolhill (Site Code: 001996)	12.7 km southeast of UWF Other Activities, Haul Route location HA4
Ballinvirick Marsh (Site Code: 001427)	12.7 km southwest of UWF Other Activities, Haul Route location HA2
Philipston Marsh (Site Code: 001847)	13.1 km south of UWF Grid Connection Access Road AR10
Ardmayle Pond (Site Code: 000945)	13.9 km south of UWF Other Activities, Haul Route location HA18
Annacarty Wetlands (Site Code: 000639)	13.9 km south of UWF Grid Connection
Fort Fergus (Ballynacally) (Site Code: 000035)	14.2 km north of UWF Other Activities, Haul Route location HA1
Dundrum Sanctuary (Site Code: 000950)	14.2 km south of UWF Grid Connection
Castle Lake (Site Code: 000239)	14.5 km north of UWF Other Activities, Haul Route location HA3
Laffansbridge (Site Code: 000965)	14.5 km southeast of UWF Other Activities, Haul Route location HA14
Ballyneill Marsh (Site Code: 001846)	15.0 km south of UWF Grid Connection, Access Road AR10

*Distance from Construction area boundaries, specific element specified in column

A8-1.2.4.3 Hen Harrier

Table 25 Distance of confirmed Hen Harrier nest sites recorded during the breeding season in 2016 and 2017 to the nearest construction area boundaries.

G = Grazing; RG = Rough Grazing; HB = Heath or bog; DE = Deciduous woodland or scrub; GO = Gorse; CF = Clear fell; NF2 = New forestry plantation trees 20-30cm high; NF3 = New forestry plantation trees c 1m high; NF4= New forestry plantation trees > 2m high; 2nd F1/F2 = Second rotation forestry plantation trees 20-30cm high; 2nd F3 = Second rotation forestry plantation trees c 1m high; 2nd F4 = Second rotation forestry plantation trees > 2m high; F= Post thicket forestry

Nest Location	Habitat Type	Distance (m) from nearest construction area boundaries	Year
A	NF	154	2016
B	HB	680	2017
C	HB	470	2017
D	NF4	500	2016
E	2NF4	903	2016
F	NF1	2154	2016

Table 26 Distance of Hen Harrier roost sites recorded in the non-breeding season of 2016/17 to the nearest construction area boundaries.

G = Grazing; RG = Rough Grazing; HB = Heath or bog; DE = Deciduous woodland or scrub; GO = Gorse; CF = Clear fell; NF2 = New forestry plantation trees 20-30cm high; NF3 = New forestry plantation trees c 1m high; NF4= New forestry plantation trees > 2m high; 2nd F1/F2 = Second rotation forestry plantation trees 20-30cm high; 2nd F3 = Second rotation forestry plantation trees c 1m high; 2nd F4 = Second rotation forestry plantation trees > 2m high; F= Post thicket forestry

Roost Location	**Habitat Type**	**Distance (m) from nearest construction area boundaries**	**Year**
1	HB	681	2016/2017
2	HB	171	2016/2017
3	HB	1313	2016/2017

Table 27 Details of Hen Harrier sightings and the habitats over which the birds were observed from vantage point surveys undertaken during the breeding season in 2016.

G = Grazing; RG = Rough Grazing; HB = Heath or bog; DE = Deciduous woodland or scrub; GO = Gorse; CF = Clear fell; NF2 = New forestry plantation trees 20-30cm high; NF3 = New forestry plantation trees c 1m high; NF4 = New forestry plantation trees > 2m high; 2nd F1/F2 = Second rotation forestry plantation trees 20-30cm high; 2nd F3 = Second rotation forestry plantation trees c 1m high; 2nd F4 = Second rotation forestry plantation trees > 2m high; F= Post thicket forestry

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
1	11/03/16	Nil Sightings																	
1	15/03/16	Nil Sightings																	
2	15/03/16	Nil Sightings																	
2	21/03/16	Nil Sightings																	
3	11/03/16	Nil Sightings																	
3	13/03/16	Nil Sightings																	
4	12/03/16	Nil Sightings																	
4	21/03/16	Hen Harrier	M	13:40														F	30
4	21/03/16	Hen Harrier	F	13:50															300
5	12/03/16	Nil Sightings																	
5	13/03/16	Nil Sightings																	
6	12/03/16	Nil Sightings																	
6	21/03/16	Hen Harrier	M	11:39		RG													558
6	21/03/16	Hen Harrier	M	11:48														F	240
6	21/03/16	Hen Harrier	M	11:48			HB												50
6	21/03/16	Hen Harrier	M	11:49			HB												20

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
6	21/03/16	Hen Harrier	F	11:49			HB												40
7	13/03/16	Nil Sightings																	
7	14/03/16	Nil Sightings																	
8	15/03/16	Hen Harrier	M	17:35		RG				CF									3
8	16/03/16	Hen Harrier	M	10:35		RG				CF									10
9	16/03/16	Hen Harrier	F	12:53				DE		CF									28
9	16/03/16	Hen Harrier	F	14:03		RG		DE											10
10	14/03/16	Hen Harrier	M	14:03			HB												30
11	15/03/16	Nil Sightings																	
12	14/03/16	Hen Harrier	M	12:07						CF									13
12	14/03/16	Hen Harrier	F	12:07						CF									13
1	04/04/16	Hen Harrier	M	11:05							NF1								8
1	04/04/16	Hen Harrier	M	11:05				DE											20
1	04/04/16	Hen Harrier	M	11:05							NF1								10
1	04/04/16	Hen Harrier	M	11:05														F	10
1	21/04/16	Nil Sightings																	
2	07/04/16	Hen Harrier	M	08:53			HB											F	420
2	07/04/16	Hen Harrier	M	09:00			HB												2100
2	07/04/16	Hen Harrier	M	09:35			HB											F	1140
2	07/04/16	Hen Harrier	M	09:55		RG	HB											F	360
2	07/04/16	Hen Harrier	F+M	10:01			HB											F	240

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
2	07/04/16	Hen Harrier	F	10:05		RG	HB											F	180
2	09/04/16	Hen Harrier	F	15:10			HB											F	10
2	09/04/16	Hen Harrier	F	15:45														F	180
2	09/04/16	Hen Harrier	F	17:10		RG												F	270
3	08/04/16	Hen Harrier	F	10:05		RG	HB											F	180
3	04/04/16	Hen Harrier	M+2 F's	14:50														F	270
4	05/04/16	Hen Harrier	F	12:13			HB												20
4	05/04/16	Hen Harrier	F	13:47			HB												20
5	05/04/16	Hen Harrier	F	10:27			HB												2100
5	05/04/16	Hen Harrier	M	09:00			HB												1140
5	05/04/16	Hen Harrier	M	09:35			HB											F	40
5	05/04/16	Hen Harrier	M	09:55		RG	HB											F	360
5	17/04/16	Nil Sightings																	
6	06/04/16	Hen Harrier	F	10:50			HB												90
6	07/04/16	Hen Harrier	F+M	16:26			HB					NF2							120
6	07/04/16	Hen Harrier	M+M	16:46			HB												40
6	07/04/16	Hen Harrier	M+M	16:48														F	300
6	25/04/16	Hen Harrier	1st y M	17:00			HB											F	1200
6	25/04/16	Hen Harrier	F	17:00			HB											F	120
6	25/04/16	Hen Harrier	F+ad M	18:10			HB											F	1800

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
6	25/04/16	Hen Harrier	2ad M's	18:40														F	30
7	07/04/16	Nil Sightings																	
7	25/04/16	Nil Sightings																	
8	06/04/16	Nil Sightings																	
9	06/04/16	Nil Sightings																	
9	07/04/16	Nil Sightings																	
10	17/04/16	Hen Harrier	3xM's	15:35														F	1200
10	25/04/16	Hen Harrier	M+F	13:30			HB											F	1800
11	05/04/16	Nil Sightings																	
12	04/04/16	Hen Harrier	M	12:15				DE										F	60
12	04/04/16	Hen Harrier	F	13:15														F	35
12	04/04/16	Hen Harrier	M	14:10														F	57
12	04/04/16	Hen Harrier	M	14:35														F	3
12	04/04/16	Hen Harrier	M	16:20														F	20
1	06/05/16	Nil Sightings																	
1	10/05/16	Nil Sightings																	
2	06/05/16	Hen Harrier	F	09:05			HB											F	45
2	06/05/16	Hen Harrier	M	09:05			HB											F	60
2	18/05/16	Hen Harrier	M	12:45			HB											F	130
3	04/05/16	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
3	06/05/16	Nil Sightings																	
4	04/05/16	Nil Sightings																	
4	19/05/16	Nil Sightings																	
5	04/05/16	Hen Harrier	M	14:05			HB												15
5	12/05/16	Hen Harrier	M	10:05		RG													13
6	05/05/16	Hen Harrier	F	15:30														F	250
6	13/05/16	Hen Harrier	M	13:25			HB											F	1020
6	13/05/16	Hen Harrier	M	13:25			HB											F	1500
7	05/05/16	Nil Sightings																	
7	19/05/16	Nil Sightings																	
8	20/05/16	Hen Harrier	M	13:40	G														6
9	13/05/16	Hen Harrier	F	10:55		RG		DE											20
9	13/05/16	Hen Harrier	F	15:03		RG		DE											187
10	05/05/16	Hen Harrier	M	08:10														F	180
10	05/05/16	Hen Harrier	F	09:05														F	70
10	05/05/16	Hen Harrier	M	10:15			HB												20
10	05/05/16	Hen Harrier	F	10:20														F	600
10	13/05/16	Hen Harrier	M	09:36														F	660
10	13/05/16	Hen Harrier	M	09:40														F	500
11	09/05/16	Nil Sightings																	
12	11/05/16	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
1	07/06/16	Nil Sightings																	
1	09/06/16	Hen Harrier	M	11:15				DE											14
2	09/06/16	Hen Harrier	M	17:15			HB											F	55
2	09/06/16	Hen Harrier	F	17:15			HB											F	30
2	15/06/16	Hen Harrier	M	08:40			HB												20
2	15/06/16	Hen Harrier	F	08:40			HB												30
2	15/06/16	Hen Harrier	M	10:15			HB												30
2	15/06/16	Hen Harrier	F	10:15			HB												30
3	07/06/16	Nil Sightings																	
3	15/06/16	Hen Harrier	M	13:25			HB												175
4	08/06/16	Hen Harrier	M	11:05			HB												20
4	13/06/16	Hen Harrier	M	16:10			HB												30
5	03/06/16	Nil Sightings																	
5	13/06/16	Hen Harrier	M	11:20			HB												25
6	11/06/16	Nil Sightings																	
6	13/06/16	Hen Harrier	M	14:30			HB											F	30
6	13/06/16	Hen Harrier	F	14:30			HB											F	20
7	03/06/16	Nil Sightings																	
7	08/06/16	Nil Sightings																	
8	10/06/16	Hen Harrier	M	11:18	G	RG													21
9	03/06/16	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
10	11/06/16	Hen Harrier	M	14:30														F	15
10	11/06/16	Hen Harrier	M	15:50			HB												45
10	17/06/16	Hen Harrier	F	10:55														F	10
11	09/06/16	Nil Sightings																	
12	08/06/16	Hen Harrier	M	10:05														F	4
12	08/06/16	Hen Harrier	M	12:20														F	11
12	08/06/16	Hen Harrier	M	13:55														F	476

REFERENCE DOCUMENTS

Table 28 Details of Hen Harrier behaviour which the birds were exhibiting during each observation and associated notes for vantage point surveys undertaken during the breeding season in 2016.

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
1	11/03/16	Nil Sightings										
1	15/03/16	Nil Sightings										
2	15/03/16	Nil Sightings										
2	21/03/16	Nil Sightings										
3	11/03/16	Nil Sightings										
3	13/03/16	Nil Sightings										
4	12/03/16	Nil Sightings										
4	21/03/16	Hen Harrier	M			DI					30	1x male and 1x female HH over traditional nest site
4	21/03/16	Hen Harrier	F	S							300	
5	12/03/16	Nil Sightings										
5	13/03/16	Nil Sightings										
6	12/03/16	Nil Sightings										
6	21/03/16	Hen Harrier	M				H				558	1x male and 1 x female HH circling together.
6	21/03/16	Hen Harrier	M					FL			240	
6	21/03/16	Hen Harrier	M				H				50	
6	21/03/16	Hen Harrier	M		C						20	
6	21/03/16	Hen Harrier	F		C						40	
7	13/03/16	Nil Sightings										

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VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
7	14/03/16	Nil Sightings										
8	15/03/16	Hen Harrier	M					FI			3	1x male HH seen at 17:35 flying over RG and CF
8	16/03/16	Hen Harrier	M					FI			10	1x male HH seen at 10:35 flying over RG and gorse
9	16/03/16	Hen Harrier	F					FI			28	1x female HH seen at 12:53 flying over CF & DE,
9	16/03/16	Hen Harrier	F					FI			10	
10	14/03/16	Hen Harrier	M	S							30	2 Golden Plover
11	15/03/16	Nil Sightings										
12	14/03/16	Hen Harrier	M		C						13	1x male HH and 1x female HH seen at 12:07 circling each other high over CF
12	14/03/16	Hen Harrier	F		C						13	
1	04/04/16	Hen Harrier	M				H				8	
1	04/04/16	Hen Harrier	M				H				20	
1	04/04/16	Hen Harrier	M				H				10	
1	04/04/16	Hen Harrier	M				H				10	
1	21/04/16	Nil Sightings										
2	07/04/16	Hen Harrier	M		C						420	1x male and 1 x female HH over traditional nest site
2	07/04/16	Hen Harrier	M						P		2100	
2	07/04/16	Hen Harrier	M			DI					1140	
2	07/04/16	Hen Harrier	M			DI					360	
2	07/04/16	Hen Harrier	F+M		C						240	

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VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
2	07/04/16	Hen Harrier	F	S							180	
2	09/04/16	Hen Harrier	F	S							10	
2	09/04/16	Hen Harrier	F		C						180	
2	09/04/16	Hen Harrier	F	S							270	
3	08/04/16	Hen Harrier	F	S							180	
3	04/04/16	Hen Harrier	M+2F's	S							270	1x male and 1 x female HH over traditional nest site
4	05/04/16	Hen Harrier	F		C						20	
4	05/04/16	Hen Harrier	F				H				20	
5	05/04/16	Hen Harrier	F				H				2100	
5	05/04/16	Hen Harrier	M						P		1140	
5	05/04/16	Hen Harrier	M			DI					40	
5	05/04/16	Hen Harrier	M			DI					360	
5	17/04/16	Nil Sightings										
6	06/04/16	Hen Harrier	F				H				90	
6	07/04/16	Hen Harrier	F+M		C						120	1x male and 1 x female HH courting over suita-ble nesting habitat
6	07/04/16	Hen Harrier	M+M	S							40	
6	07/04/16	Hen Harrier	M+M	S							300	
6	25/04/16	Hen Harrier	1sty M			DI					1200	1x male HH (Ringtail) skydancing
6	25/04/16	Hen Harrier	F		C						120	
6	25/04/16	Hen Harrier	F+ad M	S	C			FL			1800	

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VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
6	25/04/16	Hen Harrier	2ad M's	S				FL			30	
7	07/04/16	Nil Sightings										
7	25/04/16	Nil Sightings										
8	06/04/16	Nil Sightings										
9	06/04/16	Nil Sightings										
9	07/04/16	Nil Sightings										
10	17/04/16	Hen Harrier	3xM's	S				FL			1200	
10	25/04/16	Hen Harrier	M+F	S	C	DI		FL			1800	1x male and 1x female HH courting over suitable nesting habitat
11	05/04/16	Nil Sightings										
12	04/04/16	Hen Harrier	M	S							60	1x male HH soaring both in a S-N and N-S directions.
12	04/04/16	Hen Harrier	F					FL			35	1x female HH flying over forestry in an East-West direction landing into forestry.
12	04/04/16	Hen Harrier	M					FL	P		57	1x male HH flying in an E-W direction over forestry and then perches in forestry.
12	04/04/16	Hen Harrier	M					FL			3	1x male HH flying in an E-W direction over forestry
12	04/04/16	Hen Harrier	M					FL			20	1x male HH flying in an E-W direction over forestry
1	06/05/16	Nil Sightings										
1	10/05/16	Nil Sightings										
2	06/05/16	Hen Harrier	F					FL	P		45	
2	06/05/16	Hen Harrier	M					FL	P		60	

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VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
2	18/05/16	Hen Harrier	M	S			H	FL			130	
3	04/05/16	Nil Sightings										
3	06/05/16	Nil Sightings										
4	04/05/16	Nil Sightings										
4	19/05/16	Nil Sightings										
5	04/05/16	Hen Harrier	M				H				15	
5	12/05/16	Hen Harrier	M				H				13	
6	05/05/16	Hen Harrier	F	S							250	
6	13/05/16	Hen Harrier	M		C			FL			1020	1x adult male HH
6	13/05/16	Hen Harrier	M		C			FL			1500	1st year male HH; ringtail
7	05/05/16	Nil Sightings										
7	19/05/16	Nil Sightings										
8	20/05/16	Hen Harrier	M					FL			6	
9	13/05/16	Hen Harrier	F	S							20	
9	13/05/16	Hen Harrier	F	S				FL			187	
10	05/05/16	Hen Harrier	M		C	DI					180	
10	05/05/16	Hen Harrier	F		C						70	
10	05/05/16	Hen Harrier	M				H				20	
10	05/05/16	Hen Harrier	F		C						600	
10	13/05/16	Hen Harrier	M	S		DI		FL			660	2 adult male HH together
10	13/05/16	Hen Harrier	M	S				FL			500	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
11	09/05/16	Nil Sightings										
12	11/05/16	Nil Sightings										
1	07/06/16	Nil Sightings										
1	09/06/16	Hen Harrier	M				H				14	
2	09/06/16	Hen Harrier	M					FL			55	1x female and male HH together, no food pass seen
2	09/06/16	Hen Harrier	F					FL			30	
2	15/06/16	Hen Harrier	M					FL		FP	20	
2	15/06/16	Hen Harrier	F					FL		FP	30	
2	15/06/16	Hen Harrier	M					FL		FP	30	Food pass
2	15/06/16	Hen Harrier	F					FL		FP	30	Food pass
3	07/06/16	Nil Sightings										Food pass
3	15/06/16	Hen Harrier	M				H				175	Food pass
4	08/06/16	Hen Harrier	M				H				20	
4	13/06/16	Hen Harrier	M				H				30	
5	03/06/16	Nil Sightings										
5	13/06/16	Hen Harrier	M				H				25	Begging calls from female HH heard
6	11/06/16	Nil Sightings										
6	13/06/16	Hen Harrier	M					FL		FP	30	Food pass
6	13/06/16	Hen Harrier	F					FL		FP	20	Food pass
7	03/06/16	Nil Sightings										

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
7	08/06/16	Nil Sightings										
8	10/06/16	Hen Harrier	M				H				21	1x male HH flew low from N-S hunting over RG and grazing
9	03/06/16	Nil Sightings										
10	11/06/16	Hen Harrier	M					FL			15	1x male HH carrying prey into dead ground food pass not seen
10	11/06/16	Hen Harrier	M				H				45	
10	17/06/16	Hen Harrier	F					FL		FP	10	Begging calls from female HH heard
11	09/06/16	Nil Sightings										
12	08/06/16	Hen Harrier	M		C			FL			4	1x male HH, 3 sightings. Possible Food pass
12	08/06/16	Hen Harrier	M					FL			11	
12	08/06/16	Hen Harrier	M	S				FL			476	

REFERENCE DOCUMENTS

Table 29 Details of Hen Harrier sightings and the habitats over which the birds were observed from vantage point surveys undertaken during the non - breeding season in 2016/17.

G = Grazing; RG = Rough Grazing; HB = Heath or bog; DE = Deciduous woodland or scrub; GO = Gorse; CF = Clear fell; NF2 = New forestry plantation trees 20-30cm high; NF3 = New forestry plantation trees c 1m high; NF4 = New forestry plantation trees > 2m high; 2nd F1/F2 = Second rotation forestry plantation trees 20-30cm high; 2nd F3 = Second rotation forestry plantation trees c 1m high; 2nd F4 = Second rotation forestry plantation trees > 2m high; F= Post thicket forestry

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
1	13/09/16	Nil Sightings																	
10	13/09/16	Hen Harrier	Male	19:09			X												30
10	13/09/16	Hen Harrier	Male	19:15														X	10
4	14/09/16	Hen Harrier	Male	08:00			X												15
3	15/09/16	Hen Harrier	Juvenile	19:35		X													20
5	16/09/16	Nil Sightings																	
6	16/09/16	Hen Harrier	Juvenile	19:32			X												60
6	16/09/16	Hen Harrier	Male	19:38			X												30
2	17/09/16	Hen Harrier	Male	08:16			X												80
2	17/09/16	Nil Sightings																	
10	18/09/16	Hen Harrier	Immature Male	07:31			X												20
5	18/09/16	Nil Sightings																	
6	19/09/16	Hen Harrier	Juvenile	07:13			X												10
1	19/09/16	Nil Sightings																	
3	20/09/16	Hen Harrier	Juvenile	07:10		X	X												15
4	20/09/16	Hen Harrier	Male	18:28			X												70

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
4	20/09/16	Hen Harrier	Juvenile	19:28		X													20
12	20/09/16	Nil Sightings																	
12	20/09/16	Nil Sightings																	
11	21/09/16	Nil Sightings																	
11	21/09/16	Nil Sightings																	
7	22/09/16	Nil Sightings																	
7	22/09/16	Nil Sightings																	
8	27/09/16	Nil Sightings																	
8	27/09/16	Nil Sightings																	
9	28/09/16	Nil Sightings																	
9	28/09/16	Hen Harrier	Male	17:25		X													60
1	15/10/16	Nil Sightings																	
10	15/10/16	Hen Harrier	Male	17:45			X												20
10	15/10/16	Hen Harrier	Male	17:45			X												2820
10	15/10/16	Hen Harrier	Male	18:32			X												10
5	16/10/16	Nil Sightings																	
2	16/10/16	Nil Sightings																	
7	17/10/16	Nil Sightings																	
4	18/10/16	Nil Sightings																	
3	18/10/16	Nil Sightings																	
6	19/10/16	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
1	20/10/16	Nil Sightings																	
6	20/10/16	Hen Harrier	Male	18:44			X												30
7	21/10/16	Nil Sightings																	
5	21/10/16	Nil Sightings																	
4	22/10/16	Nil Sightings																	
10	24/10/16	Hen Harrier	Female	08:15			X												25
10	24/10/16	Hen Harrier	Male	08:17			X												40
10	24/10/16	Hen Harrier	Male	08:30			X												30
11	24/10/16	Hen Harrier	Male	16:29			X												10
11	24/10/16	Hen Harrier	Male	18:32			X												13
3	25/10/16	Nil Sightings																	
11	25/10/16	Nil Sightings																	
12	25/10/16	Nil Sightings																	
12	26/10/16	Nil Sightings																	
8	26/10/16	Nil Sightings																	
8	27/10/16	Hen Harrier	Male	09:50		X													13
9	27/10/16	Nil Sightings																	
9	28/10/16	Nil Sightings																	
2	29/10/16	Nil Sightings																	
9	20/11/16	Nil Sightings																	
5	21/11/16	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
6	21/11/16	Hen Harrier	Juvenile	16:18		X													40
8	22/11/16	Nil Sightings																	
3	22/11/16	Nil Sightings																	
9	23/11/16	Nil Sightings																	
4	23/11/16	Hen Harrier	Juvenile	15:20			X												10
6	24/11/16	Nil Sightings																	
8	25/11/16	Nil Sightings																	
4	28/11/16	Nil Sightings																	
5	28/11/16	Hen Harrier	Immature Male	15:09		X													360
1	28/11/16	Nil Sightings																	
1	28/11/16	Nil Sightings																	
12	28/11/16	Nil Sightings																	
12	28/11/16	Nil Sightings																	
2	29/11/16	Nil Sightings																	
2	29/11/16	Hen Harrier	Female	16:51		X	X												20
11	29/11/16	Nil Sightings																	
11	29/11/16	Hen Harrier	Female	16:24			X												12
11	29/11/16	Hen Harrier	Male	16:47			X												947
11	29/11/16	Hen Harrier	Male	16:52			X												11
3	30/11/16	Nil Sightings																	
7	30/11/16	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
7	30/11/16	Nil Sightings																	
10	30/11/16	Nil Sightings																	
10	30/11/16	Nil Sightings																	
2	15/12/16	Nil Sightings																	
2	15/12/16	Nil Sightings																	
12	16/12/16	Nil Sightings																	
5	16/12/16	Nil Sightings																	
11	19/12/16	Nil Sightings																	
6	19/12/16	Hen Harrier	Immature Female	16:08	X	X													20
6	20/12/16	Hen Harrier	Male	09:02	X	X												X	36
12	20/12/16	Nil Sightings																	
5	21/12/16	Nil Sightings																	
10	21/12/16	Nil Sightings																	
10	22/12/16	Nil Sightings																	
11	22/12/16	Hen Harrier	Male	16:00			X											X	642
11	22/12/16	Hen Harrier	Male	16:15			X											X	212
11	22/12/16	Hen Harrier	Female	16:21			X												7
	23/12/16	Hen Harrier	Male	14:10															
11	17/01/17	Hen Harrier	Male	08:55		X												X	18
11	17/01/17	Hen Harrier	Male	17:03			X												15
12	18/01/17	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
5	18/01/17	Nil Sightings																	
5	19/01/17	Nil Sightings																	
12	19/01/17	Nil Sightings																	
6	25/01/17	Nil Sightings																	
10	25/01/17	Nil Sightings																	
10	27/01/17	Nil Sightings																	
3	27/01/17	Nil Sightings																	
2	29/01/17	Nil Sightings																	
2	29/01/17	Nil Sightings																	
3	31/01/17	Nil Sightings																	
6	31/01/17	Nil Sightings																	
11	08/02/17	Hen Harrier	Male	17:25			X												14
11	08/02/17	Hen Harrier	Male	17:40			X												5
12	09/02/17	Nil Sightings																	
2	10/02/17	Hen Harrier	Male	10:10			X												15
5	10/02/17	Nil Sightings																	
6	11/02/17	Nil Sightings																	
3	12/02/17	Hen Harrier	Male	15:20		X													12
3	12/02/17	Hen Harrier	Male	15:35			X												10
3	12/02/17	Hen Harrier	Male	17:10			X												10
5	13/02/17	Nil Sightings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Duration (s)
10	14/02/17	Hen Harrier	Male	16:00			X												6
10	14/02/17	Hen Harrier	Male	17:30			X												8
10	14/02/17	Hen Harrier	Ringtail	17:45														X	20
3	15/02/17	Nil Sightings																	
11	16/02/17	Hen Harrier	Ringtail	07:34			X												5
11	16/02/17	Hen Harrier	Male	07:34		X	X											X	30
6	16/02/17	Nil Sightings																	
12	22/02/17	Nil Sightings																	
2	23/02/17	Nil Sightings																	
10	24/02/17	Nil Sightings																	

REFERENCE DOCUMENTS

Table 30 Details of Hen Harrier behaviour which the birds were exhibiting during each observation and associated notes for vantage point surveys undertaken during the non - breeding season in 2016/17.

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
1	13/09/16	Nil Sightings										
10	13/09/16	Hen Harrier	Male				X				30	1x male HH hunting over bog habitat
10	13/09/16	Hen Harrier	Male					X			10	1x male HH flying over forestry east towards Bealaclave.
4	14/09/16	Hen Harrier	Male				X				15	1x male HH hunting over bog habitat
3	15/09/16	Hen Harrier	Juve-nile					X			20	1x HH (Ringtail – prob. juv. Male) flying, lost from view
5	16/09/16	Nil Sightings										
6	16/09/16	Hen Harrier	Juve-nile					X			60	1x HH (Ringtail) circling around then flying north to north slope of Mauherslieve
6	16/09/16	Hen Harrier	Male					X			30	1x male HH flying similar flight to previous bird then circling north slope of Mauherslieve
2	17/09/16	Hen Harrier	Male				X				80	1x male HH hunting
2	17/09/16	Nil Sightings										18 Golden Plover
10	18/09/16	Hen Harrier	Imma-ture Male				X				20	1x male HH hunting over bog habitat
5	18/09/16	Nil Sightings										
6	19/09/16	Hen Harrier	Juve-nile					X			10	1x female HH seen briefly over roost area
1	19/09/16	Nil Sightings										
3	20/09/16	Hen Harrier	Juve-nile					X			15	1x female HH seen briefly over roost area
4	20/09/16	Hen Harrier	Male		X						70	1x male HH circling over bog habitat

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
4	20/09/16	Hen Harrier	Juve-nile					X			20	1x HH (Ringtail) flying direct line toward roost. South of Mauherslieve
12	20/09/16	Nil Sightings										
12	20/09/16	Nil Sightings										
11	21/09/16	Nil Sightings										
11	21/09/16	Nil Sightings										
7	22/09/16	Nil Sightings										
7	22/09/16	Nil Sightings										
8	27/09/16	Nil Sightings										
8	27/09/16	Nil Sightings										
9	28/09/16	Nil Sightings										
9	28/09/16	Hen Harrier	Male				X				60	1x male HH came from the N hunting over rough grassland and then headed in a south-erly direction.
1	15/10/16	Nil Sightings										
10	15/10/16	Hen Harrier	Male				X				20	1x male HH hunting then perched on tussock for 45 mins then flying west into dead ground at 18:32hrs .
10	15/10/16	Hen Harrier	Male					X			2820	
10	15/10/16	Hen Harrier	Male					X			10	
5	16/10/16	Nil Sightings										
2	16/10/16	Nil Sightings										
7	17/10/16	Nil Sightings										
4	18/10/16	Nil Sightings										

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
3	18/10/16	Nil Sightings										
6	19/10/16	Nil Sightings										
1	20/10/16	Nil Sightings										
6	20/10/16	Hen Harrier	Male					X			30	1x male HH landing on ground twice eventu-ally settling to roost at 18:44 hrs
7	21/10/16	Nil Sightings										
5	21/10/16	Nil Sightings										
4	22/10/16	Nil Sightings										
10	24/10/16	Hen Harrier	Fe-male				X				25	1x HH (Ringtail - probably female) hunting 08:15 hrs coming from west.
10	24/10/16	Hen Harrier	Male				X				40	1x HH (Sub ad M) hunting coming from west.
10	24/10/16	Hen Harrier	Male				X				30	1x male HH hunting coming from west.
11	24/10/16	Hen Harrier	Male				X				10	1x male HH hunting over HB, flying in an E-W direction.
11	24/10/16	Hen Harrier	Male					X			13	1x male HH flying E-W over HB habitat and landing into heather 18:30.
3	25/10/16	Nil Sightings										
11	25/10/16	Nil Sightings										
12	25/10/16	Nil Sightings										
12	26/10/16	Nil Sightings										
8	26/10/16	Nil Sightings										
8	27/10/16	Hen Harrier	Male				X				13	1x male HH hunting over rough grassland fly-ing in an E-W and then flew N, disappeared from view.
9	27/10/16	Nil Sightings										

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
9	28/10/16	Nil Sightings										
2	29/10/16	Nil Sightings										8 Golden Plover flying around top of Mau-herslieve 18:20h
9	20/11/16	Nil Sightings										
5	21/11/16	Nil Sightings										7 Golden Plover flying around
6	21/11/16	Hen Harrier	Juve-nile					X			40	1x HH (Ringtail -prob. male), flying north
8	22/11/16	Nil Sightings										
3	22/11/16	Nil Sightings										
9	23/11/16	Nil Sightings										
4	23/11/16	Hen Harrier	Juve-nile				X				10	9 Golden Plover flying around
6	24/11/16	Nil Sightings										
8	25/11/16	Nil Sightings										
4	28/11/16	Nil Sightings										20 Golden Plover on rough grassland.
5	28/11/16	Hen Harrier	Imma-ture Male				X				360	1x HH (Sub ad Male) hunting on RG for 6 minutes, 2 strikes on prey and then perched on fieldbank for 2 minutes.
1	28/11/16	Nil Sightings										
1	28/11/16	Nil Sightings										
12	28/11/16	Nil Sightings										
12	28/11/16	Nil Sightings										
2	29/11/16	Nil Sightings										
2	29/11/16	Hen Harrier	Fe-male					X			20	1x female HH flew east over VP

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
11	29/11/16	Nil Sightings										
11	29/11/16	Hen Harrier	Fe-male					X			12	1x female HH flew in from south low over bog, circled briefly and quickly dropped into heather
11	29/11/16	Hen Harrier	Male					X			947	1x male HH flew in from the south over bog, flying for 16 seconds and perched on fence post at edge of forestry. Perched on the post for 8 min 20 secs before flying a short distance onto a tree in the bog. Perched here for a fur-ther 5 mins 20 secs. Flew from tree and over bog for 78 seconds before perching briefly on the ground (22 seconds). Took off from ground and flew up towards area where fe-male roosted and dropped into heather and out of sight
11	29/11/16	Hen Harrier	Male					X			11	1x male HH flew in from the south, flying low over bog, circled briefly before landing into heather.
3	30/11/16	Nil Sightings										
7	30/11/16	Nil Sightings										
7	30/11/16	Nil Sightings										
10	30/11/16	Nil Sightings										
10	30/11/16	Nil Sightings										
2	15/12/16	Nil Sightings										
2	15/12/16	Nil Sightings										
12	16/12/16	Nil Sightings										
5	16/12/16	Nil Sightings										

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
11	19/12/16	Nil Sightings										
6	19/12/16	Hen Harrier	Imma-ture Fe-male					X			20	1x HH (Imm. Female) flying from south to north in front of VP6, flying low over grassland and rough grassland and disappeared behind hill to north of VP. Possibly heading to a roost. C. 20 Golden Plover feeding in improved grass-land field to north of the VP6.
6	20/12/16	Hen Harrier	Male				X				36	1x male HH came from the north over rough grassland and forestry, lifted the field full of JD and RO and flew over VP6 and headed south behind VP6.
12	20/12/16	Nil Sightings										
5	21/12/16	Nil Sightings										
10	21/12/16	Nil Sightings										
10	22/12/16	Nil Sightings										8 x Golden Plover flying over HB in a S-N direc-tion.
11	22/12/16	Hen Harrier	Male					X	X		642	1x male HH; first male flew from the forestry to east of bog habitat, perched on a fence post on the bog habitat for around 630 seconds and then went to roost after the second male went to roost in a clump of heather on the bog.
11	22/12/16	Hen Harrier	Male					X	X		212	1x male HH; second male joined the first male on the fence post coming from the forestry to the east of the vp. Perched there for approx. 200 seconds and was the first to head to roost on the bog.
11	22/12/16	Hen Harrier	Fe-male					X			7	1x female HH came from the west over the bog habitat and went straight into a roost near to the 2x male HH.

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
	23/12/16	Hen Harrier	Male									1x male HH flew from Knockmaroe towards Knocknabansha and then headed west to-wards Knockduff. He was flying over improved grassland and headed towards mature for-estry on Knockduff.
11	17/01/17	Hen Harrier	Male					X			18	1x male HH flying east over mature forestry and then looped back and headed west over rough grassland and over the mature forestry again and disappeared behind forestry and out of sight.
11	17/01/17	Hen Harrier	Male					X			15	1x male HH flew east over hill across heath and then looped back over the hill and headed west. Possibly heading to roost but was dis-turbed by presence of three fallow deer.
12	18/01/17	Nil Sightings										
5	18/01/17	Nil Sightings										
5	19/01/17	Nil Sightings										
12	19/01/17	Nil Sightings										
6	25/01/17	Nil Sightings										
10	25/01/17	Nil Sightings										
10	27/01/17	Nil Sightings										
3	27/01/17	Nil Sightings										
2	29/01/17	Nil Sightings										
2	29/01/17	Nil Sightings										
3	31/01/17	Nil Sightings										
6	31/01/17	Nil Sightings										

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VP Name	Date	Species	Sex	Soar-ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
11	08/02/17	Hen Harrier	Male				X				14	1x male HH hunting around roost at dusk
11	08/02/17	Hen Harrier	Male				X				5	
12	09/02/17	Nil Sightings										
2	10/02/17	Hen Harrier	Male				X				15	
5	10/02/17	Nil Sightings										
6	11/02/17	Nil Sightings										
3	12/02/17	Hen Harrier	Male				X				12	
3	12/02/17	Hen Harrier	Male				X				10	
3	12/02/17	Hen Harrier	Male				X				10	
5	13/02/17	Nil Sightings										
10	14/02/17	Hen Harrier	Male				X				6	
10	14/02/17	Hen Harrier	Male				X				8	
10	14/02/17	Hen Harrier	Ring-tail					X			20	1x male HH and 1x HH (Ringtail – prob. male) near roost at dusk
3	15/02/17	Nil Sightings										
11	16/02/17	Hen Harrier	Ring-tail					X			5	1x HH (Ringtail) leaving roost
11	16/02/17	Hen Harrier	Male					X			30	1x male HH flying from roost toward Keeper Hill.
6	16/02/17	Nil Sightings										
12	22/02/17	Nil Sightings										
2	23/02/17	Nil Sightings										
10	24/02/17	Nil Sightings										

REFERENCE DOCUMENTS

Table 31 Details of Hen Harrier sightings and the habitats over which the birds were observed from vantage point surveys undertaken during the breeding season in 2017.

G = Grazing; RG = Rough Grazing; HB = Heath or bog; DE = Deciduous woodland or scrub; GO = Gorse; CF = Clear fell; NF2 = New forestry plantation trees 20-30cm high; NF3 = New forestry plantation trees c 1m high; NF4 = New forestry plantation trees > 2m high; 2nd F1/F2 = Second rotation forestry plantation trees 20-30cm high; 2nd F3 = Second rotation forestry plantation trees c 1m high; 2nd F4 = Second rotation forestry plantation trees > 2m high; F= Post thicket forestry

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
3	12/03/17	Nil Sight-ings																	
9	13/03/17	Nil Sight-ings																	
12	13/03/17	Nil Sight-ings																	
12	14/03/17	Nil Sight-ings																	
11	14/03/17	Nil Sight-ings																	
12	14/03/17	Nil Sight-ings																	
3	14/03/17	Hen Harrier	Male	15:37			X												130
3	14/03/17	Hen Harrier	Female	15:37			X												280
11	15/03/17	Nil Sight-ings																	
10	15/03/17	Nil Sight-ings																	
1	15/03/17	Nil Sight-ings																	
8	16/03/17	Hen Harrier	Male	12:20		X												X	88
8	16/03/17	Hen Harrier	Male	15:29		X													37

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VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
5	16/03/17	Nil Sight-ings																	
5	21/03/17	Nil Sight-ings																	
6	21/03/17	Hen Harrier	Male	16:28		X													7
6	21/03/17	Hen Harrier	Male	16:44	X	X												X	162
6	22/03/17	Nil Sight-ings																	
10	22/03/17	Nil Sight-ings																	
7	23/03/17	Nil Sight-ings																	
2	24/03/17	Hen Harrier	Male	09:54			X					X							90
4	24/03/17	Nil Sight-ings																	
2	27/03/17	Hen Harrier	Male	09:55								X							35
2	27/03/17	Hen Harrier	Female	09:55								X							35
3	05/04/17	Nil Sight-ings																	
8	05/04/17	Nil Sight-ings																	
2	06/04/17	Hen Harrier	Female	08:05			X											X	270
2	06/04/17	Hen Harrier	Male	08:05			X											X	510
10	08/04/17	Hen Harrier	Male	12:15			X											X	190
10	08/04/17	Hen Harrier	Male	15:00			X											X	30
7	09/04/17	Nil Sight-ings																	

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VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
4	09/04/17	Nil Sight-ings																	
1	10/04/17	Nil Sight-ings																	
5	10/04/17	Hen Harrier	Male	12:59			X												450
5	10/04/17	Hen Harrier	Female	13:05			X												300
5	10/04/17	Hen Harrier	Male	13:13			X												10
5	10/04/17	Hen Harrier	Female	13:13			X												10
5	10/04/17	Hen Harrier	Male	14:16			X												50
5	10/04/17	Hen Harrier	Female	14:20			X												2400
7	10/04/17	Hen Harrier	Male	15:30		X													10
2	11/04/17	Hen Harrier	Male	08:00		X	X											X	761
1	12/04/17	Nil Sight-ings																	
6	12/04/17	Hen Harrier	Male	11:47			X												30
6	12/04/17	Hen Harrier	Male	13:05			X					X							1957
6	12/04/17	Hen Harrier	Male	13:26								X							430
3	17/04/17	Nil Sight-ings																	
5	17/04/17	Hen Harrier	Male	14:45			X												17
8	18/04/17	Hen Harrier	Male	08:00			X											X	900
8	18/04/17	Hen Harrier	Female	08:00			X											X	800
9	18/04/17	Nil Sight-ings																	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
6	19/04/17	Hen Harrier	Female	11:13			x											x	720
6	19/04/17	Hen Harrier	Male	11:20			x											x	100
4	19/04/17	Nil Sight-ings																	
12	22/04/17	Hen Harrier	Male	08:48														X	70
12	22/04/17	Hen Harrier	Female	08:49														X	80
11	22/04/17	Hen Harrier	Female	13:00			X											x	80
11	22/04/17	Hen Harrier	Female	13:40			X												60
11	22/04/17	Hen Harrier	Female	13:40			X												60
11	22/04/17	Hen Harrier	Male	13:40			X											X	380
12	27/04/17	Hen Harrier	Male	12:05														X	270
12	27/04/17	Hen Harrier	Male	12:05														X	80
12	27/04/17	Hen Harrier	Female	12:05														X	340
11	27/04/17	Hen Harrier	Male	15:00				X											470
11	27/04/17	Hen Harrier	Male	15:15															135
1	05/05/17	Nil Sight-ings																	
2	05/05/17	Hen Harrier	Male	14:50			X											X	384
2	05/05/17	Hen Harrier	Female	14:50			X											X	50
2	05/05/17	Hen Harrier	Male	15:00			X												330
6	06/05/17	Hen Harrier	Male	15:45			X												504
6	06/05/17	Hen Harrier	Female	15:45			X												610

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VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
1	08/05/17	Nil Sight-ings																	
4	08/05/17	Hen Harrier	Male	10:12			X												108
3	08/05/17	Hen Harrier	Female	15:50			X												30
3	08/05/17	Hen Harrier	Male	16:20			X											X	135
5	09/05/17	Hen Harrier	Male	09:46			X												70
4	09/05/17	Nil Sight-ings																	
3	18/05/17	Nil Sight-ings																	
5	18/05/17	Nil Sight-ings																	
8	19/05/17	Hen Harrier	Male	11:09		X	X							X					314
8	19/05/17	Nil Sight-ings																	
2	20/05/17	Hen Harrier	Male	12:53			X											X	80
6	20/05/17	Hen Harrier	Male	16:17		X	X											X	60
6	20/05/17	Hen Harrier	Female	16:17			X											X	10
9	22/05/17	Hen Harrier	Male	11:36			X											X	169
9	22/05/17	Hen Harrier	Male	12:03														X	8
9	22/05/17	Hen Harrier	Male	12:39		X													151
9	22/05/17	Hen Harrier	Male	14:04														X	53
9	22/05/17	Hen Harrier	Male	15:05			X							X				X	130
	22/05/17	Hen Harrier	Male	17:56		X													15

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
7	22/05/17	Nil Sight-ings																	
7	23/05/17	Nil Sight-ings																	
10	23/05/17	Hen Harrier	Male	12:18			X												18
10	23/05/17	Hen Harrier	Male	13:29			X											X	342
10	23/05/17	Hen Harrier	Male	13:33			X											X	189
10	23/05/17	Hen Harrier	Male	13:57			X							X					34
10	23/05/17	Hen Harrier	Male	13:59			X												28
10	23/05/17	Hen Harrier	Male	14:11			X												27
10	23/05/17	Hen Harrier	Male	14:12			X							X					192
10	23/05/17	Hen Harrier	Male	14:54			X							X					605
	23/05/17	Hen Harrier	Male	15:12			X											X	180
10	23/05/17	Hen Harrier	Male	15:37			X												540
10	23/05/17	Hen Harrier	Male	16:14			X												131
10	23/05/17	Hen Harrier	Male	16:25			X												680
10	23/05/17	Hen Harrier	Male	17:00			X							X				X	2145
10	23/05/17	Hen Harrier	Male	17:45			X							X				X	1080
10	23/05/17	Hen Harrier	Male	18:24			X												582
11	24/05/17	Hen Harrier	Male	11:05			X											X	35
11	24/05/17	Hen Harrier	Male	12:20														X	60
12	24/05/17	Hen Harrier	Male	15:55			X											X	80
12	24/05/17	Hen Harrier	Male	15:55			X											X	120

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VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
12	24/05/17	Hen Harrier	Female	15:55			X											X	40
7	24/05/17	Hen Harrier	Male	12:28		X												X	420
7	24/05/17	Hen Harrier	Male	12:50		X								X				X	185
11	26/05/17	Nil Sight-ings																	
12	26/05/17	Nil Sight-ings																	
1	16/06/17	Nil Sight-ings																	
3	16/06/17	Hen Harrier	Male	14:57		X													150
4	17/06/17	Nil Sight-ings																	
1	17/06/17	Nil Sight-ings																	
2	18/06/17	Hen Harrier	Male	09:10			X											X	2449
2	18/06/17	Hen Harrier	Male	12:21		X													40
4	19/06/17	Hen Harrier	Male	08:30			X												90
4	19/06/17	Hen Harrier	Male	10:55			X												20
10	19/06/17	Hen Harrier	Male	14:38			X												60
10	19/06/17	Hen Harrier	Female	14:38			X											X	200
10	19/06/17	Hen Harrier	Male	15:10			X												30
5	19/06/17	Hen Harrier	Male	10:50			X												17
5	19/06/17	Hen Harrier	Male	10:51			X												46
5	19/06/17	Hen Harrier	Female	11:53			X												23
5	19/06/17	Hen Harrier	Female	12:08			X											X	64

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VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
5	19/06/17	Hen Harrier	Male	12:55			X												76
5	19/06/17	Hen Harrier	Male	13:00			X												16
5	19/06/17	Hen Harrier	Male	13:02			X												7
5	19/06/17	Hen Harrier	Male	13:08			X												169
5	19/06/17	Hen Harrier	Male	14:16		X	X											x	55
5	19/06/17	Hen Harrier	Male	14:22			X											X	470
5	19/06/17	Hen Harrier	Female	14:25			X												171
5	19/06/17	Hen Harrier	Male	14:57														X	27
5	19/06/17	Hen Harrier	Female	15:51			X												37
5	19/06/17	Hen Harrier	Male	15:51		X	X												42
5	19/06/17	Hen Harrier	Female	15:59			X												23
5	19/06/17	Hen Harrier	Female	16:04			X												28
5	19/06/17	Hen Harrier	Male	16:10		X	X												31
5	19/06/17	Hen Harrier	Female	16:11			X												135
2	20/06/17	Hen Harrier	Male	10:47			X											X	130
11	20/06/17	Hen Harrier	Male	10:47			X											X	118
11	20/06/17	Hen Harrier	Male	12:39														X	13
11	20/06/17	Hen Harrier	Male	12:42			X											X	47
10	21/06/17	Hen Harrier	Male	08:50			X												75
10	21/06/17	Hen Harrier	Female	09:15			X												15
10	21/06/17	Hen Harrier	Male	09:44			X												20

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
12	21/06/17	Nil Sight-ings																	
8	25/06/17	Hen Harrier	Male	16:18	X	X		X											344
8	25/06/17	Nil Sight-ings																	
6	26/06/17	Hen Harrier	Male	11:55		X													25
6	26/06/17	Hen Harrier	Male	12:02		X													21
6	26/06/17	Nil Sight-ings																	
7	26/06/17	Nil Sight-ings																	
9	27/06/17	Nil Sight-ings																	
9	27/06/17	Nil Sight-ings																	
7	28/06/17	Nil Sight-ings																	
7	28/06/17	Nil Sight-ings																	
1	14/07/17	Nil Sight-ings																	
3	14/07/17	Nil Sight-ings																	
3	16/07/17	Nil Sight-ings																	
5	16/07/17	Hen Harrier	Male	13:00			X												100
2	17/07/17	Hen Harrier	Male	07:17			X												1764
2	17/07/17	Hen Harrier	Female	09:14			X												131

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
4	17/07/17	Hen Harrier	Female	15:18			X											X	5
2	20/07/17	Nil Sight-ings																	
5	24/07/17	Hen Harrier	Male	07:47			X												30
5	24/07/17	Hen Harrier	Female	09:43			X												70
5	24/07/17	Hen Harrier	Female	10:26			X												30
1	04/08/20 17	Nil Sight-ings																	
11	10/08/20 17	Nil Sight-ings																	
12	10/08/20 17	Nil Sight-ings																	
10	09/08/20 17	Hen Harrier	Female	09:55			X												60
10	09/08/20 17	Hen Harrier	Juve-nile Fe-male	09:55			X												10
10	09/08/20 17	Hen Harrier	Female	11:40			X												130
10	09/08/20 17	Hen Harrier	Juve-nile Fe-male	11:40			X												20
10	09/08/20 17	Hen Harrier	Female	13:15			X												60
10	09/08/20 17	Hen Harrier	Juve-nile Fe-male	13:15			X												180
10	09/08/20 17	Hen Harrier	Juve-nile Fe-male	14:10			X												250

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	G	RG	HB	DE	GO	CF	NF1	NF2	NF3	NF4	2nd F1/ F2	2nd F3	2nd F4	F	Dura-tion (s)
6	09/08/2017	Nil Sight-ings																	
8	10/08/2017	Hen Harrier	Female	11:48														X	140
9	10/08/2017	Nil Sight-ings																	
7	11/08/2017	Nil Sight-ings																	
5	11/08/2017	Nil Sight-ings																	
4	15/08/2017	Nil Sight-ings																	
5	15/08/2017	Nil Sight-ings																	
6	15/08/2017	Nil Sight-ings																	
4	17/08/2017	Nil Sight-ings																	
8	17/08/17	Nil Sight-ings																	
9	17/08/17	Nil Sight-ings																	

REFERENCE DOCUMENTS

Table 32 Details of Hen Harrier behaviour which the birds were exhibiting during each observation and associated notes for vantage point surveys undertaken during the breeding season in 2017.

VP Name	Date	Species	Sex	Time of sighting	Soaring	Circling	Displaying	Hunting	Flying	Perching	Food Pass	Duration (s)	Bird Notes
3	12/03/17	Nil Sightings											
9	13/03/17	Nil Sightings											
12	13/03/17	Nil Sightings											
12	14/03/17	Nil Sightings											
11	14/03/17	Nil Sightings											c. 200 Golden Plover
12	14/03/17	Nil Sightings											
3	14/03/17	Hen Harrier	Male	15:37					X			130	1x male HH and 1x female HH flying together.
3	14/03/17	Hen Harrier	Female	15:37					X			280	
11	15/03/17	Nil Sightings											
10	15/03/17	Nil Sightings											
1	15/03/17	Nil Sightings											
8	16/03/17	Hen Harrier	Male	12:20		X			X			88	1x male HH flying N-S over RG, circled over RG to south of VP and then flew over mature forestry and out of sight.
8	16/03/17	Hen Harrier	Male	15:29				X	X			37	1x male HH flying S-N over RG, and went behind farmhouse and out of sight.
5	16/03/17	Nil Sightings											
5	21/03/17	Nil Sightings											
6	21/03/17	Hen Harrier	Male	16:28					X			7	1x male HH hunting over RG north of VP. c.50 Golden Plover.

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
6	21/03/17	Hen Harrier	Male	16:44		X	X		X			162	1x male HH flew E-W over RG, circled back, displaying over grassland and forestry north of VP, flew and circled over and behind VP, across the road up onto the RG field south of vp and lost from sight behind hill.
6	22/03/17	Nil Sightings											
10	22/03/17	Nil Sightings											
7	23/03/17	Nil Sightings											
2	24/03/17	Hen Harrier	Male	09:54	X			X	X			90	1x male HH soaring over Mauher Slieve. 6 Golden Plover over Mauher Slieve.
4	24/03/17	Nil Sightings											
2	27/03/17	Hen Harrier	Male	09:55	X							35	1x male HH over traditional nest site
2	27/03/17	Hen Harrier	Female	09:55	X							35	1x male HH and 1x female HH flying together over traditional territory.
3	05/04/17	Nil Sightings											
8	05/04/17	Nil Sightings											
2	06/04/17	Hen Harrier	Female	08:05	X							270	
2	06/04/17	Hen Harrier	Male	08:05	X			X				510	
10	08/04/17	Hen Harrier	Male	12:15	X	X						190	1x male HH displaying high (c. 1km} over traditional territory.
10	08/04/17	Hen Harrier	Male	15:00					X			30	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
7	09/04/17	Nil Sightings											
4	09/04/17	Nil Sightings											
1	10/04/17	Nil Sightings											
5	10/04/17	Hen Harrier	Male	12:59			X					450	1x male HH displaying over traditional territory. Food pass between male and female HH.
5	10/04/17	Hen Harrier	Female	13:05					X			300	
5	10/04/17	Hen Harrier	Male	13:13							X	10	
5	10/04/17	Hen Harrier	Female	13:13							X	10	
5	10/04/17	Hen Harrier	Male	14:16	X							50	
5	10/04/17	Hen Harrier	Female	14:20				X				2400	
7	10/04/17	Hen Harrier	Male	15:30					X			10	1x male HH hunting
2	11/04/17	Hen Harrier	Male	08:00			X		X	X		761	1x male HH flying from Knockfune then displaying and perched on ground at traditional territory Mauher Slieve.
1	12/04/17	Nil Sightings											
6	12/04/17	Hen Harrier	Male	11:47					X			30	1x male HH over traditional nest site
6	12/04/17	Hen Harrier	Male	13:05					X	X		1957	
6	12/04/17	Hen Harrier	Male	13:26					X			430	2nd male HH flying, then both males fly away to north, one returning.
3	17/04/17	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
5	17/04/17	Hen Harrier	Male	14:45				X				17	
8	18/04/17	Hen Harrier	Male	08:00			X					900	1x male HH and 1x female HH dis-playing over traditional territory.
8	18/04/17	Hen Harrier	Fe-male	08:00					X			800	
9	18/04/17	Nil Sightings											
6	19/04/17	Hen Harrier	Fe-male	11:13		X						720	1x male HH and 1x female HH cir-cling traditional territory.
6	19/04/17	Hen Harrier	Male	11:20		X						100	
4	19/04/17	Nil Sightings											
12	22/04/17	Hen Harrier	Male	08:48		X				X		70	1x male HH and 1x female HH cir-cling traditional territory.
12	22/04/17	Hen Harrier	Fe-male	08:49		X						80	
11	22/04/17	Hen Harrier	Fe-male	13:00		X			X			80	1x female HH over traditional nest site.
11	22/04/17	Hen Harrier	Fe-male	13:40	X							60	
11	22/04/17	Hen Harrier	Fe-male	13:40	X							60	2x female HH and 1x male HH soaring between two traditional nest sites.
11	22/04/17	Hen Harrier	Male	13:40	X							380	
12	27/04/17	Hen Harrier	Male	12:05					270			270	2x male HH and 1x female HH over traditional territory
12	27/04/17	Hen Harrier	Male	12:05					80			80	
12	27/04/17	Hen Harrier	Fe-male	12:05					340			340	
11	27/04/17	Hen Harrier	Male	15:00				X				470	1x male HH over traditional terri-tory

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
11	27/04/17	Hen Harrier	Male	15:15			X					135	
1	05/05/17	Nil Sightings											
2	05/05/17	Hen Harrier	Male	14:50			X	X	X			384	1x male HH and 1x female HH over traditional territory
2	05/05/17	Hen Harrier	Fe-male	14:50					X			50	
2	05/05/17	Hen Harrier	Male	15:00				X				330	
6	06/05/17	Hen Harrier	Male	15:45		X						504	1x male HH and 1x female HH over traditional territory
6	06/05/17	Hen Harrier	Fe-male	15:45		X						610	
1	08/05/17	Nil Sightings											
4	08/05/17	Hen Harrier	Male	10:12	X							108	
3	08/05/17	Hen Harrier	Fe-male	15:50	X							30	
3	08/05/17	Hen Harrier	Male	16:20			X		X			135	
5	09/05/17	Hen Harrier	Male	09:46	X							70	
4	09/05/17	Nil Sightings											
3	18/05/17	Nil Sightings											
5	18/05/17	Nil Sightings											
8	19/05/17	Hen Harrier	Male	11:09		X	X		X			314	1x male HH flying, circling and skydancing the last 15s over heath, rough grazing and young plantation (>2m).
8	19/05/17	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
2	20/05/17	Hen Harrier	Male	12:53	X							80	1x male HH over traditional terri-tory.
6	20/05/17	Hen Harrier	Male	16:17				X	X		X	60	Food pass at same site as 2016.
6	20/05/17	Hen Harrier	Fe-male	16:17							X	10	
9	22/05/17	Hen Harrier	Male	11:36		x						169	1x male HH circling over heath and mature plantation
9	22/05/17	Hen Harrier	Male	12:03					X			8	1x male HH flying over mature plantation
9	22/05/17	Hen Harrier	Male	12:39					X			151	1x male HH flying over rough grazing
9	22/05/17	Hen Harrier	Male	14:04					X			53	1x male HH flying over mature plantation
9	22/05/17	Hen Harrier	Male	15:05		X						130	1x male HH circling over heath, mature plantation and young plantation (>2m).
CS	22/05/17	Hen Harrier	Male	17:56					X			15	1x male HH flying over rough grazing
7	22/05/17	Nil Sightings											
7	23/05/17	Nil Sightings											
10	23/05/17	Hen Harrier	Male	12:18					X			18	1x male HH flying over heath
10	23/05/17	Hen Harrier	Male	13:29		X			X			342	1x male HH flying, circling over heath and mature plantation, sec-ond male HH joins later
10	23/05/17	Hen Harrier	Male	13:33					X			189	1x male HH flying over mature plantation, joins another male HH
10	23/05/17	Hen Harrier	Male	13:57				X				34	1x male HH hunting in heath and over young plantation (>2m)
10	23/05/17	Hen Harrier	Male	13:59					X			28	1x male HH flying over heath

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
10	23/05/17	Hen Harrier	Male	14:11	X				X			27	1x male HH flying, soaring over heath
10	23/05/17	Hen Harrier	Male	14:12				X				192	1x male HH hunting in heath and over young plantation (>2m)
10	23/05/17	Hen Harrier	Male	14:54				X	X	X		605	1x male HH hunting, flying over heath and young plantation (>2m), keeps coming back to the same spot in heath
CS	23/05/17	Hen Harrier	Male	15:12				X	X			180	1x male HH flying hunting over heath and mature plantation
10	23/05/17	Hen Harrier	Male	15:37				x	X	X		540	1x male HH flying, hunting and perching in heath
10	23/05/17	Hen Harrier	Male	16:14					X			131	1x male HH flying over heath
10	23/05/17	Hen Harrier	Male	16:25					X	X		680	1x male HH flying over heath, perching and then flying away
10	23/05/17	Hen Harrier	Male	17:00				X	X	X		2145	1x male HH flying over heath and into young plantation (>2m), and then keeps coming back to perch in the same spot in heath. Doing the same circle many times
10	23/05/17	Hen Harrier	Male	17:45			X		X			1080	1x male HH flying, later skydanc-ing for 4min over heath, young plantation (>2m) and mature plantation, later chasing away a HC.
10	23/05/17	Hen Harrier	Male	18:24					X	X		582	1x male HH perching for almost 10min then flying away
11	24/05/17	Hen Harrier	Male	11:05	X				X			35	1x male HH with prey flying south.
11	24/05/17	Hen Harrier	Male	12:20			X					60	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
12	24/05/17	Hen Harrier	Male	15:55			X					80	2x male HH and 1x female HH over traditional territory
12	24/05/17	Hen Harrier	Male	15:55			X					120	
12	24/05/17	Hen Harrier	Fe-male	15:55	X							40	
7	24/05/17	Hen Harrier	Male	12:28	X	X						420	1x male HH soaring and circling higher and higher, over rough grazing and mature plantation
7	24/05/17	Hen Harrier	Male	12:50		X	X		X			185	1x male HH flying, circling and skydancing over rough grazing, young plantation (>2m) and ma-ture plantation
11	26/05/17	Nil Sightings											
12	26/05/17	Nil Sightings											
1	16/06/17	Nil Sightings											
3	16/06/17	Hen Harrier	Male	14:57				X				150	
4	17/06/17	Nil Sightings											
1	17/06/17	Nil Sightings											
2	18/06/17	Hen Harrier	Male	09:10				X		X		2449	1x male HH had a successful strike. No evidence of nesting af-ter 4 hour survey. 1x male HH was hunting for 183 seconds, 1x male HH with prey for 441 seconds. The male then perched for 1711 seconds. Then started to hunt again for 114 seconds.
2	18/06/17	Hen Harrier	Male	12:21	X							40	1x male HH soaring and headed NE

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
4	19/06/17	Hen Harrier	Male	08:30				X				90	
4	19/06/17	Hen Harrier	Male	10:55					X			20	1x male HH flying
10	19/06/17	Hen Harrier	Male	14:38		X						60	
10	19/06/17	Hen Harrier	Fe-male	14:38					X		X	200	Probable food pass; 1x female HH flying from bog to edge of for-estry perched on ground for 3 mins then returned to bog.
10	19/06/17	Hen Harrier	Male	15:10					X			30	1x male HH flying over same area as previously.
5	19/06/17	Hen Harrier	Male	10:50				X				17	1x male HH hunting low over heather bog/wet heath habitat, flew north behind ridge line and out of sight
5	19/06/17	Hen Harrier	Male	10:51	X	X						46	1x male HH circling and soaring over heather/bog/ wet heath habitat, circled off to NE behind hill top and out of view.
5	19/06/17	Hen Harrier	Fe-male	11:53	X							23	1x female HH soaring over heather bog and forestry, flew north out of sight
5	19/06/17	Hen Harrier	Fe-male	12:08	X	X						64	1x female HH soaring and flying over heather bog, flew north out of sight.
5	19/06/17	Hen Harrier	Male	12:55	X							76	1x male HH soaring over heather bog and forestry
5	19/06/17	Hen Harrier	Male	13:00					X			16	1x male HH chasing Raven east over heather bog, dropped down behind hill and out of sight
5	19/06/17	Hen Harrier	Male	13:02					X			7	1 x HH male flying over heather bog

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
5	19/06/17	Hen Harrier	Male	13:08	X							169	1 x HH male soaring high over heather bog
5	19/06/17	Hen Harrier	Male	14:16				X				55	1 x HH male hunting over heather bog, RG, MF, along ridge of hill from east to west.
5	19/06/17	Hen Harrier	Male	14:22	X	X						470	1x male HH circling and soaring over heather bog, started low but quickly gained altitude beyond 100m. Dropped down to circle close to 1x female HH and gained altitude again and lost sight of him.
5	19/06/17	Hen Harrier	Fe-male	14:25	X	X						171	1x female HH flew in from north and circled / soared up to ~50m, interacted with 1x female HH and dropped down
5	19/06/17	Hen Harrier	Male	14:57					X			27	1x male HH flying from west to east over forestry.
5	19/06/17	Hen Harrier	Fe-male	15:51	X				X			37	1x female HH flying and then soaring over heather bog, soared only to ~50m, flew off to north
5	19/06/17	Hen Harrier	Male	15:51				X	X			42	1x male HH flying close over heather bog, flew off west hunt-ing along forestry edge over rough grassland.
5	19/06/17	Hen Harrier	Fe-male	15:59		X			X			23	1x female HH circling and then hunting over heather bog up on hill
5	19/06/17	Hen Harrier	Fe-male	16:04	X	X			X			28	1x female HH circling and soaring over heather bog, gradually glided off north and out of sight

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
5	19/06/17	Hen Harrier	Male	16:10					X		X	31	1x male HH flew in from west carrying prey, directly towards heather bog on hill
5	19/06/17	Hen Harrier	Female	16:11					X	X	X	135	1x female HH flew from behind hill for food pass, landed on heather bog on south side of hill. Took off after 97 secs later and flew over hill to north and out of sight. Possibly ate food while on the ground - No sign of carrying prey on flight over hill.
2	20/06/17	Hen Harrier	Male	10:47				X				130	No evidence of nesting.
11	20/06/17	Hen Harrier	Male	10:47	X	X			X			118	1x male HH flew over heather bog at Bleanbeg, up and over mature forestry to north, circled and soared over forestry before dropping and flying east/northeast. Lost from sight behind crest of hill
11	20/06/17	Hen Harrier	Male	12:39				X	X			13	1x male HH seen briefly flying and hunting in forestry canopy and rides. Dipped out of sight behind trees
11	20/06/17	Hen Harrier	Male	12:42	X							47	1x male HH hunting along forestry edge on western boundary of bog, flew up over forestry and soared up over 100m. Descended and flew off to NE.
10	21/06/17	Hen Harrier	Male	08:50				X				75	
10	21/06/17	Hen Harrier	Female	09:15					X			15	1x female HH gathering nesting material. Male was carrying prey.

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
10	21/06/17	Hen Harrier	Male	09:44					X			20	
12	21/06/17	Nil Sightings											
8	25/06/17	Hen Harrier	Male	16:18	X				X			344	1x male HH flying, hunting and circling over rough grazing, graz-ing and scrub.
8	25/06/17	Nil Sightings											
6	26/06/17	Hen Harrier	Male	11:55					X			25	1x male HH flying over rough grazing.
6	26/06/17	Hen Harrier	Male	12:02	X							21	1x male HH soaring over rough grazing, moving down the hill.
6	26/06/17	Nil Sightings											
7	26/06/17	Nil Sightings											
9	27/06/17	Nil Sightings											
9	27/06/17	Nil Sightings											
7	28/06/17	Nil Sightings											
7	28/06/17	Nil Sightings											
1	14/07/17	Nil Sightings											
3	14/07/17	Nil Sightings											
3	16/07/17	Nil Sightings											
5	16/07/17	Hen Harrier	Male	13:00				X				100	1x male HH hunting
2	17/07/17	Hen Harrier	Male	07:17	X	X		X		X		1764	1x male HH hunting, perched on ground, circling, soaring.
2	17/07/17	Hen Harrier	Fe-male	09:14	X			X				131	1x female HH around traditional territory no evidence of active nest.

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
4	17/07/17	Hen Harrier	Fe-male	15:18					X			5	1x female HH flying toward other side of hill.
2	20/07/17	Nil Sightings											
5	24/07/17	Hen Harrier	Male	07:47				X				30	1x male HH hunting
5	24/07/17	Hen Harrier	Fe-male	09:43	X			X				70	1x female HH hunting
5	24/07/17	Hen Harrier	Fe-male	10:26				X	X			30	1x female HH interacting with Sparrowhawk.
1	04/08/17	Nil Sightings											
11	10/08/17	Nil Sightings											
12	10/08/17	Nil Sightings											
10	09/08/17	Hen Harrier	Fe-male	09:55			X		X			60	Food pass female to juvenile.
10	09/08/17	Hen Harrier	Juve-nile Fe-male	09:55					X			10	Food pass female to juvenile.
10	09/08/17	Hen Harrier	Fe-male	11:40			X	X	X			130	Food pass female to juvenile.
10	09/08/17	Hen Harrier	Juve-nile Fe-male	11:40					X			20	Food pass female to juvenile.
10	09/08/17	Hen Harrier	Fe-male	13:15			X		X			60	Food pass female to juvenile.
10	09/08/17	Hen Harrier	Juve-nile Fe-male	13:15			X		X			180	Food pass female to juvenile.

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sighting	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Perc hing	Food Pass	Dura-tion (s)	Bird Notes
10	09/08/17	Hen Harrier	Juve-nile Fe-male	14:10:00								250	Juvenile circling
6	09/08/17	Nil Sightings											
8	10/08/17	Hen Harrier	Fe-male	11:48:00			X					140	1x female HH soaring then flying west.
9	10/08/17	Nil Sightings											
7	11/08/17	Nil Sightings											
5	11/08/17	Nil Sightings											
4	15/08/17	Nil Sightings											
5	15/08/17	Nil Sightings											
6	15/08/17	Nil Sightings											
4	17/08/17	Nil Sightings											
8	17/08/17	Nil Sightings											
9	17/08/17	Nil Sightings											

REFERENCE DOCUMENTS

Table 33 Details of Hen Harrier behaviour which the birds were exhibiting during each observation and associated notes for vantage point surveys undertaken during the non-breeding season in September 2017 to February 2018 (inclusive).

VP Name	Date	Species	Sex	Time of sightings	Soaring	Circling	Displaying	Hunting	Flying	Preching	Food Pass	Duration (s)	Birds Notes
1	05/09/2017	Nil Sightings											
2	05/09/2017	Nil Sightings											
4	06/09/2017	Nil Sightings											
3	06/09/2017	Hen Harrier	Ringtail	14:55:00				x				10	Ringtail seen briefly hunting upper slopes of Mauher Slieve.
1	06/09/2017	Nil Sightings											
3	07/09/2017	Nil Sightings											
5	08/09/2017	Nil Sightings											
4	08/09/2017	Nil Sightings											
5	13/09/2017	Nil Sightings											
2	13/09/2017	Hen Harrier	Male	13:49:00				x				35	Adult male Hen Harrier hunting off site
7	11/09/2017	Nil Sightings											
7	11/09/2017	Nil Sightings											
7	11/09/2017	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
7	11/09/2017	Nil Sightings											
8	12/09/2017	Nil Sightings											
10	04/09/2017	Nil Sightings											
9	05/09/2017	Nil Sightings											
11	05/09/2017	Nil Sightings											
11	06/09/2017	Nil Sightings											
9	06/09/2017	Nil Sightings											
12	07/09/2017	Nil Sightings											
12	07/09/2017	Nil Sightings											
6	11/09/2017	Nil Sightings											
10	12/09/2017	Nil Sightings											
6	23/10/17	Nil Sightings											
7	25/10/17	Nil Sightings											
8	14/10/17	Nil Sightings											
9	17/10/17	Nil Sightings											
10	18/10/17	Nil Sightings											
11	20/10/17	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
1	12/10/17	Nil Sightings											
2	12/10/17	Hen Harrier	Fe-male	13:20					x			50	
4	13/10/17	Nil Sightings											
5	13/10/17	Hen Harrier	Ring-tail	12:30					x			10	Ringtail hunting.
3	14/10/17	Nil Sightings											
1	17/10/17	Nil Sightings											
3	18/10/17	Nil Sightings											
4	20/10/17	Nil Sightings											
2	22/10/17	Nil Sightings											
5	23/10/17	Nil Sightings											
6	23/10/17	Hen Harrier	Male	18:28					x			7	Dusk watch at possible roost site, (single adult male Hen Harrier here 2016), male going to roost at 18:28hrs
6	25/10/17	Hen Harrier	Male	18:34					x			4	Dusk watch at possible roost site, (single adult male Hen Harrier here 2016), male going to roost at 18:34hrs
10	07/11/2017	Hen Harrier	Male	09:18				x				348	ad male hunting Heather Bog, 4 snipe on site.
11	07/11/2017	Hen Harrier	Fe-male	17:05				x				30	Female going to roost.
11	07/11/2017	Hen Harrier	Male	17:08				x				30	Male going to roost.
1	08/11/2017												

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
2	09/11/2017												
6	13/11/2017												
3	15/11/2017												
11	16/11/2017	Hen Harrier	Male	16:42				x		x		1080	Dusk watch at roost site, adult male perched on fence post for 20 mins before flying to nearby roost site in heather at 1707hrs.
11	16/11/2017	Hen Harrier	Male	16:56					x			60	2nd adult male going to roost in heather at 16:56hrs
5	22/11/2017	Nil Sightings											
5	22/11/2017	Nil Sightings											
4	22/11/2017	Nil Sightings											
4	23/11/2017	Nil Sightings											
4	23/11/2017	Nil Sightings											
4	23/11/2017	Nil Sightings											
4	23/11/2017	Nil Sightings											
5	23/11/2017	Nil Sightings											
5	23/11/2017	Nil Sightings											
5	23/11/2017	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
5	23/11/2017	Nil Sightings											
5	23/11/2017	Nil Sightings											
7	28/11/17	Nil Sightings											
8	29/11/17	Nil Sightings											
9	29/11/17	Nil Sightings											
9	30/11/17	Nil Sightings											
8	28/11/17	Nil Sightings											
8	28/11/17	Nil Sightings											
12	30/11/2017	Nil Sightings											
12	29/11/2017	Nil Sightings											
7	29/11/17	Nil Sightings											
12	05/12/2017	Nil Sightings											
11	05/12/2017	Hen Harrier	Male	16:05					X			6	HH male flew E - W over bog/heath towards the conifer plantation at c. 10 - 15m.
11	06/12/2017	Nil Sightings										111	
5	06/12/2017	Nil Sightings										90	
5	06/12/2017	Nil Sightings										50	
1	01/12/2017	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
6	03/12/2017	Nil Sightings											
10	03/12/2017	HH	Male	16:10				X				80	Ad male hunting Heather Bog heading toward roost site.
10	03/12/2017	HH	Male	16:11				X				50	2nd Ad male hunting Heather Bog heading toward roost site.
4	05/12/2017	Nil Sightings											
3	07/12/2017	HH	Male	15:57				X				20	Ad male hunting Heather Bog.
10	09/12/2017	HH	Male	11:14				X				130	Ad male hunting Heather Bog.
6	09/12/2017	Nil Sightings											
2	21/12/2017	Nil Sightings											
8	06/12/2017	Nil Sightings										20	
8	06/12/2017	Nil Sightings										20	
8	06/12/2017	Nil Sightings										10	
8	06/12/2017	Nil Sightings										5	
8	06/12/2017	Nil Sightings										300	
8	06/12/2017	Nil Sightings										20	
7	07/12/2017	Nil Sightings										20	
7	07/12/2017	Nil Sightings										10	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
7	07/12/2017	Nil Sightings											
9	08/12/2017	Nil Sightings											
9	08/12/2017	Nil Sightings										240	
9	08/12/2017	Nil Sightings										300	
9	08/12/2017	Nil Sightings										5	
12	02/01/2018	Nil Sightings											
9	03/01/2018	Nil Sightings											
7	04/01/2018	Nil Sightings											
2	05/01/2018	Nil Sightings											
5	02/01/2018	Nil Sightings											
1	03/01/2018	Nil Sightings											
1	03/01/2018	Nil Sightings											
8	15/01/2018	Nil Sightings											
4	19/01/2018	Nil Sightings											
4	19/01/2018	Nil Sightings											
3	03/01/18	Nil Sightings											

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
6	05/01/18	Nil Sightings											
10	06/01/18	Nil Sightings											
11	06/01/18	Hen Harrier	Male	16:27					X	X		2220	
11	06/01/18	Hen Harrier	Male	16:27					X	X		2220	3 males sitting on fence posts be-fore going to roost.
11	06/01/18	Hen Harrier	Male	16:27					X	X		2220	Ad male and female flying around roost site at before going to roost.
11	06/01/18	Hen Harrier	Male	16:30					X			2040	
11	06/01/18	Hen Harrier	Fe-male	16:35					X			1740	All going to roost at about 17:04hrs.
10	22/01/18	Hen Harrier	Male	12:10				X	X			40	Ad male hunting Heather Bog and flying over Forestry.
11	22/01/18	Hen Harrier	Male	16:58					X	X		1320	Ad male flying in to roost site perched on fence post before go-ing to roost at 17:20hrs.
11	22/01/18	Hen Harrier	Male	17:00					X	X		1200	2nd ad male flying in to roost site perched on fence post before go-ing to roost at 17:20hrs.
11	22/01/18	Hen Harrier	Male	17:12					X			600	3rd ad male flying around roost site at before going to roost 17:22hrs
3	01/02/18	Hen Harrier	Male	12:05				X				25	Ad male hunting Heather Bog around last year's nest site.
6	02/02/18	Hen Harrier	Male	10:50				X				30	Ad male hunting Heather Bog
10	04/02/18	Hen Harrier	Male	08:13				X				70	Ad male hunting Heather Bog
11	04/02/18	Hen Harrier	Male	17:34					X	X		720	Ad male perched on fence post before going to roost at 1746hrs.
11	04/02/18	Hen Harrier	Male	17:44					X			120	2nd ad male going to roost 17:46hrs.

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VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
11	04/02/18	Hen Harrier	Male	17:44					X			120	3rd ad male going to roost 17:46hrs; different location to last months roost site; all three birds flew over skyline out of site.
11	06/02/18	Nil Sightings											
5	02/02/18	Nil Sightings											
12	05/02/18	Nil Sightings											
4	06/02/18	Nil Sightings											
1	06/02/18	Nil Sightings											
1	06/02/18	Hen Harrier	-	15:02					X			43	HH female flew N - S over gorse and grassland being mobbed by hooded crows
1	06/02/18	Nil Sightings											
4	07/02/18	Nil Sightings											
1	07/02/18	Nil Sightings											
8	01/02/18	Hen Harrier	Male	11:13				X	X			8	Male Hen Harrier fist seen hunt-ing close to drainage channel, flew behind dip in the land and was not seen emerging. Later in afternoon, assumed same adult male HH is observed hunting along hedgelines
8	01/02/18	Nil Sightings											
8	01/02/18	Hen Harrier	Male	15:10				X	X			180	
8	01/02/18	Hen Harrier								X		2400	
8	01/02/18	Hen Harrier	Male	15:12					X			24	

REFERENCE DOCUMENTS

VP Name	Date	Species	Sex	Time of sightings	Soar ing	Cir-cling	Display-ing	Hunt ing	Fly-ing	Prec hing	Food Pass	Dura-tion (s)	Birds Notes
8	01/02/18	Hen Harrier	Male	15:50					X			3	
9	02/02/18	Nil Sightings											
7	05/02/18	Nil Sightings											
2	06/02/18	Nil Sightings											
2	06/02/18	Nil Sightings											
2	06/02/18	Nil Sightings											
2	06/02/18	Nil Sightings											

REFERENCE DOCUMENTS

A8-1.2.4.4 Aquatic ecology/Fisheries

Table 34 Summary of type and number of watercourse crossings for the Whole UWF Project

Watercourse Characterisation	UWF Grid Connection		UWF Related Works	UWF Other Activities	UWF Replacement Forestry	Upperchurch Windfarm
	Grid Connection	Access & Haul Routes				
Watercourse with Fisheries value (EPA Blue Line)	14	6	1	No watercourses crossed	No watercourses crossed	Assessed previously in EIS (1 watercourse Crossing)
Watercourse with Fisheries value (EPA Blue Line Equivalent)	9	5	5			
Sub-optimal watercourse with Low fisheries value	5	5	2			
Drainage ditch with No fisheries value	37	9	24			

REFERENCE DOCUMENTS

Table 35 UWF Grid Connection Watercourse Crossings (UGC)

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
W1	572319	664474	c. 2 m wide, c. 10 cm deep, gravel (70), cobbles (5), boulders (5), sands/silts (20)	EPA mapped blue line, major river or stream	Optimal
W2	572551	664577	c. 0.5 m wide, c. 10 cm deep, silts/muds (100)	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W3	572662	664563	c. 1 m wide, c. 10 cm deep, cobbles (20), gravels (40), sands/silts (40)	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W4	573103	664507	c. 0.75 m wide, 10 cm deep, gravel (50), sands/silts (50)	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W5	573293	664445	c. 0.5 m wide, 5 - 10 cm deep, stagnant/slow flowing drain, silt/mud (100)	Drain	Poor
W6	573513	664433	c. 1 m wide, c. 30 cm deep, slow/stagnant flow. Vegetation growing in drainage ditch.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W7	573619	664382	c. 1.5/2 m wide, up to 0.5 m deep, gravel (50), sand/silt (50), PRG	EPA mapped blue line, major river or stream	Optimal
W8	574211	664477	c. 2 m wide, c. 15 cm deep, PRG,gravel (100)	EPA mapped blue line, major river or stream	Optimal
W9	574341	664284	c. 1 m wide, c. 30 cm deep, slow flow	Drain	Poor
W10	574702	663936	c. 6 m wide, > 1 m deep to cm's deep, PRG	EPA mapped blue line, major river or stream	Optimal
W11	575500	664052	c. 1.5 m wide, 10 cm deep, sandy/silty bottom	EPA mapped blue line, major river or stream	Optimal
W12	575868	663858	c. 1 m wide, 5 - 10 cm deep, gravel (60), sands/silts (35), cobbles (5)	EPA mapped blue line, major river or stream	Optimal
W13	576583	663270	c. 0.5 m wide, 5 - 10 cm deep, fast flowing, bedrock (100)	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W14	577416	662997	Shallow, narrow forestry drain	Drain	Poor
W15	577494	662982	Shallow, narrow forestry drain	Drain	Poor

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
W16	577621	662955	Shallow, narrow forestry drain	Drain	Poor
W17	578223	663139	Shallow, narrow forestry drain	Drain	Poor
W18	578574	663079	c. 60 cm wide, 30 cm deep	Drain	Poor
W19	578702	662993	c. 20 cm wide, 10 cm deep	Drain	Poor
W20	578794	662966	c. 20 cm wide, 10 cm deep	Drain	Poor
W21	578810	662961	c. 20 cm wide, 10 cm deep	Drain	Poor
W22	579097	662875	c. 60 cm wide, 30 cm deep	Drain	Poor
W23	579209	662799	c. 30 m wide, 5 - 10 cm deep, eroded through peat down to subsoil.	Drain	Poor
W24	579542	662633	Shallow, narrow forestry drain	Drain	Poor
W25	579641	662567	Shallow, narrow forestry drain	Drain	Poor
W26	579699	662480	Shallow, narrow forestry drain	Drain	Poor
W27	579643	662468	c. 50 cm wide, 10 cm deep, fast flowing stream	EPA mapped blue line, major river or stream	Optimal
W28	580322	662155	c. 30 cm wide, 5 - 10 cm deep, shallow forestry drain. Runs parallel to road on southern side and crosses beneath road flowing to north.	Drain	Poor
W29	580675	661832	Field drain, c. 30 cm wide, c. 10 cm deep, flowing across wet grassland field, vegetated with soft rush	Drain	Poor
W30	580687	661825	Field drain, c. 30 cm wide, c. 10 cm deep, flowing adjacent earth bank boundary - same stream as with WC22 adjacent	Drain	Poor
W31	580699	661824	Field drain, c. 30 cm wide, c. 10 cm deep, flowing adjacent earth bank boundary	Drain	Poor
W32	580844	661896	c. 4 m wide, fast flowing cobble (50) and gravel (45) with a fine cloaking of silt all over river bed (5)	EPA mapped blue line, major river or stream	Optimal
W33	581125	661872	Slow flowing shallow drain, c. 1 m wide, c. 5 cm deep. Silt/mud (100), vegetated	Drain	Poor
W34	581225	661902	Forestry drain	Drain	Poor

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
W35	582015	662077	Slow flowing drain c. 30 cm wide, 5 cm deep, gravel (20), mud/silt (80)	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W36	582381	661877	c. 5 m wide, 1 m to 5 cm deep, PRG	EPA mapped blue line, major river or stream	Optimal
W37	582525	661785	c. 1 m wide drainage ditch within willow scrub	Drain	Poor
W38	582663	661702	c. 30 cm wide, 10 cm deep, fast flowing	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W39	582698	661604	Drain	Drain	Poor
W40	582767	661543	Drain	Drain	Poor
W41	583032	661285	Drain	Drain	Poor
W42	583107	661214	Stream c. 1.0 m wide, fast flowing, Boulder (20), Cobble (50) and gravel (30).	EPA mapped blue line, major river or stream	Optimal
W43	583475	660746	Drain running along edge of road, c. 10 cm wide, c. 5 cm deep, fast flowing, gravels (50), cobbles (50)	Drain	Poor
W44	583481	660748	Drain on edge of field, c. 10 cm wide, c. 5 cm deep. Vegetated drain.	Drain	Poor
W45	583612	660801	Drain on boundary of field with adjancent earth bank, c. 10 cm wide, c. 5 cm deep. Vegetated drain.	Drain	Poor
W46	583789	660826	Stream c. 0.5 m wide, fast flowing, Boulder (20), Cobble (50) and gravel (30).	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W47	584128	660757	Drain c. 0.5 m wide, 10 cm deep. Gravel bed. Culverted at gate between two fields	EPA mapped blue line, major river or stream	Optimal
W48	584698	660575	Stream c. 30 cm wide and 10 cm deep at the bottom of ravine c. 5 m deep.	EPA mapped blue line, major river or stream	Optimal
W49	584876	660534	Overland flow. Nearly dry at visit. Evidence of past flows.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
W50	586291	660317	New crossing built by Coillte.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W51	586342	660345	Currently dry drain with evidence of former high flows. Currently overland flow which is beginning to cut a new drain through forestry downslope.	Drain	Poor
W52	586673	660572	Newly created drainage, currently not flowing. Culverted under track.	Drain	Poor
W53	587038	660896	Forestry drain	Drain	Poor
W54	587084	660913	c. 1.0 m high bank, c. 30 m wide and 5 cm deep. Cobble/gravel bed, fast flowing through forestry	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W55	587778	660609	Slow flowing/stagnant stream through forestry.	EPA mapped blue line, major river or stream	Optimal
W56	588137	660463	Dry stream bed	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W57	589581	660064	c. 4/6 m wide, cobble/gravel bed.	EPA mapped blue line, major river or stream	Optimal
W58	589650	660032	Shallow, slow moving/stagnant field drain	Drain	Poor
W59	589799	659980	Shallow, slow moving/stagnant field drain	Drain	Poor
W60	589863	659957	Shallow, slow moving/stagnant field drain	Drain	Poor
W61	590373	659719	c. 0.5 m wide, c. 10 cm deep, cobble (50), gravel (50) bed	EPA mapped blue line, major river or stream	Optimal
W62	592367	659835	c. 30 cm wide, c. 5 cm deep, sand/silt bottom.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W63	593748	660330	Plastic pipe c.30cm wide	Drain	Poor
W64	594612	660629	Drain c. 0.5 m wide, 10 cm deep	Drain	Poor
W65	594863	660613	Slow flowing, shallow forestry drain	Drain	Poor

Table 36 UWF Grid Connection Watercourse Crossings (Haulage Roads)

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
W66	573895	664106	Potential salmonid habitat. Livestock access, some poaching and siltation. Coarse woody debris in channel. Filamentous green algae downstream. Boulder & cobble dam downstream possible barrier to migration during periods of low flow.	EPA mapped blue line, major river or stream	Optimal
W67	582199	662430	Tributary stream of Clare River. Knockacullin stream on EPA database.	EPA mapped blue line, major river or stream	Optimal
W68	582131	662508	Low flow/stagnant forestry drain.	Drain	Poor
W69	581779	662373	Low flow pool and cascade forestry drain.	Drain	Poor
W70	581570	662279	Low flow stream.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W71	581452	662211	Near dry/stagnant forestry drain.	Drain	Poor
W72	581351	662161	Low flow stream, culvert el-evated c. 50 cm above stream on downslope site. Barrier to migration.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W73	581168	662064	Low flow/near dry stream.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W74	581007	661991	Low flow forestry stream.	EPA mapped blue line, major river or stream	Optimal
W75	581545	662355	Low flow stream.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
W76	581142	662663	Near dry/stagnant forestry drain.	EPA mapped blue line, major river or stream	Optimal
W77	581148	662765	Near dry/stagnant forestry drain.	Drain	Poor
W78	580996	662971	Dry forestry drain.	Drain	Poor

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
W79	580903	662984	Stagnant forestry drain. Existing culvert under forestry road.	Drain	Poor
W80	580870	662982	Dry forestry drain, stagnant pool downstream of culvert.	Drain	Poor
W81	580772	662991	Near dry/stagnant forestry drain.	Drain	Poor
W82	580668	663013	Near dry/stagnant forestry drain.	Drain	Poor
W83	580629	663020	Dry stream, existing culvert under a road.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W84	580544	663020	Stagnant forestry drain. Existing culvert under forestry road.	EPA mapped blue line, major river or stream	Optimal
W85	580263	662794	Very low flow, near dry watercourse.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W86	580234	662734	Very low flow, near dry watercourse.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W87	580089	662559	Dry stream, existing culvert under a road.	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W88	579895	662550	Pool and cascade system, low flow during site visit	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
W89	584658	660517	Existing culvert under farm roadway.	EPA mapped blue line, major river or stream	Optimal
W90	585404	659766	No defined watercourse at this location. Area consists of a poorly drained, poached, rush dominated area draining between the hills. Potential that there is enough overland flow in winter for water to drain through culvert.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal

Table 37 UWF Related Works Watercourse Crossings

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
WW1	595749	659884	Near dry drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW2	595702	659970	Stream, deepened and resectioned, Existing culvert under access track d/s, Barrier to migration, heavily vegetated, Low fisheries suitability	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
WW3	595624	660346	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW4	595423	660338	Near dry stream, evidence of previous high flows/erosion, c. 1.5 m cascade barrier to migration, No fisheries suitability	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
WW5	595372	660334	Near dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW6	595203	660339	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW7	595139	660440	Stream, steady flow to to 15 cm deep with wetted width of c. 75 cm. Nice gravel bed. High fisheries suitability.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
WW8	595105	660460	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW9	595097	660464	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW10	596075	660400	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW11	596062	660403	Near dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW12	595915	660710	Near dry drain culverted under road joining small slow flowing drain on downstream side. No fisheries suitability	Drain	Poor
WW13	595783	661007	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW14	595765	661079	Slow flowing, shallow drain, heavily vegetated, Low fisheries potential	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
WW15	596495	662228	Near stagnant drain, heavily poached and cow dung in stream, Vegetated, No fisheries suitability	Drain	Poor

WC_No	E_ITM	N_ITM	Watercourse Description	Watercourse Characterisation	Fisheries Evaluation
WW16	595912	661510	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW17	595637	661315	Near dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW18	595485	661140	Slow flowing, shallow drain. Deeped and re-sectioned, heavily vegetated, Low fisheries potential	Sub-optimal, heavily vegetated with low or no flow during dry periods	Sub-Optimal
WW19	595458	661086	Stream, steady flow up to 10 cm deep with wetted width c. 1.0 m, Nice gravel/cobble bed. High fisheries suitability	EPA mapped blue line, major river or stream	Optimal
WW20	595021	660778	Dry drain with culvert under road	Drain	Poor
WW21	594437	660618	Stagnant field drain, No fisheries suitability	Drain	Poor
WW22	594025	660680	Stream, steady flow to to 20 cm deep with wetted width of c. 1 m. Nice gravel bed. High fisheries suitability.	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
WW23	593736	660338	Dry field drain, No fisheries suitability	Drain	Poor
WW24	593181	661387	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW25	593114	661553	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW26	593831	661628	Dry field drain, willows creating full tunnelling, No fisheries suitability	Drain	Poor
WW27	594187	661530	Dry field drain, heavily vegetated, No fisheries suitability	Drain	Poor
WW28	594370	661382	Stream, nice gravel/cobble bed, steady flow up to 15 cm deep with wetted width c. 1.0 m. Good fisheries suitability	Headwater Stream Equivalent to EPA blue line but not mapped	Optimal
WW29	594572	660835	Stagnant, silted up field/forestry drain with existing culvert under track. No fisheries suitability.	Drain	Poor
WW30	594623	660786	Stagnant drain, existing culvert. No fisheries suitability	Drain	Poor
WW31	594277	660791	Very small spring, drains under road to land drain (overgrown) within forestry	Drain	Poor
WW32	593168	661686	Minor Stream, High Gradient, 100% overgrown	Drain	Poor

Table 38 Outline construction methodology (OCM) applicable at each watercourse crossing for the Whole Wind Farm Project

UWF Grid Connection								UWF Related Works				UWF Other Activities	UWF Re-placement Forestry	Upper-church Windfarm
Grid Connection						Access & Haul Routes								
WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type			
W1	C2	W26	A1	W51	A1	W66	A2	WW1	C1	WW26	C3	No water-courses crossed	No water-courses crossed	Assessed previously in EIS
W2	C1	W27	A1	W52	A1	W67	A2	WW2	F	WW27	C2			
W3	C1	W28	A1	W53	A1	W68	A2	WW3	C3	WW28	C3			
W4	C1	W29	C2	W54	A1	W69	A2	WW4	C1	WW29	A1			
W5	C2	W30	C2	W55	C1	W70	A2	WW5	C2	WW30	A1			
W6	C2	W31	C2	W56	A1	W71	A2	WW6	A1	WW31	B2			
W7	C3	W32	C3	W57	D	W72	A2	WW7	C2	WW32	A2			
W8	B1	W33	C2	W58	C2	W73	A2	WW8	C2					
W9	A1	W34	C2	W59	C2	W74	A2	WW9	C3					
W10	D	W35	B1	W60	C3	W75	A2	WW10	C3					
W11	C2	W36	D	W61	C3	W76	A2	WW11	A1					
W12	C3	W37	C2	W62	A1	W77	A2	WW12	B2					
W13	C1	W38	A1	W63	A1	W78	A2	WW13	C4					
W14	A1	W39	A1	W64	C3	W79	A2	WW14	C4					
W15	A1	W40	A1	W65	C3	W80	A2	WW15	C1					
W16	A1	W41	A1			W81	A2	WW16	C2					
W17	A1	W42	A1			W82	A2	WW17	C3					
W18	C1	W43	A1			W83	A2	WW18	C3					
W19	C1	W44	A1			W84	A2	WW19	C3					
W20	C1	W45	C2			W85	A2	WW20	C3					
W21	C1	W46	C2			W86	A2	WW21	B1					
W22	C1	W47	B1			W87	A2	WW22	C4					

REFERENCE DOCUMENTS

UWF Grid Connection								UWF Related Works				UWF Other Activities	UWF Re-placement Forestry	Upper-church Windfarm
Grid Connection						Access & Haul Routes								
WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type	WC No.	Crossing Type			
W23	C1	W48	C1			W88	A2	WW23	A1					
W24	A1	W49	C2			W89	A2	WW24	C1					
W25	A1	W50	A1			W90	C4	WW25	C1					

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

 Plate 3: Crossing location of the Newport (Mulkear) River. View is from the true left (eastern) bank looking northwest across the watercourse	 **Plate 4: Crossing location of the Clare River. View is from the true right (western) bank looking upstream to the east.**
 Plate 5: Crossing location of the Bilboa River. View is from the true right (western) bank looking east towards Kilcommon	 **Plate 6:** Crossing location of, a tributary watercourse of the Mulkear River. View is from the true right (western) bank looking upstream to the north.

A8-1.2.4.5 Bats

Designated sites

Bats are not listed as conservation interests for any designated sites within 15km of the Whole UWF Project.

Preliminary evaluation of potential bat roosts

Preliminary ecological appraisals were carried out for 127 buildings within 150m of Project Elements 1 – 4 (the UWF Other Activities had no source-pathway linkages): 15 had negligible suitability for bats, 86 had low suitability, 20 had moderate suitability and 6 had high suitability. 31 mature trees in the vicinity of Project Elements 1 – 4 were assessed, of which 28 had low suitability, 3 had a moderate suitability and none had high suitability; all other trees were considered to have negligible suitability for bats. Trees in conifer plantations were not evaluated individually, because they were not of sufficient age or maturity to have features suitable for bats. 32 river crossings (bridges and culverts) were inspected, of which 8 had low suitability, 2 had moderate suitability and 1 had high suitability; all other crossings had negligible suitability. The following tables provide further detail on preliminary evaluations.

Table 39 Roost suitability of buildings within the zone of influence of the Whole UWF Project

Code	ITM grid ref		Description	Rating	Surveyed?
H01	573012	664796	Bungalow	L	
H02	573011	664763	Two-storey house	L	
H03	572978	664634	Bungalow	L	
H04	572930	664448	Bungalow	L	
H05	572917	664380	Bungalow	L	
H06	572911	664350	Two-storey house	L	
H07	574447	664406	Derelict house	H	Y
H08	574531	664352	Metal-roofed barn	N	
H09	574426	664234	Two-storey house	L	
H10	574315	664163	Bungalow	L	
H11	574294	664137	Bungalow	L	
H12	575481	664331	Two-storey house	L	
H13	575421	664304	Derelict house	L	Y
H14	575389	664279	Bungalow	L	
H15	575374	664259	Bungalow	L	
H16	575358	664224	Bungalow	L	
H17	575241	664061	Ruined church	H	Y
H18	576549	663873	Bungalow	L	
H19	576498	663838	Incomplete house	M	
H20	576539	663824	Two-storey house	M	
H21	576441	663684	Two-storey house	L	
H22	576420	663645	Two-storey house	L	
H23	576398	663614	Metal-roofed barns	N	
H24	576383	663593	Bungalow	L	
H25	576350	663554	Two-storey house	L	
H26	576313	663539	Bungalow	L	
H27	580347	661791	Estate house	H	Y

Code	ITM grid ref		Description	Rating	Surveyed?
H28	580263	661588	Bungalow	L	
H29	582324	662338	Barns / farm	N	
H30	582338	662283	Derelict house	H	Y
H31	582370	662198	Two-storey house	L	Y
H32	582744	661673	Bungalow	L	
H33	582675	661584	Bungalow and sheds	L	
H34	582939	661478	Two-storey farmhouse	M	
H35	582973	661390	Modern bungalow	L	
H36	582953	661345	Modern bungalow	L	
H37	582987	661309	Modern bungalow	L	
H38	583044	661324	Modern bungalow	L	
H39	583082	661218	Bungalow	L	
H40	583182	661114	Two-storey house	L	
H41	583484	660951	Bungalow and farm	L	
H42	583638	660663	Bungalow	L	
H43	583671	660661	Bungalow	L	
H44	583716	660655	Bungalow	L	
H45	583749	660594	Farm building	L	
H46	584109	661029	Derelict house, barn	L	
H47	584376	660846	Bungalow	L	
H48	584438	660651	House, farm	L	
H49	584612	660527	House, farm	L	
H50	584660	660403	Bungalow	L	
H51	586204	660235	Metal-roofed shed	N	
H52	586507	660422	Metal-roofed barn	N	
H53	589278	660157	Two-storey house	M	
H54	589234	660067	Metal-roofed barns	N	
H55	590064	660133	Metal-roofed barn	N	
H56	590084	660133	Metal-roofed barn	N	
H57	590078	660122	Stone farm building	M	
H58	590060	660115	Two-storey house	L	
H59	590056	660103	Two-storey house	L	
H60	590072	660101	Two-storey house	L	
H61	590052	660089	Two-storey house	L	
H62	590064	660082	Two-storey house	L	
H63	590049	660077	Two-storey house	L	
H64	590041	660060	Old house	M	
H65	590058	660061	Two-storey house	L	
H66	590027	660046	Two-storey house	L	
H67	590040	660039	Pub	L	
H68	589996	659999	Two-storey house	M	Y
H69	590017	659994	House, shop & sheds	M	
H70	589978	659939	Caravan	L	
H71	589942	659936	Bungalow	L	
H72	589930	659853	Two-storey house	L	Y

Code	ITM grid ref		Description	Rating	Surveyed?
H73	589912	659861	Bungalow	L	
H74	589904	659844	Bungalow	L	
H75	589888	659816	Bungalow	L	
H76	589883	659789	Bungalow	L	
H77	590078	660061	Community Centre	L	
H78	590096	660069	Church	M	
H79	590119	660009	School	L	
H80	590188	660033	Line of bungalows	L	
H81	590209	660055	Clergy House	M	Y
H82	590267	660031	Bungalow	L	
H83	590540	659723	Bungalow	M	Y
H84	590557	659691	Bungalow	M	Y
H85	590617	660134	Derelict house	M	Y
H86	590628	660149	Two-storey house	L	Y
H87	590914	660170	Metal-roofed barns	M	Y
H88	591235	660477	ESB Substation	L	
H90	592262	659940	Bungalow	L	Y
H91	592286	659915	Bungalow	L	
H92	591440	660461	Bungalow	L	
H92	592321	659892	Metal-roofed barns	N	
H93	592349	659868	Two-storey house	M	Y
H94	592577	659794	Metal-roofed barns	N	
H95	592660	659789	Bungalow	L	
H96	592805	659732	Two-storey house	L	
H97	592823	659756	Bungalow	L	
H98	592855	659730	Bungalow	L	
H99	592961	659742	Farmhouse and barns	L	
H100	592921	659806	Bungalow and barns	L	
H101	593267	659975	Bungalow	L	
H102	593327	659998	Bungalow	L	
H103	593332	660032	Bungalow	L	
H104	593371	660016	Metal-roofed barn	L	
H105	593411	660036	Bungalow	L	
H106	593446	660059	Two-storey house	L	
H107	593654	660420	Metal-roofed barns	N	
H108	593741	660362	Bungalow	L	
H109	593756	660301	Two-storey house	L	
H110	593815	660412	Two-storey house	M	
H111	593873	660405	Ruins	L	
H112	593915	660483	Incomplete house	L	
H113	593951	660527	Two-storey house	L	
H114	593998	660679	Derelict house	M	Y
H115	593094	661520	Bungalow	M	Y
H116	594058	661685	Farmhouse and barns	H	Y
H117	594087	661628	Metal barns	N	

Code	ITM grid ref		Description	Rating	Surveyed?
H118	594177	661544	Two-storey house	L	
H119	594365	660893	Bungalow	L	
H120	594440	660889	Derelict stone house	M	
H121	595050	660559	Derelict house, shed	H	Y
H122	595061	660938	House / metal barns	L	
H123	595119	660954	Metal barn	N	
H124	595315	661219	New two-storey house	N	
H125	595674	661140	Bungalow / warehouse	L	
H126	595775	661168	Bungalow	M	Y
H127	595968	660708	Metal barns	N	

Table 40 Preliminary bat roost suitability of trees within the zone of influence of the Whole UWF Project

Code	ITM Grid Ref		Tree species	Description	Rating
T01	572218	664333	Oak	Several crevices	M
T02	572213	664603	Ash	Crevice low on trunk	L
T03	572405	664616	Oak	Broken limbs	L
T04	572952	664534	Ash	Many rotten branches	L
T05	573009	664522	Oak	Broken limbs	L
T06	573235	664481	Oak	Broken limbs	L
T07	573289	664490	Oak	Damaged branches	L
T08	573633	664377	Ash	Broken limbs	L
T09	573636	664351	Sycamore	Broken limbs	L
T10	573918	664074	Beech	Many small crevices	M
T11	574218	664470	Beech	Broken branches	L
T12	574269	664399	Ash	Broken branches, ivy	L
T13	574291	664357	Oak	Broken branches	L
T14	574291	664269	Oak	Damaged branches	L
T15	574471	664370	Oak	Broken limbs	L
T16	574742	664152	Beech	Crevices in trunk	L
T17	574738	664141	Beech	Some broken limbs	L
T18	574736	664126	Beech	Some broken limbs	L
T19	574738	664095	Oak	Some broken limbs	L
T20	574679	664051	Oak	Broken limbs, ivy	L
T21	574667	664031	Unknown	Dead trunk cavities	M
T22	574656	664006	Oak	Some broken limbs	L
T23	575721	663952	Oak	Broken limb, ivy	L
T24	575808	663888	Oak	Several broken limbs	L
T25	575827	663913	Oak	Snapped, folded limb	L
T26	576413	663662	Oak	Small wounds, ivy	L
T27	576421	663674	Oak	Small wounds, ivy	L
T28	582272	662005	Ash	Broken limb	L
T29	582324	661993	Ash	Dense ivy	L
T30	589940	659917	Sycamore	Small knotholes	L
T31	589948	659920	Sycamore	Small knotholes	L

Table 41 Preliminary bat roost suitability for bridges along the material haul routes (local roads)

Code	ITM Grid Ref		Description	Rating	Surveyed?
B02 (red)	594025	660694	Concrete culvert	N	
B03 (red)	593943	660563	Small stone culvert	N	
B01	588747	658960	Two small round culverts, plus concrete slabs	N	
B02 (blue)	588694	659622	Concrete culvert	N	
B08	582647	662486	Iron girders, concrete slabs and brick arches	L	
B09	582932	661385	Small stone culvert, very low	N	
B10	583108	661223	Two stone culverts 1m high, crevices but very low	L	
B11	583484	660732	Concrete span, some small crevices	L	
B12	573104	663725	Stone arch with some crevices	M	Y
B13	573812	663309	Stone arch with some crevices	M	Y
B15	574542	663039	Concrete slabs	N	
B16/35	576531	663857	Small concrete culvert	N	
B18	585567	659051	Two small concrete culverts, rock gabbi-ons above	N	
B19	608956	654190	Eight stone arches, sealed below. One crevice	L	
B20	606637	657993	Four stone arches, many cavities and crev-ices	H	Y
B101	544331	661245	Small concrete culvert	N	
B102	544445	660928	Small concrete culvert	N	
B103	545194	660861	Concrete bridge	N	
B104	572868	664060	Small concrete culvert	N	
B105	572659	662381	High stone arch, well sealed, no crevices	L	
B106	576223	663444	Small concrete culvert	N	
B107	576104	663363	Submerged	N	
B108	580265	661512	Small stone culvert, some crevices, but very low	L	
B109	580238	661397	Small concrete culvert	N	
B110	579993	660820	Small stone culvert, very low	N	
B111	582799	659252	Concrete slabs over small concrete culvert	N	
B112	582502	662267	Concrete slabs	N	
B113	582621	662465	Concrete slabs, no crevices	N	
B114	589298	660071	Concrete culvert	N	
B115	590235	660033	Small concrete culvert and decorative stone bridge	L	
B116	590780	660151	Submerged concrete culvert	N	
B117	608502	655291	Railway bridge of cut stone, some small crevices	L	

Bat roosts - Buildings

In addition to the preliminary roost appraisals, presence / absence bat surveys and/or roost characterisation surveys were carried out at 22 buildings that had moderate or high suitability for bats. The surveyor focussed on the building for the majority of the survey, but if no bats were observed entering the structure at dawn then the surveyor took the opportunity to track passing bats to other roosts in the surrounding area; a number of pipistrelle roosts were located using this method. Four structures were surveyed on three occasions in 2016 in order to cover the maternity period (July / August), the mating period (September / October) and the hibernation period (December).

Bat roosts were identified in 18 structures, some of which supported multiple roost types and multiple species. In total there were 12 maternity roosts, 8 non-breeding summer roosts, 4 transitional / mating roosts and 4 hibernation roosts (Table 42). Most roosts were of common pipistrelles, but roosts of soprano pipistrelles, *Myotis* sp., brown long-eared bats and Leisler's bat were also identified. Detailed descriptions of each roost are provided in a confidential annexe to this report, which will be provided to the planning authority and key statutory consultees but will not be made publicly available.

Each structure has been assigned an overall ecological value using the six-level hierarchical system outlined in *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2016). In line with this and for the purposes of this report we consider maternity and hibernation roosts of *Myotis* spp and brown long-eared bats to be of county importance, while maternity and hibernation roosts of common and soprano pipistrelles and non-breeding roosts of all other species are considered to be of local importance. Roosts containing single bats are considered to be of negligible ecological importance, although it should be noted that they still receive legal protection. On this basis, five buildings are considered to be of county importance, eight to be of local importance, and five to be of negligible importance.

It should be noted that that five roosts - numbers 3, 4, 8, 10 and 11 - are outside the zone of influence of the Whole UWF Project. In addition, roost number 18 (within a building) was identified during the survey of a nearby bridge along the haul route, but as no construction works are proposed to the bridge or road in this area, there is no risk of effects on the building. On this basis, these six roosts are not considered to be within the zone of influence of the Whole UWF Project, and will not be included in the evaluation of effects.

Table 42 Summary of bat roosts their distances from the Whole UWF Project.

No	Description of structure	Evidence of bats	Valuation	Proximity	Nearest Element
1	Ruined church	Maternity, mating and hibernation roost: 5 - 10 natterer's bats	County	20m	Wind Farm Grid Connection
2	Dwelling house	Maternity roost: 30 - 40 common pipistrelles	Local	120m	Wind Farm Grid Connection
3	Dwelling house	Day roost / satellite roost: 1 soprano pipistrelle	Negligible	350m	Wind Farm Grid Connection
4	Dwelling house	Hibernation roost: >100 brown long-eared bats, 1 natterer's bat. Summer day roost: 2 brown long-eared bats, 1 natterer's bat.	County	160m	Wind Farm Grid Connection
5	Dwelling house	Summer non-breeding roost and mating / transition roost: 3 - 4 common pipistrelles. Hibernation roost: 6 common pipistrelles, 2 brown long-eared bats	County	50m	Wind Farm Grid Connection
6	Dwelling house	Former transitional roost: >200 pipistrelles. Access points have now been sealed.	Negligible (inactive)	140m	Wind Farm Grid Connection
7	Dwelling house	Maternity roost: 40 - 50 common pipistrelles	Local	5m	Wind Farm Grid Connection
8	Dwelling house	Maternity roost: 10 - 20 common pipistrelles	Local	200m	Wind Farm Grid Connection
9	Dwelling house	Day roost / satellite roost: 1 common pipistrelle	Negligible	50m	Wind Farm Grid Connection
10	Dwelling house	Maternity roost: 40 - 50 common pipistrelles	Local	400m	Wind Farm Grid Connection
11	Outbuilding / shed	Day roost / satellite roost: 1 Myotis sp.	Negligible	430m	Wind Farm Grid Connection
12	Dwelling house	Maternity roost: 40 - 50 common pipistrelles	Local	15m	Wind Farm Grid Connection
13	Dwelling house	Maternity roost: 30 - 40 common pipistrelles Possible day roost / satellite roost: 1 Myotis sp.	Local	15m	Wind Farm Grid Connection
14	Dwelling house	Day roost / satellite roost: 1 common pipistrelle	Negligible	15m	Upperchurch Windfarm
15	Dwelling house and traditional farm buildings	Maternity roost: 50 - 60 common pipistrelles Maternity roost: 5 soprano pipistrelles.	Local	130m	UWF Related Works
16	Dwelling house and traditional farm buildings	Maternity roost: 4 - 5 natterers bats. Transitional / mating roosts: 5 - 10 natterers bats, 20 common pipistrelles, 3 brown long-eared bats. Summer non-breeding / day roost: 2 common pipistrelles, 1 Leisler's bat. Hibernation roost: natterer's bats, common pipistrelles, Leisler's bat.	County	0m	Upperchurch Windfarm
17	Dwelling house	Maternity roost: 2 – 3 natterers bats	County	5m	UWF Related Works

No	Description of structure	Evidence of bats	Valuation	Proximity	Nearest Element
18	Dwelling house	Transitional / mating roost and probable maternity roost: 40 - 50 soprano pipistrelles	Local	>10km	Whole UWF Project

Bat roosts - Trees

Ground-level roost assessments were carried out for all trees with moderate or low bat suitability within 50m of the Whole UWF Project. No live bats were seen or heard, and no field signs were observed (e.g. droppings, fur-oil staining, urine splashes), so none of these trees were confirmed to be supported roosting bats at the time of survey. All other broadleaf trees within 50m of the Whole UWF Project were inspected, but none had any potential roost features that would be suitable for bats, so they were considered to have negligible roost suitability.

Bat roosts - Bridges

All bridges with suitability for bats were inspected by torchlight. No live bats were seen or heard, and no field signs were observed (e.g. droppings, fur-oil staining, urine splashes). Therefore, none of these structures appeared to support roosting bats.

Bat detector surveys were also undertaken at the 3 bridges with moderate / high roost potential. No bats were recorded leaving or entering any of the bridges, but a soprano pipistrelle roost was detected in a building near one of the bridges.

Activity surveys

Bat activity surveys using automated detectors were carried out at 27 locations, comprising 21 initially-proposed temporary compounds or set down locations, and 6 treelines / hedgerows with high suitability as bat foraging / commuting habitat. A total of 30,637 bat passes were recorded at the 27 locations over 1,046-night hours, giving an overall Bat Activity Index (BAI) of 29.3 bat passes per hour. This is considered to be a relatively high level of activity, equivalent to approximately one bat pass every two minutes. Summary results are summarised in Table 43 and full lists of the Bat Activity Indices (BAIs) at each location are provided in Table 44.

To assist with the interpretation and comparison of BAIs we classify the results as negligible, occasional, frequent and near-constant, using a bespoke system defined in Table 45.

Bat activity indices varied significantly between sampling sites. The highest activity of all survey locations was at Castlewaller (sampling point SD11), with BAIs of 90.8 in mid-summer and 181.4 in the autumn period; on average there was between 1.5 and 3 bat passes every minute in each season, respectively. The lowest level of activity was at Newross (sampling point SD9), in which there were overall BAIs of 0.8 in mid-summer and 1.2 in the autumn period, an average of 0.01 – 0.02 bat passes per minute, respectively. However, most other locations had occasional to frequent activity in both survey periods.The most frequently-recorded species was the common pipistrelle, which accounted for 69% of all bat passes in mid-summer, and 56.8% in the autumn. Soprano pipistrelles made up 20.0% and 34.2% of passes in each season respectively, *Myotis* spp. 6.4% and 5.5%, Leisler's bat 3.1% and 1.3%, Nathusius' pipistrelle 0.6% and 0.01%, and brown long-eared bat 0.3% and 0.4%. Lesser-horseshoe bats were not recorded; the Whole UWF Project appears to be outside the geographical range of this species. Overall, the species composition is considered to be typical of rural landscapes in Ireland.

Based on the highest activity levels of each species over the two sampling periods, each location was assigned an ecological value using the six-level hierarchical system outlined in the CIEEM guidelines (2016), with reference to the bat-specific guidance outlined in Wray *et al.,* (2011). Locations were considered to be of county importance if they had near-constant activity by pipistrelles and/or frequent activity (or higher) of any other species, to be of local importance if they had frequent pipistrelle activity and occasional activity of any other species, and to be of negligible importance if they had occasional (or lower) activity of pipistrelles and negligible activity of other species. On this basis, five locations were considered to be of county importance, eighteen to be of local importance, and four to be of negligible importance.

Table 43 Summary of bat activity levels at each sampling point. *Species codes are as follows: CP (common pipistrelle), SP (soprano pipistrelle), L (Leisler's bat) and MY (Myotis spp.)*

Site	Grid ref	Habitat	Month	Characterisation of activity	Ecological value
SD1	572230	Mature treeline	Jun	Frequent CP, occasional SP	Local
	664525		Sept	Frequent CP, occasional SP & MY	
SD2	572546	Hedgerow	Aug	Frequent CP	Local
	664578		Sept	Occasional CP	
SD3	572931	Hedgerow	Jun	Negligible	Local
	664569		Sept	Frequent SP, occasional CP	
SD4	572981	Hedgerow	Jun	Frequent CP, occasional SP	Local
	664515		Sept	Occasional CP	
SD5	574373	Hedgerow	Jun	Occasional CP	Negligible
	664242		Sept	Occasional CP	
SD6	574579	Farmyard	Jun	Occasional CP	Local
	664377		Sept	Frequent CP & SP	
SD7	574700	Mature woodland	Aug	Frequent CP, occasional L	Local
	664103		Sept	Frequent CP & SP, occasional MY	
SD8	575251	Ruined church	Jun	Occasional CP & MY	Local
	664078		Sept	Occasional CP	
SD9	575302	Hedgerow	Jun	Negligible	Negligible
	664071		Sept	Negligible	
SD10	575851	Mature woodland	Aug	Frequent CP, occasional SP	Local
	663855		Sept	Negligible	
SD11	576388	Hedgerow	Jun	Frequent CP & SP	County
	663715		Sept	Near-constant SP, frequent CP, occasional MY	
SD12	576477	Hedgerow	Jun	Frequent CP & MY	County
	663726		Sept	Frequent CP, occasional MY	
SD13	576848	Road within conifer plantation	Jun	Near-constant CP	County
	663176		Sept	Frequent CP, occasional SP & MY	
SD14	576957	Road within conifer plantation	Aug	Frequent CP, occasional SP	Local
	662710		Sept	Occasional CP	
SD15	579705	Road within conifer plantation	Jun	Occasional CP & MY	Local
	662415		Sept	Negligible	
SD16	582198	Treeline	Aug	Occasional CP, SP & MY	Local
	661996		Sept	Frequent SP, occasional CP	
SD17	582330	Farmyard	Jun	Frequent CP	Local
	662341		Sept	Frequent CP, occasional SP & MY	
SD18	582859	Road within conifer plantation	Jun	Frequent CP	Local
	662078		Sept	Frequent CP	
SD19	583161	Hedgerow	Sept	Negligible	Negligible
	661101		Sept	Negligible	
SD20	584429	Roadside hedgerow	Aug	Frequent CP & MY, occasional SP	County
	660742		Sept	Frequent CP	

Site	Grid ref	Habitat	Month	Characterisation of activity	Ecological value
SD21	587239	Road within coni-fer plantation	Jun	Frequent CP, occasional L & SP	Local
	660819		Sept	Occasional CP	
SD22	588440	Road within coni-fer plantation	Aug	Occasional CP	Local
	660463		Sept	Frequent CP & SP	
SD23	589305	Hedgerow	Aug	Frequent CP & SP	Local
	660234		Sept	Frequent CP, occasional SP	
SD24	589919	Open ground	Jun	Occasional CP & L	Local
	660070		Sept	Occasional CP	
SD25	592248	Hedgerow	Jun	Occasional CP	Local
	659900		Sept	Occasional CP, SP & MY	
SD26	593610	Farmyard	Jun	Near-constant CP	County
	660433		Sept	Occasional CP	
SD27	594849	Edge of conifer plantation	Jun	Occasional CP	Negligible
	660597		Sept	Negligible	

Table 44 Bat Activity Indices for each species during each sampling period

Site	Grid ref	Month	L	CP	SP	NP	MY	MD	MN	MW	BLE	UnID	Total	Summary	Habitat	Ecological value
SD1	572230	Jun	0.1	22	2	0	0	0.1	0	0	0.1	0.2	24.7	Frequent CP, occasional SP	Mature treeline on edge of semi-improved pasture	Local
	664525	Sept	0	52.4	9.8	0	0.9	0	0.1	0.9	0	0	64.1	Frequent CP, occasional SP & *Myotis*		
SD2	572546	Aug	0.8	35.2	0.7	0	0	0.2	0.1	0	0.1	0.1	37.2	Frequent CP	Mature hedgerow bordering semi-improved pasture	Local
	664578	Sept	0.1	4.1	1.5	0	0	0	0.1	0	0	0.3	6.2	Occasional CP		
SD3	572931	Jun	0.3	1.3	0	0	0.1	0	0	0	0.2	0	1.8		Hedgerow on edge of semi-improved pasture	Local
	664569	Sept	0.1	9.3	23.4	0	0.1	0.1	0.1	0	0	0.3	33.4	Frequent SP, occasional CP		
SD4	572981	Jun	1.9	14.8	5.7	1	0.1	0.1	0.4	0	0	0.1	23.7	Frequent CP, occasional SP	Small roadside hedgerow on edge of semi-improved meadow	Local
	664515	Sept	0.2	2.8	1.9	0	0.1	0	0.2	0	0.2	0.8	6.2	Occasional CP		
SD5	574373	Jun	0.5	6.3	0.8	0	0.2	0.1	1.8	0	0	0.1	9.9	Occasional CP	Hedgerow on edge of tilled field	Negligible
	664242	Sept	0.9	6.2	1.8	0	0.2	0.2	0.3	0.7	0.1	0.2	10.6	Occasional CP		
SD6	574579	Jun	0.2	2.7	1	1	0	0.8	0.8	0	0.8	1.5	8.5	Occasional CP	Agricultural tracks beside farm buildings	Local
	664377	Sept	0.7	56.9	12.6	0	0.7	0.6	0.2	0	0.1	0.3	72.1	Frequent CP & SP		
SD7	574700	Aug	3	15.1	0.7	0	0.1	0.3	0.5	0	0.3	0.3	20.2	Frequent CP, occasional L	Riparian woodland bordering semi-improved pasture	Local
	664103	Sept	0.3	34.9	7.4	0	4.4	0.2	0.4	4.6	0	3.8	55.9	Frequent CP & SP, occasional *Myotis*		
SD8	575251	Jun	0.1	7.3	1.5	0	0	0	4.4	0	0	0.2	13.6	Occasional CP & *Myotis*	Inside ruined church	Local
	664078	Sept	0.1	7.4	4.1	0	0	0	1.3	0	0	0.3	13.3	Occasional CP		
SD9	575302	Jun	0.1	0.6	0.1	0	0	0.1	0	0	0	0	0.8		Small roadside hedgerow on edge of semi-natural meadow	Negligible
	664071	Sept	0.1	0.4	0.1	0	0	0.2	0	0	0.1	0.3	1.2			
SD10	575851	Aug	0.9	22.5	4.4	0	0	0.3	0.2	0	0.1	0.1	28.3	Frequent CP, occasional SP	Riparian woodland bordering semi-improved pasture	Local
	663855	Sept	0.2	1	0.7	0	0.2	0	0.5	0	0.1	0.7	3.5			
SD11	576388	Jun	1.1	57.6	30	0	0	0	0.7	0	0	1.3	90.8	Frequent CP & SP	Hedgerow on edge of semi-improved pasture	County
	663715	Sept	0.4	46.5	131	0	2.2	0.1	1.1	0	0	0.1	181.4	Near-constant SP, frequent CP, occasional *Myotis*		
SD12	576477	Jun	0.9	33.1	1.3	0	0.4	0	14	0	0	0.1	50.4	Frequent CP & *Myotis*	Agricultural track bordered by mature broadleaf hedgerows	County
	663726	Sept	0.9	28.5	1.3	0	2.4	0.3	2.8	0	0.2	0.7	37.2	Frequent CP, occasional *Myotis*		
SD13	576848	Jun	0.5	61.7	0.5	0	0	0	0.1	0	0	0.1	63.3	Near-constant CP	Forest road within conifer plantation	County

REFERENCE DOCUMENTS

Site	Grid ref	Month	L	CP	SP	NP	MY	MD	MN	MW	BLE	UnID	Total	Summary	Habitat	Ecological value
	663176	Sept	0.1	21.6	3.9	0	0.7	0.4	0	1	0.1	1.3	29.2	Frequent CP, occasional SP & *Myotis*		
SD14	576957	Aug	0.3	25.7	2.8	0	0.5	0.4	0.1	0	0.1	0	29.8	Frequent CP, occasional SP	Forest road within conifer plantation	Local
	662710	Sept	0.1	8.1	1.4	0	0	0.3	0.2	0.2	0	0.3	10.6	Occasional CP		
SD15	579705	Jun	0	7.4	0.5	0	0	0.7	2.9	0	0	0.1	11.6	Occasional CP & *Myotis*	Forest road within conifer plantation	Local
	662415	Sept	0	0.3	0.2	0	0	0	0	0	0	0	0.5			
SD16	582198	Aug	0.9	8.4	7.5	0	1.2	0.6	0.3	0	0.1	0.7	19.6	Occasional CP, SP & Myotis	Mature treeline bordering semi-improved pasture	Local
	661996	Sept	0.5	9.2	23.2	0	0.7	0	0.3	0.2	0.1	0.7	35	Frequent SP, occasional CP		
SD17	582330	Jun	0.5	31.7	1	1	0	1.4	0.1	0.1	0.1	0.4	35.8	Frequent CP	Farmyard bordered by conifers	Local
	662341	Sept	0.2	16.7	2.4	0	0.9	4.5	0.2	0.4	0.1	0.9	26.5	Frequent CP, occasional SP & *Myotis*		
SD18	582859	Jun	0.6	37	0.3	1	0	0.2	0.1	0	0.1	0	38.9	Frequent CP	Forest road within conifer plantation	Local
	662078	Sept	0.1	25.7	1.2	0	0.1	0.2	0.1	0	0.1	0.1	27.7	Frequent CP		
SD19	583161	Sept	0.1	1.2	0.3	0	0.2	0	0.5	0.1	0	0.1	2.5		Mature hedgerow bordering road and semi-improved pasture	Negligible
	661101	Sept	0.1	0.8	1.5	0	0.3	0	0.6	0	0	0.2	3.6			
SD20	584429	Aug	1	10.3	31.1	0	0.1	0	0.2	12	0	0.2	54.9	Frequent CP & *Myotis,* occasional SP	Edge of mature conifers, hedgerow and road	County
	660742	Sept	0.1	13.3	1.3	0	0.1	0	0	0	0	1	15.9	Frequent CP		
SD21	587239	Jun	5.2	49.5	2	1	0	0.1	0.3	0.2	0.2	0	58.1	Frequent CP, occasional L & SP	Forest road within conifer plantation	Local
	660819	Sept	0	15.3	1.3	0	0.1	0	0	0	0	0	16.8	Occasional CP		
SD22	588440	Aug	0.2	2	1	0	0	0.1	0.7	0	0.1	0	3.9	Occasional CP	Forest road within conifer plantation	Local
	660463	Sept	0.2	21.9	23.7	0	0.1	0.2	0.1	0	0.4	0.3	46.8	Frequent CP & SP		
SD23	589305	Aug	0.9	25.7	47.1	0	0.1	0.2	0.2	0.1	0.1	0.3	74.6	Frequent CP & SP	Roadside hedgerow bordering newly-planted conifers	Local
	660234	Sept	1.1	30.7	4	0	0	0	0.2	0	0	0.1	36.2	Frequent CP, occasional SP		
SD24	589919	Jun	3.1	2.2	0.1	1	0	0.1	0	0	0	0	6.1	Occasional L & CP	Open area on edge of playing fields	Local
	660070	Sept	0.3	3.9	0.8	0	0.1	0	0	0	0	0.2	5.3	Occasional CP		
SD25	592248	Jun	0.8	3.1	0.5	0	0	0.2	0.2	0	0.1	0	5.2	Occasional CP	Hedgerow in intensive grasslands	Local
	659900	Sept	1.9	10.5	2.4	0	0.3	1.5	0.5	0	1.4	0.6	19	Occasional CP & SP, occasional *Myotis*		
SD26	593610	Jun	0.8	65.2	0.2	0	0	0.3	0	0	0	0	66.7	Near-constant CP	Farmyard, close to a sileage store	County

REFERENCE DOCUMENTS

Site	Grid ref	Month	L	CP	SP	NP	MY	MD	MN	MW	BLE	UnID	Total	Summary	Habitat	Ecological value
	660433	Sept	0.9	6.3	0.4	0	0	0.2	0	0	0.1	0.1	8	Occasional CP		
SD27	594849	Jun	0.2	7.2	0.1	0	0.1	0	0	0	0	0	7.6	Occasional CP	Broadleaf trees on edge of conifer plantation	Negligible
	660597	Sept	0	0.5	0.3	0	0.1	0	0.1	0	0	0	1			

Species codes: L - Leisler's bat; CP – common pipistrelle; SP – soprano pipistrelle; NP – Nathusius' pipistrelle; MY – Myotis genus, species unidentified; MN – Natterer's bat; MD – Daubenton's bat; MW – whiskered bat; BLE – brown long-eared bat; UnID – unidentified bat

Table 45 Criteria for classification of results.

Terms of characterisation	Bat Activity Index	Average interval between calls
Negligible	<2	> 30 minutes
Occasional	2 - 12	5 – 30 minutes
Frequent	12 – 60	1 – 5 minutes
Near-constant	>60	< 1 minute

REFERENCE DOCUMENTS

Potential limitations and information gaps

In accordance with the CIEEM Guidelines (2016), this section aims to identify any aspects in which the baseline data may be deficient, and to discuss how it has been taken into account in the evaluation of effects. Overall, this study is considered to have a broad spatial and seasonal coverage, and provides a good representation of bat roosting and foraging / commuting behaviour along the Whole UWF Project. The survey effort is considered to be proportionate to the potential effects of the Whole UWF Project (Section 2.2.5 of the BCT Guidelines). Nonetheless, some minor limitations are discussed below.

Restricted access to properties

Where possible, detailed bat surveys were carried out for buildings of high or moderate suitability within 150m of Project Elements 1 – 4. It was not always possible to obtain permission to enter private property and/or to access the interior of buildings, so in some cases the presence / absence surveys were carried out from public roads. However, this is not considered to have negatively affected the results, because swarming behaviour can usually be observed at any location around a building, even if the roost entry point is not directly visible.

Weather conditions

Bat activity can vary significantly in relation to weather conditions, with higher activity during periods of warm, calm, dry weather, and lower activity during cold, windy or wet weather. In the BCT guidelines it is recommended that surveying should be avoided during periods of heavy rain, strong winds, mist or dusk temperatures below 10°C. However, it should be noted that the climate of Ireland is often unsettled during summer months, so it is not always possible to ensure that surveys are carried out during ideal weather conditions, particularly when automated detectors are deployed for a number of days at a time.

Detailed weather data for the survey period were obtained from Shannon International Airport (approx. 30km west of the Whole UWF Project site), and summarised lists are presented in Table 46. All roost surveys were carried out during suitable weather conditions. Activity surveys were scheduled to coincide with periods of suitable weather, but on three occasions in September weather conditions deteriorated on the second night. Where this was the case, the detector was left in place for additional nights until there had been at least two nights of suitable weather. With these exceptions, weather conditions were suitable for bats on all other occasions, and are not thought to have negatively influenced the quality of the data.

Table 46 Summary of average weather conditions from June to October 2016 and on selected nights in July and August 2017. Dates of bat surveys are highlighted in grey.

Date	Mean Temp	Min Temp	Mean Pressure (hPa)	Mean Wind Speed (m/s)	Precipitation (mm)
20/06/2016	14	12	1012	6.4	0
21/06/2016	16	12	1013	5	1.02
22/06/2016	14	12	1014	4.4	0
23/06/2016	15	12	1015	5	2.03
24/06/2016	14	11	1017	6.4	0.25
25/06/2016	15	13	1022	6.4	0
26/06/2016	16	13	1019	5.3	0
27/06/2016	14	12	1020	5	0
28/06/2016	14	11	1012	3.9	2.03
29/06/2016	14	12	1004	6.4	0.25
30/06/2016	13	12	1006	4.4	6.1
01/07/2016	12	10	1007	5.3	7.11

Date	Mean Temp	Min Temp	Mean Pressure (hPa)	Mean Wind Speed (m/s)	Precipitation (mm)
02/07/2016	13	11	1013	5.8	1.02
03/07/2016	14	11	1017	3.1	0
04/07/2016	14	10	1014	4.4	0.51
05/07/2016	14	11	1021	3.1	0
06/07/2016	16	12	1019	3.6	0.25
07/07/2016	17	13	1015	3.1	0
08/07/2016	16	14	1014	5.8	0.76
09/07/2016	18	16	1008	5.3	4.06
10/07/2016	14	14	999	6.7	4.06
11/07/2016	14	12	1008	6.7	0.25
12/07/2016	13	11	1015	3.9	3.05
13/07/2016	13	11	1023	4.4	0.25
14/07/2016	14	11	1026	2.8	4.06
15/07/2016	17	12	1022	5	1.02
16/07/2016	16	14	1024	3.9	0.51
17/07/2016	17	14	1023	2.8	0
18/07/2016	21	16	1020	1.7	0
19/07/2016	21	14	1013	2.8	1.02
20/07/2016	17	14	1011	4.4	0
21/07/2016	18	14	1012	4.4	1.02
22/07/2016	16	14	1019	3.6	0
23/07/2016	16	13	1019	3.1	0.51
24/07/2016	16	13	1016	3.9	0.76
25/07/2016	14	13	1019	4.4	1.02
26/07/2016	17	14	1018	4.4	0.76
27/07/2016	16	14	1017	3.9	0.51
28/07/2016	16	14	1011	5.3	0.51
29/07/2016	17	14	1013	4.4	0
30/07/2016	14	11	1017	3.1	0.51
31/07/2016	14	12	1019	3.1	0
01/08/2016	14	13	1012	3.9	8.89
02/08/2016	17	16	1006	4.4	0.51
03/08/2016	15	14	1002	8.1	7.11
04/08/2016	16	13	1011	6.4	0.51
05/08/2016	16	13	1020	3.1	0
06/08/2016	18	13	1022	5	0
07/08/2016	17	14	1021	9.7	0
08/08/2016	14	12	1026	6.4	0
09/08/2016	14	11	1031	4.4	0
10/08/2016	15	13	1029	5.3	0
11/08/2016	14	13	1025	5.8	0
12/08/2016	16	13	1021	6.4	1.02
13/08/2016	16	13	1024	5	0
14/08/2016	16	13	1026	2.2	0
15/08/2016	18	12	1021	5.8	0

Date	Mean Temp	Min Temp	Mean Pressure (hPa)	Mean Wind Speed (m/s)	Precipitation (mm)
16/08/2016	20	16	1014	5.8	1.02
17/08/2016	17	16	1010	5	4.06
18/08/2016	17	14	1009	3.9	2.03
19/08/2016	17	14	992	8.9	3.05
20/08/2016	16	14	997	11.1	4.06
21/08/2016	16	13	1013	6.7	7.87
22/08/2016	17	13	1018	4.4	11.94
23/08/2016	14	12	1020	1.7	0.76
24/08/2016	15	10	1021	2.8	0
25/08/2016	15	9	1016	2.2	2.03
26/08/2016	14	11	1016	3.9	0
27/08/2016	16	12	1014	3.1	1.02
28/08/2016	16	11	1015	3.1	0
29/08/2016	16	12	1022	2.8	0
30/08/2016	17	13	1019	5	2.03
31/08/2016	14	12	1019	4.4	0.51
01/09/2016	13	9	1019	3.9	2.03
02/09/2016	17	14	1016	5	0
03/09/2016	17	13	1007	5	5.08
04/09/2016	16	14	1011	5	0.51
05/09/2016	18	14	1013	4.4	0
06/09/2016	20	17	1017	3.9	2.03
07/09/2016	18	16	1011	5	0
08/09/2016	16	13	1005	6.4	1.02
09/09/2016	16	13	1003	6.7	9.91
10/09/2016	13	11	1011	3.9	1.02
11/09/2016	14	10	1006	7.2	0.76
12/09/2016	13	12	1001	7.2	6.1
13/09/2016	13	8	1012	1.4	0
14/09/2016	13	9	1014	2.8	4.06
15/09/2016	14	12	1012	2.2	0
16/09/2016	13	11	1020	5	0.51
17/09/2016	13	10	1024	2.2	0
18/09/2016	14	11	1021	4.4	6.1
19/09/2016	12	9	1026	1.7	0
20/09/2016	13	11	1020	3.1	0.51
21/09/2016	12	8	1012	5.3	7.11
22/09/2016	11	6	1016	3.6	2.03
23/09/2016	12	8	1015	5.3	0
24/09/2016	14	12	1002	8.9	9.91
25/09/2016	13	11	1009	6.4	3.05
26/09/2016	14	11	1014	3.6	0
27/09/2016	15	13	1018	5.3	0
28/09/2016	17	13	1018	5.3	5.08
29/09/2016	12	10	1013	8.1	4.06

Date	Mean Temp	Min Temp	Mean Pressure (hPa)	Mean Wind Speed (m/s)	Precipitation (mm)
30/09/2016	11	9	1008	4.4	3.05
01/10/2016	11	7	1009	2.2	1.02
02/10/2016	10	4	1015	3.6	0
03/10/2016	14	13	1018	9.5	0.25
04/10/2016	14	14	1023	7.2	0
05/10/2016	14	11	1024	5	0
06/10/2016	11	8	1024	6.4	0
07/10/2016	11	6	1020	3.9	0.25
08/10/2016	12	9	1027	3.9	0
09/10/2016	13	10	1030	1.4	0
26/07/2017	15	13	1003	5	2.03
07/08/2017	14	11	1016	4.4	1.02
08/08/2017	13	11	1016	3	3.05
28/08/2017	15	13	1015	2.3	0.76

A8-1.2.4.6 Habitats

A 50-m buffer was applied to work locations comprising the Whole UWF Project, with the exception of the Upperchurch Windfarm, which has already been described in the EIS for the Upperchurch Windfarm planning application. The area within the buffer is termed the 'survey corridor' hereafter. Nomenclature for vascular plants follows Parnell and Curtis (2012).

UWF Grid Connection

The habitats within the survey corridor of the UWF Grid Connection comprise a mosaic of agricultural grassland, commercial forestry plantations, peatlands, hedgerows, wet grassland, private roads and public roads. For the most part, the landscape is dominated by the Silvermines Mountains with habitats recorded reflective of this.

Table 47 Habitats (non-linear) surveyed within the survey corridor of the UWF Grid Connection, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Area within Survey Corridor (ha)	Evaluation
BL3	11.53	Local Importance (Lower Value)
ED2	4.48	Local Importance (Lower Value)
ED3	2.93	Local Importance (Lower Value)
FW2	0.11	International Importance
GA1	149.05	Local Importance (Lower Value)
GA1/ED2	0.03	Local Importance (Lower Value)
GA1/WS1	0.39	Local Importance (Lower Value)
GA2	1.58	Local Importance (Lower Value)
GS4	42.46	Local Importance (Higher Value)
GS4/HH3	0.21	Local Importance (Higher Value)
GS4/WS1	1.56	Local Importance (Higher Value)
HH3	2.06	National Importance
PB2	1.38	National Importance
PB4	2.05	Local Importance (Higher Value)
WD1	5.92	Local Importance (Higher Value)
WD2	1.89	Local Importance (Higher Value)
WD4	160.09	Local Importance (Lower Value)
WN5	0.81	Local Importance (Higher Value)
WS1	15.09	Local Importance (Higher Value)
WS5	3.93	Local Importance (Higher Value)

Table 48 Habitats (Linear) surveyed within the survey corridor of the UWF Grid Connection, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Length within Survey Corridor (m)	Evaluation
BL1	157.44	Local Importance (Lower Value)
BL2	5305.70	Local Importance (Lower Value)
BL3	863.08	Local Importance (Lower Value)
ED2	15310.76	Local Importance (Lower Value)
ED3	73.63	Local Importance (Lower Value)
FW1	2060.41	National Importance
FW2	1878.43	International Importance
FW4	5148.50	Local Importance (Lower Value)
PB4	209.85	Local Importance (Higher Value)
WL1	3711.02	Local Importance (Higher Value)
WL1/WL2	1482.35	Local Importance (Higher Value)
WL2	8444.90	Local Importance (Higher Value)
WS1	256.06	Local Importance (Higher Value)
WS3	212.42	Local Importance (Lower Value)

Buildings and artificial surfaces (BL3)

This habitat type incorporates areas of built land in the Fossitt (2000) classification. It includes all buildings (domestic, agricultural, industrial and community) other than derelict stone buildings and ruins. Modern or intact buildings made of stone are included, as are derelict buildings made of bricks, cement blocks or mass concrete. It also includes areas of land that are covered with artificial surfaces of tarmac, cement, paving stones, etc. Within the context of the current development this classification includes built roads, buildings (including farm buildings) and access tracks.

Spoil and bare ground (ED2)

This habitat type was mainly recorded on unpaved forestry roads and farm tracks within the survey corridor. The majority of the UWF Grid Connection will be laid in existing farm and forestry tracks which are categorized as spoil and bare ground. Apart from the existing farm and forestry tracks, the portion of spoil and bare ground within the survey corridor is small.

Recolonising bare ground (ED3)

This habitat was predominantly recorded along existing farm and forestry tracks which did not have regular maintenance or heavy traffic and so a range of ruderal species have re-established on the gravel or hardcore surface. Vegetation cover in this habitat was generally over 50% cover and common species recorded included nettle (*Urtica dioica*), dandelion (*Taraxacum* agg.), broadleaf plantain (*Plantago major*), pineappleweed (*Matricaria discoidea*) and shepherd's-purse (*Capsella bursa-pastoris*).

Improved agricultural grassland (GA1)

Improved agricultural grassland is intensively managed or highly modified agricultural grassland that has been reseeded and/or regularly fertilised, and is now heavily grazed and or/used for silage making The classification includes regularly reseeded monoculture grasslands and rye-grass leys that are planted as part of arable rotation. These differ significantly from areas of permanent grassland. Improved agricultural grassland is typically species poor. Sward quality varies depending on soil type, fertility, drainage and management.

Improved agricultural grasslands are located primarily in the eastern and western sections of the UWF Grid Connection route with areas of this habitat located sporadically throughout the central sections where conifer plantations are more common. No arable rotation is present.

Amenity grassland (GA2)

This grassland type is improved or species poor and is managed for purposes other than grass production. It includes amenity, recreational or landscaped grasslands but excludes farmland. Most amenity grasslands have been reseeded and are regularly mown to maintain very short swards. Within the survey corridor, amenity grassland is typically associated with lawns and other managed grassland areas in gardens, parks, and grassy sports fields.

A very small portion of the survey corridor is comprised of amenity grasslands such as lawns.

Wet grassland (GS4)

This type of grassland can be found on flat or sloping ground in upland and lowland areas. It occurs on wet or waterlogged mineral or organic soils that are poorly-drained. On sloping ground, wet grassland is mainly confined to clay-rich gleys and loams, or organic soils that are wet but not waterlogged. This category includes areas of poorly drained farmland that have not recently been improved, and seasonally-flooded alluvial grasslands. Agricultural pasture not managed in recent years within the study area was classified as wet grassland.

This habitat occurs in poorly drained shallow soils primarily in the upland areas along the mid-section of the cable route but also at a variety of locations along the route where poor drainage was present. Species recorded within the wet grassland habitat were soft rush (*Juncus effusus*) and small sedges (*Carex* spp.) in addition to grasses such as Yorkshire fog (*Holcus lanatus*), creeping bent (*Agrostis stolonifera*) and tufted hair-grass (*Deschampsia caespitosa*). Wet grassland also occurs as a blend with improved agricultural grassland at a variety of locations within the study area.

Wet heath (HH3)

Vegetation with at least 25% cover of dwarf shrubs on peaty soils and shallow wet peats that typically have an average depth of 15-50cm is classified as wet heath. Wet heath can occur in upland and lowland areas and is widespread on the lower slopes of hills and mountains that are either too dry or too steep for deep peat accumulation. Wet heath communities occupy areas where peat depth and soil conditions are intermediate between that of heath and blanket bog i.e. peat depths of 0.5m – 1m. Wet heaths are found on areas of damp-moist rather than waterlogged peats, where hydrological regime usually involves a fluctuating water table (Rodwell, 1991).

A small area of wet heath occurs in the study area on the southwestern slopes of Mauherslieve in the central section of the UWF Grid Connection. This intact area of wet heath is dominated by ling heather (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*) with the presence of species such as soft rush (*Juncus effuses*),

small sedges (*Carex* spp.), purple moor-grass (*Molinia caerulea*) and is a good representation of the habitat type.

Upland Blanket Bog (PB2)

This habitat was recorded within the survey corridor at Bleanbeg Bog adjacent to the route of the UWF Grid Connection. At this location, the majority of the bog has been previously drained and/or cut over for turbary. The upland blanket bog habitats were recorded as fragmented banks adjacent to the cut over sections. The surface of the banks supported abundant ling heather along with frequent bog asphodel (*Narteciu m ossifragum*) and bog cotton (*Eriophorum angustifolium*). Purple moor grass, cross-leaved heath, deergrass (*Trichophorum cespitosum*) and green-ribbed Sedge (*Carex binervis*) occurred occasionally. Bilberry *(Vaccinium myrtillus*) occurred rarely. *Sphagnum* spp. hummocks were observed on the surface of these peat banks. Bog Rosemary (*Andromeda polifolia*) was recorded at the margin of a turbary track at Bleanbeg Bog. This species is classed as Least Concern in the Red Data List of Vascular Plants (Wyse Jackson *et al.*, 2016).

Cutover Blanket Bog (PB4)

This habitat is located adjacent to the route of the UWF Grid Connection at Bleanbeg Bog. There is evidence of previous and ongoing turf cutting at this location along with ongoing drainage. The bog surface has been excavated c. 1 to 1.5 m below the adjoining peat banks described above (PB2) leaving a flat area of peat that has been recolonised by abundant bog cotton. Green ribbed sedge is occasional. Deergrass, bog asphodel and purple moor grass are also frequently recorded with occasional ling heather and cross-leaved heath. No sphagnum was growing in this habitat and the dry surface is trafficked by excavators and tractors associated with peat extraction. The area is also used to dry out cut turf from the bank to the north that is being actively extracted. Evidence of dumping including garden waste was observed.

(Mixed) broadleaved woodland (WD1)

This category includes woodland areas with 75-100% cover of broadleaved trees, 0-25% cover of conifers. Trees may include native and non-native species. Plantations of broadleaved trees are included if the canopy height is greater than 5m or 4m in the case of wetland areas.

There are a number of small stands of (mixed) broadleaved woodland within the survey corridor along the UWF Grid Connection. These stands are primarily located adjacent to public roads and domestic dwellings and on the edges of agricultural grassland fields. One stand is located adjacent to the Newport (Mulkear) River in the townland of Oakhampton, approximately 2km east of Mountphilips. Species composition of these mixed broadleaved woodlands comprise of birch (*Betula* spp.), ash (*Fraxinus excelsior*), willow (*Salix* spp.), rowan (*Sorbus aucuparia*) and sycamore (*Acer pseudoplatanus*).

Mixed broadleaved/conifer woodland (WD2)

This category includes woodland areas with mixed stands of broadleaved trees and conifers, where both types have a minimum cover of 25% and maximum of 75%. Trees may either be native or non-native species. This habitat type occurs at two locations along the entire length of the survey corridor. Deciduous species recorded were birch, ash, willow, rowan and sycamore and conifers were composed of a mix of larch (*Larix decidua*) and Sitka spruce (*Picea sitchensis*).

Conifer plantation (WD4)

Conifer plantations are dense stands of planted conifers where the broadleaved component is less than 25% and the overriding interest is commercial timber production. Conifer plantations are characterized by even-ages stands of trees that are usually planted in regular rows, frequently within angular blocks. Species

diversity is low and single species stands are common. The majority of planted conifers are non-native species such as Sitka spruce, lodgepole pine (*Pinus contorta*), Norway spruce (*Picea abies*), and larches (*Larix* spp.).

Conifer plantation was frequently recorded within the survey corridor with the majority located throughout the central upland sections with some smaller plantations at various points throughout the corridor. Age classes of these plantations varied from first rotation to second rotation mature.

Riparian woodland (WN5)

This classification category includes wet woodlands of river margins and low islands that are subject to frequent flooding, or where water levels fluctuate as a result of tidal movement (low reaches of rivers).

Riparian woodland comprises a small proportion of the survey corridor and was recorded at two locations. Both areas of riparian woodland occur along first order streams in the western section of the survey corrdior. The easternmost area of riparian woodland is the largest of the two recorded and is not dominated by any one species. It is composed of mature willow species, hazel (*Corylus avellana*) and alder (*Alunus glutinosa*) with an understory of broadleaved herbs including nettle (*Urtica dioica*) and wood dock (*Rumex sanguineus*) together with a layer of ground ivy (*Glechoma hederacea*). The smaller area of this habitat is recorded bordering a stream approximately 200m east of the Mountphilips 110kV Substation site and is also composed of willow, hazel and alder as well as some holly (*Ilex aquifolium*).

Scrub (WS1)

This broad category includes areas that are dominated by at least 50% cover of shrubs, stunted trees or brambles. The canopy height is generally less than 5m, or 4m in the case of wetland areas. Scrub frequently develops as a precursor to woodland and is often found in inaccessible locations, or on abandoned or marginal farmland. In the absence of grazing and mowing, scrub can expand to replace grassland or heath vegetation. Trees are included as components of scrub if their growth is stunted as a result to exposure, poor soils or waterlogging. If tall trees are present, these should have a scattered distribution and should nothave a distinct canopy.

This habitat was recorded at numerous locations along the UWF Grid Connection. The majority of these areas were dominated by willow scrub and well-established gorse (*Ulex europaeus*). Understorey botanical species diversity was typically poor.

Improved Agricultural Grassland (GA1)/Scrub (WS1) Mosaic

This habitat was recorded at locations where former grassland habitat had started to be colonised by bramble (*Rubus fructicosus agg.*) and willow scrub due to absence of grazing and/or mowing. It was recorded at one location in Kilcommon.

Stone walls and other stonework (BL1)

This habitat was recorded at one location within the survey corridor for the UWF Grid Connection at the graveyard at Newross. The stone wall was a boundary/retaining wall for the graveyard.

Earth Banks (BL2)

Earth banks are a common type of field boundary in many parts of Ireland. Constructed from local materials such as peat, earth, gravel or stone, these narrow linear ridges are often bordered by drainage ditches.

There are a number of linear earth banks located primarily at the eastern end of the UWF Grid Connection and then sporadically throughout the remainder of the survey corridor. These banks are completely vegetated with common grass species and are typically species poor.

Eroding/Upland Rivers (FW1)

This habitat classifies natural watercourses in eroding conditions which are typically associated with the upland parts of river systems where gradients are steep and water flow is fast and turbulent. This habitat was mainly recorded as smaller streams in the upland areas of the

UWF Grid Connection. However, larger watercourses such as the Clare River were classified as an upland/eroding river within the survey corridor. The Clare River is hydrologically connected to the Clare Glen SAC and the Lower River Shannon SAC downstream.

Depositing/Lowland Rivers (FW2)

This category includes watercourses where fine sediments are deposited on the river bed. Depositing conditions are typical of lowland areas where gradients are low and water flow is slow and sluggish. In a natural state, these rivers erode laterally into their banks and meander across floodplains.

The Mulkear River and Bilboa River are examples of depositing/lowland rivers within the survey corridor. The Mulkear River and Bilboa River are part of the Lower River Shannon SAC.

Drainage Ditches (FW4)

This habitat was frequently encountered within the survey corridor around the margins of agricultural grasslands and also within conifer forestry. Generally, these drains showed evidence of previous excavation but had subsequently revegetated. Water levels and flow rates within the drains were often low or absent.

Hedgerows (WL1)

Hedgerows are defined as linear strips of shrubs, often occasional trees that typically form field or property boundaries. Most hedgerows originate from planting and many occur on the raised banks of earth that are derived from the excavation of associated drainage ditches. Dimensions of hedgerows vary considerably, depending largely on management and composition and are taken as being mainly less than 5m high and 4m wide.

Many hedgerows within the survey corridor are well developed and maintained along field boundaries and roadside margins. Species composition varied due to factors such as age, management, geology, soils and exposure. Hedgerows within the study area commonly supported a high proportion of hawthorn (*Cratagegus monogyna*), blackthorn (*Prunus spinosa*), gorse (*Ulex europaeus*), holly and bramble, in addition to other native trees such as ash, hazel (*Corylus avellana*) and willow. Climbing plants such as ivy (*Hedera hibernica*) and honeysuckle (*Lonicera periclymenum*) were also recorded at a number of hedgerows along the route.

Hedgerows (WL1)/ Treelines (WL2)

This habitat was recorded occasionally where hedgerow habitat and treeline habitat were present intermittently along a field boundary.

Treelines (WL2)

A treeline is a narrow row or single line of trees that is greater than 5m in height and typically occurs along field or property boundaries. This category includes tree-lined roads or avenues, narrow shelter belts with no more than a single line of trees and overgrown hedgerows that are dominated by trees.

The species composition of this habitat recorded within the study area was ash, beech (*Fagus sylvatica*), horse chestnut (*Aesculus hippocastanum*), sycamore and some conifers, including mature Sitka spruce.

Ornamental/non-native shrub (WS3)

This habitat type was recorded in close association with dwelling houses where non-native hedging plants had been planted around the boundary of the property. This habitat was recorded at Kilcommon.

UWF Related Works

The habitats within the survey corridor of the UWF Related Works comprise a mosaic of agricultural grassland, commercial forestry plantations, peatlands, heath, earth banks, wet grassland, acid grasslands, private roads and public roads.

Table 49 Habitats (non-linear) surveyed within a 100-m survey corridor of the UWF Related Works, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Area within Survey Corridor (ha)	Evaluation
BL3	5.12	Local Importance (Lower Value)
ED2	1.74	Local Importance (Lower Value)
ED3	0.63	Local Importance (Lower Value)
GA1	113.38	Local Importance (Lower Value)
GA1/GS4	1.70	Local Importance (Higher Value)
GA1/WS1	0.42	Local Importance (Higher Value)
GA2	0.27	Local Importance (Lower Value)
GS2	0.14	Local Importance (Higher Value)
GS3	1.58	Local Importance (Higher Value)
GS4	11.95	Local Importance (Higher Value)
GS4/WS1	0.49	Local Importance (Higher Value)
HH1/GS4	0.11	Local Importance (Higher Value)
HH3	2.32	Local Importance (Higher Value)
GS3/HH3	2.81	Local Importance (Higher Value)
PB2	2.03	County Importance
PB2/GS4	0.13	Local Importance (Higher Value)
PB4	0.10	Local Importance (Higher Value)
WD1	0.15	Local Importance (Higher Value)
WD4	42.45	Local Importance (Lower Value)
WL2	0.09	Local Importance (Higher Value)
WS1	1.68	Local Importance (Higher Value)
WS2	0.78	Local Importance (Higher Value)
WS2/GS4	0.43	Local Importance (Higher Value)

Table 50 Habitats (linear) surveyed within a 100-m survey corridor of the UWF Related Works, the total length of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Length within Survey Corridor (m)	Evaluation
BL2	10429.54	Local importance (Lower value)
BL3	156.40	Local importance (Lower value)
FW1	693.78	County Importance; Local Importance (Higher Value)
FW2	433.92	Local Importance (Higher Value)
FW4	2800.05	Local importance (Lower value)
GS2	159.93	Local importance (Lower value)
WL1	702.00	Local Importance (Higher Value)
WL1/WL2	187.63	Local Importance (Higher Value)
WL2	721.43	Local Importance (Higher Value)

Earth Banks (BL2)

This was the most frequently encountered field boundary within the survey corridor along with post and wire fencing. The vegetation on these earth banks varied depending on location and altitude. Earth banks at higher elevations contained species such as heathers, bilberry, bramble and heath bedstraw typical of heath habitat. Species in the lowland earth banks included frequent bramble and gorse along with occasional hawthorn or blackthorn bushes, more typical of hedgerow or scrub habitats. Earth banks were generally 1.5 m high and c. 2 m thick. Wire and post fencing ran alongside to make the boundary stock proof. Some earth banks are in poor condition due to trampling by livestock and lack of maintenance.

Buildings and artificial surfaces (BL3)

This habitat was recorded along public roads, dwelling houses and farmyards and associated paved areas. Plant species were generally absent from this habitat or if present, restricted to common ruderal species.

Hedgerows (WL1)

Hedgerow habitat within the survey corridor was rarely recorded. The habitat, when present, comprised frequent hawthorn (*Crataegus monogyna*), bramble and gorse along with occasional blackthorn (*Prunus spinosa*) and elder (*Sambucus nigra*).

Hedgerows (WL1)/ Treelines (WL2)

This habitat was recorded occasionally where hedgerow habitat and treeline habitat were present intermittently along a field boundary.

Treelines (WL2)

Treeline habitats within the survey corridor were generally of two types; the first was dominated by mature Sitka spruce trees which were planted as shelter belts for dwellings, farmyards or along field boundaries for livestock. The second type of treeline consisted of broadleaved species including a mix of ash and sycamore.

Eroding/Upland Rivers (FW1)

The eroding/upland rivers habitat was recorded within the survey corridor as streams generally 0.5 to 1 m wetted width showing vertical erosion in the stream bed with steep banks. Boulders, cobbles and gravels were the main aggregates in the stream bed. Evidence of previous spate flows was observed but water levels were lower during the survey. Evidence of livestock poaching and subsequent siltation of watercourse was observed at one location.

Drainage Ditches (FW4)

This habitat was recorded around the margins of agricultural grasslands and also within conifer forestry plantations. Species present in the revegetated drains included abundant soft rush, hemlock water dropwort (*Oenanthe crocata*), wild angelica (*Angelica sylvestris*), nettle and bramble. Water levels and flow rates, if present, was often low.

Improved Agricultural Grassland (GA1)

This was the most frequently recorded habitat within the survey corridor of the UWF Related Works. Intensively management examples of the habitat were dominated by perennial rye grass (*Lolium perenne*) with Yorkshire fog (*Holcus lanatus*) and white clover (*Trifolium repens*) all occurring frequently. Daisy (*Bellis perennis*), ragwort (*Senecio jacobaea*), Common mouse-ear (*Cerastium fontanum*), broad-leaved dock (*Rumex obtusifolius*) and common sorrel (*Rumex acetosa*) were recorded occasionally.

In some less intensively managed and/or poorer drained areas within fields, soft rush was locally frequent along with frequent creeping buttercup (*Ranunculus repens*) and occasional meadow buttercup (*Ranunculus acris*). However, species diversity was generally low and ground conditions not sufficiently wet to include in the wet grassland habitat type, as well as evidence of agricultural improvement and/or intensive management.

Amenity Grassland (GA2)

Within the survey corridor, amenity grassland was associated with lawns and other managed grassland areas in gardens.

Dry-humid acid grassland (GS3)

The dry-humid acid grassland habitat was recorded in the upland areas of the survey corridor, at the margins of existing peatland habitats or area of former bog which has been historically harvested and has regenerated with wet heath, acid grassland or wet grassland habitats.

Sweet vernal grass (*Anthoxanthum odoratum*), mat-grass (*Nardus stricta*), common bent (*Agrostis capillaris*) and velvet bent (*Agrositis canina*) were frequently recorded grass species in this habitat. Purple moor grass and wavy hair grass (*Deschampsia flexuosa*) occurred occasionally along with green ribbed sedge, carination sedge (*Carex panicea*) and heath woodrush (*Luzula multiflora agg.*). Heath rush (*Juncus squarrosus*), flea sedge (*Carex pulicaris*) and great woodrush (*Luzula sylvatica*) occurred rarely. The forb element included frequent tormentil (*Potentilla erecta*), ling heather, cat's ear (*Hypochaeris radicata*) and heath milkwort (*Polygala serpyllifolia*).

In addition, heath bedstraw (*Galium saxatile*), devil's bit scabious (*Succisa pratensis*) and lousewort (*Pedicularis sylvatica*) were recorded at one location for this habitat.

Wet Grassland (GS4)

Wet grassland was frequently recorded in low lying areas, on poorly draining soils and adjacent to watercourses. Soft rush and creeping buttercup were locally abundant in patches within this habitat. Yorkshire fog, creeping bent (*Agrostis stolonifera*), marsh ragwort (*Senecio aquaticus*) were frequently recorded along with lesser spearwort (*Ranunculus flammula*), marsh bedstraw (*Galium palustre*), marsh foxtail (*Alopecurus geniculatus*) occurred occasionally.

Notably species rich fields were less frequently recorded and included sharp flowered rush (*Juncus acutiflorus*), sweet vernal grass, heath woodrush, marsh thistle (*Cirsium palustre*), greater bird's-foot-trefoil (*Lotus pedunculatus*), lesser stitchwort (*Stellaria graminea*), field horse tail (*Equisetum arvense*), oval sedge (*Carex ovalis),* devils bit scabious and heath spotted orchid (*Dactylorhiza maculata*).

Dry siliceous heath (HH1)

This habitat was located along firebreaks within the conifer plantation habitat where overlying peat soils had been excavated and the vegetation had recolonised the remaining shallow peat/ siliceous subsoil track. Species present included frequent ling heather and occasional bell heather along with tormentil. Gorse and bramble were also present rarely.

Wet Heath (HH3)

This habitat was recorded at the margins of existing upland blanket bog habitat where there was evidence of historic peat harvesting and subsequent vegetation regeneration on the shallower peat soils. Species present included heather with purple moor grass, heath rush and wavy hair grass. Tormentil and bilberry occurred occasionally with soft rush, bog cotton, green ribbed sedge, mat-grass and sweet vernal grass. Heath spotted orchid and deer grass occurred rarely.

Dry-humid acid grassland (GS3)/ Wet Heath (HH3) Mosaic

This habitat was recorded at locations where dry-humid acid grassland formed intimate mosaics with the adjoining wet heath habitat. The species composition present comprised those as outlined in the dry-humid acid grassland habitat above with the presence of wet heath species such as ling heather, bilberry and tormentil

Upland Blanket Bog (PB2)

Ling heather, purple moor grass and bog cotton were all frequently recorded in this habitat. Bell heather (*Erica cinerea*), Cross-leaved heath, tormentil, green ribbed sedge and deergrass were recorded occasionally. Heath rush occurred rarely.

Cutover Bog (PB4)

This habitat was recorded between banks of upland blanket bog which had been harvested for turf. The level of these cut over areas was 1 to 1.5 m below the surrounding bog. The peaty soil was waterlogged and species diversity was low with the habitat being dominated by Yorkshire fog and soft rush.

Conifer plantation (WD4)

The conifer plantation habitat within the survey corridor was dominated by Sitka spruce and was generally of a mature age class with trees 8 to 10 m high and the canopy fully closed. Understorey plants were generally absent due to heavy shade.

Immature woodland (WS2)

This habitat was recorded along the margins of recently planted conifer plantations, generally along public roads and watercourses. The species were generally broadleaved species such as frequent downy birch (*Betula pubescens*) along with occasional alder (*Alnus glutinosa*) and rowan. The trees in these planted buffer areas were generally c. 2.5 to 3 m high and immature.

Scrub (WS1)

The species composition of this habitat varied across the survey corridor. Scrub habitat included frequent gorse, bramble, hawthorn and willow. This habitat was recorded in areas of low intensity management such as adjacent to watercourses and conifer plantations, former pasture that is no longer grazed/mowed frequently.

Spoil and bare ground (ED2)

This habitat type was mainly recorded on unpaved farm tracks and, to a lesser extent, forestry roads within the survey corridor. These roads are c. 4 - 5 m wide and surfaced with hardcore or compacted earth for farm machinery, livestock or forestry machinery to access the forestry. Frequent use and/or regular maintenance/resurfacing keeps these habitats free of vegetation.

Recolonising bare ground (ED3)

This habitat was recorded along infrequently used farm tracks or yards which did not have regular maintenance or heavy traffic and so a range of ruderal species have re-established on the gravel or hardcore surface. Common species recorded included nettle, dandelion, broadleaf plantain, pineappleweed and shepherd’s-purse.

UWF Replacement Forestry

The habitats within the UWF Replacement Forestry lands comprise of improved and wet grassland with earth banks, drainage ditches and streams dividing the fields. An area of scrub and conifer plantation is concentrated on the steep sides of a small glen through which the stream flows.

Additional habitats are described herein that occur within the Best Practice survey buffer however it is not proposed that these are planted with forestry. Results are included for completeness.

Table 51 Habitats (non-linear) surveyed within a 50-m buffer of the UWF Replacement Forestry, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Area within UWF Replacement Forestry lands (ha)	Evaluation
BL3	0.000001	Local Importance (Lower Value)
ED3	0.45	Local Importance (Lower Value)
GA1	8.92	Local Importance (Lower Value)
GS4	1.77	Local Importance (Lower Value)
WD1	0.18	Local Importance (Higher Value)
WD4	0.57	Local Importance (Lower Value)
WS1	0.59	Local Importance (Higher Value)

Table 52 Habitats (linear) surveyed within a 50-m buffer of the UWF Replacement Forestry, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Length within UWF Replacement Forestry lands (m)	Evaluation
BL2	748.86	Local importance (Lower value)
BL3	228.66	Local importance (Lower value)
FW1	489.44	National Importance; Local Importance (Higher Value)
FW4	314.32	Local importance (Lower value)
WL1	44.62	Local Importance (Higher Value)
WL2	89.50	Local Importance (Higher Value)

Earth Banks (BL2)

This was the most frequently encountered field boundary within the UWF Replacement Forestry lands and associated survey buffer. The vegetation on these earth banks included frequent bramble and gorse along with occasional hawthorn, willow spp. and bracken. Earth banks were generally 1.5 m high and c. 2 m thick. Wire and post fencing ran alongside to make the boundary stock proof.

Buildings and artificial surfaces (BL3)

This habitat was only recorded along the tarmacked surface of the public road that is located close to the western boundary of the UWF Replacement Forestry lands.

Hedgerows (WL1)

Hedgerow habitat was rarely recorded within the UWF Replacement Forestry lands. The habitat was recorded adjacent to an existing farm road which allows access to the lands via the public road. Species present comprised of frequent grey willow (*Salix cinerea*) and occasional eared willow (*Salix aurita*) as well as bramble and bracken.

Treeline (WL2)

Treelines were rarely recorded within the UWF Replacement Forestry lands. One treeline consisting of frequent ash (both mature and semi-mature trees) along with mature sycamore and Sitka spruce were located along the stream in the east of the survey area.

Eroding/Upland Rivers (FW1)

The eroding/upland rivers habitat was recorded within the UWF Replacement Forestry lands at the bottom of a small glen which runs from southwest to northeast through the study area. The stream was fast flowing with predominantly riffle morphology with occasional pools with a wetted width of c. 1.5 m and up to 0.5 m deep in pool with more shallow stretches over the riffles. Cobbles and gravels were the main aggregates in the stream bed. There was evidence of erosion on the banks of the stream. The majority of the stream is enclosed in scrub and conifer plantation.

The stream is a tributary of the Foilnaman (EPA Code 16F62) which is, in turn, a headwater stream of the Clodiagh River (EPA Code:16C02).

Drainage Ditches (FW4)

This habitat was recorded around the margins of agricultural grasslands, often associated with earth bank field boundaries. The drainage ditches within the UWF Replacement Forestry lands were dry or near stagnant during the site visit. The ditches were all vegetated with abundant soft rush, bramble, nettle along with occasional wild angelica.

Improved Agricultural Grassland (GA1)

This was the most frequently recorded habitat within the UWF Replacement Forestry lands. Species recorded included abundant perennial rye grass with frequent Yorkshire fog and white clover. Broad-leaved dock and creeping buttercup were recorded occasionally. The majority of fields within the UWF Replacement Forestry lands were being used for grazing cattle. One field showed evidence of recent mowing for baled silage.

Wet Grassland (GS4)

Wet grassland was recorded in the low-lying areas adjacent to the stream. Soft rush and creeping buttercup were abundant. Yorkshire fog, creeping bent and marsh ragwort were frequently recorded. Wild angelica was frequent at the margins of the stream.

Mixed Broadleaved Woodland (WD1)

This habitat was recorded along the margin of the conifer plantations within the UWF Replacement Forestry lands as a buffer between watercourses and the plantations. Species present included abundant alder with occasional ash. Trees were 6 to 8 m tall and semi mature.

Conifer plantation (WD4)

The conifer plantation habitat within the UWF Replacement Forestry survey corridor was confined to a small areas of Sitka spruce that has been planted on the steeply sloping margins of the small glen. The plantation was semi-mature and closed canopy with the trees c. 6 to 8 m tall.

Scrub (WS1)

This habitat was recorded within the small glen, adjacent to the stream. The species composition consisted of frequent willow spp. and bramble. Bracken was locally dominant in patches. Mature ash trees and hazel shrubs occurred rarely.

Recolonising bare ground (ED3)

This habitat was recorded along the existing farm tracks within the UWF Replacement Forestry lands. Species present consisted of perennial rye grass, annual meadow grass and broadleaf plantain.

UWF Other Activities

Haul Route Activities

The habitats along the Haul Route Activities locations mainly comprise of public road with associated margin vegetation often comprising grassy verges, ornamental planting, hedgerows and treelines and scrub.

Table 53 Habitats (non-linear) surveyed within a 100-m survey corridor of the UWF Other Activities, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Area within Survey Corridor (ha)	Evaluation
BC4	0.2	Local Importance (Lower Value)
BL3	8.2	Local Importance (Lower Value)
ED2	0.2	Local Importance (Lower Value)
FW1	0.4	County Importance; Local Importance (Higher Value)
GA1	13.0	Local Importance (Lower Value)
GA2	1.7	Local Importance (Lower Value)
GS2	3.9	Local Importance (Lower Value)
GS4	1.1	Local Importance (Lower Value)
HH1	0.4	Local Importance (Lower Value)
WD1	5.1	Local Importance (Higher Value)
WD4	0.3	Local Importance (Lower Value)
WL2	0.2	Local Importance (Higher Value)
WS1	1.3	Local Importance (Higher Value)
WS2	0.3	Local Importance (Lower Value)

Table 54 Habitats (linear) surveyed within a 100-m survey corridor of the UWF Other Activities, the total of each habitat within the survey corridor and an evaluation of their conservation value.

Habitat Type	Length within Survey Corridor (m)	Evaluation
BL1	207.57	Local importance (Lower value)
BL2	29.61	Local importance (Lower value)
ED2	57.22	Local importance (Lower value)
GS2	1617.89	Local importance (Lower value)
FW1	277.06	County Importance; Local Importance (Higher Value)
FW4	16.17	Local importance (Lower value)
HD1	111.88	Local importance (Lower value)
WL1	1761.73	Local Importance (Higher Value)
WL2	268.91	Local Importance (Higher Value)

Stone walls (BL1)

Bare stone walls occur along the road corridor, as a road boundary, or forming the border for ornamental planting within residential areas.

Earth Banks (BL2)

The road corridor along the haul route, particularly in the Upperchurch area is characterised by earth banks, created during the road construction. These banks are associated with hedgerows and field boundaries or are commonly vegetated with dry grassy verge communities.

Buildings and artificial surfaces (BL3)

This habitat type included all dwellings, paved areas, footpaths and the roadway within the survey corridor. In general, these artificial surfaces are of low ecological value. However, some buildings may be of ecological value to roosting bats.

Spoil and bare ground (ED2)

This habitat type was recorded in one location at an unpaved farm tracks within the survey corridor.

Dry Meadow / Grassy Verge (GS2)

Grassy verges occurred along the road corridor throughout the haul route study area. The verge width varied; however, the botanical composition was found to be relatively homogenous with two distinct categories identified. The verge associated with recent road development and managed national roads was species poor, characterised by improved grass seed mix including rye grass and bent grass species with a low forb component such as daisy, dandelion, chickweed (*Stellaria media*) and plantain spp. Grassy verges south of the N7 motorway and west of Thurles were dominated by grasses including cock's foot grass (*Dactylis glomerata*), meadow foxtail (*Alopecurus pratensis*), Yorkshire fog and false oat grass (*Arrhenatherum elatius*) with forbs characteristic of a hedgerow understory including creeping buttercup, hogweed (*Heracleum sphondylium*), cow parsley (*Anthriscus sylvestris*), vetch (*Vicia* spp.), nettle and foxglove (*Digitalis purpurea)*.

Eroding/Upland Watercourse (FW1)

The road corridor along the UWF other activities crosses a number of minor first and second order streams. A portion of the route on the R498 follows the Nenagh River corridor in the area of Latteragh, Co. Tipperary. Ecological evaluation: The Nenagh River is evaluated as being of County Importance; while the minor streams crossed by the route are evaluated as of Local importance (Higher Value).

Drainage Ditches (FW4)

This habitat was infrequently encountered within the survey corridor, only being recorded at one location associated with the edge of a farm roadway and earth bank.

Dense Bracken (HD1)

Small areas of bracken (*Pteridium aquilinum*) cover occur on higher ground adjacent to the road corridor.

Hedgerow (WL1)

Linear hedgerow features occur throughout the rural road network within the UWF Other Activities survey corridor, associated with the road corridor and agricultural field boundaries adjoining the road. Hedgerows were dominated by native species including hawthorn, blackthorn, elder, wych elm (*Ulmus glabra*) and hazel. Along the road verge, regular maintenance kept ash and sycamore growth in check.

Treeline (WL2)

Treelines were associated with the road corridor and agricultural field boundaries. Ash and sycamore dominated, with occasional pedunculate oak (*Quercus robur*) and conifers including Sitka spruce, *Pinus* spp. and *Cupressus* spp.

Wet Grassland (GS4)

No wet grassland occurs along the road verge; however, a number of field parcels adjacent to the road was classified as such, dominated by soft rush, nettles, Yorkshire fog and Yellow iris (*Iris pseudacorus*).

Conifer Plantation (WD4)

Due west of Thurles on higher ground blocks of conifer plantation were recorded adjacent to or set back from the road. These were dominated by Sitka spruce.

Scrub (WS1)

Willow scrub and maintained sycamore, dense bramble and unmanaged hedgerow were classified as scrub habitat, occurring frequently throughout the study area.

Immature woodland (WS2)

Plantations of immature woodland were recorded adjacent to the road route used as ornamental planting, screening coniferous plantation or as commercial broadleaved plantations.

Mixed Broadleaved Woodland (WD1)

Limited areas of mature broadleaved woodland were recorded along the route, in all locations this habitat was found to be dominated or compromised by non-native species including beech and sycamore.

Dry Siliceous Heath (HH1)

Occurs on earth banks created along the road verge and on areas of road cut. Dominated by ling heather with bilberry, foxglove, tormentil, hard fern (*Blechnum spicant*), gorse and bracken. The area and extent of this habitat along the road corridor is significantly restricted and is not connected to dry heath habitats in the wider upland landscape.

Recolonising Bare Ground (ED3)

Bare ground adjacent to the road corridor, or set back from the road, resulting from road maintenance or agricultural works.

Flowerbeds and Borders (BC4)

Man-made ornamental borders and planted flowerbeds which contain non-native shrub and flower species.

Overhead Line Activities

Overhead Line Activities are associated with the existing overhead 110kV line between Killonan ESBN Station (just east of Limerick City) and ESBN Angle Mast Structure No. 90 (2.3 km north of Mountphilips substation). These activities will be carried out by ESBN or ESBN contractors. Activities include (a) re-sagging/correcting the tension, and (b) fibre-wrapping.

The relevant sections of the Killonan to Nenagh overhead line are across open farmland and near Killonan, around the perimeter of an industrial estate. In order to gain access to the ESBN structures for ESBN contractor crews and equipment, the local public road network in the vicinity of the line will be used and from there they will gain access through private land, utilising existing private track or road, wherever possible. This access already exists at each location for line maintenance and no change to the established access is anticipated.

A total of 18 habitats were recorded within a 50-metre buffer of the Overhead Line Activities. The majority of the study area was composed of improved agricultural grassland. Table 56 lists the structure numbers and the habitats located at each structure.

Site surveys were carried out by INIS ecologists Mr Howard Williams, Mr. Chris Cullen, Ms. Jennifer Pearson and Mr. Peter O'Connor from 16th to 19th January 2018 inclusive. Habitats surrounding each structure and underneath the line were recorded and classified using Fossit (2000) classification and target notes were made. Incidental observations of birds and signs/observations of non-volant mammals were also recorded.

Habitat Description of Overhead Line Activities Study Area

Improved agricultural grassland GA1

The majority of the study area consisted of improved agricultural grassland habitat. These habitats are species poor, some fields were poorly drain with approximately 40% Soft Rush (*Juncus effuses*) cover. Rye-grasses (*Lolium spp*.) were dominant. Yorkshire-fog (*Holcus lanatus*), Creeping Buttercup (*Ranunculus repens*) and docks (*Rumex spp*.) were frequent. Creeping Bent (*Agrostis stolonifera*) was also frequent in some poorly drain fields. This habitat was present at 54 of the 90 structures i.e. Angle Mast (AM), Intermediate Tower (INT) or Intermediate Pole (IMP) sites.

Amenity Grassland GA2

A small section of amenity grassland was encountered during the survey within the Annacotty Business Park. This habitat was species poor. Yorkshire fog, Rye-grasses and Creeping Buttercup were common. This habitat was present at AM 19.

Wet grassland GS4

Entire fields and some sections within improved grassland fields were classified as wet grassland. These habitats had wet or waterlogged soils. Soft Rush was abundant. Yorkshire Fog and Creeping Buttercup were frequent. Hard Rush (*Juncus inflexus*) and Iris sp. (*Iris sp.*) were occasionally encountered. This habitat was present at IMP 20, AM 21 and IMPs 46, 47 and 87.

Oak-ash-hazel woodland WN2

A small section of this habitat was recorded within the study area. Oak, Ash and Hazel were common. This habitat was located south west AM 90, 50 metres from the nearest point on the overhead line.

Riparian woodland WN5

A section of this habitat was recorded along the Ballykinlalee stream (EPA No: IE_SH_25B770660). Alder, Willow and Ash were present. No structures are present within this habitat, the overhead line passes over this habitat.

Wet willow-alder-ash woodland WN6

The habitat wet willow-alder-ash woodland was recorded on a number of occasions. Willow species (Salix spp.) were common. Alder (*Alnus glutinosa*) was frequent. Ash (*Fraxinus excelsior*) was occasional to frequent. The understory consisted of Bramble (*Rubus ulmifolius*) on occasion. Creeping Bent, Ivy (*Hedera helix*), Hart's-tongue Fern (*Phyllitis scolopendrium*) and Lady-fern (Athyrium filix-femina) was also recorded. This habitat was present at poles IMP 62 and IMP 63.

Mixed broadleaved/conifer woodland WD2

Sections of mixed broadleaved/conifer woodland were recorded within the study area. Fir (A*bies sp*.) and Pine (*Pinus sp*) species were common. Birch (*Betula sp.*) and Alder were frequent. No structues are located within this habitat. IMP 53 is located on the border of this habitat; the overhead line is approximently 7 to 15 metres form this habitat.

Conifer Plantation WD4

Large stands of mature conifer plantation were recorded within the study area. Conifer species were of even age. In some cases, plantation was bordered by broadleaved trees such as Hazel, Willow and Alder. One section of young conifer plantation was also recorded. No structures are located within this habitat. The closest structure, AM 58, is located 6 metres from this habitat.

Scrub WS1

Areas of dense scrub were recorded frequently. This habitat occurred in corridors between conifer plantation amongst other areas. European Gorse (*Ulex europaeus*) and Bramble were common. Willows, Hawthorn (*Crataegus monogyna*) and Blackthorn (*Prunus spinosa*) also formed this habitat. This habitat is present at 24 of the 90 AM/IMP/INT sites.

Broadleaved Woodland WD1/ Wet Grassland GS4

A mosaic habitat of broadleaved woodland and wet grassland habitat was recorded within the Annacotty Business Park. Within this habitat Willow and Elder were recorded. Soft Rush and Yorkshire Fog were frequent. No structures were present within this habitat, the overhead line is within 1 metre of this habitat.

Cutover Bog PB4

IMP 66 and the proximal surrounding area is located in cutover bog habitat. This bog has been used for extensive turf cutting.

Ornamental/non-native shrub WS3

Ornamental/non-native shrub habitat was recorded as linear features proximal to domestic dwellings. Escallonia (*Escallonia macrantha*) was abundant in one location.

Hedgerows WL1

Hedgerows were frequently recorded as linear boundaries to improved agricultural fields, wet grassland and other habitats. Blackthorn and Hawthorn were common. Ash and Bramble were frequent. Elder (*Sambucus nigra*) and Ivy were occasional. European Gorse was occasional and common within certain hedgerows. This habitat was present at 11 of the AM/IMP/INT sites, see table 56.

Treelines WL2

A number or field boundaries contained hedgerow which were dominated by large trees. Ash, Hazel, Horse Chestnut (*Aesculus hippocastanum*) and Beech (*Fagus sylvatica*), Elm, Hawthorn, Blackthorn were all recorded. This habitat was present at IMP 67 and IMP 69.

Drainage Ditches FW2

Drainage ditches were commonly recorded along linear features such as hedgerows and treelines. Within the ditches Common Reed and Willow were frequently recorded.

Eutrophic Lake FL1

A lake was recorded within the same improved grassland field as IMP 75. Pondweeds (*Potamogeton sp.)* and Brooklime (*Veronica beccabunga*) were frequent. Common Reed (*Phragmites australis*) and Hard Rush boarded the lake.

Depositing/lowland rivers FW2

The river Mulkear was encountered along the survey route, poles are located either side of the river and the overhead lines pass over the river. The section of river that was surveyed was classified as a depositing lowland river. At the time of survey, the river was high and fast-flowing. It is estimated that the river was 20-25 metres wide. The stream West Clyduff passes through the Annacotty Business Park from the south to the north. This habitat is present near AM 32, IMP 34, IMP 35, IMP 72 and IMP 89.

Buildings and artificial surfaces BL3

Buildings and hardstanding composed of concrete, tarmac and hard core were recorded during the study. Buildings encountered included substations, industrial and domestic buildings.

Watercourse crossings

A total of 11 water crossings are proposed for the overhead lines activites. Watercoursecrossings W1, W2, W3, W4, W5, W6 were classified as FW4 due to their artificial man-made nature. Water crossings W7, W8, W9, W10 and W11 were classified as FW2 due to the presence of fine sediments. Pole 86 is located in close proximity to the Ballykinlalee stream (EPA code: IE_SH_25B770660). Pole 2 is located approximately 20 metres south of the Groody River (EPA code: 1E_SH_25G050200). Table 55 outlines the watercourse crossings along the overhead lines activities.

Table 55 Watercourse crossings - Overhead Line Activties.

Water-course_No	Watercourse Description	Watercourse habitat type	Existing crossing
W1	c. 1 m wide, c. 1 m deep, standing water	FW4	Yes - 3 metres wide
W2	c. 1 m wide, c. 1 m deep, ditch was almost dry approximately 40 metres east of the proposed crossing location	FW4	Yes - 3 metres wide
W3	C. 2 m wide and 40 cm deep, peat (100), standing water	FW4	No

Water-course_No	Watercourse Description	Watercourse habitat type	Existing crossing
W4	c. 50 cm wide, c. 5cm deep, mud (100) standing water	FW4	No
W5	c. 1 metre wide, c. 2 metres deep, water flowing slowly	FW4	No
W6	c. 1.5 metres wide, c. 30cm deep	FW4	No
W7	c. 1 metre wide, c. 3cm deep Stone (60), silt and mud (40)	FW2	No
W8	c. 1 metre wide, Sand (20), stone (50) and rock (30), fast flowing	FW2	No
W9	c. 1.5 metres wide, c. 15cm deep, fast flowing, silt (80) and stone (20), fast flowing	FW2	No
W10	c. 1.5 metres wide, c. 15cm, silt (70), pebble (10) and stone (20), fast flowing	FW2	3 metes wide
W11	c. 2.5 metres wide, c. 20cm deep, mud (100), slow flowing	FW2	3 metes wide

All watercourses will be crossed by clear span bridge or bog mats. The bog mats or bridges will be in place for maximum one day at any location. No instream works are required to successfully complete the Overhead Lines activities.

Water crossing 3; FW4 Drainage ditch

Water crossing 10; FW2 lowland depositing

Table 56 Outlines the habitats recorded at each pole at the Overhead Line Activities.

Structure number	Structure type*	Habitats at Pole location
1	AM	BL3
2	INT	GA1
3	AM	GA1
4	INT	GA1, HL1
5	AM	WS1
6	INT	GA1
7	INT	GA1
8	INT	GA1
9	INT	GA1
10	INT	GA1
11	AM	GA1, WL1
12	IMP	GA1
13	INT	GA1
14	INT	GA1
15	INT	GA1
16	INT	GA1
17	INT	GA1, WL1
18	INT	WS1
19	AM	GA2

20	IMP	GS4
21	AM	GS4
22	IMP	BL3, WS1
23	AM	BL3 (and standing water)
24	AM	GA1
25	IMP	GA1, WL1
26	INT	GA1
27	IMP	GA1
28	IMP	GA1
29	IMP	GA1
30	IMP	GA1
31	IMP	GA1
32	AM	GA1, WL1, FW4
33	IMP	GA1
34	IMP	GA1, WL1, FW4
35	IMP	GA1, WL1, FW4
36	IMP	GA1, WL1
37	IMP	GA1, WL1
38	IMP	GA1, WL1
39	IMP	GA1
40	AM	GA1, WS1
41	IMP	GA1
42	IMP	GA1, WL1, WS1
43	IMP	GA1, WS1
44	IMP	GA1, HL2
45	IMP	GA1
46	IMP	GS4
47	IMP	GS4
48	AM	WS1
49	AM	WS1
50	IMP	WS1
51	IMP	GA1
52	IMP	GA1

53	IMP	WS1
54	IMP	WS4
55	IMP	WS4
56	IMP	WS4
57	IMP	GM1
58	AM	WS1
59	IMP	WS1
60	IMP	WS1
61	IMP	WS4
62	IMP	WN6
63	IMP	WN6
64	IMP	HD1/burnt
65	IMP	WS1
66	IMP	PB4
67	IMP	WS1, WL2
68	IMP	WS1
69	IMP	GA1, WL2
70	IMP	GA1
71	IMP	GA1
72	IMP	GA1, FW4
73	IMP	GA1, WS1
74	IMP	GA1, WS1
75	IMP	GA1
76	IMP	GA1
77	IMP	GA1
78	AM	WS4
79	IMP	GA1
80	IMP	GA1, HL2
81	IMP	GA1
82	IMP	WS1
83	IMP	WS1
84	IMP	WS1
85	IMP	GA1

86	IMP	GA1
87	IMP	GS4
88	IMP	WS1
89	IMP	GA1, FW4
90	AM	WS1, WL1

*Angle Mast (AM), Intermediate Tower (INT), Intermediate Pole (IMP)

Habitats Directive 92/43/EEC Annex I Habitat Assessments

UWF Related Works

Wet heath (HH3) habitat identified during the habitat survey at Foilnaman (Tubine 21) was assessed for correspondence to the habitat 'Northern Atlantic wet heaths with *Erica tetralix* (4010) again using the methodology outlined by Perrin *et al.*, (2014). **The habitat did not meet the required criteria to be classified as Annex I quality habitat,** primarily due to the absence of *Erica tetralix* within 20 m of the relevé.

The dry-humid acid grassland (GS3)/wet heath (HH3) mosaic habitat identified during the habitat survey at Shevry (around Turbine 2 and the borrow pit) was assessed for correspondence to the Annex habitats 'Northern Atlantic wet heaths with *Erica tetralix* (4010)' and the priority habitat 'Species-rich *Nardus* grasslands (6230)'. **This habitat did not meet the criteria presented in Perrin *et al.*,(2014) or O'Neill *et al.*, (2013) to be classified as Annex I quality habitat.**

Rare/Protected Plant Species

Small White orchid (*Pseudorchis albida*)

Desktop reviews indicated that Small White orchid (*Pseudorchis albida*) has been recorded within the R86 and R96 10km squares. The BSBI database holds a record in tetrad (2 * 2 km square) R86P (BSBI database http://bsbi.org/maps?taxonid=2cd4p9h.c3v, accessed 19/09/2017). The NBDC database shows a record from June 2009 in the the Silvermines Mountains at Knockanroe in the monad (1 * 1 km square) R8469 (http://maps.biodiversityireland.ie/#/Map, accessed 19/09/2017).

This species is listed in Schedule A of the Flora (Protection) Order, 2015 and is classed as Vulnerable in the Red Data List of Vascular Plants (Wyse Jackson *et al.*, 2016). **This species was not recorded during the habitat surveys for the project**. The desktop data indicates that the historic locations for this plant are c. 7 km north of the Whole UWF Project

Killarney Fern (*Trichomanes speciosum*)

The desktop review also showed that Killarney Fern (*Trichomanes speciosum*) has historically been recorded in the R86 hectad (10km square). This species is listed in Schedule A of the Flora (Protection) Order, 2015 and is classed as Least Concern in the Red Data List of Vascular Plants (Wyse Jackson *et al.*, 2016). No recent records exist for the species within hectads through which the Whole UWF Project will pass. **This species was not recorded during the habitat survey**.

Bog Rosemary (*Andromeda polifolia*)

Bog Rosemary (*Andromeda polifolia*) was recorded incidentally at Bleanbeg Bog during a Merlin survey in April 2017. This species is classed as Least Concern in the Red Data List of Vascular Plants (Wyse Jackson *et al.*, 2016). The species was previously unrecorded for the hectad R76 in either BSBI or NBDC databases. The plant was located c. 120 m northwest of the Whole UWF Project.

Plant Species List

A full Botanical list of species recorded, across all Project Elements is herein presented.
Table 57 List of plant species recorded during habitat surveys for the Whole UWF Project.

Common Name	Scientific Name
Alder	*Alunus glutinosa*
Annual meadow grass	*Poa annua*
Ash	*Fraxinus excelsior*
Beech	*Fagus sylvatica*
Bell heather	*Erica cinerea*
Bilberry	*Vaccinium myrtillus*
Birch	*Betula spp.*
Blackthorn	*Prunus spinosa*
Bog asphodel	*Nartecium ossifragum*
Bog cotton	*Eriophorum angustifolium*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fructicosus agg.*
Broadleaf plantain	*Plantago major*
Broad-leaved dock	*Rumex obtusifolius*
Brooklime	*Veronica beccabunga*
Carination sedge	*Carex panicea*
Cat's ear	*Hypochaeris radicata*
Cock's foot grass	*Dactylis glomerata*
Common bent	*Agrostis capillaris*
Common chickweed	*Stellaria media*
Common hogweed	*Heracleum sphondylium*
Common mouse-ear	*Cerastium fontanum*
Common Reed	*Phragmites australis*
Common sorrel	*Rumex acetosa*
Cow parsley	*Anthriscus sylvestris*
Creeping bent	*Agrostis stolonifera*
Creeping buttercup	*Ranunculus repens*
Cross-leaved Heath	*Erica tetralix*
Daisy	*Bellis perennis*
Dandelion	*Taraxacum agg.*
Deergrass	*Trichophorum cespitosum*
Devil's bit scabious	*Succisa pratensis*
Downy birch	*Betula pubescens*
Eared willow	Salix aurita
Early purple orchid	*Orchis mascula*
Elder	*Sambucus nigra*
Escallonia	*Escallonia macrantha*
European larch	*Larix decidua*

Common Name	Scientific Name
False oat grass	*Arrhenatherum elatius*
Field horse tail	*Equisetum arvense*
Flea sedge	*Carex pulicaris*
Foxglove	*Digitalis purpurea*
Gorse	*Ulex europaeus*
Great woodrush	*Luzula sylvatica*
Greater bird's-foot-trefoil	*Lotus pedunculatus*
Green-ribbed sedge	*Carex binervis*
Grey willow	*Salix cinerea*
Ground Ivy	*Glechoma hederacea*
Hard fern	*Blechnum spicant*
Hard Rush	*Juncus inflexus*
Hart's-tongue Fern	*Phyllitis scolopendrium*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Heath bedstraw	*Galium saxatile*
Heath milkwort	*Polygala serpyllifolia*
Heath rush	*Juncus squarrosus*
Heath spotted orchid	*Dactylorhiza maculata*
Heath woodrush	*Luzula multiflora agg.*
Hemlock water dropwort	*Oenanthe crocata*
Holly	*Ilex aquifolium*
Honeysuckle	*Lonicera periclymenum*
Horse chestnut	*Aesculus hippocastanum*
Iris sp	*Iris sp.*
Ivy	*Hedera hibernica*
Lesser spearwort	*Ranunculus flammula*
Lesser stitchwort	*Stellaria graminea*
Ling heather	*Calluna vulgaris*
Lodgepole pine	*Pinus contorta*
Lousewort	*Pedicularis sylvatica*
Marsh bedstraw	*Galium palustre*
Marsh foxtail	*Alopecurus geniculatus*
Marsh ragwort	*Senecio aquaticus*
Marsh thistle	*Cirsium palustre*
Mat-grass	*Nardus stricta*
Meadow buttercup	*Ranunculus acris*
Meadow fox-tail	*Alopecurus pratensis*
Nettle	*Urtica dioica*
Norway spruce	*Picea abies*
Oval sedge	*Carex ovalis*

Common Name	Scientific Name
Pedunculate oak	*Quercus robur*
Perennial rye grass	*Lolium perenne*
Pineappleweed	*Matricaria discoidea*
Pondweed sp	*Potamogeton sp*
Purple Moor-grass	*Molinia caerulea*
Ragwort	*Senecio jacobaea*
Rowan	*Sorbus aucuparia*
Sharp flowered rush	*Juncus acutiflorus*
Shepherd's-purse	*Capsella bursa-pastoris*
Sitka spruce	*Picea sitchensis*
Snowberry	*Symphoricarpos albus*
Soft rush	*Juncus effusus*
Sweet vernal grass	*Anthoxanthum odoratum*
Sycamore	*Acer pseudoplatanus*
Tormentil	*Potentilla erecta*
Tufted hair-grass	*Deschampsia caespitosa*
Velvet bent	*Agrositis canina*
Vetch spp.	*Vicia spp.*
Wavy hair grass	*Deschampsia flexuosa*
White clover	*Trifolium repens*
Wild angelica	*Angelica sylvestris*
Willow spp.	*Salix spp.*
Wood dock	*Rumex sanguineus*
Wych elm	*Ulmus glabra*
Yellow iris	*Iris pseudacorus*
Yorkshire fog	*Holcus lanatus*

Plate 7: Example of a public road which was classified as Buildings and artificial surfaces (BL3)

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Plate 8: Example of a farm track which was classified as spoil and bare ground (ED2)

Plate 9: Example of a forestry road which was classified as spoil and bare ground (ED2)

Plate 10: Example of a bog track which was classified as spoil and bare ground (ED2)

REFERENCE DOCUMENTS

Plate 11: The Newport (Mulkear) River which was classified as a depositing/lowland river (FW2)

Plate 12: Example of a stream which was classified as depositing/lowland river (FW2)

Plate 13: Example of a drainage ditch (FW4)

Plate 14: Example of improved grassland habitat (GA1)

REFERENCE DOCUMENTS

Plate 15: Example of wet grassland habitat (GS4) with abundant by soft rush (*Juncus effusus*)

Plate 16: Example of wet grassland habitat (GS4)

Plate 17: Example of wet heath habitat (HH3)

Plate 18: Example of upland blanket bog (PB2)

REFERENCE DOCUMENTS

Plate 19: Example of cutover bog (PB4)

Plate 20: Example of mixed broadleaved woodland habitat (WD1)

Plate 21: Example of conifer plantation habitat (WD4)

Plate 22: Example of scrub habitat (WS1)

REFERENCE DOCUMENTS

Plate 23: Example of mixed broadleaved / conifer woodland habitat (WD2)

Plate 24: Example of hedgerow habitat (WL1)

Plate 25: Example of treeline habitat composed of conifer trees (WL2)

Plate 26: Example of treeline habitat composed of broadleaved trees (WL2)

REFERENCE DOCUMENTS

Plate 27: Example of recently-felled woodland habitat (WS5)

Plate 28: Example of riparian woodland habitat (WN5)

Plate 29: Example of recolonising bare ground habitat (ED3)

Plate 30: Example of earth banks habitat (BL2) associated with drainage ditch (FW4)

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

A8-1.2.4.7 General Bird Species

Table 58 Results of Countryside Bird Surveys undertaken along transects T1 to T7 during the breeding season of 2016.

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeen		6 - Oakhampton		7 - Mountphilips	
Visit	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**
Species														
Barn Swallow	1	4	1	6		3	1		1	2	2	2	2	7
Blackbird	4	4	1	2	3	1	3	2	8	5	5	5	13	1
Blackcap		1							2	3	3	3	3	4
Blue Tit	1										1	1	1	3
Bullfinch										4		1		
Chaffinch	6	3	2	1	4			2	23	16	11	13	7	8
Chiffchaff									3	1	5		1	1
Coal Tit		2				1			1		3			1
Cuckoo								1		1				
Dunnock		1			1			1	2	1		1	4	4
Goldcrest	2	2			1	2			6	2	1	2		3
Goldfinch												3		1

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeen		6 - Oakhampton		7 - Mountphilips	
Visit	May-16	Jun-16	May-16	Jun-16	May-16	Jun-16	May-16	Jun-16	May-16	Jun-16	May-16	Jun-16	May-16	Jun-16
Grasshopper Warbler	1							1					1	
Great Tit									3		1	1	1	
Greenfinch										1	1	1	4	
Hen Harrier								1						
Hooded Crow		2						2				3		2
House Sparrow			1	4							2	1		
Jackdaw									2	1	1	3	3	
Jay														1
Linnet			4				2	1				1	4	1
Magpie		2					1	1			1	1		2
Mallard								1			2			
Meadow Pipit	3	1	3	4			11	14	2	2	1			
Mistle Thrush	1	1			1			3				1	1	
Moorhen														2
Pheasant									1	2		1	1	1
Pied Wagtail													1	
Redpoll		2				1		1						
Reed Bunting	1							1		3				2
Robin	5	3			6	5	2	2	8	3	11	7	12	5
Rook		10	70	2					2	5	15	21	9	10

REFERENCE DOCUMENTS

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeen		6 - Oakhampton		7 - Mountphilips	
Visit	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**	**May-16**	**Jun-16**
Siskin						1							1	
Skylark			1	2			5	3						
Song Thrush	4	6			1	2				2		5	4	
Sparrowhawk					1									
Starling											1			
Stonechat								4		2				3
Wheatear			1											
Whitethroat	1						1	2						
Willow Warbler	1						5	5	16	11	2		6	3
Wood Pigeon	1							2	3	3	5	2	2	3
Wren	3	4	1		3	2	8	3	25	14	11	15	22	14
Total Abundance	**35**	**48**	**85**	**21**	**21**	**18**	**39**	**53**	**108**	**84**	**85**	**94**	**103**	**82**
Species Diversity	**15**	**16**	**10**	**7**	**9**	**9**	**10**	**21**	**17**	**21**	**21**	**23**	**22**	**23**

REFERENCE DOCUMENTS

Table 59 Results of winter bird transect surveys undertaken along transects T1 to T4 during the non-breeding season of 2016/17.

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list

Transect No.	1 - Knockcurraghbola Commons				2 - Knocknabansha				3 - Laghile				4 - Baurnadomeeny			
Visit	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17
Species									N/A							
Kestrel					1											
Golden Plover					4								7			
Snipe	1				2								1	1	1	
Wood Pigeon																
Meadow Pipit					15	7							6			
Pied Wagtail					1	1		1								
Grey Wagtail																
Dunnock	1		1		1		1						1		1	
Robin	3		3	3	4		2	2		5	9	1		3	3	
Stonechat													3			
Song Thrush				1			1			1		1				
Mistle Thrush	1							1								
Blackbird	3	1	2		1		1			4		1	1		1	1

REFERENCE DOCUMENTS

Transect No.	1 - Knockcurraghbola Commons				2 - Knocknabansha				3 - Laghile				4 - Baurnadomeeny			
Visit	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17
Redwing			5			1									3	
Fieldfare		14				130										
Goldcrest			1							1	3					
Wren	2		1		3		1			1	2		3	1	2	
Great Tit				1							1	1				
Coal Tit	3									2						
Blue Tit	1									1						
Long-tailed Tit										2						
Magpie	2					2		1				1				
Jay																
Jackdaw					9	12										
Rook	2				20	7		8					1			1
Hooded Crow					14	3		1								
Raven																
Starling		50				100										
House Sparrow																
Chaffinch	3			1	1	1		2			4	3		1		2
Treecreeper																
Bullfinch																

REFERENCE DOCUMENTS

Transect No.	1 - Knockcurraghbola Commons				2 - Knocknabansha				3 - Laghile				4 - Baurnadomeeny			
Visit	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17
Reed Bunting																
Total Abundance	22	65	13	6	76	264	6	16	N/A	17	19	8	23	6	11	4
Species Diversity	11	3	6	4	13	10	5	7	N/A	8	5	6	8	4	6	3

Table 60 Results of winter bird transect surveys undertaken along transects T5 to T7 during the non-breeding season of 2016/17.

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list

Transect No.	5 - Killeenen				6 - Oakhampton				7 - Mountphilips			
Visit	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17
Species												
Kestrel												
Golden Plover												
Snipe												
Wood Pigeon							1	1	1			
Meadow Pipit	1			1					15	13		
Pied Wagtail						2	1		1			1
Grey Wagtail					2							
Dunnock	1		1		4		1	1	1	4	1	

REFERENCE DOCUMENTS

Transect No.	5 - Killeenen				6 - Oakhampton				7 - Mountphilips			
Visit	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17	Nov-16	Dec-16	Jan-17	Feb-17
Robin	7	1	3		6	11	10	1	3	6	4	
Stonechat												
Song Thrush							1		1	5	2	2
Mistle Thrush												
Blackbird	3		2		7	4	4		4	3	1	1
Redwing						20				3	10	
Fieldfare					10							
Goldcrest	2		2									
Wren	5	5	2		2	4			2	2	1	
Great Tit			1				1				2	
Coal Tit					1	2			1	3	1	
Blue Tit	2					3	1	2				
Long-tailed Tit	2				8							
Magpie					2			1				1
Jay										2		
Jackdaw					2							
Rook	1	1		7	30			11	2			5
Hooded Crow		3										
Raven		1										
Starling								10	11			
House Sparrow												

REFERENCE DOCUMENTS

Transect No.	5 - Killeenen				6 - Oakhampton				7 - Mountphilips			
Visit	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**	**Nov-16**	**Dec-16**	**Jan-17**	**Feb-17**
Chaffinch	2	1		2	26	2	24	3	1	1		
Treecreeper								1	1			
Bullfinch					1				1			
Reed Bunting									1			
Total Abundance	**26**	**12**	**11**	**10**	**101**	**48**	**44**	**31**	**46**	**42**	**22**	**10**
Species Diversity	**10**	**6**	**6**	**3**	**13**	**8**	**9**	**9**	**15**	**9**	**8**	**5**

REFERENCE DOCUMENTS

Table 61 Results of Countryside Bird Survey undertaken along seven transects T1 to T7 during the breeding season of 2017.

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17
Species														
Barn Swallow	1	1		5								1		
Blackbird	1	1	2	3	5	7	3		4	1	11	2	7	4
Blackcap		1		2						2		4	1	
Blue Tit	1								2	1	3	2	1	
Bullfinch					2									
Chaffinch	8	2	4	5	10	13		1	10	8	5	1	2	3
Chiffchaff		1									3	1	2	
Coal Tit	1	3		6	2	4			7	5	4	4	5	6
Dunnock		1	1	1	2	4	3	1	1		2			
Fieldfare													4	
Goldcrest			2	1	3	6			3	2	1	3		1
Goldfinch											2			
Grasshopper Warbler										1				

REFERENCE DOCUMENTS

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17	Apr-17	June-17
Great Tit	2			2	1				1		4	1		
Hooded Crow	1		1	1					2		1	1	2	1
House Martin		3												
House Sparrow											1			
Jackdaw				3										
Jay												3		1
Magpie		3	3	3						3		2		4
Mallard													2	
Meadow Pipit	1	3					8	19						2
Pheasant	1		2			1	4	2	2		1			
Pied Wagtail											1			
Redpoll			3											
Robin	2	1	4	1	9	1			8		9	2	4	
Rook	3		15	30	2		1	14		2		16	10	
Skylark	3						2	3						
Song Thrush	7	1	2	2	2	3	1		3	2			5	3
Greenfinch														
Sparrowhawk					1									
Starling			1								7			
Stonechat							1	2						2

REFERENCE DOCUMENTS

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	**Apr-17**	**June-17**	**Apr-17**	**June-17**	**Apr-17**	**June-17**	**Apr-17**	**June-17**	**Apr-17**	**June-17**	**Apr-17**	**June-17**	**Apr-17**	**June-17**
Swift								1						
Tree Creeper											1			
Willow Warbler	6	6	8	3			2	1	7	12		2	1	2
Wood Pigeon	5	3	4	10	1	2			7	2	4	3	4	4
Wren	13	12	9	14	5	10	8	7	13	11	9	8	13	9
Total Abun-dance	**56**	**42**	**61**	**92**	**45**	**51**	**33**	**51**	**70**	**52**	**69**	**56**	**63**	**42**
Species Diversity	**16**	**15**	**15**	**17**	**13**	**10**	**10**	**10**	**14**	**13**	**18**	**17**	**15**	**13**

REFERENCE DOCUMENTS

Table 62 Results of winter bird transect surveys undertaken along transects T1 to T7 during the non-breeding season of 2017/18 (November 2017 to December 2017).

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority.

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority.

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority.

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list.

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**
Species														
Blackbird	1	0	0	1	1	2	2	1	2	0	6	0	8	1
Blue Tit	0	1	0	1	0	1	0	1	0	0	1	0	1	0
Bullfinch	0	1	0	1	1	0	0	0	0	0	3	0	2	0
Chaffinch	0	0	0	0	1	1	0	0	0	0	0	0	1	0
Coal Tit	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Dunnock	0	1	0	1	1	1	1	0	0	0	0	0	0	0
Goldcrest	0	2	1	0	0	0	0	0	0	0	0	0	2	0
Great Tit	0	0	0	0	1	0	0	0	1	0	5	0	0	0
Grey Wagtail	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Hooded Crow	1	0	0	2	0	2	0	9	0	4	1	0	3	0
House Sparrow	0	0	0	0	0	0	0	0	0	0	0	0	5	0
Jackdaw	0	2	0	6	0	0	0	2	0	0	0	2	1	2
Jay	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Kestrel	0	0	0	0	0	0	0	0	1	0	0	0	0	0

REFERENCE DOCUMENTS

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**	**Nov-17**	**Dec-17**
Long-tailed Tit	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magpie	0	0	0	1	0	0	0	0	1	2	0	0	1	0
Meadow Pipit	20	1	9	2	1	8	6	3	0	0	0	0	1	**0**
Mistle Thrush	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Pheasant	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Pied Wagtail	0	0	1	0	0	2	0	3	0	0	2	0	0	0
Raven	2	0	0	0	0	0	0	0	0	0	1	0	0	0
Robin	2	1	0	1	0	1	2	0	1	1	8	1	9	0
Rook	15	0	13	12	0	0	0	6	0	0	7	15	2	4
Snipe	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Song Thrush	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Starling	40	0	52	0	0	0	0	0	0	0	0	10	50	**0**
Wood Pigeon	0	0	0	0	1	0	0	0	0	0	1	0	1	0
Fieldfare	0	0	0	15	0	0	0	2	0	10	0	9	0	0
Redwing	0	0	0	20	0	0	0	0	0	0	0	0	0	0
Wren	0	1	0	1	1	1	0	0	0	0	1	0	1	0
Goldfinch	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Total Abundance	**81**	**10**	**76**	**64**	**4**	**20**	**12**	**29**	**2**	**17**	**38**	**38**	**91**	**9**
Species Diversity	**7**	**8**	**5**	**13**	**4**	**10**	**5**	**10**	**2**	**4**	**13**	**6**	**18**	**4**

REFERENCE DOCUMENTS

Table 63 Results of winter bird transect surveys undertaken along transects T1 to T7 during the non-breeding season of 2017/18 (January to February 2018).

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**
Species														
Blackbird	1	2	0	1	2	3	1	2	1	2	2	5	2	0
Blue Tit	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Bullfinch	0	0	0	0	1	1	0	0	0	0	0	0	0	1
Chaffinch	0	0	0	0	3	0	0	0	0	4	0	1	0	2
Coal Tit	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dunnock	2	0	0	1	4	0	0	0	0	3	1	1	0	1
Goldcrest	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Great Tit	0	0	0	0	0	0	0	0	0	2	0	2	1	0
Grey Wagtail	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hooded Crow	7	1	0	0	0	0	2	0	0	2	0	0	2	0
House Sparrow	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Jackdaw	7	0	0	38	0	0	0	0	0	0	0	4	0	4
Jay	0	0	0	0	0	0	0	0	1	0	0	0	0	0

REFERENCE DOCUMENTS

Transect No.	1 - Knockcur-raghbola Com-mons		2 - Knocknabansha		3 - Laghile		4 - Baurnadomeeny		5 - Killeenen		6 - Oakhampton		7 - Mountphilips	
Visit	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**	**Jan-18**	**Feb-18**
Kestrel	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long-tailed Tit	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magpie	0	0	0	0	0	0	0	0	0	0	0	4	0	0
Meadow Pipit	0	19	3	10	0	0	2	0	0	0	0	0	0	0
Mistle Thrush	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pheasant	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Pied Wagtail	2	0	0	1	0	2	0	0	0	0	0	0	0	0
Raven	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Robin	2	4	1	3	0	4	1	0	0	5	2	4	1	0
Rook	2	0	0	8	3	0	20	0	70	10	20	24	0	30
Snipe	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Song Thrush	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Starling	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wood Pigeon	0	0	0	0	0	0	0	0	0	0	0	5	0	0
Stonechat	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Fieldfare	0	0	0	0	0	0	0	0	0	0	0	10	0	0
Wren	0	0	0	0	0	0	0	4	2	0	2	3	0	0
Total Abundance	**23**	**25**	**6**	**63**	**13**	**10**	**6**	**29**	**73**	**29**	**27**	**63**	**6**	**42**
Species Diversity	**7**	**4**	**3**	**8**	**5**	**4**	**4**	**6**	**4**	**8**	**5**	**11**	**4**	**8**

REFERENCE DOCUMENTS

Incidental Bird Recordings at Overhead Line Activities Study Area

All incidental sightings of birds were recorded within the overhead lines activities study area. Table 64 lists the bird species and the total number of each species recorded. A total of 64 bird species consisting of 109 individual birds were recorded.

Table 64 List of birds recorded during survey, total count and Birds of Conservation Concern in Ireland status for each species encountered.

Species	BOCCI status (Colhoun and Cummins, 2013)	Total Count
Blackbird	Green	7
Blue Tit	Green	3
Bullfinch	Green	5
Chaffinch	Green	22
Coal Tit	Green	2
Goldcrest	Amber	2
Great Tit	Green	6
House Sparrow	Amber	6
Jay	Green	2
Long-tailed Tit	Green	5
Pied Wagtail	Green	1
Robin	Amber	9
Rook	Green	2
Snipe	Amber	11
Song Thrush	N/A	2
Starling	Amber	5
Stonechat	Amber	1
Wood Pigeon	Green	3
Little Egret	Green	1

Magpie	**Green**	6
Goldfinch	**Green**	5
Redwing	**Green**	1
Wren	**Green**	2
Species Diversity		**23**
Total Abundance		**109**

Kingfisher Survey

Kingfisher surveys following the methodology presented in National Roads Authority (2008) was undertaken on the 8-11th March 2016. Watercourse crossings were evaluated for any evidence of nest holes within 300m of crossing locations (in tandem with Otter surveys). In each case banks were inspected for evidence of Kingfisher, and general suitability of banks in proximity to crossing locations for nesting Kingfisher. Target notes were made on suitable nesting banks, and any observed nest holes. No nest holes, suitable nest banks or visual observations of Kingfisher were noted.

Red Grouse Survey

Red Grouse tape lure surveys, under NPWS license, were undertaken at suitable habitats along the WWFP during 2017. The survey at Goulmore on the southwest flank of Mauherslieve was undertaken on 23rd March 2017. The survey was undertaken in partially overcast, dry conditions with a light (F2) NE wind. No Red Grouse were observed directly or heard to respond to the tape lure during the survey. No incidental evidence such as feathers, droppings, etc. were recorded during transects.

The survey at Bleanbeg Bog was undertaken on 30th March 2017. The survey was undertaken in overcast, dry conditions with a light (F2) SW wind. A single male Red Grouse was observed to fly away from the observer during the survey. The bird was recorded at 579061 E 663255 N (ITM) (outside the construction area boundaries). No incidental evidence such as feathers, droppings, etc. were recorded during transects.

Merlin Survey

A total of four visits were made to Bleanbeg Bog for Merlin surveys during the 2017 breeding season; 27th April, 30th May, 22nd June and 31st July. No direct observations of Merlin or evidence of breeding Merlin were recorded during the surveys.

A8-1.2.4.8 General Bird Species Recorded and Corresponding Sensitivity Rating

Table 65, below, lists all species recorded across all surveys and all project elements. The corresponding sensitivity rating in line with the criteria outlined in the Biodiversity Chapter is also provided. Species included here includes those recorded from standardised survey effort and additionally anecdotal observations. Not all species will have been recorded as present at the location of works pertinent to the development under consideration.

Table 65 Bird Sensitivity Rating for bird species recorded across all bird surveys.

Red = Red-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of highest conservation priority

Orange = Amber-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of lesser conservation priority

Green = Green-listed species in the Birds of Conservation Concern (Colhoun and Cummins, 2013) are those of which are of least conservation priority

White = Not assessed/omitted from the Birds of Conservation Concern (Colhoun and Cummins, 2013) list

Species	BOCCI Status	EU Birds Directive	Sensitivity Rating
Barn Swallow	Amber	-	Low
Blackbird	Green	-	Negligible
Blackcap	Green	-	Negligible
Blue Tit	Green	-	Negligible
Bullfinch	Green	-	Negligible
Buzzard	Green	-	Negligible
Chaffinch	Green	-	Negligible
Chiffchaff	Green	-	Negligible
Coal Tit	Green	-	Negligible
Collared Dove	Green	-	Negligible
Common Snipe	Amber	-	Low
Crossbill	Green	-	Negligible
Cuckoo	Green	-	Negligible
Curlew	Red	-	**High**
Dunnock	Green	-	Negligible
Fieldfare	N/A	-	Negligible

REFERENCE DOCUMENTS

Species	BOCCI Status	EU Birds Directive	Sensitivity Rating
Goldcrest	Amber	-	Low
Golden Plover	Red	Annex I	**High**
Goldfinch	Green	-	Negligible
Grasshopper Warbler	Green	-	Negligible
Great Tit	Green	-	Negligible
Greenfinch	Amber	-	Low
Grey Wagtail	Red	-	Low
Hen Harrier	Amber	Annex I	**Very High**
Hooded Crow	Green	-	Negligible
House Martin	Green	-	Negligible
House Sparrow	Amber	-	Low
Jackdaw	Green	-	Negligible
Jay	Green	-	Negligible
Kestrel	Amber	-	Low
Lesser Redpoll	Green	-	Negligible
Linnet	Amber	-	Low
Magpie	Green	-	Negligible
Mallard	Green	-	Negligible
Meadow Pipit	Red	-	Medium
Mistle Thrush	Amber	-	Low
Moorhen	Green	-	Negligible
Peregrine Falcon	Green	Annex I	Low
Pheasant	N/A	-	Negligible
Pied Wagtail	Green	-	Negligible
Raven	Green	-	Negligible
Red Grouse	Red	-	Medium
Redwing	N/A	-	Negligible
Reed Bunting	Green	-	Negligible
Robin	Amber	-	Low

REFERENCE DOCUMENTS

Species	BOCCI Status	EU Birds Directive	Sensitivity Rating
Rook	Green	-	Negligible
Sand Martin	Amber	-	Low
Sedge Warbler	Green	-	Negligible
Siskin	Green	-	Negligible
Skylark	Amber	-	Low
Song Thrush	Green	-	Negligible
Sparrowhawk	Amber	-	Low
Starling	Amber	-	Low
Stonechat	Amber	-	Low
Swift	Amber	-	Low
Tree Creeper	Green	-	Negligible
Wheatear	Amber	-	Low
Whitethroat	Green	-	Negligible
Willow Warbler	Green	-	Negligible
Wood Pigeon	Green	-	Negligible
Woodcock	Red	-	Low
Wren	Green	-	Negligible

REFERENCE DOCUMENTS

A8-1.2.4.9 Non-Volant Mammals

Detail on Badger observations/evidence are herein included in the table below. We would note that the location of setts is not provided here but in the confidential Annex.

Table 66 Observations of badger recorded during surveys for the Whole UWF Project.

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
1	Badger	Badger tracks/print	583604	660790	
2	Badger	Badger snuffle hole	583618	660805	
3	Badger	Badger tracks/print	583618	660805	
4	Badger	Badger tracks/print	583834	660803	Lots of tracks here
5	Badger	Badger tracks/print	583677	660793	
6	Badger	Badger snuffle hole	583785	660849	
7	Badger	Badger tracks/print	583818	660854	
8	Badger	Badger tracks/print	583813	660839	
9	Badger	Badger snuffle hole	583827	660839	All over the area
10	Badger	Badger snuffle hole	583911	660809	
11	Badger	Badger snuffle hole	583919	660810	
12	Badger	Badger tracks/print	583942	660861	
13	Badger	Badger snuffle hole	583942	660861	
14	Badger	Badger tracks/print	584075	660766	
15	Badger	Badger snuffle hole	584102	660765	
16	Badger	Badger tracks/print	583967	660655	
17	Badger	Badger tracks/print	583763	660655	
18	Badger	Badger tracks/print	583740	660627	
19	Badger	Badger tracks/print	583666	660634	
24	Badger	Badger tracks/print	583144	661182	
25	Badger	Badger tracks/print	582869	661449	

REFERENCE DOCUMENTS

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
26	Badger	Badger tracks/print	582845	661477	
27	Badger	Badger snuffle hole	582491	661804	Lots of snuffle holes here
32	Badger	Badger tracks/print	580374	661747	In mud on track
33	Badger	Badger tracks/print	582469	661868	In mud on track
35	Badger	Badger tracks/print	594777	660632	
37	Badger	Badger snuffle hole	591771	659964	
38	Badger	Badger tracks/pad	591768	659965	
40	Badger	Badger tracks/print	589544	659817	
42	Badger	Badger tracks/print	589533	659777	
45	Badger	Badger snuffle hole	589574	659927	
47	Badger	Badger snuffle hole	589561	660002	
48	Badger	Badger snuffle hole	589532	659971	
51	Badger	Badger tracks/print	586278	660309	
52	Badger	Badger tracks/print	585525	660330	
53	Badger	Badger snuffle hole	585370	660382	
54	Badger	Badger tracks/print	585243	660432	
55	Badger	Badger snuffle hole	585160	660488	
57	Badger	Badger snuffle hole	585107	660410	
58	Badger	Badger snuffle hole	584884	660554	
59	Badger	Badger snuffle hole	584416	660749	
60	Badger	Badger latrine/scat	584412	660743	
61	Badger	Badger latrine/scat	584263	660742	
62	Badger	Badger latrine/scat	584031	660905	
63	Badger	Badger snuffle hole	583554	661902	
66	Badger	Badger snuffle hole	582305	661864	
67	Badger	Badger snuffle hole	581021	661934	
68	Badger	Badger scat and print	580824	661872	

REFERENCE DOCUMENTS

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
69	Badger	Badger scat and print	580385	662105	
70	Badger	Badger tracks/print	579860	662320	
72	Badger	Badger snuffle hole	576891	663200	
73	Badger	Badger snuffle hole	576082	663734	
74	Badger	Badger tracks/print	575835	663896	
75	Badger	Badger latrine/scat	575498	664056	
76	Badger	Badger snuffle hole	573775	664423	
77	Badger	Badger tracks/print	573278	664416	
78	Badger	Badger tracks/print	573199	664513	
79	Badger	Badger tracks/print	573089	664611	
80	Badger	Badger tracks/print	573034	664481	
86	Badger	Badger tracks/print	583839	662244	
89	Badger	Badger snuffle hole	583922	661633	
90	Badger	Badger tracks/print	584197	661365	
91	Badger	Badger snuffle hole	584192	661125	
92	Badger	Badger tracks/print	584206	661142	
93	Badger	Badger snuffle hole	584214	661147	
94	Badger	Badger tracks/print	584264	661108	
95	Badger	Badger tracks/print	584279	660981	
96	Badger	Badger tracks/print	584217	660875	
97	Badger	Badger tracks/print	578850	662999	
101	Badger	Badger tracks/print	578652	663054	
109	Badger	Badger tracks/print	578856	662996	Trail of badger prints all along cutover bog 'track'
112	Badger	Badger tracks/print	584237	661108	Badger print along muddy poached cow path
119	Badger	Badger latrine/scat	582822	661663	Badger latrine on edge of narrow path between hedgebanks
120	Badger	Badger tracks/print	582815	661671	Prints on muddy poached ground on narrow path between hedge-banks

REFERENCE DOCUMENTS

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
123	Badger	Badger tracks/print	574733	664143	Badger Pad in farm track down to field on banks of Newport (Mul-kear) River
137	Badger	Badger tracks/print	591669	659538	In mud on forestry track
150	Badger	Badger tracks/print	572468	664451	
153	Badger	Badger latrine/scat	572278	664412	Small holes with scat inside along edge of hedgerow in field
154	Badger	Badger latrine/scat	572251	664437	Small holes with scat inside along edge of hedgerow in field
155	Badger	Badger latrine/scat	572220	664438	Small holes with scat inside along edge of hedgerow in field
156	Badger	Badger latrine/scat	572187	664435	Small holes with scat inside along edge of hedgerow in field
157	Badger	Badger latrine/scat	572114	664432	Small holes with scat inside along edge of hedgerow in field
158	Badger	Badger latrine/scat	572052	664432	Small holes with scat inside along edge of hedgerow in field
163	Badger	Badger Print	594687	661526	Print on muddy farm track
164	Badger	Badger Latrine	594690	661471	Latrine on field edge. 3 droppings in 3 excavations.

Table 67 Observations of otter recorded during surveys for the Whole UWF Project.

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
22	Either Mink or Otter	Mink or Otter	583987	660771	Attributed to Otter although possibly Mink
30	Otter	Otter path	573602	664395	Along field and into scrub on banks of Newport (Mulkear)
31	Otter	Otter slide	574657	663947	On riverbank into Newport (Mulkear)
46	Otter	Otter tracks/print	589574	659933	
50	Otter	Otter tracks/print	589680	660357	
160	Otter	Otter spraint	583481	660727	Count of 10 spraint on boulder under bridge
161	Otter	Otter spraint	583500	660727	Count of 1 spraint on mossy boulder upstream of bridge

REFERENCE DOCUMENTS

Table 68 Observations of all other non-volant mammals recorded during surveys for the Whole UWF Project.

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
34	Deer sp.	Deer tracks/slot	594802	660625	
41	Deer sp.	Deer tracks/slot	589544	659817	
43	Deer sp.	Deer tracks/slot	589525	659746	
81	Deer sp.	Deer tracks/slot	583342	662286	
82	Deer sp.	Deer tracks/slot	583428	662332	
83	Deer sp.	Deer tracks/slot	583533	662444	
84	Deer sp.	Deer tracks/slot	583777	662359	
85	Deer sp.	Deer tracks/slot	583800	662280	
87	Deer sp.	Deer tracks/slot	583971	661717	
88	Deer sp.	Deer tracks/slot	583954	661766	
98	Deer sp.	Deer tracks/slot	578808	663007	
99	Deer sp.	Deer tracks/slot	578773	663018	
100	Deer sp.	Deer tracks/slot	578689	663047	
102	Deer sp.	Deer tracks/slot	578003	663012	
103	Deer sp.	Deer tracks/slot	576672	663245	
104	Deer sp.	Deer tracks/slot	576658	663225	
105	Deer sp.	Deer bark stripping	576874	663199	Bark stripping on grey willow
106	Deer sp.	Deer tracks/slot	577055	663163	Slot and crossing point on forestry access road
107	Deer sp.	Deer tracks/slot	577928	662992	
110	Deer sp.	Deer tracks/slot	578908	662999	Series of prints all along cutover bog 'track'
111	Deer sp.	Deer droppings	578775	663025	Droppings in bog habitat next to cutover bog 'track'
127	Deer sp.	Deer tracks/slot	590636	659789	Deer slots in mud
138	Deer sp.	Deer tracks/slot	591710	659547	In mud on forestry track
143	Deer sp.	Deer tracks/slot	572567	664537	Slots and droppings on track
125	Fallow Deer	Live Animal	576399	662967	3 Deer observed at edge of forestry at Castlewaller

REFERENCE DOCUMENTS

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
126	Fallow Deer	Live Animal	577193	663988	2 Deer observed at edge of forestry at Fiddane
71	Pine Marten	Pine Marten scat	579786	662361	
108	Pine Marten	Pine Marten scat	578055	663013	Scat on prominent rock at edge of forestry access road. Track leading into forest. PM smell. Hair and vertebrae in scat.
122	Pine Marten	Live Animal	591753	659592	Running across forestry track during CBS transect
133	Pine Marten	Pine Marten scat	591470	659524	Fur main component
36	Fox	Fox tracks/print	591755	659983	
113	Fox	Fox scat	584242	661108	Fox droppings with blackberries evident prominently on access path
114	Fox	Fox scat	584275	661053	Fox droppings with blackberries evident prominently on access path
115	Fox	Fox scat	584278	661011	Fox droppings with blackberries evident prominently on access path
116	Fox	Fox scat	583924	661712	Fox droppings on forestry access path
117	Fox	Fox scat	583119	661674	Fox droppings on farm road next to forestry
118	Fox	Fox scat	583001	661750	Fox droppings under rowan tree on hedgebank on narrow path
130	Fox	Fox scat	590796	659706	In middle of forestry track
131	Fox	Fox scat	590840	659673	In middle of forestry track
132	Fox	Fox scat	591031	659583	In middle of forestry track
134	Fox	Fox scat	591489	659524	On forestry track
135	Fox	Fox scat	591627	659521	Edge of forestry track
147	Fox	Fox tracks/print	572470	664456	Fox print in mud
148	Fox	Fox scat	572451	664462	Fox scat on top of GWT shrew in track within field
159	Fox	Fox scat	580458	661920	Fox dropping on mound of spoil/earth at corner of field
162	Fox	Fox Scat	594483	661518	Droppings on edge of farm track
165	Fox	Fox Scat	594689	661471	Droppings at mammal crossing point on earth bank.
167	Fox	Fox Scat	594584	661694	Dropping on mammal trail near crossing point of stream
56	Irish Hare	Hare tracks/print	585107	660410	
124	Irish Hare	Live Animal	574697	664256	Live animal in field adjacent to CBS transect route

REFERENCE DOCUMENTS

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
140	Squirrel sp.	Pine cone feeding sign	591862	659677	Evidence from Sitka spruce pine cone at edge of forestry
142	Squirrel sp.	Hazelnut feeding sign	572568	664538	Split hazelnut shell with distinctive notch on tip
139	Wood Mouse	Pine cone feeding sign	591859	659675	Evidence from Sitka spruce pine cone at edge of forestry

Table 69 Observations of invasive non-volant mammals recorded during surveys for the Whole UWF Project.

Observation ID	Species	Evidence	Easting (ITM)	Northing (ITM)	Notes
149	Greater white toothed shrew	Corpse	572451	664462	GWT shrew under fox scat
44	Mink	Mink scat	589955	659868	
49	Mink	Mink scat	589586	660097	
22	Mink or Otter	Mink or Otter Print	583987	660771	
136	Rabbit	Rabbit Burrow	591666	659516	Edge of forestry in bank

REFERENCE DOCUMENTS

Overhead Line Activities Mammal records

Incidental records of mammal signs and individuals were made during surveys with the overhead line activietes study area, findings are detailed below.

Otter

An old Otter holt was recorded within the bank of a drainage ditch shared by watercourse crossing 2 (W2). An otter pathway located 80 metres west of AM 3 was recorded leading from the Groody River over a grassland field and into an adjoining stream.

Badger

No active Badger setts were recorded within close proximity to the poles. An old badger sett was recorded within the hedgerow 180 metres north east AM 78.

Fox

The smell of fox was recorded along a hedgerow leading to water crossing 1 (W1).

Deer

A herd of 6 deer, Fallow, were observed in the conifer planation adjacent to IMP 83.

Rabbit

Rabbit burrows were recorded on occasion within some of the hedgerows. A rabbit was observed adjacent to Annacotty Business Park.

Mammal pathways

Mammal pathways were recorded frequently within hedgerows and through treelines. These could be used by a number of mammals including Badger and Fox.

Plate 31: Deer slot in mud.

Plate 32: Badger print in mud.

Plate 33: Otter spraint on boulder under bridge.

Plate 34: Greater white toothed shrew and fox droppings on track in field.

REFERENCE DOCUMENTS

Plate 35: Badger snuffle hole in foreground with main sett entrance under Hawthorn tree in background.

Plate 36: Badger sett entrance with bedding scattered outside entrance.

Plate 37: Deer slot in mud on track entering forestry.

Plate 38: Evidence of bark stripping by deer on willow at the edge of a forestry track.

A8-1.2.4.10 Amphibians/Reptiles

Table 70 Incidental observations of amphibians and reptiles recorded during surveys for the Whole UWF Project.

Obser-vation ID	Species	Easting (ITM)	Northing (ITM)	Location	Date	Notes
1	Frog	580390	662081	Kileenen	05/04/2017	Tadpoles in puddle on road
2	Frog	580423	662065	Kileenen	05/04/2017	Tadpoles in puddle in field
3	Frog	583961	660727	Bealaclave	22/09/2016	Adult in wet grassland
4	Frog	593269	661083	Knockmaroe	13/07/2017	Adult in disturbed ground near mobile phone mast
5	Frog	593127	661667	Grousehall	13/07/2017	Adult in species rich wet grassland
6	Frog	594368	661161	Foilnaman	19/05/2017	Adult in improved grassland next to plantation
7	Frog	573746	664413	Oakhampton	18/05/2017	Adult in grassland
8	Frog	590370	659703	Kilcommon	19/05/2017	Adult in wet grassland
9	Vivip-arous Lizard	595169	659348	Shevry	13/07/2017	In acid grassland

A8-1.2.4.11 Invertebrates-Marsh Fritillary

Table 71 Observations of Marsh Fritillary recorded during surveys for the Whole UWF Project.

Observation ID	Easting (ITM)	Northing (ITM)	Evidence	Year	Location
1	583585	660748	Larval Web	Sep-16	Bealaclave
2	583577	660743	Larval Web	Sep-16	Bealaclave
3	583567	660755	2 Caterpillars	Apr-17	Bealaclave
4	583589	660745	1 Caterpillar	Apr-17	Bealaclave
5	583588	660745	1 Caterpillar	Apr-17	Bealaclave
6	583586	660746	1 Caterpillar	Apr-17	Bealaclave
7	583583	660749	12 Caterpillars	Apr-17	Bealaclave
8	583584	660749	40 Caterpillars	Apr-17	Bealaclave
9	583586	660749	1 Caterpillar	Apr-17	Bealaclave
10	583583	660750	11 Caterpillars	Apr-17	Bealaclave
11	584915	660445	Larval Web	Sep-16	Baurnadomeeny
12	584916	660469	Larval Web	Sep-16	Baurnadomeeny
13	584905	660498	51 Caterpillars	Apr-17	Baurnadomeeny
14	584952	660508	31 Caterpillars	Apr-17	Baurnadomeeny
15	584948	660508	16 Caterpillars	Apr-17	Baurnadomeeny
16	584949	660506	2 Caterpillars	Apr-17	Baurnadomeeny
17	584930	660506	34 Caterpillars	Apr-17	Baurnadomeeny
18	584930	660498	7 Caterpillars	Apr-17	Baurnadomeeny
19	584932	660495	Larval Web	Apr-17	Baurnadomeeny
20	584932	660495	20 Caterpillars	Apr-17	Baurnadomeeny
21	584930	660494	41 Caterpillars	Apr-17	Baurnadomeeny
22	584928	660491	3 Caterpillars	Apr-17	Baurnadomeeny
23	584931	660489	30 Caterpillars	Apr-17	Baurnadomeeny
24	584931	660488	12 Caterpillars	Apr-17	Baurnadomeeny
25	584934	660503	25 Caterpillars	Apr-17	Baurnadomeeny
26	584918	660471	34 Caterpillars	Apr-17	Baurnadomeeny
27	584922	660469	17 Caterpillars	Apr-17	Baurnadomeeny
28	584937	660462	10 Caterpillars	Apr-17	Baurnadomeeny
29	584943	660441	14 Caterpillars	Apr-17	Baurnadomeeny
30	584936	660438	23 Caterpillars	Apr-17	Baurnadomeeny
31	584927	660443	35 Caterpillars	Apr-17	Baurnadomeeny
32	584910	660466	10 Caterpillars	Apr-17	Baurnadomeeny
33	584928	660580	26 Caterpillars	Apr-17	Baurnadomeeny
34	584926	660587	23 Caterpillars	Apr-17	Baurnadomeeny
35	584921	660591	65 Caterpillars	Apr-17	Baurnadomeeny
36	584882	660474	26 Caterpillars	Apr-17	Baurnadomeeny
37	584884	660470	28 Caterpillars	Apr-17	Baurnadomeeny

Observation ID	Easting (ITM)	Northing (ITM)	Evidence	Year	Location
38	584928	660478	Mating Adults	Jun-17	Baurnadomeeny
39	584931	660485	Mating Adults	Jun-17	Baurnadomeeny
40	584932	660488	Single Adult	Jun-17	Baurnadomeeny
41	584931	660482	Single Adult	Jun-17	Baurnadomeeny
42	583597	660756	Larval Web	Sep-17	Bealaclave
43	584897	660504	Larval Web	Sep-17	Baurnadomeeny
44	584902	660499	Larval Web	Sep-17	Baurnadomeeny
45	584918	660507	Larval Web	Sep-17	Baurnadomeeny
46	584920	660513	2 Larval Webs	Sep-17	Baurnadomeeny
47	584946	660526	Larval Web	Sep-17	Baurnadomeeny
48	584924	660506	Larval Web	Sep-17	Baurnadomeeny
49	584920	660501	Larval Web	Sep-17	Baurnadomeeny
50	584929	660484	Larval Web	Sep-17	Baurnadomeeny
51	584932	660484	Larval Web	Sep-17	Baurnadomeeny
52	584934	660484	Larval Web	Sep-17	Baurnadomeeny
53	584935	660485	Larval Web	Sep-17	Baurnadomeeny
54	584933	660481	3 Larval Webs	Sep-17	Baurnadomeeny
55	584995	660531	Larval Web	Sep-17	Baurnadomeeny
56	595775	659918	Larval Web	Sep-17	Shevry
57	595732	659852	Larval Web	Sep-17	Shevry
58	595751	659829	Larval Web	Sep-17	Shevry
59	595775	659815	Larval Web	Sep-17	Shevry

Plate 39: Wet grassland rich in Devil's bit scabious at Bealaclave where Marsh Fritillary webs were recorded.

Plate 40: Wet grassland at Shevry which contained patches of Devil's bit scabious where Marsh Fritillary webs were recorded.

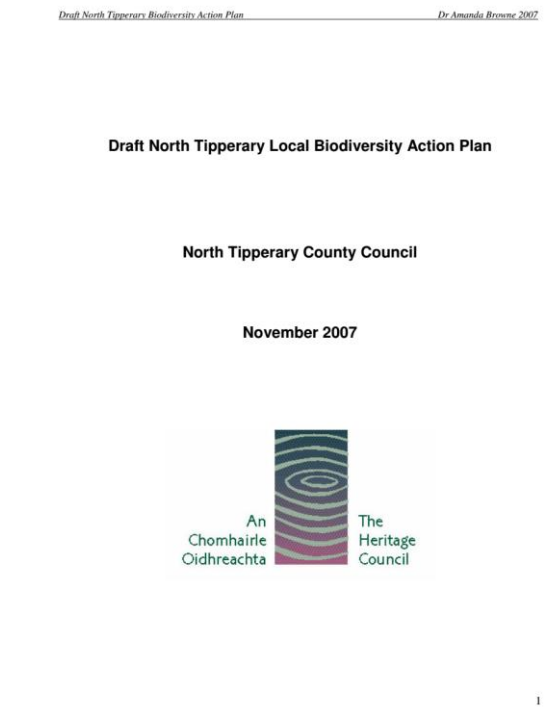
Plate 41: Wet Heath/Wet Grassland mosaic at Baurnadomeeny which contained widespread patches of Devil's bit scabious where Marsh Fritillary webs were recorded.

Plate 42: Example of Marsh Fritillary larvae basking outside the larval web at the base of a Devil's bit scabious plant in Belaclave.

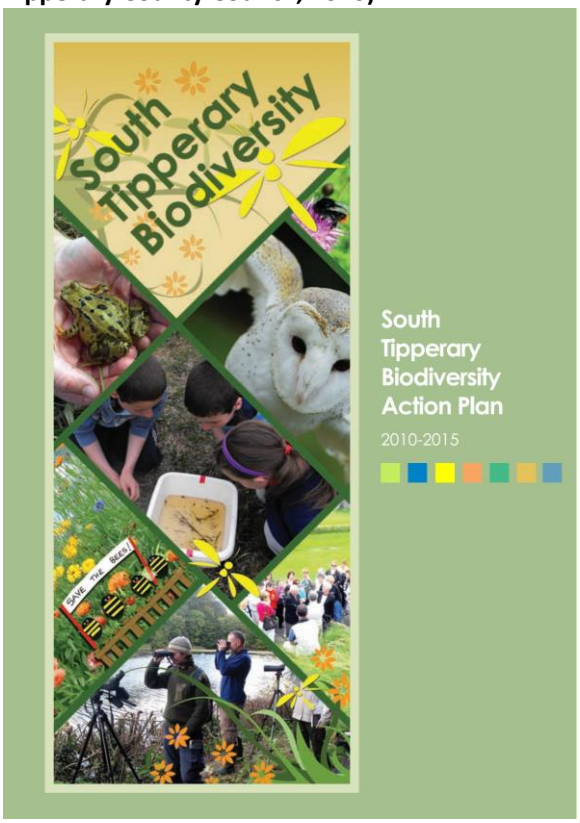
REFERENCE DOCUMENTS

A8-1.2.5 Policy Context

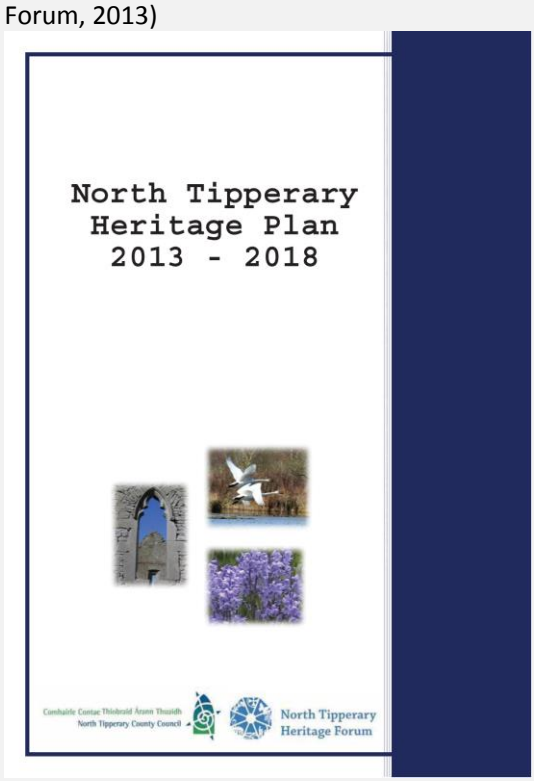
Draft North Tipperary Local Biodiversity Action Plan (North Tipperary County Council, 2007)



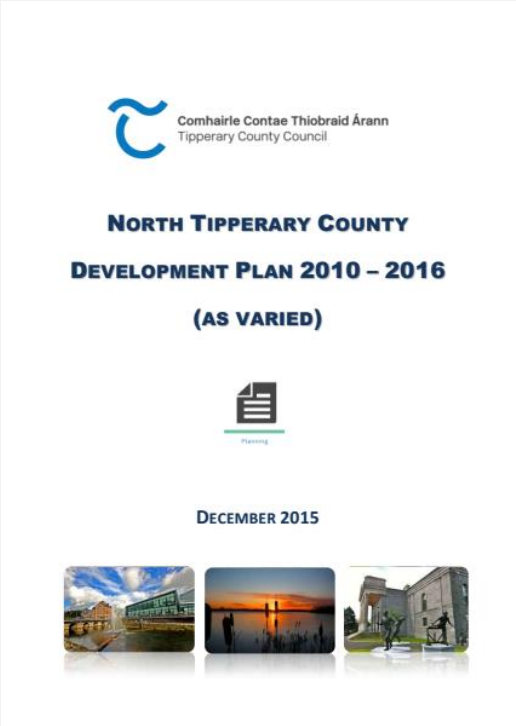
South Tipperary Biodiversity Action Plan (South Tipperary County Council, 2010)



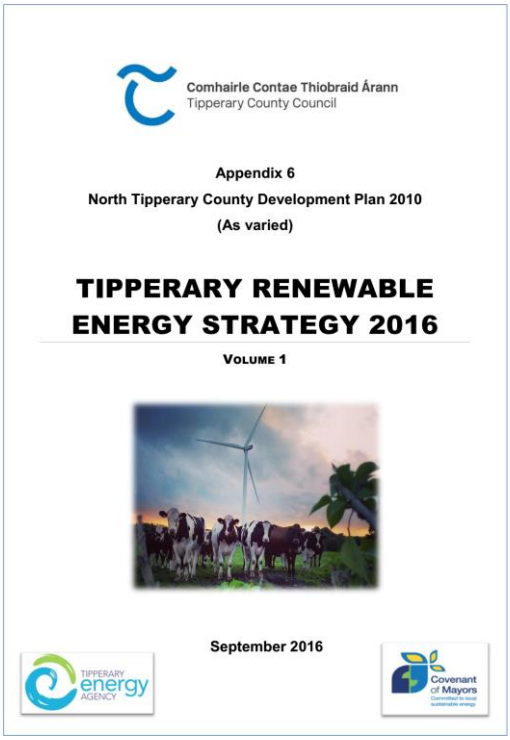
North Tipperary Heritage Plan 2013 – 2018 (North Tipperary County Council and North Tipperary Heritage Forum, 2013)



North Tipperary County Development Plan 2010 - 2016 (as varied) (Tipperary County Council, 2015)



Tipperary Renewable Energy Strategy 2016 Volume 1 (Tipperary County Council, 2016)

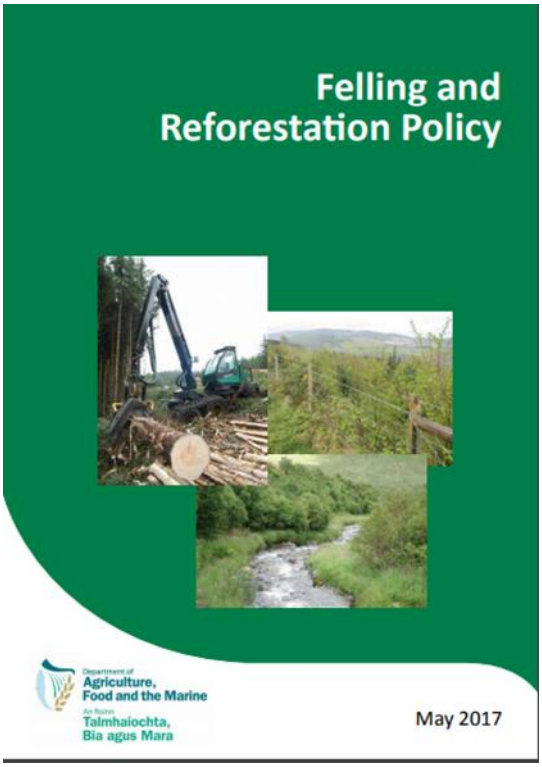

Comhairle Contae Thiobraid Árann
Tipperary County Council

Appendix 6
North Tipperary County Development Plan 2010
(As varied)

TIPPERARY RENEWABLE ENERGY STRATEGY 2016

VOLUME 1

September 2016



Department of Agriculture, Food and the Marine (2017). Felling and Reforestation Policy.

A8-1.3 Impact Calculations

A8-1.3.1.1 Birds

The following table summarises the habitat impact calculations in respect of those General Bird Species scoped in for evaluation as per Chapter 8.

Table 72 Summary Impact calculations for General Bird Species within the Whole UWF Project.

Species	Golden Plover	Meadow Pipit	Curlew	Hen Harrier (Foraging)
Total Suitable Habitat within WWFP (ha)	**348.53**	**353.44**	**67.28**	**598.68**
Total Suitable Habitat within Windfarm Grid Connection (ha)	197.89	199.95	53.19	388.49
Total Suitable Habitat within Windfarm Ancillary Activities (ha)	19.72	20.14	5.42	27.18
Total Suitable Habitat within Windfarm Related Works (ha)	120.24	122.67	6.90	170.98
Total Suitable Habitat within Windfarm Replacement Forestry (ha)	10.68	10.68	1.77	12.03
Total Permanent Land Take within WWFP (ha)	**6.94**	**6.94**	**1.14**	**9.58**
Total Permanent Land Take within Windfarm Grid Connection (ha)	2.77	2.77	0.63	5.12
Total Permanent Land Take within Windfarm Ancillary Activities (ha)	0.00	0.00	0.00	0.00
Total Permanent Land Take within Windfarm Related Works (ha)	0.19	0.19	0.07	0.48
Total Permanent Land Take within Windfarm Replacement Forestry (ha)	3.98	3.98	0.44	3.99
Total Permanent land take as percentage of Total Suitable Habitat within WWFP (%)	**1.99**	**1.96**	**1.69**	**1.60**
Total Permanent land take as percentage of Total Suitable Habitat within Windfarm Grid Connection (%)	1.40	1.39	1.18	1.32
Total Permanent land take as percentage of Total Suitable Habitat within Windfarm Ancillary Activities (%)	0.00	0.00	0.00	0.00
Total Permanent land take as percentage of Total Suitable Habitat within Windfarm Related Works (%)	0.16	0.15	1.03	0.28
Total Permanent land take as percentage of Total Suitable Habitat within Windfarm Replacement Forestry (%)	37.27	37.27	24.86	33.17

Golden Plover: Suitable habitat defined asImproved Agricultural grassland, wet grassland, upland blanket bog, cutover bog, or mosaics of same present within the respective Project Element boundary.

Meadow Pipit: Suitable habitat defined as Improved Agricultural grassland, wet grassland or mosaics of same present within the respective Project Element boundary.

Curlew: Suitable Habitat defined as Wet grassland, Upland Blanket Bog or mosaics of same present within the respective Project Element boundary.

Hen Harrier Foraging: Suitable Foraging Habitat defined as Improved Agricultural Grassland (on a precautionary basis evaluated as suitable for foraging); Wet Grassland, Wet Grassland and Scrub Mosaic, Deciduous Woodland, Coniferous Plantation (all age classes present and inclusive of forest rides) , and Scrub present within the respective Project Element boundary.

A8-1.3.1.2 Habitats

The following tables details total areas present within each Project Element of those habitats evaluated as of Local Importance (Higher Value) or above, as per the Best Practice guidance referenced in Chapter 8. The respective proportion of the overall study area covered by each, in addition to the total area of permanent land use change (or habitat loss) and what proportion of the study area that represents is also presented.

Table 73 Impact calculations for habitats greater than Local Importance (Higher Value) in the UWF Grid Connection element of the Whole UWF Project.

Habitat Type	Evaluation	Total Area Present (ha)	Percentage of Overall Study Area (%)	Area of Habitat Permanently Lost (ha)	Proportion of Study Area Habitat Lost (%)
FW2	International Importance	0.11	0.03	0.00	0.000
GS4	Local Importance (Higher Value)	42.46	10.42	0.27	0.626
GS4/HH3	Local Importance (Higher Value)	0.21	0.05	0.00	0.000
GS4/WS1	Local Importance (Higher Value)	1.56	0.38	0.04	2.717
HH3	National Importance	2.06	0.51	0.00	0.000
PB2	National Importance	1.38	0.34	0.00	0.000
PB4	Local Importance (Higher Value)	2.05	0.50	0.00	0.000
WD1	Local Importance (Higher Value)	5.92	1.45	0.09	1.575
WD2	Local Importance (Higher Value)	1.89	0.46	0.00	0.000
WN5	Local Importance (Higher Value)	0.81	0.20	0.00	0.000
WS1	Local Importance (Higher Value)	15.09	3.70	0.11	0.723
WS5	Local Importance (Higher Value)	3.93	0.97	0.00	0.000
	Total	**77.48**	**19.01**	**0.51**	**0.659**

Table 74 Impact calculations for habitats greater than Local Importance (Higher Value) in the UWF Related Works element of the Whole UWF Project.

Habitat Type	Evaluation	Total Area Present (ha)	Percentage of Overall Study Area (%)	Area of Habitat Permanently Lost (ha)	Proportion of Study Area Habitat Lost (%)
GA1/GS4	Local Importance (Higher Value)	1.70	0.892	0.000	0.000
GA1/WS1	Local Importance (Higher Value)	0.42	0.220	0.000	0.000
GS2	Local Importance (Higher Value)	0.14	0.073	0.000	0.000
GS3	Local Importance (Higher Value)	1.58	0.829	0.000	0.000
GS3/HH3	Local Importance (Higher Value)	2.81	1.475	0.000	0.000
GS4	Local Importance (Higher Value)	11.95	6.273	0.066	0.551
GS4/WS1	Local Importance (Higher Value)	0.49	0.257	0.000	0.000
HH1/GS4	Local Importance (Higher Value)	0.11	0.058	0.000	0.000
HH3	Local Importance (Higher Value)	2.32	1.218	0.000	0.000
PB2	County Importance	2.03	1.066	0.005	0.251
PB2/GS4	Local Importance (Higher Value)	0.13	0.068	0.000	0.000
PB4	Local Importance (Higher Value)	0.10	0.051	0.000	0.000
WD1	Local Importance (Higher Value)	0.15	0.079	0.000	0.000
WL2	Local Importance (Higher Value)	0.09	0.046	0.000	0.000
WS1	Local Importance (Higher Value)	1.68	0.882	0.004	0.237
WS2	Local Importance (Higher Value)	0.78	0.411	0.000	0.000
WS2/GS4	Local Importance (Higher Value)	0.43	0.227	0.000	0.000
	Total	**26.91**	**14.125**	**0.075**	**0.278**

Table 75 Impact calculations for habitats greater than Local Importance (Higher Value) in the UWF Replacement Forestry element of the Whole UWF Project.

Habitat Type	Evaluation	Total Area Present (ha)	Percentage of Overall Study Area (%)	Area of Habitat Permanently Lost (ha)	Proportion of Study Area Habitat Lost (%)
WD1	Local Importance (Higher Value)	0.18	1.56	0.000	0
WS1	Local Importance (Higher Value)	0.59	5.10	0.000	0
	Total	**0.77**	**6.66**	**0.00**	**0.00**

Table 76 Impact calculations for habitats greater than Local Importance (Higher Value) in the UWF Other Activities element of the Whole UWF Project.

Habitat Type	Evaluation	Total Area Present (ha)	Percentage of Overall Study Area (%)	Area of Habitat Permanently Lost (ha)	Proportion of Study Area Habitat Lost (%)
FW1	County Importance; Local Importance (Higher Value)	0.39	1.1	0.000	0.000
WD1	Local Importance (Higher Value)	5.15	14.2	0.000	0.000
WL2	Local Importance (Higher Value)	0.2	0.5	0.000	0.000
WS1	Local Importance (Higher Value)	1.3	3.6	0.000	0.000
Total		**7.05**	**19.39**	**0.00**	**0.00**

Note: The habitat impact for the Upperchurch Windfarm element of the Whole UWF Project has been previously assessed in the EIS[1].

[1] Ecopower Developments Ltd. (2012) Upperchurch Windfarm Environmental Impact Statement prepared by Malachy Walsh and Partners (MMW)

Tables 13-22 and 13-23 from the EIS, summarising the total habitat loss, are herein re-produced for completeness.

TABLE 13-22: TABLE SUMMARISDNG HABITAT LOSS AS A RESULT OF THE PROPOSED DEVELOPMENT.

Habitat	Selection as key ecological receptor	Total area of habitat (ha) within the study area.	Percentage of total habitat within the study area (%)	Area of habitat to be lost (ha).	Percentage of total habitat loss (%)
Improved Agricultural Grassland (GA1)	Yes	228.34	42.53	5.98	1.11
Wet Grassland (GS4)	Yes	19.94	3.71	0.5	0.09
Mosaic of Improved Grassland (GA1) & Wet Grassland (GS4)	Yes	11.44	2.13	0.3	0.06
Mosaic Wet Heath (HH3) & Upland Blanket Bog (PB3)	Yes	15.54	2.89	0.01	0.002
Acid Grassland (GS3)	Yes	20.34	4.68	0.57	0.11
Mosiac Upland Blanket Bog (PB3) & Acidic Grassland (GS3)	Yes	3.16	3.79	0.45	0.08
Upland Blanket Bog (PB2)	Yes	25.13	0.59	0	0
Coniferous Plantation (WD4)	No	202.2	37.66	1.18	0.22
Spoil and Bare Ground (ED2)	No	4.3	0.80	0.66	0.12
Buildings and Artificial Surfaces (BL3)	No	4.2	0.78	-	-
Neutral Grassland (GS1)	Yes	2.25	0.42	0	0.00
Total (ha) (excluding FW1, FW4, WL1 and WL2)		**536.84 ha**	**100%**	**9.65Ha**	**1.79%**

TABLE 13-23: SUMMARISDNG LINEAR LENGTH OF HABITAT LOST AS A RESULT OF THE PROPOSED DEVELOPMENT.

Habitat	Selection as key ecological receptor	Total linear length of habitat (meters) within the study area..	Percentage of total habitat within the study area (%)	Area of habitat to be lost (m).	Percentage of total habitat loss (%)
Eroding/Upland River (FW1)	Yes	1486.88	-	0	-
Drainage Ditches (FW4)	Yes	1258.5	-	48.1	-
Hedgerow (WL1)	Yes	24968.69	-	980.77	-
Treelines (WL2)	Yes	668.73	-	-	-

Plate 43: Tables 13-22 and 13-23 from the Upperchurch Windfarm EIS.

Table 77 Impact calculations for permanent hedgerow and tree removal in the UWF Grid Connection element of the Whole UWF Project.

Project Element	UWF Grid Connection
Permanent Hedgerow Removal (m)	45
Permanent Mature Tree Removal	26
Permanent Immature Tree Removal	4

Table 78 Impact calculations for hedgerow and tree removal in the UWF Related Works element of the Whole UWF Project.

Project Element	UWF Related Works
Permanent Hedgerow Removal (m)	170
Permanent Mature Tree Removal	1
Permanent Immature Tree Removal	3

Table 79 Impact calculations for hedgerow and tree removal in the UWF Replacement Forestry element of the Whole UWF Project.

Project Element	UWF Replacement Forestry
Permanent Hedgerow Removal (m)	0
Permanent Mature Tree Removal	0
Permanent Immature Tree Removal	0

Table 80 Impact calculations for hedgerow and tree removal in the Upperchurch Windfarm element of the Whole UWF Project.

Project Element	Upperchurch Windfarm
Permanent Hedgerow Removal (m)	980.77
Permanent Mature Tree Removal	24
Permanent Immature Tree Removal	0

Table 81 Impact calculations for hedgerow and tree removal in the UWF Other Activities element of the Whole UWF Project.

Project Element	UWF Other Activities
Permanent Hedgerow Removal (m)	0
Permanent Mature Tree Removal	0
Permanent Immature Tree Removal	0

A8-1.3.1.3 Invertebrates

Table 82 Impact calculations for suitable Marsh Fritillary habitat for the Whole UWF Project.

Site	Baurnadomeeny	Bealaclave	Shevry	Total
MF Suitable Habitat Area (ha)	0.57	0.10	0.54	1.21
MF Suitable Habitat Overlap (ha)	0.003	0.00	0.06	0.06
Overlap Area as % of Total Suitable Habitat	0.52	0.049	11.48	5.35
Permanent Land Take (ha)	-	-	0.06	0.06
% of Suitable MF Habitat being Permanently Lost	-	-	5.11	5.11

A8-1.4 Cumulative Impact of the Whole UWF Project with Other Projects/Activities

Table 83 details the cumulative receptor scoping from which Spatial Boundaries in respect of the in-combination appraisal of each receptor as identified were evaluated.

Table 83 Spatial boundary for cumulative impact assessment for each of the identified receptors

Environmental Component	Regional Issues of Concern	Receptors	Indicators	Spatial Boundary for Cumulative
Designated Sites	Threats and Pressures as per Conservation Objectives	European Sites	Adverse effects on integrity of site	Whole UWF Project boundary plus 15km
Designated Sites	Threats and Pressures as per Conservation Objectives	European Sites	Reduction in Favourable Conservation Status of Qualifying Interest/Special Conservation Interest	Whole UWF Project boundary plus 15km
Designated Sites (National)	Threats and Pressures as available	NHA's and pNHA's	Any trends, pressures as identified in available literature	Whole UWF Project boundary plus 15km
Birds	Habitat Loss	Hen Harrier	Reduction in Habitat Extent within SPA/Silvermines Mountains	SPA plus 5km
Birds	Protection of Nests outside SPA's	Hen Harrier	Reduction in habitat ex-situ to SPA but contiguous	SPA plus 5km
Birds	Population Reduction	Hen Harrier	Reduction in Population Extent within SPA/Silvermines Mountains	SPA plus 5km
Birds	Protection of Nests outside SPA's	Hen Harrier	Reduction in Population Extent ex-situ to SPA but contiguous	SPA plus 5km
Birds	Habitat Loss	General Birds	Reduction in Biodiversity due to habitat change	1km (or townland)
Habitats	Non-native invasive plant species	Japanese Knotweed, Himalayan Knotweed, Giant Hogweed, Rhododendron, Cherry Laurel, Himalayan Balsam	Increase in range	100m
Habitats	Retention of trees in developments	HNV trees	Direct loss without replacement	100m
Flora	Alteration or damage of Flora Protection Order (2015) species or habitat	FPO species	Reduction in range/habitat extent	100m

REFERENCE DOCUMENTS

Environmental Component	Regional Issues of Concern	Receptors	Indicators	Spatial Boundary for Cumulative
Fauna	Alien Mammals	Greater White Toothed Shrew	Increase in range	2km
Fauna	Alien Mammals	American Mink	Increase in range	100m
Fauna	Alien Mammals	Grey Squirrel	Increase in range	100m
Habitats	Retention of 'typical high nature value' hedges	Hedgerows	Reduction in connectivity due to severance	100m
Habitats	Loss of Semi-natural grassland	Upland grassland Silvermines mountains	reduction in area	100m
Habitats	Overgrazing/Burning/Peat Extraction/Afforestation	Heaths	Area reduction/habitat degradation	100m
Habitats	Development/Overgrazing/Afforestation/Peat Extraction/Dumping/Recreational Use/Invasive Species	Peatlands	Habitat Degradation/ loss	100m
Aquatic Habitats	Pollution	Freshwater Pearl Mussel	Reduction in water quality	Downstream catchment
Aquatic Habitats	Pollution	Salmonids	Reduction in water quality	Downstream catchment
Aquatic Habitats	Pollution	Sea Lamprey	Reduction in water quality	Downstream catchment
Aquatic Habitats	Pollution	Eel	Reduction in water quality	Downstream catchment
Aquatic Habitats	Pollution	Trout	Reduction in water quality	Downstream catchment
Aquatic Habitats	Drainage	Freshwater Pearl Mussel	Reduction in habitat	Downstream catchment
Aquatic Habitats	Drainage	Salmonids	Reduction in habitat	Downstream catchment
Aquatic Habitats	Drainage	Sea Lamprey	Reduction in habitat	Downstream catchment
Aquatic Habitats	Drainage	Eel	Reduction in habitat	Downstream catchment
Aquatic Habitats	Drainage	Trout	Reduction in habitat	Downstream catchment
Aquatic Habitats	Engineering	Freshwater Pearl Mussel	Effective Habitat Loss (loss of passage)	Downstream catchment
Aquatic Habitats	Engineering	Salmonids	Effective Habitat Loss (loss of passage)	Downstream catchment
Aquatic Habitats	Engineering	Sea Lamprey	Effective Habitat Loss (loss of passage)	Downstream catchment
Aquatic Habitats	Engineering	Eel	Effective Habitat Loss (loss of passage)	Downstream catchment
Aquatic Habitats	Engineering	Trout	Effective Habitat Loss (loss of passage)	Downstream catchment

REFERENCE DOCUMENTS

Environmental Component	Regional Issues of Concern	Receptors	Indicators	Spatial Boundary for Cumulative
Aquatic Habitats	Land Management Practice	Freshwater Pearl Mussel	loss of habitat (drainage) / alteration of physical features (habitats)	Downstream catchment
Aquatic Habitats	Land Management Practice	Salmonids	loss of habitat (drainage) / alteration of physical features (habitats)	Downstream catchment
Aquatic Habitats	Land Management Practice	Sea Lamprey	loss of habitat (drainage) / alteration of physical features (habitats)	Downstream catchment
Aquatic Habitats	Land Management Practice	Eel	loss of habitat (drainage) / alteration of physical features (habitats)	Downstream catchment
Aquatic Habitats	Land Management Practice	Trout	loss of habitat (drainage) / alteration of physical features (habitats)	Downstream catchment
Invertebrates	Identification and Protection of Breeding Sites	Marsh Fritillary	Inadvertent loss of colonies	2km
Amphibians	No information on distribution	Frog	Reduction in population through mortality	100m
Amphibians	No information on distribution	Frog	Reduction in population through secondary effects/habitat loss	100m
Reptiles	No information	Lizard	Reduction in population through secondary effects/habitat loss	100m
Mammals - Bats	Bridge roosts	All Bat Species	Loss of habitat	300m
Mammals - Bats	Valuable habitats	All Bat Species	Habitat Severance	300m
Mammals - Bats	Protection of Roosts	All Bat Species	Roost loss	300m
Other mammals	Destruction and Fragmentation of Habitats	Badger	Loss of Setts	2km
Other mammals	Destruction and Fragmentation of Habitats	Irish Hare	Loss of habitat	100m
Other mammals	Destruction and Fragmentation of Habitats	Red Squirrel	loss of habitat	100m
	Destruction and Fragmentation of Habitats	Otter	Loss of Habitat	7km
	Road Construction	Badger	Mortality (traffic)	2km
	Road Construction	Other Mammals	Mortality (traffic)	100m

All planning applications within15km of the construction area boundaries

REFERENCE DOCUMENTS

Table 84 Other Plans or Projects and Activiites within the Spatial Boundary for Cumulative Evaluation

Name	Industry	Details	Location	Status	Planning Authority	Planning Ref
Bunkimalta Windfarm	Energy	16 wind turbines, each having a rated electrical output of approximately 2,500 - 3,000 kilowatts, access tracks, a fenced Electrical Transformer Station comprising a single-storey Control Building and Substation, an effluent treatment system, three anemometer masts, repository areas, borrow pits and all associated site works, above and below ground. modifications to the existing entrance from the L-2163 to the Keeper Hill Coillte Forest. installation of approximately 22.25km of 38kV underground cable (UGC) between Bunkimalta Wind Farm and Nenagh 110kV substation, to be installed primarily in public roads. Bunkimalta Windfarm is located c.3.5km to the north of the UWF Grid Connection, and c.11km to the northwest of the UWF Related Works, and c.12.5km to the northwest of the UWF Replacement Forestry.	Bunkimalta, Keeper Hill, Co. Tipperary, Co. Tipperary	Consented	Tipperary	13510035 16600433 16600432
Castlewaller Windfarm	Energy	16 turbines (each with a maximum hub height of 100m, maximum rotor diameter of 90m, and with a total tip height of 145m), one permanent meteorological mast, 2 borrow pits, a sub-station including a control building, new internal access roads, upgrading of existing internal access roads, expansion of drainage system, turbine hardstands, wastewater holding tank, underground cables and ancillary works. The UWF Grid Connection 110kV UGC route passes through the footprint of the consented windfarm.	Castlewaller, Newport, Co. Tipperary	Consented	Tipperary	16600472, 11510251.
Killuragh Digester Plant	Energy	construction of a digester plant, associated ABP building and associated site works to process farm slurry and other organic material to provide renewable energy and fertilizer	Killuragh, Pallasgreen, Co Limerick	Consented	Limerick	111066
Newport Distributor Road	Civil	Distributor Road between R503 and local road (Murroe Road) in Newport Village and associated site works including footpaths, lighting, cycletracks, drainage, etc	Tullow, Newport, Co. Tipperary	Consented	Tipperary	07511157, 13510103
Housing Development Doon	Re-sidential	Construction of 25 no. houses consisting of 5 no. 4 bed detached dwellings, 20 no. 3 bed semi-detached dwellings, a bored well,	Bottle Hill, Doon, Co Limerick	Consented	Limerick	16530

Name	Industry	Details	Location	Status	Planning Authority	Planning Ref
		entrance and roads together with associated site works and services				
Housing Developments, Annacotty	Re-sidential	Construction of 48 dwellings at Annacotty & construction of 240 dwellings in three areas/lots at Walkers Road	Annacotty, Co Limerick	Consented	Limerick	137026 137094
Gortnahalla Turbine	Energy	Single wind generator with a maximum output set at 500kw, hub height 65m	Gortnahalla, Upperchurch, Co. Tipperary	Built or Expired	Tipperary	12510368
Thurles Regional Water Treatment Works	Utilities	The construction of a water treatment plant and outfall to the River Suir. The water treatment plant will consist of a water treatment and administration building, sludge dewatering building, ESB sub-station, generator & oil tank enclosure, raw water balancing tank, clear water tanks, sludge balancing tank, sludge thickening and sludge holding tank, washwater tank, sludge skip and emergency sludge storage area, chemical storage tanks, washwater storage tank and all associated site development and site excavation works above and below ground	Bohernacrusha, Killeenyarda, Holycross, Co. Tipperary	Consented	Tipperary	16600877
Industrial / warehouse Units, Thurles	Industrial	1 No. Light Industrial/Warehousing building (gross floor area 2360.6sq.m.). The development consists of (1) 1 No. Building of total floor area 2360.6sq.m. subdivided into Units. (2) Roundabout and Access Road from Nenagh Road (R498) complete with necessary improvement works and road markings. (3) Car parking and loading areas. (4) Landscaping. (5) Site development works to facilitate the site. (6) Foul water pumping station and all associated works	Bawntameena, Nenagh Road, Thurles, Co. Tipperary	Consented	Tipperary	16600037
Agriculture – Turkey Tunnel & Pig Unit	Agri-culture	a loose turkey poly tunnel, open feeding yard, slatted tank in existing house now used for pigs, change of use from hay barn/loose shed to pig shed/milling shed grain store	Gortussa, Dundrum, Co. Tipperary	Consented	Tipperary	14600343
Agriculture - Milking Parlour	Agri-culture	(1) a dairy cubicle house complete with under-ground slatted tanks, (2) a walled silage base, (3) a general agricultural shed, (4) an extension to existing calf house incorporating the existing farm yard manure slab, the demolition of existing animal house and all associated site works.	Portnard, Cappamore, Co. Limerick	Consented	Limerick	15255

Name	Industry	Details	Location	Status	Planning Authority	Planning Ref
Agriculture – Milking Parlour	Agri-culture	(1) milking parlour and dairy, (2) unroofed easy-feed layout for dairy cows, (3) geomembrane lined slurry lagoon and all ancillary works	Bunkey, Lisnagry,, Co Limerick	Consent ed	Limerick	15194
Agricultural sheds and stores	Agri-culture	1) to construct a slatted cubicle dairy building complete with underground slatted tank, (2) to erect a circular slurry storage tower, (3) to construct 2 x walled silage stores with associated concrete area for the storage of round bales, (4) to construct 5 x individual feed store buildings, (5) to construct farm yard manure storage building, (6) to construct fodder storage buildings	Killuragh, Pallasgree n, Co. Limerick	Consent ed	Limerick	17133
Forestry	Activity	Commercial conifer forestry plantations throughout the Slievefelim to Silvermine Mountains upland area	n/a	Ongoing	n/a	n/a
Agriculture	Activity	Dry stock farming, mainly cattle, along with some dairy farming, throughout the Slievefelim to Silvermine Mountains upland area.	n/a	Ongoing	n/a	n/a

A8-1.5 References

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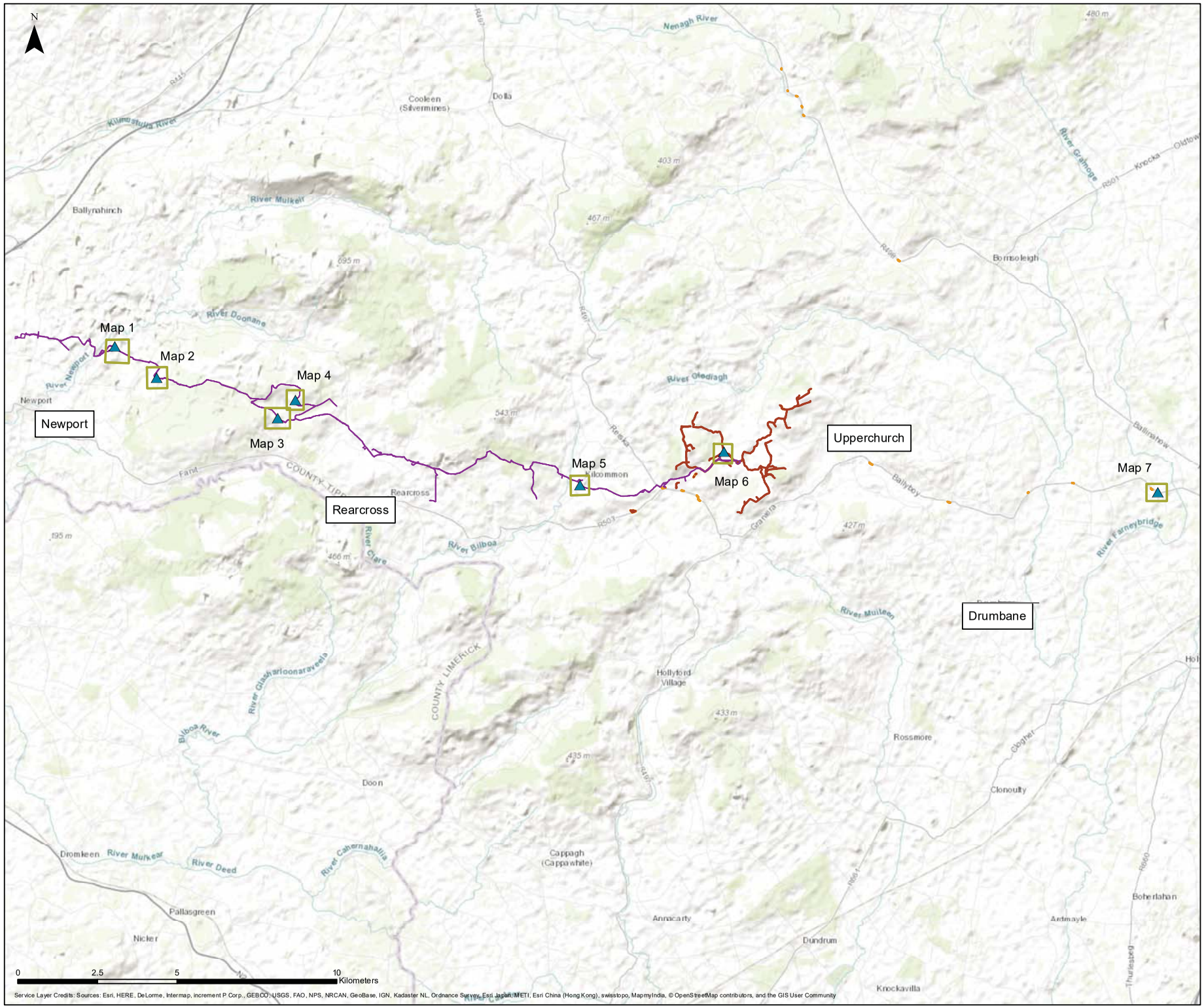
A8-1.6 Detailed Biodiversity Mapping



Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations Overview Map

Legend:

- Infestation Location
- UWF Grid Connection Construction Works Area
- UWF Related Works Construction Works Area
- Other Activities Construction Works Boundary

For illustrative purposes only. Map not to scale

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Drawn:	Checked:	Authorised:
POC	CC	HW

Date:	Map Reference:
12/02/2018	EDL - A3 - 12 - 01

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Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 1 of 7

Legend:

- Himalayan Knotweed
- UWF Grid Connection Construction Works Area

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POC	CC	HW

Date:	Map Reference:
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Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 2 of 7

Legend:

- Japanese Knotweed
- UWF Grid Connection Construction Works Area

For illustrative purposes only. Map not to scale

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Ennis, Co. Clare

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 3 of 7

Legend:

- Japanese Knotweed
- UWF Grid Connection Construction Works Area

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Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 4 of 7

Legend:

- Japanese Knotweed
- Construction Works Boundary

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Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 5 of 7

Legend:

- Japanese Knotweed
- UWF Grid Connection Construction Works Area

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Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 6 of 7

Legend:

- Japanese Knotweed
- UWF Related Works Construction Works Area

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Project: Whole Windfarm Project

Title:
Figure. A8 - 1.Terrestrial Habitats: Invasive Species Locations
Map 7 of 7

Legend:

- Japanese Knotweed
- Other Activities Construction Works Boundary

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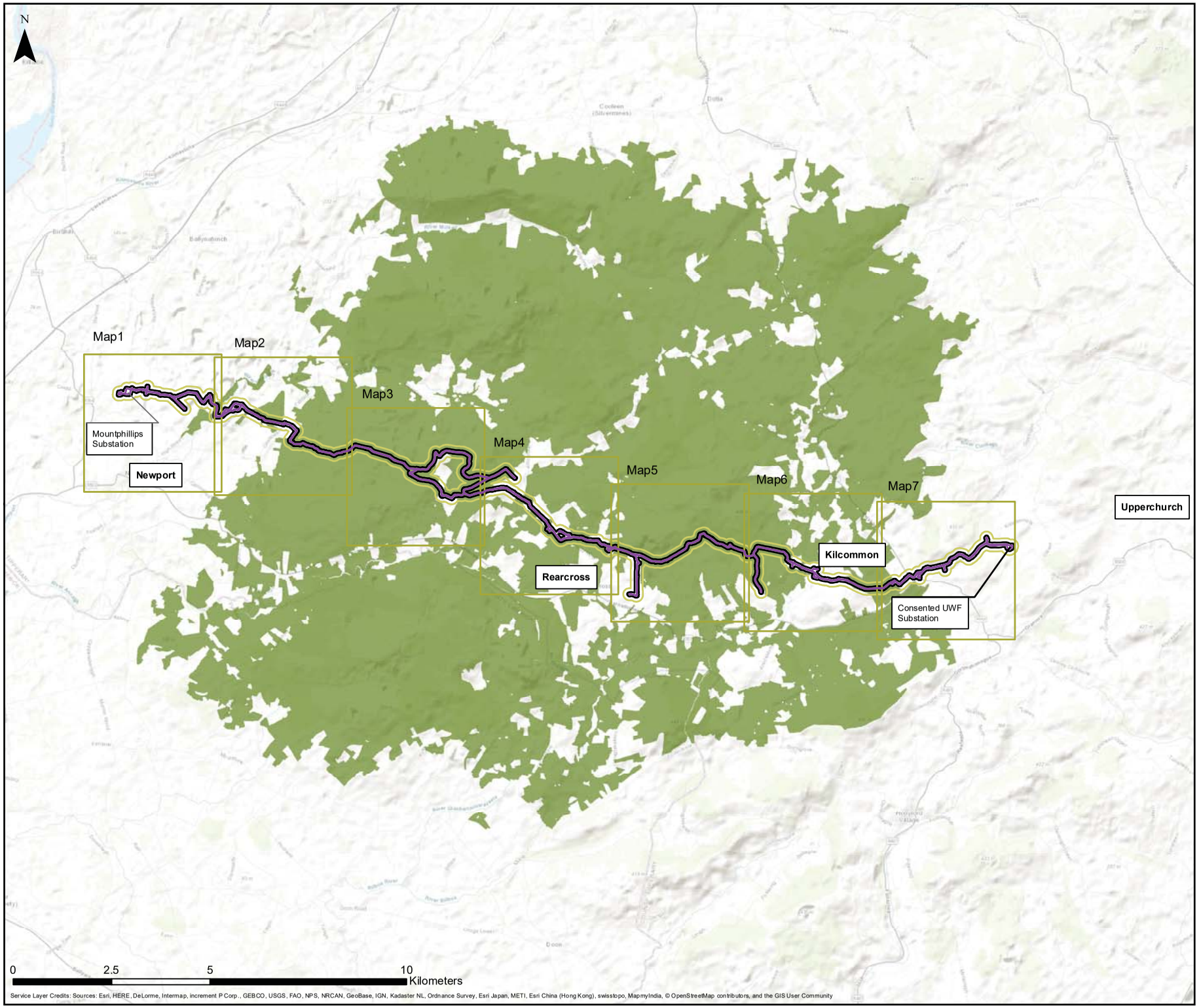

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Overview Map

Legend:
- UWF Grid Connection Construction Works Area
- Study Area Boundary (150m)
- Study Area Boundary (50m)
- Slievefelim SPA

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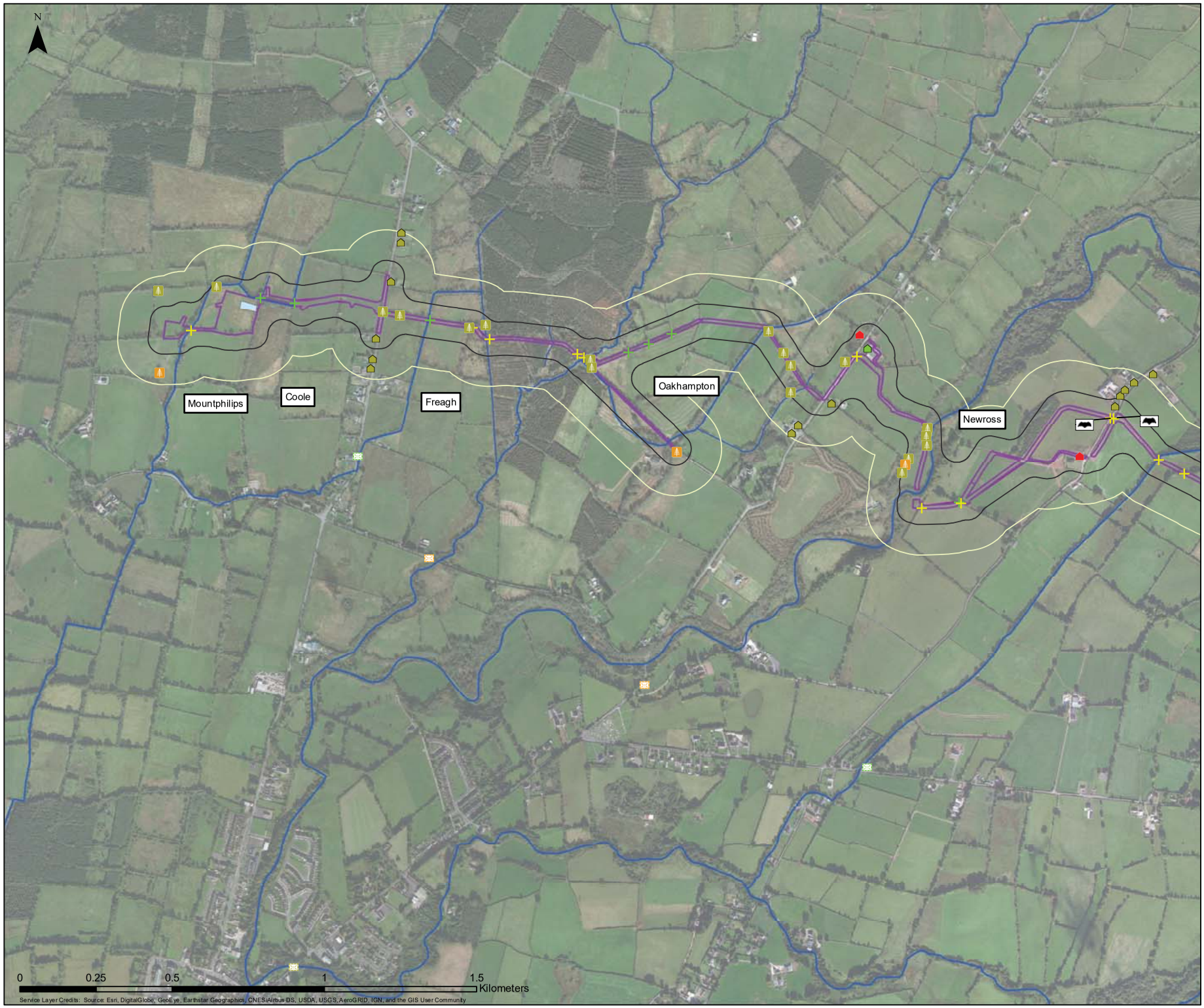

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 1 of 7

Legend:

Bat Crossing Locations

Bat Roost Suitability: *

Bridges
- Moderate
- Low
- Negligible

Trees
- Moderate
- Low

Buildings
- High
- Low
- Negligible

- Study Area Boundary (50 m)
- Study Area Boundary (150m)
- Temporary hedge/tree removal and pruning
- Permanent hedge/tree removal
- UWF Grid Connection Construction Works Area
- Temporary Construction Compound
- Watercourses
- UWF Grid Connection Construction Works Area

** Buildings identified are those evaluated as having some suitability for bats. Any other buildings visible on mapping are either outside the study area or are considered to have zero suitability for bats*

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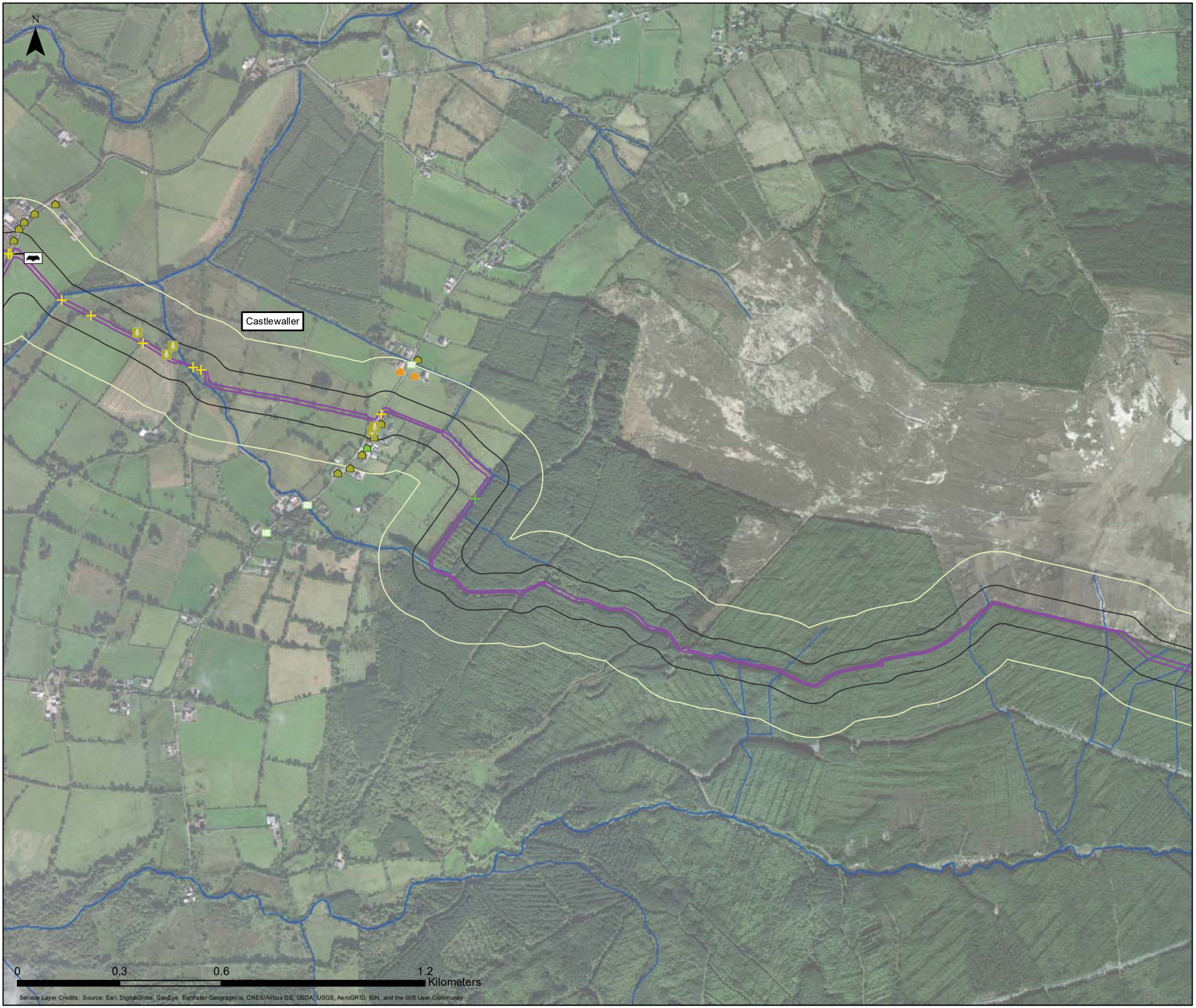

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 2 of 7

Legend:

Bat Crossing Locations

Bat Roost Suitability:*

Bridges
- Negligible

Trees
- Low

Buildings
- Moderate
- Low
- Negligible

- Study Area Boundary (50 m)
- Study Area Boundary (150m)
- Temporary hedge/tree removal and pruning
- Permanent hedge/tree removal
- UWF Grid Connection Construction Works Area
- Watercourses

** Buildings identified are those evaluated as having some suitability for bats. Any other buildings visible on mapping are either outside the study area or are considered to have zero suitability for bats*

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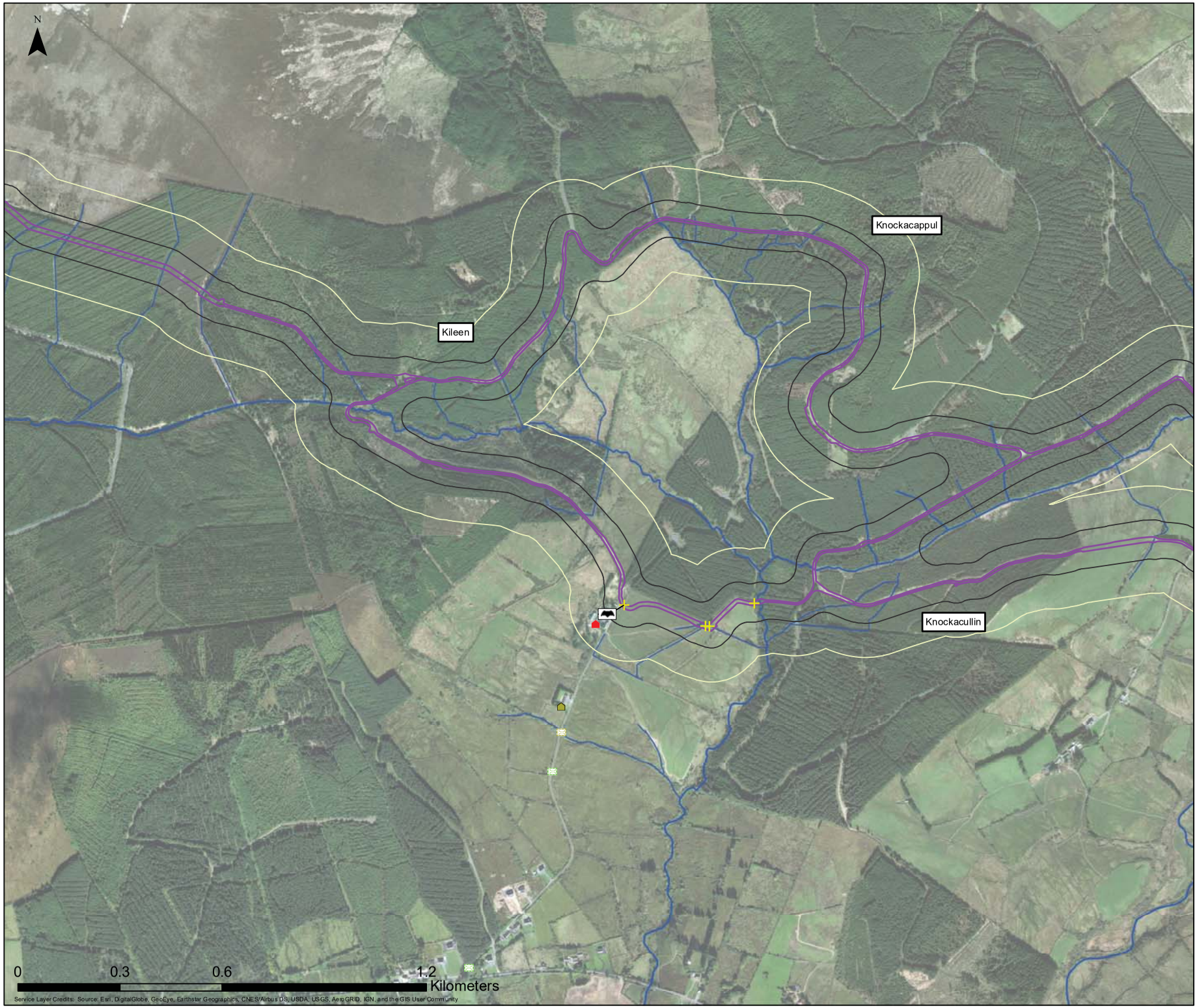

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 3 of 7

Legend:

Bat Crossing Locations

Bat Roost Suitability:*

Bridges
- Low
- Negligible

Buildings
- High
- Low

- Study Area Boundary (50 m)
- Study Area Boundary (150m)
- Temporary hedge/tree removal and pruning
- Watercourses
- UWF Grid Connection Construction Works Area

** Buildings identified are those evaluated as having some suitability for bats. Any other buildings visible on mapping are either outside the study area or are considered to have zero suitability for bats*

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Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 4 of 7

Legend:

Bat Roost Suitability:*

Bridges
- Low
- Negligible

Trees
- Low

Buildings
- High
- Moderate
- Low
- Negligible

- Study Area Boundary (50 m)
- Study Area Boundary (150m)
- UWF Grid Connection Construction Works Area
- Watercourses
- Temporary hedge/tree removal and pruning
- Permanent hedge/tree removal

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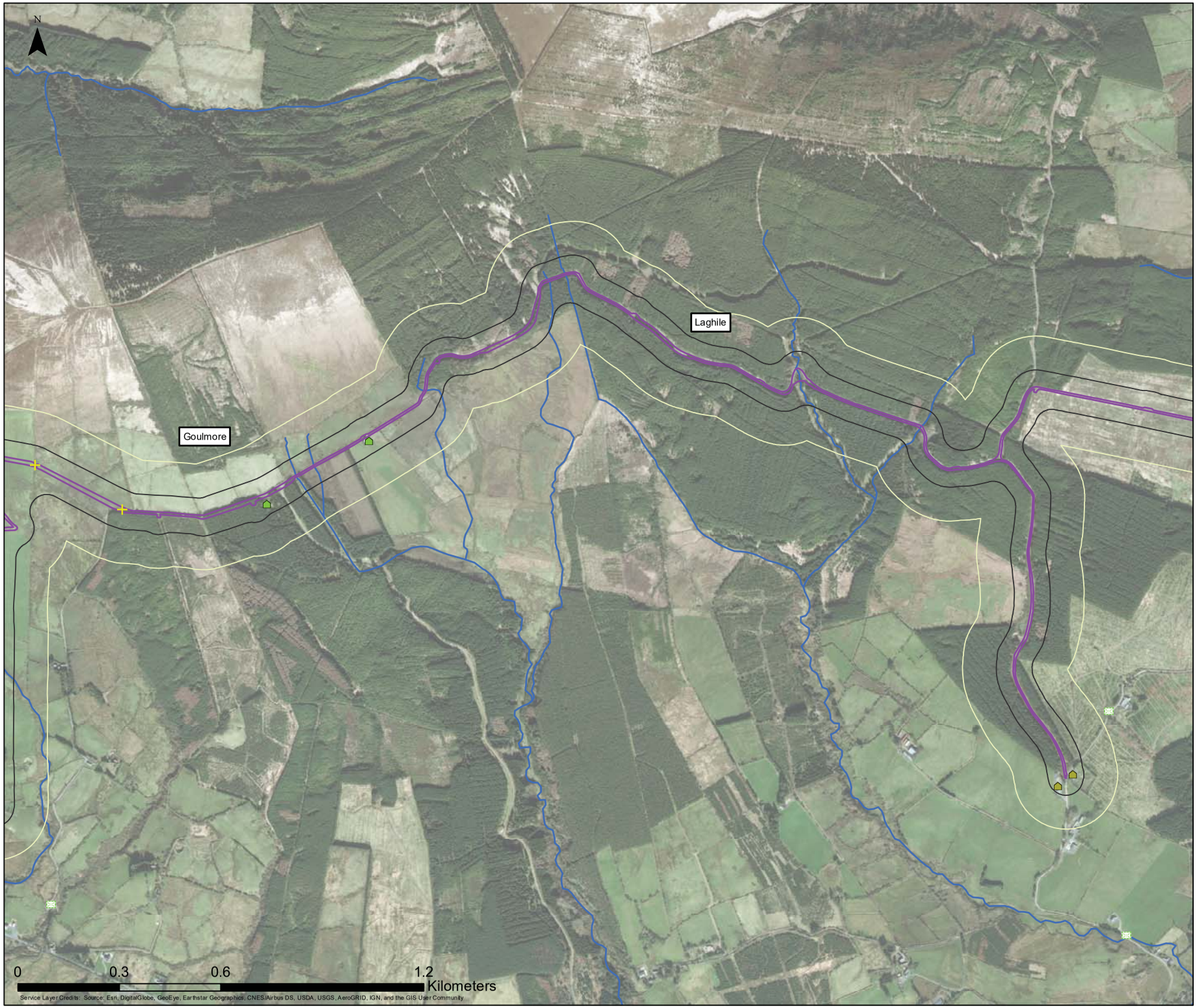

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 5 of 7

Legend:

Bat Roost Suitability:*

Bridges
- Negligible

Buildings
- Low
- Negligible

- Study Area Boundary (50 m)
- Study Area Boundary (150m)
- UWF Grid Connection Construction Works Area
- Watercourses
- Temporary hedge/tree removal and pruning

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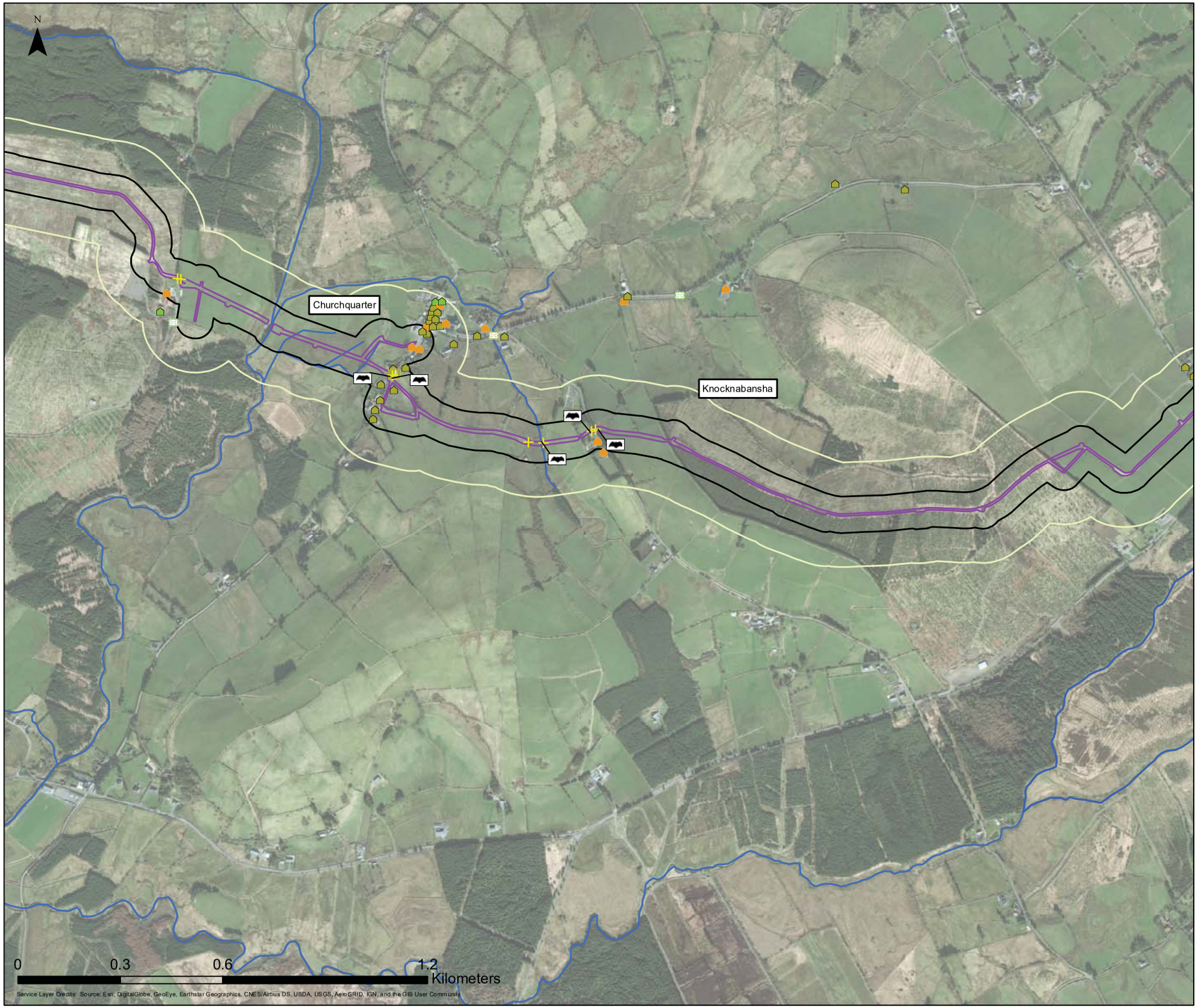

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 6 of 7

Legend:

Bat Crossing Locations

Bat Roost Suitability:*

Bridges
- Low
- Negligible

Trees
- Low

Buildings
- Moderate
- Low
- Negligible

- Study Area Boundary (50m)
- Study Area Boundary (150m)
- UWF Grid Connection Construction Works Area
- Watercourses
- Temporary hedge/tree removal and pruning

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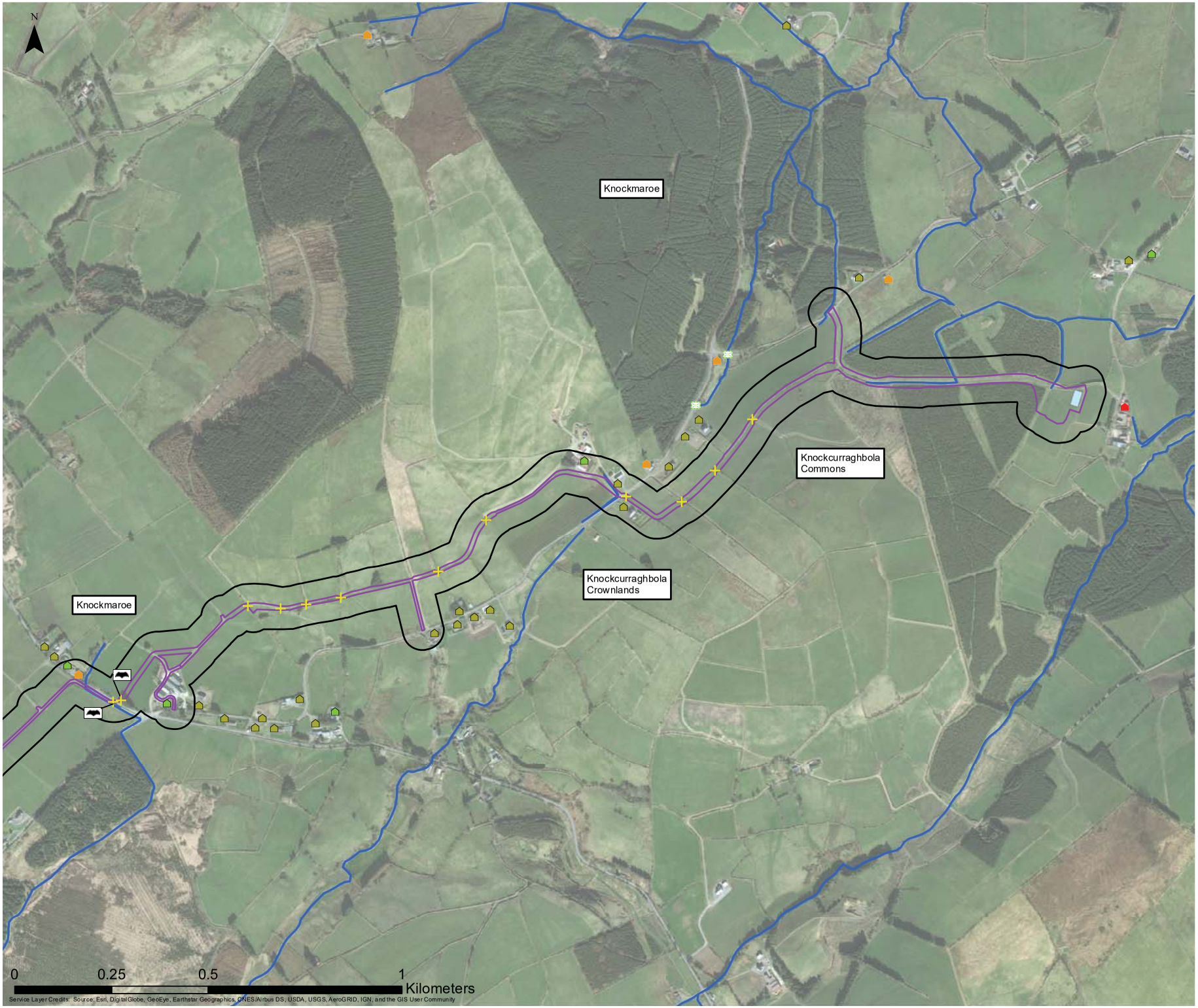

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 2: Bats within the UWF Grid Connection Study Area.
Map 7 of 7

Legend:

Bat Crossing Locations

Bat Roost Suitability:*

Temporary hedge/tree removal and pruning

Bridges

Rating

Negligible

Buildings

Rating

High

Moderate

Low

Negligible

UWF Grid Connection Construction Works Area

Study Area Boundary (50m)

Watercourses

Temporary Construction Compound

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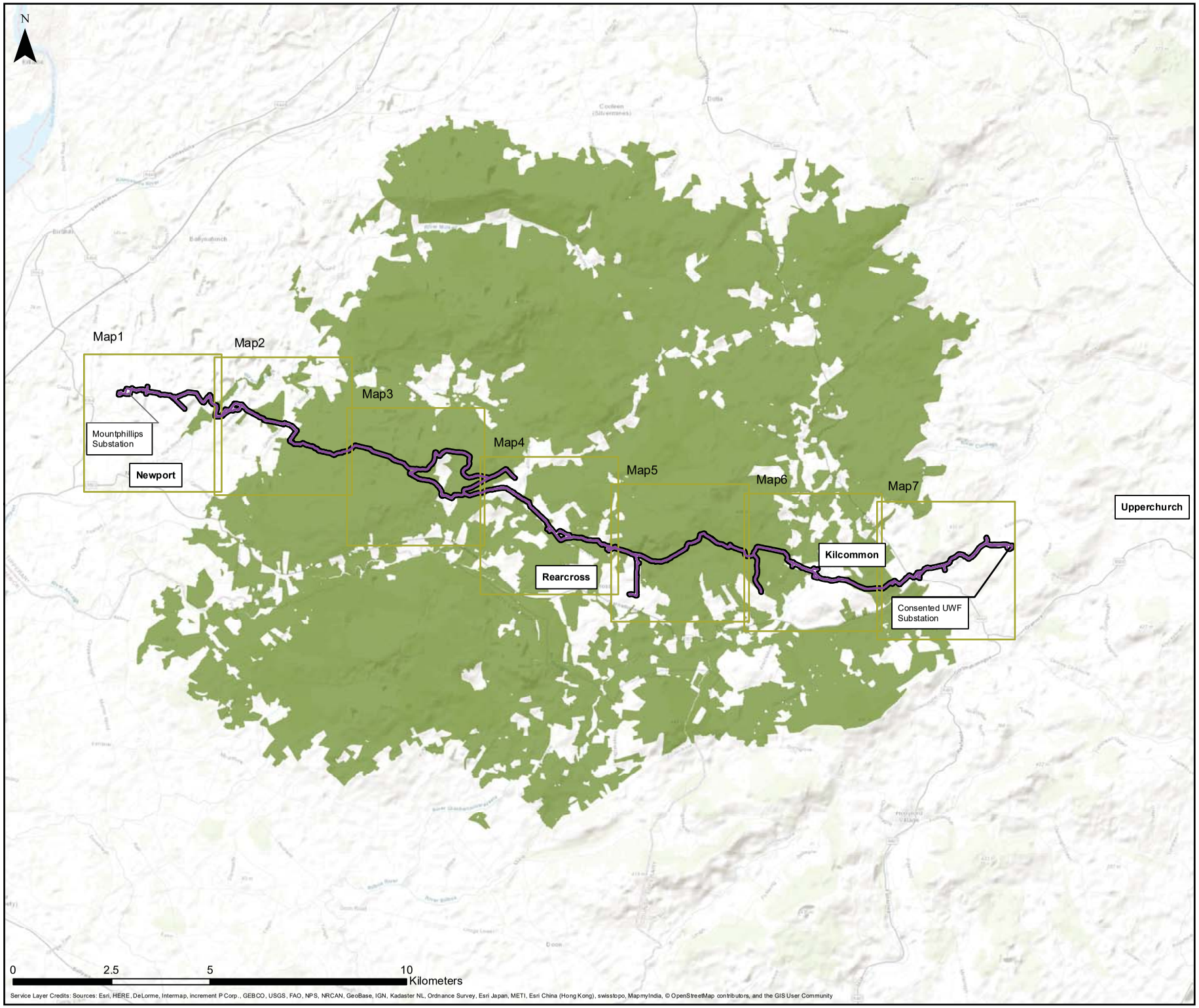

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area. Overview Map

Legend:

- UWF Grid Connection Construction Works Area
- Study Area Boundary (50m)
- Slievefelim SPA

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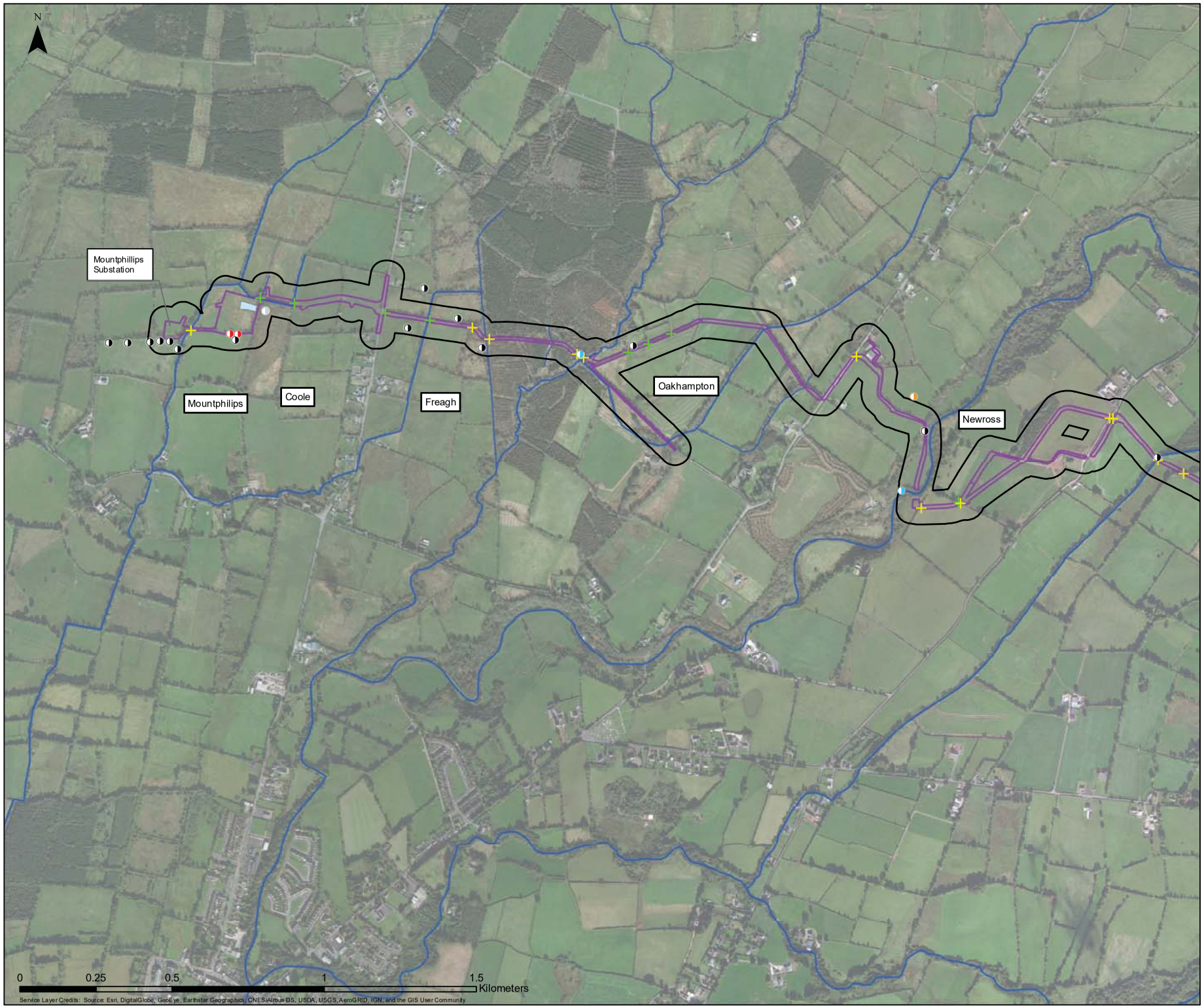

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 1 of 7

Legend:

- Badger (Tracks,snuffle hole, latrine, scat)
- Deer sp.
- Fox
- Irish Hare
- Otter (Tracks, path, slide,spraint)
- Squirrel sp.
- Temporary hedge/tree removal and pruning
- Permanent hedge/tree removal
- UWF Grid Connection Construction Works Area
- Study Area Boundary (50m)
- Temporary Construction Compound
- Watercourses

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Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 2 of 7

Legend:

- Badger (Tracks,snuffle hole, latrine, scat)
- Deer sp.
- Fallow Deer
- Pine Marten
- Study Area Boundary (50 m)
- Watercourses
- UWF Grid Connection Construction Works Area
- Temporary hedge/tree removal and pruning
- Permanent hedge/tree removal

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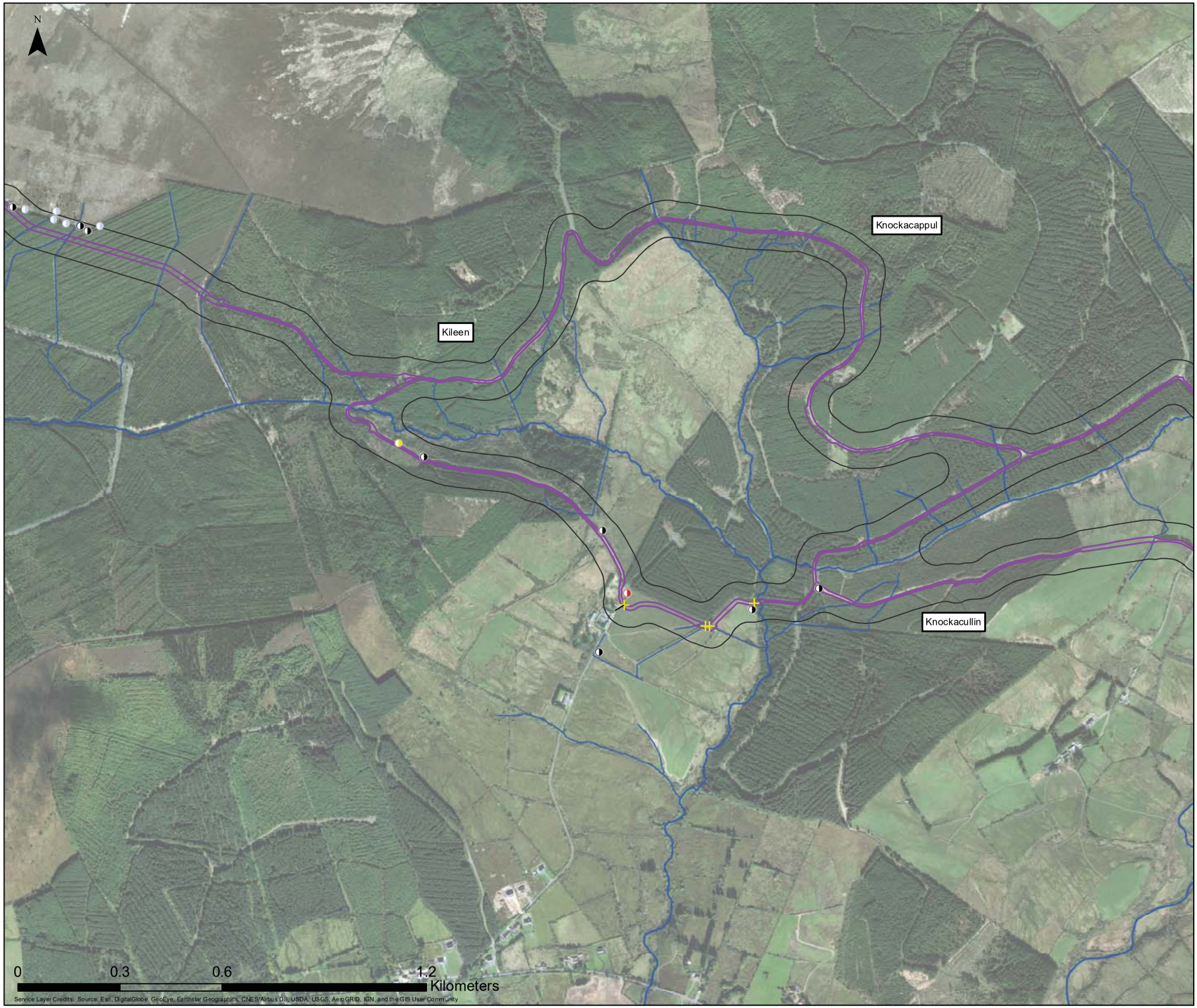

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 3 of 7

Legend:

- Badger (Tracks,snuffle hole, latrine, scat)
- Deer sp.
- Fox
- Pine Marten
- Study Area Boundary (50 m)
- Temporary hedge/tree removal and pruning
- UWF Grid Connection Construction Works Area
- Watercourses

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Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 4 of 7

Legend:

- Badger (Tracks,snuffle hole, latrine, scat)
- Fox
- Irish Hare
- Mink or Otter
- Otter (Tracks, path, slide,spraint)
- Study Area Boundary (50 m)
- Temporary hedge/tree removal and pruning
- Permanent hedge/tree removal
- UWF Grid Connection Construction Works Area
- Watercourses

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Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 5 of 7

Legend:

- Badger (Tracks,snuffle hole, latrine, scat)
- Study Area Boundary (50 m)
- UWF Grid Connection Construction Works Area
- Watercourses
- Temporary hedge/tree removal and pruning

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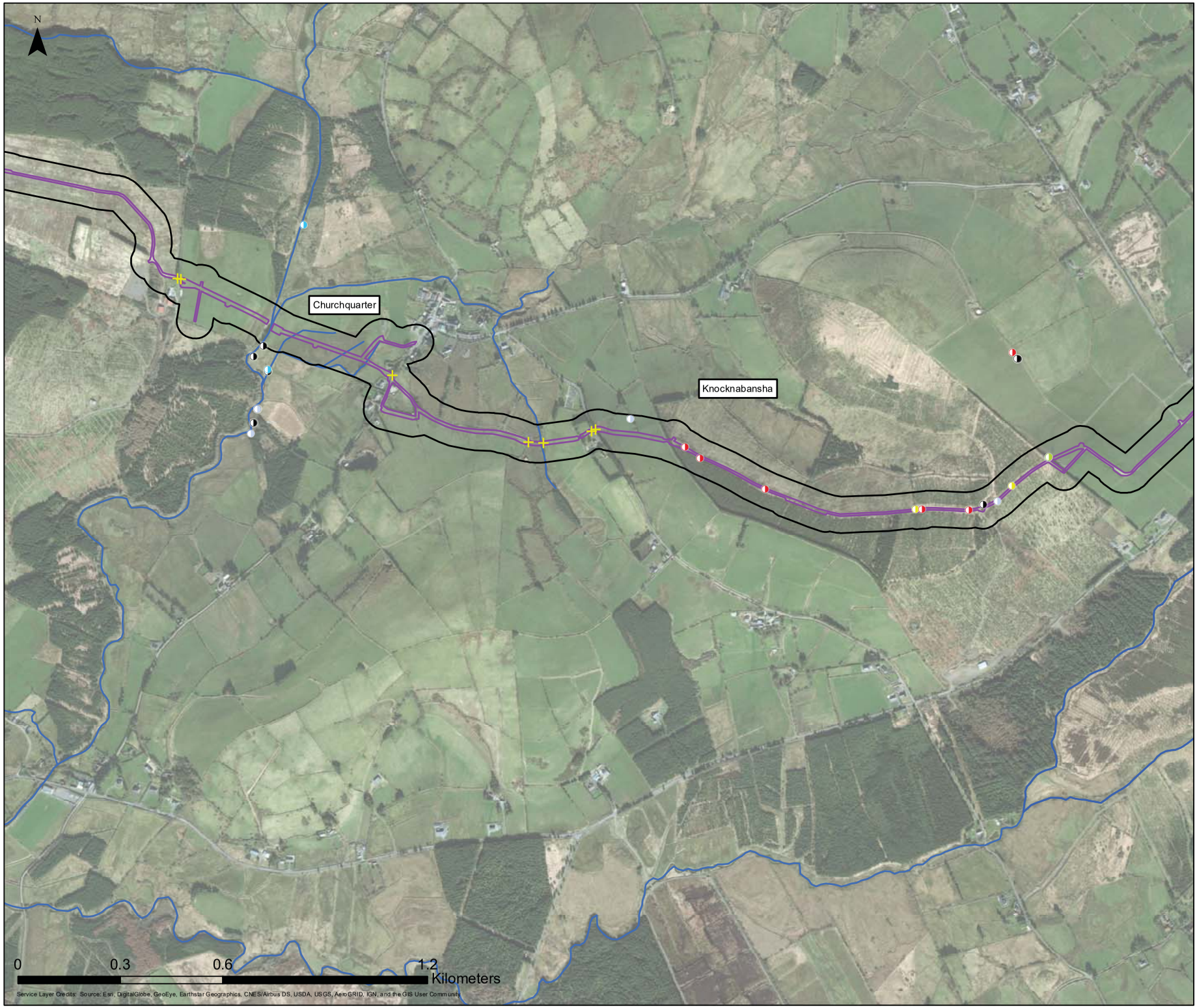

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Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 6 of 7

Legend:

- Badger (Tracks,snuffle hole, latrine, scat)
- Deer sp.
- Fox
- Otter (Tracks, path, slide,spraint)
- Pine Marten
- Squirrel sp.
- Wood Mouse
- Study Area Boundary (50m)
- UWF Grid Connection Construction Works Area
- Watercourses
- Temporary hedge/tree removal and pruning

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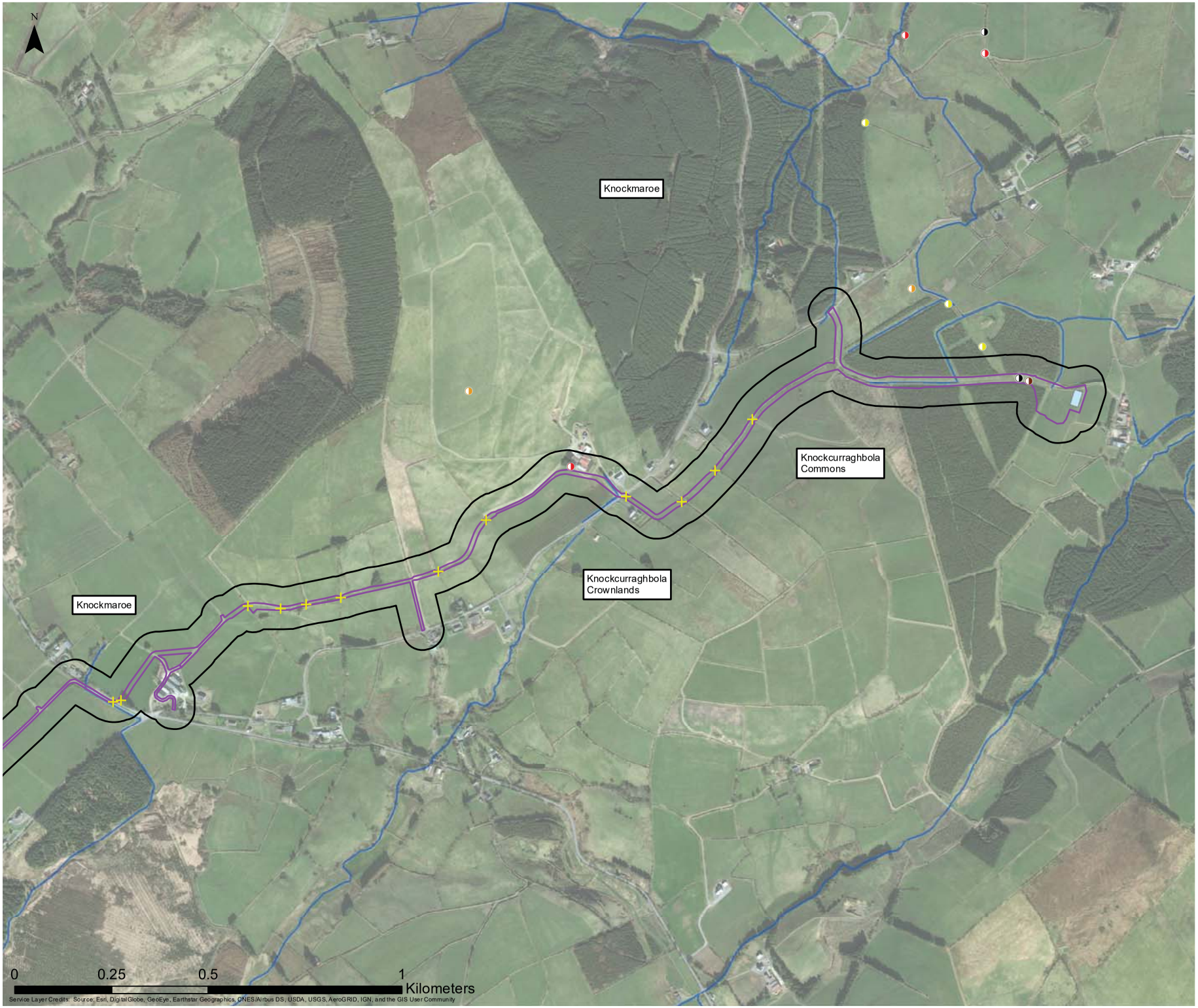

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 3: Non-Volant Mammals within the UWF Grid Connection Study Area.
Map 7 of 7

Legend:

- Badger (Tracks, snuffle hole, latrine, scat)
- Deer sp.
- Fox
- Irish Hare
- Pine Marten
- Temporary hedge/tree removal and pruning
- UWF Grid Connection Construction Works Area
- Study Area Boundary (50m)
- Watercourses
- Temporary Construction Compound

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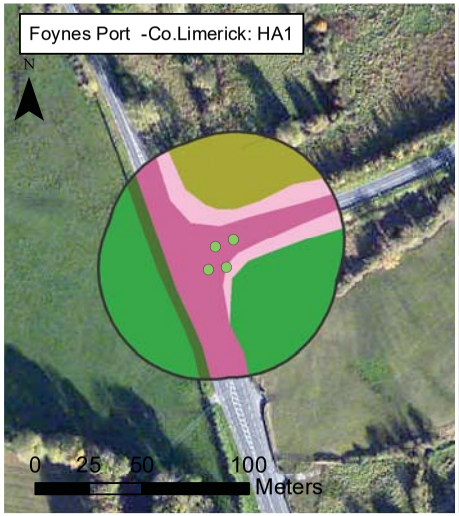

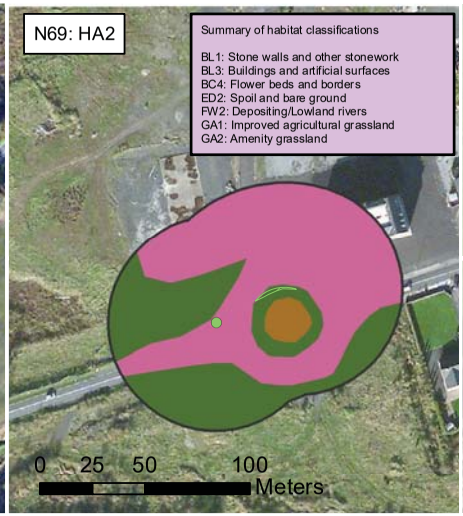

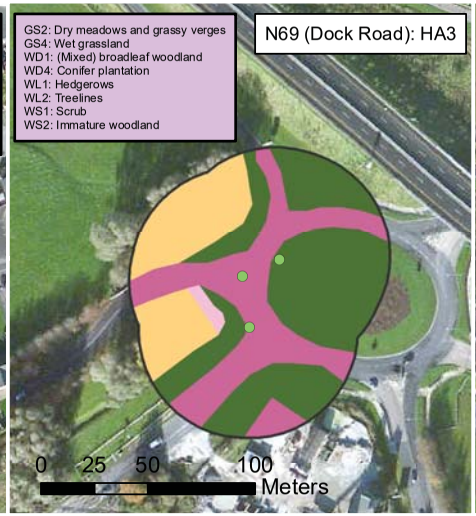

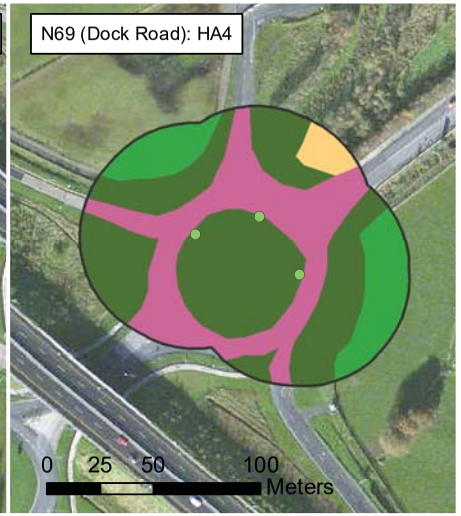

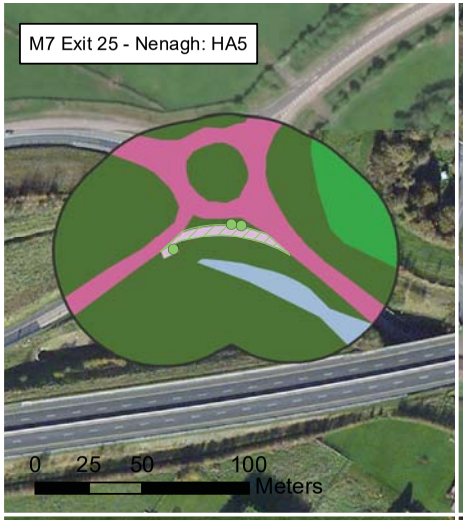

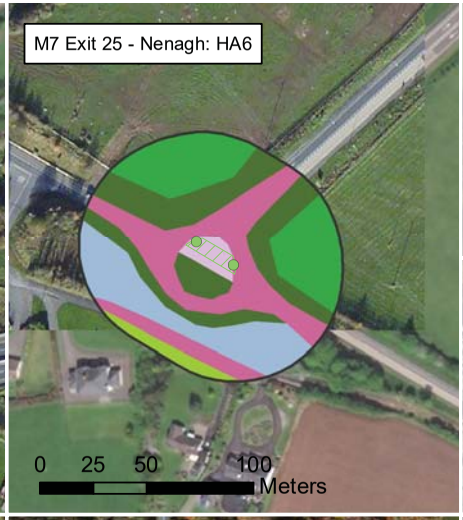

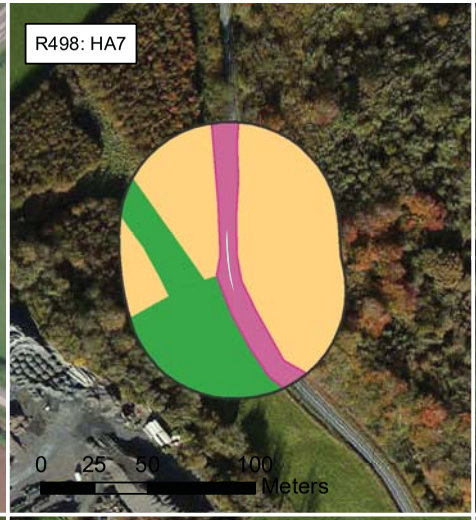

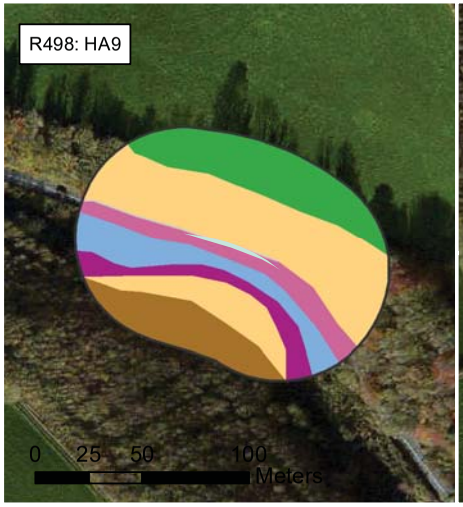

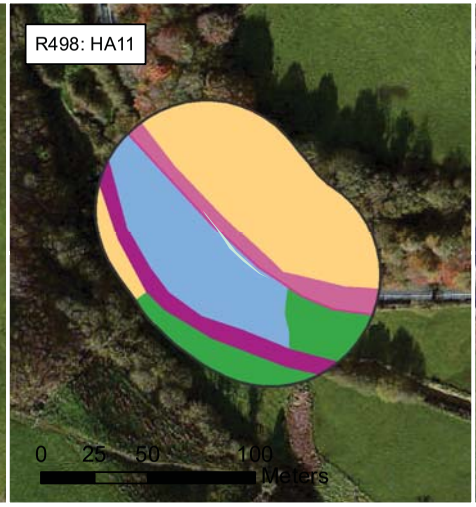

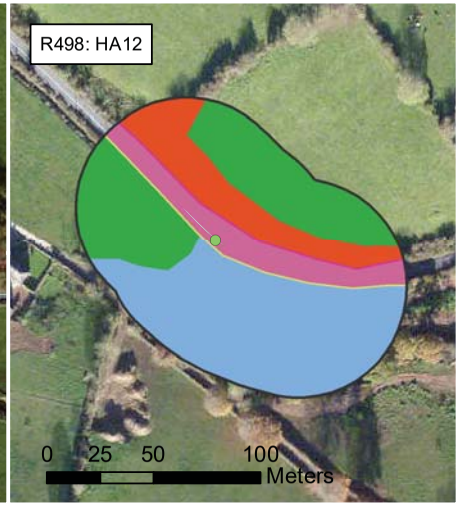

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 4: Other Activities (Habitats, General Birds, Watercourses, Amphibians & Reptiles, Marsh Fritillary) Map 1 of 2

Legend:
- Study Area Boundary (50m)
- BL1
- GS2
- WL1
- BC4
- BL3
- ED2
- FW2
- GA1
- GA2
- GS2
- GS4
- WD1
- WD4
- WL2
- WS1
- WS2
- Street Furniture
- Ancillary Activities Haul Route Street Furniture Not in Sockets
- Ancillary Activities Matting Overlay
- Ancilliary Haul Route Activities: Vegetation Trimming

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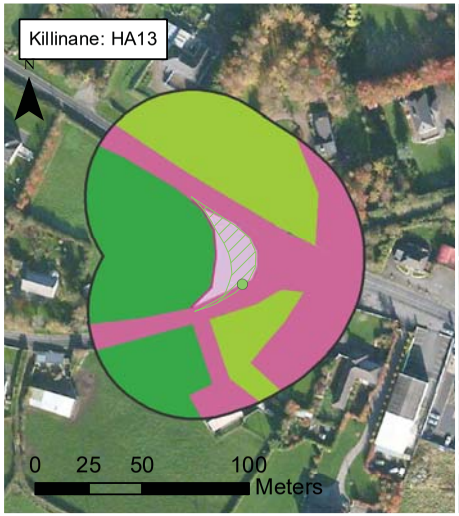

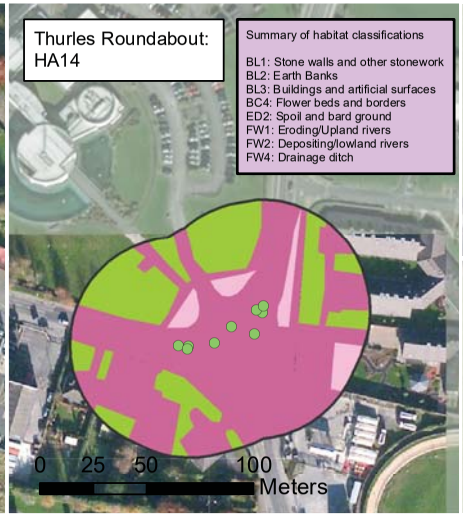

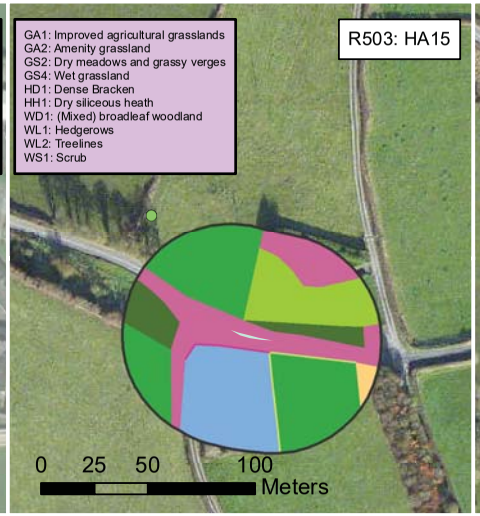

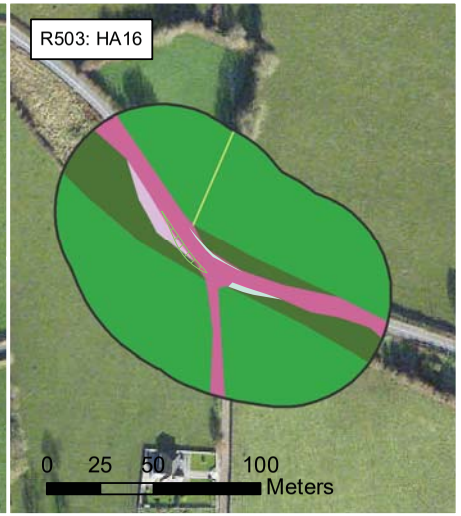

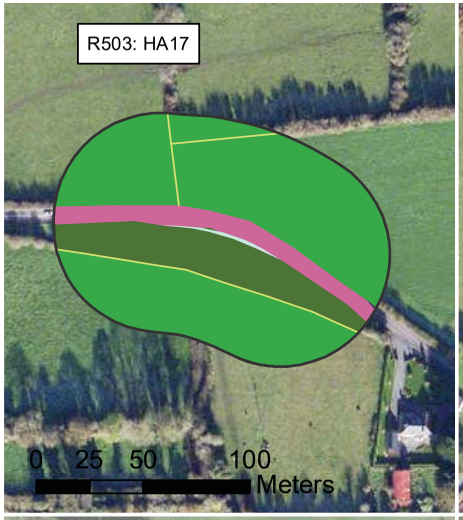

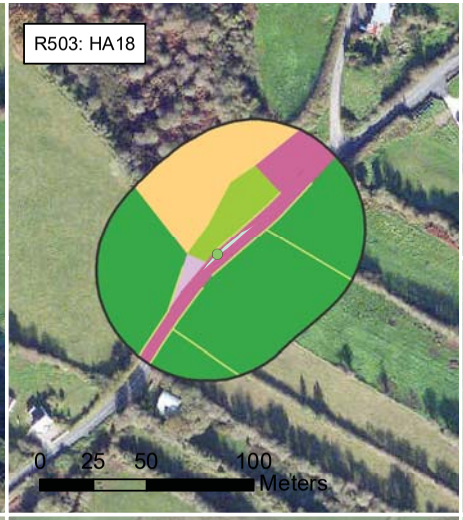

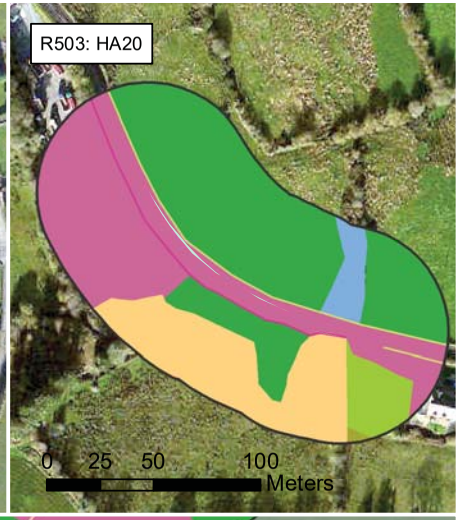

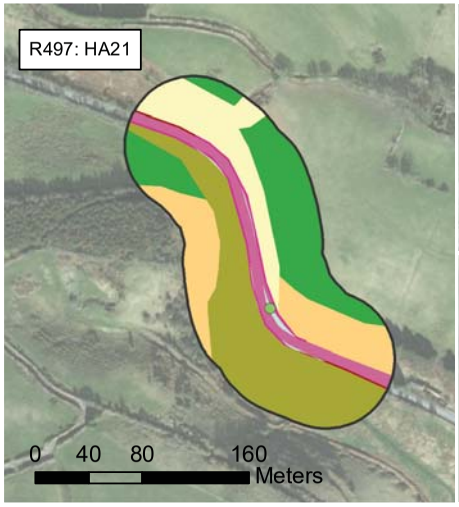

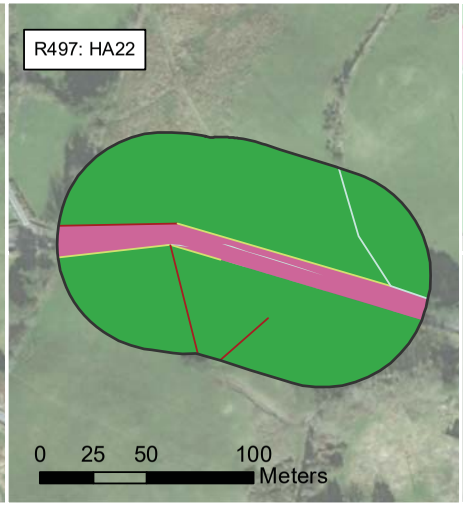

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 4: Other Activities (Habitats, General Birds, Watercourses, Amphibians & Reptiles, Marsh Fritillary) Map 2 of 2

Legend:

- Study Area Boundary (50m)
- BL1
- BL2
- ED2
- FW1
- FW2
- FW4
- GS2
- HD1
- WL1
- WL2
- BC4
- BL3
- ED2
- GA1
- GA2
- GS2
- GS4
- HH1
- WD1
- WS1
- Ancillary Haul Route Activities: Street Furniture
- Ancillary Haul Route Activities: Matting Overlay
- Ancilliary Haul Route Activities: Vegetation Trimming

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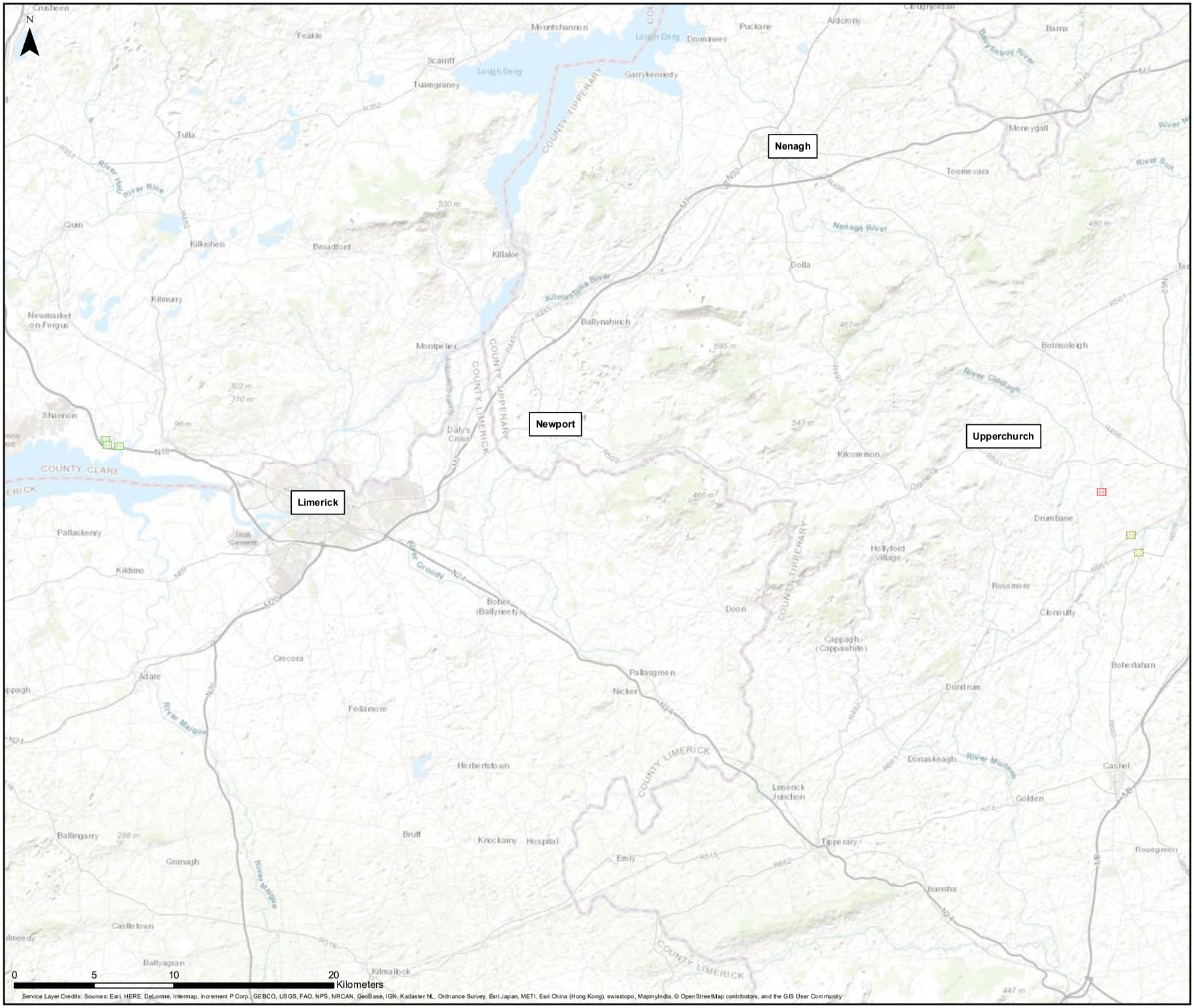

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 5: Other Activities (Bats)

Legend:
Bat Roost Suitability:

Bridges

- High
- Moderate
- Low
- Negligible

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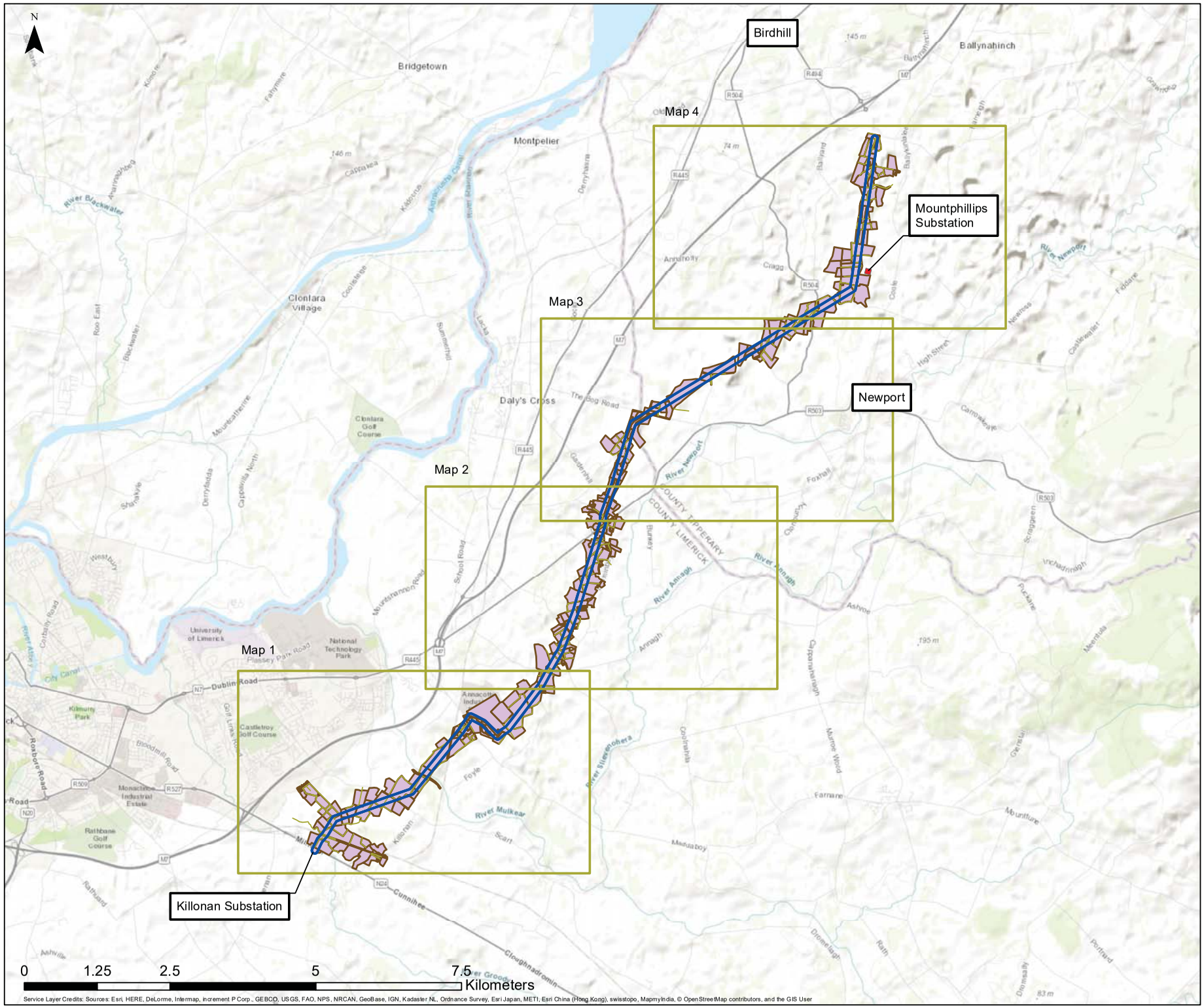

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 6: Other Activities: Terrestrial Habitats along the Killonan OHL Overview Map

Legend:
- Mountphillips Substation
- OHL 50m Buffer
- Linear Habitats
- Habitats

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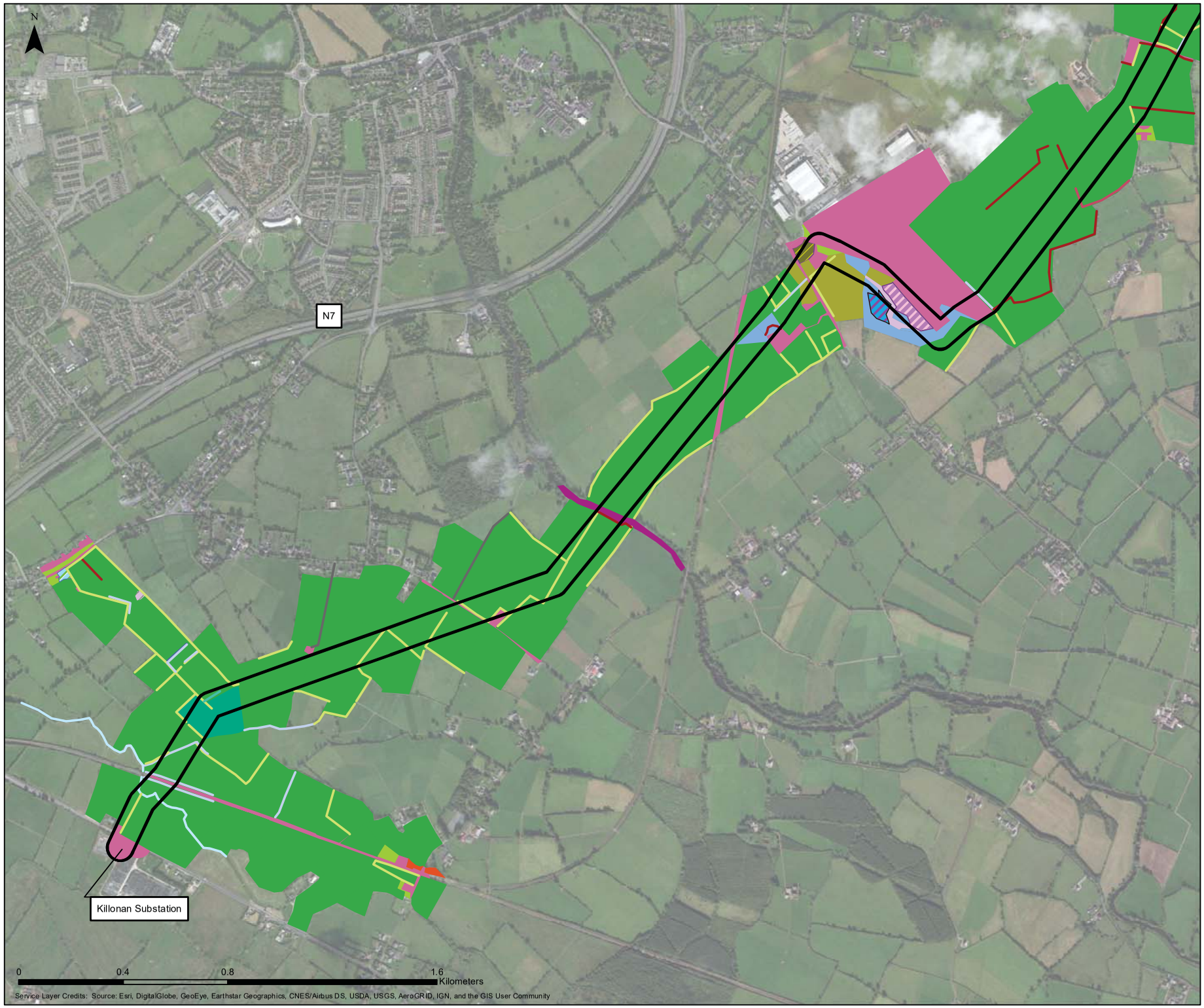

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 6: Other Activities: Terrestrial Habitats along the Killonan OHL
Map 1 of 4

Legend:

- OHL 50m Buffer
- BL3
- FW2
- FW4
- WL1
- WL1/BL1
- WL2
- WL2/BL2
- WL2/FW4
- BL2/ED2
- BL3
- ED2
- ED2/ED3
- FW2
- GA1
- GA1/GS4
- GA2
- GS4
- WD1/GS4
- WL2
- WS1
- WS1/ED2
- WS1/WS2

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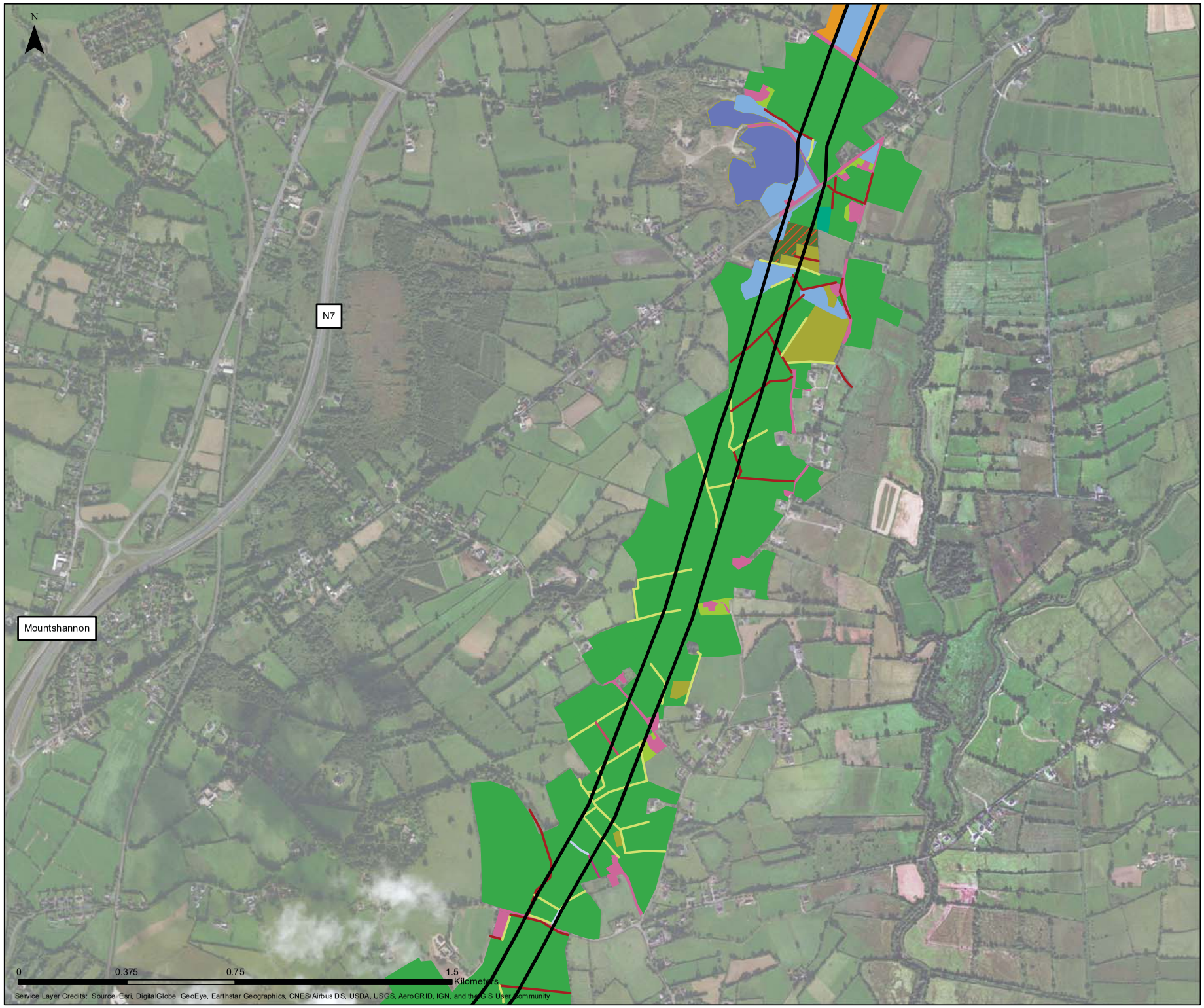

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 6: Other Activities: Terrestrial Habitats along the Killonan OHL
Map 2 of 4

Legend:

- OHL 50m Buffer
- BL2
- FW4
- WL1
- WL1/FW4
- WL2
- WL2/BL2
- BL3
- ED3
- FL8
- GA1
- GA1/GS4
- GA2
- GS4
- WD2
- WN6
- WS1

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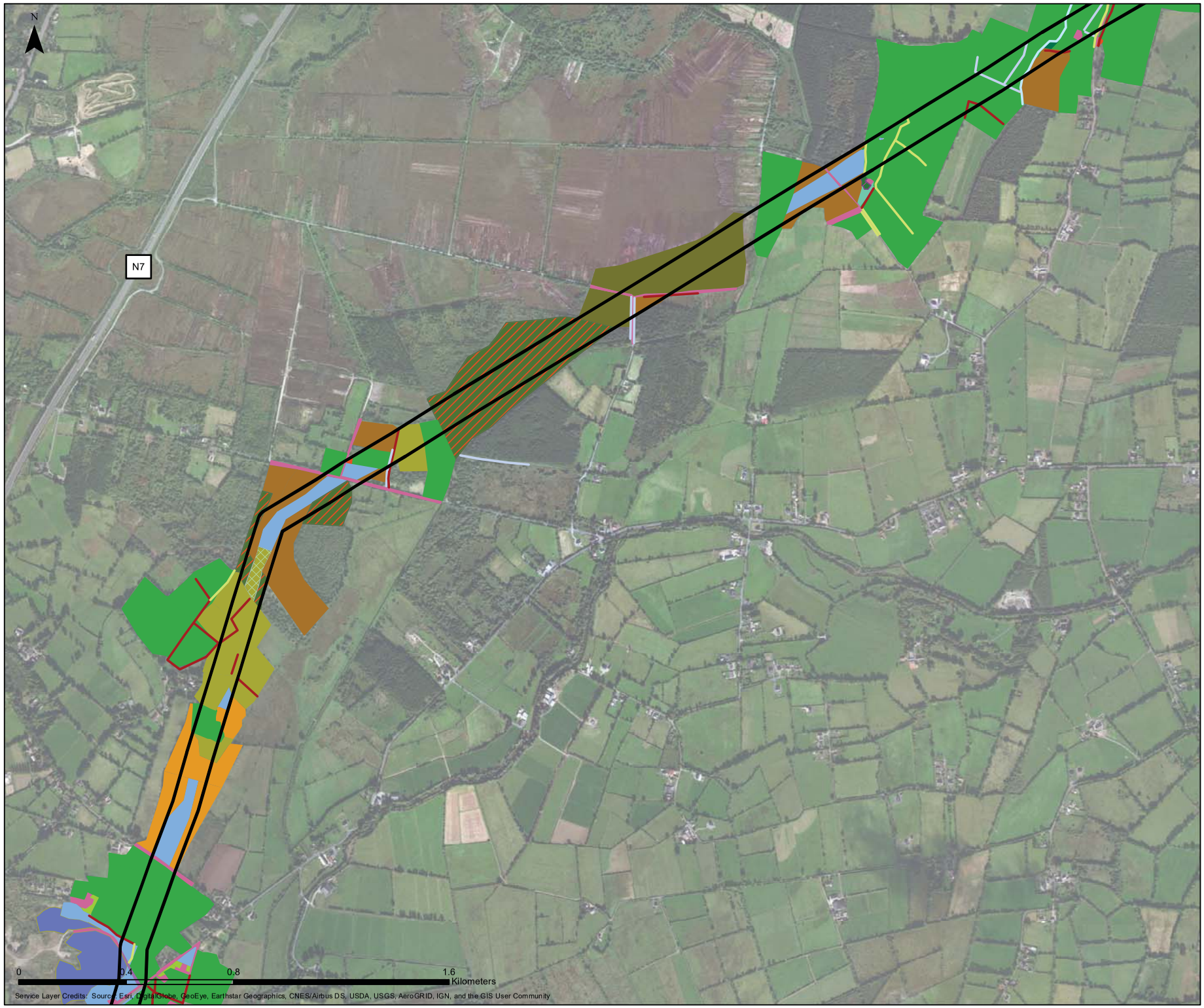

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 6: Other Activities: Terrestrial Habitats along the Killonan OHL
Map 3 of 4

Legend:

- OHL 50m Buffer
- BL2
- FW2
- FW4
- WL1
- WL2
- BL3
- ED3
- FL8
- GA1
- GA1/ED2
- GA1/WS1
- GA2
- GM1
- GS4
- PB4
- WD2
- WD4
- WL2
- WN2
- WN6
- WS1
- WS1/BL3

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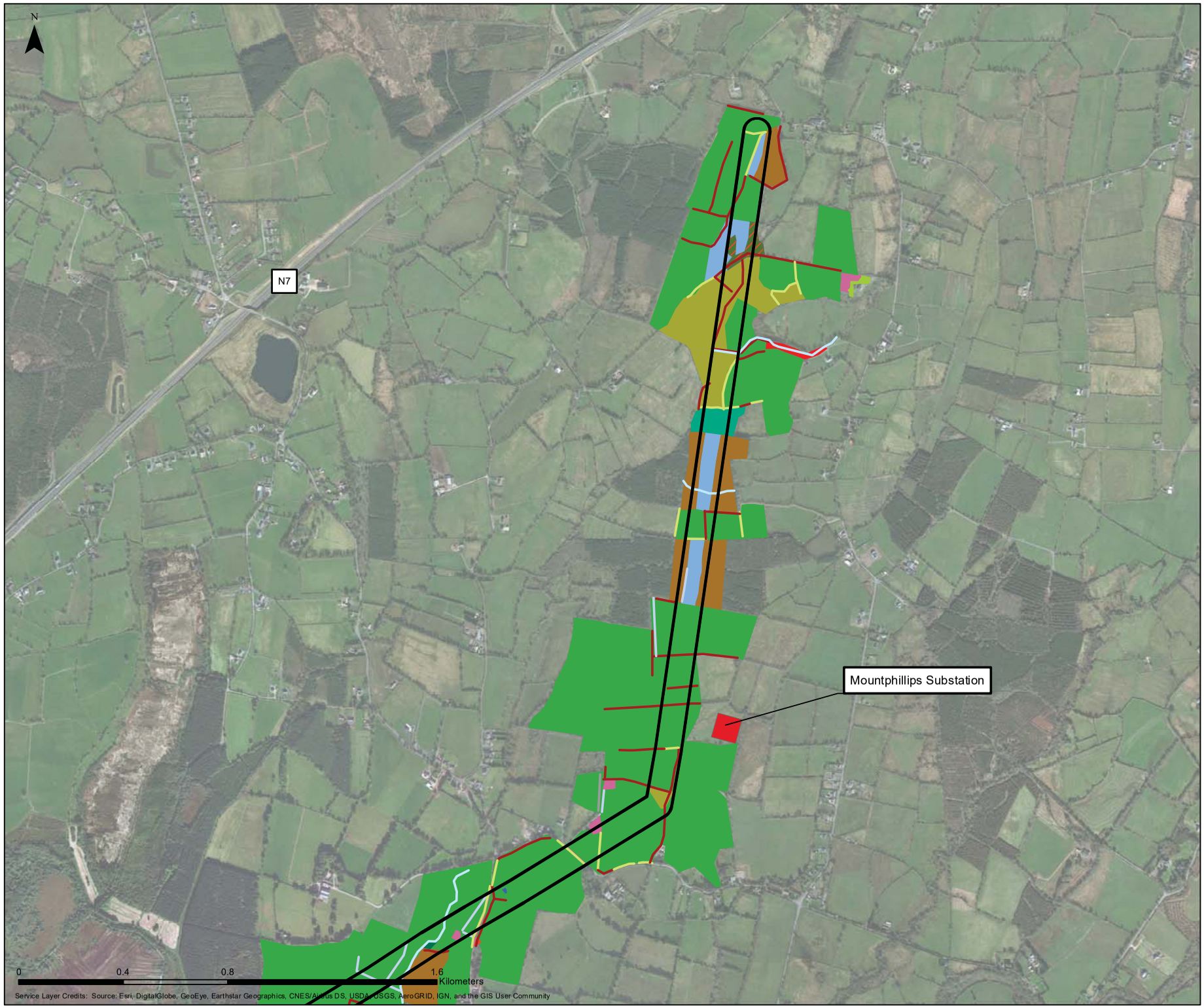

Client: Ecopower Developments Ltd.

Project: Whole Windfarm Project

Title:
Figure A8 - 6: Other Activities: Terrestrial Habitats along the Killonan OHL
Map 4 of 4

Legend:

- Mountphillips Substation
- OHL 50m Buffer
- BL2
- FW2
- FW4
- WL1
- WL2
- BL3
- FL5
- GA1
- GA1/GS4
- GA1/WS1
- GA2
- GS4
- WD4
- WL2
- WN5
- WN6
- WS1

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A8-1.7 Confidential Annex

The Confidential Annex contains highly sensitive information on protected species that are vulnerable to persecution. It may be reviewed by the planning officers of the Competent Authorities and by the Statutory Consultees (e.g. the National Parks and Wildlife Service), but should not be published on any online system or made available in any other public format.

The Confidential Annex is not for general public dissemination due to its highly sensitive nature.

It is therefore not included in this public copy of Appendix 8.1.

Members of the public can view this confidential annex, upon appointment, at the premises of the Competent Authority

Appendix to Chapter 9: Land

No Appendices for Chapter 9

Appendix to Chapter 10: Soils

The data and descriptions in this appendix have informed Chapter 10: Soils of the EIA Report, in relation to the Lower River Shannon SAC, Bleanbeg Bog NHA and Local Soils, Subsoils & Bedrock.

The information presented in this Appendix 10.1 is outlined below and the relevant element(s) of the Whole UWF Project are also identified.

Appendix 10.1 Section	Section Heading	Relevant Individual Project Element
A10.1	Trail Hole Investigations	UWF Grid Connection
A10.2	Borehole Investigations	UWF Grid Connection
A10.3	Peat Stability Assessment	UWF Grid Connection
A10.4	Consented Upperchurch Windfarm Site Investigation Data	UWF Related Works Upperchurch Windfarm
A10.5	Geophysical Survey Report	UWF Grid Connection

Appendix 10.1: Trial Hole Investigations

HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-01

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 21/01/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 172290
NORTHING: 164486
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
				-0.40			Firm, greyish brown to grey SILT - SILT/CLAY (with some orange mottling)
				-0.80			Firm to very firm, orange/brown slightly gravelly CLAY (with minor sand discontinuities)
				-2.00	1		Soft to firm, grey, gravelly sandy CLAY with some cobbles (wet, groundwater seepage below approx 1mbgl, layer unstable)
				-3.00	2		Firm, greyish brown, slightly gravelly, sandy CLAY with some cobbles and boulders Bedrock not met
					3		End of Hole @ 3mbgl. Total Depth of Trial Pit

REMARKS:

Suspected old stone land drain with minor inflows intercepted at 0.7mbgl

PIT LENGTH: 3m
PIT BREADTH:
FINAL DEPTH: 3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-02

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 21/01/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 172280
NORTHING: 164455
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
							Firm, grey SILT (with some orange mottling)
				-0.60			Firm to very firm, greyish brown, slightly gravelly, sandy CLAY with some cobbles Refusal at 2.7m due to dense ground and boulders
					1		
					2		
				-2.70			End of Hole @ 2.7mbgl.
					3		Total Depth of Trial Pit

REMARKS:

Suspected old stone land drain with minor inflows intercepted at 0.8mbgl

PIT LENGTH: 2.7m
PIT BREADTH:
FINAL DEPTH: 2.7mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-03

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 193931
NORTHING: 160306
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
				-0.50			Dark brown to black, soft, slightly gravelly SILT/CLAY (high organic content).
				-1.50	1		Orange brown, firm, slightly gravelly SILT with some angular cobbles.
							End of Hole @ 1.5mbgl.
							Total Depth of Trial Pit

REMARKS:

Dry hole.

PIT LENGTH: 1.5m
PIT BREADTH:
FINAL DEPTH: 1.5mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-04

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 192301
NORTHING: 159854
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
				-0.50			Dark brown, firm SILT/CLAY.
				-1.30	1		Orange brown, soft to firm, slightly gravelly SILT with some angular cobbles.
							End of Hole @ 1.3mbgl.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-05

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 191819
NORTHING: 159916
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
					1		Orange brown, firm, slightly gravelly SILT/CLAY with angular cobbles more frequent with depth.
				-1.20			Top of weathered bedrock.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.2m
PIT BREADTH:
FINAL DEPTH: 1.2mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-06

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 191059
NORTHING: 160198
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
				-0.70			Orange brown, firm, gravelly SILT/CLAY.
				-1.20	1		Greyish brown, very firm, gravelly SILT/CLAY with angular cobbles.
							Top of weathered bedrock.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.2m
PIT BREADTH:
FINAL DEPTH: 1.2mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-07

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 189843
NORTHING: 159993
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			**Peaty Topsoil**
					1		Grey, very soft SILT (alluvium)
				-2.00	2		End of hole @ 2.0mbgl Total Depth of Trial Pit

REMARKS:
Groundwater seepage from Silt

PIT LENGTH: 2.0m
PIT BREADTH:
FINAL DEPTH: 2.0mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-08

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 188506
NORTHING: 160524
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			**Peaty Topsoil**
				-0.30			Red brown, soft, slightly sandy SILT.
					1		Greyish brown, slightly sandy SILT with angular cobbles.
				-1.50			Top of weathered bedrock.
							Total Depth of Trial Pit

REMARKS:

Dry hole.

PIT LENGTH: 1.5m
PIT BREADTH:
FINAL DEPTH: 1.5mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-09

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 188585
NORTHING: 159497
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
				-0.40			Reddish brown, firm SILT/CLAY.
				-1.30	1		Greyish brown, firm, slightly gravelly SILT/CLAY with angular cobbles.
							Top of weathered bedrock.
							Total Depth of Trial Pit

REMARKS:

Dry hole.

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-10

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 187731
NORTHING: 160533
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Peaty Topsoil**
				-0.30			Reddish brown, soft SILT.
					1		Reddish grey, firm, gravelly SILT with angular cobbles.
				-1.50			Top of weathered bedrock.
					2		Total Depth of Trial Pit

REMARKS:

Dry hole.

PIT LENGTH: 1.5m
PIT BREADTH:
FINAL DEPTH: 1.5mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-11

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 186940
NORTHING: 160668
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							Reddish brown, gravelly SILT.
				-0.40			Loose weathered SHALE with high silt content.
					1		
				-1.30			End of hole@ 1.3mbgl.
							Total Depth of Trial Pit

REMARKS:

Dry hole.

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-12

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 185863
NORTHING: 160192
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Topsoil.
					1		Brown, firm, sandy, gravelly SILT with angular cobbles.
				-1.50			Top of weathered bedrock.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.5m
PIT BREADTH:
FINAL DEPTH: 1.5mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-13

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 184881
NORTHING: 160530
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							Peaty Topsoil.
				-0.20			Orange brown, soft to firm, gravelly SILT.
					1		
				-1.40			End of hole @1.4mbgl.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-14

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 184159
NORTHING: 160722
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			**Peaty Topsoil.**
					1		Orange brown, firm, sandy gravelly SILT/CLAY.
				-1.40			End of hole @1.4mbgl.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-15

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 01/02/2016
LOGGED BY: D. Broderick
CONTRACTOR:

EASTING: 183871
NORTHING: 161597
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Peaty Topsoil.**
					1		Orange brown, soft to firm, gravelly SILT.
				-1.40			Top of weathered bedrock.
							Total Depth of Trial Pit

REMARKS:

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-16

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 182977
NORTHING: 162125
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							Peaty Topsoil.
				-0.30			Reddish brown, firm, slightly gravelly SILT.
					1		
				-1.40			End of Hole @1.4mbgl
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-17

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 182439
NORTHING: 161862
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							Topsoil
				-0.15			Silty, sandy GRAVELS (fluvial).
					1		
				-1.30			End of Hole @1.3mbgl
							Total Depth of Trial Pit

REMARKS:

Groundwater Inflows 1m below ground level.

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-18

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 181796
NORTHING: 162308
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**TOPSOIL**
				-0.50			Light brown, soft, sandy SILT.
				-1.60	1		Grey, silty, sandy GRAVEL.
							End of Hole @1.6mbgl Total Depth of Trial Pit
					2		

REMARKS:
Dry hole.

PIT LENGTH: 1.6m
PIT BREADTH:
FINAL DEPTH: 1.6mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-19

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 181005
NORTHING: 161776
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Thin Topsoil.
							Grey, soft, slightly gravelly, sandy SILT.
				-0.90			
					1		Grey, firm, silty, sandy GRAVEL.
				-1.40			
							End of Hole @1.4mbgl
							Total Depth of Trial Pit

REMARKS:
Groundwater inflows from gravel.

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-20

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 180153
NORTHING: 162220
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Peaty Topsoil
				-0.30			Red brown, soft, gravelly SILT.
							Broken weathered rock.
					1		
				-1.20			End of hole @1.2mbgl
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.2m
PIT BREADTH:
FINAL DEPTH: 1.2mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-21

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 179818
NORTHING: 162466
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			Peat
				-0.30			Grey, firm CLAY.
					1		Purple/beige, firm, sandy, gravelly CLAY.
				-1.80	2		End of Hole @1.8mbgl Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.8m
PIT BREADTH:
FINAL DEPTH: 1.8mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-22

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 180325
NORTHING: 161912
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							Peat
				-0.40			Red brown, very firm, slightly sand, gravelly SILT with angular cobbles.
					1		
				-1.40			Top of weathered rock.
							Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-23

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 180308
NORTHING: 163225
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.20			Peaty Topsoil.
					1		Orange/grey, soft to firm, sandy CLAY (with tree roots).
				-1.90	2		End of Hole @1.9mbgl Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.9m
PIT BREADTH:
FINAL DEPTH: 1.9mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-24

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 178210
NORTHING: 163052
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Peaty Topsoil.
				-0.30			Purple/grey, soft, slightly sandy, silty SAND.
				-1.20	1		Broken, blocky SANDSTONE/SILTSTONE.
							End of Hole @1.2mbg
							Total Depth of Trial Pit

REMARKS:
Groundwater seepage from broken rock.

PIT LENGTH: 1.2m
PIT BREADTH:
FINAL DEPTH: 1.2mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-25

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 176895
NORTHING: 163156
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			Peaty Topsoil.
				-0.30			Dark brown, soft, slightly sandy SILT.
				-1.20	1		Red brown, firm, gravelly, sandy SILT with rounded cobbles and boulders.
							End of Hole @1.2mbg Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.2m
PIT BREADTH:
FINAL DEPTH: 1.2mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-26

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 173046
NORTHING: 164854
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
				-0.60			Beige brown, soft to firm, sandy SILT.
				-1.30	1		Grey, soft, silty SAND.
							End of Hole @1.3mbg Total Depth of Trial Pit

REMARKS:
Dry hole.

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-27

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 02/02/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradwshaw

EASTING: 172672
NORTHING: 163926
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
					1		Reddish brown, soft to firm, sandy SILT.
				-1.30			End of Hole @1.3mbgl Total Depth of Trial Pit

REMARKS:

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-28

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 09/06/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 176432
NORTHING: 163667
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.30			**Topsoil**
				-0.70			**SILT** Firm, light grey, sandy SILT
			Groundwater inflow	-1.60	1		**SILT** Soft to firm, reddish brown gravelly sandy SILT with rounded to sub rounded cobbles of sandstone.
					2		End of hole @1.6mbgl Total Depth of Trial Pit

REMARKS:
Groundwater inflow below 1.2m

PIT LENGTH: 1.6m
PIT BREADTH:
FINAL DEPTH: 1.6mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-29

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 09/06/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 175413
NORTHING: 164150
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**Topsoil**
							Redish brown soft tofirm SILT/CLAY with angular to sub-angular cobbles of sandstone. Dry.
				-1.00	1		End of hole @1.0mbgl
							Total Depth of Trial Pit

REMARKS:

PIT LENGTH: 1m
PIT BREADTH:
FINAL DEPTH: 1.0mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-30

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 09/06/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 174372
NORTHING: 164265
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.30			**Topsoil** Soft to firm, reddish brown SILT/CLAY
			Groundwater inflow		1		**SILT** Soft to firm slightly gravell, sandy SILT
				-1.70			End of hole @1.7mbgl
					2		Total Depth of Trial Pit

REMARKS:
Groundwater inflow below 1.2m

PIT LENGTH: 1.7m
PIT BREADTH:
FINAL DEPTH: 1.7mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-31

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 09/06/2016
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 172979
NORTHING: 164498
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			**TOPSOIL**
					1		**SILT/CLAY** Firm, orange/brown, slightly sandy SITL/CLAY with some rounded to sub-rounded limestone cobbles
				-1.60	2		Total Depth of Trial Pit

REMARKS:

PIT LENGTH: 1.6m
PIT BREADTH:
FINAL DEPTH: 1.6mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-32

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 193245
NORTHING: 160061
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.30			**TOPSOIL** Dark brown TOPSOIL
				-1.40	1		**SILT/CLAY** Orange/red, firm to very firmgravelly SILT/CLAY
					2		End of hole @1.4mbgl Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-33

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 191696
NORTHING: 159478
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							PEAT Dry fibrous PEAT
				-0.45			**SILT** Orange, soft to firm SILT with angular to sub-angular clasts
				-1.00	1		**SILT** Light grey, soft to firm slightly sandy SILT
				-1.20			End of hole @1.2mbgl Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 1.2m
PIT BREADTH:
FINAL DEPTH: 1.2mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-34

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 190807
NORTHING: 159681
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							SILT/CLAY Weathered, loose shaley bedrock ith some red/brown SILT/CLAY
					1		
				-1.40			End of hole @1.4mbgl
							Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-35

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 183224
NORTHING: 161013
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			**TOPSOIL** Dark brown TOPSOIL
				-0.80			**SILT/CLAY** Reddish brown, firm SILT/CLAY with occasional angular to sub-angular clasts Refusal on bedrock
					1		End of hole @0.8mbgl Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 0.8m
PIT BREADTH:
FINAL DEPTH: 0.8mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-36

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 182158
NORTHING: 161995
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.15			**TOPSOIL** Dark brown TOPSOIL
				-0.40			**SILT/CLAY** Dark grey SILT/CLAY
				-1.10	1		**SILT/CLAY** Reddish orange, very firm sandy, gravelly SILT/CLAY with angular to sub-angular clasts
							End of hole @1.1mbgl
							Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 1.1m
PIT BREADTH:
FINAL DEPTH: 1.1mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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TRIAL PIT LOG

TRIAL PIT NUMBER: TH-37

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 178579
NORTHING: 163048
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
							SILT Light brown, firm sandy SILT
				-0.30			**SILT/CLAY** Reddish brown, very firm, slightly gravelly, sandy SILT/CLAY with angular to sub-angular clasts
					1		
				-1.40			End of hole @1.4mbgl Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

PAGE 1 of 1

SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-38

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 178460
NORTHING: 163081
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.30			**SILT** Light grey, firm SILT
				-1.30	1		**SILT/CLAY** Reddish brown, very firm, slightly gravelly, sandy SILT/CLAY with abundant angular clasts
							End of hole @1.3mbgl Total Depth of Trial Pit

REMARKS:
Dry hole

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-39

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 173672
NORTHING: 164337
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**TOPSOIL**
				-0.70			**SILT/CLAY** Brown, firm sandy SILT/CLAY
				-1.30	1		**GRAVEL** Greyish brown, dense, silty sandy GRAVEL (fluvial deposits) with rounded cobbles
							End of hole @1.3mbgl
							Total Depth of Trial Pit

REMARKS:
Groundwater inflows below 1.1m

PIT LENGTH: 1.3m
PIT BREADTH:
FINAL DEPTH: 1.3mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-40

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 172552
NORTHING: 164494
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**TOPSOIL**
				-0.40			**SILT/CLAY** Brown, firm SILT/CLAY
				-0.65			**CLAY** Light grey, very firm to stiff CLAY
				-1.40	1		**CLAY** Greyish brown, very firm to stiff, slightly gravelly CLAY with sub-rounded to angular cobbles
							End of hole @1.4mbgl Total Depth of Trial Pit

REMARKS:

Lots of orange mottling in the clay (poor drainage)
Dry hole

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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HYDRO-ENVIRONMENTAL SERVICES

TRIAL PIT LOG

TRIAL PIT NUMBER: TH-41

PROJECT NUMBER: P1299-2
SITE: Upperchurch Grid Connection
CLIENT: Ecopower Developments Ltd.

DATE STARTED: 05/05/2017
LOGGED BY: D. Broderick
CONTRACTOR: James Bradshaw

EASTING: 172550
NORTHING: 164519
ELEVATION:

Comments	Sample Number	Sample Type	Water Strikes	Elevation	Meters Below Ground Surface	Lithology	Formation Description
				0.00	0		Ground Surface
				-0.10			**TOPSOIL**
				-0.40			**SILT** Dark grey, firm slightly sandy SILT
				-1.40	1		**CLAY** Orange brown, very firm to stiff slightly gravelly CLAY
							End of hole @1.4mbgl Total Depth of Trial Pit

REMARKS:

Lots of orange mottling in the clay (poor drainage)
Dry hole

PIT LENGTH: 1.4m
PIT BREADTH:
FINAL DEPTH: 1.4mbgl
EXCAVATOR:

LEGEND
∇ - Water strike
D - Disturbed sample
B - Bulk disturbed sample
W - Water sample
V - Vane test
T - No. of threads
R - Average length of ribbons
Dil - Dilatancy recorded
ND - No dilatancy recorded

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SCALE As shown

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Appendix to Chapter 10: Soils

Appendix 10.2: Borehole Investigations

APPENDIX 10.2
to EIAR Chapter 10: Soils

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
GW	RC01
Logged By:	Sheet 1 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	17/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
								Open hole boring. Driller described: Sandy Clay.	1
		1.50	SPT	N=5 (3,2/0,2,2,1)	1.50			Open hole boring. Driller described: Sandy gravelly Clay.	2
					2.30			Open hole boring. Driller described: Grey Silt.	3
		3.00	SPT	N=9 (1,0/0,1,3,5)					4
					4.10			Open hole boring. Driller described: Silty sandy Gravel.	5
		4.50	SPT	N=13 (3,3/2,4,3,4)					6
		6.00	SPT	N=11 (2,0/2,3,3,3)					7
					6.60			Open hole boring. Driller described: Yellow, sandy Clay.	8
		7.50	SPT	N=25 (4,5/6,6,5,8)					9
		9.00	SPT	N=22 (4,3/2,6,8,6)					

Continued on Next Sheet

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	17/05/2016 08:00	0.00	Start of shift.
Dry	17/05/2016 18:00	10.00	End of borehole.

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
GW	RC01
Logged By:	Sheet 2 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	17/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		10.00	SPT	N=58 (7,8/11,14,12,21)	10.00			End of Borehole at 10.00m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	17/05/2016 08:00	0.00	Start of shift.
Dry	17/05/2016 18:00	10.00	End of borehole.

pgl priority geotechnical
Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
HW	**RC02**
Logged By:	Sheet 1 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	18/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								Open hole boring. Driller described: Sandy Clay.
					1.10			Open hole boring. Driller described: Sandy Gravel.
		1.50	SPT	N=4 (3,1/0,1,1,2)				
					2.50			Open hole boring. Driller described: Clay.
		3.00	SPT	N=4 (2,2/1,1,1,1)	3.00			Open hole boring. Drliller described: Grey yellow Clay.
		4.50	SPT	N=7 (1,4/2,2,1,2)				
		6.00	SPT	N=13 (2,5/5,3,2,3)				
		7.50	SPT	N=6 (4,1/1,3,1,1)				
		9.00	SPT	N=25 (2,8/6,6,7,6)				

Continued on Next Sheet

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	18/05/2016 08:00	0.00	Start of shift.
Dry	18/05/2016 18:00	10.00	End of borehole.

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
HW	**RC02**
Logged By:	Sheet 2 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	18/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		10.00	SPT	N=28 (4,4/5,6,8,9)	10.00			End of Borehole at 10.00m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	18/05/2016 08:00	0.00	Start of shift.
Dry	18/05/2016 18:00	10.00	End of borehole.

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
HW	RC03
Logged By:	Sheet 1 of 2

Project Name: Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location: Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client: Ecopower		**Date:** 18/05/2016 -	

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		1.50	SPT	N=31 (6,9/8,7,7,9)				Open hole boring. Driller described: Sandy clayey Gravel with cobble content.
					2.80			Open hole boring. Driller described: Sandy Clay.
		3.00	SPT	N=5 (2,1/1,1,2,1)	3.00			Open hole boring. Driller described: Yellow, silty Sand.
		4.50	SPT	N=5 (1,0/1,1,2,1)				
		6.00	SPT	N=15 (2,6/9,4,1,1)				
					6.80			Open hole boring. Driller described: Sandy gravelly Clay.
		7.50	SPT	N=7 (2,2/1,2,2,2)	7.50			Open hole boring. Driller described: Sandy Clay.
		9.00	SPT	N=40 (4,9/8,10,10,12)				

Continued on Next Sheet

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	18/05/2016 08:00	0.00	Start of shift.
Dry	18/05/2016 18:00	10.00	End of borehole.

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
HW	RC03
Logged By:	Sheet 2 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	18/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		10.00	SPT	N=20 (6,4/3,5,5,7)	10.00			End of Borehole at 10.00m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	18/05/2016 08:00	0.00	Start of shift.
Dry	18/05/2016 18:00	10.00	End of borehole.

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
GW	**RC04**
Logged By:	Sheet 1 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	18/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
								Open hole boring. Driller described: Sandy Gravel with cobble content.	1
		1.50	SPT	32 (6,6/32 for 225mm)					2
		3.00	SPT	N=46 (5,5/11,14,10,11)					3
					3.50			Open hole boring. Driller described: Gravelly sandy Clay.	4
		4.50	SPT	N=28 (3,3/5,6,8,9)					5
		6.00	SPT	N=5 (4,1/0,1,1,3)					6
		7.50	SPT	N=7 (2,2/2,1,2,2)					7
									8
		9.00	SPT	N=22 (1,0/3,4,6,9)					9

Continued on Next Sheet

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	18/05/2016 08:00	0.00	Start of shift.
Dry	18/05/2016 18:00	10.00	End of borehole.

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
GW	RC04
Logged By:	Sheet 2 of 2

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RO
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	18/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		10.00	SPT	0 (18,25/0 for 0mm)	10.00			End of Borehole at 10.00m

10 11 12 13 14 15 16 17 18

Groundwater:

Struck	Rose to	After	Sealed	Comment
				None encountered.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
10.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 10.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	18/05/2016 08:00	0.00	Start of shift.
Dry	18/05/2016 18:00	10.00	End of borehole.

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
GW	RC05
Logged By:	Sheet 1 of 1
AH	

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RC
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	19/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								Open hole boring. Driller described: Sandy Clay.
					0.60			Open hole boring. Driller described: Sandy gravelly Clay.
		1.50	SPT	N=45 (6,8/13,10,10,12)	1.60			Open hole boring. Driller described: Gravel.
					2.70			Open hole boring. Driller described: Sandy Gravel with boulder content.
		3.00	SPT	0 (75 for 20mm/0 for 0mm)	3.00			Open hole boring. Driller described: Sand with boulder content.
	▼				3.40			Open hole boring. Driller described: Rock. Assumed Sandstone.
		3.60	SPT	0 (75 for 2mm/0 for 0mm)	3.60			Lithology: Weak to moderately weak, dark red, fine to medium grained SANDSTONE with cross bedding and carbonaceous deposits. Weathering: Slightly weathered with orange oxidation colouration, clay smearing on fracture surfaces and minor loss of strength in part. Fracturing: 2 apparent sets. Set 1 dipping 15 degrees with planar smooth to planar rough fracture surfaces and close spacing. Set 2 is dipping 30 to 40 degrees with undulating smooth to undulating rough fracture surfaces and close spacing. *Non-intact.* *Carbonate calcretes, 2cm dia.* *Cross bedding.*
					6.60			End of Borehole at 6.60m

Groundwater:

Struck	Rose to	After	Sealed	Comment
3.40				See shift data.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
6.60		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated ta 6.60m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	19/05/2016 08:00	0.00	Start of shift.
3.4	19/05/2016 18:00	6.60	End of borehole.

REFERENCE DOCUMENTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Drilled By:	Borehole No.
GW	**RC06**
Logged By:	Sheet 1 of 1
AH	

Project Name:	Upperchurch Windfarm	**Project No.** P16074	**Co-ords:**	**Hole Type** RC
Location:	Upperchurch Windfarm, Co Tipperary.		**Level:**	**Scale** 1:50
Client:	Ecopower		**Date:**	20/05/2016 -

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		1.50	SPT	N=6 (2,1/1,1,2,2)				Open hole boring. Driller described: Slightly peaty Sand.
					2.10			Open hole boring. Driller described: Sandy Gravel.
	▼				2.70			Open hole boring. Driller described: Rock. Assumed Sandstone.
		3.00	SPT	0 (75 for 0mm/0 for 0mm)	3.00			Lithology: Weak to moderately strong, thinly laminated dark red, fine to medium grained SANDSTONE with carbonaceous rich laminae. Weathering: Slightly weathered with minor orange oxidation colouration, apparent loss of strength in part, surface colour bleaching and clay smearing on fracture surfaces. Fractures: 1 apparent set dipping 0 - 10 degrees with planar smooth to planar rough fracture surfaces and close to very close spacing. *Carbonaceous calcretes.*
					6.00			End of Borehole at 6.00m

1 2 3 4 5 6 7 8 9

Groundwater:

Struck	Rose to	After	Sealed	Comment
2.80				See shift data.

Hole Information:

Hole Depth (m)	Hole Diameter (mm)	Casing Diameter (mm)
6.00		

Equipment & Methods: Deltabase 520.

Remarks:

Borehole terminated at 6.00m bgl.

Shift Data:

Groundwater	Shift	Hole Depth	Remarks
	20/05/2016 08:00	0.00	Start of shift.
2.8	20/05/2016 18:00	6.00	End of borehole.

Photographic Record

Number:	**RC05_1**	**Project** Upperchurch Winderfarm **Project No** P16074 **Engineer** Ecopower	

Number:	**RC06_1**	**Project** Upperchurch Winderfarm **Project No** P16074 **Engineer** Ecopower	

Appendix to Chapter 10: Soils

Appendix 10.3: Peat Stability Assessment

REFERENCE DOCUMENTS

APPENDIX 10.3
PEAT STABILITY ASSESSMENT

REPORT ON

PEAT STABILITY APPRAISAL AND GEOTECHNICAL DESIGN

FOR

UWF GRID CONNECTION

(MOUNTPHILIPS TO UPPERCHURCH 110KV UGC)

CO. TIPPERARY

Prepared for:

Ecopower Developments Ltd

December 2017

AGEC Ltd
The Grainstore
Singletons Lane
Bagenalstown
Co. Carlow
R21 XA66

E-mail: info@agec.ie

DOCUMENT APPROVAL FORM

Document title:	Report on Peat Stability Appraisal and Geotechnical Design for UWF Grid Connection (Mountphilips To Upperchurch 110kV UGC) Co. Tipperary		
File reference Number:	1719_041	Document Revision No.	1

File Reference Number	Document Revision No.	Amendment / Comment
1719_018	0	Draft – for comment
1719_041	1	Final

Task	Nominated authority	Approved (signature)
Prepared by	Author(s): Billy Murphy	Billy Murphy
Checked by	Geotechnical Project Manager: Paul Jennings	Paul Jennings
Approved by	Geotechnical Project Director: Turlough Johnston	T. Johnston
Quality check	Quality Manager: Marion English	Marion English

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1 INTRODUCTION

1.1 Peat Failure

Peat failure in this report refers to a significant mass movement of a body of peat that would have an adverse impact on proposed activities and the surrounding environment. Peat failure excludes localised movement of peat such as creep movement or erosion type events.

1.2 Background

The activities for the UWF Grid Connection will include the construction of a 28km long underground 110kV grid connection (referred to herein as the 'Mountphilips to Upperchurch 110kV UGC' or the '110kV UGC') which will connect the new Mountphilips Substation near Newport town to the Upperchurch Windfarm substation in Knockcurraghbola Commons near Upperchurch village. The 110kV UGC is routed in a west-east alignment through the Silvermine Mountains between Upperchurch and Newport, Co. Tipperary.

Applied Ground Engineering Consultants Ltd (AGEC) was engaged in May 2016 by Ecopower Developments Ltd (Ecopower) to undertake an appraisal of peat stability and geotechnical design for the Mountphilips to Upperchurch 110kV Underground Cables.

Most of the route of the 110kV UGC is within non-peat areas. Where peat is present it is generally thin with peat thickness ranging from about 0.25m to 1m along about 4.7km of the route. Deeper peat occurs in the Castlewaller/Killeen forestry lands which occurs over about 0.8km length of the total 28km long route.

A walkover inspection of the site was carried out by AGEC in May 2016, February and May 2017. Peat data recorded by AGEC was used in the appraisal of peat stability and geotechnical design for the 110kV UGC.

In the main EIA Report, the route of the 110kV UGC is broken into a number of sections, the relevant section number is used in this report along with the various peat depth probes (reference points) carried out by AGEC. These peat depth reference points are also used to identify particular locations along the route of the 110kV UGC. The location of the peat depth reference points is shown on Drawings UWFGC_PSAGD_01 to 06.

It is noted that there is deeper peat in the Castlewaller/Killeen forestry, on Section S39 of the 110kV UGC route, where the relevant peat depth reference points are 74 to 87 and 94 to 96. This part of the 110kV UGC route is shown on UWFGC_PSAGD_02. The drawings are included with this report in ~~Chapter 10~~.

1.3 Applied Ground Engineering Consultants

Applied Ground Engineering Consultants (AGEC) was established in 2001 to provide specialist geotechnical and engineering geology advice to the civil engineering industry. Over the years, our service offering has expanded, and we have worked on major projects both nationally and internationally.

AGEC have been involved in over 120 wind farm and related developments in both Ireland and the UK at various stages of development and particularly for sites in soft ground conditions, particularly peat (see ~~Chapter~~ 11 of this report). AGEC are recognised specialists in peat stability appraisal, geohazard mapping in peat land areas, investigation and site appraisal in peat.

1.4 Scope of work

AGEC were requested by Ecopower to carry out the following activities in relation to the appraisal of peat stability and geotechnical design at the site:

(1) Site walkover which included:

- (a) Peat probing to measure depth of peat at various locations along the proposed route (where present)
- (b) Measurement of slope inclination at various locations along the proposed route
- (c) Measurements of indicative peat undrained shear strength (where applicable)
- (d) Mapping of salient qualitative factors, such as geomorphological features
- (e) Identification of areas at low / medium / high risk of peat instability
- (f) Recordings of man-made features from walkover, such as cut-away peat.

(2) Reporting of the following:

- (a) An overview of the ground conditions
- (b) Peat stability appraisal (deterministic and qualitative approach)
- (c) Risk appraisal for the 110kV UGC
- (d) Drawings showing distribution of peat and peat depth along the route
- (e) Recommendations for specific construction considerations to suit the ground conditions to mitigate against potential peat instability risks
- (f) Geotechnical design of the 110kV UGC including peat stability, floating road, peat arising storage and land take requirements
- (g) A construction methodology as well as preliminary design drawings (i.e. typical cable corridor details)

2 OVERVIEW

2.1 Main Approaches to Peat Stability Appraisal

The main approaches for appraising peat stability include the following:

(1) Deterministic (factor of safety)

(2) Qualitative (judgement)

(3) Index / Probabilistic (probability)

(4) Geomorphological

Approaches (2) to (4) listed above would be considered subjective and do not provide a definitive indication of stability; in addition, a high level of judgement / experience is required which makes it difficult to relate the findings to real conditions. AGEC apply a more objective approach, the deterministic approach.

The risk appraisal uses the results of the deterministic approach in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to appraise the risk of instability on a peat land site.

AGEC undertook the appraisal following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2007). The Peat Hazard and Risk Assessment Guide (PHRAG) is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

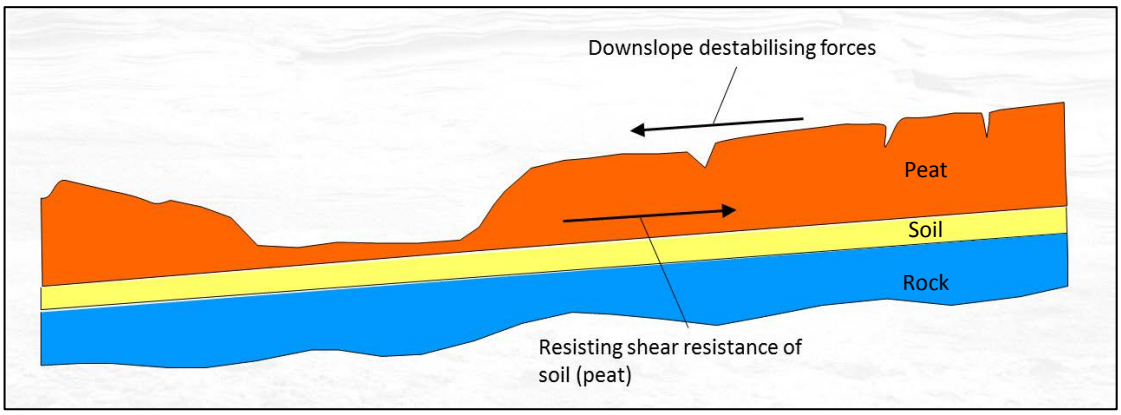
2.2 Deterministic Approach

The peat stability appraisal is carried out across a wide area of peatland to determine the stability of peat slopes and to identify areas of peatland where instability may be an issue. The appraisal provides a numerical value (factor of safety) of the stability of individual parcels of peatland. The findings of the appraisal discriminate between areas of stable and unstable peat, and areas of marginal stability where restrictions may apply.

A deterministic appraisal requires geotechnical information and site characteristics which are obtained from desk study and site walkover, e.g. properties of peat / soil / rock, slope geometry, depth of peat, underlying strata, groundwater, etc. An adverse combination of the factors listed above could potentially result in instability. Using the information above a factor of safety is calculated for the stability of individual parcels of peatland on a site.

The global factor of safety is a measure of the stability of a particular slope. For any slope, the degree of stability depends on the balance of forces between the weight of the peat/soil working downslope (destabilising force) and the inherent strength of the peat/soil (shear resistance) to resist the downslope weight, see Figure 1.

Figure 1 Peat slope showing balance of forces to maintain stability



The global factor of safety provides a direct measure of the degree of stability of a slope and is the ratio of the shear resistance over the downslope destabilising force. Provided the available shear resistance is greater than the downslope destabilising force then the global factor of safety will be greater than 1.0 and the slope will remain stable. If the global factor of safety is less than 1.0, the slope is unstable and liable to fail. The acceptable range for global factor of safety is typically greater than 1.3.

2.3 Qualitative Approach

As part of AGEC's approach to assessing stability, a qualitative risk appraisal is also carried out taking into account qualitative factors, which cannot necessarily be quantified, such as the presence of mechanically cut peat, quaking peat, bog pools, sub peat water flow, slope characteristics and numerous other factors. The qualitative factors used in the appraisal are compiled based on AGEC's experience of appraisals and construction in peat land sites and peat failures throughout Ireland and the UK. This approach follows the guidelines for geotechnical risk management as given in Clayton (2001), as referenced in the best practice for Peat Hazard and Risk Assessment Guide (Scottish Executive, 2007), and takes into account the approach of MacCulloch (2005).

2.4 Risk Appraisal

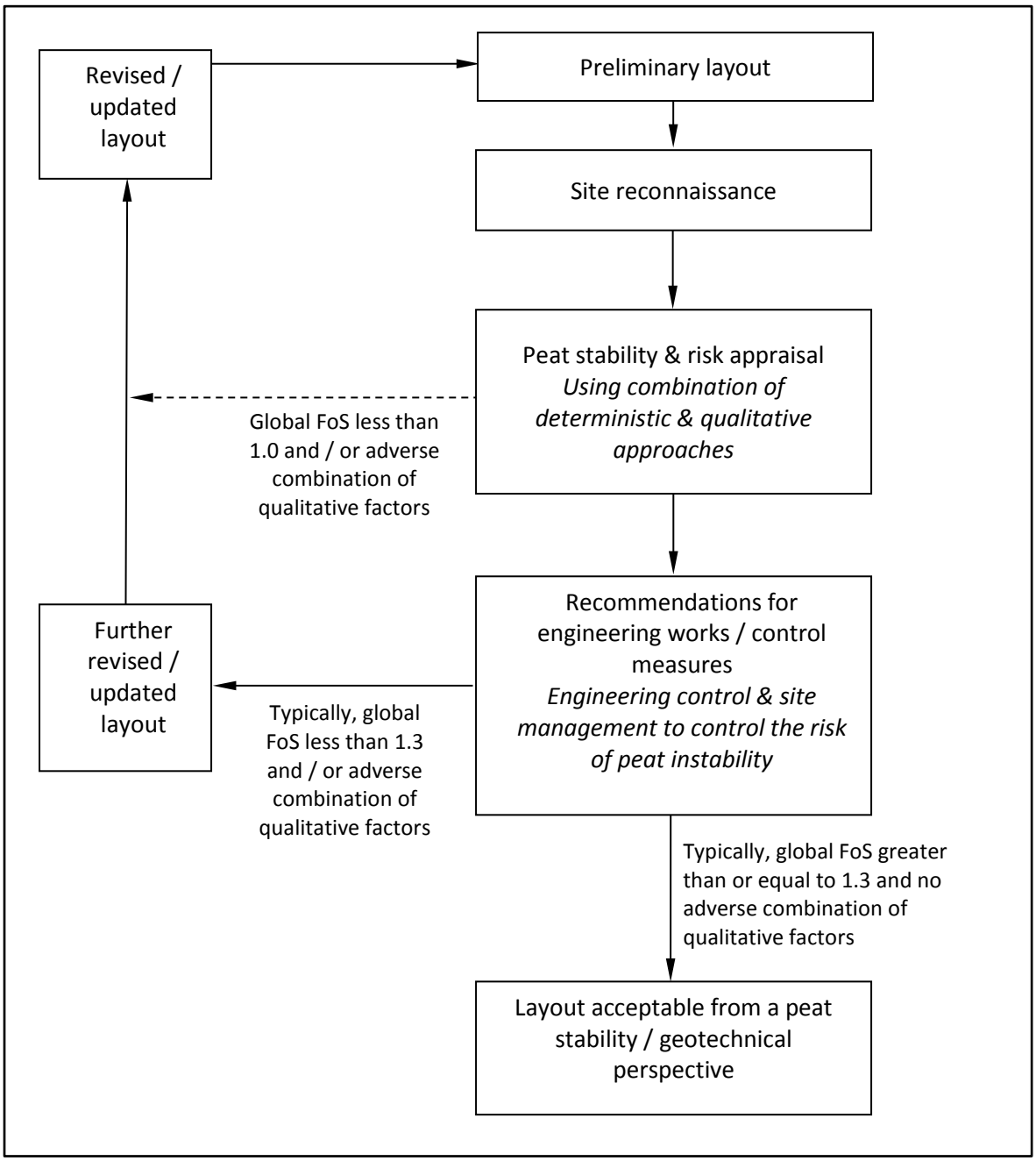
This approach follows the guidelines for geotechnical risk management as given in Clayton (2001), as referenced in PHRAG.

The risk appraisal uses the results of the stability analysis (deterministic approach) in combination with qualitative factors, which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability.

The route of the 110kV UGC was spilt into segments within the peatland, for each segment, a risk rating (product of probability and impact) is calculated and rated and recommended control measures applied, as required, to reduce the risk to an acceptable level.

An overview of the general methodology is shown in Figure 2.

Figure 2 Flow diagram showing general methodology for peat stability appraisal



3 DESK STUDY AND SITE RECONNAISSANCE

3.1 Desk Study Methodology

The main relevant sources of interest with respect to the site include:

- Geological plans
- Ordnance Survey plans
- Literature review of peat failures

The Geological Survey of Ireland (GSI, 1996 and 2017) geological plans for the site were used to verify the bedrock conditions.

The ordnance surveys plans were reviewed to determine if any notable features or areas of particular interest (from a geotechnical point of view) are present on the site.

The desk study also included a review of both published literature and GSI online dataset viewer (GSI, 2017) on peat failures / landslides in the vicinity of the site.

3.2 Desk Study Findings

3.2.1 General

There are no recorded peat failures in the western extent of the 110kV UGC (GSI, 2006 & 2017).

The nearest recorded peat failure is located some 10km south of the study area. The failure occurred at Castlegarde, Co. Limerick, in 1708, the failure mechanism is not specified. Another peat failure recorded is located some 15km north west of the study. The failure occurred at Slieve Bernagh, in 2003, the failure mechanism was a flow and the area described as blanket bog.

Based on the Geological Survey of Ireland's dataset viewer (GSI, 2017) no other peat failures occurred within a 20km radius of the site.

There are four (4) recorded landslide (non-peat) failures located within a 10km radius of the Upperchurch Grid Connection Project. The closest recorded landslide (no peat) failure is 3km south of the proposed cable route. The failure mechanism for these failures are described as unspecified slides, no material type is described.

The presence, or otherwise, of relict peat failures or clustering of relict failures within an area is an indicator that particular site conditions exist that pre-dispose a site to failure or not as the case may be. Hence based on the historical data reviewed above it can be concluded that site conditions in the area of the proposed cable route have low potential for peat failure.

3.2.2 Soils and Subsoils

A review of the GSI subsoils maps indicate that the site is underlain by predominantly till derived from Devonian Sandstone with some areas of blanket peat and occasionally some outcrops of rock at the surface (GSI, 2017).

3.2.3 Bedrock

The bedrock underlying the alignment of the Mountphilips to Upperchurch 110kV UGC is described by the Geological Survey of Ireland (GSI, 1996 & 2017) and shown on Sheet 18 (Geology of Tipperary), Sheet 18 shows four bedrock formations, from west to east along the route of the 110kV UGC: Ballysteen formation, Lower Limestone Shale, Keeper Hill formation, and Hollyford formation.

The underlying bedrock for the four formations consists of the following;

(1) Ballysteen formation – Fossiliferous dark grey muddy limestone.

(2) Lower Limestone Shale – Sandstone, mudstone and thin limestone.

(3) Keeper Hill formation – Pale & red sandstone, grit & claystone.

(4) Hollyford formation – Greywacke, siltstone & grit.

No karst features were identified on the site following a review of GSI database (2017).

3.3 Site Reconnaissance Methodology

As part of the appraisal of potential peat failure at the site, AGEC carried out a site reconnaissance. This comprised walkover inspections of the site with recording of general ground conditions and information for use in the stability analysis (peat depth, peat strength and slope inclination) and qualitative appraisal with respect to the development of the site.

The method adopted for carrying out the site reconnaissance relied on geotechnical engineers experienced in peat failure appraisal (see Chapter 11 of this report) carrying out a visual appraisal and review of the site supplemented with measurement.

The methodology used to carry out the site reconnaissance to obtain the required data is given below.

3.3.1 Peat Depth

Peat depths were recorded along the route of the 110kV UGC using probes manually pushed into the peat. Typical spacing between probes varied depending on the thickness of peat, but was typically 100 to 200m.

3.3.2 Peat Strength

Peat strength testing was carried out in situ using a Geonor H-60 Hand-Field Vane Tester. From AGEC's experience hand vanes give indicative results for in situ strength of peat and would be considered best practice for the field appraisal of peat strength.

3.3.3 Slope Angle

Slope angles were measured along the proposed route were obtained during site reconnaissance by AGEC using handheld equipment, namely Silva Clino Master which has an accuracy of +/- 0.25 degrees. Slope angles derived from contour survey plans would be considered approximate, as such surveys are dependent on the density of survey data and do not always reflect local variations in ground topography.

3.3.4 Qualitative Factors

Qualitative factors include a variety of salient geomorphological, hydrological, vegetative and other factors, which are used in the qualitative appraisal. These factors are given a designation based on their presence and/or condition, see Table 1.

The designation for each factor is subjective and is based on the judgement / experience of the geotechnical engineer.

Table 1 Qualitative factors used to appraise potential for peat failure

Qualitative Factor	Designation (1)	Explanation / Description of Qualitative Factor
Evidence of sub peat water flow	No	Based on site walkover observations. Sub peat water flow generally occurs in the form of natural piping at the base of peat. Where there is a constriction or blockage in natural pipes a build-up of water can occur at the base of the peat causing a reduction in effective stress at the base of the peat resulting in failure; this is particularly critical during periods of intense rainfall.
	Possibly	
	Probably	
	Yes	
Evidence of surface water flow	Dry	Based on site walkover observations. The presence of surface water flow indicates if peat in an area is well drained or saturated and if any additional loading from the ponding of surface water onto the peat is likely.
	Localised / Flowing in drains	
	Ponded in drains	
	Springs / surface water	
Evidence of previous failures / slips	No	Based on site walkover observations. The presence of clustering of relict failures may indicate that particular pre-existing site conditions predispose a site to failure.
	In general area	
	On site	
	Within 500m of location	
Type of vegetation	Grass / Crops	Based on site walkover observations. The type of vegetation present indicates if peat in an area is well drained, saturated, etc. Vegetation that indicates wetter ground may also indicate softer underlying peat deposits.
	Improved Grass / Dry Heather	
	Wet Grassland / Juncus (Rushes)	
	Wetlands Sphagnum (Peat moss)	
General slope characteristics upslope / downslope from infrastructure location	Concave	Based on site walkover observations. Slope morphology in the area of the infrastructure location is an important factor. A number of recorded peat failures have occurred in close proximity to a convex break in slope.
	Planar to concave	
	Planar to convex	
	Convex	
Evidence of very soft / soft clay at base of peat	No	Based on inspection of exposures in general area from site walkover. Several reported peat failures identify the presence of a weak layer at the base of the peat along which shear failure has occurred.
	Yes	
Evidence of mechanically cut peat	No	Based on site walkover observations. Mechanically cut peat typically cut using a 'sausage' machine to extract peat for harvesting. Areas which have been cut in this manner have been linked to peat instability. The mechanical cuts can notably reduce the intrinsic strength of the peat and also allow ingress of rainfall / surface water.
	Yes	
Evidence of quaking or buoyant peat	No	Based on site walkover observations. Quaking / buoyant peat is indicative of highly saturated peat, which would generally be considered to have a low strength. Quaking peat is a feature on sites that have been previously linked with peat instability.
	Yes	
Evidence of bog pools	No	Based on site walkover observations. Bog pools are generally an indicator of areas of weak, saturated peat. Commonly where there are open areas of water within peat these can be interconnected, with the result that there may be sub-surface bodies of water. The presence of bog pools has been previously linked with peat instability.
	Yes	
Other	Varies	Based on site walkover observations. The following are some of the features which may be identified: Excessively deep peat, weak peat, overly steep slope angles, etc.

Note
(1) The list of features / indicators for each qualitative factor are given in general increasing order of probability of leading to peat instability / failure.

3.4 Site Reconnaissance Findings

The site reconnaissance comprised walkover inspections of the site in May 2016, February and May 2017.

3.4.1 General Ground Conditions

The general ground conditions of the site reconnaissance are as follows:

(1) The route of the 110kV UGC is located within the Slievefelim to Silvermine Mountains upland area; landform is typically undulating with land use consisting of mixed agricultural grassland and forestry.

(2) Most of the route of the 110kV UGC will be located within existing farm and forestry access roads and across agricultural grassland, the remainder of the cable route will be located in forestry. Most of the forestry areas are located on peat. The forestry areas contain mature with some young forestry

(3) The soil found along the 110kV UGC route typically comprises topsoil, peaty top soil, silt/clay, peat, glacial till, and rock outcrop.

(4) Based on the walkover survey, trial hole investigations carried out by HES, and the exposures present at the site the sequence of superficial deposits were typically described as topsoil, silt/clay and peaty topsoil, overlying slightly sandy, gravelly silt with cobbles and boulders overlying bedrock. Soil thickness is likely variable with bedrock at surface or at shallow depth at some locations.

(5) No evidence of past failures or any significant signs of peat instability were noted on site.

(6) Based on the findings from the site reconnaissance, the ground under the footprint of the 110kV UGC would be considered to have a low risk of peat instability.

3.4.2 Peat Depth

No peat was recorded across most (about 22.5km) of the route of the 110kV UGC.

Peat depths in the range of 0.25 to 1m were recorded over a total of 4.7km of the route in Killeen.

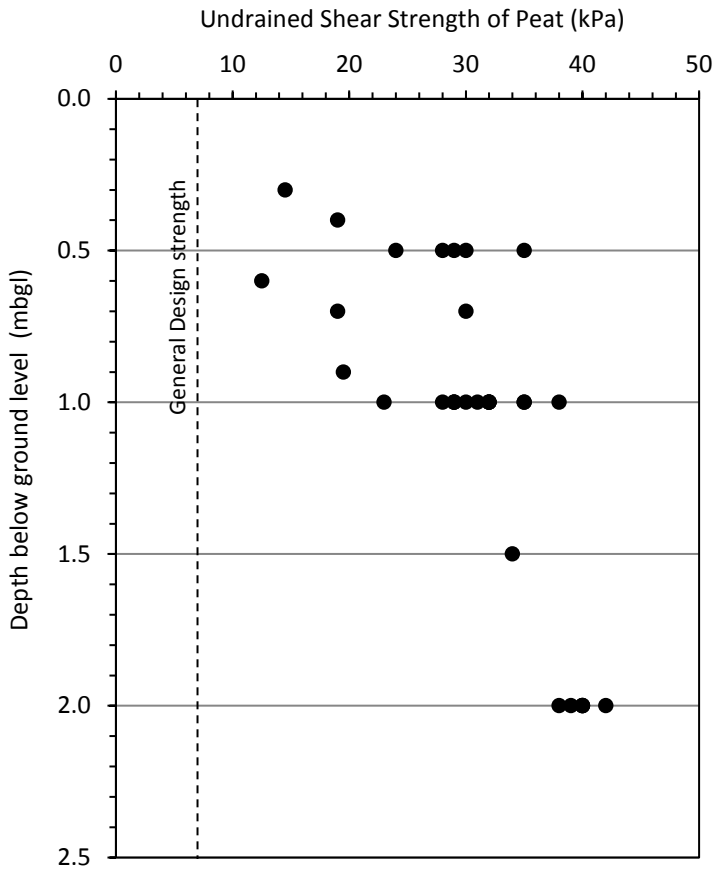
Deeper areas of peat were encountered on 110kV UGC route section S39 in Castlewaller and Killeen townlands between peat probe reference points 74 to 87 and 94 to 96 (see Drawing UWFGC.PSAGD_02 in Chapter 10 of this report) where peat depths vary from 0.7 to 3m with an average of 2.1m.

3.4.3 Peat Strength

Peat vane strength tests ranged from 13 to 84kPa with an average of about 34kPa (Figure 3).

Peat strength at sites of known peat failures (assuming undrained loading failure) are generally very low, for example the undrained shear strength at the Derrybrien failure (AGEC, 2004) as derived from essentially back analysis, though some testing was carried out, was estimated at about 2.5kPa.

Figure 3 Undrained shear strength (C_u) profile for peat with depth



Notes:
(1) Shear strength results based on insitu shear vane readings
(2) General design strength for checking stability (sliding failure): 7kPa
(3) For specific locations along the route the lower bound strength determined at the specific location is used for design check.

3.4.4 Slope Angle

Slope angles along the proposed route range from 1 to 13 degrees, with an average of about 4 degrees.

3.4.5 Qualitative Factors

During the walkover, the required qualitative factors were collated for use in the qualitative appraisal at selected points along the route of the 110kV UGC, these are included in Chapter 11 of this report.

A summary of the qualitative factors along the route of the 110kV UGC is given in Table 2.

Table 2 Summary of qualitative factors

Qualitative Factor	Factor Present / Observation	Explanation / Description of Qualitative Factor
Evidence of sub peat water flow	No	Based on site walkover observations, there was no evidence of sub peat water flow.
Evidence of surface water flow	Localised / Flowing in drains	Based on site walkover observations, water was observed flowing in drains.
Evidence of previous failures / slips	No	Based on site walkover observations, there is no evidence of previous failures / slips.
Type of vegetation	Forestry (Young and mature trees)	Based on site walkover observations, heather, rushes, peat moss and forestry are present along the route in peat.
	Improved Grass / Dry Heather	
	Wet Grassland / Juncus (Rushes)	
	Wetlands Sphagnum (Peat moss)	
General slope characteristics upslope / downslope from infrastructure location	Planar	Based on site walkover observations, the general slope characteristic of the cable route is planar.
Evidence of very soft / soft clay at base of peat	No	Based on inspection of exposures in general area from site walkover, no evidence of clay was observed at the base of the peat where present.
Evidence of mechanically cut peat	No	Based on site walkover observations, there was no evidence of mechanically cut peat.
Evidence of quaking or buoyant peat	No	Based on site walkover observations, there was no evidence of quaking / buoyant peat.
Evidence of bog pools	No	Based on site walkover observations, there was no evidence of the presence of bog pools.
Other	N/A	None recorded

Note
(1) The qualitative factors recorded at selected points along the route are included in Chapter 12 of this report.

3.5 Summary

(1) Based on the findings from the site reconnaissance, the location of the 110kV UGC would be considered to have a low risk of peat failure / slide.

(2) Outside of the peat areas, the ground conditions along the route of the 110kV UGC do not present any geotechnical risk.

(3) No evidence of past failures or any significant signs of peat instability were noted on site

(4) Notwithstanding the above, a number of deeper peat areas are present on site which will require specific construction methods, but do not represent a peat slide / failure risk.

(5) A peat depth plan, which includes any construction buffer zones, has been produced for the site (Drawings UWFGC_PSAGD_01 to 06). These drawings show peat depths along the route of the 110kV UGC. Areas along the route of the 110kV UGC which have an elevated or higher construction risk and that require additional control measures are presented in Chapter 12 of this report.

(6) Control measures identified for particular segments of the route of the 110kV UGC in the risk appraisal will be taken into account and implemented throughout the design and construction works (see Chapters 7 and 12 of this report).

4 PEAT STABILITY APPRAISAL METHODOLOGY

The peat stability appraisal analyses the stability of the natural peat slopes for individual parcels along the proposed route. The appraisal also analyses the stability of the natural peat slopes with a surcharge loading of 10 kPa, equivalent to placing 1 m of stockpiled peat on the surface of the peat slope.

4.1 General Methodology for Peat Stability Appraisal

Stability of a peat slope is dependent on several factors working in combination. The main factors that influence peat stability are slope angle, shear strength of peat, depth of peat, pore water pressure and loading conditions.

An adverse combination of factors could potentially result in peat sliding. An adverse condition of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton and DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To appraise the factor of safety for a peat slide, an undrained (short term stability) and drained (long term stability) analysis has been undertaken to determine the stability of the peat slopes on site.

(1) The undrained loading condition applies in the short term during construction and until construction induced pore water pressures dissipate.

(2) The drained loading condition applies in the long term. The condition examines the effect of in particular, the change in groundwater level as a result of rainfall on the existing stability of the natural peat slopes.

Undrained shear strength values (c_u) for peat are used for the short term stability. Based on the findings of the Derrybrien failure, undrained loading during construction was found to be the critical failure mechanism.

A drained analysis requires effective cohesion (c') and effective friction angle (ø') values for the calculations. These values can be difficult to obtain because of disturbance experienced when sampling peat and the difficulties in interpreting test results due to the excessive strain induced within the peat. To determine suitable drained strength values a review of published information on peat was carried out.

Table 3 shows a summary of the published information on peat together with drained strength values.

Table 3 List of effective cohesion and friction angle values

Reference	Cohesion, c' (kPa)	Friction Angle, ø' (degs)	Testing Apparatus / Comments
Hanrahan et al (1967)	5 to 7	36 to 43	From triaxial apparatus
Rowe and Mylleville (1996)	2.5	28	From simple shear apparatus
Landva (1980)	2 to 4	27.1 to 32.5	Mainly ring shear apparatus for normal stress greater than 13 kPa
	5 to 6	-	At zero normal stress
Carling (1986)	6.5	0	-
Farrell and Hebib (1998)	0	38	From ring shear and shear box apparatus. Results are not considered representative.
	0.61	31	From direct simple shear (DSS) apparatus. Result considered too low therefore DSS not considered appropriate
Rowe, Maclean and Soderman (1984)	1.1	26	From simple shear apparatus
	3	27	From DSS apparatus
Sandorini et al (1984)	4.5	28	From triaxial apparatus
McGreever and Farrell (1988)	6	38	From triaxial apparatus using soil with 20% organic content
	6	31	From shear box apparatus using soil with 20% organic content
Hungr and Evans (1985)	3.3	-	Back-analysed from failure
Madison et al (1996)	10	23	-
Dykes and Kirk (2006)	3.2	30.4	Test within acrotelm
Dykes and Kirk (2006)	4	28.8	Test within catotelm
Warburton et al (2003)	5	23.9	Test in basal peat
Warburton et al (2003)	8.74	21.6	Test using fibrous peat
Entec (2008)	3.8	36.8	Generalised values derived from various peat tests (shear box and triaxial)

From Table 3 the values for c' ranged from 1.1 to 10 kPa and ø' ranged from 21.6 to 43°. The average c' and ø' values are 5 kPa and 30° respectively. Based on the above, it was considered to adopt a conservative approach and to use design values below the averages.

For design the following general drained strength values have been used for the site:

c' = 4 kPa
ø' = 25 degrees

4.2 Deterministic Approach - Analysis of Factor of Safety

The purpose of the analysis was to determine the global Factor of Safety (FoS) of the peat slopes using infinite slope analysis. The analysis was carried out at points along the route of the 110kV UGC in peat.

The global FoS provides a direct measure of the degree of stability of the slope. A global FoS of less than unity indicates that a slope is unstable, a global FoS of greater than unity indicates a stable slope.

In carrying out the FoS analysis, the safety factors included in Eurocode 7 (EC7) (IS EN 1997-1:2005) and previous standard BS 6031:1981 (BSI,1981) have been taken in to account. The typical safety factors within EC 7 range from 1.25 to 1.4. Based on the above, an acceptable global FoS of 1.3 is required.

As a general guide the global FoS limits for peat slopes in this report are summarised in Table 4.

Table 4 Factor of safety limits for slopes

Global Factor of Safety (FoS)	Degree of Stability
Less than 1.0	Unstable
Between 1.0 and 1.3	Marginally stable
1.3 or greater	Acceptable

A lower bound undrained shear strength, c_u for the peat of 7kPa was selected for the appraisal (Figure 3). It should be noted that a c_u of 7kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site. The actual peat strength along the route has a significantly higher undrained strength.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

Where,
F = Factor of Safety
c_u = Undrained strength
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
α = Slope angle

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2\alpha \tan\phi'}{\gamma z \sin\alpha \cos\alpha}$$

Where,
F = Factor of Safety
c' = Effective cohesion
γ = Bulk unit weight of material
z = Depth to failure plane assumed as depth of peat
γ_w = Unit weight of water
h_w = Height of water table above failure plane
α = Slope angle
ϕ' = Effective friction angle

For the drained analysis, the level of the water table above the failure surface is required to calculate the factor of safety for the slope. Since the water level in peat can be variable and can be recharged by rainfall, it is not feasible to establish its precise location throughout the site. Therefore, a sensitivity analysis using water level ranging from 0 to 100% of the peat depth was conducted, where 0% equates to the peat being completely dry and 100% equates to the peat being fully saturated.

The following general assumptions were used in the analysis of peat slopes at each location:

(1) Peat depths are based on the maximum peat depth recorded at each location from the walkover survey.

(2) A lower bound undrained shear strength, c_u for the peat of 7kPa was selected for the appraisal. It should be noted that a c_u of 7kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site.

(3) Slope angle on base of sliding assumed to be parallel to ground surface.

For the stability analysis two load conditions were examined, namely

Condition (1): no surcharge loading;

Condition (2): surcharge loading of 10kPa, equivalent to 1m of stockpiled peat assumed as a worst case.

4.3 Qualitative Approach

A list of qualitative factors appraised on site is shown in Table 1.

It should be noted that the presence of one of the qualitative factors alone from Table 1 is unlikely to lead to peat instability / failure. Peat instability / failure at a site is generally a combination of a number of these factors occurring at a particular location.

4.4 Risk Appraisal Methodology

A risk appraisal was carried out along the corridor of the 110kV UGC route. This approach follows the guidelines for geotechnical risk management as given in Clayton (2001), as referenced in PHRAG, and takes into account the approach of MacCulloch (2005).

The risk appraisal uses the results of the stability analysis (deterministic approach) in combination with qualitative factors (Table 1), which cannot be reasonably included in a stability calculation but nevertheless may affect the occurrence of peat instability to appraise the risk for each infrastructure element.

The stability analysis takes into account the peat depth, slope angle and shear strength properties of the peat (see Chapter 3 of this report). The qualitative factors used in the risk appraisal have been compiled based on AGEC's experience of appraisals and construction in peat land sites and peat failures throughout Ireland and the UK.

Probability

The likelihood of a hazard (peat failure) occurring has been based on the results of the stability calculation FoS and qualitative factors from Table 1, where present.

The probability assigned to the global FoS and qualitative factors is judged on a qualitative scale (Table 5).

Table 5 Probability scale

Scale	Global Factor of Safety	Probability of Failure
1	1.30 or greater	Negligible / None
2	1.29 to 1.20	Unlikely
3	1.19 to 1.11	Likely
4	1.01 to 1.10	Probable
5	≤1.0	Very Likely

Scale	Likelihood of Qualitative Factor leading to Peat Failure	Probability of Failure
1	Negligible / None	Least
2	Unlikely	
3	Likely	
4	Probable	
5	Very Likely	Greatest

Impact

The severity of the risk is also appraised qualitatively in terms of impact. The impact of a peat failure on the environment within and beyond the immediate corridor of the 110kV UGC is appraised based on the potential travel distance of a peat failure. Where a peat failure enters a water course it can travel a considerable distance downstream. Therefore, the proximity of a potential peat failure to a drainage course is a significant indicator of the likely potential impact.

The risk is determined based on the combination of hazard and impact. A qualitative scale has been derived for the impact of the hazard based on distance of infrastructure element to a watercourse (Table 6).

The location of watercourses is based on topographic maps and supplemented by site observations from walkover survey.

Note that not all watercourses are shown on Ordnance Survey mapping.

Table 6 Impact scale

Scale	Criteria	Impact
1	Proposed infrastructure element greater than 150 m of watercourse	Negligible / None
2	Proposed infrastructure element within 150 to 101 m of watercourse	Low
3	Proposed infrastructure element within 100 to 51 m of watercourse	Medium
4	Proposed infrastructure element within 50 m of watercourse	High

Risk Rating

The degree of risk is determined as the product of probability (P) and impact (I), which gives the Risk (R) as follows:

The Risk is calculated from: R = P x I

The Risk can range from 1 to 20 as shown in Table 7.

Table 7 Qualitative risk rating

Impact \ Probability	1	2	3	4	5
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5

Risk Rating	Risk Rating & Control Measures
10 to 20	Unacceptable: re-location or significant control measures required
5 to 9	Substantial: notable control measures required
3 to 4	Tolerable: only routine control measures required
1 to 2	Trivial: none or only routine control measures required

Note. Where any individual contributory factor is given a probability of 5 then this defaults to an 'Unacceptable' risk rating irrespective of the impact.

In many cases a simple 4- to 5-level risk rating is considered sufficient (Clayton, 2001); in this case, a 4-level risk rating is used. The control measures in response to the qualitative risk ratings are included in the Geotechnical Risk Register in Chapter 12 of this report.

The risk is calculated individually for each contributory factor. Control measures are required to reduce the risk to at least a 'Tolerable' risk rating.

5 RESULTS OF PEAT STABILITY AND RISK APPRAISAL

5.1 Peat Stability

5.1.1 Deterministic Approach - Analysis of Global Factor of Safety

Undrained Analysis

The results of the undrained analysis for the natural peat slopes are presented in Chapter 13 of this report. The undrained analysis for load condition 2 is considered the most critical load case as most peat failures occur in the short term upon loading of the peat surface.

The calculated global FoS for load condition (1) is in excess of 1.30 for all locations analysed with a **range of FoS of 3.51 to in excess of 10**, indicating a low risk of peat instability.

The calculated global FoS for load condition (2) is in excess of 1.30 for all locations analysed with a **range of FoS of 2.28 to in excess of 10**, indicating a low risk of peat instability.

The stability analysis shows that the calculated global FoS is acceptable at all locations for the undrained analyses.

Drained Analysis

The results of the drained analysis for the peat are presented in Chapter 13 of this report. As stated previously, the drained loading condition examines the effect of in particular, rainfall on the stability of the natural peat slopes.

The calculated global FoS for load condition (1) is in excess of 1.30 for all locations analysed with a **range of FoS of 6.58 to in excess of 10**, indicating a low risk of peat instability.

The calculated global FoS for load condition (2) is in excess of 1.30 for all locations analysed with a **range of FoS of 3.32 to in excess of 10**, indicating a low risk of peat instability.

The stability analysis shows that the calculated global FoS is acceptable at all locations for the drained analyses.

5.1.2 Qualitative Approach

The results of the qualitative approach for the peat appraisal are based on the findings of the walkover, which are based on Table 1 and included in Chapter 12 of this report.

5.2 Summary of Risk Appraisal

The results of the risk appraisal for potential peat failure at the locations/segments where peat is present along the route of the 110kV UGC is given in the Geotechnical Risk Register in Chapter 12 of this report and summarised in Table 8.

Note that sections of the route that are not within peatlands are not included. Outside of the peat areas, the ground conditions along the cable route do not present any geotechnical risk.

The risk ratings for the locations where peat is present along the 110kV UGC are designated as trivial, and tolerable following some control measures being implemented.

The above shows that the route of the 110kV UGC has a low and acceptable risk of potential peat failure.

The results of the risk appraisal concur with the findings from the site reconnaissance, namely that the route of the 110kV UGC is considered to have a low risk of peat failure / slide.

Details of the required control measures can be found in the Geotechnical Risk Register (Chapter 12 of this report) for each segment of the route where peat is present.

Table 8 Summary of geotechnical risk register (in peat)

110kV UGC Section	Segment of 110kV UGC covered by Peat Depth Reference Points	Drawing Number	Risk Rating (before application of Control Measures)		Specific Control Measures Required	Risk Rating (after application of Control Measures)		Comment
			Risk	Risk Rating		Risk	Risk Rating	
Castlewaller / Killeen Forestry (floating road): Section S39	74 to 76 & 91/92	02	0 to 4	Tolerable	Yes	0 to 4	Trivial to Tolerable	
	77 to 82 & 96	02	0 to 2	Trivial	No	0 to 2	Trivial	
	83 to 85 & 95	02	0 to 4	Tolerable	Yes	0 to 4	Trivial to Tolerable	
	86 to 87 & 93 to 95	02	0 to 4	Tolerable	Yes	0 to 4	Trivial to Tolerable	
Other Forestry in peat at Knockacullin: Sections S45 & S46	105 to 113	03	0 to 4	Tolerable	Yes	0 to 4	Trivial to Tolerable	
Bleanbeg Bog NHA: Section S38	12 to 15	02	0 to 2	Trivial	No	0 to 2	Trivial	Peat within bank beside route. No peat under existing tracks.
Existing Forestry Tracks in peat in Castlewaller, Killeen, Knockacullin, Knocknabansha: Sections S37, S40, S47 and S85	62 to 68 & 115 to 116	02, 05, 06	0 to 4	Tolerable	Yes	0 to 4	Trivial to Tolerable	Peat within bank beside route. No peat under existing tracks.
Agricultural grassland in peat: Sections S42 to S44, S66, S75 to S77	19 to 21 & 114, 46 to 55	03 & 05	1 to 3	Tolerable	Yes	1 to 3	Trivial to Tolerable	

Notes:

(1) For details of peat depths refer to Chapter 13 in this report. Peat depth colour zones shown on Drawings UWFGC.PSAGD_01 to 06 are based on average depths.

(2) Where localised minimal peat thickness is recorded (typically less than 0.5m) then risk is considered negligible and is not included in the qualitative risk assessment.

6 EVALUATION OF PEAT STABILITY RISK ASSOCIATED WITH THE GEOTECHNICAL DESIGN

6.1 General

The cable route layout within peat comprises a cable trench, peat storage area and floating road. The floating road comprises crushed stone (granular fill) placed onto a suitable geogrid placed onto the peat surface, see Drawing UWFG.PSAGD_07. An evaluation of the peat stability risk associated with the geotechnical design is given below.

6.2 Cable Route Corridor Details in Peat

The layout of the 110kV UGC within peat is given in Drawing UWFG.PSAGD_07. The layout within existing tracks and adjacent to the NHA boundary is shown in Drawings UWFG.PSAGD_08 and 09.

6.3 Cable Trench

The cable trench is to be excavated to a firm stratum below peat, as per cable designer's requirement. All trench excavations shall be fully supported to prevent localised instability.

A summary of the excavated peat volumes calculated for the 110kV UGC is given in Table 9.

Table 9 Summary of excavated peat volumes

110kV UGC Section	Typical Cable Trench Dimensions	Peat Volume (m^3) (1)
Bleanbeg Bog NHA Section S38	Trench along existing track with is down to component ground.	0
Castlewaller / Killeen Forestry (floating road): Section S39	0.6m wide x 1.2m deep (average peat depth) trench. Length of internal cable route within peat 0.8km (approx.)	820
Agricultural grassland in peat Sections S42, S43, S44	0.6m wide x 0.25m deep (average peat depth) trench. Length of internal cable route within peat 0.4km (approx.)	75
Other Forestry in peat at Knockacullin: Sections S45 & S46	0.6m wide x 0.5m deep (average peat depth) trench. Length of internal cable route within peat 0.4km (approx.)	145
Existing Forestry Tracks in peat in Castlewaller, Killeen, Knockacullin, Knocknabansha: Sections S75 & S76	Trench along existing forestry tracks within competent ground.	0
Agricultural grassland in peat: Sections S66	0.6m wide x 0.25m deep (average peat depth) trench. Length of internal cable route within peat 0.7km (approx.)	130
Agricultural grassland in peat: Sections S75 to S77	0.6m wide x 1.25m deep (average peat depth) trench. Length of internal cable route within peat 0.4km (approx.)	300

Note (1) A factor of 20% has been applied to the excavated peat volume which comprises 15% bulking factor to allow for expected increase in volume and a 5% contingency factor.

Based on the above, the peat arisings excavated per metre length of the 110kV UGC in peat will be about 0.5m^3, this assumes the cable trench is excavated within a fully supported trench.

6.4 Floating Road (in Peat) - Section S39

(See Drawing UWFGC.PSAGD_02, peat depth reference points 74 to 87 and 93 to 96)

The route of the 110kV UGC within peat comprises a cable trench, peat storage area and floating road through forestry lands in Castlewaller and Killeen townlands. The floating road comprises 1m thick of suitable granular stone up to 4.5m wide placed onto a suitable geogrid placed onto the peat surface (see Drawing UWFG.PSAGD_07). For additional stability, a second layer of geogrid will be laid within the crushed stone layer of the road.

It is proposed that the trees felled for the construction of the 110kV UGC will be placed below the floating road to provide additional support. For design purposes timber placed below the floating road is not considered.

A general check on sliding failure in peat shows a minimum global **FoS of 2.44**, which is greater than the required minimum of 1.3 and shows that the peat is stable. Stability outputs are given in Chapter 13 in this report.

A specific design check of the proposed floating road has also been carried out to ensure the floating road is feasible within the peatland. Floating roads are generally not advised where a cross-slope angle of greater than 6 degrees is present; which is not the case at Section S39 through the forestry at Castlewaller and Killeen.

A stability analysis check of the floating tracks was carried out at the critical location within deeper peat areas i.e. peat depth of 3m with undrained peat strength of 13kPa, which was the typical lower bound strength in this area.

The stability analysis was carried out using Talren 5 software (software used to determine the stability of geotechnical structures). The analysis of the floating road was carried out with typical site construction traffic loading applied to the surface of the access track i.e. 20tN axle loading.

A specific stability analysis was carried out using the partial factors within Eurocode 7 (EC7) (BS EN 1997-1:2004) the basis for geotechnical design of engineering works. The design philosophy used in EC7 applies partial factors to soil parameters, actions and resistances which is used to determine the factor of safety (FoS_{PF}) for the floating access track configuration. A FoS_{PF} of less than unity (i.e. 1.0) indicates instability, a FoS of greater than unity indicates stability. A FoS_{PF} of in excess of 1.0 will be required for the access track stability analyses in accordance with EC7.

Note that the global FoS presented in Chapter 5 of this report requires a minimum of 1.3 for an acceptable degree of stability, whereas using partial factors the required minimum for stability is an FoS_{PF} of 1.

The results using partial factors shows a minimum **FoS_{PF} of 1.13**, which is greater than 1.0 and as such is stable. Stability outputs are given in Chapter 15.

6.5 Other Forestry (in Peat) - Sections S45 and S46

(See Drawing UWFGC.PSAGD_03, peat depth reference points 105 to 113)

Sections S45 and 46 of the route of the 110kV UGC is also located on forestry lands within peatland.

The peat depth in these sections range from 0.2m to locally 1.2m, with an average depth of 0.5m. Due to the shallow nature of the peat in this area road construction will be non-critical, compared to the Castlewaller and Killeen townlands, see above.

A general check on sliding failure shows a minimum global **FoS of 2.82**, which is greater than the required minimum of 1.3 and shows that the peat is stable. Stability outputs are given in Chapter 13.

6.6 Bleanbeg Bog NHA - 140m of Section S38

(See Drawing UWFGC.PSAGD_02, peat depth reference points 12 to 15)

At Section S38, 140m length of the cable route is located within the boundary of the Bleanbeg Bog NHA boundary (see Drawings UWFGC.PSAGD_09). At this location, the 110kV UGC will be installed in the centre of an existing forestry track. There is an adjacent existing cut peat slope to this track which is up to 1.8m high, and which in places is vertical.

Based on site reconnaissance, the existing cut peat slope appears to have been formed some time ago and is notably well-drained with high undrained peat strengths (ranging from 23 to 32kPa). The cut slope shows no signs of instability and would be considered stable.

A specific stability analysis on the impact of constructing the cable trench in the vicinity of the peat cut slope has been carried out using slope stability software (Talren). Using partial factors, a FoS_{PF} of less than unity (i.e. 1.0) indicates instability, a FoS of greater than unity indicates stability. A FoS_{PF} of in excess of 1.0 will be required for stability in accordance with EC7.

The results give a minimum **FoS_{PF} of 1.42**, which shows that the peat is stable. Stability outputs are given in Chapter 15.

The peat stability and risk appraisal has clearly shown that the proposed 110kV route has a low and acceptable risk of potential peat slide / failure. The results show that there will be no adverse impact on the existing peat slope from the 110kV UGC works.

6.7 Existing Forestry Tracks (in Peat) - Sections S37, S38, S40, S47 & S85

(See Drawings UWFGC.PSAGD_02, 03, 05 and 06)

Sections S37, S40, S41, S47 and S85 of the route of the 110kV UGC are within existing forestry tracks located within peatland, see Table 10.

These existing tracks are founded on mineral soil below the peat.

The 110kV UGC will be located centrally within the existing track, with no impact on the surrounding peat (see Drawing UWFGC.PSAGD_08).

Whilst the route on these sections is on existing tracks that are founded on mineral soil below the peat, there are in some locations peat banks beside the track. The specific stability of the peat banks adjacent the track at Bleanbeg Bog NHA have been assessed above.

A general check on sliding failure for the banks adjacent existing forestry tracks in peat shows a minimum global **FoS of 3.15**, which is greater than the required minimum of 1.3 and shows that the peat is stable. Stability outputs are given in Chapter 13 in this report.

Table 10 Summary of existing forestry tracks in peat

110kV UGC Section	Segment of 110kV UGC covered by Peat Depth Reference Points	Drawing Number	Comment
Castlewaller forestry track: Section S37	115/116, 5 to 12	02	
Bleanbeg Bog NHA: Section S38	12 to 15	02	Up to 1.8 m height of peat in bank beside route
Killeen forestry track: Section S40	16 - 88*, 88 to 92	02, 03	*16 - 88 refers to the length of track between these two points
Knockacullin forestry track: Section S47	97 to 104	03	
Knocknabansha forestry track: Section S85	59 to 71	05 and 06	
Existing Forestry Tracks in Peat in Castlewaller, Killeen, Knockacullin, Knocknabansha: Sections S37, S40, S47 and S85	62 to 68 & 115 to 116	02, 05, 06	

6.8 Agricultural Grassland (in Peat) - Sections S42 to S44, S66, S75 to S77

(See Drawings UWFGC.PSAGD_03 and 05)

Sections S42, S43, S44, S66 and S75 to S77 of the route of the 110kV UGC are located on agricultural lands within peatland.

The peat depth in these sections range from 0.4m to locally 2.5m, with an average depth of about 0.7m. Peat depth reference points 46 to 49 show a local area of deeper peat with a depth from 1.1 to 2.5m. This is located within a relative flat area of rough agricultural land with slope angles ranging from 1 to 2 degrees. Due to the relative flat nature of the area, a check on sliding failure shows a minimum global **FoS of 16.63**, which is notably high indicating a stable area.

Given the relatively deeper peat in the area of points 46 to 49, the use of suitable construction equipment will be required in this area, i.e. wide tracked excavators, tracked dumpers, or alternatively temporary bog mat road to avoid bogging of construction equipment. Any peat arisings would need to be ~~disposed of~~ along the route in areas avoiding water-courses/ecologically sensitive areas.

A general check on sliding failure for all agricultural grassland in peat shows a minimum global **FoS of 2.28**, which shows that the peat is stable. Stability outputs are given in Chapter 13 in this report.

7 CONSTRUCTION ACTIVITIES

7.1 General

For the construction phase of the 110kV UGC, the following activities that are considered to have potential for possible peat stability are as follows:

(1) Excavations in peat for underground cables (including along the NHA boundary).

(2) Excavation and placement of arisings.

(3) Construction of floating road.

Peat management of the above construction activities are outlined below, and will be incorporated into the construction methodology for sections of the 110kV UGC in peat, notably within the deeper peat in the Castlewaller forestry (see Drawings UWFGC.PSAGD_07).

(1) A corridor of trees, 15m wide, will be felled along the route of the 110kV UGC through Castlewaller Forestry.

(2) The floating road will be constructed by placing the felled trees and branches along the northern side of the felled corridor on top of the peat to form a supporting layer for the floating road. Before trees are laid down at locations where main drains cross the corridor, culverts will be placed into the existing main drains to maintain the existing drainage regime. It is estimated that there will be about 10 main drains crossing beneath the floating road and grid connection works in this manner.

(3) Any minor drains will be connected to the culverted main drains upslope of the works by excavating interceptor drains parallel to the works so water flows from the minor drains into the main drains then under the floating road and grid connection works area. This will prevent any ponding of water upslope of the works and avoid water coming into contact with any sediment from the works.

(4) Once the trees have been laid along the route of the proposed floating road, a layer of geogrid will be laid on to the felled trees and a layer of granular fill (Class 6F or similar) will be spread on top of the geogrid. A second layer of geogrid will then be laid on the granular fill and a capping layer of granular fill laid to complete the construction of the floating road.

(5) The grid connection trench will then be dug by a long reach, low ground pressure tracked excavator working on the peat surface and will excavate a trench to a depth of 0.2m into the competent layer beneath the peat.

(6) The excavated peat will be placed by the long reach excavator on the far side of the floating road (upslope side). The ground conditions at the location of any placed peat will be inspected prior to placement by a competent geotechnical engineer.

(7) As the peat is being excavated a second excavator, working from the near side of the floating road will immediately backfill the excavated trench with a layer of 0.15m granular fill. This layer of granular fill will be brought up to a depth of 1.25m from the top of the trench. A 0.065m bedding layer of lean mix concrete will then be laid and the ducting installed. Warning tapes will then be installed. The final layer to the top of the trench will be finished with a 0.3m layer of peat.

(8) All excavations will be adequately supported with shoring systems if required or alternatively, peat slopes will be battered to a safe slope inclination if required. Slope inclinations on stored peat will be reviewed by a geotechnical engineer or appropriately competent person during

construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes/shoring will be required.

(9) The works will be supervised by a geotechnical engineer or appropriately competent person, as appropriate.

(10) Only short sections (about 20m length) of the trench will be opened at any one time and construction works to infill the trench will be carried out in the shortest possible time.

(11) All excavated peat that is stored along the route will be graded to complement the topography and drainage system in the area.

(12) Once works through the peatland has been completed, any bare peat/soil will be re-seeded by hand. The surface of the road will be covered with geo-cell which will be covered with peat and planted with seeds and local vegetation.

7.2 Movement Monitoring

To monitor possible peat movements, sighting posts should be installed upslope and downslope of the 110kV UGC at staggered intervals. Details of sighting posts are given below.

(1) A line of sighting posts shall comprise:

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

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

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

(2) Lines of sighting posts shall be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located alongside the trench at 10m intervals, or at locations where there are relatively steeper slopes or softer, or at any location where monitoring would be deemed useful.

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

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

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

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

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

7.3 Contingency Measures

7.3.1 Excessive Movement

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

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

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

(3) Re-commencement of activities shall only start following a cessation of movement and agreement with all parties (that is for example designer, contractor and developer).

7.3.2 Onset of Peat Slide

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

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

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

(3) All relevant authorities, including Tipperary County Council, Inland Fisheries Ireland and National Parks and Wildlife Service should be notified if a peat slide event occurs on site.

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

7.3.3 Check Barrage

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

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

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well graded coarse rock pieces from about 0.3m up to typically 1m.

The rock fill for the check barrage could be sourced from locally won granular fill material, such as quarry at Rear Cross.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a

peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

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

The check barrage procedure is as follows:

(1) Access to the check barrage location shall be along vehicular access tracks/roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

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

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures may be required and would be appraised by all parties (such as the designer, contractor and developer) and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding have been satisfactorily completed.

8 SUMMARY AND RECOMMENDATIONS

8.1 Summary

The following summary is given.

(1) AGEC was engaged by Ecopower Developments to undertake an appraisal of peat stability and geotechnical design for the UWF Grid Connection, in particular the Mountphilips to Upperchurch 110kV Underground Cables.

(2) The Mountphilips to Upperchurch 110kV Underground Cables (referred to herein as the 110kV UGC) is located within the Slievefelim to Silvermine Mountains uplands area. The lands along the route of the 110kV UGC are typically undulating and consist of mixed land use of agricultural grassland and commercial forestry. Most of the footprint of the 110kV UGC is within peaty topsoil / topsoil underlain by glacial till.

(3) The majority of the 110kV UGC is located on agricultural grasslands, and on existing forestry roads and farm roads; the remainder of the 110kV UGC is located in forestry. Most of the forestry areas are located on blanket peat. The forestry areas contain mature with some young forestry. No peat was recorded across most (about 22.5km) of the route of the 110kV UGC. Peat depths of 0.25m to 1m were recorded over a total of 4.7km of the route in Killeen, with peat depths generally under 0.25m.

(4) Deeper areas of peat were encountered on the 110kV UGC route section S39 in Castlewaller and Killeen townlands as determined from peat probe reference points 74 to 87 and 94 to 96 (see Drawing UWFGC.PSAGD_2 in Chapter 10 of this report) where peat depths vary from 0.7 to 3m with an average of 2.1m.

(5) An analysis of peat sliding was carried out at selected points along the route of the 110kV UGC for both the undrained and drained conditions. The purpose of the analysis was to determine the global Factor of Safety (FoS) of the peat slopes.

(6) For both the undrained and drained analysis, the calculated global FoS for all load conditions at the selected locations, shows that at all locations have an acceptable FoS of greater than 1.3, indicating a low risk of peat instability.

(7) A risk appraisal along the route of the 110kV UGC showed that the risk ranged from trivial to tolerable following some control measures being implemented (see Table 8). This again shows that the proposed route has a low and acceptable risk of potential peat failure

(8) In summary, the findings of the peat appraisal showed that the peat along the 110kV UGC has an acceptable margin of safety and is suitable for the development of the 110kV UGC. The findings include recommendations and control measures for construction work in peatlands to ensure that all works adhere to an acceptable standard of safety, see below.

8.2 Recommendations

Notwithstanding that the site has an acceptable margin of safety, to ensure that all works achieve an acceptable standard for work in peatlands the construction methodologies given in Chapter 7 and control measures for specified sections of the works, see Chapter 12 of this report, are required to be implemented.

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CHAPTER 10

DRAWINGS UWFGC.PSAGD_01 to UWFGC.PSAGD_09

S:\2017\1719 Upperchurch Grid Connection (Ecopower)\CAD\1719 Baseplan Rev 3.dwg

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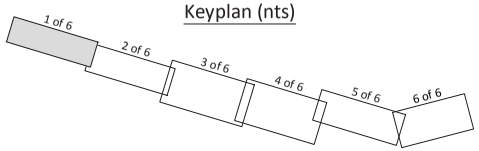
Keyplan (nts)



Legend:

Cable route

25 Peat depth reference point used in report

Peat Depth Legend (mbgl):

0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3
NO PEAT												

Note:

1) Peat depth coloured zones have been calculated using a contouring technique which provides average peat depths based on the nearest point values. For the specific peat depths refer to Chapter 13 of this report.

2) Width of corridor shown indicatively on drawings.

Drawing UWFGC.PSAGD_01 - Cable route showing peat distribution and depth

Scale: N.T.S. @ A3

Rev 1

Date: 21 Dec 2017

S:\2017\1719 Upperchurch Grid Connection (Ecopower)\CAD\1719 Baseplan Rev 3.dwg

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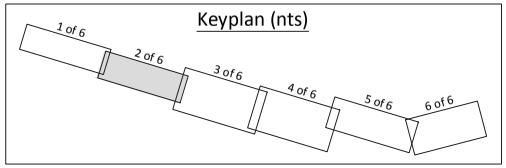


Legend:

Cable route

25 — Peat depth reference point used in report

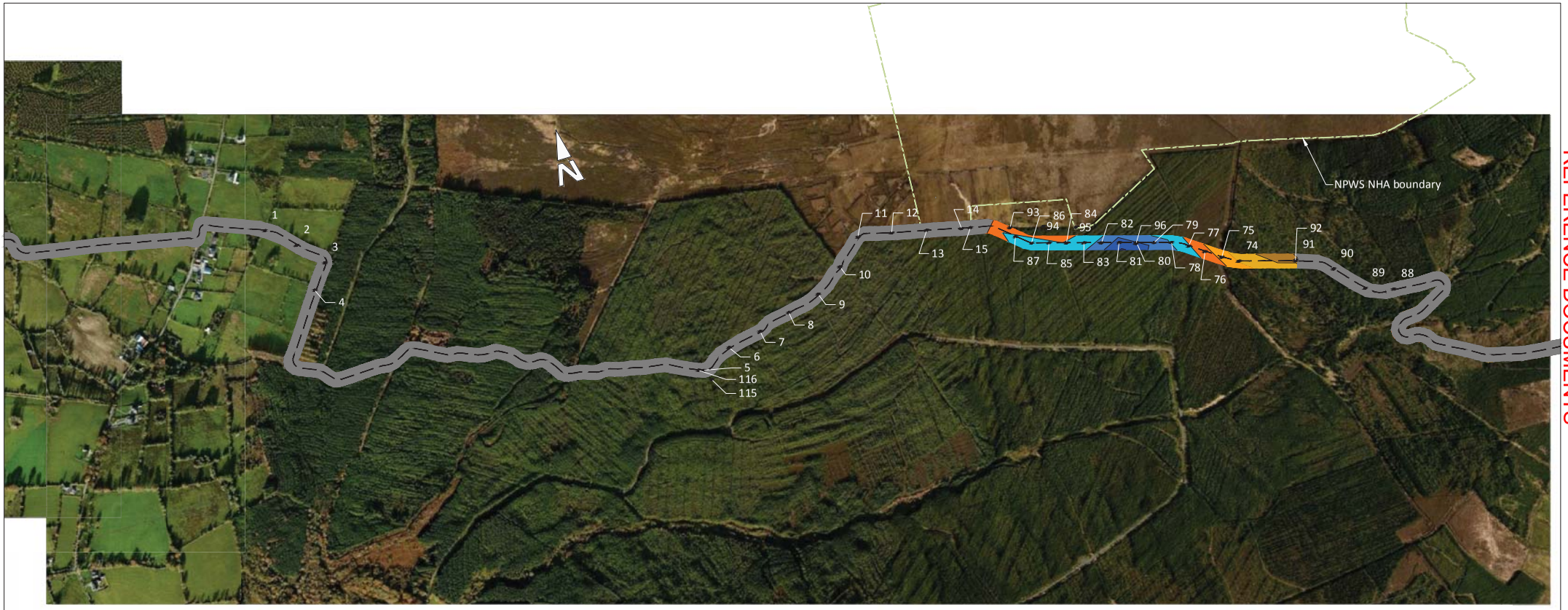
Peat Depth Legend (mbgl):

NO PEAT	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3

Note:

1) Peat depth coloured zones have been calculated using a contouring technique which provides average peat depths based on the nearest point values. For the specific peat depths refer to Chapter 13 of this report.

2) Width of corridor shown indicatively on drawings.



Drawing UWFGC.PSAGD_02 - Cable route showing peat distribution and depth

Scale: N.T.S. @ A3

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Date: 21 Dec 2017

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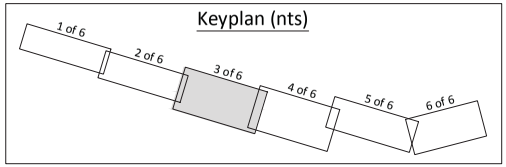
Keyplan (nts)



Legend:

Cable route

25 — Peat depth reference point used in report

Peat Depth Legend (mbgl):

NO PEAT	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3

Note:

1) Peat depth coloured zones have been calculated using a contouring technique which provides average peat depths based on the nearest point values. For the specific peat depths refer to Chapter 13 of this report.

2) Width of corridor shown indicatively on drawings.

Drawing UWFGC.PSAGD_03 - Cable route showing peat distribution and depth

Scale: N.T.S. @ A3

Rev 1

Date: 21 Dec 2017

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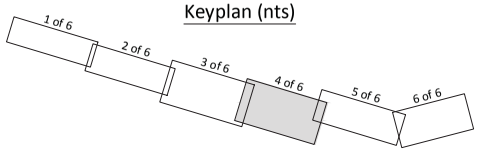
Keyplan (nts)



Legend:

Cable route

25 — Peat depth reference point used in report

Peat Depth Legend (mbgl):

NO PEAT	0	0.25	0.5	0.75	1	1.25	1.5	1.75	2	2.25	2.5	2.75	3

Note:

1) Peat depth coloured zones have been calculated using a contouring technique which provides average peat depths based on the nearest point values. For the specific peat depths refer to Chapter 13 of this report.

2) Width of corridor shown indicatively on drawings.

Scale: N.T.S. @ A3

Drawing UWFGC.PSAGD_04 - Cable route showing peat distribution and depth

Rev 1

Date: 21 Dec 2017

APPENDIX 10.3 Peat Stability Assessment
REFERENCE DOCUMENTS

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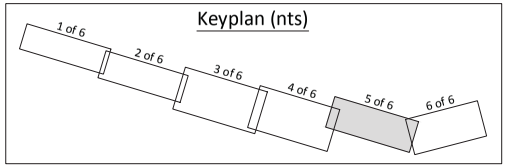

Legend:

Cable route

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Peat Depth Legend (mbgl):

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Note:

1) Peat depth coloured zones have been calculated using a contouring technique which provides average peat depths based on the nearest point values. For the specific peat depths refer to Chapter 13 of this report.

2) Width of corridor shown indicatively on drawings.

Scale: N.T.S. @ A3

Drawing UWFGC.PSAGD_05 - Cable route showing peat distribution and depth

Rev 2

Date: 21 Dec 2017

APPENDIX 10.3 Peat Stability Assessment
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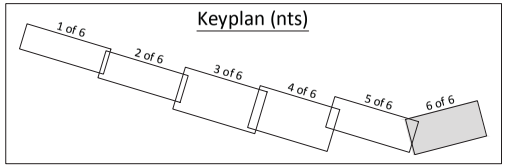
Keyplan (nts)



Legend:

Cable route

25 — Peat depth reference point used in report

Peat Depth Legend (mbgl):

NO PEAT	0 – 0.25	0.25 – 0.5	0.5 – 0.75	0.75 – 1	1 – 1.25	1.25 – 1.5	1.5 – 1.75	1.75 – 2	2 – 2.25	2.25 – 2.5	2.5 – 2.75	2.75 – 3

Note:

1) Peat depth coloured zones have been calculated using a contouring technique which provides average peat depths based on the nearest point values. For the specific peat depths refer to Chapter 13 of this report.

2) Width of corridor shown indicatively on drawings.

Drawing UWFGC.PSAGD_06 - Cable route showing peat distribution and depth

Scale: N.T.S. @ A3

Rev 1

Date: 21 Dec 2017

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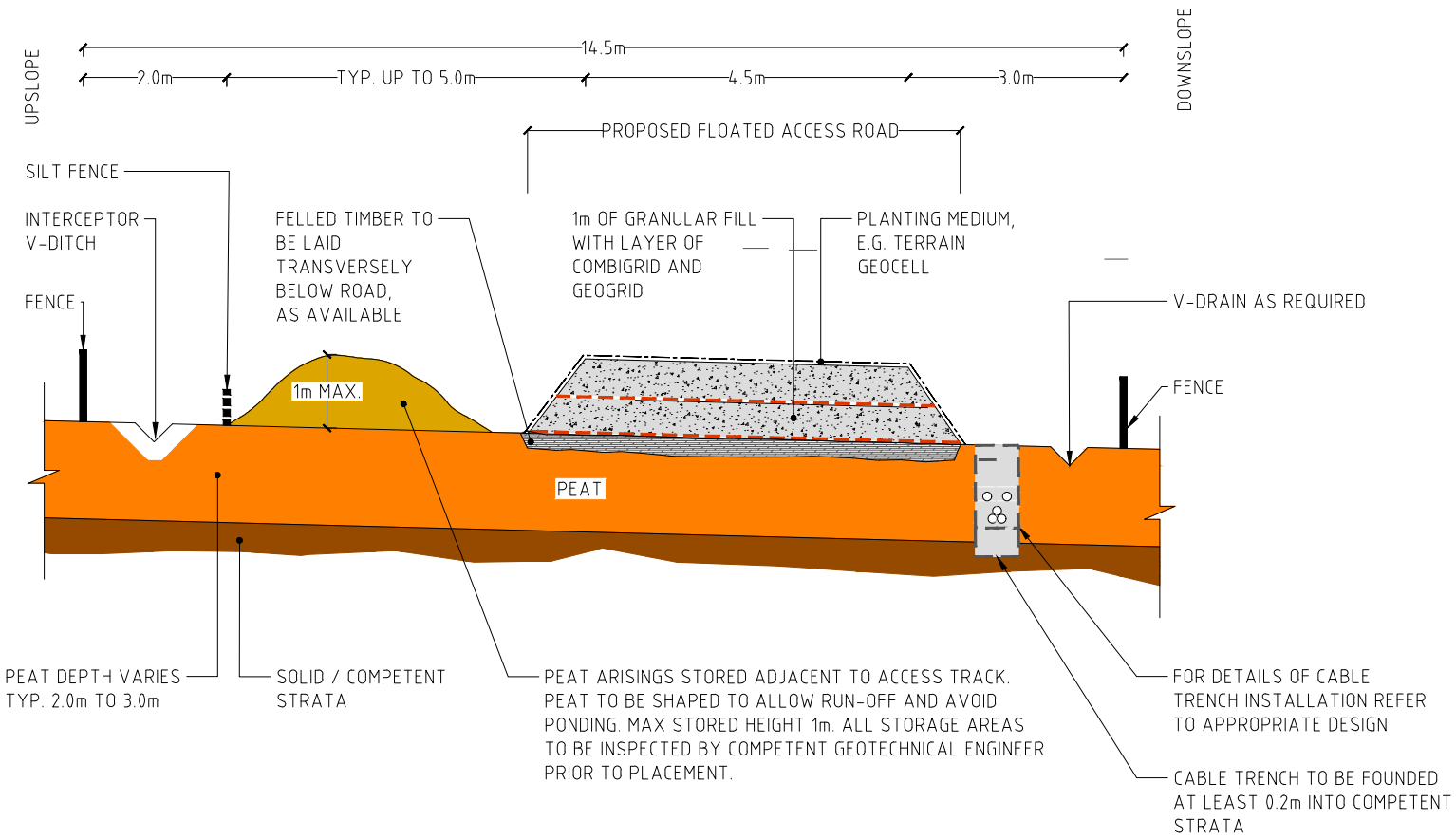

Drawing UWFGC.PSAGD_07 - Typical section through working corridor - Peat

Scale: N.T.S. @ A4

Rev 0

Date: 26-05-2017

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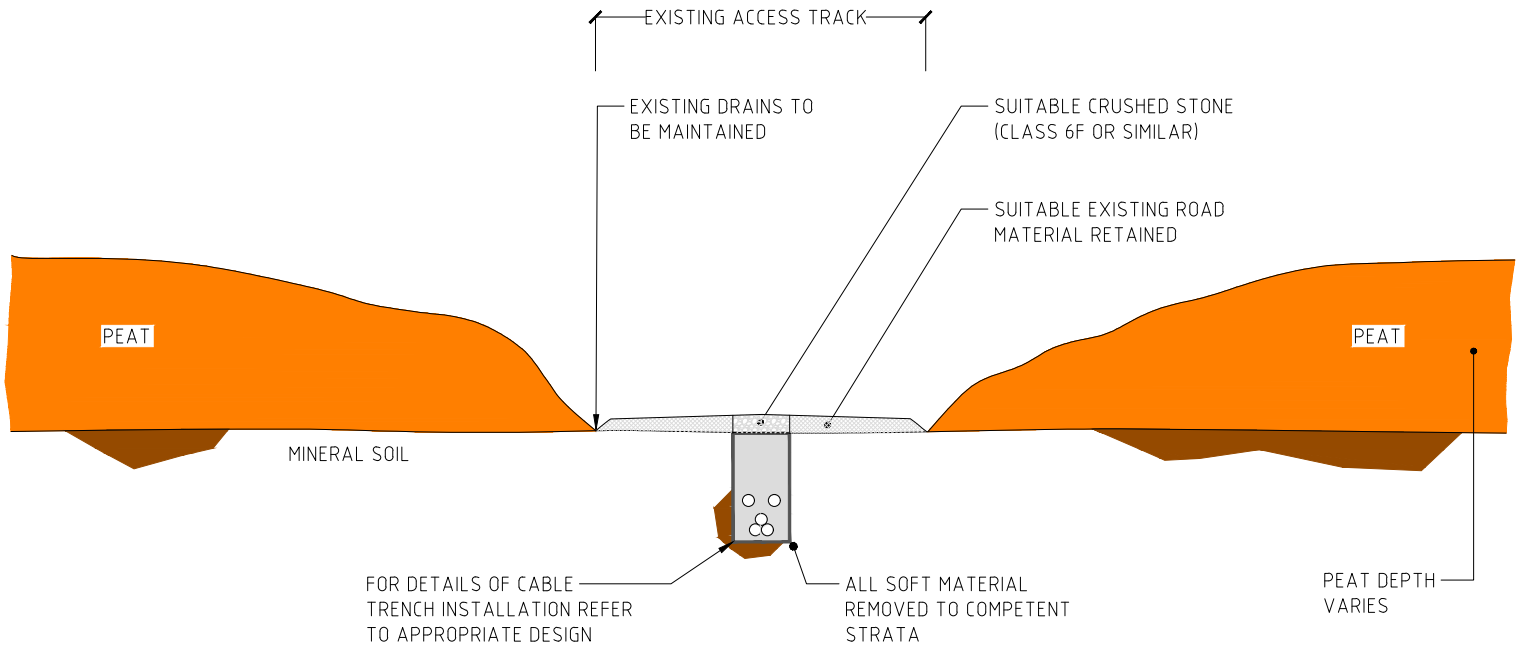

Drawing UWFGC.PSAGD_08 - Typical section through existing track

Scale: N.T.S. @ A4

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Date: 26-05-2017

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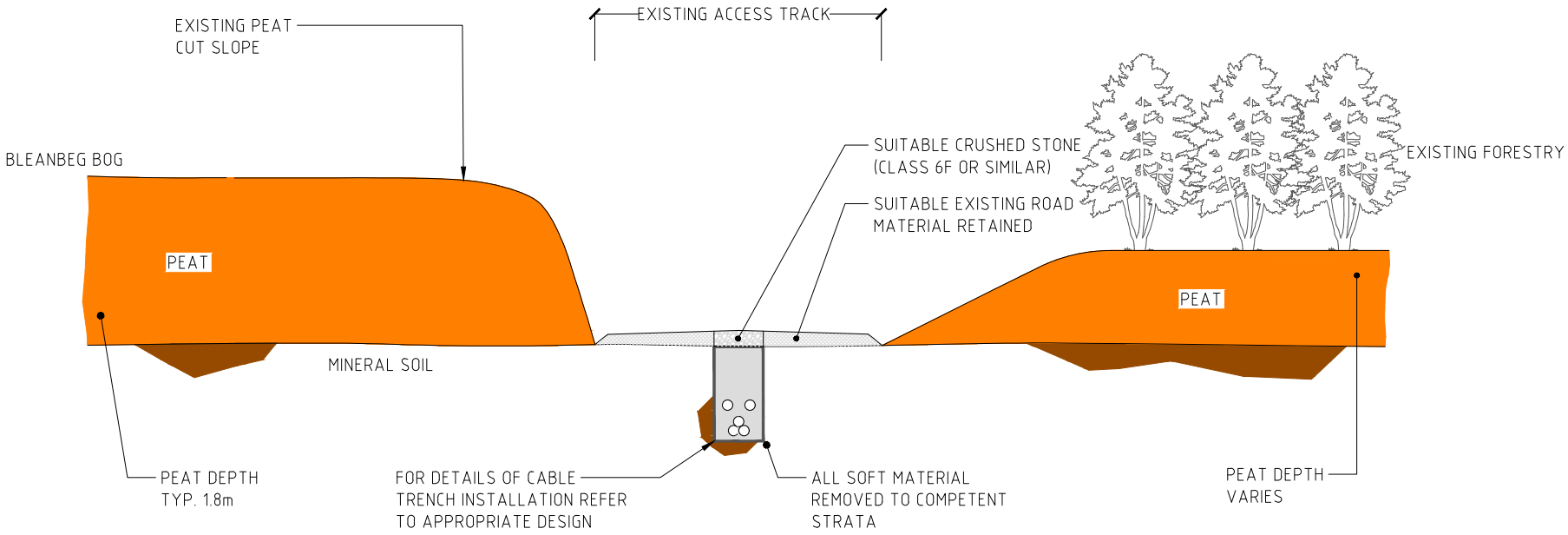

Drawing UWFGC.PSAGD_09 - Typical section near NHA boundary

Scale: N.T.S. @ A4

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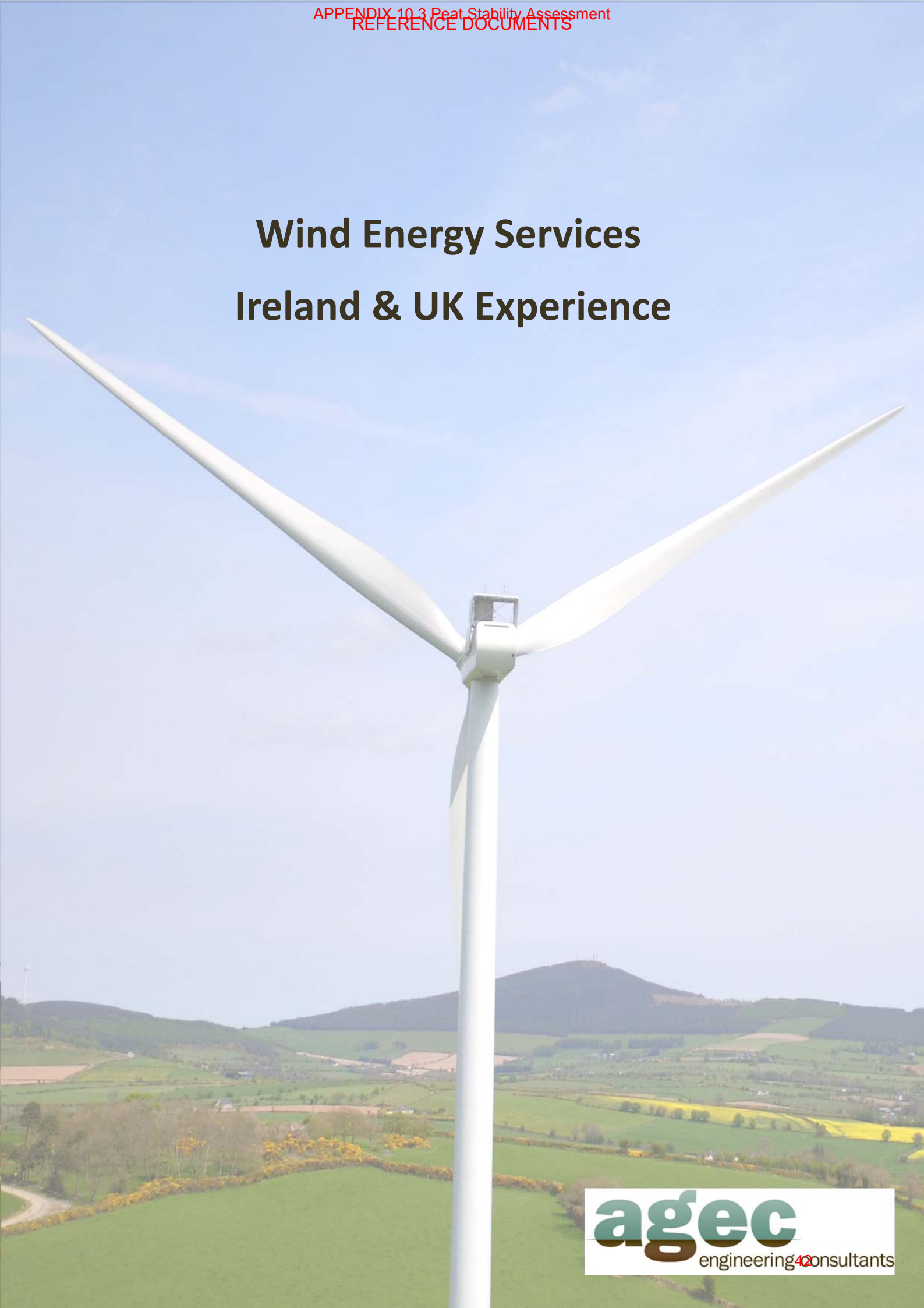
Date: 26-05-2017

CHAPTER 11

AGEC PREVIOUS EXPERIENCE WITH WIND FARM RELATED PROJECTS

Wind Energy Services

Ireland & UK Experience



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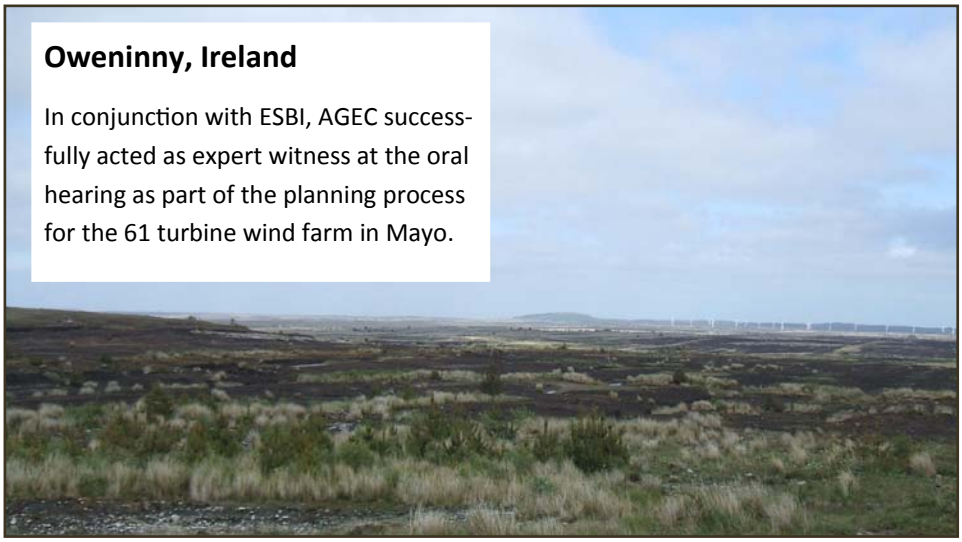
AGEC's Wind Farm Experience

With over 15 years' experience AGEC has established itself as one of the leading geotechnical engineering consultancies in wind farm developments.

AGEC has been involved in over 120 wind farm developments across Ireland and the UK at various stages of development. From preliminary feasibility stage through planning and from scheme development at tender design and detailed design stage, through to the construction & operational stages.

The potential power generated from the wind farm schemes in which AGEC have been involved is estimated at over 3,000MW.

In all aspects of our role we bring value engineering and lateral thinking to de-risk complex projects.



Oweninny, Ireland

In conjunction with ESBI, AGEC successfully acted as expert witness at the oral hearing as part of the planning process for the 61 turbine wind farm in Mayo.

Kilgallioch, Scotland

In partnership with Farrans Construction, AGEC were lead geotechnical designers for the third largest wind farm in the UK with 96 turbines. The estimated energy generated from the wind farm is thought to power over 130,000 homes.

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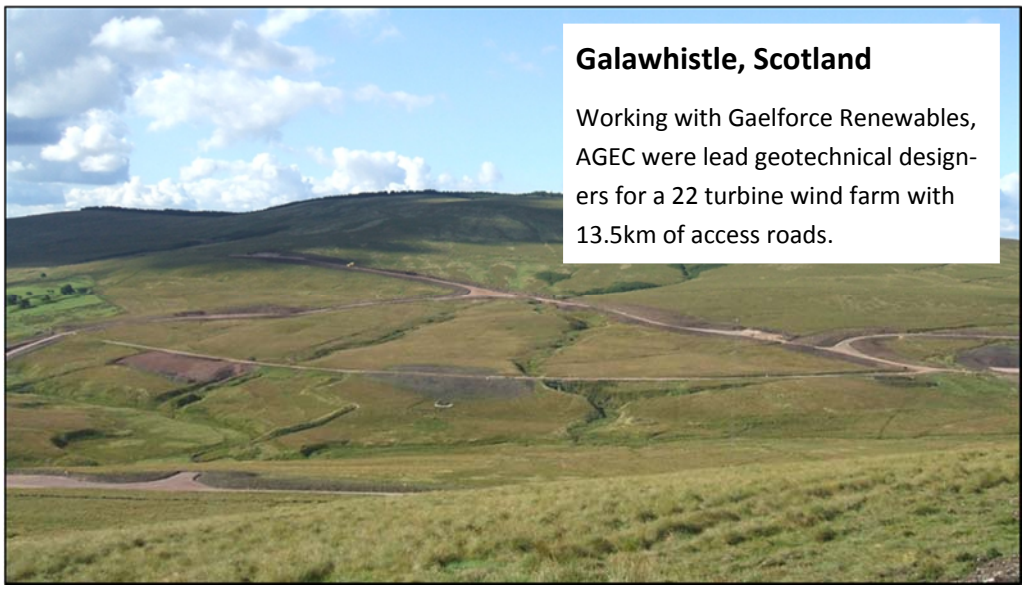
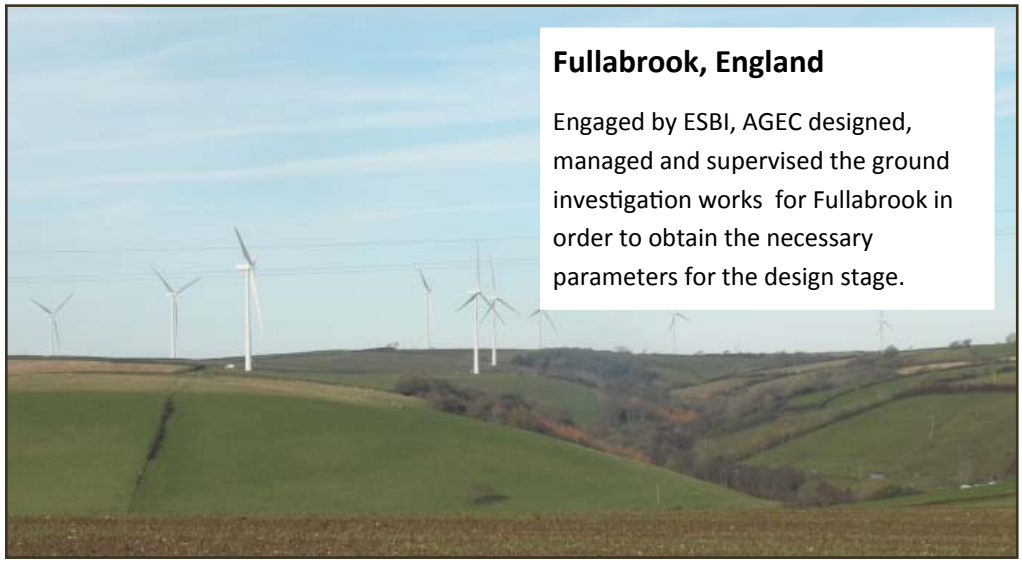


Galawhistle, Scotland

Working with Gaelforce Renewables, AGEC were lead geotechnical designers for a 22 turbine wind farm with 13.5km of access roads.

Galway Wind Park, Ireland

In partnership with Roadbridge, AGEC were appointed lead geotechnical designers. Upon completion the wind park will be the largest onshore wind project in Ireland.



Fullabrook, England

Engaged by ESBI, AGEC designed, managed and supervised the ground investigation works for Fullabrook in order to obtain the necessary parameters for the design stage.

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Value Engineering

Harburnhead is a 22 turbine wind farm which will have an installed capacity of over 50MW serving approximately 30,000 homes.

A significant area of the proposed development was known to be blighted by former Limestone Quarries and extensive shallow mines. Many sinkholes were present across the work area. Up to 8m of peat soils were present in certain areas of the site which presented design and construction issues.

AGEC were engaged by Farrans Construction as geotechnical designers for the project. Value engineering was a key component during the course of the design of the 22 turbine bases. Previous designs for the project indicated that pile foundations would be required for approximately 25% of the bases. AGEC eliminated the need for piling in all but one base through the introduction of deeper foundations with temporary works and site inspections of proposed sub-formations by experienced geotechnical staff.

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Capabilities in Wind Farm Developments

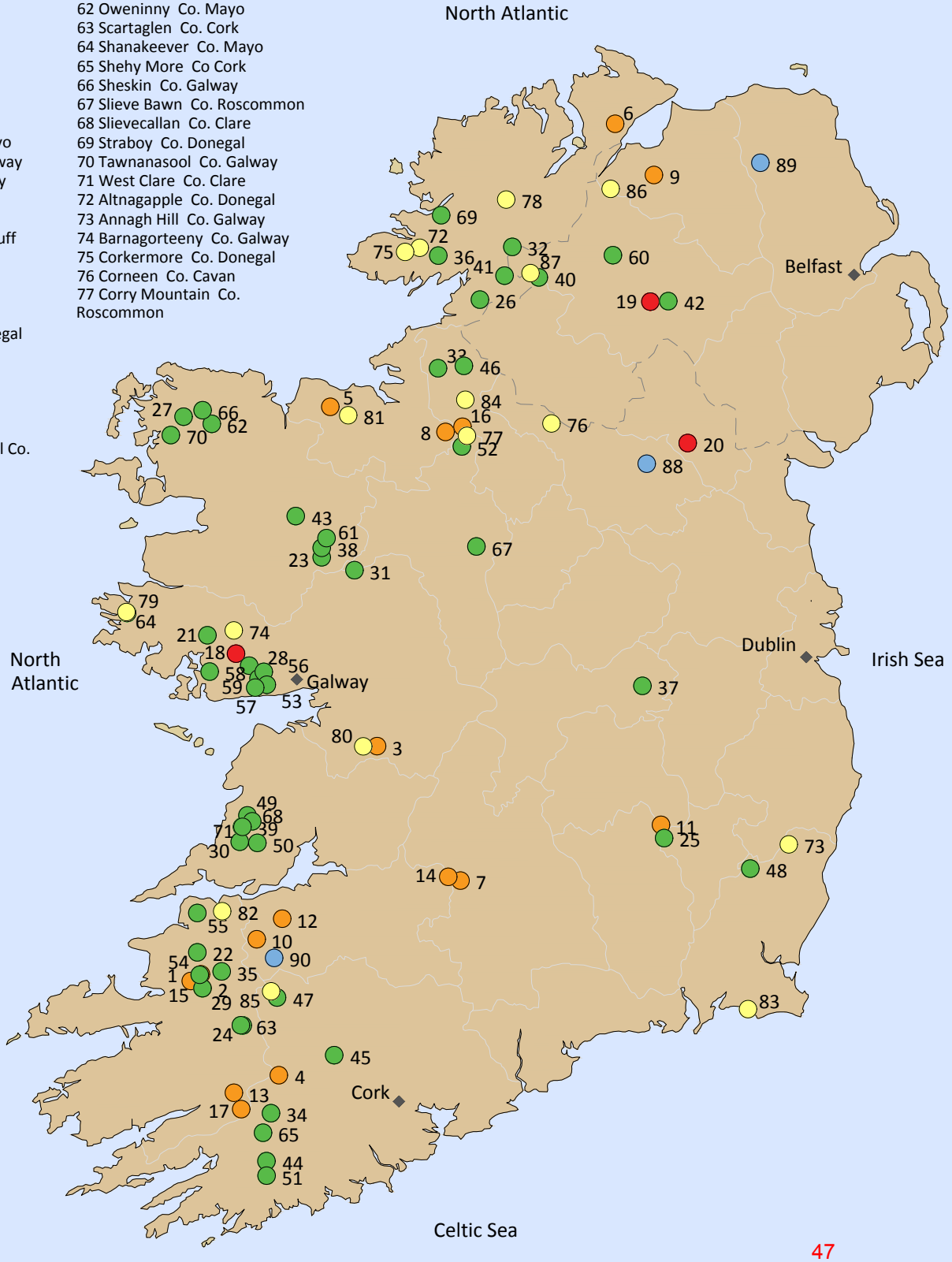
- Geotechnical assessment of sites for wind farm development
- Planning consultancy services - compilation of hydrogeology, soils & geology sections of Environmental Impact Statement (EIS) for planning stage
  - Geotechnical assessment report
  - Peat stability assessment report
  - Peat & spoil management plans
- Expert witness at planning/oral hearings
- Design, procurement & supervision of ground investigations
- Geotechnical tender design & support
- Geotechnical risk assessments
- Geotechnical detailed design for wind farm developments
  - Turbine base formation design – gravity and piled foundations
  - Access track design
  - Substation & construction compound platform and foundation design
  - Crane hardstand & piling platform design
  - Earthwork specifications
  - Spoil storage solutions
  - Construction supervision
- Earthwork balance calculations
- Reusability & excavatability assessments
- Impact assessments of on-site blasting
- Construction supervision of ground works & monitoring
- Geotechnical certification of works
- Compilation & review of data for geotechnical related claims

WIND FARM PROJECTS:

1 Ballincollig Hill Co. Kerry
2 Cahercullenagh Co. Kerry
3 Derrybrien Co. Galway
4 Curragh Mountain Co. Cork
5 Dunneil Co. Sligo
6 Flughland Co. Donegal
7 Garracummer Co. Tipperary
8 Garvagh Glebe Co. Leitrim
9 Glenconway Co. Derry
10 Dromada Co. Limerick
11 Gortahile Co. Laois
12 Grouselodge Co. Limerick
13 Kilgarvan Co. Kerry
14 Knockastanna Co. Tipperary
15 Knocknagoum & Maghaknockane s Co. Kerry
16 Moneenatieve Co. Roscommon
17 Sillahertane Co.Kerry
18 Galway Wind Park Co. Galway
19 Gortfinbar Tyrone
20 Old Mill Co. Monaghan
21 Arderry Co. Galway
22 Ballyhorgan Co. Cork
23 Ballykinave Co.Mayo
24 Barna Co Galway
25 Bilboa Co. Laois
26 Bradlieve Co. Donegal
27 Briska & Uggool Co. Mayo
28 Buffy/Adderroo Co. Galway
29 Cahercullenagh Co. Kerry
30 Cahermurphy Co. Clare
31 Cappagh Co. Galway
32 Carrickaduff & Lismullyduff Co. Donegal
33 Carrickeeny Co. Leitrim
34 Cleanrath Co. Cork
35 Cloghboola Co. Kerry
36 Clogheravaddy Co. Donegal
37 Cloncreen Co. Offaly
38 Cloontooa Co. Mayo
39 Coor West Co. Clare
40 Crilly Co Donegal
41 Croaghnameal North Croaghbrack and Lough Cuill Co. Donegal.
42 Crockagarran Tyrone
43 Cuillalea Co. Mayo
44 Dromleena Co. Cork
45 Esk Co. Cork
46 Faughary Co. Leitrim
47 Foiladaun Co. Cork
48 Gibbet Hill Co. Wexford
49 Glendine Co. Clare
50 Glenmore Co. Clare
51 Killaveenoge Co. Cork
52 Kilronan Co. Roscommon
53 Knockalough Co. Galway
54 Knocknagoum & Maghanknockanes Co. Kerry
55 Larna Co. Kerry
56 Lealetter Co. Galway
57 Lettergunnet Co. Galway
58 Lettermuckoo Co. Galway
59 Letterpeak Co. Galway
60 Lisnaharney Co. Tyrone
61 Magheramore Co. Mayo
62 Oweninny Co. Mayo
63 Scartaglen Co. Cork
64 Shanakeever Co. Mayo
65 Shehy More Co Cork
66 Sheskin Co. Galway
67 Slieve Bawn Co. Roscommon
68 Slievecallan Co. Clare
69 Straboy Co. Donegal
70 Tawnanasool Co. Galway
71 West Clare Co. Clare
72 Altnagapple Co. Donegal
73 Annagh Hill Co. Galway
74 Barnagorteeny Co. Galway
75 Corkermore Co. Donegal
76 Corneen Co. Cavan
77 Corry Mountain Co. Roscommon
78 Culliagh Co. Donegal
79 Forraskaheen Co. Galway
80 Keelderry Co. Galway
81 Kingsmountain Co. Sligo
82 Leanamore Co. Kerry
83 Richfield Co. Wexford
84 Tullynamoyle Co. Leitrim
85 Rockchapel Co Cork
86 Slievekirk Extension Derry
87 Tievenameenta Co. Tyrone
88 Bindoo Co. Cavan
89 Long Mountain Co. Antrim
90 Tournafulla & Rathcahill Co. Limerick

AGEC SERVICE:

- Site development assessment/services
- EIA & planning stage consultancy/services
- Tender design/support
- Detailed design services & construction support
- Construction & post-construction support



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tel: +44 (0) 1217735497

Key Experience of Report Authors

Dr Paul Jennings (BEng (Hons), PhD, DipArb, MIEI, CEng) is a geotechnical engineer with 30 years' experience of design and construction of sub-surface structures, foundations, earthworks, infrastructure and earth-retaining structures; planning, supervision and interpretation of ground investigation; and providing expert geotechnical advice and reporting. Paul has particular experience in providing expert advice for slope stability problems, engineered earthworks and sensitive embankments, soft ground engineering, infrastructure, deep-excavations and forensic investigation of landslides.

Billy Murphy (BEng (Hons), MIEI) is a civil engineer with over 7 years' experience in geotechnical design and analysis, site assessment, supervision of site investigations, supervision of construction works, bearing capacity, settlement and slope stability analysis, preparing project fee proposals and technical report writing. Billy worked part time with AGEC from 2008 to 2010 before moving to Canada and working with Golder Associates for five and a half years. Billy moved back to Ireland and joined AGEC in October 2016.

CHAPTER 12

GEOTECHNICAL RISK REGISTER

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 02 - Point No. 74 to 76 & 91/92

Distance to Watercourse (m)	**< 50**
Maximum Measured Peat Depth (m):	**2.6**
Control Required:	**Yes**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 2.79 (u), 6.70 (d)	1	4	4	Tolerable	No	See Below	1	4	4	Tolerable
2	Evidence of sub peat water flow	1	4	4	Tolerable	No		1	4	4	Tolerable
3	Evidence of surface water flow	1	4	4	Tolerable	Yes		1	4	4	Tolerable
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		1	4	4	Tolerable
5	Type of vegetation	1	4	4	Tolerable	No		1	4	4	Tolerable
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Tolerable	No		1	4	4	Tolerable
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)
iv	Sufficient drainage / water flow should be maintained to ensure that there is no build-up of water upstream of any proposed crossing (Specific).

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 02 - Point No. 77 to 82 & 96

Distance to Watercourse (m)	**> 150**
Maximum Measured Peat Depth (m):	**3.0**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 2.44 (u), 6.73 (d)	1	1	1	Trival	No	See Below	1	1	1	Trival
2	Evidence of sub peat water flow	1	1	1	Trival	No		1	1	1	Trival
3	Evidence of surface water flow	1	1	1	Trival	No		1	1	1	Trival
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Trival	No		2	1	2	Trival
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Trival	No		1	1	1	Trival
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 02 - Point No. 83 to 85 & 95

Distance to Watercourse (m)	**< 50**
Maximum Measured Peat Depth (m):	**2.3**
Control Required:	**Yes**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 6.08 (u), 16.83 (d)	1	4	4	Tolerable	No	See Below	1	4	4	Tolerable
2	Evidence of sub peat water flow	1	4	4	Tolerable	No		1	4	4	Tolerable
3	Evidence of surface water flow	1	4	4	Yes	No		0.5	4	2	Trival
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Tolerable	Yes		1	4	4	Tolerable
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Tolerable	No		1	4	4	Tolerable
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)
iv	Sufficient drainage / water flow should be maintained to ensure that there is no build-up of water upstream of any proposed crossing (Specific).

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 02 - Point No. 86 to 87 & 93 to 95

Distance to Watercourse (m)	**< 50**
Maximum Measured Peat Depth (m):	**2.1**
Control Required:	**Yes**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 4.32 (u), 11.37 (d)	1	4	4	Tolerable	No	See Below	1	4	4	Tolerable
2	Evidence of sub peat water flow	1	4	4	Tolerable	No		1	4	4	Tolerable
3	Evidence of surface water flow	1	4	4	Tolerable	Yes		0.5	4	2	Trival
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Tolerable	No		1	4	4	Tolerable
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Tolerable	No		1	4	4	Tolerable
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
ii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)
iv	Sufficient drainage / water flow should be maintained to ensure that there is no build-up of water upstream of any proposed crossing (Specific)

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 03 - Point No. 105 to 113

Distance to Watercourse (m)	**< 50**
Maximum Measured Peat Depth (m):	**1.2**
Control Required:	**Yes**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 2.82 (u), 4.32 (d)	1	4	4	Tolerable	No	See Below	1	4	4	Tolerable
2	Evidence of sub peat water flow	1	4	4	Tolerable	No		1	4	4	Tolerable
3	Evidence of surface water flow	1	4	4	Tolerable	Yes		0.5	4	2	Trival
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Tolerable	No		1	4	4	Tolerable
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Tolerable	No		1	4	4	Tolerable
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)
iv	Sufficient drainage / water flow should be maintained to ensure that there is no build-up of water upstream of any proposed crossing (Specific).

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 02 - NHA Boundary (Point No. 12 to 15)

Distance to Watercourse (m)	**> 150**
Maximum Measured Peat Depth (m):	**1.8**
Control Required:	**No**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 5.36 (u), 11.96 (d)	1	1	1	Trival	No	See Below	1	1	1	Trival
2	Evidence of sub peat water flow	1	1	1	Trival	No		1	1	1	Trival
3	Evidence of surface water flow	1	1	1	Trival	No		1	1	1	Trival
4	Evidence of previous failures/slips	0	1	0	Not Applicable	No		0	1	0	Not Applicable
5	Type of vegetation	2	1	2	Trival	No		2	1	2	Trival
6	General slope characteristics upslope/downslope from infrastructure location	1	1	1	Trival	No		1	1	1	Trival
7	Evidence of very soft/soft clay at base of peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
8	Evidence of mechanically cut peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	1	0	Not Applicable	No		0	1	0	Not Applicable
10	Evidence of bog pools	0	1	0	Not Applicable	No		0	1	0	Not Applicable
11	Other	0	1	0	Not Applicable	No		0	1	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 02, 05, 06 - Point No. 62 to 68 & 115 to 116

Distance to Watercourse (m)	**< 50**
Maximum Measured Peat Depth (m):	**0.8**
Control Required:	**Yes**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 3.15 (u), 4.13 (d)	1	4	4	Tolerable	No	See Below	1	4	4	Tolerable
2	Evidence of sub peat water flow	1	4	4	Tolerable	No		1	4	4	Tolerable
3	Evidence of surface water flow	1	4	4	Tolerable	Yes		0.5	4	2	Trival
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Tolerable	No		1	4	4	Tolerable
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Tolerable	No		1	4	4	Tolerable
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)
iv	Sufficient drainage / water flow should be maintained to ensure that there is no build-up of water upstream of any proposed crossing (Specific).

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

Upperchurch Cable Route - Geotechnical Risk Register (Rev 1)

Drawing 03, 05 - Point No. 19 to 21 & 114 & 24, 46 to 55

Distance to Watercourse (m)	**< 50**
Maximum Measured Peat Depth (m):	**2.5**
Control Required:	**Yes**

		Pre-Control Measure Implementation						Post-Control Measure Implementation			
Ref.	Contributory/Qualitative Factors to Potential Peat Failure	Prob	Impact	Risk	Risk Rating	Specific Control Required	Control measures to be implemented during construction	Prob	Impact	Risk	Risk Rating
1	FOS = 2.28 (u), 3.32 (d)	1	4	4	Tolerable	No	See Below	1	4	4	Tolerable
2	Evidence of sub peat water flow	1	4	4	Tolerable	No		1	4	4	Tolerable
3	Evidence of surface water flow	1	4	4	Tolerable	Yes		0.5	4	2	Trival
4	Evidence of previous failures/slips	0	4	0	Not Applicable	No		0	4	0	Not Applicable
5	Type of vegetation	1	4	4	Tolerable	No		1	4	4	Tolerable
6	General slope characteristics upslope/downslope from infrastructure location	1	4	4	Tolerable	No		1	4	4	Tolerable
7	Evidence of very soft/soft clay at base of peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
8	Evidence of mechanically cut peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
9	Evidence of quaking or buoyant peat	0	4	0	Not Applicable	No		0	4	0	Not Applicable
10	Evidence of bog pools	0	4	0	Not Applicable	No		0	4	0	Not Applicable
11	Other	0	4	0	Not Applicable	No		0	4	0	Not Applicable

i	Maintain hydrology of area as far as possible (General)
ii	Use of experienced contractors and trained operators to carry out the work (General)
iii	Use of suitable construction equipment during construction i.e. wide tracked excavators, tracked dumpers (General)
iv	Sufficient drainage / water flow should be maintained to ensure that there is no build-up of water upstream of any proposed crossing (Specific).

Note
(1) FOS abbreviations are: u: FOS for undrained analysis, d: FOS for drained analysis.

CHAPTER 13

CALCULATED FOS FOR PEAT SLOPES ON SITE

Calculated FoS of Natural Peat Slopes for Upperchurch Cable Route (Undrained Analysis)

Point No. (Drawing)	Easting	Northing	Slope	Undrained shear strength	Bulk unit weight of Peat	Peat Depth	Surcharge Equivalent Placed Fill Depth (m)	Factor of Safety for Load Condition		Comments
			β (deg)	c_u (kPa)	γ (kN/m^3)	(m)	Condition (2)	Condition (1)	Condition (2)	
1 (UWFGC.PSAGD_02)	176666	163615	2.0	No peat recorded at this location						
2 (UWFGC.PSAGD_02)	176740	163549	2.0	No peat recorded at this location						
3 (UWFGC.PSAGD_02)	176803	163478	2.0	No peat recorded at this location						
4 (UWFGC.PSAGD_02)	176753	163411	2.0	No peat recorded at this location						
5 (UWFGC.PSAGD_02)	177750	162872	2.0	No peat recorded at this location						
6 (UWFGC.PSAGD_02)	177838	162913	4.0	No peat recorded at this location						
7 (UWFGC.PSAGD_02)	177937	162931	4.0	No peat recorded at this location						
8 (UWFGC.PSAGD_02)	178030	162959	4.0	No peat recorded at this location						
9 (UWFGC.PSAGD_02)	178126	162986	4.0	No peat recorded at this location						
10 (UWFGC.PSAGD_02)	178208	163042	4.0	No peat recorded at this location						
11 (UWFGC.PSAGD_02)	178281	163109	3.0	No peat recorded at this location						
12 (UWFGC.PSAGD_02)	178378	163093	3.0	No peat recorded at this location						
13 (UWFGC.PSAGD_02)	178475	163071	3.0	7	10	1.5	2.5	**8.93**	**5.36**	Peat depth in bank beside existing track. No peat below existing track.
14 (UWFGC.PSAGD_02)	178572	163047	3.0	7	10	0.9	1.9	**14.88**	**7.05**	
15 (UWFGC.PSAGD_02)	178597	163042	2.0	7	10	1.8	2.8	**11.15**	**7.17**	
16 (UWFGC.PSAGD_03)	180431	162038	3.0	No peat recorded at this location						
17 (UWFGC.PSAGD_03)	180479	161950	3.0	No peat recorded at this location						
18 (UWFGC.PSAGD_03)	180487	161851	4.0	No peat recorded at this location						
19 (UWFGC.PSAGD_03)	180577	161845	4.0	7	10	0.4	1.4	**25.15**	**7.19**	
20 (UWFGC.PSAGD_03)	180671	161812	4.0	7	10	0.6	1.6	**16.77**	**6.29**	
21 (UWFGC.PSAGD_03)	180745	161784	1.0	No peat recorded at this location						
22 (UWFGC.PSAGD_03)	182450	161816	1.0	No peat recorded at this location						
23 (UWFGC.PSAGD_03)	182532	161759	1.0	No peat recorded at this location						
24 (UWFGC.PSAGD_03)	182622	161716	13.0	7	10	0.4	1.4	**7.98**	**2.28**	Peaty topsoil
25 (UWFGC.PSAGD_03)	182706	161662	2.0	No peat recorded at this location						
26 (UWFGC.PSAGD_03)	182741	161569	2.0	No peat recorded at this location						
27 (UWFGC.PSAGD_03)	182812	161500	3.0	No peat recorded at this location						
28 (UWFGC.PSAGD_03)	182885	161431	2.0	No peat recorded at this location						
29 (UWFGC.PSAGD_03)	182957	161362	3.0	No peat recorded at this location						
30 (UWFGC.PSAGD_03)	183029	161292	3.0	No peat recorded at this location						
31 (UWFGC.PSAGD_03)	183100	161222	4.0	No peat recorded at this location						
32 (UWFGC.PSAGD_03)	183161	161146	2.0	No peat recorded at this location						
33 (UWFGC.PSAGD_04 & 03)	183215	161063	2.0	No peat recorded at this location						
34 (UWFGC.PSAGD_04 & 03)	183278	160985	4.0	No peat recorded at this location						
35 (UWFGC.PSAGD_04 & 03)	183342	160908	3.0	No peat recorded at this location						
36 (UWFGC.PSAGD_04 & 03)	183403	160829	5.0	No peat recorded at this location						
37 (UWFGC.PSAGD_04 & 03)	183464	160749	4.0	No peat recorded at this location						
38 (UWFGC.PSAGD_04 & 03)	183543	160716	3.0	No peat recorded at this location						
39 (UWFGC.PSAGD_04 & 03)	183635	160755	2.0	No peat recorded at this location						
40 (UWFGC.PSAGD_04 & 03)	183734	160767	4.0	No peat recorded at this location						
41 (UWFGC.PSAGD_04 & 03)	183833	160783	8.0	No peat recorded at this location						
42 (UWFGC.PSAGD_04)	183932	160771	5.0	No peat recorded at this location						
43 (UWFGC.PSAGD_04)	184032	160768	3.0	No peat recorded at this location						
44 (UWFGC.PSAGD_04)	184123	160731	2.0	No peat recorded at this location						
45 (UWFGC.PSAGD_04)	184191	160708	2.0	No peat recorded at this location						
46 (UWFGC.PSAGD_05)	189682	159995	2.0	7	10	2.5	3.5	**8.03**	**5.73**	
47 (UWFGC.PSAGD_05)	189776	159962	1.0	7	10	1.5	2.5	**26.74**	**16.05**	
48 (UWFGC.PSAGD_05)	189871	159929	1.0	7	10	1.1	2.1	**36.47**	**19.10**	
49 (UWFGC.PSAGD_05)	189958	159884	6.0	No peat recorded at this location						
50 (UWFGC.PSAGD_05)	190039	159908	4.0	No peat recorded at this location						
51 (UWFGC.PSAGD_05)	190043	159814	1.0	No peat recorded at this location						
52 (UWFGC.PSAGD_05)	190117	159750	1.0	7	10	0.5	1.5	**80.23**	**26.74**	
53 (UWFGC.PSAGD_05)	190212	159719	2.0	No peat recorded at this location						
54 (UWFGC.PSAGD_05)	190310	159701	1.0	No peat recorded at this location						
55 (UWFGC.PSAGD_05)	190406	159674	2.0	7	10	0.4	1.4	**50.17**	**14.34**	Peaty topsoil
56 (UWFGC.PSAGD_05)	190505	159686	5.0	No peat recorded at this location						
57 (UWFGC.PSAGD_05)	190597	159716	3.0	No peat recorded at this location						
58 (UWFGC.PSAGD_05)	190696	159701	12.0	No peat recorded at this location						
59 (UWFGC.PSAGD_05)	190794	159681	12.0	No peat recorded at this location						
60 (UWFGC.PSAGD_05)	190883	159637	7.0	No peat recorded at this location						
61 (UWFGC.PSAGD_05)	190974	159595	1.0	No peat recorded at this location						
62 (UWFGC.PSAGD_05)	191061	159547	10.0	7	10	0.3	1.3	**13.64**	**3.15**	Peat depth in bank beside existing track. No peat below existing track.
63 (UWFGC.PSAGD_06 & 05)	191154	159510	1.0	No peat recorded at this location						
64 (UWFGC.PSAGD_06 & 05)	191248	159475	7.0	7	10	0.2	1.2	**28.93**	**4.82**	
65 (UWFGC.PSAGD_06 & 05)	191347	159468	2.0	7	10	0.4	1.4	**50.17**	**14.34**	
66 (UWFGC.PSAGD_06)	191446	159472	2.0	7	10	0.2	1.2	**100.35**	**16.72**	
67 (UWFGC.PSAGD_06)	191546	159483	2.0	7	10	0.3	1.3	**66.90**	**15.44**	
68 (UWFGC.PSAGD_06)	191646	159479	2.0	7	10	0.7	1.7	**28.67**	**11.81**	
69 (UWFGC.PSAGD_06)	191742	159501	5.0	No peat recorded at this location						
70 (UWFGC.PSAGD_06)	191818	159565	4.0	No peat recorded at this location						
71 (UWFGC.PSAGD_06)	191900	159622	6.0	No peat recorded at this location						
72 (UWFGC.PSAGD_06)	191991	159664	5.0	No peat recorded at this location						
73 (UWFGC.PSAGD_06)	192022	159657	4.0	No peat recorded at this location						
74 (UWFGC.PSAGD_02)	579257	662771	1.0	7	10	0.8	1.8	**50.14**	**22.29**	
75 (UWFGC.PSAGD_02)	579215	662797	6.0	7	10	0.7	1.7	**9.62**	**3.96**	
76 (UWFGC.PSAGD_02)	579174	662826	4.0	7	10	2.6	3.6	**3.87**	**2.79**	
77 (UWFGC.PSAGD_02)	579133	662855	5.0	7	10	2.1	3.1	**3.84**	**2.60**	
78 (UWFGC.PSAGD_02)	579090	662878	5.0	7	10	2.3	3.3	**3.51**	**2.44**	
79 (UWFGC.PSAGD_02)	579042	662892	4.0	7	10	2.3	3.3	**4.37**	**3.05**	
80 (UWFGC.PSAGD_02)	578994	662907	3.0	7	10	2.3	3.3	**5.82**	**4.06**	
81 (UWFGC.PSAGD_02)	578946	662921	3.0	7	10	2.7	3.7	**4.96**	**3.62**	
82 (UWFGC.PSAGD_02)	578898	662935	2.0	7	10	2.2	3.2	**9.12**	**6.27**	
83 (UWFGC.PSAGD_02)	578850	662949	2.0	7	10	2.3	3.3	**8.73**	**6.08**	
84 (UWFGC.PSAGD_02)	578802	662964	2.0	7	10	2.1	3.1	**9.56**	**6.47**	
85 (UWFGC.PSAGD_02)	578754	662978	2.0	7	10	2.1	3.1	**9.56**	**6.47**	
86 (UWFGC.PSAGD_02)	578706	662992	3.0	7	10	2.1	3.1	**6.38**	**4.32**	
87 (UWFGC.PSAGD_02)	578667	663023	3.0	7	10	2.1	3.1	**6.38**	**4.32**	
88 (UWFGC.PSAGD_02)	179704	162525	2.0	No peat recorded at this location						
89 (UWFGC.PSAGD_02)	179626	162551	1.0	No peat recorded at this location						
90 (UWFGC.PSAGD_02)	179556	162630	2.0	No peat recorded at this location						
91 (UWFGC.PSAGD_02)	179459	162686	2.0	7	10	1.2	2.2	**16.72**	**9.12**	
92 (UWFGC.PSAGD_02)	179458	162684	1.0	No peat recorded at this location						
93 (UWFGC.PSAGD_02)	178705	163010	2.0	7	10	2.0	3.0	**10.03**	**6.69**	
94 (UWFGC.PSAGD_02)	178798	162986	2.0	7	10	1.8	2.8	**11.15**	**7.17**	
95 (UWFGC.PSAGD_02)	178885	162956	2.0	7	10	1.7	2.7	**11.81**	**7.43**	
96 (UWFGC.PSAGD_02)	179037	162862	2.0	7	10	3.0	4.0	**6.69**	**5.02**	
97 (UWFGC.PSAGD_03)	181746	161984	No recorded peat at this location							
98 (UWFGC.PSAGD_03)	181697	161981	No recorded peat at this location							
99 (UWFGC.PSAGD_03)	181648	161969	No recorded peat at this location							
100 (UWFGC.PSAGD_03)	181601	161952	No recorded peat at this location							
101 (UWFGC.PSAGD_03)	181559	161926	6.0	7	10	0.2	1.2	**33.67**	**5.61**	Peaty topsoil
102 (UWFGC.PSAGD_03)	181512	161913	No recorded peat at this location							
103 (UWFGC.PSAGD_03)	181462	161912	No recorded peat at this location							
104 (UWFGC.PSAGD_03)	181413	161904	No recorded peat at this location							
105 (UWFGC.PSAGD_03)	181365	161890	10.0	7	10	0.4	1.4	**10.23**	**2.92**	Peaty topsoil
106 (UWFGC.PSAGD_03)	181317	161875	8.0	7	10	0.2	1.2	**25.40**	**4.23**	Peaty topsoil
107 (UWFGC.PSAGD_03)	181270	161859	8.0	7	10	0.3	1.3	**16.93**	**3.91**	Peaty topsoil
108 (UWFGC.PSAGD_03)	181223	161843	7.0	7	10	0.4	1.4	**14.47**	**4.13**	Peaty topsoil
109 (UWFGC.PSAGD_03)	181174	161846	7.0	7	10	0.5	1.5	**11.57**	**3.86**	
110 (UWFGC.PSAGD_03)	181128	161866	8.0	7	10	0.8	1.8	**6.35**	**2.82**	
111 (UWFGC.PSAGD_03)	181106	161876	6.0	7	10	1.2	2.2	**5.61**	**3.06**	
112 (UWFGC.PSAGD_03)	180964	161834	6.0	7	10	0.6	1.6	**11.22**	**4.21**	
113 (UWFGC.PSAGD_03)	180914	161841	5.0	7	10	0.5	1.5	**16.12**	**5.37**	
114 (UWFGC.PSAGD_03)	180865	161849	4.0	7	10	0.3	1.3	**33.53**	**7.74**	Peaty topsoil
115 (UWFGC.PSAGD_02)	177765	162839	2.0	7	10	0.8	1.8	**25.09**	**11.15**	Peat depth in bank beside existing track. No peat below existing track.
116 (UWFGC.PSAGD_02)	177736	162876	7.0	7	10	0.4	1.4	**14.47**	**4.13**	
							Minimum =	**3.51**	**2.28**	
							Maximum =	**100.35**	**26.74**	
							Average =	**20.25**	**7.37**	

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m^3
(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa.
(3) Slope inclination (β) based on site readings.
(4) A lower bound undrained shear strength, cu for the peat of 7kPa was selected for the assessment. It should be noted that a cu of 7kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site.
(5) Peat depths based on probes carried out by AGEC.
(6) For load conditions see report text.

Calculated FoS of Natural Peat Slopes for Upperchurch Cable Route (Drained Analysis)

Point No. (Drawing)	Slope	Design c'	Bulk unit weight of Peat	Unit weight of Water	Depth of In situ Peat	Friction Angle	Surcharge Equivalent Placed Fill	Equivalent Total Depth of Peat (m)	Factor of Safety for Load Condition		Comments
	α (deg)	c' (kPa)	γ (kN/m³)	γ_w (kN/m³)	(m)	ø' (deg)	Condition (2)	Condition (2)	Condition (1)	Condition (2)	
									100% Water	100% Water	
1 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
2 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
3 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
4 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
5 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
6 (UWFGC.PSAGD_02)	4.0	No peat recorded at this location									
7 (UWFGC.PSAGD_02)	4.0	No peat recorded at this location									
8 (UWFGC.PSAGD_02)	4.0	No peat recorded at this location									
9 (UWFGC.PSAGD_02)	4.0	No peat recorded at this location									
10 (UWFGC.PSAGD_02)	4.0	No peat recorded at this location									
11 (UWFGC.PSAGD_02)	3.0	No peat recorded at this location									
12 (UWFGC.PSAGD_02)	3.0	No peat recorded at this location									
13 (UWFGC.PSAGD_02)	3.0	4	10.0	10.0	1.5	25	1.0	2.5	**14.00**	**11.96**	Peat depth in bank beside existing track. No peat below existing track.
14 (UWFGC.PSAGD_02)	3.0	4	10.0	10.0	0.9	25	1.0	1.9	**17.40**	**12.93**	
15 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**	
16 (UWFGC.PSAGD_03)	3.0	No peat recorded at this location									
17 (UWFGC.PSAGD_03)	3.0	No peat recorded at this location									
18 (UWFGC.PSAGD_03)	4.0	No peat recorded at this location									
19 (UWFGC.PSAGD_03)	4.0	4	10.0	10.0	0.4	25	1.0	1.4	**21.04**	**10.77**	
20 (UWFGC.PSAGD_03)	4.0	4	10.0	10.0	0.6	25	1.0	1.6	**16.25**	**10.26**	
21 (UWFGC.PSAGD_03)	1.0	No peat recorded at this location									
22 (UWFGC.PSAGD_03)	1.0	No peat recorded at this location									
23 (UWFGC.PSAGD_03)	1.0	No peat recorded at this location									
24 (UWFGC.PSAGD_03)	13.0	4	10.0	10.0	0.4	25	1.0	1.4	**6.58**	**3.32**	Peaty topsoil
25 (UWFGC.PSAGD_03)	2.0	No peat recorded at this location									
26 (UWFGC.PSAGD_03)	2.0	No peat recorded at this location									
27 (UWFGC.PSAGD_03)	3.0	No peat recorded at this location									
28 (UWFGC.PSAGD_03)	2.0	No peat recorded at this location									
29 (UWFGC.PSAGD_03)	3.0	No peat recorded at this location									
30 (UWFGC.PSAGD_03)	3.0	No peat recorded at this location									
31 (UWFGC.PSAGD_03)	4.0	No peat recorded at this location									
32 (UWFGC.PSAGD_03)	2.0	No peat recorded at this location									
33 (UWFGC.PSAGD_04 & 03)	2.0	No peat recorded at this location									
34 (UWFGC.PSAGD_04 & 03)	4.0	No peat recorded at this location									
35 (UWFGC.PSAGD_04 & 03)	3.0	No peat recorded at this location									
36 (UWFGC.PSAGD_04 & 03)	5.0	No peat recorded at this location									
37 (UWFGC.PSAGD_04 & 03)	4.0	No peat recorded at this location									
38 (UWFGC.PSAGD_04 & 03)	3.0	No peat recorded at this location									
39 (UWFGC.PSAGD_04 & 03)	2.0	No peat recorded at this location									
40 (UWFGC.PSAGD_04 & 03)	4.0	No peat recorded at this location									
41 (UWFGC.PSAGD_04 & 03)	8.0	No peat recorded at this location									
42 (UWFGC.PSAGD_04)	5.0	No peat recorded at this location									
43 (UWFGC.PSAGD_04)	3.0	No peat recorded at this location									
44 (UWFGC.PSAGD_04)	2.0	No peat recorded at this location									
45 (UWFGC.PSAGD_04)	2.0	No peat recorded at this location									
46 (UWFGC.PSAGD_05)	2.0	4	10.0	10.0	2.5	25	1.0	3.5	**17.94**	**16.63**	
47 (UWFGC.PSAGD_05)	1.0	4	10.0	10.0	1.5	25	1.0	2.5	**42.00**	**35.88**	
48 (UWFGC.PSAGD_05)	1.0	4	10.0	10.0	1.1	25	1.0	2.1	**47.55**	**37.63**	
49 (UWFGC.PSAGD_05)	6.0	No peat recorded at this location									
50 (UWFGC.PSAGD_05)	4.0	No peat recorded at this location									
51 (UWFGC.PSAGD_05)	1.0	No peat recorded at this location									
52 (UWFGC.PSAGD_05)	1.0	4	10.0	10.0	0.5	25	1.0	1.5	**72.56**	**42.00**	
53 (UWFGC.PSAGD_05)	2.0	No peat recorded at this location									
54 (UWFGC.PSAGD_05)	1.0	No peat recorded at this location									
55 (UWFGC.PSAGD_05)	2.0	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**	Peaty topsoil
56 (UWFGC.PSAGD_05)	5.0	No peat recorded at this location									
57 (UWFGC.PSAGD_05)	3.0	No peat recorded at this location									
58 (UWFGC.PSAGD_05)	12.0	No peat recorded at this location									
59 (UWFGC.PSAGD_05)	12.0	No peat recorded at this location									
60 (UWFGC.PSAGD_05)	7.0	No peat recorded at this location									
61 (UWFGC.PSAGD_05)	1.0	No peat recorded at this location									
62 (UWFGC.PSAGD_05)	10.0	4	10.0	10.0	0.3	25	1.0	1.3	**10.44**	**4.44**	Peat depth in bank beside existing track. No peat below existing track.
63 (UWFGC.PSAGD_06 & 05)	1.0	No peat recorded at this location									
64 (UWFGC.PSAGD_06 & 05)	7.0	4	10.0	10.0	0.2	25	1.0	1.2	**20.33**	**6.55**	
65 (UWFGC.PSAGD_06 & 05)	2.0	4	10.0	10.0	0.4	25	1.0	1.4	**42.02**	**21.55**	
66 (UWFGC.PSAGD_06)	2.0	4	10.0	10.0	0.2	25	1.0	1.2	**70.70**	**22.91**	
67 (UWFGC.PSAGD_06)	2.0	4	10.0	10.0	0.3	25	1.0	1.3	**51.58**	**22.18**	
68 (UWFGC.PSAGD_06)	2.0	4	10.0	10.0	0.7	25	1.0	1.7	**29.74**	**20.10**	
69 (UWFGC.PSAGD_06)	5.0	No peat recorded at this location									
70 (UWFGC.PSAGD_06)	4.0	No peat recorded at this location									
71 (UWFGC.PSAGD_06)	6.0	No peat recorded at this location									
72 (UWFGC.PSAGD_06)	5.0	No peat recorded at this location									
73 (UWFGC.PSAGD_06)	4.0	No peat recorded at this location									
74 (UWFGC.PSAGD_02)	1.0	4	10.0	10.0	0.8	25	1.0	1.8	**55.37**	**39.45**	
75 (UWFGC.PSAGD_02)	6.0	4	10.0	10.0	0.7	25	1.0	1.7	**9.93**	**6.70**	
76 (UWFGC.PSAGD_02)	4.0	4	10.0	10.0	2.6	25	1.0	3.6	**8.88**	**8.27**	
77 (UWFGC.PSAGD_02)	5.0	4	10.0	10.0	2.1	25	1.0	3.1	**7.52**	**6.82**	
78 (UWFGC.PSAGD_02)	5.0	4	10.0	10.0	2.3	25	1.0	3.3	**7.33**	**6.73**	
79 (UWFGC.PSAGD_02)	4.0	4	10.0	10.0	2.3	25	1.0	3.3	**9.17**	**8.41**	
80 (UWFGC.PSAGD_02)	3.0	4	10.0	10.0	2.3	25	1.0	3.3	**12.23**	**11.22**	
81 (UWFGC.PSAGD_02)	3.0	4	10.0	10.0	2.7	25	1.0	3.7	**11.73**	**10.97**	
82 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	2.2	25	1.0	3.2	**18.57**	**16.94**	
83 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	2.3	25	1.0	3.3	**18.34**	**16.83**	
84 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	2.1	25	1.0	3.1	**18.81**	**17.05**	
85 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	2.1	25	1.0	3.1	**18.81**	**17.05**	
86 (UWFGC.PSAGD_02)	3.0	4	10.0	10.0	2.1	25	1.0	3.1	**12.54**	**11.37**	
87 (UWFGC.PSAGD_02)	3.0	4	10.0	10.0	2.1	25	1.0	3.1	**12.54**	**11.37**	
88 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
89 (UWFGC.PSAGD_02)	1.0	No peat recorded at this location									
90 (UWFGC.PSAGD_02)	2.0	No peat recorded at this location									
91 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	1.2	25	1.0	2.2	**22.91**	**18.57**	Peaty topsoil
92 (UWFGC.PSAGD_02)	1.0	No peat recorded at this location									
93 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	2.0	25	1.0	3.0	**19.09**	**17.18**	
94 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	1.8	25	1.0	2.8	**19.72**	**17.45**	
95 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	1.7	25	1.0	2.7	**20.10**	**17.60**	
96 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	3.0	25	1.0	4.0	**17.18**	**16.22**	
97 (UWFGC.PSAGD_03)	No peat recorded at this location										
98 (UWFGC.PSAGD_03)	No peat recorded at this location										
99 (UWFGC.PSAGD_03)	No peat recorded at this location										
100 (UWFGC.PSAGD_03)	No peat recorded at this location										
101 (UWFGC.PSAGD_03)	6.0	4	10.0	10.0	0.2	25	1.0	1.2	**23.68**	**7.64**	
102 (UWFGC.PSAGD_03)	No peat recorded at this location										
103 (UWFGC.PSAGD_03)	No peat recorded at this location										
104 (UWFGC.PSAGD_03)	No peat recorded at this location										
105 (UWFGC.PSAGD_03)	10.0	4	10.0	10.0	0.4	25	1.0	1.4	**8.49**	**4.32**	Peaty topsoil
106 (UWFGC.PSAGD_03)	8.0	4	10.0	10.0	0.2	25	1.0	1.2	**17.83**	**5.74**	Peaty topsoil
107 (UWFGC.PSAGD_03)	8.0	4	10.0	10.0	0.3	25	1.0	1.3	**12.99**	**5.55**	Peaty topsoil
108 (UWFGC.PSAGD_03)	7.0	4	10.0	10.0	0.4	25	1.0	1.4	**12.06**	**6.16**	Peaty topsoil
109 (UWFGC.PSAGD_03)	7.0	4	10.0	10.0	0.5	25	1.0	1.5	**10.41**	**6.00**	
110 (UWFGC.PSAGD_03)	8.0	4	10.0	10.0	0.8	25	1.0	1.8	**6.95**	**4.93**	
111 (UWFGC.PSAGD_03)	6.0	4	10.0	10.0	1.2	25	1.0	2.2	**7.64**	**6.19**	
112 (UWFGC.PSAGD_03)	6.0	4	10.0	10.0	0.6	25	1.0	1.6	**10.85**	**6.84**	
113 (UWFGC.PSAGD_03)	5.0	4	10.0	10.0	0.5	25	1.0	1.5	**14.54**	**8.40**	
114 (UWFGC.PSAGD_03)	4.0	4	10.0	10.0	0.3	25	1.0	1.3	**25.83**	**11.09**	Peaty topsoil
115 (UWFGC.PSAGD_02)	2.0	4	10.0	10.0	0.8	25	1.0	1.8	**27.69**	**19.72**	Peat depth in bank beside existing track. No peat below existing track.
116 (UWFGC.PSAGD_02)	7.0	4	10.0	10.0	0.4	25	1.0	1.4	**12.06**	**6.16**	
								Minimum =	**6.58**	**3.32**	
								Maximum =	**72.56**	**42.00**	
								Average =	**21.50**	**14.14**	

Notes:

(1) Assuming a bulk unit weight for peat of 10kN/m³

(2) Assuming a surcharge equivalent to fill depth of 1m of peat i.e. 10kPa.

(3) Slope inclination (β) based on site readings.

(4) A lower bound undrained shear strength, cu for the peat of 7kPa was selected for the assessment. It should be noted that a cu of 7kPa for the peat is considered a conservative value for the analysis and is not representative of all peat present across the site.

(5) Peat depths based on probes carried out by AGEC.

(6) For load conditions see report text.

CHAPTER 14

SITE PHOTOS

Photo 1 Forested area along route

Photo 2 Forested area along route

Photo 3 Agricultural area along route

Photo 4 Agricultural area along route

Photo 5 Existing track through forested area along route

Photo 6 Existing track through forested area along route

Photo 7 Existing track through forested area along route

Photo 8 Existing track through forested area along route

Photo 9 Existing track near NHA boundary along route

Photo 10 Existing track near NHA boundary along route

Photo 11 Existing paved road along route

Photo 12Existing paved road along route

Photo 13 Water crossing along route

Photo 14 Water crossing along route

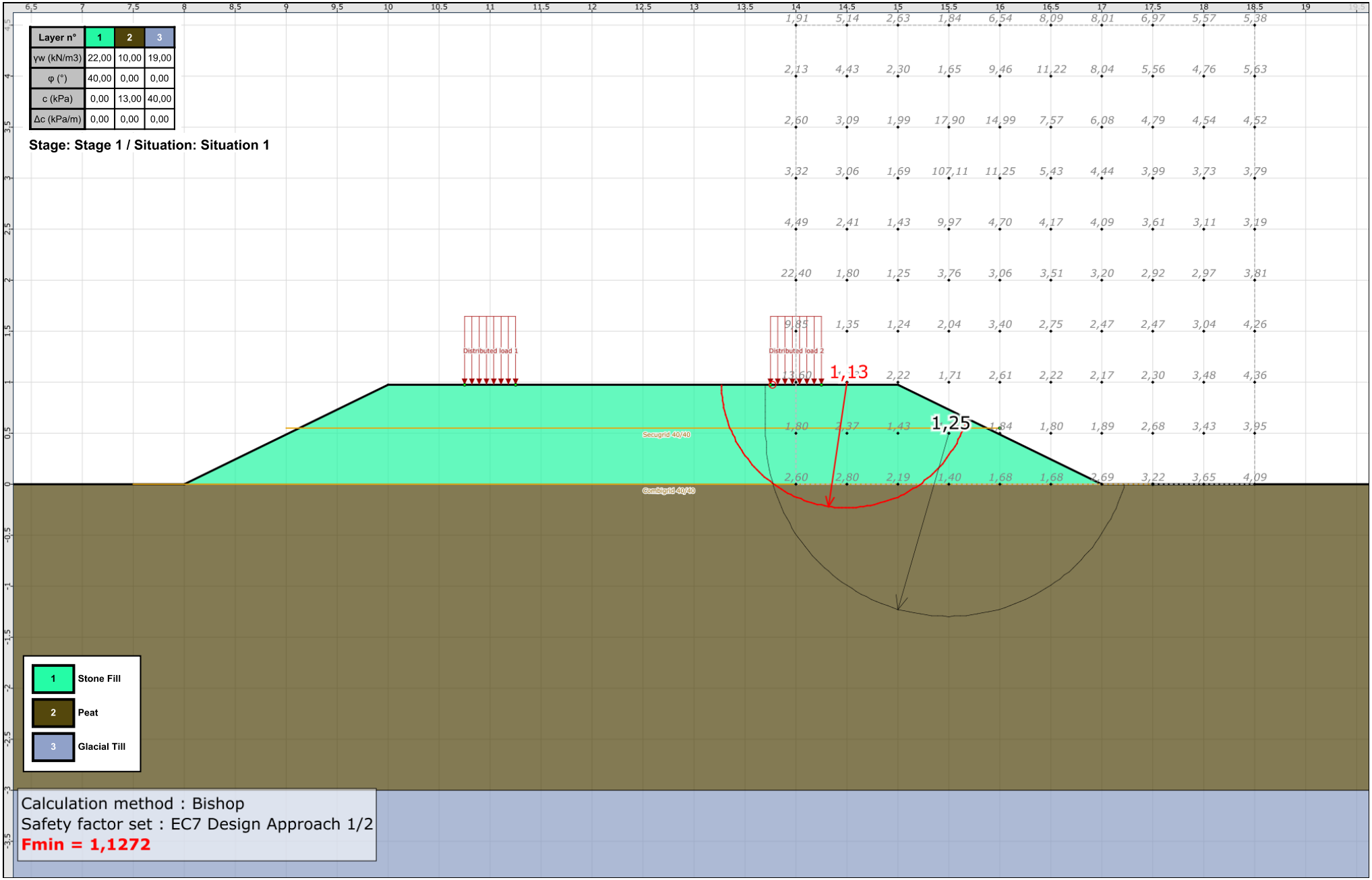
CHAPTER 15

TALREN STABILITY ANALYSIS

Scale 1:50

Layer n°	1	2	3
γw (kN/m3)	22,00	10,00	19,00
φ (°)	40,00	0,00	0,00
c (kPa)	0,00	13,00	40,00
Δc (kPa/m)	0,00	0,00	0,00

Stage: Stage 1 / Situation: Situation 1



Calculation method : Bishop
Safety factor set : EC7 Design Approach 1/2
Fmin = 1,1272

terrasol setec

Talren v5
v5.2.5

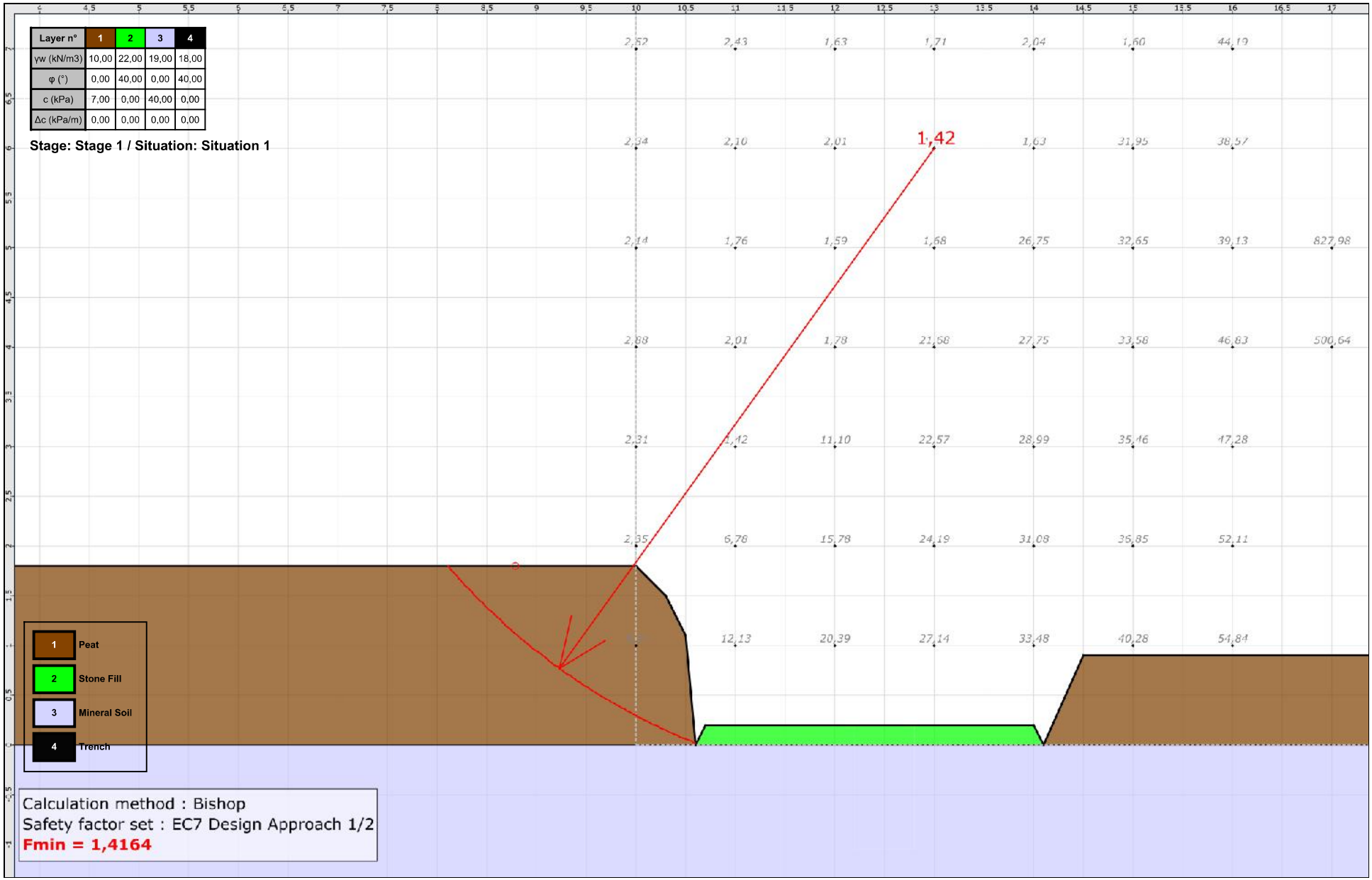
Printed on : 25-May-2017 15:18:56
Calculation made by : AGEC

Project : Upperchurch Grid Connection

Scale 1:51

Layer n°	1	2	3	4
γw (kN/m3)	10,00	22,00	19,00	18,00
φ (°)	0,00	40,00	0,00	40,00
c (kPa)	7,00	0,00	40,00	0,00
Δc (kPa/m)	0,00	0,00	0,00	0,00

Stage: Stage 1 / Situation: Situation 1



terrasol
setec

Talren v5
v5.2.5

Printed on : 26-May-2017 09:16:19
Calculation made by : AGEC

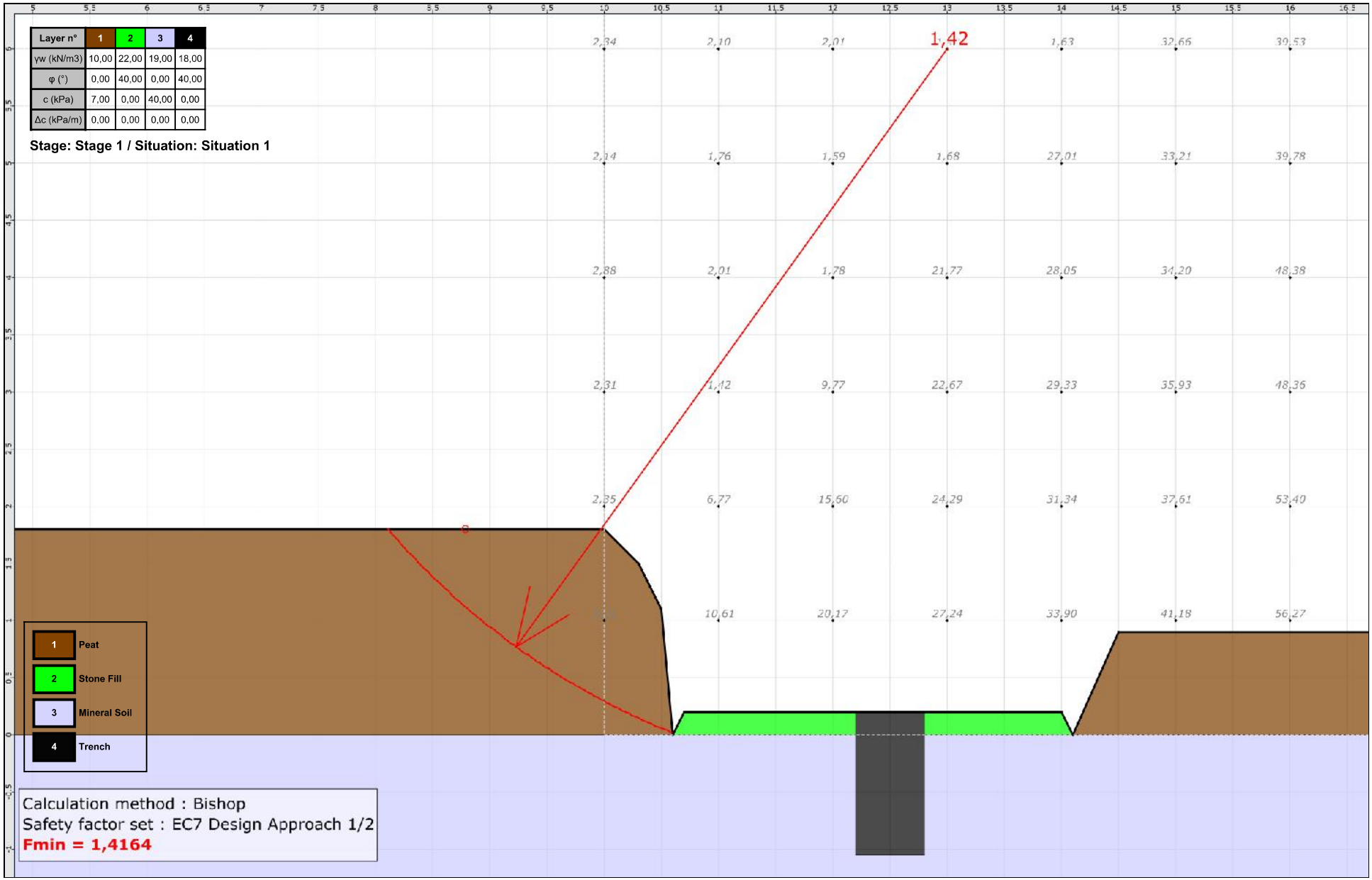
Project : NHA Boundary with no trench

APPENDIX 10.3 Peat Stability Assessment
REFERENCE DOCUMENTS

Scale 1:45

Layer n°	1	2	3	4
γw (kN/m3)	10,00	22,00	19,00	18,00
φ (°)	0,00	40,00	0,00	40,00
c (kPa)	7,00	0,00	40,00	0,00
Δc (kPa/m)	0,00	0,00	0,00	0,00

Stage: Stage 1 / Situation: Situation 1



APPENDIX 10.3 Peat Stability Assessment
REFERENCE DOCUMENTS

terrasol
setec

Talren v5
v5.2.5

Printed on : 26-May-2017 09:12:39
Calculation made by : AGEC

Project : NHA Boundary with Trench

Appendix to Chapter 10: Soils

Appendix 10.4: Consented Upperchurch Windfarm Site Investigations

APPENDIX 10.4
to EIAR Chapter 10: Soils

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T01
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 194902 N: 158932
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	28 October 2011	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.30					
Soft brown stony CLAY, stone size typically less than100mm	0.80					
Weathered SILTSTONE becoming more solid with depth	2.00					
End of trial pit at siltstone bedrock						

Remarks:
No groundwater encountered at 2m depth

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T02
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 195261 N: 159221
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	28 October 2011	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.30					
Soft brown stony CLAY, stone size typically less than100mm	1.20					
Heavily weathered SILTSTONE	2.60					
End of trial pit at siltstone bedrock						

Remarks:
No groundwater encountered at 2.60m depth

T02 - Photograph 1

T02 - Photograph 2

T02 - Photograph 3

T02 - Photograph 4

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T03
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 195574 N: 159410
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	28 October 2011	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.20					
Soft stony CLAY, progressively more stony with depth	1.80					
End of trial pit at SILTSTONE bedrock						

Remarks:
No groundwater encountered at 1.80m depth

T03 - Photograph 1

T03 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T04
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 195988 N: 159620
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	28 October 2011	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.20					
Soft light brown/orange CLAY	0.50					
Soft brown/grey stony CLAY	1.50					
Very loose weathered SILTSTONE (trial pit sides unstable)	2.90					
End of trial pit at solid siltstone						

Remarks:
No groundwater encountered at 2.90m depth
Clay sample taken

T04 - Photograph 1

T04 - Photograph 2

T04 - Photograph 3

T04 - Photograph 4

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T06
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 196450 N: 160319
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	28 October 2011	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.20					
Loose brown stony CLAY	1.00					
Hard weathered SILTSTONE (progressively harder with depth)	2.30					
End of trial pit at siltstone bedrock						

Remarks:
No groundwater encountered at 2.30m depth

T06 - Photograph 1

T06 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T07
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 195989 N: 160428
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft grey CLAY with some organic content	0.45					
Stiff stony grey CLAY	1.00					
Stiff stony yellow CLAY	2.70					
End of trial pit within clay stratum						

Remarks:
Clay is very dry.
No water in excavation.

T07 - Photograph 1

T07 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T08
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 195598 N: 160397
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft grey CLAY with some organic content	0.45					
Soft stony grey CLAY	2.00					
End of trial pit at SILTSTONE bedrock						

Remarks:
Siltstone bedrock is very hard.
No water in excavation.

T08 - Photograph 1

T08 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T09
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 196117 N: 161662
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft stony yellow CLAY	1.70					
Weathered SHALE	2.00					
SHALE	2.80					
End of trial pit within shale stratum						

Remarks:
Shale rock is competent at 2.00m depth below the surface.
No water in excavation.

T09 - Photograph 1

T09 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T10
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 196539 N: 161601
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.20					
Soft stony yellow CLAY	1.00					
Weathered SILTSTONE	1.80					
End of trial pit at siltstone bedrock						

Remarks:
Siltstone bedrock is very hard.
No water in excavation.

T10 - Photograph 1

T10 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T11
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 196417 N: 161965
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	Unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.30					
	0.80					
Weathered SILTSTONE	1.70					
End of trial pit at siltstone bedrock						

Remarks:
No water in excavation.

T11 - Photograph 1

T11 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T12
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 196253 N: 162314
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.20					
Soft brown CLAY	1.20					
Weathered SHALE	3.00					

Remarks:
Shale rock is competent at 2.00m below the surface.
No water in excavation.

T12 - Photograph 1

T12 - Photograph 2

T12 - Photograph 3

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T13
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 196716 N: 162269
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft stony yellow CLAY	0.70					
Weathered SILTSTONE	1.60					
End of trial pit at siltstone bedrock						

Remarks:
No water in excavation

T13 - Photograph 1

T13 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T15
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 197132 N: 162393
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	11 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft brown/yellow CLAY	1.10					
Weathered SILTSTONE	2.10					
End of trial pit at siltstone bedrock						

Remarks:
Siltstone bedrock is very hard.
No water in excavation.

T15 - Photograph 1

T15 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T16
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 197224 N: 162824
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	10 May 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft grey CLAY	0.60					
Soft yellow CLAY	1.60					
Weathered SHALE	2.60					
End of excavation at SILTSTONE bedrock						

Remarks:
No groundwater encountered.

T16 - Photograph 1

T16 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T17
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 193559 N: 162081
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	12 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic PEAT	0.10					
Soft yellow stony CLAY	0.40					
Weathered SILTSTONE with some clay content	1.20					
End of trial pit at siltstone bedrock						

Remarks:
No groundwater encountered.

T17 - Photograph 1

T17 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T18
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 193534 N: 161809
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	12 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft orange/yellow CLAY	0.45					
Soft stony yellow CLAY with angular cobbles	1.40					
Weathered SILTSTONE with some clay content	2.20					
End of trial pit at siltstone bedrock						

Remarks:
Minor ingress of groundwater into the excavation after 20 minutes.

T18 - Photograph 1

T18 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T19
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 193430 N: 161039
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	12 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft yellow stony CLAY	1.10					
Weathered SILTSTONE	1.70					
End of trial pit at siltstone bedrock						

Remarks:
Siltstone is hard at 1.70m below the surface.
No groundwater infiltration.

T19 - Photograph 1

T19 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T20
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 193367 N: 160612
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	12 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft yellow stony CLAY	1.10					
Weathered SILTSTONE	1.70					
End of trial pit at siltstone bedrock						

Remarks:
Siltstone is hard at 1.70m below the surface.
No groundwater infiltration.

T20 - Photograph 1

T20 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T21
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 192992 N: 160336
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	10 May 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Organic soil	0.15					
Soft brown CLAY	0.45					
Heavily weathered SILTSTONE	1.50					
End of trial pit at siltstone bedrock						

Remarks:
Siltstone is hard at 1.50m below the surface.
No groundwater infiltration.

T21 - Photograph 1

T21 - Photograph 2

Trial Pit Log

Project:	Wind Farm Development	**Trial Pit ID**	T22
Location:	Upperchurch, Thurles, County Tipperary	**ING Coordinates**	E: 194754 N: 160387
Client:	Ecopower Ltd., Sion Road, Kilkenny	**Elevation:**	unknown
Date:	12 April 2012	**Logged by:**	S. Doyle

Strata Description	**Depth (m)**	**OD level**	**Water depth**	**Samples /Tests**		
				Type	**Depth**	**Result**
Peaty organic soil	0.30					
Stiff stony grey CLAY	1.50					
Stiff stony yellow CLAY	2.20					
End of trial pit within clay stratum						

Remarks:
No groundwater infiltration.

T22 - Photograph 1

T22 - Photograph 2

Appendix to Chapter 10: Soils

Appendix 10.5: Geophysical Survey Report

REFERENCE DOCUMENTS

REFERENCE DOCUMENTS

AGL17303_02

APPENDIX 10.5
GEOPHYSICAL SURVEY REPORT

REPORT

ON THE

GEOPHYSICAL INVESTIGATION

AT

MULKEAR RIVER CROSSING, UPPERCHURCH WINDFARM, CO. TIPPERARY

FOR

ECOPOWER

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12TH FEBRUARY 2018

Geophysical Investigation,
Mulkear River Crossing, Upperchurch Windfarm
For Ecopower

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOSERVICES LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGL17303		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
TONY LOMBARD M.SC (GEOPHYSICS)	IAN SHARKEY DIP. (MIN ENG.)	V.01	30TH JANUARY 2018
TONY LOMBARD M.SC (GEOPHYSICS)	IAN SHARKEY DIP. (MIN ENG.)	V.02	12TH FEBRUARY 2018

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1. EXECUTIVE SUMMARY

APEX Geoservices Limited was requested by ECOPOWER to carry out a geophysical investigation at the Mulkear River, Newport, County Tipperary. The investigation was requested prior to directional drilling beneath the river for the grid connection element of the Upperchurch Wind Farm.

The area under investigation is underlain by the Keepers Hill Formation consisting of sandstone, grits and claystone.

The geophysical investigation comprised of Electrical Resistivity Tomography and Seismic Refraction profiling.

The objectives of the investigation were to provide information on the type and thickness of the soils, estimate soil stiffness, assess depth to and weathering of bedrock, identify bedrock type and identify any faults / fissures in the bedrock.

The results of the investigation are displayed in a series of maps and figures presented in **Appendix A**.

Soil material has been interpreted as comprising sandy gravelly clay and clayey sandy gravel. The soil has been interpreted as ranging in thickness from c. 0m across part of the river bed to c. 2.0 – 3.6m thick away from the river.

Slightly weathered to fresh bedrock has been interpreted from c. 0m beneath part of the river bed to c. 3.4m 60m south of the river centre and c. 5.5m 46m north of the river centre.

Bedrock type has been interpreted as slightly weathered to fresh shaley sandstone and sandstone with a possible unconformable / faulted contact beneath the river bed.

Beneath the river bed the depth to the proposed directional drilling route is c. 5m, within interpreted slightly weathered – fresh bedrock.

There is a good correlation between the interpreted depth to bedrock and the bedrock levels in the client supplied rotary corehole data.

2. INTRODUCTION

APEX Geoservices Limited was requested by ECOPOWER to carry out a geophysical investigation at the Mulkear River, Newport, County Tipperary. The investigation was requested prior to directional drilling beneath the river for the grid connection element of the Upperchurch Wind Farm. The purpose of the investigation is to provide information on the sub-soil conditions including the depth to bedrock and thickness of the overburden.

2.1 Survey Objectives

The objectives of the investigation are to:

- Provide information on the type and thickness of the soils
- Estimate the soil stiffness
- Assess the depth to bedrock and the weathering of the bedrock
- Identify the bedrock type
- Identify any potential faults / fissure zones within the bedrock

2.2 Site Background and Topography

The site is situated across a stretch of the Mulkear River c. 2.7 km northwest of the village of Newport in County Tipperay. At this location the river is c. 14m wide and is bound to the north and south by open agricultural land which is generally flat lying with elevation ranging c. 88.0 – 91.6m OD. The river bed is c. 1.5 – 3.0m below parts of the surrounding river bank landscape.

The site is shown below in Fig. 2.1 and the river crossing is shown in Fig 2.2.

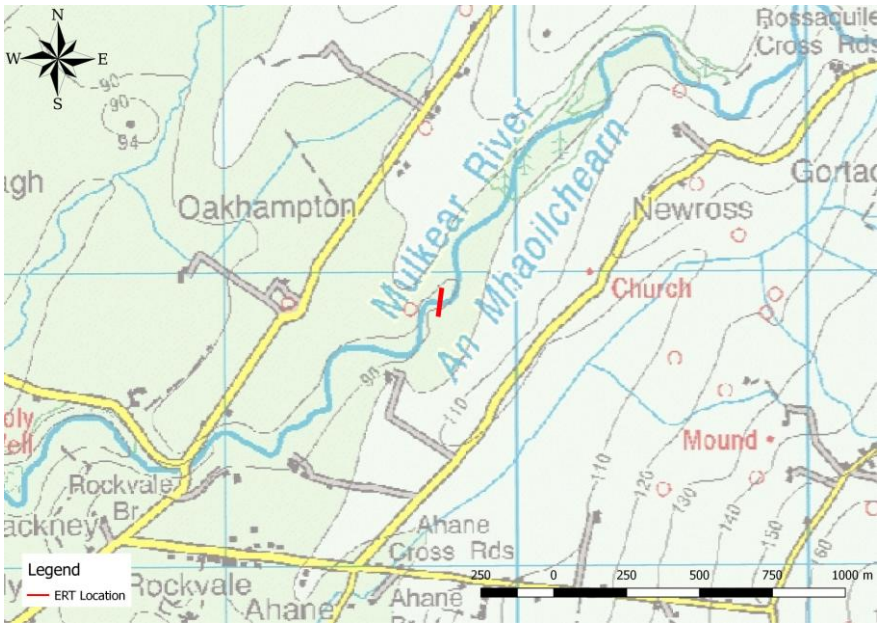

Fig 2.1: Location map (site marked in red).

Fig. 2.2 Geophysical Investigation across the Mulkear River.

2.2.1 Soils and Bedrock Geology

The Geological Survey of Ireland (GSI)/Teagasc subsoils map for the area (Fig. 2.3) indicates that the site is in an area of till derived from sandstone and alluvium.

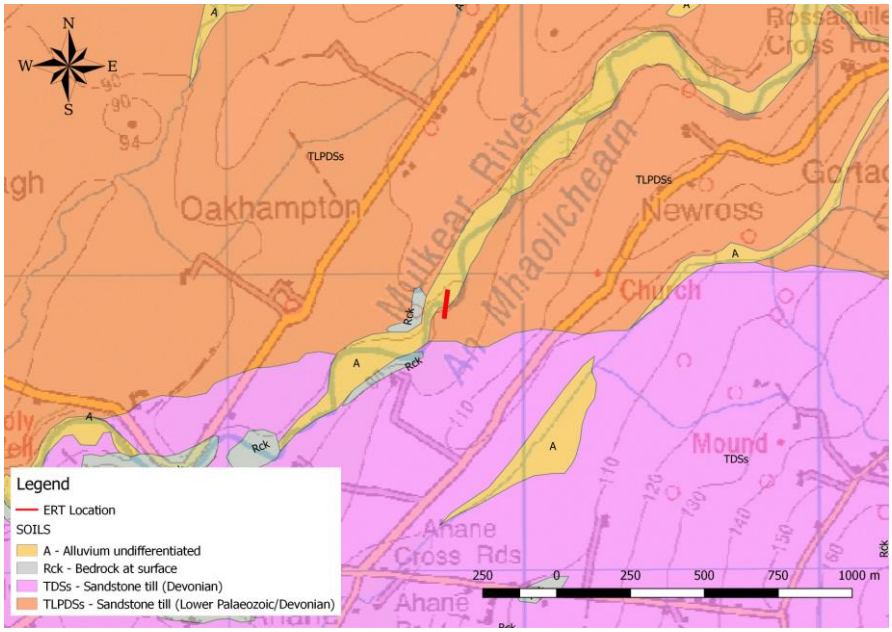

Fig 2.3: The GSI / Teagasc subsoils map (site marked in red).

The GSI 1:100k Bedrock Geology map for the area (Fig. 2.3) indicates Keeper Hill Formation sandstone, grits and claystone underlie the site. The map also indicates the bedrock dips to the west and southwest and outcrop is present c. 200m to the southwest.

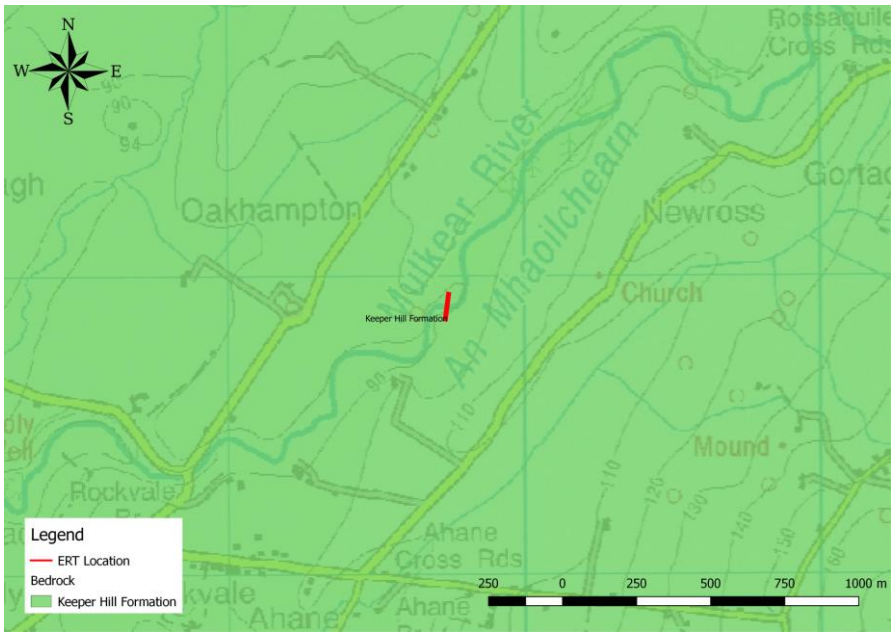

Fig 2.4: The GSI bedrock map (site marked in red).

2.2.2 Aquifer classification and Groundwater vulnerability

The bedrock is classified as a 'Locally Important Aquifer - bedrock which is moderately productive only in local Zones' (Fig. 2.5).

The area under investigation is located within an area of extreme groundwater vulnerability (Fig. 2.6).

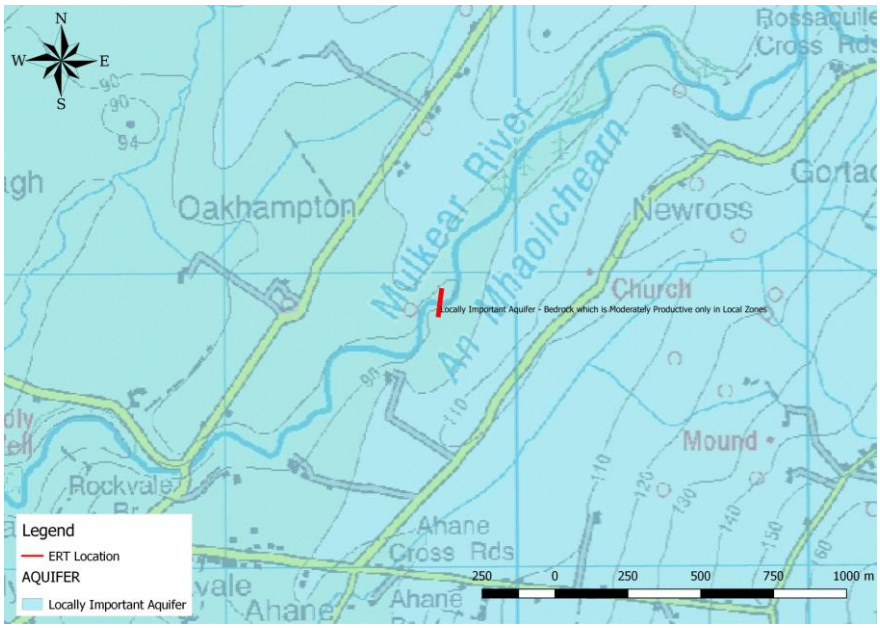

Fig 2.5: The GSI aquifer map (site marked in red).

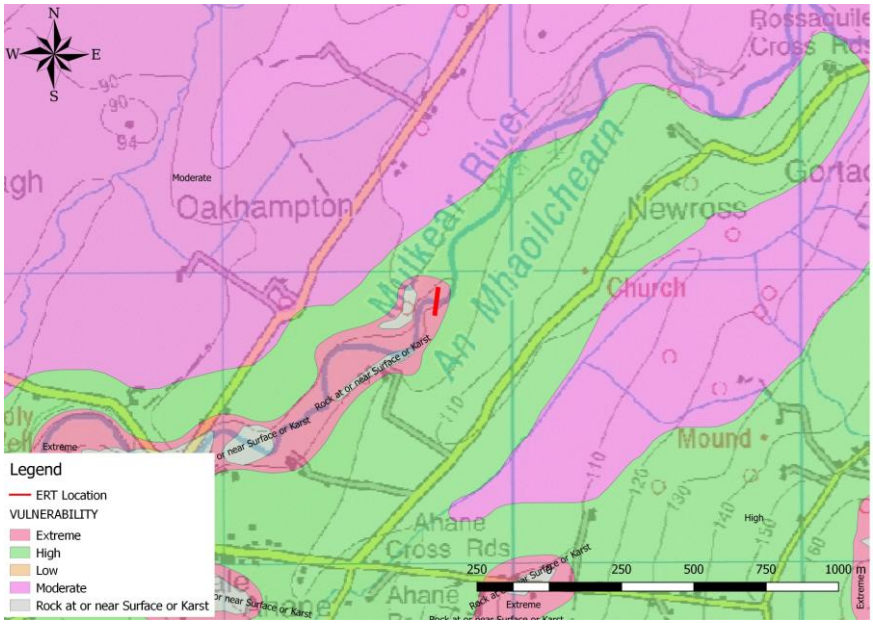

Fig 2.6: The Vulnerability map (site marked in red).

2.2.3 Historical Data

The historical 6 inch sheet (Fig. 2.7) for the area describes rock outcrop of grits to the south of the river crossing.

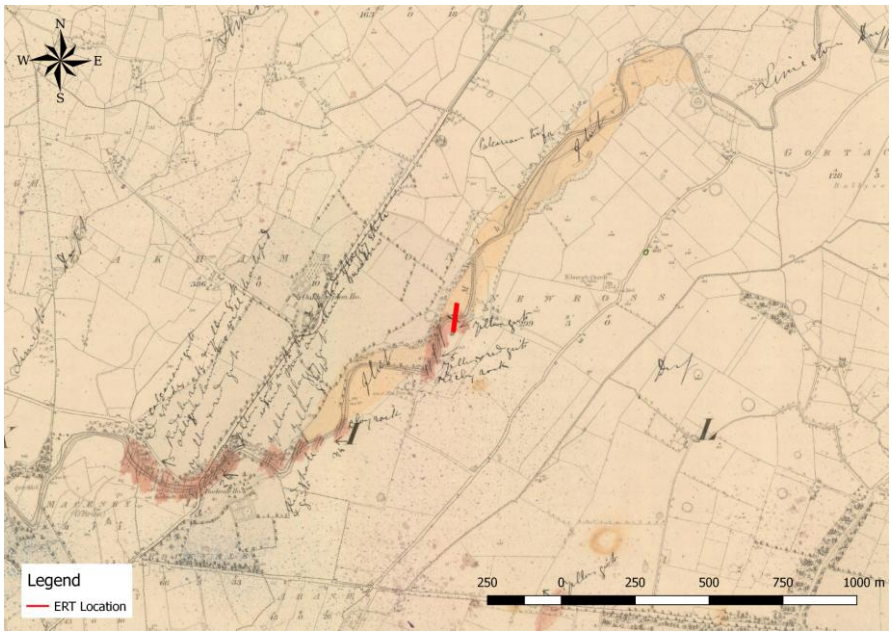

Fig 2.7: The historical 6 inch map (site marked in red).

2.2.4 Direct Investigation Data

A suite of direct investigation information was supplied by the client for incorporation into this report.

Rotary corehole datasets were acquired at two locations, RC05, to the south of the River Mulkear and RC06 to the north of the river.

The southerly corehole, RC05, describes sandy clay to c. 1.60m below ground level (BGL), over sandy gravel with boulders at 3.0m BGL over weak – moderately weak sandstone bedrock with carbonaceous deposits and clay smearing at 3.4m BGL.

The northern corehole, RC06, describes peaty sand to c. 2.1m over sandy gravel / weathered rock over weak – moderately weak sandstone bedrock with carbonaceous deposits and clay smearing at 3.0m BGL.

2.3 Survey Rationale

Electrical Resistivity Tomography (ERT) soundings will image the resistivity of the materials in the subsurface along a profile to produce a cross-section showing the variation in resistivity to 35m BGL, depending on the length of the profile. Each cross-section will be interpreted to determine the material type along the profile at increasing depth, based on the typical resistivities returned for Irish ground materials.

Seismic Refraction Profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities. Readings are taken using geophones connected via multi-core cable to a seismograph. This method should allow us to profile the depth to the top of the bedrock, along profiles across the site.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX B: DETAILED METHODOLOGY**.

3. RESULTS

The investigation was carried out over a single session on the 11th January 2018 and involved the collection of 2no. ERT profiles (2 x 93m) and 4 no. seismic refraction profiles (4 x 46m) across the site.

3.1 ERT

The ERT profiles and geological interpretations are displayed in Appendix A: Drawing No. AGL17264_02. The recorded electrical resistivities have been broadly interpreted in conjunction with the borehole data on the following basis:

Apparent Resistivity (Ohm-m)	Interpretation
80 - 275	Sandy Gravelly CLAY
275 - 550	Clayey Sandy GRAVEL
95 - 380	Shaley SANDSTONE
380 - 905	SANDSTONE

3.2 Seismic refraction profiling

The seismic data, in conjunction with the ERT profiles and geological interpretations are displayed in Appendix A: Drawing No. AGL17264_02.

The data indicated three velocity layers that have been interpreted in conjunction with the borehole data on the following basis:

Layer	Seismic Velocity (m/s)	Average Seismic Velocity (m/s)	Interpretation	Stiffness/Rock Quality	Excavatability
1	278 - 400	350	Soil	Soft / Loose	Diggable
2*	1506 - 1800	1664	Soil	Stiff / Dense	Diggable
			Possible Highly-Moderately Weathered Bedrock	Poor	Marginally Rippable
3	3011 - 3198	3099	Slightly Weathered-Fresh Bedrock	Good	Break/Blast

* Note; Layer 2 velocities may be indicative of stiff to very stiff soil and/or highly to moderately weathered bedrock.

3.3 Integrated Interpretation

The area under investigation at the Mulkear River, is generally characterised by a sequence of sandy gravelly clay and clayey sandy gravel over relatively flat lying bedrock which is closer to the surface beneath the river bed.

Materials with a Vp seismic velocity in the range 278 – 400m/s and 1506-1800m/s and model resistivity values in the range 80 - 275 Ohm-m and 275 - 550 Ohm-m were interpreted as soil layers. These range from soft / loose – stiff / dense.

To the south and north of the river the material type was interpreted as consisting of layers of clayey sandy gravel and these layers are c. 2.0 – 3.6m thick.

Close to the river the material type was interpreted as consisting of layers of sandy gravelly clay which are c. 2.0 - 3.0m thick in the southern bank of the river. Across the river bed these layers are absent on the western ERT profile, R1, (see Appendix A: Drawing No.s AGL17264_02) and c. 0.9 – 1.1m thick on R2.

The combined ERT and seismic refraction data indicates that some highly to moderately weathered bedrock may be present towards the base of the interpreted soil layer on the eastern ERT profile R2. A thin possible weathered rock layer c. 0.3 – 0.4m thick is also indicated on the rotary corehole data.

Materials with a Vp seismic velocity in the range 3011 – 3198m/s were interpreted as slightly weathered to fresh bedrock. Based on resistivity values of 55 - 380 Ohm-m and 380 - 905 Ohm-m bedrock type was interpreted as shaley sandstone and sandstone respectively. The lowest values of 95 Ohm-m indicate increased shale content to the south of the river.

Lateral variation in the bedrock resistivity values indicates contact between the two rock types, close to the southern bank of the river may be unconformable / faulted.

The depth to bedrock across the area under investigation varies from c. 0.0m beneath part of the river bed to c. 3.4m 60m south of the river centre and c. 5.5m 46m north of the river centre.

Beneath the river bed the depth to the proposed directional drilling route is c. 5m, within interpreted bedrock.

There is a good correlation between the interpreted depth to bedrock and the bedrock levels in the client supplied rotary corehole data.

4. REFERENCES

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5. APPENDIX A: DRAWINGS

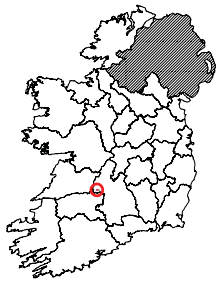
The information derived from the geophysical investigation as well as correlation with the available direct investigation is presented in the following drawings:

AGL17303_01	Fig. 1 Geophysical Investigation Locations	Scale 1:1000 @A3
AGL17303_02	Fig. 1 Results and interpretation ERT profile R1	Scale 1:1000 @A3
AGL17303_02	Fig. 2 Results and interpretation ERT profile R2	Scale 1:1000 @A3

FIGURE 1:GEOPHYSICAL INVESTIGATION LOCATIONS

SCALE 1:1000

INDEX MAP:



LEGEND:

- R1 — 2D resistivity profile
- S1 — Seismic refraction profile
- RC05 — Rotary core
- 110kV UGC — Proposed 110kV cable route

The information displayed here is to be used in conjunction with AGL17303_01 Report on the Geophysical Investigation at Mulkear River - Newport for Ecopower, APEX Geoservices Ltd. 08th February 2018.

APPENDIX 10.5: Geophysical Survey Report

REFERENCE DOCUMENTS

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PROJECT:	MULKEAR RIVER, UPPERCHURCH WINDFARM GEOPHYSICAL INVESTIGATION
CLIENT:	ECOPOWER
DRAWING No:	AGL17303_01
SCALE:	AS INDICATED @ A3
DATE:	08th FEBRUARY 2018

Version:	Date:	Drawn By:	Checked:
01	30/01/2018	AP	TL
02	12/02/2018	AP	TL

FIGURE 1: RESULTS AND INTERPRETATION ERT PROFILE R1
SCALE 1:500

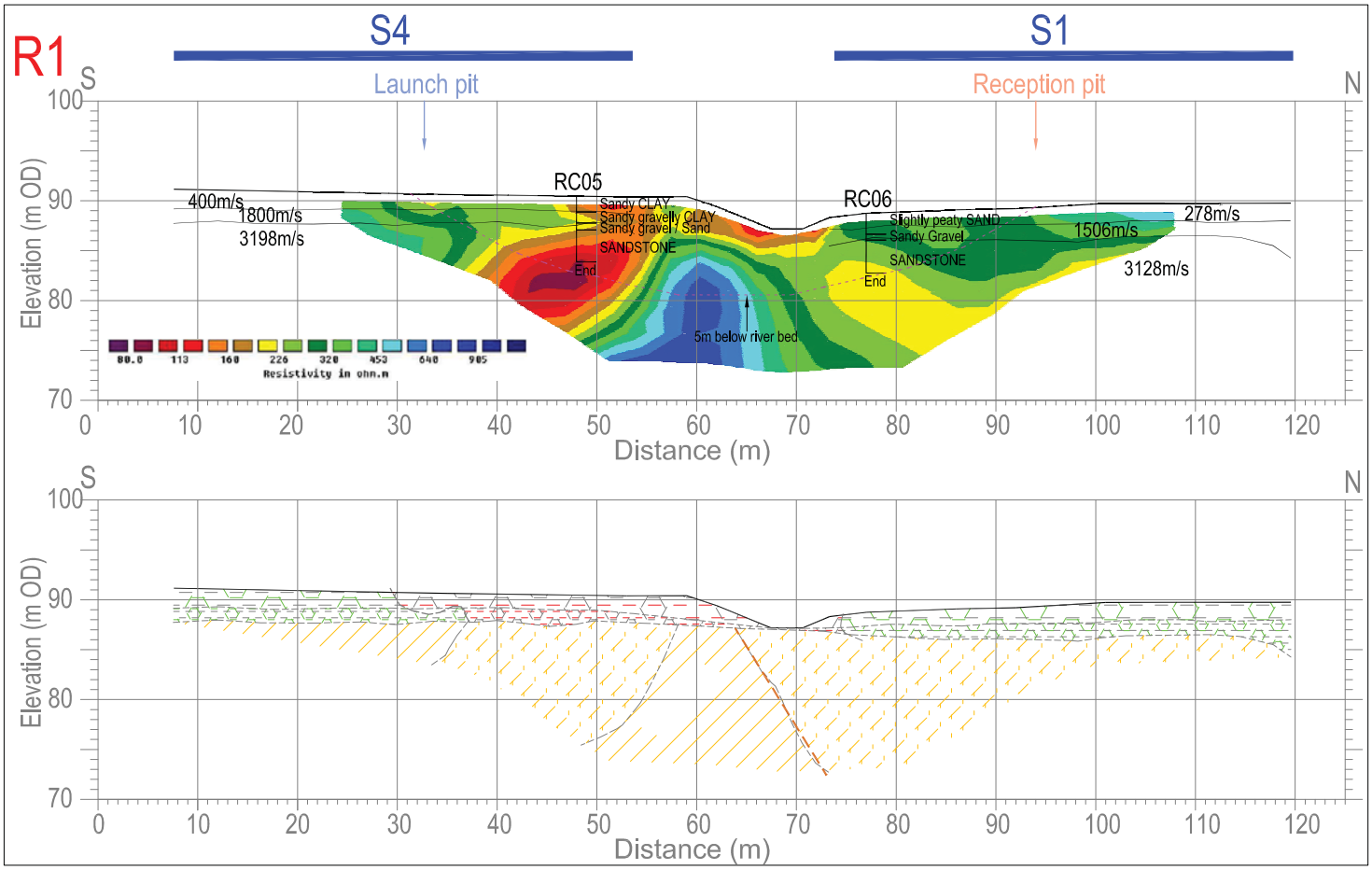
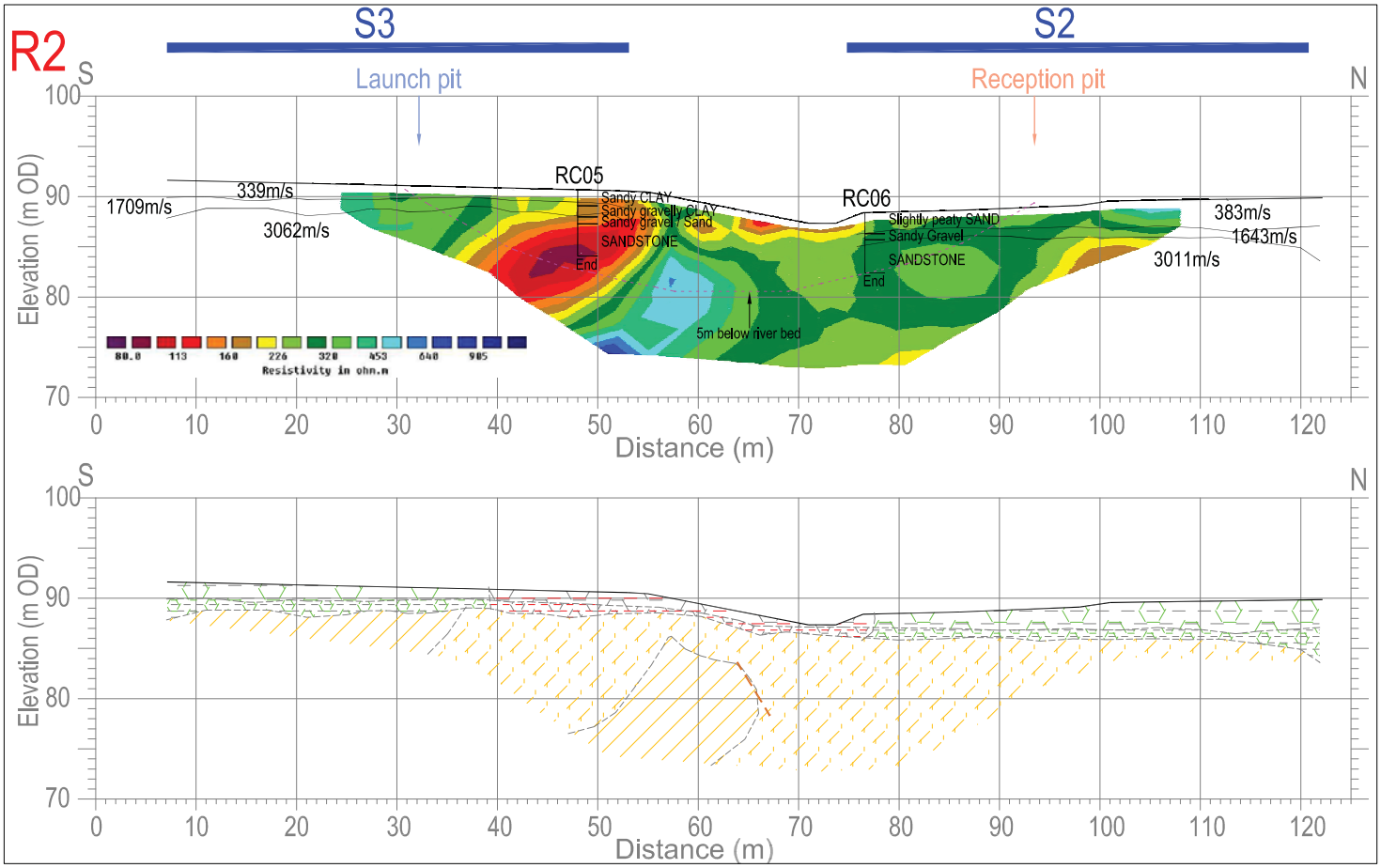


FIGURE 2: ERT RESULTS AND INTERPRETATION ERT ROFILE R2
SCALE 1:500



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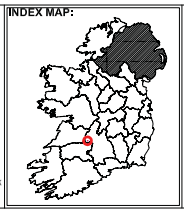
INDEX MAP:



LEGEND:

- R1 — 2D resistivity profile
- S1 — Seismic refraction profile
- RC05 — Rotary core
- 1600m/s — Seismic velocity (m/s)
- Client Supplied Directional Drilling Route
- Possible Fault
- Soft sandy gravelly Clay
- Stiff sandy gravelly Clay
- Loose sandy clayey gravel
- Dense sandy clayey gravel
- Sandstone
- Sandstone

NOTES:

The information displayed here is to be used in conjunction with AGL17303_01 Report on the Geophysical Investigation at Mulkear River - Newport for Ecopower, APEX Geoservices Ltd. 12th February 2018.

PROJECT:	MULKEAR RIVER, UPPERCHURCH WINDFARM GEOPHYSICAL INVESTIGATION
CLIENT:	ECOPOWER
DRAWING NO:	AGL17303_02
SCALE:	AS INDICATED @ A3
DATE:	12th FEBRUARY 2018

Version:	Date:	Drawn By:	Checked:
01	30/01/2018	AP	TL
02	12/02/2018	AP	TL

6. APPENDIX B: DETAILED METHODOLOGY

A number of geophysical techniques were used to provide a high quality interpretation and reduce any ambiguities, which may otherwise exist.

6.1 Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the soil material as well as on the underlying soil and bedrock.

6.1.1 Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. The 2D-resistivity profiling method involves the use of up to 64 electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

6.1.2 Data Collection

Profiles were recorded using a TIGRE resistivity meter, imaging software, two 32 takeout multicore cables and up to 64 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after survey.

6.1.3 Data Processing

The field readings were stored in computer files and inverted using the RES2DINV package (Campus Geophysical Instruments, 1997) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-Depth model of the resistivities.

The inverted 2D-Resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Distance is indicated along the horizontal axis of the profiles. Profiles have been contoured using the same contour intervals and colour codes.

6.2 Seismic refraction profiling

6.2.1 Principles

This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

6.2.2 Data Collection

A Geode high resolution 24 channel digital seismograph, 24 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (2 & 3m spacing). Equipment was carried and operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile,(eg. 69m profile ~23m depth, 33m profile ~ 11m depth)

Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors. All profiles were surveyed to Irish National Grid using a Trimble Geo 7X high-accuracy GNSS handheld.

6.2.3 Data Processing

The recorded data was processed and interpreted using the ray-tracing and tomographic inversion methods, to acquire depths to boundaries and the P-wave velocities of these layers, using the SeisImager/2D programme from Geometrics.

SeisImager/2D interprets seismic refraction data as a laterally varying layered earth structure. The programme includes three methods for data analysis, time-term inversion, the reciprocal method and tomography.

The tomography method creates an initial velocity model, then traces rays through the model, comparing the calculated and measured traveltimes. The model is then modified and the process repeated to minimise the difference between the calculated and measured times. The data was processed using this method followed by conversion to a layered model.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

6.3 Spatial Relocation

All the geophysical investigation locations were acquired using Trimble Geo 7X high-accuracy GNSS handheld using the settings listed below. This system allows collecting GPS data with sub-meter accuracy.

Coordinate zone:	ITM (Republic of Ireland)
Datum:	Ordnance
Coordinate units:	Meters
Altitude units:	Meters
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

7. APPENDIX C: COMPANY PROFILE

7.1 The Company

APEX Geoservices Limited is Irelands leading geophysical and geological consultancy providing expert services to the environmental and natural resource industries.

As an independent Irish owned company APEX Geoservices Limited is able to offer a wide range of professional services for consultant engineers, contractors, government and semi-state bodies as well as private clients.

Utilising the latest technologies we provide a range of applications from overburden thickness to cavity detection, groundwater vulnerability to rippability estimates and aggregate exploration.

Geophysics plays a vital role in providing a comprehensive understanding of the subsurface for a wide range of projects. When combined with drilling and other direct investigative methods geophysics provides an increase in the overall understanding of the subsurface conditions and can make huge savings, both financial and in project efficiencies, as well as reducing the risks associated with unforeseen ground conditions.

We acknowledge that geophysical techniques have certain limitations, as do all other investigation methods and these limitations are taken into account in the design, execution and interpretation of our geophysical surveys.

Geophysics is often promoted as a relatively quick, cheap and easily performed survey but experience has shown that many surveys run into difficulties and ultimately produce unsatisfactory results, due to lack of a full understanding of the technique, a lack of familiarity with ground conditions, and inexperienced personnel working to an inadequate budget. There is no other company servicing the Irish market which can provide the range of expertise and experience that APEX Geoservices can bring to geophysical surveying.

All surveys are carried out under the supervision of registered professional geologists (PGeo or CGeol). Possession of these qualifications shows a commitment to a code of ethics and professional behavior, as well as giving recourse for complaint in the event of unsatisfactory service.

As a multidisciplinary organization we offer the following comprehensive range of services associated with assessment of the subsurface:

- geophysical investigations
- survey design and specification
- desk studies
- aerial photography interpretation
- geological and geotechnical core logging
- topographic surveying
- environmental monitoring
- site supervision

7.2 Personnel

The company was formed by Peter O'Connor and Yvonne O'Connell in 2001 and, as a result of continued growth the company has over 175 years combined relevant experience.

APEX Geoservices have an unrivalled combination of qualified and experienced geophysicists and surveyors, proficiency in data acquisition and processing, and, critically, the experience of Irish ground conditions required to obtain the best results from geophysical surveys.

As well as the full time staff the company draws on the experience of several associates and specialists within different related fields, including:

- AGEC - Applied Geotechnical Engineering Consultancy
- Talamhireland – quaternary geological consultant
- Hydro-Environmental Services – environmental consultancy
- Peter Jackson – independent geophysical consultant
- University College Dublin – Engineering Geophysics Research Unit

This integrated approach provides us with a much broader capability and enables us to provide a comprehensive solution from the initial assessment of a project to the final realisation of the solution.

The technical staff within the company generally have geophysics or geological based degrees with others holding engineering and environmental and surveying qualifications giving a wide range of experience to draw upon. The survey will be carried out under the supervision of a qualified and professionally registered Geophysicist and experienced field personnel. All personnel are on full time permanent contracts and hold up to date safe pass certification.

7.3 Experience

APEX Geoservices Limited has carried out several hundred projects from single day site assessment for private clients to large scale geotechnical projects spanning several months. Due to our capability both technically, logistically and financially we are able to offer the same high level of delivery for all projects irrespective of the duration or technical complexity.

With our own internal GIS system and an increasing requirement for geo-referenced data sets we routinely link GPS systems to many of our geophysical survey instruments including conductivity and resistivity equipment, microgravity meters as well as the GPR system.

Detailed below are examples of previous projects.

N8 Cashel – Mitchelstown Roadbridge/AGEC

A geophysical survey was carried out along selected centerline sections, side roads and junctions on the proposed N8 Cashel to Michelstown Road Improvement Scheme, Co. Tipperary. The survey consisted of microgravity surveying, and 2D resistivity and seismic refraction profiling. The results of the survey identified the presence of voiding in the overburden and underlying rock, assessed the variations in overburden material type and thickness and mapped the depth to rock head.

Metro North GSL/Norwest Holst

The geophysical survey consisted of 2D resistivity and seismic refraction profiling, MASW and microgravity. The survey was carried out along the proposed Metro Line from St. Stephen's Green to Swords. The survey was carried out by up to four field crews in different environments varying from pedestrian streets, to airport runways to green fields. The results of the survey included the depth, type, quality and excavatability of bedrock, overburden type and stiffness. The geophysical survey was carried out concurrently with a large ground investigation program consisting of trial pits, cable percussive boreholes and rotary percussive boreholes. The results of the direct investigation and the geophysical survey were combined in an integrated report.

Middleton Railway Irish Drilling

The geophysical survey was carried out along the Glounthaune-Midleton Railway Line, Co. Cork to investigate the presence of voiding in the overburden and underlying rock. The survey was carried out along 10.4 km of the centre line of the existing rail line from Johnstown to Midleton using Ground Penetrating Radar and Microgravity Techniques. The survey highlighted 34 anomalies related to karstification in the bedrock.

Farr, Inverness, Scotland

Due to difficult access to the site a large tracked vehicle was used to investigate 31 wind-farm bases in Farr, Scotland using GPR, 2D resistivity and seismic refraction profiling. The survey mapped the base of the peat layer, determined the type and thickness of the overburden material under the peat, mapped the depth to rockhead and identified local depressions in the bedrock surface. A program of trial pits, cable percussive boreholes and rotary percussive boreholes was carried out concurrently with the geophysical survey. The results of the geophysical survey compared favourably with these direct investigations.

N9 Nenagh - Limerick pavement assessment

A traffic speed GPR survey, with integrated GPS, was carried out to assess the bitumen thickness on the Nenagh By-Pass. The GPR data compared favourably with cores taken. The survey was carried out at traffic speed along the running lanes and hard shoulders of the road.

Lough Neagh Basin Gravity Survey

A large geothermal project is planned for the Lough Neagh Basin. A large geophysical program was undertaken to provide a better understanding on the nature of the deep structure of the basin. APEX Geoservices Ltd. carried out a regional gravity survey strecting from Antrim to Ballymena as part of this project.

7.4 Key Personnel CV's

Curriculum Vitae

EurGeol Peter O'Connor PGeo., M.SC., Dip. EIA Mgt. — Managing Director

Nationality Irish
Profession Geophysicist
Specialisation Environmental and Engineering Geophysics
Natural Resource Exploration, Business Development.

Experienced geophysicist and entrepreneur who has successfully promoted the incorporation of near surface geophysical methods into mainstream ground investigations for civil engineering and environmental projects. Over 35 years experience of all geophysical methods including; seismic reflection and refraction, resistivity, gravity, magnetics, EM, GPR, MASW, downhole and crosshole seismic, marine refraction and reflection. Applications include major infrastructural projects; measurement of physical properties; estimation of quantities and excavatability for rock excavation; exploration and testing of sand, gravel and rock aggregate sites; karst investigations; groundwater and mineral investigations; noise and vibration monitoring; pile integrity testing; wind and solar farm development. Familiar with working in urban, rural and remote environments in Ireland, UK, Europe, Middle East and Africa. Experience of desk studies; walkover surveys; technical presentations and training; expert witness consulting and appearance. Initiation, funding and mentoring of collaborative research projects with universities and research institutes. Business development and management.

QUALIFICATIONS

Diploma in EIA Management, University College Dublin. **1994**
M.Sc., Applied Geophysics, University College Galway. **1983**
B.Sc., Geology, Chemistry, Maths, University College Dublin. **1979**

AFFILIATIONS

Professional Member and President 2003-2005, Institute of Geologists of Ireland.
Founder and former Chairman, Geophysical Association of Ireland.
Chairman, Local Organising Committee, EAGE Near-Surface 2009 Dublin.
Member, The Geotechnical Society of Ireland.
Member, Irish Association for Economic Geology.
Member, International Association of Hydrogeologists.
Member, European Association of Geoscientists and Engineers

EXPERIENCE

APEX Geoservices Ltd., Wexford – *Managing Director* **2001 - present**
SME owner/manager responsible for design and delivery of Engineering and Environmental Geophysical Surveys in Ireland, UK, Europe, Middle East and Africa. Management duties included design, specification, scheduling and supervision of projects, client liaison, staff recruitment and training , business and technical development, research and development, business and technical presentations.

B.J. Murphy & Associates, Dublin - *Technical Manager* **1991 – 2001**
Management of geophysical department carrying out engineering and environmental geophysical surveys, natural resource exploration projects and soil probing.

Cobh Exploration Ltd., Waterford. *Geophysicist* **1988 – 1991**
Supervision and interpretation of geological, geochemical and geophysical surveys. Report writing and compilation. Business development.

Geocom Ireland Ltd., Dublin.– *Geophysicist* **1984 - 1988**
Development and application of geophysics to engineering projects. Software development.

Borexco International Ltd., Dublin and Tulsa, Ok. – *Geophysicist* **1981 - 1982**
Acquisition, processing and interpretation of airborne magnetic data. Computer programming.

Geosource (UK) Ltd., Dublin, London, Egypt, Oman. – *Seismologist* **1979 - 1981**
CDP Processing of land seismic reflection data for hydrocarbon exploration. Quality Control. Crew and Client Liason.

RESEARCH **1990 - present**

Initiated, sourced funding and participated/mentored collaborative research projects with UCD, QUB, CIT, NGI.

Curriculum Vitae

EurGeol Yvonne O'Connell PGeo., M.SC — Project Manager, Director

Nationality Irish
Profession Geophysicist
Specialisation Environmental and Engineering Geophysics

Experience in Engineering and Environmental Geophysical Surveys and Aggregate Exploration projects for motorways, by-passes, relief roads, landfill investigation surveys, pipelines, tunnels, various foundation and rock excavation projects including estimation of quantities and excavatability for sunken basement developments, greenfield sand, gravel and rock quarry sites across Ireland and noise and vibration monitoring.

QUALIFICATIONS

1995 **M.Sc., Applied Geophysics**
University College Galway

1994 **B.Sc., Earth Science**
University College Galway

AFFILIATIONS

Professional Member, Institute of Geologists of Ireland.
President, Geophysical Association of Ireland.
Member, The Geotechnical Society of Ireland.
Member, Irish Association for Economic Geology.
Member, Environmental and Engineering Geophysics Society

EXPERIENCE

APEX Geoservices Ltd – *Project Manager and Director* **2001 - Present**
Geophysicist responsible for design, tendering, scheduling and supervision of Engineering and Environmental Geophysical Surveys and Aggregate Exploration projects.

Business and technical development, as well and as sales and marketing. Organisation and supervision of geophysical field crews, data acquisition and quality control, real time data processing, data interpretation and reporting.

B.J. Murphy & Associates - Geophysicist & Technical Manager **1996 - 2001**
Engineering and Environmental Geophysical Surveys and Aggregate Exploration projects. Geophysical surveys included motorways, by-passes and relief roads throughout Ireland. Landfill investigation surveys, pipelines, tunnels, various foundation and rock excavation projects including estimation of quantities and excavatability for several sunken basement developments. Aggregate Exploration work including site selection and assessment for greenfield sand, gravel and rock quarry sites across Ireland. Noise and Vibration Monitoring. UK experience included geophysical site investigations in Wigan, Jersey and Derry.

Management duties included design, tendering, scheduling and supervision of projects, business and technical development, as well and as sales and marketing.

B.J. Murphy & Associates – Contract Geophysicist **1995 - 1996**
Geophysical surveying and data processing for civil and environmental engineering projects.

Archaeo Geophysics Division, University College Galway - *Contract Geophysicist* **1995 - 1996**
Magnetic susceptibility surveying and data processing of 2D geo-electrical profiles from archaeological sites.

GeoArc Ltd., Galway - *Contract Geophysicist* **1995 – 1996**
Archaeo-geophysical surveying using magnetic susceptibility on proposed building sites.

University of North Wales, Bangor **1995 – 1996**
Interpretation of shallow seismic reflection data from Cork Harbour to delineate the distribution and geometry of glacial deposits, as part of the EC funded SHELF Quaternary Research Project.

Curriculum Vitae

Tony Lombard M.Sc. — Senior Geophysicist

Nationality	Irish
Profession	Geophysicist
Specialisation	Engineering and Environmental Geophysics

Experience in Engineering and Environmental Geophysical Surveys for large scale construction and development projects and in Seismic Data Processing for the petroleum and natural resource sectors.

QUALIFICATIONS

B.Sc. Geology, University College Cork **1996**

M.Sc. Applied Geophysics, University College Galway **1997**

Cert. Sustainable Energy, Cork Institute of Technology **2012**

AFFILIATIONS

Geophysical Association of Ireland
Geothermal Association of Ireland
European Geothermal Energy Council
European Association of Geoscientists and Engineers

EXPERIENCE

APEX Geoservices Ltd – *Senior Geophysicist* **2012 – Present**
Geophysicist with responsibility for data acquisition and quality control, data processing, data interpretation and reporting.

Minerex Geophysics Ltd - *Geophysicist* **2006 - 2011**
Duties included tender / quote preparation, project planning and design, project start up meetings, data acquisition, data processing and final reporting.

Responsibility for data quality control, supervision of field personnel, client liaison and project management.

Main project disciplines included environmental and engineering geophysics, the renewable energy sector, contaminated land remediation, resource mapping and utility surveys.

Veritas DGC Ltd, – *Geophysicist* **1998 – 2005**
Veritas DGC is a geophysical company specialising in the provision of seismic data services to the petroleum industry.

Duties included seismic data processing from receipt of initial demultiplexed data and project planning in conjunction with customer representatives to progress reviews and production of digital format final products.

Responsible for Time Domain data processing and Pre-Stack Depth Migration of seismic reflection data from terrestrial, transition zone and marine environments.

Curriculum Vitae

Ian Sharkey Dip. Min. Eng. — Project Manager

Nationality Irish
Profession Senior Geophysical Technician
Specialisation Environmental, Engineering and Mining Geophysics

Experience in the implementation and management of large scale geophysical surveys. Recent projects include the Metro North Ground Investigation, N8 Fermoy to Mitchelstown and numerous geotechnical and utility projects. Responsible for managing of a specialist team concentrating on GPR surveys for engineering and geological investigations, as well as equipment maintenance, design and adaptation for specific applications, most recently integrating GPS to geophysical equipment for real time geo-referencing of data sets.

QUALIFICATIONS

Dip. Mineral Engineering, Athlone Institute of Technology **1999**

Camborne School of Mines, Underground Surveying Certificate **1999**

AFFILIATIONS

Member, Geophysical Association of Ireland.

EXPERIENCE

APEX Geoservices Ltd. - *Project Manager* **2007 - Present**
Organisation and supervision of geophysical field crews, data acquisition and quality control, real time data processing, data interpretation and reporting.

Responsible for the line management of all team members, monitoring of performance of both individuals and projects, assigning training programs and implementing individual development plans.

APEX Geoservices Ltd. - *Operations Manager* **2005 - 2007**
Operations Manager responsible for the implementation of geophysical surveys. The role includes maintenance of geophysical equipment and training of personnel.

APEX Geoservices Ltd. - *Geophysical Technician* **2002 - 2005**
Geophysical Technician responsible for engineering geophysical field surveys using seismic, resistivity, EM, gravity, magnetics and GPR and DGPS surveying. Responsible for data acquisition and QC of geophysical data. Recent projects include N7 Cullahill-Cashel, Fermoy By-pass, LUAS Utility Mapping.

Geotechnics Ireland Ltd. - *Geophysical Technician* **2000 - 2002**
Geophysical Technician responsible for engineering geophysical surveys using seismic, resistivity, EM, gravity, magnetics and GPR. Operation of window sampling equipment, probing, logging of window samples and cores. Part of crew carrying out investigations for foundations, excavations, landfill, hydrogeological mapping, utilities mapping on a wide range of infrastructural projects in Ireland.

Pyhasallmi Mine, Finland – *Processing Technician* **1999-2000**
Processing Plant Technician responsible for maintenance of the Rod and Ball Mills and improved design of the mill feed systems.