APPENDIX 2.1

NON-WIND ENERGY RELATED PLANNING APPLICATIONS WITHIN 2KM OF THE APPLICATION SITE

APPENDIX 2-1

Non-wind energy related planning applications within 2km of the application site are set out in Appendix 2-1 of this chapter of the EIAR.

Table 2-5 Non-Wind Energy Applications Within the Vicinity of the Site

Pl.Ref	Description	Decision
91/310	Retain dwelling house	Granted by KCC 03/05/1991
91/816	Retain front boundary wall	Granted by KCC 01/07/1991
91/864	Cattle housing	Granted by KCC 27/06/1991
91/911	Bungalow	Granted by KCC 17/07/1991
91/1760	Extension to a dwelling house	Granted by KCC 12/12/1991
92/28	Extend and alter dwelling	Granted by KCC 19/02/1992
92/105	Construct a slatted house and concrete yard	Granted by KCC 04/03/1992
92/185	Extension to a dwelling house	Granted by KCC 19/03/1992
92/188	Erect an extension to dwelling house	Granted by KCC 23/03/1992
92/372	Lay a silage slab	Granted by KCC 01/05/1992
92/760	Construct a dwelling house	Granted by KCC 26/06/1992
92/1170	2 dwellings with septic tanks	Granted by KCC 30/11/1992
93/257	Construct a dwelling house	Granted by KCC 28/04/1993
93/337	Potato store	Granted by KCC 21/04/1993
93/420	Dwelling house	Granted by KCC 06/05/1993
93/1173	Bungalow	Granted by KCC 11/04/1994

Pl.Ref	Description	Decision
93/1376	Extend dwelling	Granted by KCC 23/11/1993
93/1393	Alter entrance to convent & retain & complete wall	Granted by KCC 16/11/1993
93/1394	Retain entrance to school	Granted by KCC 16/11/1993
94/482	Erect a milking parlour	Granted by KCC 03/06/1994
94/526	Construct a dwelling house	Granted by KCC 30/06/1994
94/684	A self contained unit	Granted by KCC 04/08/1994
94/906	Easy feed cubicle house, slurry tanks &slurry channel & concrete yard	Granted by KCC 29/07/1994
94/1033	Extend dwellinghouse	Granted by KCC 09/11/1994
95/76	Garage and store and patio to existing house	Granted by KCC 30/03/1995
95/399	Cattle housing	Granted by KCC 28/08/1995
95/573	Two-storey extension to dwelling house	Granted by KCC 29/09/1995
95/833	Dwelling house	Granted by KCC 27/07/1995
95/1276	Retain woodwork workshop	Granted by KCC 21/11/1995
95/1422	Retain and complete extensions to house	Granted by KCC 12/02/1996
95/1962	Construct a dwelling house	Granted by KCC 15/03/1996
96/121	Erect garage and fuel store.	Granted by KCC 02/04/1996
96/886	Install a biocycle waste water treatment unit	Granted by KCC 31/10/1996
96/1042	Construct a slatted cattle unit, associated underground slurry tanks and concrete yard	Granted by KCC 19/08/1996

Pl.Ref	Description	Decision
96/1641	Construct a dwelling house	Granted by KCC 25/11/1996
97/101	To erect a slatted tank and house	Granted by KCC 14/04/1997
97/1329	Construct 4 no. dwelling houses	Granted by KCC 04/09/2000
97/1792	Construct a dwelling house	Granted by KCC 24/11/1997
98/401	Erect a dormer bungalow	Granted by KCC 02/06/1998
98/458	Alter and extend existing bungalow	Granted by KCC 08/06/1998
98/486	Erect a dormer bungalow	Granted by KCC 08/06/1998
98/585	Construct a dwelling house	Granted by KCC 19/06/1998
98/885	Erect an extension and retain existing garage	Granted by KCC 27/07/1998
98/1217	Construct a dwelling house	Granted by KCC 14/08/1998
98/1217	Construct a dwelling house	Granted by KCC 14/08/1998
98/1502	Erect six dormer dwellings	Granted by KCC 23/11/1998
98/1895	Retention of as built rooms in a dwelling house	Granted by KCC 16/11/1998
98/2368	Erect extension to dwelling house	Granted by KCC 28/12/1998
98/2718	Erect dressing rooms, toilets and back stage facilities	Granted by KCC 15/03/1999
98/2740	Erect seventeen (17) two-storey dwellings (seven individual and five pairs of semi-detached dwellings) together with service road and ancillary services	Granted by KCC 08/02/1999
98/2885	Construction of a dwelling house	Granted by KCC 12/03/1999
98/2897	Retain existing garage	Granted by KCC 01/03/1999

Pl.Ref	Description	Decision
99/33	Construct a dwelling house	Granted by KCC 12/04/1999
99/384	Erect a bungalow with septic tank	Granted by KCC 19/07/1999
99/497	Erect a bungalow and septic tank	Granted by KCC 08/06/1999
99/1546	Construct a dwelling house	Granted by KCC 13/09/1999
99/1555	Extend existing dwelling(dormer type)	Granted by KCC 13/09/1999
99/2076	Renovate existing house and to develop roof space using mansard roof design	Granted by KCC 29/10/1999
99/2513	Build a bungalow with attic space, septic tank and percolation area	Granted by KCC 04/12/1999
99/2779	Retain the renovations and extension	Granted by KCC 04/01/2000
99/2956	Erect a dwelling house	Granted by KCC 14/01/2000
99/3000	Construct a dwelling house	Granted by KCC 18/01/2000
99/3208	Build a cattle shed complete with slated tank and silage base	Granted by KCC 29/03/2000
99/3359	Retain and complete dwelling house on revised site boundaries	Granted by KCC 15/02/2000
99/3450	Construct a dwelling house	Granted by KCC 01/03/2000
00/657	Install bioclear wastewater treatment unit, to erect extension to rear and to refurbish existing cottage	Granted by KCC 12/06/2000
00/1049	Construct slatted cattle house and silage base	Granted by KCC 08/08/2000
00/1789	Construct a dwelling house	Granted by KCC 20/11/2000
00/3560	Build a bungalow and to convert existing cottage to domestic store and install a bioclear waste water unit	Granted by KCC 05/02/2001
00/3723	Construct a dwelling house	Granted by KCC 20/02/2001

Pl.Ref	Description	Decision
00/4059	Construct a dwelling house	Granted by KCC 19/03/2001
00/4117	Erect a 3 bedroom bungalow with biocycle	Granted by KCC 22/03/2001
01/232	Construct a slatted cow cubicle house and silage slab	Granted by KCC 07/05/2001
01/778	Alterations and extension to a dwelling house	Granted by KCC 18/06/2001
01/838	Construct a dwelling house	Granted by KCC 25/06/2001
01/1019	Demolish existing house and construct new bungalow with septic tank and new boundary walls	Granted by KCC 09/07/2001
01/1374	Erect a dwelling house	Granted by KCC 10/08/2001
01/1571	Construct a new dwelling house	Granted by KCC 03/09/2001
01/2571	Erect a two storey farmhouse consisting of 4 no bedrooms, bathroom, lounge/dining, kitchen, utility room and conservatory to side and biocycle	Granted by KCC 26/11/2001
01/3220	Erect a two storey traditional dwelling house and connect to the public sewer including all necessary site works	Granted by KCC 21/01/2002
01/3506	Construct 48 no. dwelling houses	Granted by KCC 26/04/2002
01/3683	Renovate and extend extension consisting of a dormer type extension at rear and conversion of attic in existing premises	Granted by KCC 12/03/2002
01/3873	Erect a montessori pre- school complete with staff and ancillary services	Granted by KCC 22/03/2002
02/360	Demolish an existing garage and construct extension to the north eastern elevation of existing dwelling	Granted by KCC 20/08/2002
02/664	Extend existing dwelling house	Granted by KCC 04/06/2002
02/770	Build a dwelling house and associated site works	Granted by KCC 27/06/2002
02/1127	Erect a garden centre, advertising sign, entrance and parking area and to retain existing shed as retail outlet to garden centre	Granted by KCC 02/08/2002

Pl.Ref	Description	Decision
02/1263	Construct a dwelling house	Granted by KCC 21/08/2002
02/2238	Erect a viewing grandstand, with ball alley, changing rooms & public toilets attached& new dressing rooms for juvenile players, ancillary site works including new septic tank& percolation area, erect extension to existing clubrooms	Granted by KCC 08/08/2003
02/2422	Erect a dwelling house	Granted by KCC 23/12/2002
02/2451	Construct a dwelling house	Granted by KCC 28/12/2002
02/2605	Erect a dwelling house septic tank percolation area detached garage and all associated site works	Granted by KCC 13/01/2003
02/2644	Retention of 2 no. sheds	Granted by KCC 16/01/2003
02/2847	Construct a dwelling house	Granted by KCC 14/02/2003
03/419	Alter and extend dwellinghouse	Granted by KCC 19/05/2003
03/485	Retain and complete dwelling as built (previous planning reg 96/629) including all associated site works	Granted by KCC 26/05/2003
03/542	Erect a dwelling house with septic tank and percolation area	Refused by KCC 12/06/2003
03/1041	Alter and extend existing house	Granted by KCC 17/07/2003
03/1246	To erect 10 x semi-detached dwelling houses and for full permission to demolish existing derelict dwelling, old shed, front boundary wall and for all roads services and ancillary site works associated with same	Granted by KCC 04/08/2003
03/1617	Construct bungalow with a bio-clear wastewater treatment unit	Granted by KCC 02/10/2003
03/1799	Construct a dwelling house	Granted by KCC 21/10/2003
03/2156	Construct a dwelling house	Granted by KCC 22/10/2003
03/2161	Erect 3 no. dwellinghouses, with ancillary site works including access roadway	Granted by KCC 17/10/2003
03/2529	Demolish existing outhouses and erect a dwelling house with ancillary site works	Granted by KCC 26/11/2003

Pl.Ref	Description	Decision
03/3198	Erect a dwelling house with ancillary site works including a septic tank and percolation area	Granted by KCC 27/01/2004
03/3509	Build a house and domestic garage / store area together with all associated site works	Granted by KCC 24/01/2006
04/400	Construct a dwelling house	Granted by KCC 31/03/2004
04/496	Construct 4 no. dwelling houses	Granted by KCC 11/05/2004
04/712	Construct dry yard onto adjacent buildings	Granted by KCC 24/05/2004
04/913	Construct an extension to existing dwelling	Granted by KCC 02/06/2004
04/1019	Construct a dwelling house	Granted by KCC 17/08/2004
04/1254	Construct a dwelling house	Granted by KCC 23/06/2004
04/1503	Erect a dwelling house complete with septic tank and percolation area and all ancillary site works associated with same	Granted by KCC 05/07/2004
04/1832	Construct an extension to a dwelling house	Granted by KCC 29/07/2004
04/2000	Alter and extend a dwelling house	Granted by KCC 11/08/2004
04/2102	Erect dwelling house and ancillary site works including sewage treatment unit and percolation area	Granted by KCC 18/08/2004
04/2136	Construct an extension to a dwelling house	Granted by KCC 23/08/2004
04/2185	Dwelling house	Granted by KCC 27/08/2004
04/2241	Demolish an existing garage and build an extension to his house	Granted by KCC 31/08/2004
04/2825	Construct 2 no. dwellings on adjacent sites with 1 vehicular access also with wastewater treatment unit and irrigation area for each dwelling	Granted by KCC 19/10/2004
04/2855	Construct a cattle house complete with slatted tanks and silage slab	Granted by KCC 21/10/2004

Pl.Ref	Description	Decision
04/3010	Construct a dwelling house	Granted by KCC 04/11/2004
04/3010	Demolish existing dwelling house and construct a new dwelling	Granted by KCC 04/11/2004
04/3010	Demolish existing house and construct a dwelling house	Granted by KCC 04/11/2004
04/3186	Retain alterations to a dwelling	Granted by KCC 17/11/2004
04/3760	Build a house and install a septic tank	Granted by KCC 21/02/2005
04/4144	Construct a dwelling house	Granted by KCC 18/04/2005
04/4234	Construct a bungalow with attic development served with septic tank and percolation area	Granted by KCC 28/02/2005
04/4332	Construct an easy feed cattle house complete with slatted tank and slatted slurry/effluent tank in existing farmyard	Granted by KCC 16/03/2005
05/602	Construct 26 no. semi-detached and 17 no. detached houses together with service road and ancillary site works, further to previous grant of permission on 7/05/03 (planning reg. no. 2501/02)	Granted by KCC 18/07/2005
05/627	Construct a slatted cubicle house and general store, manure pit and concrete apron/concrete yard on my land	Granted by KCC 31/05/2005
05/1029	Erect a dwelling house with ancillary site works, including sewage treatment unit and percolation area	Granted by KCC 05/07/2005
05/1149	Build 10 no. two storey three bedroom houses (ref. no. of outline permission 03/1246)	Granted by KCC 13/07/2005
05/1364	Construct a dwelling house	Granted by KCC 26/07/2005
05/1447	Construct a 2m high concrete block wall to the boundary of property	Granted by KCC 01/09/2005
05/1508	Retain existing private two storey dwelling with attic conversion	Granted by KCC 05/08/2005
05/1608	2 no. dwellings, septic tanks and percolation areas	Granted by KCC 21/10/2005
05/1668	Build a house and install a septic tank	Granted by KCC 03/10/2005

Pl.Ref	Description	Decision
05/2036	Build a house and domestic garage/storage area together with all associated site works	Granted by KCC 12/09/2005
05/2084	Construct a dwelling house	Granted by KCC 28/10/2005
05/3245	Build 2 no. houses and install septic tanks on his land	Granted by KCC 24/02/2006
05/3252	Erect a dwelling house complete with septic tank and percolation area and all ancillary site works	Granted by KCC 19/12/2005
05/3265	Construct 3 no. dormer style dwelling houses with proprietary wastewater treatment systems	Granted by KCC 28/02/2006
05/3833	Construct a bungalow with attic development, septic tank and percolation area	Granted by KCC 20/03/2006
05/4100	Construct 2 no. dwelling houses	Granted by KCC 08/08/2007
06/193	Retain shed and house extension and permission to extend existing dwelling	Granted by KCC 21/04/2006
06/200	Retain 3 no. velux windows at rear of existing dwelling	Granted by KCC 22/05/2006
06/264	Build a storey and a half dwelling house and domestic garage and to install a septic tank and percolation area on our site	Granted by KCC 09/10/2006
06/404	Construct an easy feed slatted unit complete with slatted tank, slurry tower and all associated ancillaries	Granted by KCC 09/05/2006
06/509	Construct a dwelling house	Granted by KCC 17/05/2006
06/550	Construct a storey and a half style dwelling house, septic tank and percolation area and separate garage and all associated site works	Granted by KCC 31/07/2006
06/806	Retain his domestic garage / utility store on his site	Granted by KCC 09/06/2006
06/869	Construct a dwelling house and all associated site works (planning ref. no. 03/2253)	Granted by KCC 19/06/2006
06/902	Build a bungalow served by an envirocare treatment unit and percolation area including all ancillary site works	Granted by KCC 19/06/2006
06/1183	Construct a storey and a half type dwelling with a proprietary treatment plant and percolation area, new site entrance, boundary walls and associated site works on our site	Granted by KCC 05/07/2006

Pl.Ref	Description	Decision
06/1437	Convert a silage base to a cubicle house	Granted by KCC 24/07/2006
06/1541	Construct a dairy on my land	Granted by KCC 01/08/2006
06/1594	Construct a dwelling house	Granted by KCC 01/09/2006
06/1976	Construct a milking complex, incorporating conversion of calf houses to dairy, plant room, store and reroofing of same, roofed collecting yard/ easy feed area, easy feed cubicle house, walled silage pit/ apron/ concrete yard, easy feed loose house and cylindrical tower type slurry tank	Granted by KCC 29/08/2006
06/2136	Build 2 houses and install 2 waste water treatment units	Granted by KCC 05/09/2006
06/2138	Construct a dwelling house	Granted by KCC 05/01/2007
06/2256	Construct a dwelling house with septic tank and percolation area on site 1 (planning reg. no. 05/3245)	Granted by KCC 19/09/2006
06/2257	Construct a dwelling house with septic tank and percolation area on site no. 2 (planning reg. no. 05/3245)	Granted by KCC 20/09/2006
06/2404	To construct a single storey house with a waste water treatment unit and percolation area	Granted by KCC 29/09/2006
06/2552	Construct 2 no. dwellings with individual wastewater treatment systems, irrigation areas and all other associated site works	Granted by KCC 09/10/2006
06/2611	(a) demolish an existing slurry pit (b) erect an easy feed cattle shed and cubicles (c) erect a slurry tower (d) erect a slurry tank (e) install an effluent tank for water effluent off existing calves houses and (f) all associated site services	Granted by KCC 16/10/2006
06/2715	To construct a house with wastewater treatment system and soil polishing filter	Granted by KCC 23/10/2006
06/2887	Construct a slurry tank	Granted by KCC 03/11/2006
06/2969	Build 2 no. houses and install 2 no. septic tanks on his sites	Refused by KCC 04/10/2006
06/3094	Erect security fencing	Granted by KCC 16/11/2006
06/3537	Construct a dwelling house	Granted by KCC 13/06/2007

Pl.Ref	Description	Decision
06/3547	Demolish and reconstruct a conservatory	Granted by KCC 20/12/2006
06/3779	Construct a slatted cattle house	Granted by KCC 15/01/2007
06/3850	Construct a dwelling house	Granted by KCC 08/01/2007
06/3855	Build a house with effluent treatment system and permission to build a domestic garage and permission to improve existing access road to our site	Refused by KCC 05/12/2006
06/4060	Build a house and install a wastewater treatment unit on site no. 1	Granted by KCC 22/03/2007
06/4175	Construct 2 no. dwelling houses with attic conversion served by proprietary treatment units and percolation areas including all necessary ancillary site works	Granted by KCC 08/02/2007
06/4243	Build 2 no. private single storey dwellings served with envirocare treatment units	Granted by KCC 23/04/2007
06/4358	Build a domestic garage on his site	Granted by KCC 22/03/2007
06/4410	Construct (1) an overground slurry tower, (2) construct a yard cover shed with flow channel connecting onto new overground slurry tower, (3) construct an easy feed wintering unit for livestock, (4) extend silo base wall, (5) replace existing earth bank slurry pit with reinforced concrete slurry pit, (6) lay underground piping carrying rainwater from farm out to watercourse on my lands	Granted by KCC 22/02/2007
06/4708	Build a dormer bungalow and to install septic tanks and percolation areas and associated works	Refused by KCC 02/04/2007
06/4829	Construct a dwelling house	Granted by KCC 09/02/2007
06/4930	Construct a slatted livestock house with a silage wall	Granted by KCC 23/03/2007
06/5072	Erect a dormer style dwelling with septic tank and percolation area and also for a domestic garage and all inclusive ancillary site works	Refused by KCC 23/08/2007
07/16	Construct a dwelling house	Granted by KCC 30/03/2007
07/503	(1) erect a slurry tower with associated ancillaries, (2) construct a cubicle livestock shed and easy feed livestock shed incorporating underground slurry storage tank and (3)	Granted by KCC 08/05/2007

Pl.Ref	Description	Decision
	construct a silage slab with silage walls and concrete apron including associated site works	
07/571	Build a dwelling house with a proprietary waste water treatment system and irrigation area including all necessary ancillary site works on site a (planning reg. no. 06/2552)	Granted by KCC 15/05/2007
07/879	(1) construct an easy feed wintering unit for live stock incorporating underground slurry tanks and ancillary concrete. (2) construct a milking parlour and dairy complex wit ancillary concrete. (3) demolish 2 no. existing slurry pits on my lands	Granted by KCC 01/06/2007
07/1062	Construct an extension with underground tank onto existing agricultural building on our land	Granted by KCC 12/06/2007
07/1086	Build a private single storey dwelling with 1 no. vehicle access served with wastewater treatment unit and irrigation area (planning reg. no. 04/2825)	Granted by KCC 18/06/2007
07/1180	Erect a slatted shed with two underground tanks and easy feed system and all associated ancillaries	Granted by KCC 21/08/2007
07/1390	Build a single storey dwelling house with proprietary waste water treatment system incl all necessary ancillary site works at site b (planning reg. no. 06/2552)	Granted by KCC 08/08/2007
07/1445	Build a private two storey extension at side of existing single storey dwelling and also for new front porch	Refused by KCC 05/06/2007
07/1706	Construct a dwelling house	Granted by KCC 25/09/2007
07/2319	(1) construct silage base with apron with ancillary concrete works, (2) construct an under ground effluent tank with all ancillary pipe and drainage channels, (3) modify and extend existing cubicle house to include under ground slurry tanks easy feed passage, double passage cubicle house, ancillary concrete works on our lands	Granted by KCC 06/09/2007
07/2400	Construct an overground steel slurry storage tank and associated site works	Granted by KCC 11/09/2007
07/2591	Build a single storey dwelling house with developed attic space serviced with an envirocare waste water treatment system and all necessary ancillary site works	Refused by KCC 20/12/2007
07/2641	Demolish shed and construct livestock house	Granted by KCC 21/09/2007
07/2711	Build a domestic garage and all associated site works on his site	Granted by KCC 24/09/2007
07/2850	Construct a dwelling house with septic tank and percolation area including all necessary ancillary site works and services	Refused by KCC 30/08/2007

Pl.Ref	Description	Decision
07/2940	(1) modify and extend an existing easy feed slatted house to include an underground slurry tank with ancillary scraper system and ancillary concrete (2) construct an easy feed wintering unit for livestock incorporating an underground slurry tank with ancillary concrete (3) construct a slurry lagoon with ancillary concrete	Granted by KCC 09/10/2007
07/2949	Construct a dwelling house with proprietary wastewater treatment system including all associated site works and services	Granted by KCC 09/10/2007
07/3084	(1) construct a dwelling house served by envirocare waste water treatment unit with raised percolation area and (2) improve access roadway, including all necessary ancillary site works and services	Refused by KCC 12/09/2007
07/3289	Construct an extension to existing livestock shed to include calving facilities and calf housing	Granted by KCC 08/11/2007
07/3292	Construct a dwelling house	Granted by KCC 07/11/2007
07/3450	Erect a dwelling house with garage, sewage treatment unit, percolation area and ancillary site works	Granted by KCC 27/11/2007
07/93614	Extension of duration for 07/3614	Refused by KCC 12/11/2012
07/4007	Build a private single storey dwelling with attic accommodation, served with treatment unit (planning ref. no. 06/2136)	Granted by KCC 30/04/2008
08/64	Build a shed and store	Refused by KCC 04/03/2008
08/65	Erect a storey and a half type dwelling house with proprietary sewage treatment unit, percolation area and ancillary site works	Refused by KCC 04/03/2008
08/282	Construct a livestock cubicle and slurry channel	Granted by KCC 08/05/2008
08/337	Construct a slatted house on my land	Granted by KCC 16/05/2008
08/463	Retain my dwelling house as constructed on my site	Granted by KCC 20/05/2008
08/485	(1) construct a calf house with ancillary farm yard and concrete and waste system, (2) construct an easy feed wintering unit for livestock incorporating underground slurry tanks and ancillary concrte on my lands	Granted by KCC 26/05/2008

Pl.Ref	Description	Decision
08/498	Construct a dwelling house	Granted by KCC 17/11/2008
08/566	Construct a slatted easy feed system with associated underground tanks and ancillary concrete farmyard and to construct a silo base and apron on my lands	Granted by KCC 10/07/2008
08/675	Alter and extend our lady of Lourdes and St. Michaels church (protected structure). to include (1) new stained glass window to proposed Padre Pio shrine in lieu of existing doors, (2) new services changing room, priests changing room, public disabled persons accessible toilets and office with new rooflights to sacristy roof and (3) ancillary site works	Granted by KCC 10/06/2008
08/1183	Construct a dwelling house	Granted by KCC 11/03/2009
08/1237	Build a dormer style dwelling house, garage, mechanical aeration unit, soil polishing filter and associated site works	Refused by KCC 18/07/2008
08/1249	Extension to a dwelling house	Granted by KCC 20/08/2008
08/1431	Build a dwelling house with septic tank and percolation area on our site (planning ref no. 05/1608)	Granted by KCC 10/09/2008
08/1537	(1) construct a dwellinghouse served by mechanical waste water treatment unit, wetland and intermittent soil polishing filter, (2) improve access roadway including all necessary and ancillary site works and services	Refused by KCC Refused by An Bord Pleanála (08.230708) 11/03/2009
08/1573	Construct a dwelling house	Granted by KCC 25/09/2008
08/2244	Demolish existing house and workshop and construct new dwelling house with ancillary site works, including sewage treatment unit and percolation area	Granted by KCC 05/01/2009
08/92250	Extension of duration for 08/2250	Granted by KCC 31/01/2014
08/2850	Construct a single dwelling house incorporating attic conversion with a domestic garage and store, a septic tank tank and percolation area, new site entrance, boundary walls and associated site works	Granted by KCC 26/03/2009
09/221	Retain an agricultural machinery storage shed including all necessary ancillary site works	Refused by KCC 20/04/2009
09/730	Demolish existing dwelling house and outbuildings and erect a dwelling house with ancillary site works including a sewage treatment unit and percolation area	Granted by KCC 19/08/2009

Pl.Ref	Description	Decision
09/980	Alter and extend existing dwelling house with ancillary site works, including a sewage treatment unit and percolation area	Granted by KCC 10/11/2009
09/1354	Retain part of existing shed for domestic use and to demolish a 2m section of the said shed reducing the length from 13.6 m to 11.6 m including all necessary associated works	Refused by KCC 16/12/2009
09/1563	Extension to a dwelling house	Granted by KCC 18/05/2010
09/1604	Erect an extension to Lixnaw community centre with ancillary site works	Granted by KCC 25/03/2010
09/1644	Demolish outbuildings ,(b)construct an extension ,(c)internal alterations ,& all associated site works at Knockaunacurraheen ,Lixnaw	Granted by KCC 19/10/2010
10/178	Build 2 no. private single storey dwellings, with rooms in the attic, served with treatment units (outline permission planning reg. no. 4243/06)	Granted by KCC 30/06/2010
10/492	Retain existing dwelling house, septic tank and percolation area within revised site boundaries, full planning permission to construct a single storey extension with attic / storage space to the rear of existing dwelling together with extended dining room to existing kitchen, full planning permission to carry out sundry alteration to the north west and south west elevations, full planning permission to carry out all necessary ancillary site works at our site	Granted by KCC 13/08/2010
10/562	Demolition of existing derelict dwelling and the construction of a replacement traditional style dwelling with septic tank and percolation area and all associated works	Granted by KCC 24/02/2011
10/688	Demolish existing house and erect a new single storey dwelling house with attic accommodation and ancillary site works	Granted by KCC 04/10/2010
10/911	Construct a two storey dwelling house, domestic shed/garage, waste water treatment unit with percolation area and all associated site works	Granted by KCC 20/01/2011
10/1179	Retain dwelling, septic tank and percolation area within revised site boundaries	Granted by KCC 18/02/2011
11/5	Construct an extension to existing dwelling house	Granted by KCC 26/07/2011
11/165	Construct a house and garage and install a mechanical aeration unit and polishing filter	Granted by KCC 14/09/2011

Pl.Ref	Description	Decision
12/165	Retain bungalow with a waste water treatment unit and percolation area with a change to the north elevation also to retain domestic garage/utility store all within revised boundaries to site	Granted by KCC 15/10/2012
12/267	Construct a slatted house and associated underground slurry tank and concrete yard on my land	Granted by KCC 18/07/2012
12/804	Construct a commercial shed for the storage of agricultural machinery which will utilise an existing agricultural entrance along with all ancillary site works	Refused by KCC 25/01/2013
13/135	Construct a farm slatted unit building with part for storage of farm machinery	Granted by KCC 06/06/2013
13/140	Retain garage constructed to the rear of dwelling	Refused by KCC 08/05/2013
13/231	Construct a milking parlour	Granted by KCC 12/07/2013
13/794	Construct a dwelling house	Granted by KCC 06/05/2014
14/380	Alter and extend the existing gateway from the public road, adjacent to Ballynagare bridge to its lands	Granted by KCC 10/09/2014
14/901	Demolish existing cottage, erect a single storey dwelling house with attic accommodation and put in place ancillary site works on my site	Granted by KCC 31/03/2015
15/292	Install an 80m x 40m artificial grass pitch with 6.5m high perimeter fencing, erect 4 no. 15m high floodlight columns with lights, and ancillary site works	Granted by KCC 12/10/2015
15/1135	(1) demolish existing hay shed and old cubicle house and (2) replace these with an easy feed slatted house for overwintering cattle, complete with straw bedded area, dungstead, cattle crush and underground slatted slurry tank and all associated ancillary site works	Granted by KCC 22/03/2016
16/549	Construct an easy feed slatted cattle house for dairy cows complete with underground slatted slurry tanks duct, feed barriers and canopy, build a shed over a soiled yard, demolish existing old dungstead and replace with a new dungstead and all associated ancillary site works	Granted by KCC 29/08/2016
16/654	Construct a shed for grain storage, cattle feed storage, hay and straw and a dungstead and all associated ancillary site works	Granted by KCC 30/09/2016
17/81	Retain existing dwelling as built and existing domestic shed as built within revised site boundaries (previous planning reg 01/1374)	Granted by KCC 04/05/2017

Pl.Ref	Description	Decision
17/382	Construct an easy feed slatted house, incorporating cubicles and an area for loose straw bedding for cows, incorporating existing slatted tank and all associated ancillary site works	Granted by KCC 24/07/2017
17/1061	(1) construct of an integrated constructed wetland (icw) for the treatment of combined waste water from the Lixnaw agglomeration, comprising of two settlement ponds, four treatment cells and pump station, (2) construction of a viewing window to the river brick, (3) decommission existing waste water treatment plant and pump station and (4) ancillary works associated with the development	Granted by KCC 21/03/2018
17/1243	Retention of sheds and kennels	Granted by KCC 22/03/2018
18/468	Erect a single storey dwelling house with attic accommodation and all associated site works	Granted by KCC 13/09/2018
18/793	(a) construct a single storey extension consisting of a living room onto side of existing single storey dwelling and (b) retain existing dog kennel	Granted by KCC 10/06/2019
18/852	Retention of a sunroom	Granted by KCC 26/11/2018
18/1050	Construct a dwelling house	Granted by KCC 26/03/2019
19/162	Construct a dwelling house with mechanical treatment unit and polishing filter and all ancillary works	Granted by KCC 12/12/2019
19/453	Retain existing garage to the rear of dwelling house and all ancillary works	Granted by KCC 26/07/2019
19/733	Construct an easy feed slatted unit complete with underground slatted slurry tank, canopy and feed barrier and all associated site works	Granted by KCC 29/10/2019
19/870	Put on external natural stone onto the front facade of existing dwelling and all associated site works	Granted by KCC 13/11/2019
19/928	For a cattle house including a calf creep area, slatted house, underground slurry tank and feed passage	Granted by KCC 02/12/2019
19/1302	Construct 2 no. slatted cubicle houses	Granted by KCC 26/03/2020
20/178	Construct an extension to an existing cublicle house with an easy feed slatted area, new cubicle area for cows, complete with underground slatted slurry tank extending into the dairy holding area all associated ancillary site works	Granted by KCC 06/07/2020
20/277	Construct a dwelling house	Granted by KCC 06/08/2020

Pl.Ref	Description	Decision
20/319	Demolish part of machinery shed, rebuild, extend and re roof the shed to include solar panels and all associated ancillary site works	Granted by KCC 07/08/2020
20/848	Retain (1) machinery house (2) milking complex including milking parlour, dairy, cattle handling area with cattle crush and slurry channel (3) calf house (4) house for storing straw with seperate area for medicines/ chemicals etc (5) slatted easy-feed house (6) cubicle house (7) tower slurry tank (8) calf house (9) silage base complete with effluent channels (10) concrete yard (11) 2 no. meal feed bins	Granted by KCC 15/12/2020

APPENDIX 2.2

PLANNING APPLICATIONS WITHIN A 200M RADIUS OF THE PREFERRED GRID CONNECTION ROUTE

APPENDIX 2-2

Planning applications within a 200m radius of the preferred grid connection route are set out in Appendix 2-2 of this chapter of the EIAR.

Table 2-6 Applications Within the Vicinity of the Grid Connection

Pl.Ref	Description	Decision
91/85	Permission for an alternative entrance and access road	Granted by KCC 13/02/1991
91/126	Retention of a slatted shed	Granted by KCC 21/10/1991
91/626	Extension to a dwelling house	Granted by KCC 21/05/1991
91/800	Construct a dwelling house	Granted by KCC 28/06/1991
91/1720	Construct dwelling house	Granted by KCC 05/12/1991
91/1737	Construct a dwelling house	Granted by KCC 09/12/1991
91/2024	Extend a dwelling house	Granted by KCC 10/02/1992
92/188	Extension to dwelling house	Granted by KCC 23/03/1992
92/960	Extension of a dwelling	Granted by KCC 14/09/1992
92/1015	Retention of part of a dwelling	Granted by KCC 08/10/1992
92/1097	Erect a slatted unit	Granted by KCC 10/09/1992
92/1732	Construct a slatted beef unit	Granted by KCC 22/01/1993
92/1907	Cattle pen and slurry tank	Granted by KCC 05/05/1993
93/830	Construct a dwelling house	Granted by KCC 22/07/1993
93/866	Construct a dwelling house	Granted by KCC 21/07/1993
93/1393	Alter entrance to convent	Granted by KCC 16/11/1993
93/1394	Retain school entrance	Granted by KCC 16/11/1993
93/1376	Extend dwelling house	Granted by KCC 23/11/1993
93/1753	Construct a slatted unit	Granted by KCC 02/02/2004
93/1767	Construct a dwelling house	Granted by KCC 24/01/1994
94/375	Construct a dwelling house	Granted by 06/05/1994
94/481	Construct a dwelling house	Granted by KCC 23/05/1994
94/526	Construct a dwelling house	Granted by KCC 30/06/1994
94/847	Change of use of a building and extension to same	Granted by KCC 15/07/1994

Pl.Ref	Description	Decision
94/906	Install easy feed cubicle	Granted by KCC 29/07/1994
94/995	Retain extensions to existing structures	Granted by KCC 19/08/1994
95/159	Construct slatted house	Granted by KCC 28/03/1995
95/393	Extension of a dwelling house	Granted by KCC 16/05/1995
95/581	Demolish and erect a new dwelling house	Granted by KCC 15/06/1995
95/722	Extend abbatoir	Granted by KCC 15/09/1995
95/1422	Retain and complete extensions to a house	Granted by KCC 11/01/1996
95/1479	Construct a dwelling house	Granted by KCC 23/11/1995
95/1722	Extension to dwelling house	Granted by KCC 31/01/1996
95/1855	Extension of a nursing home	Granted by KCC 07/05/1996
96/166	Construct a silage yard	Granted by KCC 28/03/1996
96/741	Extension to a dwelling house	Granted by KCC 11/06/1998
96/886	Install wastewater treatment unit	Granted by KCC 27/09/1996
96/932	Construct a slatted feed house	Granted by KCC 30/07/1996
96/1584	Construct a dwelling house	Granted by KCC 30/10/1996
96/2044	Construct new garda station and demolish existing one	Granted by KCC 03/12/1996
96/2150	Construct a dwelling house	Granted by KCC 01/04/1997
97/378	Construct a dwelling house	Granted by KCC 17/04/1997
97/503	Install septic tank	Granted by KCC 22/05/1997
97/968	Extend house and alterations to a bottle store	Granted by KCC 11/06/1997
97/1792	Construct a dwelling house	Granted by KCC 23/10/1997
97/2060	Extension to dwelling house	Granted by KCC 28/10/2007
97/2208	Extension of a nursing home	Granted by KCC 24/11/1997
98/111	Construct a dwelling house	Granted by KCC 23/02/1998
98/461	Construct a slatted tank	Granted by KCC 05/05/1998
98/585	Construct a dwelling house	Granted by KCC 15/05/1998
98/1895	Retain as built dwelling house	Granted by KCC 14/10/1998

Pl.Ref	Description	Decision
98/2368	Construct extension to dwelling house	Granted by KCC 25/11/1998
98/3018	Construct three dwelling houses	Granted by KCC 12/02/1999
99/1262	Construct dwelling house	Granted by KCC 06/09/1999
99/1321	Retain existing dwelling	Granted by KCC 22/07/1999
99/1532	Construct a dwelling house	Granted by KCC 10/08/1999
99/1774	Install bioclear unit to serve existing dwelling	Granted by KCC 01/09/1999
99/2461	Retain car crushing facility	Granted by KCC 25/01/2000
99/2894	Construct two dwelling houses	Granted by KCC 31/05/2000
99/3000	Construct dwelling house	Granted by KCC 15/12/1999
99/3057	Extension to a dwelling house	Granted by KCC 21/02/2000
99/3763	Construct 15 no. dwelling houses	Granted by KCC 12/05/2000
00/681	Construct a dwelling house	Granted by KCC 02/06/2000
00/1695	Retain and complete storage shed	Granted by KCC 12/10/2000
00/1789	Construct a dwelling house	Granted by KCC 18/10/2000
00/1946	Construct a dwelling house	Granted by KCC 15/08/2000
00/2008	Construct a dwelling house	Granted by KCC 17/08/2000
00/1230	Construct a dwelling house	Granted by KCC 16/02/2001
00/2254	Construct a dwelling house	Granted by KCC 08/09/2000
00/2295	Construct a dwelling house	Granted by KCC 12/09/2000
00/2584	Retain grain storage facility	Granted by KCC 03/10/2000
00/2953	Construct a dwelling house	Granted by KCC 18/10/2000
00/3149	Construct a dwelling house	Granted by KCC 14/03/2001
00/3402	Construct a dwelling house	Granted by KCC 21/05/2001
00/3559	Extension of a nursing home	Granted by KCC 04/01/2001
00/3625	Extend dwelling house	Granted by KCC 09/01/2001
00/3759	Construct two dwelling houses	Granted by KCC 06/03/2001
00/3895	Retain greyhound kennels	Granted by KCC 09/04/2001

Pl.Ref	Description	Decision
00/4117	Construct a dwelling house	Granted by KCC 21/02/2001
01/838	Construct a dwelling house	Granted by KCC 23/05/2001
01/868	Re roof existing stores	Granted by KCC 07/06/2001
01/943	Construct a dwelling house	Granted by KCC 04/12/2001
01/989	Construct a dwelling house	Granted by KCC 07/06/2001
01/2336	Construct a slatted unit	Granted by KCC 28/09/2001
01/3220	Construct 2 no. dwelling houses	Granted by KCC 17/12/2001
01/3371	Extend silage base and slatted tanks	Granted by KCC 10/01/2002
01/3501	Construct a dwelling house	Granted by KCC 27/03/2002
01/3506	Construct 50 no. dwelling houses	Granted by KCC 25/03/2002
01/3524	Construct a road and outline permission for dwelling houses	Granted by KCC 25/03/2002
01/3873	Construct a Montessori school	Granted by KCC 19/02/2002
01/9232	Construct a domestic garage	Granted by KCC 04/04/2001
02/664	Extend existing dwelling	Granted by KCC 02/05/2002
02/747	Construct a slatted unit	Granted by KCC 15/05/2002
02/802	Construct a holding yard	Granted by KCC 20/05/2002
02/844	Rebuild shop unit	Granted by KCC 31/05/2002
02/1015	Construct a dwelling house	Granted by KCC 18/06/2002
02/1263	Construct a dwelling house	Granted by KCC 19/07/2002
02/1344	Build residential accommodation	Granted by KCC 25/02/2002
02/2496	Erect a 100kV OHL	Granted by KCC 17/06/2003
02/2605	Construct a dwelling house	Granted by KCC 10/12/2002
02/2732	Construct a dwelling house	Granted by KCC 07/07/2003
02/3102	Construct a dwelling house	Granted by KCC 10/02/2003
03/202	Relocation of a house (Pl ref no. 02/1015)	Granted by KCC 26/03/2003
03/419	Alter and extend dwelling house	Granted by KCC 15/04/2003
03/669	Construct a dwelling house	Granted by KCC 08/05/2003

Pl.Ref	Description	Decision
03/1041	Alter and extend existing dwelling	Granted by KCC 13/06/2003
03/1810	Retain extension to dwelling house	Granted by KCC 15/08/2003
03/2310	Construct 4 no. dwelling houses	Granted by KCC 10/10/2003
03/2343	Construct a dwelling house	Granted by KCC 02/10/2003
03/2361	Construct 8 no. dwelling houses	Granted by KCC 06/10/2003
03/2376	Construct a slatted shed	Granted by KCC 06/10/2003
03/2259	Construct a dwelling house	Granted by KCC 15/09/2003
03/2345	Retention of houses	Granted by KCC 03/10/2003
03/2529	Demolish outhouses and erect dwelling house	Granted by KCC 22/10/2003
03/2761	Construct a dwelling house	Granted by KCC 20/11/2003
03/2783	Construct a dwelling house	Granted by KCC 17/11/2003
03/3067	Construct a dwelling house	Granted by KCC 11/12/2003
03/3765	Construct two dwelling houses	Granted by KCC 13/02/2004
03/3929	Construct 10 no. dwelling houses	Granted by KCC 03/06/2004
03/4013	Construct a dwelling house	Granted by KCC 24/04/2004
04/496	Construct 4 no. dwelling houses	Granted by KCC 07/04/2004
04/497	Retain as built houses	Granted by KCC 06/04/2004
04/712	Construct dry yard	Granted by KCC 20/04/2004
04/851	Construct a dwelling house	Granted by KCC 26/04/2007
04/913	Construct extension to a dwelling house	Granted by KCC 29/04/2004
04/1032	Construct a covered holding yard	Granted by KCC 07/05/2004
04/1254	Construct dwelling house	Granted by KCC 20/05/2004
04/1524	Extend a dwelling house	Granted by KCC 28/05/2004
04/2136	Construct extension to a dwelling house	Granted by KCC 20/07/2004
04/2241	Demolish garage and extend dwelling house	Granted by KCC 28/07/2004
04/2821	Construct a dwelling house	Granted by KCC 20/09/2004
04/3324	Construct a dwelling house	Granted by KCC 03/11/2004

Pl.Ref	Description	Decision
04/3956	Construct a milking parlour	Granted by KCC 11/01/2005
04/4433	Construct 5 no. dwelling houses	Granted by KCC 17/02/2005
04/4434	Erect a dwelling house	Granted by KCC 17/02/2005
05/245	Construct a silage slab	Granted by KCC 13/04/2005
05/466	Construct 4 no. dwelling houses	Granted by KCC18/04/2005
05/490	Construct a dwelling house	Granted by KCC 21/04/2005
05/1508	Retain existing dwelling house	Granted by KCC 04/07/2005
05/1594	Construct a dwelling house	Granted by KCC 22/12/2005
05/2268	Three houses to be served with envirocare and associated works	Granted by KCC 06/02/2006
05/2278	Construct a dwelling house	Granted by KCC 06/10/2005
05/2359	Construct a dwelling house	Granted by KCC 06/09/2005
05/2460	Construct a dwelling house	Granted by KCC 04/11/2005
05/2539	Construct a dwelling house	Granted by KCC 16/09/2005
05/4100	Construct two dwelling houses (previous pl. ref no. 02/2456)	Granted by KCC 02/02/2007
06/9	Construct a dwelling house	Granted by KCC 27/02/2006
06/37	Connect a windfarm to substation	Granted by KCC 06/03/2006
06/200	Retain 3 no. velux windows	Granted by KCC 18/04/2006
06/278	Change of use of a tarmacadam plant	Granted by KCC 01/06/2006
06/329	Construct slatted cubicle accommodation	Granted by KCC 03/04/2006
06/408	Construct a storeroom extension	Granted by KCC 06/04/2006
06/1031	Extend cubicle houses	Granted by KCC 24/05/2006
06/1437	Convert silage base to easy feed unit	Granted by KCC 20/06/2006
06/1449	Construct a dwelling house	Granted by KCC 25/08/2006
06/1677	Construct a slatted shed	Granted by KCC 06/07/2006
06/1687	Extend the area of a waste facility	Granted by KCC 11/10/2006
06/2138	Construct a dwelling house	Granted by KCC 23/11/2006
06/2258	Construct a dwelling house	Granted by KCC 16/08/2006

Pl.Ref	Description	Decision
06/2568	Construct a wintering unit	Granted by KCC 12/09/2006
06/2824	Erect a cattle house	Granted by KCC 25/09/2006
06/2887	Construct an overground slurry tank	Granted by KCC 02/10/2006
06/3160	Construct a slurry store	Granted by KCC 24/10/2006
06/3553	Construct extension to a dwelling house	Granted by KCC 17/11/2006
06/3794	Construct a dwelling house	Granted by KCC 11/06/2007
06/4373	Construct acattle shed	Granted by KCC 21/03/2007
06/4289	Construct a dwelling house	Granted by KCC 08/01/2007
06/4430	Extension to a dwelling house	Granted by KCC 23/-1/2007
06/4669	Construct a slatted livestock unit	Granted by KCC 05/02/2007
06/4756	Construct a slurry tank and livestock house	Granted by KCC 13/02/2007
06/4930	Construct slatted livestock house	Granted by KCC 19/02/2007
07/16	Construct a dwelling house	Granted by KCC 26/02/2007
07/156	Construct a slurry tank and ancillary concrete	Granted by KCC 12/03/2007
07/290	Construct a silo base extension	Granted by KCC 23/03/2007
07/644	Construct a septic tank	Granted by KCC 17/04/2007
07/908	Construct a septic tank	Granted by KCC 25/04/2007
07/1196	Construct a dwelling house	Granted by KCC 17/05/2007
07/2319	Construct a silage base and apron	Granted by KCC 02/08/2007
07/2420	Construct a slatted shed	Granted by KCC 10/08/2007
07/2451	Extension to a restaurant	Granted by KCC 14/08/2007
07/2521	Construct a dwelling house	Granted by KCC 15/08/2007
07/2849	Construct a dwelling house	Granted by KCC 31/08/2007
07/2864	Construct a dwelling house	Granted by KCC 31/08/2007
07/2941	Construct a garage	Granted by KCC 04/09/2007
07/2995	Change of use from residential to commercial unit	Granted by KCC 15/11/2007
07/3036	Demolish cattle shed and construct medical centre	Granted by KCC 06/12/2007

Pl.Ref	Description	Decision
07/3218	Complete works to dwelling house	Granted by KCC 02/10/2007
07/3408	Retain attic space	Granted by KCC 11/10/2007
07/3416	Alter and extend church	Granted by KCC 23/10/2007
07/3450	Construct a dwelling house	Granted by KCC 24/10/2007
07/3544	Construct a feed house	Grated by KCC 06/12/2007
07/4040	Construct a dwelling house	Granted by KCC 19/03/2008
07/4045	Construct a dwelling house	Granted by KCC 19/02/2008
07/4665	Construct 2 no. dwelling houses	Granted by KCC 01/05/2008
07/92167	Modify and extend a feeding unit	Granted by KCC 20/07/2007
08/233	Extension to a dwelling house	Granted by KCC 28/03/2008
08/415	Construct a dwelling house	Granted by KCC 18/04/2008
08/498	Demolish and construct a new dwelling house	Granted by KCC 14/10/1998
08/675	Alter and extend church	Granted by KCC 07/05/2008
08/1820	Retain 2 no. sheds	Granted by KCC 19/09/2008
08/2244	Demolish and construct a new dwelling house	Granted by KCC 24/11/2008
08/2327	Construct a dwelling house	Granted by KCC 08/12/2008
08/2693	Retain and complete rooms in a dwelling house	Granted by KCC 29/01/2009
09/151	Retain a dwelling house	Granted by KCC 29/06/2009
09/421	Construct a screening wall	Granted by KCC 21/05/2009
09/980	Alter and extend existing dwelling	Granted by KCC 07/10/2009
09/1604	Extension to community centre	Granted by KCC 19/02/2010
09/1526	Retain an extension toa dwelling house	Granted by KCC 19/03/2010
09/1618	Retention of a takeaway	Granted by KCC 25/02/2010
09/1644	Demolish outbuildings and construct extension	Granted by KCC 15/09/2010
10/1290	Retain dwelling house	Granted by KCC 31/03/2011
11/5	Extension to dwelling house	Granted by KCC 22/06/2011
11/508	Construct a bay window	Granted by KCC 05/08/2011

Pl.Ref	Description	Decision
11/571	Relocation of proposed wind turbine	Granted by KCC 07/12/2011
11/966	Retain an extension to a dwelling house	Granted by KCC 28/05/2012
12/94	Recommence quarry operations	Granted by KCC 13/09/2012
12/315	Construct a dwelling house	Granted by KCC 04/07/2012
12/571	Construct a dwelling house	Granted by KCC 18/01/2003
13/4	Construct an agricultural shed	Granted by KCC 28/02/2013
13/325	Demolish existing structure and construct a livestock house	Granted by KCC 19/08/2013
13/349	Retain elements to dwelling house	Granted by KCC 03/02/2014
13/354	Construct a dwelling house	Granted by KCC 08/10/2013
13/369	Construction of fodder store and extension to farm buildings	Granted by KCC 07/08/2013
13/503	Construct a boundary wall	Granted by KCC 30/09/2013
13/688	Change of use of a retail dwelling	Granted by KCC 03/01/2014
13/794	Demolish existing house and construct a new dwelling house	Granted by KCC 01/04/2014
14/165	Install a septic tank	Granted by KCC 28/08/2014
14/745	Construct a dwelling house	Granted by KCC 09/06/2015
14/781	Demolish existing sheds and construct slatted livestock house	Granted by KCC 20/01/2015
15/694	Change of use of a building	Granted by KCC 06/01/2016
16/46	Design changes to Pl. Ref no.14/745	Granted by KCC 15/03/2016
16/102	Construct slatted cubicle house	Granted by KCC 29/03/2016
16/616	Retention of a met mast	Granted by KCC 17/08/2016
16/1245	Constructed slatted beef house	Granted by KCC 20/04/2017
17/453	Construct a lean-to cubicle accommodation	Granted by KCC 12/07/2017
17/493	Construct a dwelling house	Granted by KCC 24/07/2017
17/1243	Retain sheds and kennels	Granted by KCC 15/02/2018
18/102	Construct a dwelling house	Granted by KCC 04/04/2018
18/1050	Construct a dwelling house	Granted by KCC 20/02/2019
19/117	Retain extension to dwelling house	Granted by KCC 03/01/2020

Pl.Ref	Description	Decision
19/356	Changes to elevations toa house	Granted by KCC 29/05/2019
19/601	Construct a slatted cubicle house	Granted by KCC 02/08/2019
19/681	Construct a new milking parlour	Granted by KCC 22/08/2019
19/913	Demolish shed and construct weighbridge	Granted by KCC 27/11/2019
19/956	Extension to dwelling house	Granted by KCC 05/11/2019
20/285	Construct a dwelling house	Granted by KCC 13/07/2020
20/616	Retention of existing dwelling	Granted by KCC 04/09/2020
20/1048	Construct a shed	Granted by KCC 12/02/2021
20/1199	Construct a dwelling house	Granted by KCC 30/04/2021
21/66	Extend existing animal house	Granted by KCC 24/03/2021
21/140	Construct a fodder store	Granted by KCC 13/04/2021
21/560	Upgrade septic tank and retain existing dwelling	Granted by KCC 01/09/2021

APPENDIX 2.3

SCOPING RESPONSES

Our Case Number: ABP-309013-20

Your Reference: Ballynagare Wind Farm Ltd.

An Bord Pleanála

MKO
Received on
04 JAN 2021
200512.
Thomas Blackwell

MKO
Planning & Environmental Consultants
Tuam Road
Galway
Co. Galway
H91 VW84

Date: 22 December 2020

Re: 10 no. turbines of approximately 5.6 megawatts each.
Land to the north of Lixnaw in the townlands of Dysert Marshes, Curraghcroneen and Ballynagare, Co.Kerry

Dear Sir / Madam,

An Bord Pleanála has received your request to enter into pre-application consultations under section 37B of the Planning and Development Act, 2000, as amended in respect of the above mentioned proposed development. A receipt for the fee lodged is enclosed.

Please be advised that the amendments introduced by the Planning and Development (Amendment) Act, 2010 provide for the Board to recover its costs in conducting pre-application consultations. These costs together with costs incurred by the Board in determining any application made to it will be included in the Board's decision. The Board will offset any application fees paid by the applicant against its costs.

Further advice or details in relation to the above will be provided by the Board at pre-application consultation meetings (if held).

The Board will revert to you in due course in respect of this request.

If you have any queries in the meantime please contact the undersigned officer of the Board quoting the above mentioned An Bord Pleanála reference number in any correspondence with the Board.

Yours faithfully,

pp Michelle Mulhern

Kieran Somers
Executive Officer
Direct Line: 01-8737250

PC01

Teil	**Tel**	(01) 858 8100
Glao Áitiúil	**LoCall**	1890 275 175
Facs	**Fax**	(01) 872 2684
Láithreán Gréasáin	**Website**	www.pleanala.ie
Ríomhphost	**Email**	bord@pleanala.ie

64 Sráid Maoilbhríde
Baile Átha Cliath 1
D01 V902

64 Marlborough Street
Dublin 1
D01 V902

An Bord Pleanála

Táille Reachtúil
Statutory Receipt

ABP-309013-20

Ainm an Chustaiméara: **Name of Customer:**	Ballynagare Wind Farm Ltd.
Gníomhaire: **Agent:**	MKO
Íocaíocht Faighte: **Payment Received:**	€4500
Modh Íocaíochta: **Payment Method:**	Wire Transfer
Uimh. Aitheantais Lóisteála: **Lodgement ID:**	LDG-033676-20
Cineál na Lóisteála: **Lodgement Type:**	Application
Iarratas ar éisteacht ó bhéal **Oral Hearing Request:**	No
Dáta Faighte: **Date Received:**	21/12/2020
Faighte ag: **Received by:**	Nichola Meehan

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Irish Aviation Authority
The Times Building
11–12 D'Olier Street
Dublin 2, D02 T449,
Ireland

Údarás Eitlíochta na hÉireann
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MKO
Received on
13 JAN 2021
200512
Thomas Blackwell

11th January 2021

Mr Thomas Blackwell
McCarthy Keville O Sullivan
Planning & Environmental Consultants
Block 1, G.F.S.C.
Moneenageisha Road,
Co Galway

Development: ***Proposed Wind Farm Located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw Co Kerry. Ref: 200512***

Dear Mr. Blackwell,

Thank you for your letter and request for comments for the preliminary environmental impact assessment for the proposed Ballynagare WF, Co. Kerry.

As the number of proposed turbines, the blade tip height and elevations of each turbine and the layout is not provided, Safety Regulation Division - Aerodromes cannot make any specific comments at this time.

The development appears to be 40kms approximately Northwest of Kerry Airport and as such, it is likely that the following general observations would be proffered during a formal planning process: In the event of planning consent being granted, the applicant should be conditioned to contact the Irish Aviation Authority to:

(1) agree an aeronautical obstacle warning light scheme for the wind farm development,

(2) provide as-constructed coordinates in WGS84 format together with above mean sea level tip height elevations at each wind turbine location

Turbine No.	*WGS-84 Co-ordinates*	*Ground elevation (Malin Head OD)*	*Blade tip elevation of turbine (Malin Head OD)*	*Height of turbine (height from ground level to blade tip)*	*Confirm if turbine has obstacle lighting.*
T1	53.346125, -6.258288	75m	225m	150m	No

Bord Stiúrthóirí/Board of Directors
Peter Kearney (Príomhfheidhmeannach/Chief Executive)
Cian Blackwell, Marie Bradley, Ernie Donnelly,
Gerry Lumsden, Joan McGrath, Diarmuid Ó Conghaile,
Eimer O'Rourke

Oifig Chláraithe:
Foirgneamh na hAmanna, 11-12 Sráid D'Olier
Baile Atha Cliath 2, D02 T449, Éire
Uimhir Chláraithe: 211082. Áit Chláraithe: Éire
Cuideachta Dliteanais Theoranta

Registered Office:
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Dublin 2, D02 T449, Ireland
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NSAI Certified

(3) notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.

Your letter has been shared with other relevant domains within the IAA, i.e. Engineering, the Air Navigation Service Provider and Airspace, etc., and they may furnish you with separate observations in due course.

Yours sincerely

PP:

Deirdre Forrest
Corporate Affairs

QUALITY
ISO 9001-2015
NSAI Certified

Thomas Blackwell

From: RAFFERTY Audrey <audrey.rafferty@iaa.ie>
Sent: Thursday 14 January 2021 12:04
To: Thomas Blackwell; MKO-Admin
Subject: FAO: Thomas Blackwell Re : Ballynagare Wind Farm

Dear Mr Blackwell

Thank you for your letter on the 8th of December.

The Irish Aviation Authority (IAA) Safety Regulation Division (SRD) does not get involved in the planning process. The IAA SRD is to be notified as detailed hereafter:

According to S.I. 215 of 2005, Irish Aviation Authority (Obstacles to Aircraft in Flight), the IAA SRD requires any person who seeks to erect a manmade object to notify the aerodrome operator of the intended operation **at least thirty days** in advance if the structure is to be erected in the vicinity of the aerodrome or the areas around the aerodrome and other protected surfaces associated with the aerodrome. Aerodrome Operators can be contacted via IAA AIP AD 1.3 INDEX TO AERODROMES AND HELIPORTS, to evaluate the impact of the intended operation on the protected airspace established for the aerodrome.

Additionally, any person who seeks to erect a manmade object in excess of 45 metres anywhere within the state above ground or water surface level must also notify the IAA SRD of the intended crane erection **at least thirty days** in advance, as a crane operating at or above this height may constitute an obstacle to air navigation. The IAA SRD can be contacted via airspace@iaa.ie.

The State requires electronic terrain and obstacle data (eTOD) in accordance with International Civil Aviation Organisation (ICAO) Annex 15 requirements which shall be surveyed by Ordnance Survey Ireland (OSi). The cost of this OSi surveyed data is to be borne by the developer. Additionally, the following data is to be supplied once construction is planned or commenced or available to the airspace team via airspace@iaa.ie:

- The WGS84 coordinates (In degrees, minutes and seconds) for each turbine?
- Height above ground level (to blade tip) and elevation above mean sea level (to blade tip)?
- Verification if it's a standalone wind farm or is merged with others. Does the wind farm have any alternative names?
- Horizontal extent (rotor diameter) of turbines and blade length where applicable?
- Lighting of the wind farm, which turbine(s) is/are lit, and what type of lighting?

ICAO Light Type	Colour
Low-intensity Type A (fixed obstacle)	Red
Low-intensity Type B (fixed obstacle)	Red
Low-intensity Type C (mobile obstacle)	Yellow/Blue
Low-intensity Type D (follow-me vehicle)	Yellow
Low-intensity Type E	Red
Medium-intensity Type A	White
Medium-intensity Type B	Red
Medium-intensity Type C	Red
High-intensity Type A	White
High-intensity Type B	White

Kind Regards

Audrey Rafferty
Corporate Affairs
Irish Aviation Authority
11-12 Dolier Street
Dublin 2

01 603 1103

========== PLEASE consider the environment; PRINT ONLY when necessary! DISCLAIMER: This message contains information that is confidential, may be privileged and is the property of The Irish Aviation Authority (IAA). If you are not the intended recipient, you may not use this email or the information it contains. If you are not the intended recipient please notify the sender immediately and delete all copies of this message. Thank you. This email message has been swept for the presence of computer viruses. Internet Emails are not necessarily secure. The IAA accepts no responsibility for malicious content such as viruses or for changes made to this message after it was sent. _____ Registered Office: The Times Building, 11-12 D'Olier Street, Dublin 2. D02 T449 Registered Number: 211082 Place of Registration: Ireland A limited liability company
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T: +353 (0) 61 712 000
E: comments@shannonairport.ie

www.shannonairport.ie

AERFORT NA sionainne
shannon AIRPORT

Thomas Blackwell
McCarthy Keville O'Sullivan Ltd.
Tuam Rd.
Galway
H91 VW84

MKO
Received on
2 2 JAN 2021
200512
Thomas Blackwell

21 January 2021

EIA Scoping document – proposed Ballynagare Wind farm, Co. Kerry

Dear Thomas,

Your correspondence dated 8th December 2020 refers.

Shannon Airport Authority DAC would make the following general comments in respect of this type of development.

The sitting of wind turbines at this location may have implications for the operations of the communication, navigation and surveillance systems used by Air Traffic Control for the separation and safety of aircraft. The geographical siting of these turbines may also have implications for the flight paths of aircraft.

Regard must be had to the IAA's *Obstacles to Aircraft in Flight Order, 2002 (S.I. No.14 of 2002),* as amended, which specifies the criteria used to determine whether or not any object anywhere in the State is deemed to be an obstacle affecting aircraft operations. Also, in order to assure the safety and efficiency of aircraft operations in the vicinity of airports, the International Civil Aviation Organisation (ICAO) has defined a volume of air space above which new objects are not permitted to interfere.

Shannon Airport Authority has specific responsibility to define the airspace around its aerodrome which must be maintained free from obstacles so as to permit the intended aircraft operations at the aerodrome to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around it. This is achieved by establishing a series of obstacle limitation surfaces (OLS) that define the limits to which objects (temporary or permanent) may project into the airspace.

It would also be best practice that all wind energy developers should seek the views of the Irish Aviation Authority (IAA) at the pre-planning stage of consultation, with details of locations and proposed heights of turbines, to ensure that proposed developments do not cause difficulties with air navigation safety. It is unclear to us at this time whether any pre-planning consultation with the IAA – Safety Regulation Division has already happened in this instance.

If any potential adverse effects relating to this wind turbine development were identified as part of the consultation process, Shannon Airport Authority DAC would fully support any submission from the IAA.

Finally, should planning permission be granted for this development in the future, we would ask that the developer deploys the appropriate obstacle avoidance lighting in accordance with *Chapter Q – Visual Aids for Denoting Obstacles* CS ADR-DSN.Q.851 / GM1 ADR-DSN.Q.851 *Marking and Lighting of wind turbines* contained in the EASA Easy Access Rules for Aerodromes (Regulation (EU) No. 139/2014).

If you require anything further, please do not hesitate to contact me.

Yours sincerely,

Paul Hennessy

Paul Hennessy
Safety Compliance and Environment Manager
Shannon Airport Authority DAC.

Uisce Éireann
Bosca OP 6000
Baile Átha Cliath 1
D01 WA07
Éire

Irish Water
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Ireland

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T: +353 01 89 25001
www.water.ie

MKO,
Tuam Rd,
Co. Galway,
H91 VW84

15th February 2021

Re: EIAR Scoping Request – Proposed Ballynagare Wind Farm located approx. 9 km west of Listowel and approx. 2 km north of Lixnaw, co. Kerry.

Dear Mr. Blackwell,

Irish Water (IW) acknowledges receipt of your request in respect of the Environmental Impact Assessment Report (EIAR) scoping for the proposed Windfarm located in County Kerry.

Please see attached our suggested scope in relation to Water Services. On receipt of the planning referral, Irish Water will review the EIAR as part of the planning process

Queries relating to the terms and observations above should be directed to planning@water.ie

Yours sincerely,

Signed on behalf of Irish Water:

PP: Ali Robinson

Yvonne Harris
Connections and Development Services

Stiúrthóirí / Directors: Cathal Marley (Chairman), Niall Gleeson, Eamon Gallen, Yvonne Harris, Brendan Murphy, Maria O'Dwyer
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1, D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

Response to EIAR Scoping Report Requests

IW currently does not have the capacity to advise on scoping of individual projects. However, in general we would like the following aspects of Water Services to be considered in the scope of an EIAR where relevant;

a) Impacts of the development on the capacity of water services (do existing water services have the capacity to cater for the new development if required). This is confirmed by IW in the form of a Confirmation of Feasibility (COF). If a development will require a connection to either a public water supply or sewage collection system the developer is advised to submit a Pre Connection Enquiry (PCE) enquiry to IW to determine the feasibility of connection to the Irish Water network. All pre-connection enquiry forms are available from https://www.water.ie/connections/get-connected/

b) Any up-grading of water services infrastructure that would be required to accommodate the development.

c) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an IW collection network

d) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks & potential measures to minimise/stop surface waters from combined sewers

e) Any physical impact on IW assets – reservoir, drinking water source, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets

f) If you are considering a development proposal, it is best practice to contact us in advance of designing your proposal to determine the location of public water services assets. Details, where known, can be obtained by emailing an Ordinance Survey map identifying the proposed location of your intended development to datarequests@water.ie. Other indicators or methodologies for identifying infrastructure located within your lands are the presence of registered wayleave agreements, visible manholes, vent stacks, valve chambers, marker posts etc. within the proposed site.

g) Any potential impacts on the assimilative capacity of receiving waters in relation to IW discharge outfalls including changes in dispersion /circulation characterises

h) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence/ present a risk to the quality of the water abstracted by IW for public supply.

i) Where a development proposes to connect to an IW network and that network either abstracts water from or discharges waste water to a “protected”/sensitive

area, consideration as to whether the integrity of the site/conservation objectives of the site would be compromised.

j) Mitigation measures in relation to any of the above

This is not an exhaustive list.

Please note

- The Confirmation of Feasibility from IW, to the applicant, should be issued prior to applying for planning permission.
- Irish Water will not accept new surface water discharges to combined sewer networks

Thomas Blackwell

From: Defence Property Management Planning <PropertyManagementPlanning@defence.ie>
Sent: Thursday 7 January 2021 09:10
To: Thomas Blackwell
Cc: Gareth O'Flaherty (Defence); Sarah Zacharia (Defence)
Subject: 200512 Ballynagare WindFarm
Attachments: Ballynagare Wind Farm - Observations Letter.pdf

Good morning Thomas,

In response to your e-mail request below, please find attached letter from the Department of Defence outlining our observations on the Ballynagare Wind Farm Scoping Document.

Best Regards

Don

Don Watchorn

Property Management Branch

An Roinn Cosanta

Department of Defence

Bóthar an Stáisiúin, An Droichead Nua, Contae Chill Dara, W12 AD93.

Station Road, Newbridge, Co.Kildare, W12 AD93.

T +353 (0)45 492199
E-mail don.watchorn@defence.ie

From: Defence Property Management Planning
Sent: Thursday 10 December 2020 14:42
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Cc: Gareth O'Flaherty (Defence) <Gareth.OFlaherty@defence.ie>; Sarah Zacharia (Defence) <Sarah.Zacharia@defence.ie>
Subject: RE: 200512 Ballynagare WF

Good afternoon Thomas,

We wish to acknowledge receipt of your e-mail below and attached documentation.

We will confer with our Military colleagues on the proposed Ballynagare Windfarm and revert with any comments/observations in due course.

I have taken over from Ms. Olive Mulhall, who has transferred to another branch within the Department.

Best regards

Don

Don Watchorn

Property Management Branch

An Roinn Cosanta

Department of Defence

Bóthar an Stáisiúin, An Droichead Nua, Contae Chill Dara, W12 AD93.

Station Road, Newbridge, Co.Kildare, W12 AD93.

T +353 (0)45 492199
E-mail don.watchorn@defence.ie

From: Olive Mulhall (Defence) <Olive.Mulhall@defence.ie>
Sent: Tuesday 8 December 2020 14:01
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Cc: Defence Property Management Planning <PropertyManagementPlanning@defence.ie>
Subject: RE: 200512 Ballynagare WF

Dear Mr. Blackwell,

I no longer work in this area so I have cc'd my colleagues in Property Management who will revert in due course.

Kind regards,
Olive

Olive Mulhall

Planning and Organisation Branch

An Roinn Cosanta

Department of Defence

Bóthar an Stáisiúin, An Droichead Nua, Contae Chill Dara, W12 AD93.

Station Road, Newbridge, Co.Kildare, W12 AD93.

T +353 (0)45 452438

E-mail: Olive.Mulhall@defence.ie

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Tuesday 8 December 2020 13:37
To: Olive Mulhall (Defence) <Olive.Mulhall@defence.ie>
Subject: 200512 Ballynagare WF

Ms. Mulhall,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

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An Roinn Cosanta
Department of Defence

Thomas Blackwell
MKO Ltd.
Tuam Road
Galway
H91 VW84

07th January 2021

Re: Ballynagare Wind Farm Scoping Document.

Dear Mr. Blackwell,

I write with regards to the above mentioned proposed development and to your e-mail dated 08th December 2020 requesting feedback and observations.

After consultations with our Air Corps colleagues at Casement Aerodrome The Department of Defence would like to make the following observations:

1. All turbines should be illuminated by high intensity obstacle lights allowing the hazard to be identified and avoided by aircraft in flight.

2. Obstruction lights used should be incandescent or of a type visible to Night Vision Equipment. Obstruction lighting fitted to obstacles must emit light at the near Infra-Red (IR) range of the electromagnetic spectrum specifically at or near 850nanometres (nm) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.

We would appreciate if you could keep us informed on all developments relating to this proposed development, especially in regards the observations made by the Department of Defence.

Please contact me if you have any queries in this regard.

Yours faithfully,

Sent via e-mail due to Covid19 restrictions

_____

Don Watchorn
Property Management Branch
Department of Defence
Station Road, Newbridge
Co. Kildare W12 AD93
045 492199 don.watchorn@defence.ie

Thomas Blackwell

From: Defence Property Management Planning <PropertyManagementPlanning@defence.ie>
Sent: Thursday 10 December 2020 14:42
To: Thomas Blackwell
Cc: Gareth O'Flaherty (Defence); Sarah Zacharia (Defence)
Subject: RE: 200512 Ballynagare WF

Good afternoon Thomas,

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We will confer with our Military colleagues on the proposed Ballynagare Windfarm and revert with any comments/observations in due course.

I have taken over from Ms. Olive Mulhall, who has transferred to another branch within the Department.

Best regards

Don

Don Watchorn

Property Management Branch

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Department of Defence

Bóthar an Stáisiúin, An Droichead Nua, Contae Chill Dara, W12 AD93.

Station Road, Newbridge, Co.Kildare, W12 AD93.

T +353 (0)45 492199
E-mail don.watchorn@defence.ie

From: Olive Mulhall (Defence) <Olive.Mulhall@defence.ie>
Sent: Tuesday 8 December 2020 14:01
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Cc: Defence Property Management Planning <PropertyManagementPlanning@defence.ie>
Subject: RE: 200512 Ballynagare WF

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Kind regards,
Olive

Olive Mulhall

Planning and Organisation Branch

An Roinn Cosanta

Department of Defence

Bóthar an Stáisiúin, An Droichead Nua, Contae Chill Dara, W12 AD93.

Station Road, Newbridge, Co.Kildare, W12 AD93.

T +353 (0)45 452438

E-mail: Olive.Mulhall@defence.ie

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Tuesday 8 December 2020 13:37
To: Olive Mulhall (Defence) <Olive.Mulhall@defence.ie>
Subject: 200512 Ballynagare WF

Ms. Mulhall,

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As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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Ireland

t: +353 1 281 9878
e: info@birdwatchireland.ie
w: birdwatchireland.ie

Patron
Michael D. Higgins
President of Ireland

Éarlamh
Micheál D.Ó hUigínn
Uachtarán na hÉireann

14/04/2021

Re: BirdWatch Ireland pre-application submission for the proposed Ballynagare wind farm, Co. Kerry

Dear Alex,

BirdWatch Ireland would like to make the following recommendations to inform the ornithological and ecological assessments associated with the pre-application phase of the proposed Ballynagare wind farm.

The final planning application should be supported by ornithological and ecological surveys that address the potential direct, indirect and cumulative impacts of the project on:

- Wintering Whooper Swans. The data from the last swan census (ISC2020) and from the I-WeBS database. Has identified three important Whooper Swan subsites in the immediate vicinity of the site: 0KS05 Ballynagare Bridge, 0KS03 Lixnaw, 0KS02 Ballyouneen.
- Water Quality impacts on the Lower River Shannon SAC, Cashen River Estuary NHA.
- Breeding raptors - Hen harrier, Buzzard, Kestrels, Barn owl.
- Wintering wildfowl - Golden plovers and Curlews.
- The ecology surveys should also assess whether the site supports Marsh fritillary, Otter, Bats etc.
- The habitat survey should identify the presence of any raised bog or degraded raised bog on site as well as any Annex I Habitats under the Habitats Directive.

Beir bua agus beannacht



Fintan Kelly
Policy Officer
BirdWatch Ireland

Directors: G Lyons, Chairperson, J Dowdall, C Casey, B Martin, J Fitzharris, J Lynch, T Culley, S Wilson

Registered charity no. 5703. BirdWatch Ireland is the trading name of the Irish Wildbird Conservancy, Cáirde Éanlaith Éireann, a company limited by guarantee. Registered in Ireland, no. 116468. Registered office: Unit 20, Block D, Bullford Business Campus, Kilcoole, Co.Wicklow, Ireland.

Thomas Blackwell

From: Fintan Kelly <fkelly@birdwatchireland.ie>
Sent: Monday 28 June 2021 13:25
To: Alexander Kelly; Fintan Kelly
Cc: Thomas Blackwell
Subject: RE: Fintan Kelly sent you a new message

Dear Alex,

I contacted you via reply@crm.wix.com on 14/04/2021. The email contained BirdWatch Irelands pre-application submission which asked that the final planning application should be supported by ornithological and ecological surveys that address the potential direct, indirect and cumulative impacts of the project on:

- Wintering Whooper Swans. The data from the last swan census (ISC2020) and from the I-WeBS database. Has identified three important Whooper Swan subsites in the immediate vicinity of the site: 0KS05 Ballynagare Bridge, 0KS03 Lixnaw, 0KS02 Ballyouneen.
- Water Quality impacts on the Lower River Shannon SAC, Cashen River Estuary NHA.
- Breeding raptors - Hen harrier, Buzzard, Kestrels, Barn owl.
- Wintering wildfowl - Golden plovers and Curlews.
- The ecology surveys should also assess whether the site supports Marsh fritillary, Otter, Bats etc.
- The habitat survey should identify the presence of any raised bog or degraded raised bog on site as well as any Annex I Habitats under the Habitats Directive.

I also highlighted that I had a lot of trouble finding your contact and emails to the @emp.grup domain weren't working. I flagged concerned that other observers might have similar difficulties.

Beir bua agus beannacht

Fintan Kelly

From: Alexander Kelly <ak@emp.group>
Sent: Monday 28 June 2021 12:53
To: Fintan Kelly <09bf6c94-66d8-413e-88e1-f6cf9f0d70e7@crm.wix.com>; Fintan Kelly <fkelly@birdwatchireland.ie>
Cc: Thomas Blackwell <tblackwell@mkoireland.ie>
Subject: RE: Fintan Kelly sent you a new message

Hi Fintan,

Hope all is well with you.
I note that we never received any information on the species that you considered should be covered in the ecological assessments.
Is there anything you would like to share with us?

Kind regards,

Alex

From: Fintan Kelly <09bf6c94-66d8-413e-88e1-f6cf9f0d70e7@crm.wix.com>
Sent: Tuesday 13 April 2021 14:15
To: Alexander Kelly <ak@emp.group>
Subject: Fintan Kelly sent you a new message

Fintan Kelly just sent you an email on https://www.ballynagarewindfarm.ie/

Hi Alex,
Thanks for getting back to me. I appreciate the offer but I'm really stretched at the moment with various deadlines.
Ideally from our perspective it would be great if I could send you a brief one pager highlighting some of the species we believe should be covered by the ecological assessments.
Would that be beneficial?
Beir bua agus beannacht
Fintan

Reply Now

You can also hit reply to this email.

Never miss a lead.
Download the Wix Mobile App.
Edit your email settings

Thomas Blackwell

From: Fintan Kelly <fkelly@birdwatchireland.ie>
Sent: Tuesday 29 June 2021 09:46
To: Alexander Kelly
Cc: Thomas Blackwell
Subject: FW: Re: BirdWatch Ireland pre-application submission for the proposed Ballynagare wind farm, Co. Kerry
Attachments: 20210414_BWI_Pre_App Submission_Ballynagare WF.docx

Hi Alex,

I'm forwarding the email again with the attachment.
Best of luck with your surveys and assessments.

Beir bua agus beannacht

Fintan

From: Fintan Kelly
Sent: Wednesday 14 April 2021 09:37
To: reply@crm.wix.com
Subject: Re: BirdWatch Ireland pre-application submission for the proposed Ballynagare wind farm, Co. Kerry

Dear Alex,

Please find attached BirdWatch Ireland's pre-application submission in regards to the proposed Ballynagare wind farm.
I had a lot of trouble finding your contact and emails to the @emp.grup domain aren't working for me. I'd be concerned that other observers might have similar difficulties.

Beir bua agus beannacht

Fintan

Thomas Blackwell

From: Dawn Quin <admin@batconservationireland.org>
Sent: Tuesday 15 December 2020 16:51
To: Thomas Blackwell
Subject: Re: 200512 Ballynagare Windfarm

Dear Thomas,

Thank you for your e-mail.

Unfortunately as we are a very small organisation with limited resources, we do not have the capacity to comment on planning issues.

Kind regards
Dawn

Dawn Quinn
Administrative Manager
Bat Conservation Ireland

admin@batconservationireland.org
www.batconservationireland.org

---- On Tue, 08 Dec 2020 13:26:24 +0000 **Thomas Blackwell <tblackwell@mkoireland.ie>** wrote ----

Mr. Hopkirk,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

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An Roinn Turasóireachta, Cultúir,
Ealaíon, Gaeltachta, Spóirt agus Meán
Department of Tourism, Culture,
Arts, Gaeltacht, Sport and Media

Your Ref: 200512
Our Ref: **G Pre00255/2020**
(Please quote in all related correspondence)

26 January 2021

Thomas Blackwell
McCarthy Keville O'Sullivan Ltd
Tuam Road
Galway
Via email: tblackwell@mkoireland.ie

Re: EIA Scoping Document for Proposed Ballynagare Windfarm, County Kerry

A chara

I refer to correspondence to the Department of Culture, Heritage and the Gaeltacht on 8th December received in connection with the above.

Outlined below are heritage-related observations/recommendations co-ordinated by the Development Applications Unit under the stated heading.

Archaeology

All proposed development and strategies should be in compliance with the National Monuments Acts 1930 to 2004 and with the national policy on protection of archaeological heritage – 'Framework and Principles for the Protection of the Archaeological Heritage' published in 1999.

General Guidance:

1. All areas of archaeological heritage should be addressed, including;
   a) Immovable cultural heritage e.g. monuments and ancient field boundaries.
   b) Underwater cultural heritage.
   c) Movable cultural heritage e.g. loose carved stones, sculptures, architectural fragments etc.
2. All impacts which may impinge on the archaeological heritage should be assessed by a suitably qualified archaeologist.

3. Where appropriate, specialists in the field of archaeological heritage should be consulted throughout the process, from design through to implementation.

4. All surveys pertaining to archaeological heritage must be of a high standard in order to allow informed decisions to be taken.

5. All impacts must be assessed, to include ground disturbance, impacts on the setting of the monuments and visual impacts. These should include direct, indirect, temporary and cumulative impacts.

6. Mitigation of impacts, identified through consultation, should be taken into account within the development at the earliest possible stages. Various approaches should be considered, such as avoidance, design modification and relocation where appropriate.

7. Where there are no archaeological monuments present but the development is large in scale, e.g., over 0.5 hectares in area and over 1 kilometre in length, it is recommended that an archaeological assessment should be undertaken, unless there are substantial grounds to show that it is not necessary. Refer to Framework and Principles for the Protection of the Archaeological Heritage 1999, in particular section 3.6.6 in regard to Environmental Impact Assessment (EIA).

Further information and relevant publications can be obtained on www.archaeology.ie

In the event that additional heritage-related observations become available before the deadline date, a further letter will issue.

The above observations/recommendations are based on the papers submitted on a pre-planning basis and are made without prejudice to any observations that may be made in the context of any consultation arising on foot of any development application referred to the Minister, by the planning authority/ies, in their role as statutory consultee under the Planning and Development Act, 2000, as amended.

You are requested to send further communications to the Development Applications Unit (DAU) at manager.dau@chg.gov.ie, or to the following address:
The Manager, Development Applications Unit (DAU), Government Offices, Newtown Road, Wexford, Y35 AP90

Is mise, le meas

Sinéad O' Brien

Sinéad O' Brien
Development Applications Unit

Thomas Blackwell

From: Manager DAU <Manager.DAU@chg.gov.ie>
Sent: Monday 21 December 2020 04:50
To: Thomas Blackwell
Subject: DAU Ref: G Pre00255/2020 RE: 200512 Ballynagare Wind Farm

Our Ref: G Pre00255/2020 (Please quote in all related correspondence)

A Chara

I acknowledge receipt of your recent consultation.

In the event of observations, you will receive a co-ordinated heritage-related response by email from Development Applications Unit (DAU).

The normal target turnaround for pre-planning and other general consultations is six weeks from date of receipt. In relation to general consultations from public bodies under the European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 to 2011, the Department endeavours to meet deadline dates, where requested.

If you have not heard from DAU and wish to receive an update, please email manager.dau@chg.gov.ie .

Kind Regards
Sinéad

—
Sinéad O' Brien
Executive Officer
—
Aonad na nIarratas ar Fhorbairt
Development Applications Unit

Bóthar an Bhaile Nua, Loch Garman, Contae Loch Garman Y35 AP90
Newtown Road, Wexford, County Wexford Y35 AP90

—

From: Thomas Blackwell [mailto:tblackwell@mkoireland.ie]
Sent: Tuesday 8 December 2020 13:39
To: Manager DAU
Subject: 200512 Ballynagare Wind Farm

To Whom it May Concern,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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Tuam Road, Galway
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+353 (0) 91 735611
www.mkoireland.ie

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Thomas Blackwell

From: planning applications <planning.applications@failteireland.ie>
Sent: Wednesday 23 December 2020 10:24
To: Thomas Blackwell
Subject: RE: 200512 Ballynagare Wind Farm
Attachments: Fáilte Ireland EIAR Guidelines.pdf

Hello Thomas,

Thank you for sending Fáilte Ireland the Scoping Letter/information regarding the preparation of an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm
Please see attached a copy of Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA, which you may find informative as part of the assessment process and in the preparation of the EIAR .The purpose of this report is to provide guidance for those conducting Environmental Impact Assessment and compiling an Environmental Impact Assessment Reports (EIAR), or those assessing EIARs, where the project involves tourism or may have an impact upon tourism. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.

Regards,

Yvonne

Yvonne Jackson
Product Development-Environment & Planning Support | Fáilte Ireland
Áras Fáilte, 88/95 Amiens Street, Dublin 1. D01WR86
T +353 (0)1 884 7224 | **M** +353 (0) 860357590 | **www.failteireland.ie**



Please consider the environment before printing this email

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Tuesday 8 December 2020 13:41
To: planning applications <planning.applications@failteireland.ie>
Subject: 200512 Ballynagare Wind Farm

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Ms. Jackson,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
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Fáilte Ireland
National Tourism Development Authority

EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects



An tÚdarás Náisiúnta Forbartha Turasóireachta
Áras Fáilte, 88–95 Sráid Amiens
Baile Átha Cliath 1
D01 WR86
Éire

National Tourism Development Authority
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1. Introduction

Tourism is a growing sector and substantial part of the Irish Economy. It contributes to both urban and rural economies in every part of the country. The impact and interaction of tourism with the environment is complex and the assessment of environmental impacts is of utmost importance to creating a sustainable tourism economy and protecting the natural resources that are so often a tourism attraction.

The purpose of this report is to provide guidance for those conducting Environmental Impact Assessment and compiling an Environmental Impact Assessment Reports (EIAR), or those assessing EIARs, where the project involves tourism or may have an impact upon tourism. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.

This guidance document has been prepared by Cunnane Stratton Reynolds on behalf of Fáilte Ireland to update their EIA guidelines in line with changes in legislative requirements.

2. Background to this Document

Tourism is one of the largest and most important sectors of the economy, providing employment for approximately **260,000 people**, an economic contribution of **€8.4 billion**, and exchequer revenue of **€1.78 billion** in 2018, which helps fund other key public services.

In 2018 Ireland welcomed **10.6 million overseas visitors.**

Fáilte Ireland is the National Tourism Development Authority. Fáilte Irelands role is to support the tourism industry and work to sustain Ireland as a high-quality and competitive tourism destination. They provide a range of practical business supports to help tourism businesses better manage and market their products and services.

Fáilte Ireland also work with other state agencies and representative bodies, at local and national levels, to implement and champion positive and practical strategies that will benefit Irish tourism and the Irish economy.

Fáilte Ireland promotes Ireland as a holiday destination through a domestic marketing campaign (DiscoverIreland.ie) and manage a network of nationwide tourist information centres that provide help and advice for visitors to Ireland.

Tourism related projects cover a broad range of plans, programmes and developments, from the Wild Atlantic Way to a single hotel conversion. These guidelines apply to projects involving or impacting upon tourism. A tourism plan, strategy or programme where it is part of the statutory plan making process under the Planning and Development Acts (as amended), may be more appropriately assessed by a Strategic Environmental Assessment (SEA) as discussed in the next section.

It should be borne in mind that EIA is required where there is anticipated to be a significant impact on the environment, where tourism projects are of a prescribed type or meet thresholds identified below.

Where Natura 2000 Designated Sites are potentially affected by tourism development Appropriate Assessment must be carried out by the appropriate authority in accordance with Article 6(3) of the EU Habitats Directive.

3. Legislation and Statutory Guidance

Environmental Impact Assessment is a procedure that ensures that the environmental implications of decisions are taken into account before planning based decisions are made. The assessment results in a report, called an Environmental Impact Assessment Report (EIAR).

Legislation

These guidelines are produced under current EIAR legislative requirements, having regard to Directive 2011/92/EU (known as 'Environmental Impact Assessment' – EIA Directive), as amended by Directive EU 2014/52 which came into effect in May of 2017. These requirements were transposed into Irish Law on 1 September 2018 as most of the provisions of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) came into effect. The principle of both Directives is to ensure that plans, programmes and projects likely to have significant effects on the environment are made subject to an environmental assessment, prior to their approval or authorisation.

Statutory Guidance

In response to the changes to the EIAR requirements under Directive EU 2014/52, the Environmental Protection Agency (EPA) developed Draft guidelines on the information to be contained in Environmental Impact Assessment Reports in August 2017. At the time of this document the guidelines have not been adopted from draft.

In addition to the EPA statutory guidance, the Department of Housing has produced Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment in August 2018.

The process of EIA is set out in the EPA EIAR Guidelines, which this document should be read in conjunction with and used as supplementary guidance to. The process for ascertaining whether an EIAR is required is known as ‘screening’ and the process to determine the breath and scope of an EIAR is known as ‘scoping’. Guidance on this can be found in Section 3.2 of the EPA Guidelines.

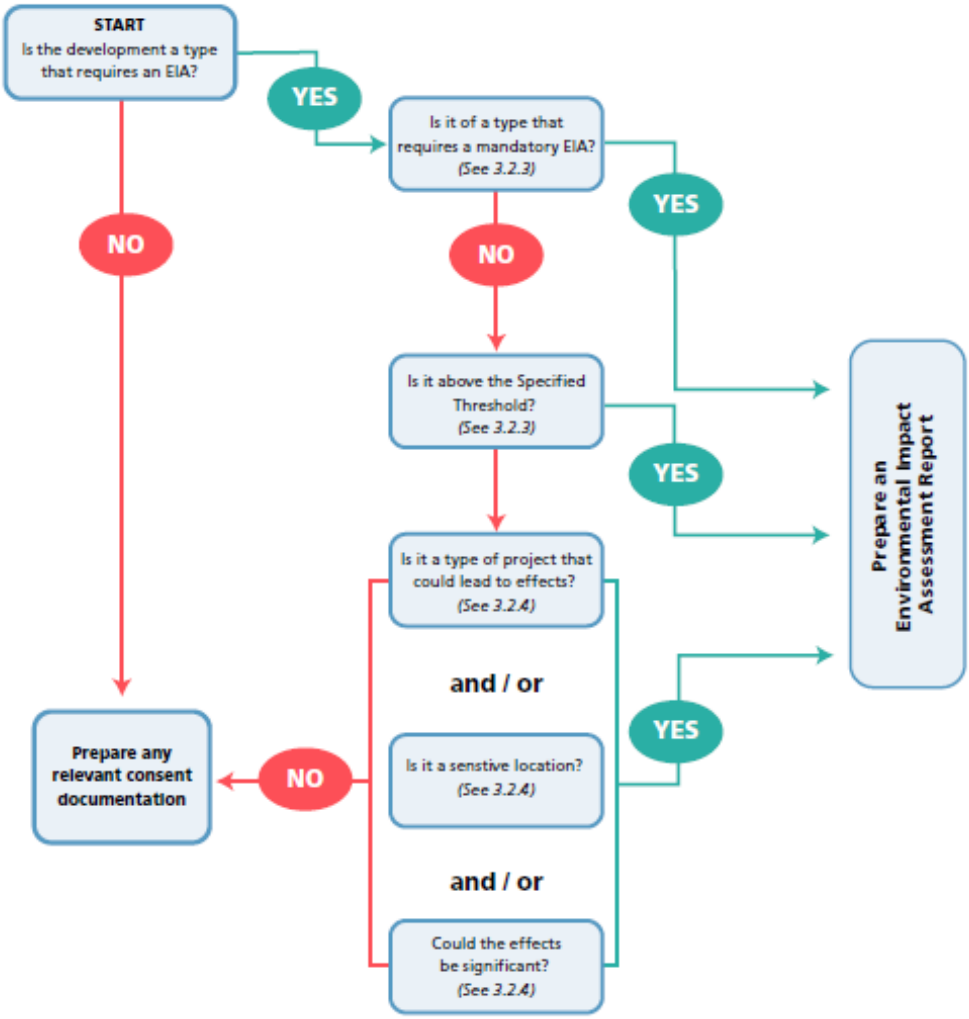
Screening

Through EIAR Screening, developments are either considered as requiring an EIAR due to the project type or because they exceed a threshold level. The screening process begins by establishing whether the proposal is a ‘project’ as understood by the Directive (as amended).

The prescribed development types and thresholds are set out in Annex I and II of the EIA Directive as transposed into Schedule 5 of the Planning and Development Regulations 2010-2018 (as amended). Development which do not exceed these thresholds but may require an EIAR are called sub threshold. Sub-Threshold considerations are outlined in Schedule 7 of European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) as transposed from Annex III of the Directive. The Guidelines on Environmental Impact Assessment Reports note that projects at first glance may not appear to come under the Schedule

but on closer examination when the process is further examined, they may do so because of the sensitivity or significance of the receiving environment etc. Sub threshold developments require an EIAR if they are likely to have significant environmental impacts and must undergo assessment for likely significant impacts through an EIAR screening report. The contents of a screening report for subthreshold development are contained in Annex III of the EIA Directive.

Figure 1: EIAR Screening Process



(Taken from Fig 3.2 of the EPA Guidelines)

Tourism locations should be identified as sensitive receptors in screening assessments for particular impacts, depending on scale and sensitivity, as they would in a full EIAR. Section 6 below can act as guidance for Screening Reports as well as for full EIAR.

The screening process for considering where an EIAR is necessary, is summarised below in Figure 1 (excerpted from Figure 3.2 of the EPA Guidelines).

Strategic Environmental Assessment (SEA) is a more strategic level of environmental assessment that examines plans, policies, objectives and programmes specifically rather than projects. For some tourism developments it may be more appropriate that they be examined through SEA, while individual projects or specific proposals are likely to be more assessed through EIAR. If a project is part of a plan, programme or policy/objective assessed by SEA there will still be a requirement for an EIAR for that development.

EIAR Scoping

Scoping an EIAR is an opportunity to look at the breadth of issues and ensure that any areas of possible significant impact are assessed. Identifying sensitivities and stakeholders should take account of tourism facilities and consider Fáilte Ireland in scoping requests where necessary.

4. Assessing Tourism

There is no legal definition of 'tourism' in Irish legislation. The UNWTO definition of sustainable tourism is *"Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities"* . This is widely accepted as a key definition of tourism as we move to a more sustainable future.

Tourism assessments are frequently carried out by economic consultants and by specific tourism consultants. It is always advisable, particular for tourism projects, that suitably qualified and experienced personnel are used to determine the impact of tourism related projects or to assess the impact of more general proposals on a tourism asset identified in a particular location. There is a requirement for EIAR under current legislation to contain a statement of competency within all EIAR documents, including screening and scoping reports.

Projects which involve a tourism element

Tourism projects are wide ranging and diverse. While there are some projects which cater to tourism and are easily identified as such - Hotels, Museums, etc. there are other projects where tourism is a key service or element, but which may not be immediately obvious - forest trails, community facilities and others. EIAR conducted for developments containing tourist elements should be completed in accordance with the current guidance from the EPA.

Projects which include a tourism element have potential particular environmental effects which differ from a non-tourism development. These impacts can be intermittent, event related, inconsistent, dependent on weather, temporal, temporary or seasonal. This is considered within the prescribed environmental topics for EIAR outlined in Section 7 below.

Projects which may have an impact upon tourism

While tourism projects may be diverse, the projects which can impact tourism are considerably more wide ranging, from large infrastructural developments to local energy developments. Disruption to or suppression of a tourist resource or amenity can have very local or more strategic impacts, directly or indirectly- for example energy projects in a rural area can have both a negative and positive impact in different regards. There can be temporary, periodic or even seasonal impacts occurring during construction or operational periods.

According to the Fáilte Ireland Tourism Facts 2018 Report, the most important factors in determining the attractiveness of tourism destinations for visitors to Ireland are;

- Beautiful Scenery and Unspoiled Environment
- Hospitality
- Safety
- Nature, Wildlife and Natural Attractions
- History and Culture
- Pace of Life

These factors used for the promotion of tourism in Ireland are also barometers of sensitivity to change in tourism sensitive or dominant locations where development may have an impact upon the tourism asset. The potential for development to impact these sensitivities, and the environmental criteria under which they can be considered, are identified in section 7 of the guidelines.

5. Guiding Principles of EIAR

As outlined in the EPA Draft EIAR Guidelines, the fundamental principles to be followed when preparing an EIAR, including screening and scoping, are:

- Anticipating, avoiding and reducing significant effects
- Assessing and mitigating effects
- Maintaining objectivity
- Ensuring clarity and quality
- Providing relevant information to decision makers
- Facilitating better consultation.

Environmental assessment should be undertaken in accordance with the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

6. Consideration of Competency and Qualifications

As per Section 2.5 of the EPA Guidelines, EIAR is required to be completed by 'competent experts'.

Contributors to the preparation of environmental impact assessment reports, including screening and scoping assessments, should be qualified and competent. Sufficient expertise, in the relevant field of the project concerned, is required for the purpose of its examination by the competent authorities in order to ensure that the information provided by the developer is complete and of a high level of quality so that a full and proper assessment can be undertaken.

For tourism related projects, or projects likely to affect tourism assets, competent experts in the area of tourism should be utilised in the environmental assessment.

The competency of all involved in the production of an EIAR or any related report (eg. Screening and scoping) is required to be stated at the beginning of the EIAR report with further details as necessary in each following chapter.

Where tourism projects involve for example heritage or cultural components, input from heritage consultants, conservation architects, or historians may be required.

7. EIAR Requirements

The following are the key requirements for an EIAR under the current guidance. This is not a definitive list and should be read in conjunction with regulations.

- project description;
- assessment of alternatives considered;

- baseline assessment;
- impact assessment;
- cumulative impact
- interaction of impacts
- mitigation.

Project Description

Project descriptions are required to describe the whole project including site, scale, design and key factors. It is important that the EIAR and design team have a consistent understanding of the development description in full. The key requirements are outlined in section 3.5 of the EPA Guidelines however they identify the following;

- the location of the project
- the physical characteristics of the whole project
- the main characteristics of the operational phase of the project
- an estimate, by type and quantity, of the expected residues and emissions

The location of the project should include identifying key sensitive receptors (including tourism receptors). In the operational phase of the project any tourism based, or potentially tourism related activity, should be identified.

Assessment of Alternatives

The assessment of alternatives is a requirement of EIAR

Where tourism projects are location dependent the assessment of alternatives should consider alternative methods and technologies, detail the key considerations culminating in the selection of the design, the reasoning for these and the environmental effect of these decisions. This is particularly important for tourism projects which are often location tied. The developer is expected to consider reasonable alternatives. What is considered reasonable my vary from case to case.

Baseline Assessment

Baseline descriptions are evidence based, current descriptions of environmental characteristics with consideration of likely changes to the baseline environment evidenced in planning histories, unimplemented permissions, and applications pending determination. Baseline assessments should identify any tourism sensitivities in the zone of influence of a development. This zone of influence of a development is highly dependant on its **Context, Character, Significance,** and **Sensitivity**, as outlined in the Draft Guidelines. These characteristics apply to both the development and the environment.

For example, in a tourism context;

The location of sensitive tourism resources that are likely to be directly affected should be highlighted, and other premises which although located elsewhere, may be the subject of in combination impacts such as alteration of traffic flows or increased urban development.

The character of an area from a tourism perspective should be described and the principal types of tourism in the area. Where relevant, the specific environmental resources or attributes in the existing environment which each group uses or values should be stated and where relevant, indicate the time, duration or seasonality of any of those activities.

The significance of the tourism assets or activities likely to be affected should be highlighted. Reference to any existing formal or published designation or

recognition of such significance should be. Where possible the value of the contribution of such tourism assets and activities to the local economy should be provided.

If there are any significant concerns or opposition to the development known to exist among tourism stakeholders and interest groups, this should be highlighted. Identify, where possible, the particular aspect of the development which is of concern, together with the part of the existing tourism resource which may be threatened or impacted.

In addition, the baseline should include any methodologies employed in the study to obtain information, if particular databases are used to locate sensitive receptors they should be acknowledged. In relation to tourism information, the suggested information sources at the end of this document are a non-exhaustive list which may be of assistance in identifying tourism receptors.

Impact Assessment

The topics for consideration of impact are prescribed in the EIA Directive and transcribed into Irish law by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018). Impact assessment should contain the likely significant effects of a development arising from both construction and operation of a development. Advice on describing the effects is contained within the Draft Guidelines and includes the **quality, significance, extent, probability, type** and **duration** of the effect, with particular descriptors for each. In describing effects upon tourism receptors these descriptors should take account of the particular aspects and sensitivities of tourism, for example a temporary annual effect from a development may have different impacts upon tourism if it falls at peak season rather than off-peak.

Impact assessment should be carried out as per EPA guidelines and the best practice for that prescribed topic. It may be considered appropriate to consider impact on tourism assets under the 'material assets' topic below.

Population and Human Health

The consideration of tourism projects within the Population and Human Health is extensive, with impacts ranging from rural employment population impacts of seasonal tourism, to the health impact of air pollution from increased traffic in urban areas.

The impact upon tourism can be considered within this section through the sensitivities of Hospitality, Safety and Pace of Life. Changes in population can impact the perception of pace of life or safety in a particular location. Impacts upon these issues in areas which rely heavily on tourism or have a particular sensitive tourism generator should be considered in this section.

Biodiversity

Particular tourist activities can have a significant impact upon biodiversity. Landscapes which are 'unspoiled' can be attractors of tourism. However, the disturbance to ecology must be managed to minimise impact. Biodiversity is also a tourism asset and should be protected as such from other development and should be provided for in proposals where possible.

Land, Soils and Geology

A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however particular activities or facilities which use geological features may have an impact upon soils and geology, such as mountain biking trails, recreational uses of old quarries etc. Indirect impacts such as material use for extensive landscaping and public realm should also be considered.

Water

Tourism uses can be water intense, depending on development type. Recreational use of a surface water feature, water-based leisure centres etc have different impacts to standard development.

Air Quality and Climate

Tourism impact upon air quality is dependent on activity proposed and sensitivity of the location.

Noise and Vibration

A link between tourism and this prescribed environmental factor, beyond the normal development impacts, is rare, however the impact upon tourism of issues of noise and vibration can be significant. Construction adjoining hotels for example should consider the sensitivity of the development and ensure mitigation is in place.

Material Assets; Traffic and Transport

The different transport patterns associated with tourism activities is a key impact of tourism and should be considered especially for tourism projects. These produce temporal and seasonal changes on the norm and specialist consideration and interpretation should be given. Tourism proposals should, where possible, be well served by public transport and should be accessible by modes other than the car. The impact of traffic on tourism assets can be substantial and can vary in severity according to season, the weather, etc. The impact of construction traffic can be a particular concern in tourism sensitive areas in terms of noise pollution and visual impact. The construction programme of developments should work to avoid peak tourism periods in tourism areas and should consider planned or anticipated tourism events and festivals.

Cultural Heritage

Cultural heritage can be a key component of tourism projects and the impact of tourism on the maintenance of cultural heritage should be given the utmost consideration, whether positive or negative. As a tourism attraction, cultural heritage should be strongly considered in non-tourism developments and the impact upon tourism considered as a potential impact.

Archaeology

Archaeology can be of tourism interest and can be an attractive or key component of tourism projects. Archaeology can be a tourism attractor but is generally not kept in situ except in key cases which could also be considered under cultural heritage.

Material Assets; Waste Management

Tourism is a resource heavy activity and can impact waste streams and waste segregation. Impacts here should be considered strongly and with knowledge of the variation that arises from the particular tourist activity. Waste and Waste disposal issues can also impact the perception of an unspoiled environment, effecting tourism, which should be considered.

Material Assets

Material assets are utilities and infrastructure. Tourism itself could be considered a material asset as its impact upon the economy and the infrastructure in place to support it is a material consideration in assessing economic impact.

Landscape

The visual impact of a tourism development, especially in locations which are visually sensitive or renowned for their scenic or landscape beauty, should be considered carefully. A

development intended to utilise or enjoy a particular vista or environment should minimise impact upon that environment.

Major Accident and Natural Disaster

There is a requirement for tourist developments to describe expected significant effects on the environment of the proposed development's vulnerability to major accidents and/or natural disasters relevant to it. Where appropriate measures should be identified to prevent or mitigate the significant adverse effects of such accidents or disasters, including resulting from climate change, on the environment and detail the preparedness for the proposed response.

Interaction of Effects

Where two or more environmental impacts combine or interact they should be considered under the prescribed topics. It is best practice to provide a table of interactions within an EIAR or EIAR Screening Report.

Mitigation

Mitigation should follow the hierarchy of minimisation in descending order of preference- Avoid, Reduce, Remedy

Avoid sensitive tourism resources- such as views, access and amenity areas including habitats as well as historical or cultural sites and structures.

Reduce the exposure of sensitive resources to excessive environmental impact

Reduce the adverse effects to tourism land uses and patterns of activities, especially through interactions arising from significant changes in the intensity of use or contrasts of character or appearance.

Remedy any unavoidable significant residual adverse effects on tourism resources or activities.

Mitigation measures must be measurable and achievable within the bounds of the project.

Cumulative Impact

The cumulative impact is that of the project combined with any known likely project which will interact or compound an environmental impact.

Transboundary Impact

Transboundary impacts should be included in EIAR. In the case of tourism, especially international travel, the transboundary impacts may not be proximate to the EIAR site.

8. Sources of information on Tourism

Information available online

Fáilte Ireland

Fáilte Ireland offers detailed research analysis and insights into the Irish Tourism Industry. The National Tourism Development Authority has a portfolio of research across a number of areas including facts an figures, briefing papers and reports and visitor feedback. The Fáilte Ireland website has a dedicated research library which can be accessed here

Tourism Ireland

Tourism Ireland is responsible for marketing the island of Ireland overseas as a holiday and business tourism destination. Tourism Ireland publishes a range of research documents including; visitor facts and figures, seasonal updates and industry insights which are accessible here

Local Authorities

Local Authorities are an invaluable source of information. They produce tourism strategies and audits of tourism assets within their jurisdiction. Local authorities will also produce landscape and seascape studies. Protected views and prospects as well as the record of protected structures and other designated protected buildings are contained within the Statutory Development Plans.

Regional Authorities

Regional Authorities can also be consulted on high level strategic tourism and potential Regional Spatial and Economic Strategies (RSESs) should be consulted.

Central Statistics Office

The Central Statistics Office (CSO) is Ireland's national statistical office and their purpose is to impartially collect, analyse and make available statistics about Ireland's people, society and economy. The Tourism and Travel Section of the Central Statistics Office is the major source for tourism statistics in Ireland and is updated regularly.

Thomas Blackwell

From: Trish Smullen <Trish.Smullen@gsi.ie>
Sent: Thursday 17 December 2020 13:41
To: Thomas Blackwell
Cc: Clare Glanville; John Butler
Subject: 20/315 Preparation of EIAR for proposed Ballynagare Wind Farm, Co Kerry
Attachments: 20_315 Proposed Ballynagare Wind Farm Co. Kerry.pdf

Re: Preparation of an EIAR for the proposed Ballynagare Wind Farm, Co. Kerry
Your Ref: 200512
Our Ref: 20/315

Dear Mr.Blackwell,

With reference to your letter dated 08 December 2020, concerning the preparation of an EIAR for the proposed Ballynagare Wind Farm, Co. Kerry, please find attached response from Geological Survey Ireland.

If you have any further queries or if we can be of further assistance, please do not hesitate to contact me (Trish.Smullen@gsi.ie), or my colleague Clare Glanville (Clare.Glanville@gsi.ie).

Yours sincerely,

Trish Smullen
Geological Survey Ireland

From: John Butler
Sent: 08 December 2020 14:04
To: Clare Glanville; Sophie O'Connor; Brian McConnell; Monica Lee; Taly Hunter Williams; Sean Cullen; Charise McKeon; Jim Hodgson; Eoin McGrath; Trish Smullen
Subject: EIS 20/315 - Preparation of EIAR for proposed Ballynagare Wind Farm, Co Kerry

EIS 20/315

Preparation of EIAR for proposed Ballynagare Wind Farm, Co Kerry. Request for observations by McCarthy Keville O'Sullivan. Letter and scoping document is enclosed.

Regards,

John

From: Thomas Blackwell [mailto:tblackwell@mkoireland.ie]
Sent: 08 December 2020 13:42
To: John Butler
Subject: 200512 Ballynagare Wind Farm

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Mr. Butler,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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Tá eolas sa teachtaireacht leictreonach seo (agus b'fhéidir sa chomhaid ceangailte leis) a d'fhéadfadh bheith príobháideach nó faoi rún. Is le h-aghaidh an duine/na ndaoine nó le h-aghaidh an aonáin atá ainmnithe thuas agus le haghaidh an duine/na ndaoine sin amháin atá an t-eolas. Murab ionann tusa agus an té a bhfuil an teachtaireacht ceaptha dó bíodh a fhios agat nach gceadaítear nochtadh, cóipeáil, scaipeadh nó úsáid an eolais agus/nó an chomhaid seo. Más trí earráid a fuair tú an teachtaireacht leictreonach seo cuir, más é do thoil é, an té ar sheol an teachtaireacht ar an eolas láithreach. Deimhnítear leis seo freisin nár aims odh víreas sa phost seo tar éis a scanadh.

An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Thomas Blackwell
MKO
Tuam Road,
Galway, H91 VW84

17 December 2020

Re: Preparation of an EIAR for the proposed Ballynagare Wind Farm, Co. Kerry
Your Ref: 200512
Our Ref: 20/315

Geological Survey Ireland is the national earth science agency and has datasets including Bedrock Geology, Quaternary Geology, Geological Heritage Sites, Mineral deposits, Groundwater Resources, Geohazards and the Irish Seabed. These comprise maps, reports and extensive databases that include mineral occurrences, bedrock/mineral exploration groundwater/site investigation boreholes, karst features, wells and springs. Please see our website for data availability and we recommend using these various data sets, when undergoing the EIAR, planning and scoping processes. Geological Survey Ireland should be referenced to as such and should any data or geological maps be used, they should be attributed correctly to Geological Survey Ireland.

Dear Mr.Blackwell,

With reference to your letter dated 08 December 2020, concerning the preparation of an EIAR for the proposed Ballynagare Wind Farm, Co. Kerry, Geological Survey Ireland (a division of the Department of Environment, Climate and Communications), would like to make the following comments.

Geoheritage

Geological Survey Ireland is in partnership with the National Parks and Wildlife Service (NPWS, Department of Culture, Heritage and Gaeltacht), to identify and select important geological and geomorphological sites throughout the country for designation as geological NHAs (Natural Heritage Areas). This is addressed by the Geoheritage Programme of Geological Survey Ireland, under 16 different geological themes, in which the minimum number of scientifically significant sites that best represent the theme are rigorously selected by a panel of theme experts.

County Geological Sites (CGS), as adopted under the National Heritage Plan, include additional sites that may also be of national importance, but which were not selected as the very best examples for NHA designation. All geological heritage sites identified by GSI are categorised as CGS pending any further NHA designation by NPWS. CGS are now routinely included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer.

The CGSs for County Kerry remain unaudited and as such there is limited detailed information on each site available publicly. The sites are listed in a master list of unaudited sites and are presented on Geological Survey Ireland's Map Viewer as sites with buffer zones but no specific site boundary. **Our records show that there is an unaudited CGS in the vicinity of the proposed windfarm development.**

> **Lixnaw Quarry**, Co. Kerry (GR 90620, 129760), under IGH theme: IGH 8 Lower Carboniferous. A working quarry in striped Carboniferous limestone of Visean age. This is an unusual and distinctive rock type.

With the current plan, there are no envisaged impacts on the integrity of current CGSs by the proposed development. However, if the proposed development plan is altered, please contact Clare Glanville (Clare.Glanville@gsi.ie) for further information and possible mitigation measures if applicable.

Groundwater

Groundwater is important as a source of drinking water, and it supports river flows, lake levels and ecosystems. It contains natural substances dissolved from the soils and rocks that it flows through, and can also be contaminated by human actions on the land surface. As a clean, but vulnerable, resource, groundwater needs to be understood, managed and protected.

Through our Groundwater Programme, Geological Survey Ireland provides advice and maps to members of the public, consultancies and public bodies about groundwater quality, quantity and distribution. Geological Survey Ireland monitors groundwater nationwide by characterising aquifers, investigating karst landscapes and landforms and by helping to protect public and group scheme water supplies. **We recommend using our National Aquifer, Vulnerability and Recharge maps on our Map viewer to this end.**

The GWFlood project was a groundwater flood monitoring and mapping programme aimed at addressing the knowledge gaps surrounding groundwater flooding in Ireland and ran from 2016 to 2019. The project is providing the data and analysis tools required by local and national authorities to make scientifically-informed decisions regarding groundwater flooding. **Although primarily focused on karst areas, this may provide information to benefit the proposed windfarm development. We recommend using our GWFlood tools found under our programme activities (in conjunction with OPW data), to this end.**

With regards to Climate Change, there is a need to improve the monitoring capacity of groundwater levels in Ireland so that the potential impacts of climate change can be monitored and assessed. In this context the GSI has established the **GWClimate** project in January 2020. **GWClimate** will 1) establish a long-term strategic groundwater level monitoring network and 2) develop modelling and analytical approaches for evaluating the impacts of Climate Change to Irish groundwater systems. **Further information can be found on the Groundwater flooding page of the Groundwater Programme.**

Geological Mapping

Geological Survey Ireland (GSI) maintains online datasets of bedrock and subsoils geological mapping that is reliable, accessible and meets the requirements of all users including depth to bedrock and physiographic maps. These datasets include depth to bedrock data and subsoil classifications. **We would encourage you to use these data which can be found here, in your future assessments**.

Geohazards

Geohazards can cause widespread damage to landscapes, wildlife, human property and human life. In Ireland, landslides are the most prevalent of these hazards. Geological Survey Ireland has information available on past landslides for viewing as a layer on our Map Viewer. Geological Survey Ireland also engages in national projects such as Landslide Susceptibility Mapping and **GWFlood** Groundwater Flooding. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so.

Natural Resources (Minerals/Aggregates)

Geological Survey Ireland is of the view that the sustainable development of our natural resources should be an integral part of all development plans from a national to regional to local level to ensure that the materials required for our society are available when required. Geological Survey Ireland highlights the consideration of mineral resources and potential resources as a material asset which should be explicitly recognised within the environmental assessment process. Geological Survey Ireland provides data, maps, interpretations and advice on matters related to minerals, their use and their development in our Minerals section of the website. The Active Quarries, Mineral Localities and the Aggregate Potential maps are available on our Map Viewer.

We would recommend use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential within the area. In keeping with a sustainable approach we would recommend use of our data and mapping viewers to identify and ensure that natural resources used in the proposed windfarm development are sustainably sourced from properly recognised and licensed facilities.

Other Comments

Should development go ahead, all other factors considered, Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. Should any significant bedrock cuttings be created, we would ask that they will be designed to remain visible as rock exposure rather than covered with soil and vegetated, in accordance with safety guidelines and engineering constraints. In areas where natural exposures are few, or deeply weathered, this measure would permit on-going improvement of geological knowledge of the subsurface and could be included as additional sites of the geoheritage dataset, if appropriate.

Alternatively, we ask that a digital photographic record of significant new excavations could be provided. Potential visits from Geological Survey Ireland to personally document exposures could also be arranged.

The data would be added to Geological Survey Ireland's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to Beatriz Mozo, Land Mapping Unit, at Beatriz.Mozo@gsi.ie, 01-678 2795.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to contact me (Trish.Smullen@gsi.ie), or my colleague Clare Glanville (Clare.Glanville@gsi.ie).

Yours sincerely,



Trish Smullen
Geoheritage Programme
Geological Survey Ireland

Thomas Blackwell

From: MKO-Admin
Sent: Thursday 14 January 2021 12:58
To: Thomas Blackwell
Subject: FW: Scoping consultation for proposed Ballynagare Windfarm- EHIS Ref No 1495
Attachments: Cover letter Ballynagare Windfarm Scoping Co Kerry EHIS 1495.docx; HSE submission Ballynagare Windfarm Co Kerry Scoping EHIS 1495.docx; HSE South Emergency Management Consultation Report EMENV 071.docx; ETHANE Aide Memoire 2.pdf

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From: Brendan Dunne (EHO- Kerry) <Brendan.Dunne@hse.ie>
Sent: Thursday 14 January 2021 12:57
To: MKO-Admin <info@mkoireland.ie>
Subject: Scoping consultation for proposed Ballynagare Windfarm- EHIS Ref No 1495

ATTENTION OF **THOMAS BLACKWELL. - Ref no 200512 - Proposed Ballynagare Windfarm**

A chara
Please find attached environmental health service cover letter and submission report for the above proposed development. Also attached is HSE South Emergency Management submission and ethane aid memoir.

Regards,

Brendan Dunne,
Senior Environmental Health Officer
Environmental Health Service
Block C Edward Court
Edward Street
Tralee
Co Kerry
Tel: 066 7184992 Fax: 066 7184980

Seirbhís Sláinte Níos Fearr á Forbairt | Building a Better Health Service

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

ENVIRONMENTAL HEALTH SERVICE
Health Service Executive – South
Unit 4 – Liber House
Monavalley
Tralee
Co. Kerry

Tel: (066) 7184992/7184981

Date: 21 January 2021

Name: Mr Thomas Blackwell, MKO, Tuam Road, Galway

Consultant's reference: 200512

Re: EIA Scoping Report

Proposed development: Proposed Ballynagare Wind Farm, Co. Kerry

Applicant: Emerging Markets Power (EMPower)

EHIS Reference: 1495

Dear Mr Blackwell

Please find enclosed the HSE Consultation Report in relation to the above proposal.

The following HSE departments were made aware of the consultation request for the proposed development on 18 December 2020

- Emergency Planning – David O'Sullivan
- Estates – Helen Maher
- Assistant National Director for Health Protection – Kevin Kelleher/ Laura Murphy
- CHO – Michael Fitzgerald

If you have any queries regarding this report the initial point of contact is Mr John Moynihan, Principal Environmental Health Officer who will refer your query to the appropriate person.

Yours sincerely

John Moynihan
Principal Environmental Health Officer

HSE EIA Scoping

Environmental Health Service Submission Report

Date: 21.1.21

Our reference: EHIS 1495

Report to: Mr Thomas Blackwell, MKO, Tuam Road, Galway

Type of Consultation: EIA Scoping

Proposed development: Proposed Ballynagare Wind Farm, Co. Kerry

Applicant: Emerging Markets Power (EMPower)

Proposed Development: Proposed development of a wind farm at Ballynagare, Co. Kerry

General Introduction

The following documents should be taken into consideration when preparing the Environmental Impact Assessment Report:

- Guidelines on the information to be contained in EIS (2002), 187kb
- Advice Notes on Current Practice in the preparation of EIS (2003), 435kb
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment

https://www.housing.gov.ie/sites/default/files/publications/files/guidelines_for_planning_authorities_and_an_bord_pleanála_on_carrying_out_eia_-_august_2018.pdf

EU publication: Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report, EU, 2017

http://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf

Adoption of the Directive (2014/52/EU) in April 2014 initiated a review of the above guidelines. The draft new guidelines can be seen at:

http://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes

Generally the Environmental Impact Assessment should examine all likely significant impacts and provide the following information for each:

a) Description of the receiving environment;

b) The nature and scale of the impact;

c) An assessment of the significance of the impact;

d) Proposed mitigation measures;

e) Residual impacts.

Directive 2014/52/EU has an enhanced requirement to assess likely significant impacts on Population and Human Health. It is the experience of the Environmental Health Service (EHS) that impacts on human health are often inadequately assessed in EIAs in Ireland. It is recommended that the wider determinants of health and wellbeing are considered in a proportionate manner when considering the EIA. Guidance on wider determinants of health can be found at www.publichealth.ie

In addition to any likely significant negative impacts from the proposed development, any positive likely significant impacts should also be assessed.

The HSE will consider the final EIAR accompanying the planning application and will make comments to the relevant planning authority on the methodology used for assessing the likely significant impacts and the evaluation criteria used in assessing the significance of the impact.

This report only comments on Environmental Health Impacts of the proposed development. It is based on an assessment of the correspondence submitted to this office dated 8th December 2020.

The Environmental Health Service (EHS) recommends that the following matters are included and assessed in the EIAR

- Public Consultation
- Decommissioning phase
- Siting and location of turbines
- Opportunity for Health Gain
- Noise & Vibration
- Shadow Flicker
- Air Quality

• Surface and Groundwater Quality

• Geological Impacts

• Ancillary facilities and cumulative impacts

Public Consultation

It is strongly recommended that early and meaningful public consultation with the local community is carried out to ensure all potentially significant impacts have been adequately addressed.

All parties affected by the proposed development, **including those who may benefit financially from the project,** must be fully informed of what the proposal entails especially with regard to potential impacts on surrounding areas.

Sensitive receptors and other stakeholders should be identified to ensure all necessary and appropriate mitigation measures are put in place to avoid any complaints about the proposed wind farm development in the future.

It is acknowledged that current restrictions around public gatherings as a result of Covid 19 prevention measures will impact on opportunities for public consultation events. However it is expected that meaningful public consultation, where the local community is fully informed of the proposed development, will be undertaken. Members of the public should be given sufficient opportunities to express their views on the proposal wind farm.

The Environmental Impact Assessment Report (EIAR) should clearly demonstrate the link between public consultations and how those consultations have influenced the decision-making process in the EIA.

To assist with the consultation and planning process it is recommended that the applicant develops a dedicated website for the proposed wind energy project. All correspondence, maps, project updates and documentation including the EIAR should be uploaded to the website.

Decommissioning Phase

The EIAR should detail what the eventual fate of the turbines and associated material will be, i.e. will the material be recycled or how will it be disposed of.

Information should also be provided regarding the proposed methodology to be used for the disposal of the materials forming the foundations of the wind turbines.

The EIAR should indicate the proposed future use of the wind farm site at the end of the planning permission period.

Siting, Location and details of Turbines

The EIAR should include a map and a description of the proposed location of each of the proposed wind turbines.

The Environmental Health Service expects that details (height and model) of the turbines to be installed will be available at the time planning permission is sought and will be included in the EIAR.

Details of turbine foundation structures, including depth, quantity and material to be used should also be included in the EIAR.

Opportunity for Health Gain

The EPA has issued guidance with regard to meeting the requirements of Directive 2014/52/EU which assesses the impact of certain public and private projects on the environment. The proposed development should be assessed with a view to the potential to include opportunities for health gain within the site of the proposed wind farm by including greenways, cycle-paths or walking trails within the development site.

Assessment of Consideration of Alternatives

The EIAR should consider an assessment of alternatives. The EHS recommends that alternative renewable energy options to on shore wind farms should be assessed as part of the EIAR.

Noise & Vibration

The potential impacts for noise and vibration from the proposed development on all noise sensitive locations must be clearly identified in the EIAR. The EIAR must also consider the appropriateness and effectiveness of all proposed mitigation measures to minimise noise and vibration.

A baseline noise monitoring survey should be undertaken to establish the existing background noise levels. Noise from any existing turbines in the area should not be included as part of the back ground levels.

In addition, an assessment of the predicted noise impacts during the construction phase and the operational phase of the proposed wind farm development must be undertaken which details the change in the noise environment resulting from the proposed wind farm development.

The Draft Revised Wind Energy Development Guidelines were published in December 2019. Whilst these have yet to be adopted, any proposed wind farm development should have consideration of the draft Guidelines.

https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf

It is recommended that the transformer proposed as part of the development is manufactured with a specified and guaranteed noise emission level in order to minimise the impact on sensitive

receptors and that the minimising of noise is a criterion used for the selection and installation of substation equipment.

Shadow Flicker

It is recommended that a shadow flicker assessment is undertaken to identify any dwellings and sensitive receptors which may be impacted by shadow flicker. The assessment must include all proposed mitigation measures. Dwellings should include all occupied properties and any existing or proposed properties for which planning consent has been granted for construction or refurbishment.

It is recommended that turbine selection will be based on the most advanced available technology that permits shut down during times when residents are exposed to shadow flicker. As a result no dwelling should be exposed to shadow flicker.

Air Quality

Due to the nature of the proposed construction works generation of airborne dust has the potential to have significant impacts on sensitive receptors. A Construction Environmental Management Plan (CEMP) should be included in the EIAR which details dust control and mitigation measures. Measures should include:

- Sweeping of hard road surfaces
- Provision of a water bowser on site, regular spraying of haul roads
- Wheel washing facilities at site exit
- Restrict speed on site
- Provide covers to all delivery trucks to minimise dust generation
- Inspect and clean public roads in the vicinity if necessary
- Material stockpiling provided with adequate protection from the wind
- Dust monitoring at the site boundary
- Truck inspection and maintenance plan
- Details of a road maintenance agreement between the wind farm operator and the Local Roads Authority to clarify responsibility for the upkeep and repair of access roads during the construction phase of the project.

Surface and Ground Water Quality

The proposed development has the potential to have a significant impact on the quality of both surface and ground water. All drinking water sources, both surface and ground water, must be

identified. Public and Group Water Scheme sources and supplies should be identified. Measures to ensure that all sources and supplies are protected should be described. The Environmental Health Service recommends that a walk over survey of the site is undertaken in addition to a desktop analysis of Geological Survey of Ireland data in order to identify the location of private wells used for drinking water purposes.

Any potential significant impacts to drinking water sources should be assessed. Details of bedrock, overburden, vulnerability, groundwater flows, aquifers and catchment areas should be considered when assessing potential impacts and any proposed mitigation measures.

Geological impacts

A detailed assessment of the current ground stability of the site for the proposed wind farm and all proposed mitigation measures should be detailed in the EIAR. The assessment should include the impact construction work may have on the future stability of ground conditions, taking into consideration extreme weather events, site drainage and the potential for soil erosion.

Information should be provided on the make and model of the turbines and on construction details for the turbine foundations, including the depth and volume of concrete required. An accurate assessment of the potential impacts of the foundations on water quality and peat stability cannot be undertaken without this information.

Reference is made to a peat slide which occurred near Ballybofey in Co. Donegal on November 13th 2020 which may have been linked to construction activity at Meenbog Wind Farm. Potential impacts on water supply associated with contamination following a peat slide include sedimentation and alteration of pH levels.

The Environmental Health Service recommends that a detailed Peat Stability Assessment should be undertaken to assess the suitability of the soil for the proposed development. The EIAR should include provision for a peat stability monitoring programme to identify early signs of potential bog slides ('pre-failure indicators' see the Scottish Government's 'Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments 2017) https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2017/04/peat-landslide-hazard-risk-assessments-best-practice-guide-proposed-electricity/documents/00517176-pdf/00517176-pdf/govscot%3Adocument/00517176.pdf

Ancillary Facilities

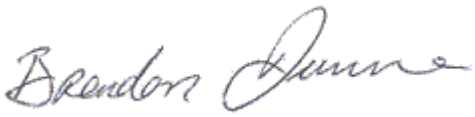
The EIAR should include details of the location of all site office, construction compound, fuel storage depot, sanitary accommodation and canteen, First Aid facilities, disposal of wastewater and the provision of a potable water supply to the site canteen.

Cumulative Impacts

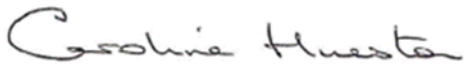
All existing or proposed wind farm developments in the vicinity should be clearly identified in the EIAR.

The impact on sensitive receptors of the proposed development combined with any other wind farm developments in the vicinity should be considered. The EIAR should include a detailed assessment of any likely significant cumulative impacts of the proposed renewable energy development.

The EIAR should state clearly if there is any future proposal to extend the proposed Ballynagare Wind Farm.



Brendan Dunne
Senior Environmental Health Officer
Kerry



Caroline Hueston
Environmental Health Officer
Environment Operational Unit
HSE West
Ennistymon Health Centre
Ennistymon
Co. Clare

Seirbhís Sláinte Níos Fearr á Forbairt | Building a Better Health Service

EMH EMERGENCY MANAGEMENT HEALTH

HSE South Emergency Management Consultation Report

Report to	**John Moynihan, PEHO, Kerry**	**Date**	**23rd Dec., 2020**
Type of consultation: EIS □ Scoping X Screening □ EIAR □ EPA □ Other (please specify):			
Authority	**Health Service Executive**		
Consultants Ref. Number	**200512 EHIS 1495**		
EM Reference Number	**EMENV071**		
Applicant	**Emerging Markets Power (EM Power) / Consultants: MKO, Tuam Road, Galway**		
Proposal	**Development of Ballynagare Wind Farm, near Lixnaw and Listowel, Co. Kerry**		

HSE South Emergency Management Observations:

Please be advised that the HSE South Emergency Management function does not have any specific observations to make with respect to this application. However, please note the following recommendations within the context of site operations:

1. Should an incident occur at the site and the site operator requires the assistance of the emergency services, the incident information should be provided in the `ETHANE` format (please see attached).
2. Emergency Services access to the site should be clearly identified. This should be undertaken via appropriate high visibility signage, i.e.; a green sign with a yellow border and white lettering citing the abbreviation RVP
3. The site should have a mechanism in place to account for personnel during an evacuation in order to provide the responding emergency services with an estimate of the number of people accounted and unaccounted for.
4. The site should identify any critical / vulnerable facilities within the geographical catchment area, such as hospitals, schools, nursing homes, etc, that could be directly or indirectly affected by an incident at the site.
5. Where the `off-site` impacts of an incident at the site affects a vulnerable cohort / population such as children within crèches, schools; patients / clients / residents within nursing homes, etc; the emergency services will require assistance from the site operator in determining the impact on the local community.
6. The site operator is encouraged to develop a business continuity plan that includes a plan for severe weather. For more advice on this, please see the Department of Business, Enterprise and Innovation, *Business Continuity Planning in Severe Weather.* https://dbei.gov.ie/en/Publications/Publication-files/Business-Continuity-Planning-in-Severe-Weather-Check-List-for-Businesses.pdf

All correspondence or any queries with regard to this report should be forwarded to Ms. Maryanne Horgan, Emergency Management Office, HSE South, Eye, Ear and Throat Hospital, Western Road, Cork, T12 WP62 or maryanne.horgan@hse.ie

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EMH EMERGENCY MANAGEMENT HEALTH

Dial 999 / 112 – Request the service you require: An Garda Síochána, Ambulance Service and / or Fire and Rescue Service

WHEN YOU ARE CONNECTED TO THE REQUISITE SERVICE(S)

GIVE THE FOLLOWING INFORMATION **This is:_____Eircode_____** (Name, Telephone Number and Eircode Address of site) ***An incident has occurred at this site - standby for ETHANE message***	
E	
	Exact location of the incident
T	
	Type of incident, e.g.; fire, explosion, gas leak, etc
H	
	Hazards – current and potential
A	
	Access and Egress – what is the safest approach route for responding emergency services and where is your emergency services meeting point (RVP)
N	
	Number of casualties and their condition – specify adult / children if known
E	
	The emergency services present and required
N.B. If you require another emergency service stay on the line and repeat the steps again	



Thomas Blackwell

From: Jochen Roller <Jochen.Roller@housing.gov.ie>
Sent: Friday 4 June 2021 17:27
To: Susan Doyle
Subject: RE: Information request
Attachments: 2021_187_Rare_and_protected_species_records.zip

Dear Susan,

Please find requested species data attached. I ran the queries on our data for an area of 5km around the provided shapefile.

In addition to the attached, we hold information on hen harrier breeding sites from nearby Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA 004161. If you would like to receive a breakdown of these (numbers of breeding sites within 3km and 5km of the study area), please let me know and I will extract that information.

Species records are provided as both Excel file and shapefile (in Irish Grid TM75). Records are represented as squares in the shapefile, with the side lengths of the squares corresponding to the resolution (1x1m to 10x10km) in which the observations were recorded. Please beware that any records overlapping the area of interest were extracted, and that the dataset contains historic records that have been recorded on a 10km square (hectad) level and may be from locations outside of the area of interest.

Just to reiterate, as per the data policy, our datasets are not complete or perfect in terms of quality, so it is important to note that the absence of information in the NPWS dataset for an area, does not necessarily imply a low biodiversity value for that area. These data should not be seen as a replacement for field surveys.

Please note that the NPWS species dataset is incomplete, particularly for fish, bats and birds. Can I also remind you that locations for sensitive species should not be made publicly available.

The list of what qualifies as a rare or threatened species is available at https://www.npws.ie/sites/default/files/general/Listed_species_checklist_Dec12.pdf. It covers species listed one or more of the following documents: EU Directives (Birds & Habitats), Wildlife Act, 1976 & Wildlife (Amendment) Act, 2000, Flora (Protection) Order 1999 or Published National Red Lists. This list is regularly updated, as new legislation is added, or red lists are published, so it is worth checking back to the version available on the NPWS website regularly.

Habitats and species data from the Article 17 (Habitats Directive) and Article 12 (Birds Directive) Assessments in 2019 and 2013 are available for download from our website on: http://www.npws.ie/maps-and-data/habitat-and-species-data

GIS datasets used in the production of Site-specific Conservation Objectives for designated sites can also be downloaded from http://www.npws.ie/maps-and-data/habitat-and-species-data

The National Biodiversity Data Centre, Inland Fisheries Ireland, BirdWatch Ireland and Bat Conservation Ireland may have additional records of use.

Best regards,
Jochen

Jochen Roller | GIS Consultant | National Parks & Wildlife Service | 90 North King Street, Smithfield, Dublin 7, D07 N7CV | Jochen.Roller@housing.gov.ie

From: Susan Doyle [mailto:sdoyle@mkoireland.ie]
Sent: Monday 31 May 2021 12:27
To: jochen.Roller@chg.gov.ie
Subject: Information request

Dear Jochen,

Please find attached a data request form for a site in Ballynagare, County Kerry. MKO is currently conducting an EIAR at this site, therefore any information you could provide regarding protected species on or within proximity of the site would be greatly appreciated.

Shapefiles are attached showing the study area. If you require further information, please do not hesitate to get in touch.

Kind regards,
Susan.

Susan Doyle
Ornithologist
MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

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Tá an t-eolas sa ríomhphost seo faoi rún, chomh maith le gach comhad atá ceangailte leis, agus i gcomhair úsáid an duine nó an chórais a bhfuil sé dírithe air amháin. Má fhaigheann tú an ríomhphost seo trí bhotún, cuir scéal chugainn ag webmaster@chg.gov.ie. Tá an ríomhphost seo arna sheiceáil ag scanóir víreas agus dealramh air go bhfuil sé glan.

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Is faoi rún agus chun úsáide an té nó an aonán atá luaite leis, a sheoltar an ríomhphost seo agus aon comhad atá nasctha leis. Má bhfuair tú an ríomhphost seo trí earráid, déan teagmháil le bhainisteoir an chórais.

Deimhnítear leis an bhfo-nóta seo freisin go bhfuil an teachtaireacht ríomhphoist seo scuabtha le bogearraí frithvíorais chun víorais ríomhaire a aimsiú.

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Thomas Blackwell

From: Jochen Roller <Jochen.Roller@housing.gov.ie>
Sent: Tuesday 8 June 2021 12:04
To: Susan Doyle
Subject: RE: Information request

Follow Up Flag: Follow up
Flag Status: Completed

Dear Susan,

Sure - we hold the following data on Hen Harrier from the National Surveys (there has been no National Survey in 2020) within the Stack's SPA (004161) for the vicinity of the site (as in the provided shapefile):
2015:
- 0-3km around the site: no records
- 3-5km around the site: One confirmed and one possible breeding sites

2010:
- 0-3km around the site: One confirmed breeding site and one additional sighting
- 3-5km around the site: One confirmed breeding site and one additional sighting

2005:
- 0-3km around the site: One confirmed breeding site
- 3-5km around the site: One confirmed breeding site

In addition, we have two pairs of breeding curlew recorded in the SPA 004161 for 3-5 km around the site, with one record from 2018 and the other from 2015.

All the best,
Jochen

Jochen Roller | GIS Consultant | National Parks & Wildlife Service | 90 North King Street, Smithfield, Dublin 7, D07 N7CV | Jochen.Roller@housing.gov.ie

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From: Susan Doyle [mailto:sdoyle@mkoireland.ie]
Sent: Friday 4 June 2021 19:47
To: Jochen Roller <Jochen.Roller@housing.gov.ie>
Subject: RE: Information request

Dear Jochen,

Thank you for sending on the requested information. The breakdown of the hen harrier breeding numbers from the Stack's SPA (004161) would also be greatly appreciated, as hen harrier are a species of concern in the area around the site.

Thanks again and enjoy the long weekend,
Susan.

Susan Doyle
Ornithologist

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Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

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From: Jochen Roller <Jochen.Roller@housing.gov.ie>
Sent: Friday 4 June 2021 17:27
To: Susan Doyle <sdoyle@mkoireland.ie>
Subject: RE: Information request

Dear Susan,

Please find requested species data attached. I ran the queries on our data for an area of 5km around the provided shapefile.

In addition to the attached, we hold information on hen harrier breeding sites from nearby Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA 004161. If you would like to receive a breakdown of these (numbers of breeding sites within 3km and 5km of the study area), please let me know and I will extract that information.

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Just to reiterate, as per the data policy, our datasets are not complete or perfect in terms of quality, so it is important to note that the absence of information in the NPWS dataset for an area, does not necessarily imply a low biodiversity value for that area. These data should not be seen as a replacement for field surveys.

Please note that the NPWS species dataset is incomplete, particularly for fish, bats and birds. Can I also remind you that locations for sensitive species should not be made publicly available.

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GIS datasets used in the production of Site-specific Conservation Objectives for designated sites can also be downloaded from http://www.npws.ie/maps-and-data/habitat-and-species-data

The National Biodiversity Data Centre, Inland Fisheries Ireland, BirdWatch Ireland and Bat Conservation Ireland may have additional records of use.

Best regards,
Jochen

Jochen Roller | GIS Consultant | National Parks & Wildlife Service | 90 North King Street, Smithfield, Dublin 7, D07 N7CV | Jochen.Roller@housing.gov.ie

---

From: Susan Doyle [mailto:sdoyle@mkoireland.ie]
Sent: Monday 31 May 2021 12:27
To: jochen.Roller@chg.gov.ie
Subject: Information request

Dear Jochen,

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Shapefiles are attached showing the study area. If you require further information, please do not hesitate to get in touch.

Kind regards,
Susan.

Susan Doyle
Ornithologist

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Deimhnítear leis an bhfo-nóta seo freisin go bhfuil an teachtaireacht ríomhphoist seo scuabtha le bogearraí frithvíorais chun víorais ríomhaire a aimsiú.

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Thomas Blackwell

From: MKO-Admin
Sent: Monday 4 January 2021 17:33
To: Thomas Blackwell
Subject: FW: RE: EIA Scoping Document for Proposed Ballynagare Wind Farm, Co. Kerry - FAO Thomas Blackwell
Attachments: TII20-112107 - Ballynagare wind farm Kerry.pdf

From: INFO <Information@tii.ie>
Sent: Monday 4 January 2021 17:25
To: MKO-Admin <info@mkoireland.ie>
Subject: FW: RE: EIA Scoping Document for Proposed Ballynagare Wind Farm, Co. Kerry - FAO Thomas Blackwell

Dear Mr. Blackwell,

I refer to your letter of 8 December 2020, copy attached, regarding the above.

Transport Infrastructure Ireland (TII) wishes to advise that it is not in a position to engage directly with planning applicants with respect to proposed developments. TII will endeavour to consider and respond to planning applications referred to it given its status and duties as a statutory consultee under the Planning Acts. The approach to be adopted by TII in making such submissions or comments will seek to uphold official policy and guidelines as outlined in the Spatial Planning and National Roads Guidelines for Planning Authorities (DoECLG, 2012). Regard should also be had to other relevant guidance available at www.TII.ie.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals following the examination of any valid planning application referred.

With respect to EIAR Scoping issues, the recommendations indicated below provide only general guidance for the preparation of EIAR, which may affect the national road network. The developer should have regard, inter alia, to the following:

1. As outlined in the Spatial Planning and National Roads Guidelines, it is in the public interest that, in so far as is reasonably practicable, the national road network continues to serve its intended strategic purpose. The EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network in order to demonstrate that the development can proceed complementary to safeguarding the capacity, safety and operational efficiency of that network.
2. Consultations should be had with the relevant local authority/national road design office with regard to locations of existing and future national road schemes.
3. In relation to cabling and potential connection routing, the scheme promoter should note locations of existing and future national road schemes and develop proposals to safeguard proposed road schemes. As outlined above, please consult with the local authority/national road design office in relation to any schemes in planning in the area. Proposals should be developed to safeguard proposed road schemes as TII will not be responsible for costs associated with future relocation of cable routing where proposals are catered for in an area of a proposed national road scheme. In that regard, consideration should be given to routing options, use of existing crossings, depth of cable laying, etc.

   In the context of existing national roads, alternatives to the provision of cabling along the national road network, such as alternative routing or the laying of cabling in private lands adjoining the national road, should be considered in the interests of safeguarding the investment in and the potential for future upgrade works

to the national road network. The cable routing should avoid all impacts to existing TII infrastructure such as traffic counters, weather stations, etc. and works required to such infrastructure shall only be undertaken in consultation with and subject to the agreement of TII, with any costs attributable borne by the applicant/developer. The developer should also be aware that separate approvals may be required for works traversing the national road network.

4. Clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route and all structures on the haul route should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal load proposed.
5. Where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's TTA Guidelines (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the TII TTA Guidelines which addresses requirements for sub-threshold TTA.
6. TII Standards should be consulted to determine the requirement for Road Safety Audit (RSA) and Road Safety Impact Assessment (RSIA).
7. Assessments and design and construction and maintenance standards and guidance are available at TII Publications that replaced the NRA Design Manual for Roads and Bridges (DMRB) and the NRA Manual of Contract Documents for Road Works (MCDRW).
8. The developer, in conducting Environmental Impact Assessment, should have regard to TII Environment Guidelines that deal with assessment and mitigation measures for varied environmental factors and occurrences. In particular:

a) TII's Environmental Assessment and Construction Guidelines, including the Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (National Roads Authority, 2006),
b) The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004)).

Notwithstanding any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practice.

I trust that the above comments are of use in your EIAR preparation.

Yours sincerely,

Alban Mills
Senior Regulatory & Administration Executive
Ref No. TII20-112107

Bonneagar Iompair Éireann
Transport Infrastructure Ireland

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Próiseálann BIÉ sonraí pearsanta a sholáthraítear dó i gcomhréir lena Fhógra ar Chosaint Sonraí atá ar fáil ag http://www.tii.ie/about/

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Córas r-phoist BIE: Tá an ríomhphost seo agus aon chomhaid a tharchuirtear leis faoi rún agus beartaithe lena n-úsáid ag an duine aonair nó ag an eintiteas a bhfuil siad dírithe chuige/chuici amháin. Más rud é go bhfuair tú an ríomhphost seo trí bhotún, cuir sin in iúil do postmaster@tii.ie, le do thoil, agus scrios an ríomhphost bunaidh agus aon cheangaltáin.

Thomas Blackwell

From: Matthew Craig <matthew.craig@2rn.ie>
Sent: Wednesday 9 December 2020 17:33
To: Thomas Blackwell
Cc: Johnny Evans; windfarms@rte.ie
Subject: RE: 200512 Ballynagare Wind Farm

Hi Thomas,

Thanks for the additional information.
2RN have no fixed linking that would that would be affected by this site.
There is however a risk of interference to the DTT viewers in the area receiving from our sites at Knockmoyle and Conc An Oir. We would therefore request that the Protocol be signed between the Developer and 2RN should the site go ahead.

Regards

Matthew Craig

Project Engineer
Projects and Coverage Planning
2RN
Block B, Cookstown Court, Old Belgard Road, Tallaght, Dublin 24, Ireland
D24 WK28
Phone: + 353 (0) 1 2082261
Mobile: + 353 (0) 87 7509955

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From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: 09 December 2020 13:40
To: Matthew Craig <matthew.craig@2rn.ie>
Cc: Johnny Evans <Johnny.Evans@2rn.ie>; windfarms@rte.ie
Subject: RE: 200512 Ballynagare Wind Farm

Matthew,

Here are the proposed turbine locations. I have include shapefiles, and excel with the ITM coordinates, and a KML file so hopefully one of them will work for you. We are proposing the following turbine dimensions:

Tip Height: 165m
Hub Height: 90m
Rotor Diameter : 150m (75m blades)

If there is any additional information that you need please let me know.

Best regards,

Thomas

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

MKO
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
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From: Matthew Craig <matthew.craig@2rn.ie>
Sent: Wednesday 9 December 2020 10:14
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Cc: Johnny Evans <Johnny.Evans@2rn.ie>; windfarms@rte.ie
Subject: RE: 200512 Ballynagare Wind Farm

Hi Thomas,

To assist us in quickly and efficiently processing your information, could you please send me the coordinates, hub and tip height for each of the proposed turbines?

Regards

Matthew Craig

Project Engineer
Projects and Coverage Planning
2RN
Block B, Cookstown Court, Old Belgard Road, Tallaght, Dublin 24, Ireland
D24 WK28
Phone: + 353 (0) 1 2082261
Mobile: + 353 (0) 87 7509955

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From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: 08 December 2020 13:43
To: Johnny Evans <Johnny.Evans@2rn.ie>

Cc: windfarms@rte.ie
Subject: 200512 Ballynagare Wind Farm

Mr. Evans,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
www.mkoireland.ie

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Thomas Blackwell

From: Alister Cole <Alister.Cole1@three.ie>
Sent: Friday 21 August 2020 10:03
To: Thomas Blackwell
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

I have reviewed the proposed windfarm at Ballynagare and 3Ireland do not have any microwave links traversing or that will be affected.

Best regards,

Alister

Alister Cole
Transmission Engineer

Mobile: 086 6024556
Email: Alister.Cole1@three.ie

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: 19 August 2020 14:48
To: Alister Cole <Alister.Cole1@three.ie>
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Alister,

Please find attached google earth file. Let me know if you have any difficulties with it.

Best regards,

Thomas

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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From: Alister Cole <Alister.Cole1@three.ie>
Sent: Wednesday 19 August 2020 14:37
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

Would you please be able to supply a google earth file (kmz)?

Thanks and regards,

Alister

Alister Cole
Transmission Engineer

Mobile: 086 6024556
Email: Alister.Cole1@three.ie

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: 19 August 2020 13:22
To: Alister Cole <Alister.Cole1@three.ie>; Gerry Callan <Gerry.Callan@three.ie>
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Alister and Gerry,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if Three Ireland has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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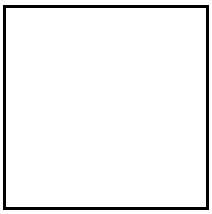

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Thomas Blackwell

From: Roger Woods <rwoods@bai.ie>
Sent: Thursday 10 December 2020 10:13
To: Thomas Blackwell
Subject: RE: 200512 Ballynagare WF

Hi Thomas

The BAI does not perform an in-depth analysis of the effect of wind turbines on FM networks. However, we are not aware of any issues from existing windfarms into existing FM networks. Also, the proposed windfarms are not located close to any existing or planned FM transmission sites.

Regards

Roger

Senior Executive Engineer
Broadcasting Authority of Ireland
2-5 Warrington Place
Dublin D02 XP29

Tel: 01 6441200
Fax: 01 6441299

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Tá an ríomhphost seo agus aon iatán a ghabhann leis rúnda agus is leis an duine sin amháin a bhfuil siad seolta chuige/chuici a bhaineann siad. Muna duitse an ríomhphost seo, ní ceart é a léamh ná a scaoileadh chuig aon tríú páirtí. Iarrtar ort teachtaireacht a sheoladh chuig an seoltóir nó chuig info@bai.ie, agus an ríomhphost seo a scrios.

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Tuesday 8 December 2020 13:33
To: Roger Woods <rwoods@bai.ie>
Subject: 200512 Ballynagare WF

Mr. Woods,

McCarthy Keville O'Sullivan Ltd. is preparing an Environmental Impact Assessment Report Statement (EIAR) for the proposed Ballynagare Wind Farm, located approximately 9 kilometres west of Listowel and approximately 2 kilometres north of Lixnaw, Co. Kerry.

As part of the EIA process, we would welcome any comments that you might have in relation to the proposed project, including baseline data, survey techniques or potential impacts that should be considered as part of the assessment process and in the preparation of the EIAR. In order to facilitate this, a Scoping Document providing details of the proposed project and the site of the proposed development is enclosed with this letter.

If you could return any comments or suggestions at your earliest convenience it would be much appreciated. If you require any further information, please do not hesitate to contact me.

Yours Sincerely,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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Thomas Blackwell

From: Martin O Donoghue <Martin.ODonoghue@comreg.ie>
Sent: Tuesday 18 August 2020 10:17
To: Thomas Blackwell
Cc: Eoin Gilson; Licensing; Tara Kavanagh
Subject: RE: [Confidential] 200512 Ballynagare Co. Kerry - Proposed Windfarm Site
Attachments: List of Operators.xlsx

Hi Thomas,

Please find attached the list of operators within 20km.
Can you please direct all future inquiries to licensing@comreg.ie?

Kind Regards,

Martin O'Donoghue

Innealtóir Speictrim Raidió

Radio Spectrum Engineer

An Coimisiún um Rialáil Cumarsáide
Commission for Communications Regulation

1 Lárcheantar na nDugaí, Sráid na nGildeanna, BÁC 1, Éire, D01 E4X0.
One Dockland Central, Guild Street, Dublin 1, Ireland, D01 E4X0.
Teil | Tel +353 1 8049670
Rphost | Email martin.odonoghue@comreg.ie
Suíomh | Website www.comreg.ie

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Monday 17 August 2020 17:21
To: Martin O Donoghue <Martin.ODonoghue@comreg.ie>; Tara Kavanagh <tara.kavanagh@comreg.ie>
Cc: Eoin Gilson <egilson@mkoireland.ie>
Subject: 200512 Ballynagare Co. Kerry - Proposed Windfarm Site

Hi Martin and Tara,

We are working on a constraints study for a proposed wind farm site near Ballynagare, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM 489,406 N632,311. A site location map and associated shapefile are attached showing the area of search.

We would like to check if there are operators or resources in the study areas. Would it be possible to send this information on to me please?

If you have any queries, please do not hesitate to contact me.

Regards,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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Tá an ríomhphost seo, chomh maith le haon iatáin a bhaineann leis faoi rún agus d'fhéadfadh leis a bheith faoi phribhléid nó cosanta ó aon nochtadh. Is don seolaí(aithe) ainmnithe thuas amháin é. Níl sé ceadaithe go mbeidh rochtain ag éinne eile ar an ríomhphost seo. Más rud é nach tusa an faighteoir ainmnithe, ná cló amach, léigh, cóipeáil, nocht d'éinne nó bain úsáid as an eolas sa ríomhphost seo in aon tslí eile, le do thoil. Más rud é go bhfuair tú an ríomhphost seo trí earráid, dean teagmháil leis an seoltóir láithreach agus scrios an t-ábhar ina iomlán, bíodh sé i gcóip leictreonach nó chrua.

Thomas Blackwell

From: John Bagnall <john.bagnall@eir.ie>
Sent: Friday 25 September 2020 11:37
To: Thomas Blackwell
Cc: Mobile Networks TXN
Subject: Re: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

We have no transmission services in or near the project boundary; our nearest is over 5km away and poses no risk to the network.

Please keep sending future windfarm development analysis and large infrastructure project requests to MobileNetworksTXN@eir.ie for Eir Mobile (formerly Meteor) network analysis.

Kind regards,

John Bagnall
Transmission Design & Engineering

M: +353 85 1053746
E: john.bagnall@eir.ie
Address: EirCode - D24 HX03

On Wed, 19 Aug 2020 at 13:22, Paul Marron <paul.marron@eir.ie> wrote:

> Hi Thomas,
> I'm forwarding your request to my colleague John Bagnall. He will have a look and get back to you.
> Regards,
> Paul
>
> ---------- Forwarded message ---------
> From: **Thomas Blackwell** <tblackwell@mkoireland.ie>
> Date: Wed, 19 Aug 2020 at 13:20
> Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints
> To: Paul.Marron@eir.ie <Paul.Marron@eir.ie>
>
> Dear Paul,
>
> We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.
>
> Could you please let me know if Eir or Meteor Mobile Communications has any links in this area? If so we will incorporate these into our constraints map.
>
> If you have any queries, please do not hesitate to contact me.

Regards,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

MKO

Tuam Road, Galway

Ireland, H91 VW84

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--

Paul Marron

Transmission Engineer

Eir Mobile Networks

2022 Bianconi Ave, Citywest, Dublin 24.

www.eir.ie

Mobile: 0876548499 ¦ **Email**: paul.marron@eir.ie

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Thomas Blackwell

From: Dominic Crudden <dominic.crudden@emrsolutions.ie>
Sent: Monday 24 August 2020 11:25
To: Thomas Blackwell
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Dear Thomas,

EMR Integrated Solutions do not have any links in the shaded area of the map, but we do have links from Knockanore high site which is in the north of the circled area (east of Ballybunion).

Please send through turbine locations when these have been determined so that a final assessment can be completed.

Regards,

Dominic Crudden
Business Development

EMR integrated solutions

Mobile: +353 (86) 7712819
Office: +353 (1) 8013131
Fax: +353 (1) 8013166
Email: dominic.crudden@emrsolutions.ie
Website: https://emr.ie/

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From: Thomas Blackwell [mailto:tblackwell@mkoireland.ie]
Sent: Wednesday 19 August 2020 13:20
To: info <info@emrsolutions.ie>
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Dear Sir or Madam,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if MP&E Trading or EMR Solutions has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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Thomas Blackwell

From: Peter O`Brien <peter.obrien@enet.ie>
Sent: Thursday 20 August 2020 09:57
To: Thomas Blackwell
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

We like to keep about a 100m distance from the turbines so based on your calculations we should be fine,

Best Regards,
Peter

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Thursday, August 20, 2020 9:49 AM
To: Peter O`Brien <peter.obrien@enet.ie>
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Peter,

Thanks for this information. It looks like your link just clips the very edge of our study area but should not be effected by any of our proposed turbines. Based on the information you provided the A-End antenna is at an elevation of approximately 256m (plus the 15m antenna height) and the B-end antenna is at approximately 356m (plus the 15m antenna height). Our study area is at approximately 1m elevation and the maximum tip height for the turbines will not exceed 170 metres, and is most likely to be no more than 156.5m.

My calculation is that the link would be crossing the site at an elevation of approximately 300m OD, therefore there should be no potential for interference with the link from any of the proposed turbines as it will not be possible for any part of a turbine to be within about 130 metres of the link.

Can you please confirm the minimum set back distance/buffer that you would need from your link to ensure that that there is no interference?

Best regards,

Thomas

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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From: Peter O`Brien <peter.obrien@enet.ie>
Sent: Wednesday 19 August 2020 15:00
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

Only one link potentially affected at the moment:

A-End Coordinates	E-End Antenna Height	B-End Coordinates	B-End Antenna Height	Frequency
52°31'24.85"N 9°36'18.88"W	15m	52°12'44.00"N 9°42'42.00"W	15m	8GHz

Best Regards,
Peter

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Wednesday, August 19, 2020 2:48 PM
To: Peter O`Brien <peter.obrien@enet.ie>
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Peter,

Please find attached Google Earth file of the project site.

Regards,

Thomas

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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From: Peter O`Brien <peter.obrien@enet.ie>
Sent: Wednesday 19 August 2020 13:36
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

Can you send the proposed area on in a Google Earth kml?

Regards,
Peter

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Wednesday, August 19, 2020 1:09 PM
To: Peter O`Brien <peter.obrien@enet.ie>
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Dear Peter,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if Enet has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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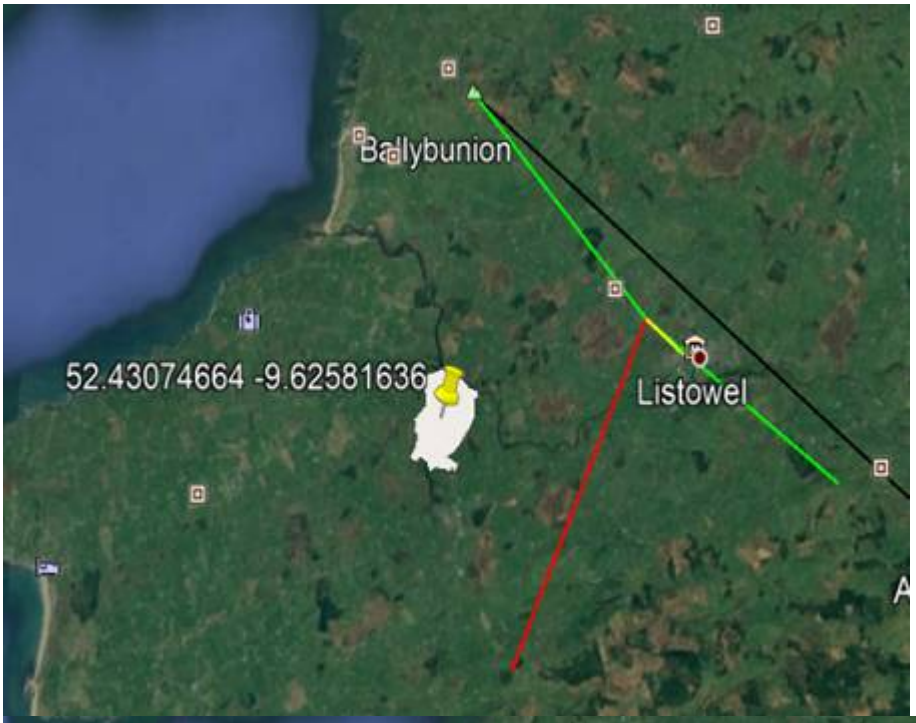
Thomas Blackwell

From: Lorna Brennan <lorna.brennan@imaginegroup.ie>
Sent: Thursday 20 August 2020 10:14
To: Thomas Blackwell
Cc: Ronnie O'Neill
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

Based on the information provided Imagine have 5 active links in the search area, none of these are within the proposed wind farm location.
Link details as below.

Link	Start Coordinates	End Coordinates	Buffer Distance (m)
1	52°31'24.75"N 9°36'18.71"W	52°20'40.96"N 9°15'13.95"W	50m
2	52°31'24.75"N 9°36'18.71"W	52°27'30.08"N 9°30'49.03"W	50m
3	52°21'46.49"N 9°35'23.72"W	52°27'30.08"N 9°30'49.03"W	50m
4	52°26'48.82"N 9°29'27.93"W	52°27'30.08"N 9°30'49.03"W	50m
5	52°24'43.83"N 9°24'52.87"W	52°27'30.08"N 9°30'49.03"W	50m





Kind Regards,
Lorna

From: Ronnie O'Neill
Sent: 19 August 2020 17:26
To: Lorna Brennan
Subject: Fwd: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Can you have a look please ?

Rgds,

Ronnie O'Neill
Network Deployment Manager
Network Deployment
imagine

t.+353 1 437 5000

m.+353 86 8277 022

w.imagine.ie

imagine
Sandyford Business Centre
Blackthorn Road, Sandyford, D18 AW89

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Wednesday, August 19, 2020 1:10:27 PM
To: Ronnie O'Neill <Ronnie.ONeill@imaginegroup.ie>
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Dear Ronnie,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if Imagine Network Services has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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Thomas Blackwell

From: Jimmy Sugrue <jsugrue@ivertec.ie>
Sent: Monday 14 September 2020 08:19
To: Thomas Blackwell
Cc: Gerard O'Sullivan; Joe Hayes
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints
Attachments: Ivertec towers - North Kerry.pdf

Hi Thomas.

Ivertec runs a wireless broadband service from 3 towers to the North, South and South-East of the proposed wind farm.

Customers could lose service as a clear line of sight is required to provide a reliable wireless connection. The customer base includes large and small businesses, national schools under contract form the department of education, homes, farmers and tele-workers.

As rural areas go this part of North Kerry is relatively heavily populated. Ivertec has a customer base of approx. 2,000 customers in the North Kerry area and significant percentage of these could potentially be impacted by the wind farm development.

See map attached of potentially affected areas.

Regards,
Jimmy.

From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Wednesday 19 August 2020 13:07
To: Jimmy Sugrue <jsugrue@ivertec.ie>
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Dear Jimmy,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if Imagine Network Services has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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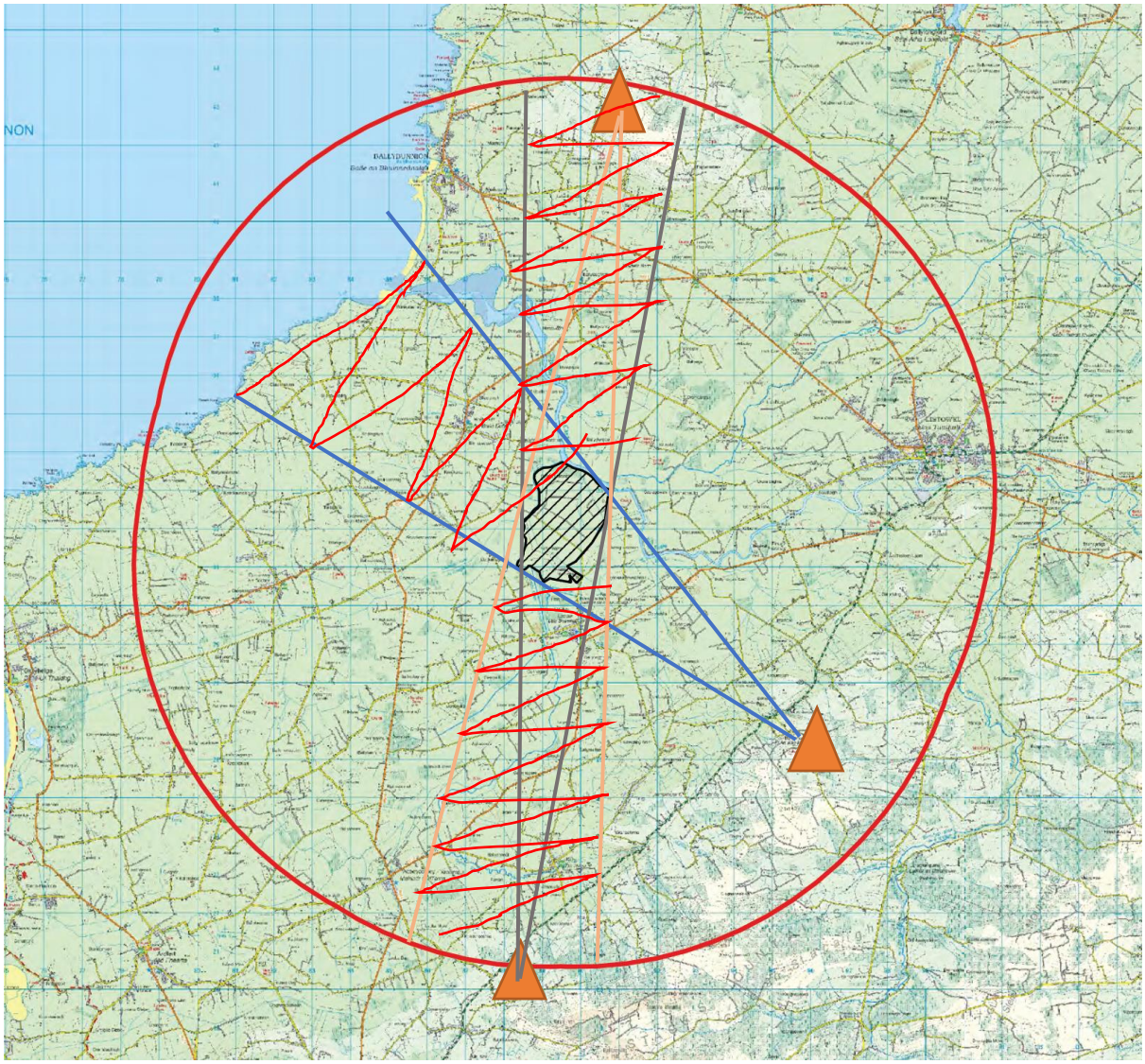
Ivertec towers to North, South and South-East of proposed wind-farm.

Customers whose Line of Sight to a tower is intersected by the proposed wind farm will have their broadband service negatively impacted.



Thomas Blackwell

From: Trevor Galvin <trevor@radiokerry.ie>
Sent: Thursday 3 September 2020 11:10
To: Thomas Blackwell
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints
Attachments: windfarm.zip

Hi Thomas,

We have one link intersecting the telecoms study area and the edge of the windfarm boundary.

See attached files showing link using your mapping.

Regards,

Trevor

From: Thomas Blackwell [mailto:tblackwell@mkoireland.ie]
Sent: Wednesday 19 August 2020 13:21
To: Trevor Galvin
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Trevor,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if Radio Kerry has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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Thomas Blackwell

From: Mark Nolan <Mark.Nolan@virginmedia.ie>
Sent: Tuesday 8 September 2020 08:03
To: Thomas Blackwell
Subject: RE: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Thomas,

This will have no impact on Virgin Media radio links in the area.

Rgds

Mark

Mark Nolan | B2B Wireless Networks Manager
Virgin Media | Limerick, Roxboro Rd, Limerick
D: + 353 1 245 8480 | M: + 353 862315007
Mark.Nolan@virginmedia.ie | www.virginmedia.ie

From: Thomas Blackwell [mailto:tblackwell@mkoireland.ie]
Sent: 19 August 2020 13:22
To: Mark Nolan <Mark.Nolan@virginmedia.ie>
Subject: 200512 - Ballynagare Wind Farm, Co. Kerry - Telecommunications Constraints

Hi Mark,

We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.

Could you please let me know if Virgin Media has any links in this area? If so we will incorporate these into our constraints map.

If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmentalist

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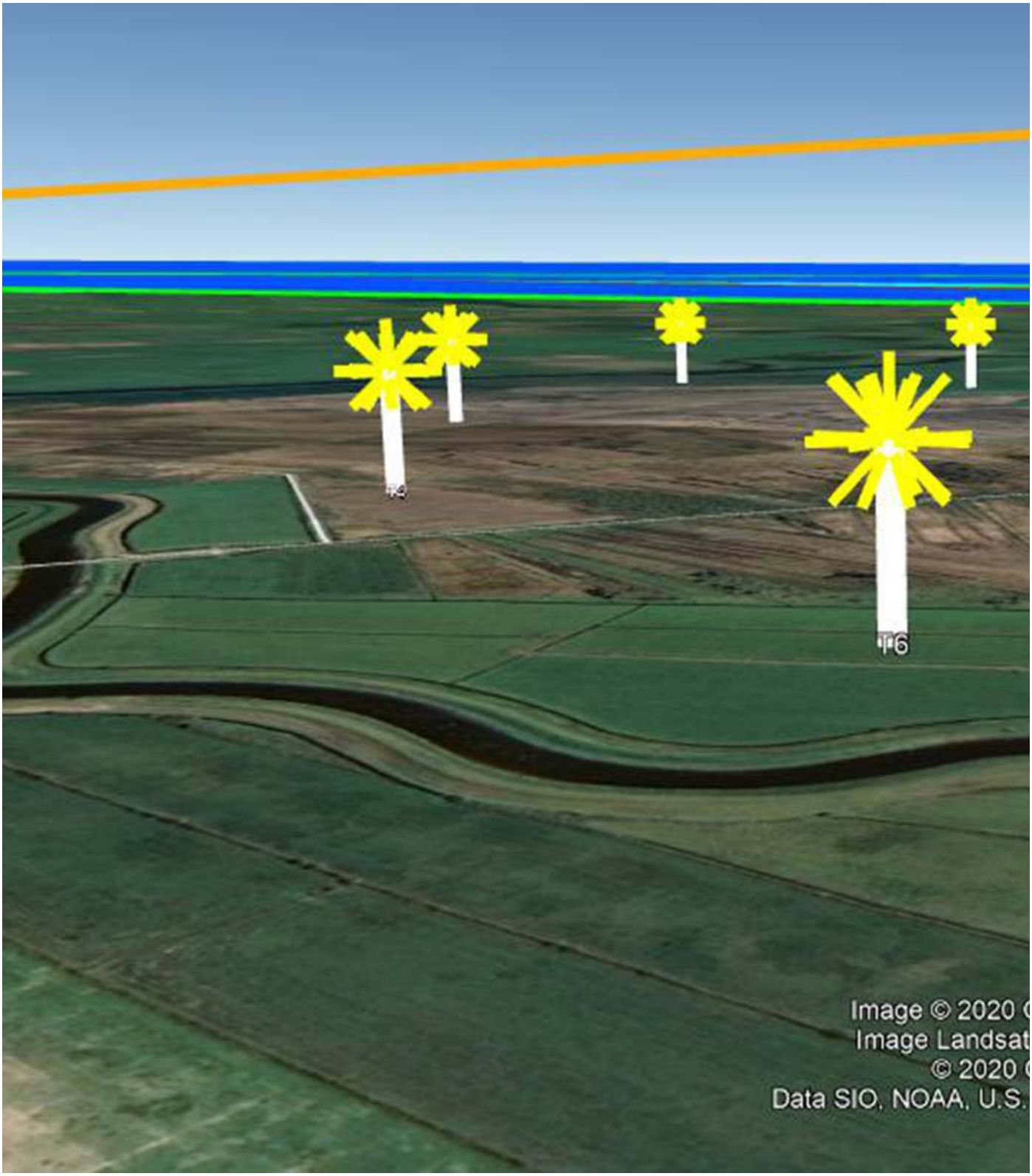
Thomas Blackwell

From: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Sent: Monday 21 December 2020 15:43
To: Thomas Blackwell
Cc: Lyons, Sean, Vodafone Ireland (External); Neill o', Shane, Vodafone Ireland; Cassidy, Emma, Vodafone Ireland; McHugh, Brian, Vantage Towers Ireland; Murphy, Daragh, Vodafone Ireland; Dennehy, Darragh, Vantage Towers Ireland
Subject: RE: 200512 Ballynagare WF

Hi Thomas,

Assuming there is no increase in the Turbine dimensions listed, than yes, you are correct, it will pass over the top without issue. Due to the position of the hub, the maximum height of 165m (hub + rotor blade) is more prevalent. I have calculated the clearance as being approximately 169m above Turbine T6.

No issues so long as there is no change to the turbine dimensions



Gavin Byrne
TX Planning & Design Engineer
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gavin.byrne@vodafone.com

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Ireland: No. 326967

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From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Monday 21 December 2020 13:31
To: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Cc: Lyons, Sean, Vodafone Ireland (External) <sean.lyons@vodafone.com>; Neill o', Shane, Vodafone Ireland <shane.oneill2@vodafone.com>; Cassidy, Emma, Vodafone Ireland <emma.cassidy@vodafone.com>; McHugh, Brian, Vantage Towers Ireland <brian.mchugh@vantagetowers.com>; Murphy, Daragh, Vodafone Ireland <daragh.murphy@vodafone.com>; Dennehy, Darragh, Vantage Towers Ireland <darragh.dennehy@vantagetowers.com>
Subject: RE: 200512 Ballynagare WF

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Hi Gavin,

Given the elevation of the transmitters on Knockanore and Slieve Mish would the signal not go over the top of our turbines with more than 30m to spare? I may not fully understand the technology so if I am off base on this just let me know.

Best regards,

Thomas

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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From: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Sent: Monday 21 December 2020 12:15
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Cc: Lyons, Sean, Vodafone Ireland (External) <sean.lyons@vodafone.com>; Neill o', Shane, Vodafone Ireland <shane.oneill2@vodafone.com>; Cassidy, Emma, Vodafone Ireland <emma.cassidy@vodafone.com>; McHugh, Brian, Vantage Towers Ireland <brian.mchugh@vantagetowers.com>; Murphy, Daragh, Vodafone Ireland <daragh.murphy@vodafone.com>; Dennehy, Darragh, Vantage Towers Ireland <darragh.dennehy@vantagetowers.com>
Subject: RE: 200512 Ballynagare WF
Importance: High

Hi Thomas,

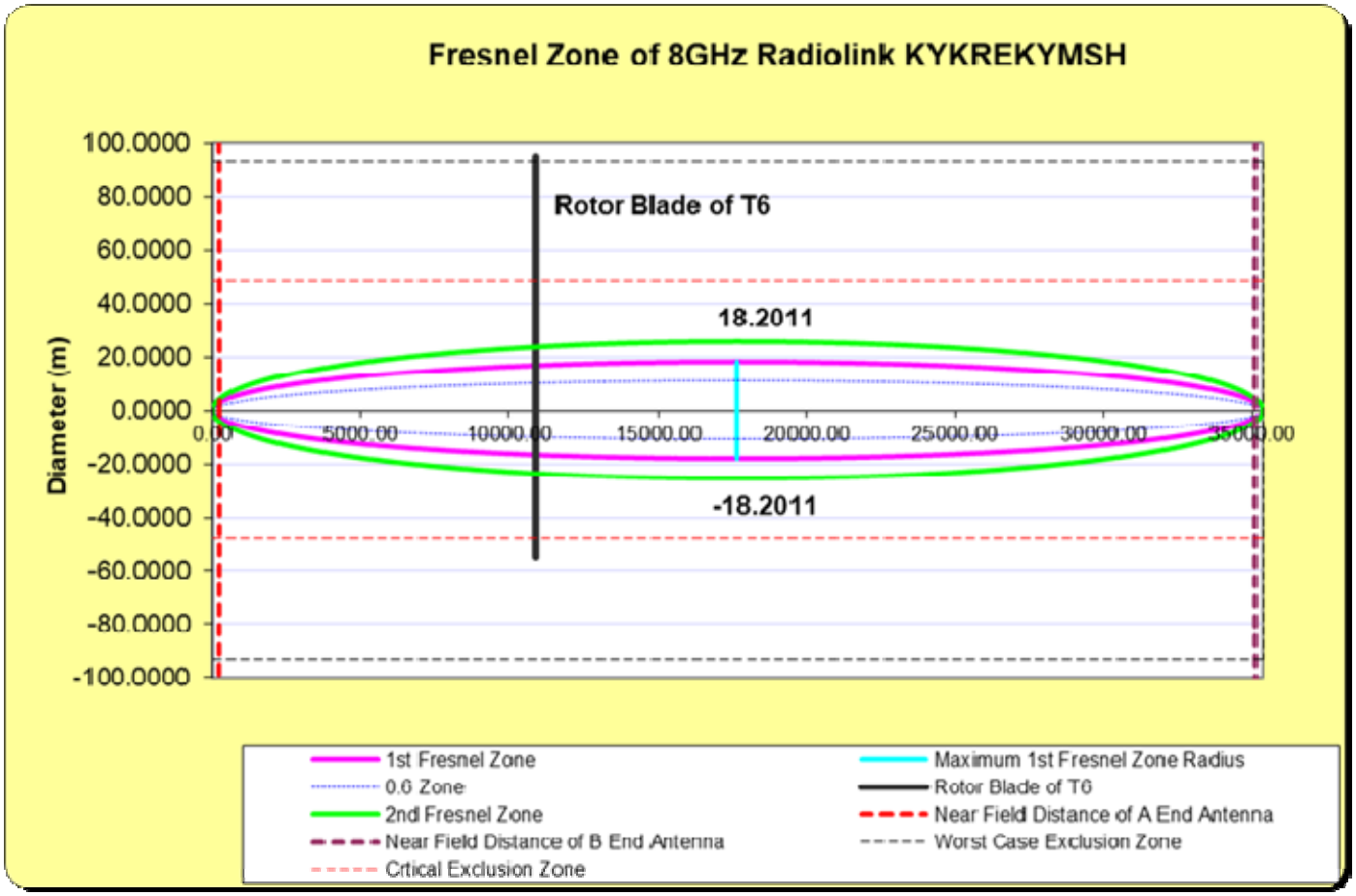
Than you for the co-ordinates. As feared, there is an impact on the Vodafone network.

The turbine T06 will block our trunk radio between Knockanore and Slieve Mish. This is an 8GH 6+0 trunk radio system, and is part of the SW ring. If this microwave is impacted, it will cause service interruptions to the entire SW Trunk Radio ring, impacting approx 200 sites in Cork, Kerry, Limerick, Clare and Tipperary areas.

All other Turbines in their current locations have no impact.

Can you please relocate T06 to ensure that a minimum clearance of 30m is maintained between the rotor tip and the maximum 1st Fresnel Diameter (36.4m).

Any questions, please let me know



Gavin Byrne
TX Planning & Design Engineer
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MountainView, Leopardstown, Dublin 18, Registered in Ireland: No. 326967

vodafone.ie

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From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Wednesday 9 December 2020 13:29
To: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Cc: Lyons, Sean, Vodafone Ireland (External) <sean.lyons@vodafone.com>; Neill o', Shane, Vodafone Ireland <shane.oneill2@vodafone.com>; Cassidy, Emma, Vodafone Ireland <emma.cassidy@vodafone.com>; McHugh, Brian, Vantage Towers Ireland <brian.mchugh@vantagetowers.com>; Murphy, Daragh, Vodafone Ireland <daragh.murphy@vodafone.com>; Dennehy, Darragh, Vantage Towers Ireland <darragh.dennehy@vantagetowers.com>
Subject: RE: 200512 Ballynagare WF

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Gavin,

Here are the proposed turbine locations. I have include shapefiles, and excel with the ITM coordinates, and a KML file so hopefully one of them will work for you. We are proposing the following turbine dimensions:

Tip Height: 165m
Hub Height: 90m
Rotor Diameter : 150m (75m blades)

If there is any additional information that you need please let me know.

Best regards,

Thomas

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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From: Byrne, Gavin, Vodafone Ireland <gavin.byrne@vodafone.com>
Sent: Wednesday 9 December 2020 09:57
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Cc: Lyons, Sean, Vodafone Ireland (External) <sean.lyons@vodafone.com>; Neill o', Shane, Vodafone Ireland <shane.oneill2@vodafone.com>; Cassidy, Emma, Vodafone Ireland <emma.cassidy@vodafone.com>; McHugh, Brian, Vantage Towers Ireland <brian.mchugh@vantagetowers.com>; Murphy, Daragh, Vodafone Ireland <daragh.murphy@vodafone.com>; Dennehy, Darragh, Vantage Towers Ireland <darragh.dennehy@vantagetowers.com>
Subject: RE: 200512 Ballynagare WF

Thanks Thomas. As discussed previously, Vodafone have a trunk microwave just on the western border of the marsh. Please ensure there is a +30m clearance between this trunk microwave 1st Fresnel zone and the rotor tip.

If you have precise turbine locations and dimensions that we can assess to ensure there's suitable clearance, please send them onto me.



Gavin Byrne
TX Planning & Design Engineer
Converged Transmission
+353876448159
gavin.byrne@vodafone.com

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MountainView, Leopardstown, Dublin 18, Registered in
Ireland: No. 326967

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From: Thomas Blackwell <tblackwell@mkoireland.ie>
Sent: Tuesday 8 December 2020 14:11
To: Thomas Blackwell <tblackwell@mkoireland.ie>
Subject: 200512 Ballynagare WF

CYBER SECURITY WARNING: This email is from an external source - be careful of attachments and links. Please follow the Cyber Code and report suspicious emails.

Good Afternoon,

I previously contacted you via email regarding the proposed Ballynagare Wind Farm near Lixnaw Co. Kerry. I have attached a copy of our formal scoping document for your files. If you have previously responded to my earlier email correspondence then there is no need to respond again and this document is for information purposes only. If you do have any questions or additional comments please do not hesitate to contact me.

Best regards,

Thomas Blackwell

Thomas Blackwell, MSc. BA.
Senior Environmental Consultant

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APPENDIX 2.4

COMMUNITY REPORT

Community Report

Proposed Ballynagare Wind Farm

Co. Kerry

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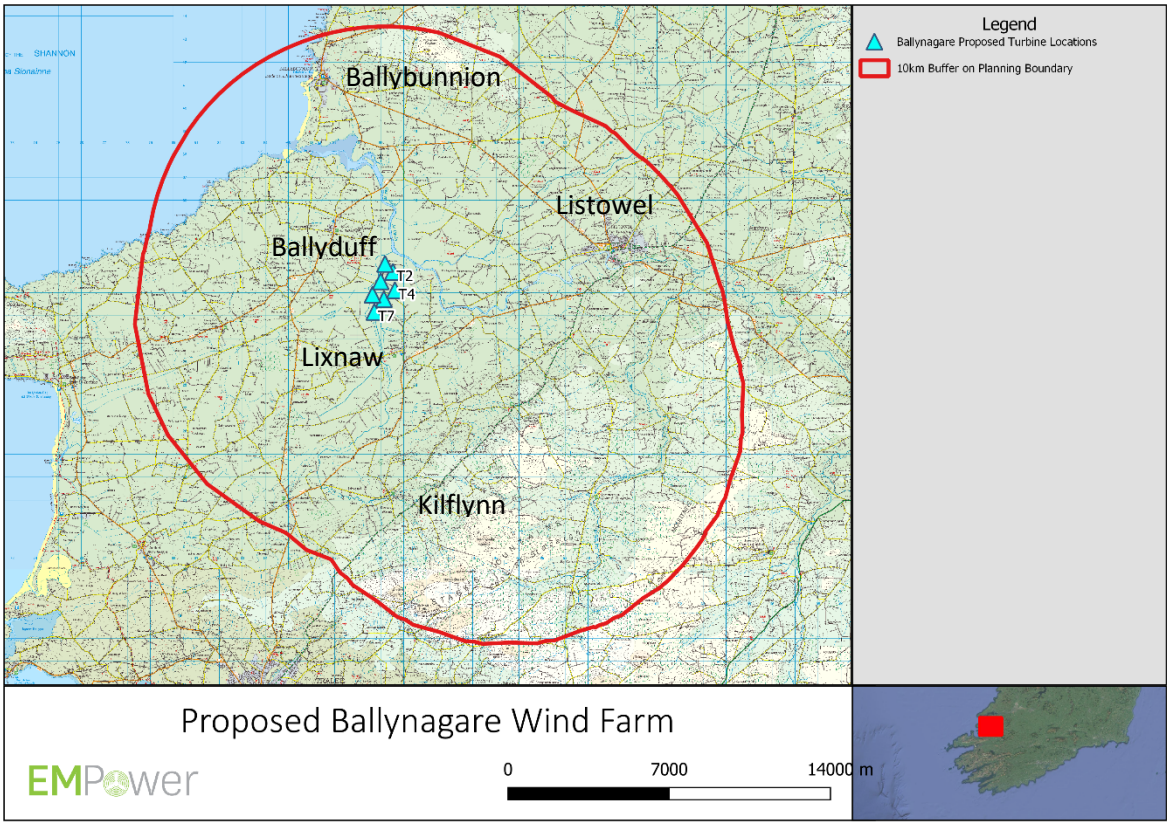
1. Introduction

Ballynagare Wind Farm Ltd (The Applicant) has engaged and consulted with the local community and interested stakeholders for the proposed Ballyangare wind farm (the Project), in order to ensure that all views, concerns and suggestions were considered as part of the project design and the Environmental Impact Assessment process.

The Project is proposed as a 7- wind turbine development, situated approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. Figure 1.1.1 illustrates the communities within 10km of the proposed project. The 10km buffer is based on the project's planning boundary, and so takes in communities within 10km of the proposed grid connection also.



1.1.1 Map of Proposed Ballynagare Wind Farm Context

In relation to national guidance on community engagement and consultation for wind energy developments, the Wind Energy Development Guidelines (Department of Environment, Heritage and Local Government, 2006) state that:

"While it is not a mandatory requirement, it is strongly recommended that developers of a wind energy project should engage in active consultation and dialogue with the local community at an early stage in the planning process, ideally prior to submitting a planning application".

The Draft Revised Wind Energy Guidelines (Department of Housing, Planning and Local Government, 2019) further address this topic in the following:

"In order to promote the observance of best practice, planning authorities should require applicants to prepare and submit a Community Report with their planning application and a condition on any

subsequent planning permission should require developers to carry out the development in accordance with the approved Community Report".

This Community report serves to outline the process that the Applicant undertook while engaging and consulting with the local community and interested stakeholders for the proposed Project),.

EMPower believes in transparent and productive engagement with any stakeholders interested in our projects but especially with the local communities in which our projects are located. We strive to develop projects that will be of overall economic, environmental and social benefit to the local communities in which they are situated and also wider society.

In the past, developers have often initiated the community consultation process shortly before submission of a planning application, when the key design decisions have been made. EMPower have sought to involve the local community much earlier in the Environmental Impact Analysis and project design, in order to facilitate constructive dialogue at a time when it can have a meaningful impact on environmental analysis and project design.

The Draft Revised Wind Energy Guidelines (Department of Housing, Planning and Local Government, 2019) state that;

"meaningful community consultation also helps developers:

- *to refine the design approach to a project reflecting a broadly based community perspective*
- *to explain the potential benefits of a project more clearly to communities*
- *to establish relationships with the community, as well as empowering communities to interact with and benefit more fully from projects."*

In line with national policy, EMPower are committed to meaningful, transparent consultation, which facilitates more informed and active engagement with the proposed project's design.

2. Summary of Consultation

2.1 Community Liaison Officer

Alexander Kelly is the appointed Community Liaison Officer for the proposed Project. Alexander holds a MSc in Sustainable Energy Planning and Management and has been working with EMPower since October 2017 as a project manager. Alexander has led the community consultation process at the proposed Project since the first public event held in November 2020. Alexander's contact information is published on the project website.

2.2 Proposed Ballynagare Wind Farm Public Consultation Webinar No.1

Community engagement commenced in 2020 with a public information Webinar event hosted on the evening of the 3rd December. This webinar was hosted at the outset of the Environmental Impact Assessment process in order to provide information related to the proposed development of the Ballynagare Wind Farm. EMPower's objective was to address any community concerns early in the development stage, provide accurate project information on what has been done to date and also give an indication of the next steps. The initial study area was presented to attendees, as well as an estimation of capacity and scale of the project. Initially, the study area was considered capable of facilitating a 10 wind turbine layout of equating to 56 MW. An overview of the environmental studies and activities intended to be included in the EIAR was also provided.

This meeting was attended by over 100 participants, the majority of whom were resident within the locality of the proposed development.

Issues raised during and in the days prior to this meeting included the below:

- Impacts to local flora and fauna
- Impacts to peat habitats
- Impacts to waterbodies
- Scale and number of turbines
- Visual effects
- Noise impacts to local residents
- Access for turf cutting
- Access for recreational uses
- Community benefit fund

This early feedback was used to inform the development of the Environmental Impact Analysis and project design, as will later be described in the Section 4 Evolution of Project Design.

2.3 Proposed Ballynagare Wind Farm Public Consultation Webinar No.2

During the Public Consultation Webinar hosted in March 2021, information about the ongoing environmental baseline surveys and an initial 10-turbine wind farm layout were presented, as well as the further information about the community fund allocation. There was also an interactive Q&A session during which the applicant answered questions submitted by local residents. The materials presented at this Webinar are included in the Community Consultation Report Appendix Section 3.2.

2.4 Proposed Ballynagare Wind Farm Public Consultation Webinar No.3

Furthermore, EMPower held an additional Public Consultation Webinar on the 29th September 2021, which was advertised in the Kerryman Newspaper on 22nd September 2021. This Webinar presented the final 7- wind turbine design iteration for the proposed project , while again discussing the concluding environmental studies and potential community benefit fund.

The materials presented at this Webinar are included in the Community Consultation Report Appendix Section 3.3. The Public Consultation Webinar video can be viewed on the project website **(www.ballynagarewindfarm.ie).**

2.5 Ballynagare Wind Farm Project Website

Prior to this public event, a project website was also established in order to share information with the local community. This website has continued to be updated regularly with project resources by EMPower throughout the development of the proposed project. Information presented on the project website includes :

- Company information
- Environmental Impact Analysis information
- Project Maps
- Webinar videos
- Relevant publications
- Wind Energy FAQ
- Contact information

2.6 Contact with 1.5km Residents

EMPower endorses a focus on the residents of dwellings within 1.5 km of the proposed project as these residents will be closest to the proposed development if consented and will be most sensitive to any potential effects caused by the proposed development. We identified residents within 1.5km by taking the initial project study area and applying a 1.5 km buffer on each turbine. Within this area dwellings that are lived in, vacant and with the potential to be occupied were mapped.

Unfortunately, it was not possible to perform ubiquitous house visits to all within 1.5km, as this would have contradicted the public health guidance surrounding COVID-19. Alternatively, the EMPower team offered home visits on request to local residents throughout the community consultation campaign. As the health and safety of our staff and the public is our top priority, any such visits would be in full compliance of the latest health guidance and restrictions.

In order to ensure the health and safety of staff and local residents during public consultation, while still engaging with the community, the applicant sent a letter and public consultation brochure to each household within 1.5 kilometres of the project study area on 22nd November 2020.

This letter outlined the proposed project and invited the recipient to a live online Public Consultation Webinar, hosted by the applicant on 3rd December 2020. This event was advertised in the Kerryman Newspaper on the 25th November 2020.

EMPower delivered a Frequently Asked Questions (FAQ) compilation to all residents within 1.5km of the proposed project on 14th March 2021, along with notification for the 2nd Public Consultation Webinar to be held on 24th March 2021.

On 26th September 2021, EMPower produced and distributed a community consultation leaflet to all residents within 1.5km of the project area. This community consultation leaflet included project information regarding the final wind farm design, key environmental studies and community benefits.

2.7 Virtual Consultation Room

During the third Proposed Ballynagare Public Consultation Webinar presentation, EMPower staff also introduced the Virtual Consultation Room for the proposed Project. This online space allows residents to access information such as videos, project literature, maps and photomontages in an interactive way. The Virtual Data Room can also be accessed from the project website **(www.ballynagarewindfarm.ie).**

2.8 Frequently Asked Questions Summary

All participants in the public consultation events and communications were encouraged to submit feedback to the Applicant by email, telephone, in-person or post. All feedback and comments received were maintained in a stakeholder register and used to inform the ongoing project design and environmental studies. For example, access for turf cutting and those wishing to use the bog for recreational walking was considered while developing the civils design and construction management plan to ensure that access be provided during periods of regular use during the summer.

A summarisation of key questions received was compiled and delivered to the households of each resident within 1.5km of the proposed project study area on 24th March 2021. This letter featured 27 questions posed by the local community throughout the consultation process. We considered that these questions and answers would be of benefit to all near neighbours of the development, not only those who attended the consultation events or submitted them via email.

Along with these frequently asked questions (FAQ) compilation, details of the planning submission dates and procedures for submitting an observation were included in this letter. This FAQ and Planning Submission Letter is included in the Community Consultation Report Appendix Reference 2.2.

2.9 Community Consultation Activity and Communication Trackers

A summarisation of the key community consultation activities is presented on the following page.

Additionally, the development team has maintained a Community Consultation Communication tracker throughout the development process. For each consultation submission, this contains the subject, content, status and the contact information of the submitter. The original emails are also catalogued for reference. An excerpt from the Community Consultation Communication tracker is presented on page 8.

2.9.1 Ballynagare Wind Farm Community Consultation Activity Tracker

Date	Engagement Activity	Participants	Notes
22nd November 2020	Launch of project website (www.ballynagarewindfarm.ie)	Public domain	www.ballynagarewindfarm.ie
22nd November 2020	Letter and Public Consultation leaflet sent to all residents within 1.5km of Proposed Ballynagare Wind Farm study area detailing project design and announcing public consultation Webinar to be held at 7pm on 2nd December 2020	Residents within 1.5km	See Reference 2.1 - Letter to Local Residents, Nov. 2020
25th November 2020	Advertisement in Kerryman Newspaper, announcing proprosed project and public consultation event on 3rd December 2020.	Public domain	See Reference 5.1 - Public Consultation Advertisements
2nd December 2020	**Proposed Ballynagare Wind Farm Public Consultation Webinar No.1**	98 Attendees	See Reference 3.1 - Public Consultation Webinar No.1 Slides
25th November 2020 - Ongoing	Responses to queries raised during public consultation event through phone calls, project emails and website	Community Liaison Officer	All queries and responses compiled in Community Consultation Tracker.
14th March 2021	Letter and FAQ Compilation sent to all residents within 1.5km of Proposed Ballynagare Wind Farm announcing public consultation Webinar to be held at 7pm on 24th March 2020	Residents within 1.5km	See Reference 2.2 - Letter & FAQ to Local Residents, Mar. 2021
17th March 2021	Advertisement in Kerryman, announcing public consultation Webinar on 24th March 2020	Kerryman Newspaper	See Reference 5.1 - Public Consultation Advertisements
24th March 2021	**Proposed Ballynagare Wind Farm Public Consultation Webinar No.2**	14 Attendees	See Reference 3.2 - Public Consultation Webinar No.2 Slides

Date	Engagement Activity	Participants	Notes
22nd September 2021	Advertisement in Kerryman Newspaper, announcing public consultation Webinar at 7pm on 29th September 2021	Kerryman Newspaper	See Reference 5.1 - Public Consultation Advertisements
26th September 2021	Letter and Community Consultation Leaflet sent to all residents within 1.5km of Proposed Ballynagare Wind Farm announcing public consultation Webinar to be held at 7pm on 29th September 2021	Residents within 1.5km	See Reference 2.1 - Letter to Local Residents, Sep. 2021
29th September 2021	**Proposed Ballynagare Wind Farm Public Consultation Webinar No.3**	10 Attendees	See Reference 3.3 - Public Consultation Webinar No.3 Slides
29th September 2021 - Ongoing	Responses to queries raised during public consultation webinar through phone calls, project emails and website	Community Liaison Officer	All queries and responses compiled in Community Consultation Tracker.
6th October 2021	Advert published in Kerryman Newspaper to announce submission of the Proposed Ballynagare Wind Farm planning application to Kerry County Council	Kerryman Newspaper	See Reference 5.1 - Public Consultation Advertisements
November 2021	Ballynagare Public Consultation Webinar presentation slides and video recording published on project website	Public domain	www.ballynagarewindfarm.ie
November 2021	Launch of Public Consultation Virtual Room. This website is accessible through the main project website (www.ballynagarewindfarm.ie)	Public domain	See Reference 4.1 - Virtual Consultation Room Materials

2.9.2 Excerpt from the Ballynagare Wind Farm Community Communication Tracker

Consultee	Query subject	Content	First enquiry date	Response date	Further queries after initial EMPower response	Topic Closed / Open
Community Consultee 1	Webinar format	Voicemail	18/11/2020	21/11/2020	No	Closed
Community Consultee 2	Housing Distance	To whom it may	22/11/2020	25/11/2020	Yes, by email	Closed
Community Consultee 3	Housing Distance	Hi,	23/11/2020	25/11/2020	No	Closed
Community Consultee 4	Community Fund	To whom It may	23/11/2020	25/11/2020	Yes, by email and phone	Closed
Community Consultee 5	Consultation process	Voicemail	23/11/2020	25/11/2020	No	Closed
Community Consultee 6	Environmental concerns, Whooper Swan	Telephone	25/11/2020	26/11/2020	No	Closed
Community Consultee 7	Access route	With reference to	26/11/2020	01/12/2020	No	Closed
Community Consultee 8	Employment query	Can you confirm if	26/11/2020	01/12/2020	No	Closed
Community Consultee 9	Housing distance	Hi	28/11/2020	30/11/2020	Yes, by email	Closed
Community Consultee 10	Communication with community	Hello,	29/11/2020	09/12/2020	No	Closed
Community Consultee 11	webinar presentation materials, access to site, site details	Telephone	29/11/2020	01/12/2020	No	Closed
Community Consultee 12	Webinar	To Whom it may	29/11/2020	01/12/2020	No	Closed
Community Consultee 13	Land ownership, environmental queries,	To whom it may	30/11/2020	01/12/2020	No	Closed
Community Consultee 14	Developer details	I would appreciate	30/11/2020	01/12/2020	No	Closed
Community Consultee 15	Website queries	Voicemail	30/11/2020	30/11/2020	No	Closed
Community Consultee 16	Numerous environmental queries	To whom it may	01/12/2020	09/12/2020	No	Closed
Community Consultee 17	Community Fund	Incoming Voice Mail	01/12/2020	01/12/2020	No	Closed
Community Consultee 18	Development on other sites	Phone call to the	01/12/2020	01/12/2020	No	Closed
Community Consultee 19	Numerous environmental queries, communication between	To whom it may	02/12/2020	09/12/2020	No	Closed
Community Consultee 20	Community Fund, webinar presentation materials	Hello,	02/12/2020	09/12/2020	No	Closed
Community Consultee 21	Turf Cutting	Hi EMP	02/12/2020	09/12/2020	No	Closed

3 Influence of Engagement on Evolution of Project Design

Through engaging with the local community, the project team has gained a detailed understanding of the primary concerns of the near neighbours. The project team utilised this feedback, not only to appreciate and where possible, alleviate the concerns of the local residents, but also to inform elements of the project design and analysis.

Local events and correspondence over phone and email with residents was of great benefit to the project team, particularly in understanding more about the land use, traffic activity, flora and fauna during the early stages of the environmental studies. As the project progressed, local feedback contributed to key design decisions and mitigation efforts. Below are the primary topics of community feedback and how they influenced the project design.

- **Environmental Impact** – Early in the public consultation process, it was clear that the mitigation potential adverse environmental impacts associated with the proposed development was a key priority for the local community. We have taken the utmost care and diligence to ensure that all environmental impact analysis is carried out to best practice standards. A major design change and the elimination of one turbine and associated access was undertaken in order to reduce potential impacts on the Whooper Swan population observed to be using the land at Ballyouneen.

- **Community Fund** – The local community have provided key input for the Proposed Community Benefit Fund breakdown in line with RESS information guidelines. We will continue to consult with local community members, clubs and societies throughout the development of the Proposed Ballynagare Wind Farm. We aim to establish a local working group for to propose an administrative structure for this fund in the coming months.

- **Site access** – In response to feedback from local residents, site access will be carefully managed throughout the construction and operational phases to ensure that safe access is granted for turf cutting activities and those who currently use the site for recreational purposes. We will continue to consult the local community on this matter throughout design and implementation of the detailed construction management plan.

- **Noise** – Noise analysis was undertaken to ensure compliance with the 2006 Wind Energy Development Guidelines. In response to concerns from the local community members regarding noise emissions, a candidate turbine with serrated edged blades was adopted in order to further reduce noise output. Additionally, the elimination of 3 turbines from the initial proposed layout serves to reduce the overall noise impact, in particular for the local residents of Dysert and Croughcroneen.

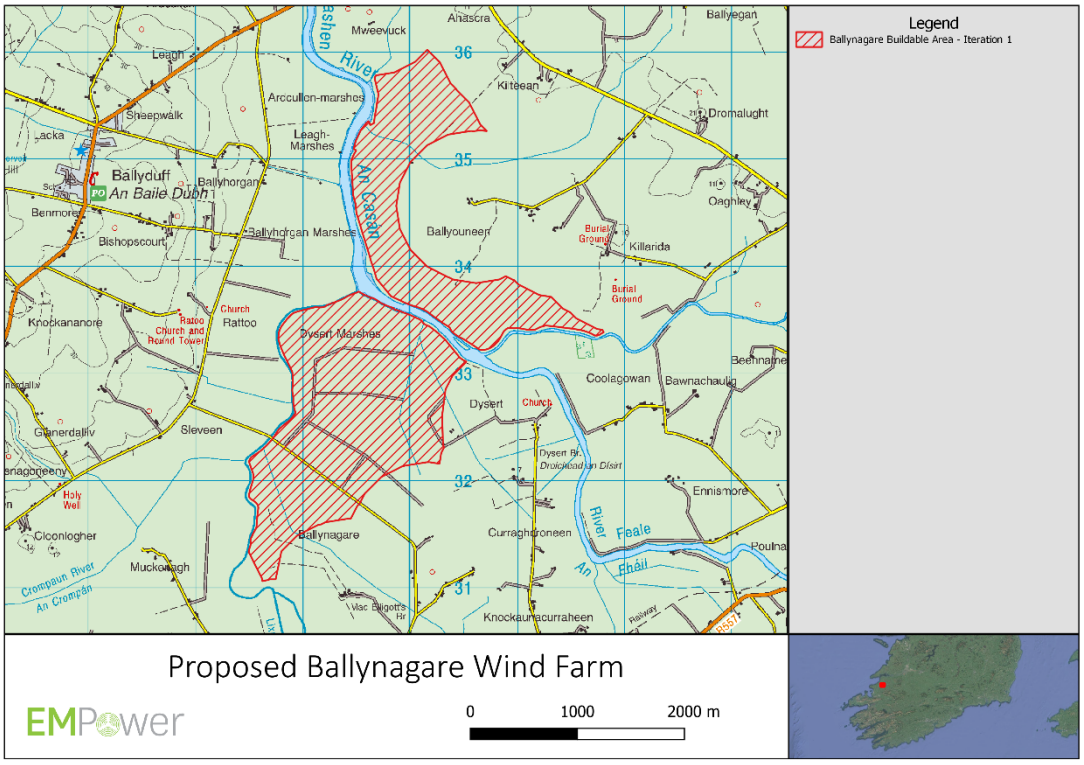
- **Landscape & Visuals** – While optimising the wind farm's technical design in order to be competitive in the RESS auction process and deliver the cheapest electricity prices for Irish consumers, we strived to ensure that the wind farm would not create significant visual impacts on its receiving landscape. The elimination of three turbines from the initial design serves to reduce the visual impacts of the wind farm, in particular for the residents of Dysert and Croughcroneen with whom we received active engagement.

4 Evolution of Project Design

The final proposed turbine layout takes account of all project constraints, the distances to be maintained between turbines and from houses, roads, etc. The layout is based on a combination of the results of all site investigations that have been carried out during the EIAR process, the community engagement process that began in November 2020 and the scoping with statutory and non-statutory consultees.

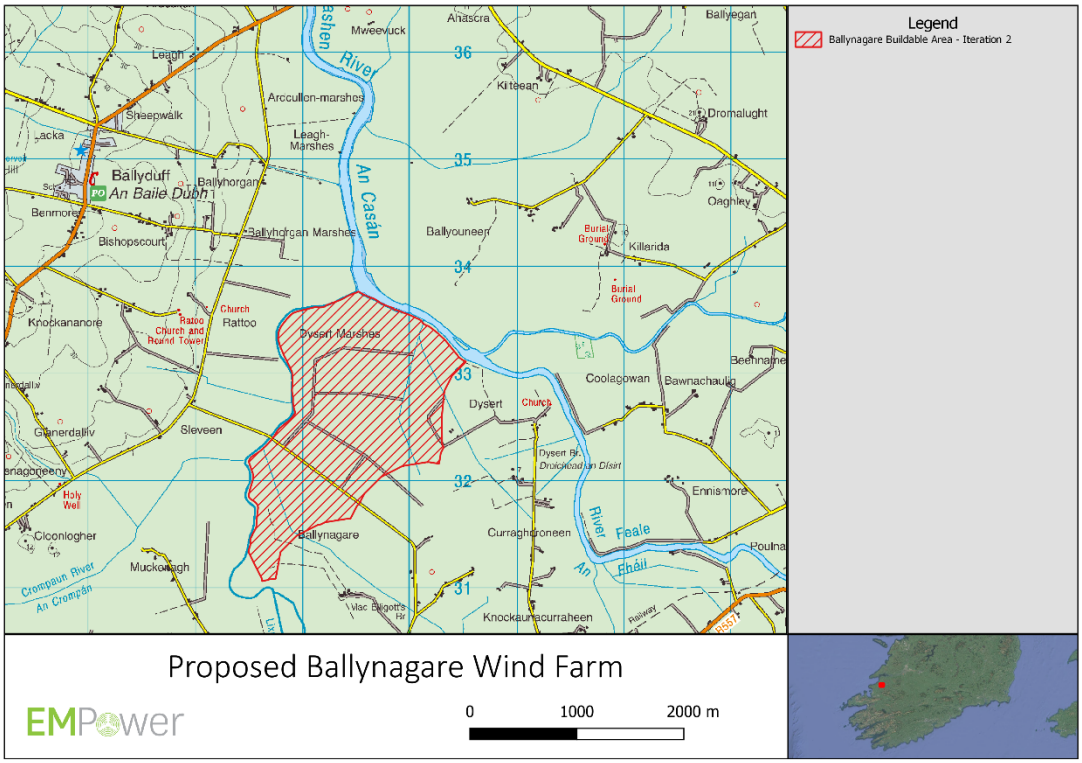
The EIAR and wind farm design process was an iterative process, whereby the community played a key role in providing feedback and constructive input at each stage.

There were a number of reviews of the specific locations of the various turbines during the optimisation of the site layout. The initial constraints and site screening study identified a significant buildable area to the north and east of the River Feale, primarily in the area of Ballyouneen, as well as to the south in the areas of Dysert Marshes and Ballynagare. The total buildable area was considered potentially suitable for up to 16 no. turbines (a cluster of 10 no. turbines to the south of the River Feale and a cluster of 6 turbines to the north). This buildable area is shown in the image below.



Following one year of ornithological surveys and analysis, the decision was made to exclude the northern buildable area from further development. This decision was taken proactively in the interest of mitigating impacts on the population of Whooper Swan observed to be active in this area during the winter months. This practice of mitigation through design was consistently used throughout the iterative layout development, as new information became available from environmental studies and key stakeholders.

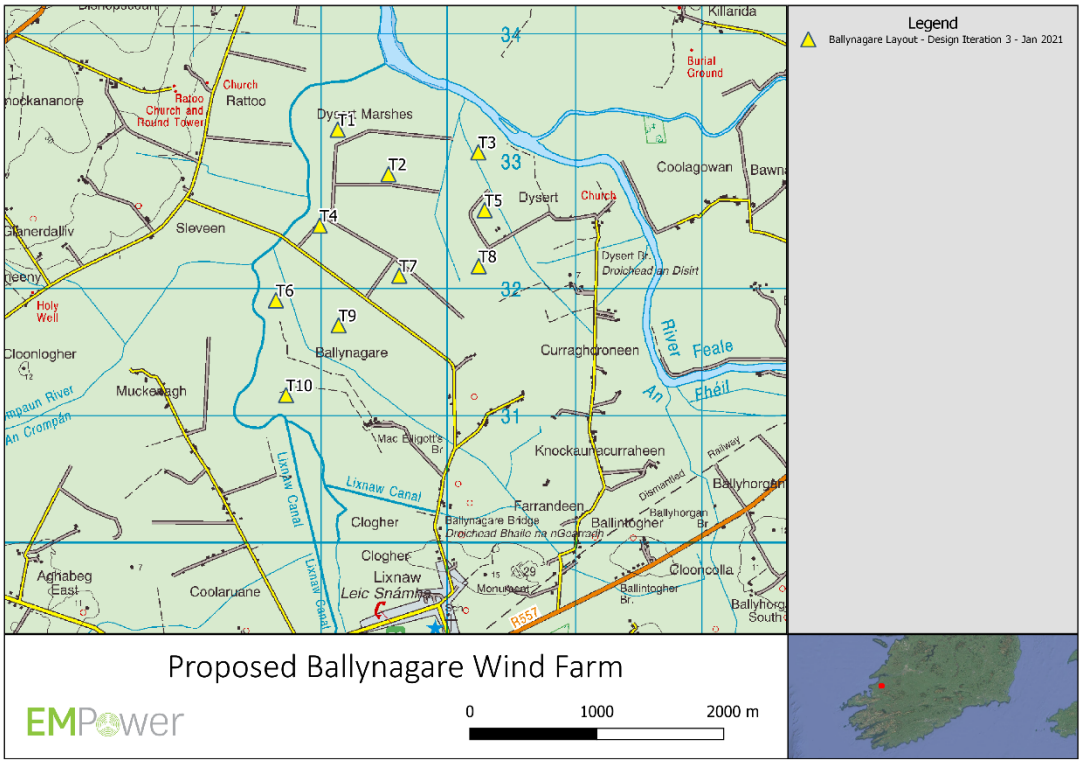
The reduced Buildable Area of the proposed Ballynagare site is illustrated in the image below. This proposed site extents was presented to the local community at the initial Public Consultation Webinar in December 2020. Valuable feedback was received during this initial community consultation which informed the iterative layout design.



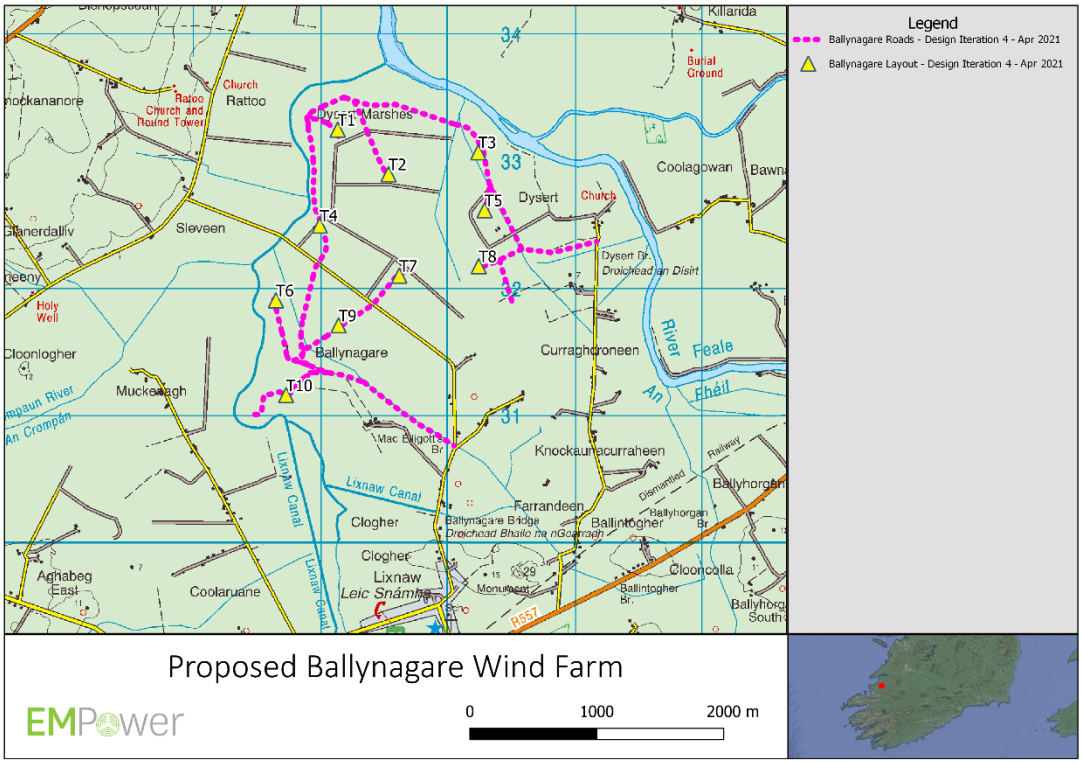
The first iteration of the wind turbine layout was developed within the bounds of the reduced Buildable Area, taking account of the initial constraints analysis conducted on the proposed project. A total of ten turbines was considered constructable on the townlands of Ballynagare, Dysert, Dysert Marshes and Curraghcroneen. This design, which is illustrated in Figure 3.8, was presented to key stakeholders and the local community in March 2021.

Key elements of feedback from this initial consultation are listed below:

- Potential adverse visual Impacts to local residents, specifically in the Dysert, Curraghcroneen and Lixnaw areas
- Potential adverse noise impacts
- Potential adverse impacts on peat habitats
- Potential adverse impacts on whooper swan population
- Concerns over scale and number of turbines



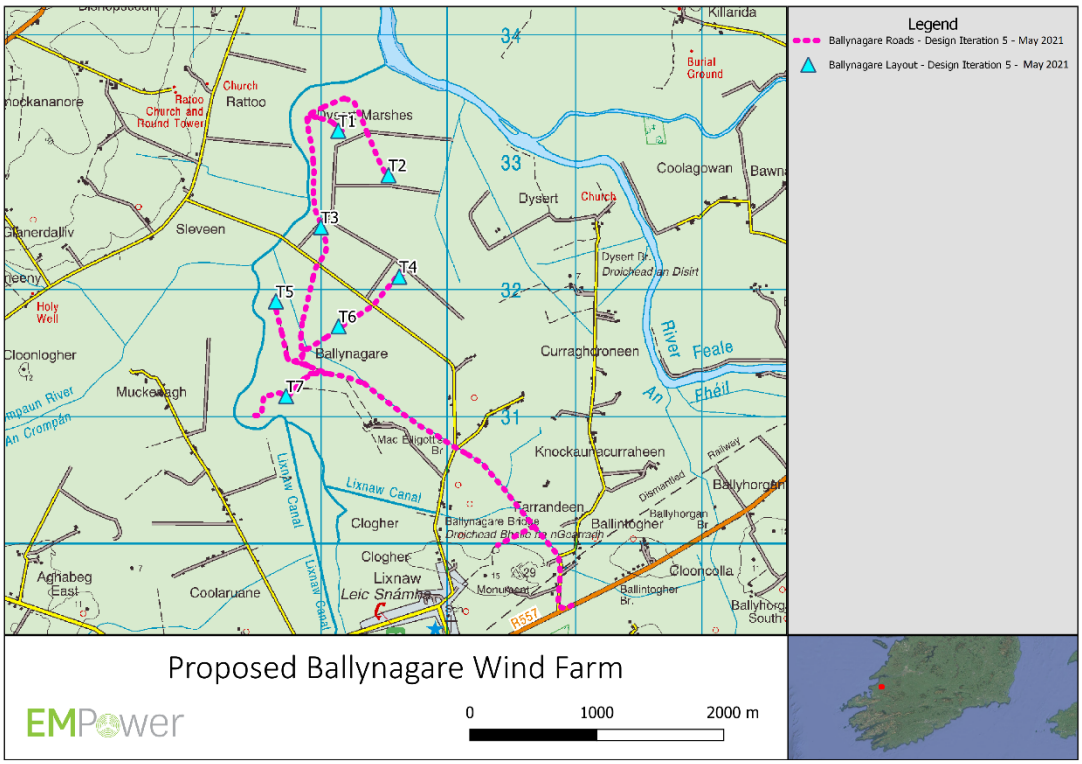
The turbine layout was further refined and a connected road network proposed in April 2021. While solving the need to connect all project turbines with the existing local road network, the initial internal roads layout was primarily based on land availability. A key concern during this stage of design was to ensure safe access for turf cutting activities and local residents that might chose to use the site for recreational purposes. For these reasons, disruption to the existing road network will be reduced to a minimum.



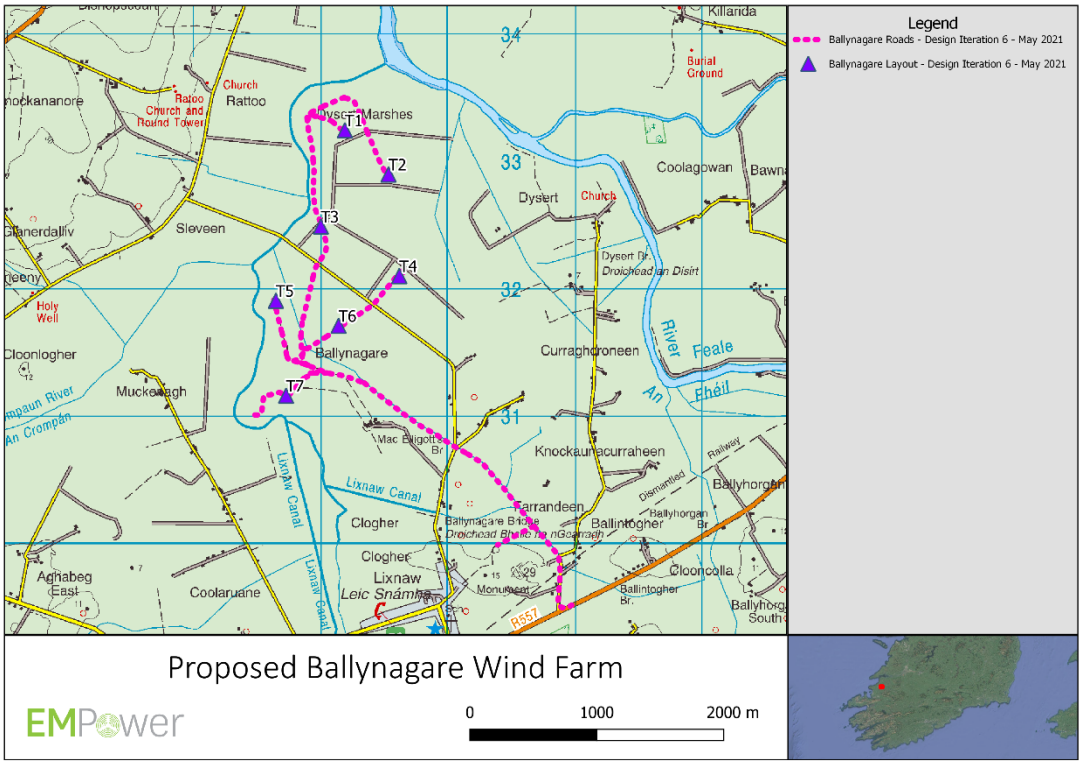
In May 2021, the Applicant made the decision to reduce the Proposed Ballynagare Wind Farm to 7 turbines by removing the 3 most easterly turbines from the development. This decision served to increase the distance from the nearest Ballynagare project turbine to the Whooper Swan grazing areas north of the River Feale from approximately 300m to over 600m. This adjustment also served to increase the distance of the Project's turbines from residents of Dysert and Curraghcroneen areas, and thereby further mitigating potential impacts of the proposed wind farm for these communities. Furthermore, the associated revision to the internal roads design avoids the need to use local in Curraghcroneen for component delivery or construction traffic. This updated roads layout allowed the Project Site to connect directly to the R-557.

Potential impacts on local avian species, proximity to housing and the potential impacts arising from the use of local roads were among the key concerns raised in the public consultation process. The exclusion of the three most easterly turbines helps to mitigate these potential impacts and demonstrates the value the local community's input during the project design phase.

The updated 7-turbine layout is illustrated in the image below.



Further slight adjustments were made to the turbine layout, including the micro-siting of turbines and hardstands, in June 2021, following an engineering review. The final (fourth iteration) proposed layout is shown in the image below.



5 Ongoing Contact

The nature and frequency of interaction between the project development team and the local community will depend on the phase of development. Consistent in all phases detailed below will be a dedicated Community Liaison Officer for the project who remains contactable at all times. As the project advances, updates regarding the project's status and activity will be posted to the project website and where appropriate, circulated to the local community.

In line with the Governments Code of Practice 2016 the project will publish an annual summary report of all engagement activities on the project website.

5.1 Permitting and Pre-Construction

While the permitting process for the proposed Ballynagare Wind Farm is ongoing, EMPower will remain available to the community for any comments or queries relating to the planning application, Environmental Impact Assessment or any other topics raised. EMPower will also circulate project updates regarding this permitting process to the local community.

A collaborative design process for the Ballynagare Community Benefit Fund will be established between the project developers and the members of the local community. The project team will start a process of reaching out initially to residents within the 1.5km zone and then slightly further afield, in order to bring together a small group of people who are interested in working on the design and structure of a community based entity that would ultimately run this Community Benefit Fund. This process will start with a scoping exercise followed by a series of facilitated workshops. It is hoped that representatives involved in existing local development initiatives will be stakeholders in this process and will therefore contribute to this strategy.

As part of this process, the project development team will closely follow any developments to the latest Terms and Conditions of the Renewable Energy Support Scheme (RESS), including the RESS Investment Scheme Community Investment which was eventually not included in RESS-1. Should the Department of the Environment, Climate and Communications (DECC) develop and implement an appropriate mechanism for community investment in future RESS schemes that the proposed Ballynagare Wind Farm aims to participate in, we would actively promote this within the community.

Prior to construction, the Project will also quantify the materials and services required and seek to identify local suppliers to provide materials and services where possible.

5.2 Construction phase

Approximately 6 months prior to the commencement of construction of the proposed Ballynagare Wind Farm, the development team will establish a liaison group. Monthly meetings will be held with this group to prepare for the construction phase and monitor activities during construction. Our priority is to ensure the safety of all staff and local residents, while communicating effectively with those directly impacted by construction activities. The Construction Environmental Management Plan and Traffic Management Plan will be key references for these procedures and communications, particularly in minimising impacts on local road users.

5.3 Operational Phase

The project will continue with a proposed annual meeting with the liaison group to update the group on project performance and address any issues identified. The Community Liaison Officer will also be available throughout this period to directly address and investigate any issues raised by local residents. As stated above, the project website will also be maintained as a method of providing regular, up to date information on the project.

5.4 Decommissioning Phase

A year prior to the commencement of decommissioning of the project, the project team will engage with all residents within the 1.5km zone to outline the decommissioning plan and address any issues identified at that time.

6 Potential Enduring Benefits of this Project

Ballynagare Wind Farm has the potential to bring significant positive benefit to the local community. The project will create sustainable local employment, it will contribute annual rates to the local authority and it will provide opportunity for local community investment in the project in line with the new Renewable Energy Support Scheme.

6.1 Community Benefit Fund

We believe that the local community should not only be actively consulted regarding a renewable energy project, but that they should also benefit from its success. In line with this belief, the updated Wind Energy Development Guidelines and the Renewable Energy Support Scheme (RESS) both promote the adoption of energy production based Community Benefit Funds. The Project's Community Benefit Fund will be designed to fully adhere to all conditions stipulated in these two policies. Based on the Terms and Conditions of the first RESS auction, EMPower expects that for each megawatt hour (MWh) of electricity produced by the wind farm, the project will contribute €2 into a community fund for the RESS period i.e. first 15 years of operation.

The average capacity factor of wind energy projects in Ireland is 28.3% (SEAI, 2019). Assuming this efficiency, and a capacity of 42 MW, the community benefit fund would amount to an average of €208,243 per annum over the 15 RESS period. The actual fund will vary around the average from year to year, depending on wind conditions. Onsite wind measurement suggest that the proposed Ballynagare wind farm will be capable of achieving an above average capacity factor, and therefore a larger community fund.

As the beneficiaries of the fund, EMPower also believes that it is the community who should guide the administration and allocation of the Community Benefit Fund. To ensure this is possible, we will seek to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund. We aim to commence this work in early 2022.

Valuable consultation has already been undertaken with the local community regarding how they would like to see the fund distributed. Based on this initial feedback, the guiding Terms and Conditions of RESS, and the EMPower staff's experience of best practice community fund administration, we have presented a framework for the proposed Ballynagare Wind Farm Community Benefit Fund, which was presented at both Public Consultation Webinars. The framework can also be viewed at the project website and the Virtual Consultation Room (www.ballynagarewindfarm.ie).

6.2 Community Investment Opportunity

EMPower welcomes the possibility for local communities to invest in projects in a meaningful way as a means to directly gain from the financial dividends that a project can provide should it be consented, built and operated. Although not included in the first RESS auction Terms and Conditions, DECC state they;

“will continue to investigate opportunities to deliver on these investment opportunities and further develop the overall package of community participation and benefits in future RESS auctions in line with Ireland’s climate ambitions and the European Green Deal”.

EMPower will seek to further explore the possibilities of community investment through consultation with the local community. In parallel, should DECC establish a viable method to implement investment opportunities within the RESS framework, we will be happy to promote this in our project area.

6.3 Employment Opportunities

As well as these direct financial benefits, Ballynagare wind farm will provide local employment opportunities. According to SEAI's "A Macroeconomic Analysis of Onshore Wind Deployment to 2020", 2.11 direct jobs are created per MW of installed wind capacity. Given a capacity of 42 MW, Ballynagare Wind Farm could create 88 direct jobs. Following SEAI's calculations, 71 of these would created for the construction phase, while 17 operations and maintenance jobs would endure throughout the project's lifetime.

7 Conclusion

As outlined in this report, we have at all times aimed to establish a meaningful and transparent consultation with the local community regarding the proposed Ballynagare Wind Farm project. We would aim to continue this dialogue throughout all future phases of development, construction, operations and decommissioning. We look forward to jointly developing the wind farm design and community benefits alongside our near neighbours and other stakeholders.

We would welcome a planning condition that requires us to adhere to commitments made in this community report for the lifetime of the development, in compliance with the Code of Practice for Wind Energy Development in Ireland - Guidelines for Community Engagement issued by the Department of Communications, Climate Action and Environment (December 2016) or updated revision.

Community Consultation Report Appendix

Contents

Reference 1.1 – Ballynagare Community Brochure – Nov. 2020

Reference 1.2 – Ballynagare Community Brochure – Sep. 2021

Reference 2.1 – Letter to Local Residents, Nov. 2020

Reference 2.2 – Letter & FAQ to Local Residents, Mar. 2021

Reference 2.3 – Letter to Local Residents, Sep. 2021

Reference 3.1 – Public Consultation Webinar No.1 Slides

Reference 3.2 – Public Consultation Webinar No.2 Slides

Reference 3.3 – Public Consultation Webinar No.3 Slides

Reference 4.1 – Virtual Public Consultation Room Materials

Reference 5.1 – Public Consultation Advertisements

Reference 1.1 – Ballynagare Community Brochure – Nov. 2020

EMPower

EMPower is an Irish based international renewable energy developer with over 700 MW in development in Europe and Africa. Our senior management team has a combined 95 years' experience delivering projects from conception to operation across five continents.

EMPower is owned by GGE Ireland Limited, Wind Power Invest A/S and EMP Holdings Limited. We commenced project development in Ireland in 2018 following the government's announcement of the Renewable Energy Support Scheme (RESS) and Ireland's revised emissions target of 70% renewables by 2030.

Our vision is to provide low carbon, ecologically non-invasive, affordable energy to facilitate Ireland's expanding economy and sustainable energy targets. We are currently conducting an Environmental Impact Assessment (EIA) for the proposed 10-turbine windfarm situated in the townlands of Ballynagare, Curraghcroneen, Dysert and Dysert Marshes. EMPower follows Equator Principles and IFC Performance Standards throughout all stages of development in order to ensure the protection of our local ecology and communities.

Our project website (www.ballynagarewindfarm.ie) will be updated regularly with reports as they are made available and the final EIA will be published for comments prior to submission. Please submit comments through the website or email us directly at info@emp.group.

95 Years

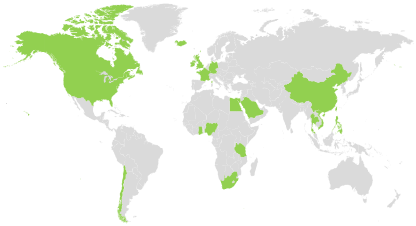
Combined Experience of EMPower Management Team in Renewable Energy

700 MW+

Wind Energy Capacity Currently Under Development By EMPower

5 Continents

Combined Geographical Experience of EMPower Team in Renewable Energy



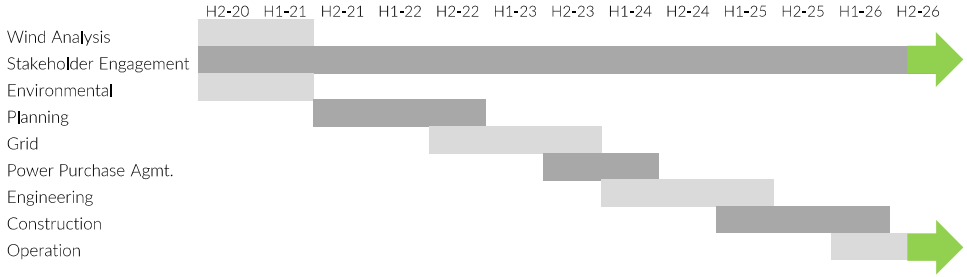
Ballyouneen Wind Farm



- 10 Turbines
- 56 MW
- Clean power for 33,000 Irish Homes
- No Overhead Transmission Lines

The proposed development area of Ballynagare Wind Farm consists of a 609 acre site located 2.5km south-east of Ballyduff village, County Kerry. EMPower proposes to develop up to 10 turbines, of 170m tip-height, subject to environmental impact assessment and planning permission. The site was identified in the Kerry County Development Plan as an Open to Consideration area for wind development.

Project Schedule

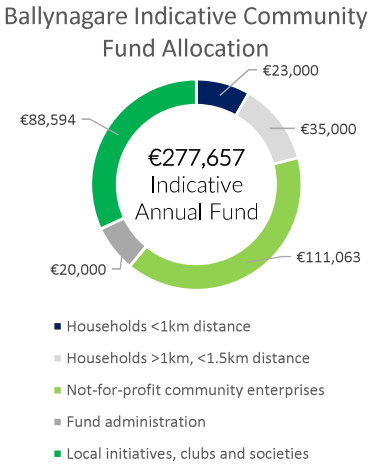


Community Benefit Scheme

The proposed Ballynagare Wind Farm will require a €61.8 million investment and will provide sustainable, low carbon energy generation infrastructure to meet Ireland's growing demand. The development benefits to the local community include significant investment in local infrastructure such as roads and electrical systems, local job creation, and a contribution of €10.1 million in county council rates over the project lifetime.

Ballynagare Wind Farm will also provide a community fund calculated in accordance with the Renewable Electricity Support Scheme (RESS) Terms and Conditions at **€2 per MWh** of electricity produced by the project. This is to be made available to the local community for the duration of the RESS (15 years). The average capacity factor of wind energy projects in Ireland is 28.3% (SEAI, 2019). Using this efficiency figure as an example, and a capacity of 56 MW, the community benefit fund would amount to an average of €277,657 per annum. The actual fund will vary around the average from year to year, depending on wind conditions. Onsite wind measurements suggest that Ballynagare will be capable of achieving an above average capacity factor, and therefore a larger community fund.

This scheme is proposed to be divided as per the indicative illustration in the chart below. An annual payment of **€1,000** will be provided to each household within 1km of any Ballynagare Wind Farm turbine. An annual payment of **€500** will be provided to each household located between 1km and 1.5km of a turbine. These payments will be fixed and will not fluctuate. 40% of the fund, amounting to approximately €111,000 per year in this example, will be allocated to not-for-profit community enterprises, with an emphasis on low-carbon initiatives. The remainder of the fund will be directed towards local clubs, societies and initiatives, with an emphasis on the villages of Lixnaw and Ballyduff. We welcome any suggestions from the community on suitable local projects that could be supported under this initiative.



95

Direct jobs in construction phase

22

Highly skilled jobs over project lifetime

€ 61.8 million

Investment in Irish infrastructure

€ 4.2 million

Total Indicative Community Fund Contribution

€ 10.1 million

County Council Rates Contribution

Environmental Impact Assessment

Following initial site screening activities, EMPower have commissioned an Environmental Impact Assessment (EIA) for the Ballynagare Wind Farm to assess what effects the project might have on the environment and local community. This is being carried out by the independent environmental and engineering consultancy, McCarthy Keville O'Sullivan (MKO), and the resulting reports will be issued to the planning and regulatory authorities. The final design will ensure that any sensitive areas are protected throughout development. A description of some key ESIA activities is presented to the right.

Social Impact Assessment

This involves examining the social effects of infrastructure projects on the surrounding community, examining land use, employment, health and safety, tourism and local amenities.

Ecology

An ecological impact assessment will be carried out in order to assess the impact on the site's flora and fauna, evaluating potential impacts on the local ecosystem. In line with industry best practice, EMPower are conducting 2 years bird surveys prior to planning application submission.

Shadow Flicker

Shadow flicker refers to alternating changes in light intensity caused by the moving turbine rotors impacting dwellings. EMPower will carry out a shadow flicker analysis to avoid any impact of shadow flicker on local buildings in line with current guidelines.

Noise Assessment

A noise assessment will be carried out to assess the impact of noise on the surrounding community by installing sound meters at noise sensitive locations (houses) and using turbine noise curves to establish noise emissions and design out any potential impacts.

Landscape and Visual

A zone of theoretical visibility (ZTV) will be produced outlining which turbines will be visible from various locations. Photo montages will identify the visual impact of the project by showing the operational turbines in situ.

Wind Energy FAQ

How efficient is wind energy?

Wind turbines produce electricity approximately 85% of the time. The other 15% of the time they are not turning for reasons, such as: very low wind speeds, very high wind speeds, and maintenance/repair work.

After six to seven months, a wind turbine will have produced as much energy as has gone into constructing it. Ballynagare Wind Farm is anticipated to produce enough electricity to power 33,000 Irish homes.

Do wind farms effect house prices?

Several studies from the United Kingdom by The Centre for Economics and Business Research (CEBR), The Institute of Chartered Surveyors, The House of Commons Library and Renewable UK conclude wind farms have little or no impact on property values.

Are turbines linked to health issues?

The balance of scientific evidence and human experience to date clearly concludes that wind turbines are not harmful to human health – in fact, wind energy reduces harmful air emissions and creates no harmful waste products when compared with other sources of electricity.

What is a turbine's lifetime emissions?

Wind energy emits no toxic substances such as mercury and air pollutants like smog-creating nitrogen oxides, acid rain-forming sulphur dioxide and particulate deposits.

A 2014 study by the Intergovernmental Panel on Climate Change (IPCC) found onshore wind energy to have the lowest mean lifecycle emissions of all viable sources, such as solar, nuclear energy and natural gas, at just 11 grams CO_2(e) per kWh.

EMPower

Get in touch

Website : www.ballynagarewindfarm.ie
Email : info@emp.group
Phone : +353 1 588 0178
Write : EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1

Ballynagare Wind Farm

Statement of Community Consultation

EMPower



Reference 1.2 – Ballynagare Community Brochure – Sep. 2021

Proposed Ballynagare Project

Project Newsletter 2 – September 2021

EMPower



Introduction

This is the second public newsletter which has been released for the proposed Ballynagare Wind Farm project. The proposed project is now at a stage where all the environmental assessment data has been gathered and collated in order to inform the final proposed project layout.

This newsletter sets out an overview of all aspects of the proposed Ballynagare Wind Farm project and we look forward to addressing any question or queries you may have prior to the project submitting a planning application. We can address any queries by phone call and email at a time that suits you. Also in person meetings may be possible subject to current Covid-19 Government guidelines and restrictions.

To supplement the detail in this project newsletter we have also put together an interactive virtual tour of the proposed Ballynagare Wind Farm project with added detail on topics such as interactive landscape and visual displays, environmental impact assessment, transport and grid routes and layout maps. You will also be able to view some recorded material prepared by members of the projects design team in this interactive virtual platform.

The projects interactive virtual tour material will be launched in the coming weeks and will be accessible from the home page of the project website at (www.ballynagarewindfarm.ie).

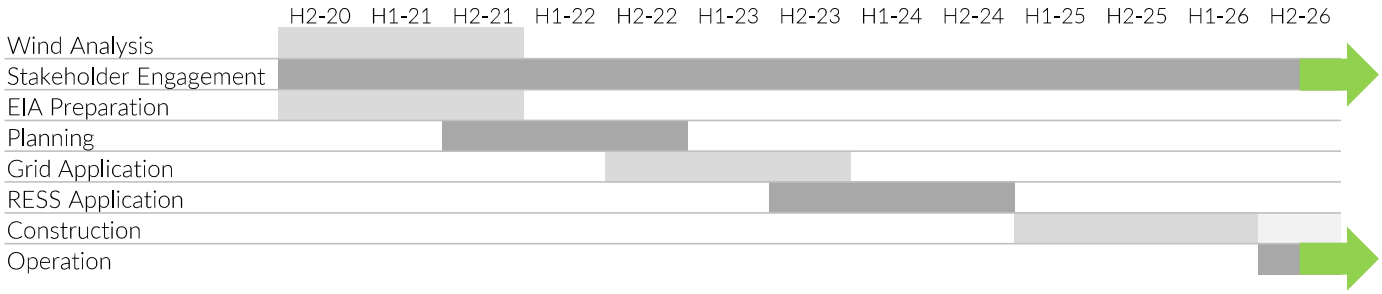
Please be assured that we will continue to make every effort to ensure that we provide you with all the information you need in order to fully understand the details of this proposed project. We are also committed to making available the necessary resources within our design team to support any engagement type which suits you best.

Once you have had a chance to look through the proposed project details contained in this newsletter and you have any areas of the proposed project you wish to discuss further, please make contact with the project team using the contact details located on the back page of this newsletter or on the project website (www.ballynagarewindfarm.ie).



Picture 1: View of the proposed Ballynagare Study Area

Proposed Project Schedule



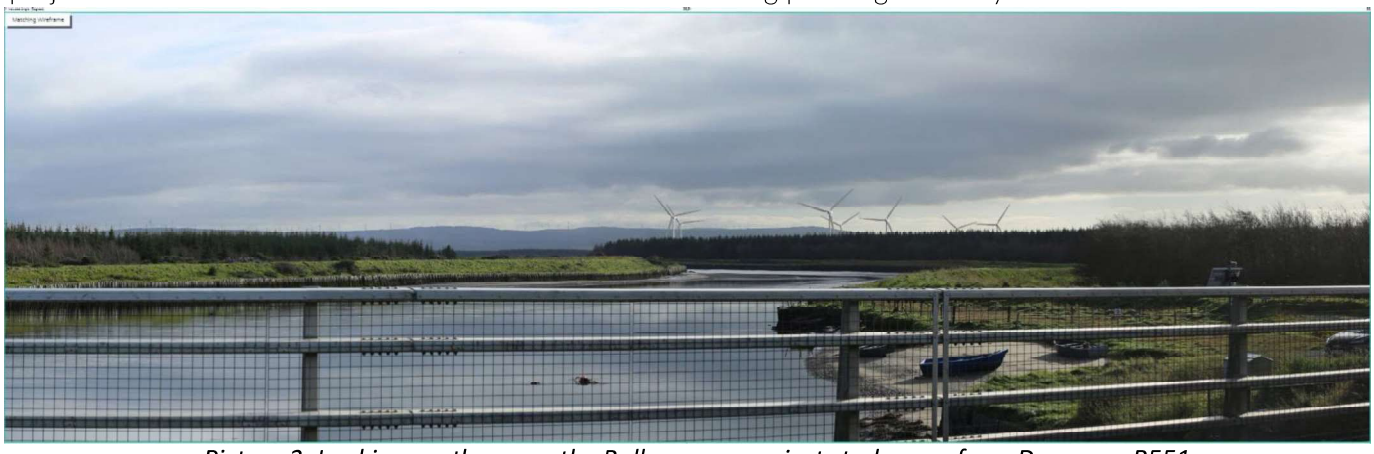
The Proposed Development

The proposed Ballynagare Wind Farm project is located approximately 2km north of the village of Lixnaw and approximately 8.8km southwest of the town of Listowel, Co. Kerry on lands contained within the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, and Monument.
It is proposed to connect the project to the national grid via a 38kV underground cable via the existing Clahane electricity substation in the townland of Pallas located approximately 7 kilometers southeast.
The projects' turbine component delivery route is proposed between the R557 and the proposed new development entrance. You will find a layout map highlighting the proposed project particulars on the second last page of this newsletter.
EMPower are requesting a 10-year planning permission for a project with an operational life span of 35 years.
The proposed wind farm project's final design proposal includes the following:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas and 1 material borrow pit
- Provision of 1 no. permanent meteorological mast with a maximum height of 110 metres;
- Upgrade of existing roads and access junctions and provision of new entrances;
- 2 peat storage areas and 2 temporary construction compounds and all site drainage works;
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- All ancillary site and ground works, apparatus and signage

Photo Montage Illustrating Final Design

Photo montages identified the visual impact of this proposed project by simulating the proposed operational turbines in situ from 29 locations surrounding the Study Area. These illustrations are used to inform the final design and turbine selection. One such Illustration is shown below. This representation of the final proposed design looks south at the 7 proposed Ballynagare wind turbines from Derryco on the R551. All 29 view points will be made publicly available on our dedicated Community Consultation Room located on the projects website before a submission is made to the consenting planning authority.



Picture 2: Looking south across the Ballynagare project study area from Derryco – R551

Project Design Process

The design process for the proposed Ballynagare wind farm started with a review of existing information to avoid or minimize potential impacts, This included limiting the angle of slope of the ground where development can occur, including a setback distance from watercourses and residences, as well as a setback distance from any nearby European designated habitat sites.

As detailed in previous correspondence and webinars, a final turbine layout was developed taking into account all design considerations including the separation distance required between the turbines. The location and alignment of the associated infrastructure, such as roads, crane hard stands and substation, was then developed following confirmation of the proposed turbine layout. The locations of the proposed wind turbines and all other proposed infrastructure locations have been informed by rigorous site investigations and assessments carried out over a three-year period including:

- Ecological Surveys
- Ornithological Surveys
- Geotechnical/Hydrological Site Investigations
- Shadow Flicker Modelling
- Noise Modelling
- Archaeological Surveys
- Landscape and Visual Assessment

The proposed development layout map's have been continuously updated throughout the development's design process based on the findings of each of the site investigations and assessments that have been completed. All these map's will be available to view on the project website and will be included in the projects application for planning permission.

Some of the areas of this design process where we have had the most conversations with interested stakeholders and local residents are listed hereafter:



Scoping and Consultation

Development projects such as wind farms require a detailed Environmental Impact Assessment Report (EIAR). In order to ensure that the Environmental Impact Assessment (EIA) process was appropriate to the project and locality, an information document was prepared and circulated to a list of statutory and non-statutory consultees including, among others, National Parks and Wildlife, Inland Fisheries Ireland, area telecommunication providers, Transport Infrastructure Ireland, Kerry County Council, The Aviation Authority and Fáilte Ireland plus many more. This is done to ensure that the EIAR addresses all relevant, location specific, topics. The project team are currently coordinating the final compilation of the EIAR and it will accompany the planning submission for this project. The final EIAR will be available for viewing on the following website www.ballynagarewindfarm.ie

Land, Soils and Geology

The geology of the projects Study Area consists of narrow peat fields and peat bog historically subject to peat harvesting which is surrounded by agricultural grasslands. Detailed investigations including site walkovers, peat stability assessments, trial pit excavations and bore holes were undertaken to access the geology of the Study Area. If this project is consented, construction of the wind farm infrastructure will require the removal of subsoils and possibly rock to create solid foundations. Excavation of bedrock from proposed on-site borrow pits and suitable off-site aggregate sources will provide appropriate construction material for access roads, turbine bases and general hard-standing foundations. The removal and the reuse of subsoils and bedrock does not represent a significant impact on the geology of the site. No significant impacts or cumulative impacts on the soil and geological environment are anticipated as a result of the proposed wind farm and its grid connection.

Human Beings and Population

The proposed project assessments examine the potential impacts of this proposed project (both beneficial and adverse) on the local and regional community. The key issues examined fully in the Environmental Impact Assessment Report include:

- Economic and Employment Activity;
- Construction activities dust / noise emissions
- Visual impacts during operation
- Existing land Use;
- Shadow flicker during operation
- Traffic nuisance during construction
- Human Health and Safety;
- Population, tourism and recreational trends

Noise

Noise is generated by wind turbines as they rotate to generate power. This only occurs above the 'cut-in' wind speed and below the 'cut-out' wind speed. Below the cut-in wind speed there is insufficient strength in the wind to rotate the blades and above the cut-out wind speed the turbine is automatically shut down to prevent any malfunctions from occurring. The cut-in speed at the turbine hub-height is approximately 3 meters per second (11 kph) and the cut-out wind speed is approximately 25 meters per second (90 kmh).

The principal sources of noise are from the blades rotating in the air (aerodynamic noise) and from internal machinery, normally the gearbox and, to a lesser extent, the generator (mechanical noise). The blades are carefully designed with a view to minimising noise whilst optimising power transfer from the wind.

Vibration is generated by construction activities such as rock breaking and passing heavy goods vehicles. Construction noise will occur during excavation and earth moving, laying of roads and hard standings, transportation of materials and erection of the wind turbines if this project is consented. The construction phase will be phased and temporary.

Noise and vibration assessments were undertaken for the operational, construction and decommission phases of the proposed development. Baseline noise monitoring was undertaken at receptor locations surrounding the proposed Ballynagare Wind Farm's Study Area to establish the existing background noise levels. These measurement locations were chosen as they represent some of the closest locations and represent different noise environments in the vicinity of the proposed development.

Following the establishment of the existing noise levels prior to any development, appropriate noise level limits were then determined in line with Government policy and guidance. The noise limits seek to strike a balance between the noise restrictions placed on a wind farm, the protection of amenity and the national and global benefits of renewable energy development. The predicted noise emissions from the wind farm are then compared against these limits. The wind farm will be designed and operated in a manner that ensures the prescribed limits won't be exceeded and will be validated by post construction noise monitoring if this project is consented.

Biodiversity

As part of the projects Environmental Impact Assessmnet, extensive desktop studies and field surveys have been carried out over several years for the proposed Ballynagare Wind Farm project. These surveys analysed the different habitats, mammals, bats, birds as well as aquatic ecology throughout the project's Study Area and associated proposed grid connection and turbine delivery routes.

The proposed projects Study Area comprises 15 habitat types predominately cut-over bog which remains in use turbary activity and improved agricultural grassland. Some areas of the habitat have little vegetation, however other areas are regenerating with Reed and large sedge swamp vegetation, Purple-moor grass, heather, Cross leaved Heath, Bog Mytrle and Bog Asphodel and also areas with common scrub.
Species such as the Marsh Fritillary butterfly, bats, Otter and Badger were also identified following analysis. Many bird species activities were also considered during the proposed projects design including the Hooper Swan, Golden Plover, Hen Harrier and Goose to name a few.
Following this environmental analysis, the proposed development is not considered to significantly affect any of the key ecological receptors identified.

Water

Topography at the proposed project study area is generally flat and low-lying with ground elevations ranging from 0-5m OD. The proposed project is located in the Tralee Bay Feale Catchment and is bordered by the Brick river to the west and the River Feale to the east. These two watercourses confluence to the north of the proposed project, forming the Cashen River Estuary. The Lower River Shannon SAC is located immediately to the west, north and east of the proposed project while the Cashen River Estuary pNHA is also located to the northeast along the upper tidal reaches of the Feale River. Flood embankments have been installed along the Brick and Feale Rivers. The proposed project is not situated within any environmentally designated areas.

If this project is consented a drainage management and surface water monitoring program will be employed to control water during construction activities. This will ensure that surface runoff from the project areas will not decrease the current water quality. Impacts on water during the construction phase of the project will be imperceptible to none. Based on proposed mitigation measures integrated into the proposed projects design, there is no potential for significant impacts on the hydrology and groundwater as a result of the proposed project development.

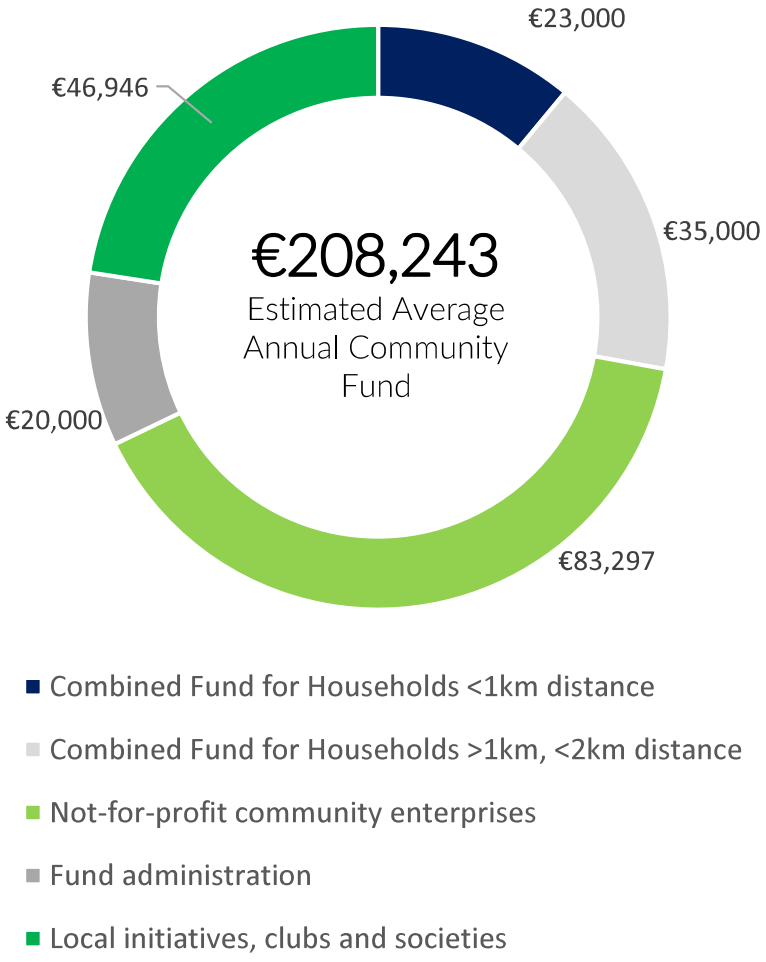
Community Benefit

The proposed Ballynagare wind farm will require approximately a €46.2 million investment and will provide sustainable, low carbon energy generation infrastructure to meet Ireland's growing demand. The development benefits to the local community include significant investment in local infrastructure such as roads and electrical systems, local job creation, and a contribution of €8.6 million in County Council rates over the project lifetime.

The proposed Ballynagare Wind Farm will also provide a community fund calculated in accordance with the Renewable Electricity Support Scheme (RESS) Terms and Conditions at €2 per MWh of electricity produced by the project. This is to be made available to the local community for the duration of the RESS (15 years). The average capacity factor of wind energy projects in Ireland is 28.3% (SEAI, 2019). Assuming this efficiency, and a capacity of 42 MW, the community benefit fund would amount to an average of €208,243 per annum over the 15 RESS period. The actual fund will vary around the average from year to year, depending on wind conditions. Onsite wind measurement suggest that the proposed Ballynagare wind farm will be capable of achieving an above average capacity factor, and therefore a larger community fund.

This fund is proposed to be divided as per the illustration in the chart below. An annual minimum payment of €1,000 will be provided to each household within 1km of any Ballynagare Wind Farm turbine. An annual minimum payment of €500 will be provided to each household located between 1km and 1.5km of a turbine. These payments will be fixed and will not fluctuate. 40% of the fund, amounting to approximately €83,297 per year in this example, will be allocated to not-for-profit community enterprises, with an emphasis on low-carbon initiatives. The remainder of the fund will be directed towards local clubs, societies and initiatives. We welcome any suggestions from the community on suitable local projects that could be supported under this initiative.

Ballynagare Indicative Community Fund Allocation



71
Direct jobs in construction phase

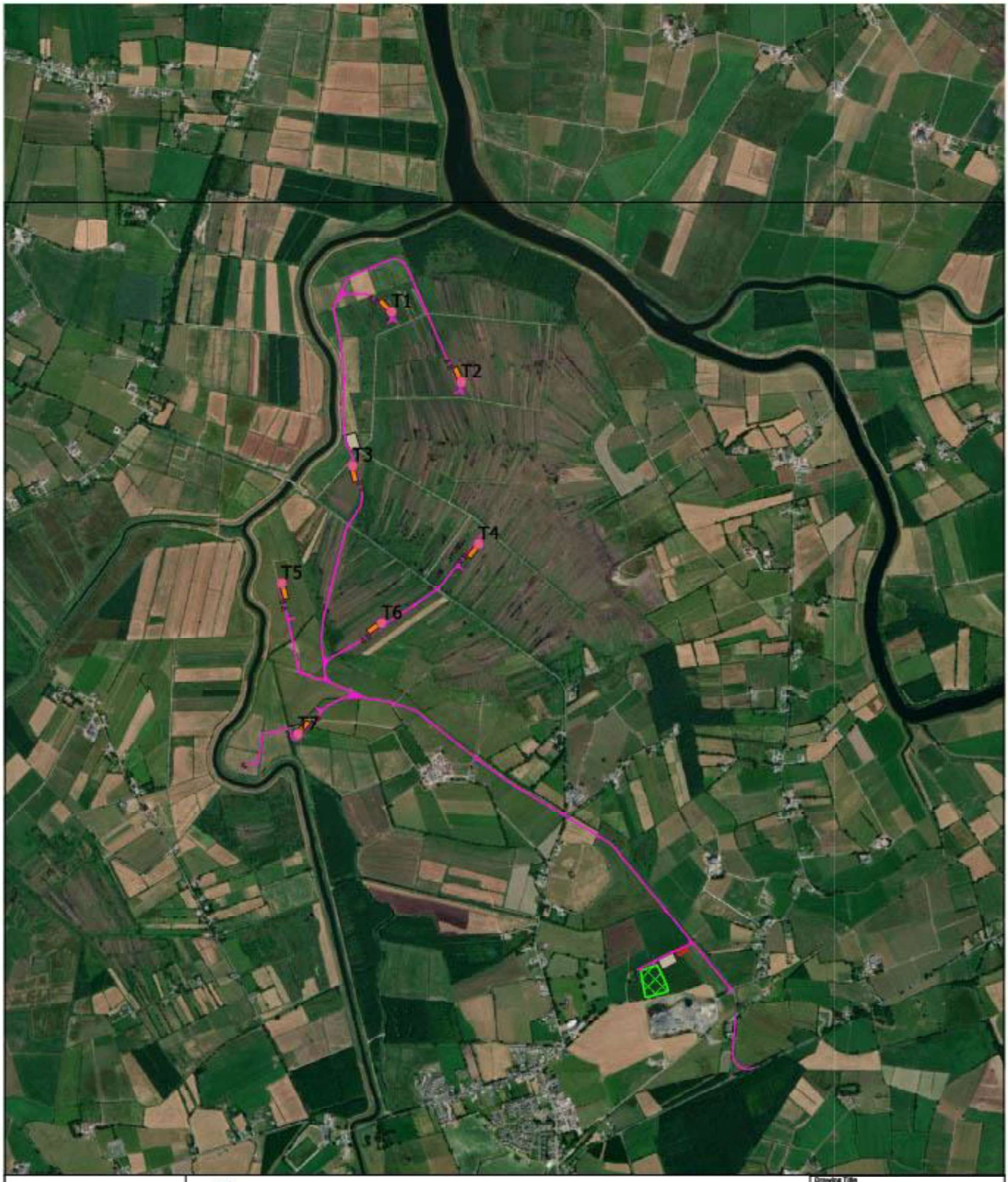
17
Highly skilled jobs over project lifetime

€ 46.2 million
Investment in Irish infrastructure

€ 3.1 million
Total Community Fund Contribution

€ 10.1 million[2]
County Council Rates Contribution

1 – Over 15 year RESS contract
2 – Estimated €8,000 per mega watt installed for 30 year project lifespan



Map Legend

- Proposed Turbine Location
- Proposed Site Roads
- Proposed Borrow Pit
- Proposed Construction Compounds
- Proposed Hardstand
- Proposed Met Mast
- Proposed Substation

N

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Drawing Title: Site Location Map

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
TB	AK
Project No.	Drawing No.
200512	Figure 1
Scale	Date
1:25000	15/09/2021

MKO
Planning and Environmental Consultants
Tuam Road, Galway
Ireland, H91 VW84
+353 (0) 91 735611
email:info@mkoireland.ie
Website: www.mkoireland.ie

Contact Us

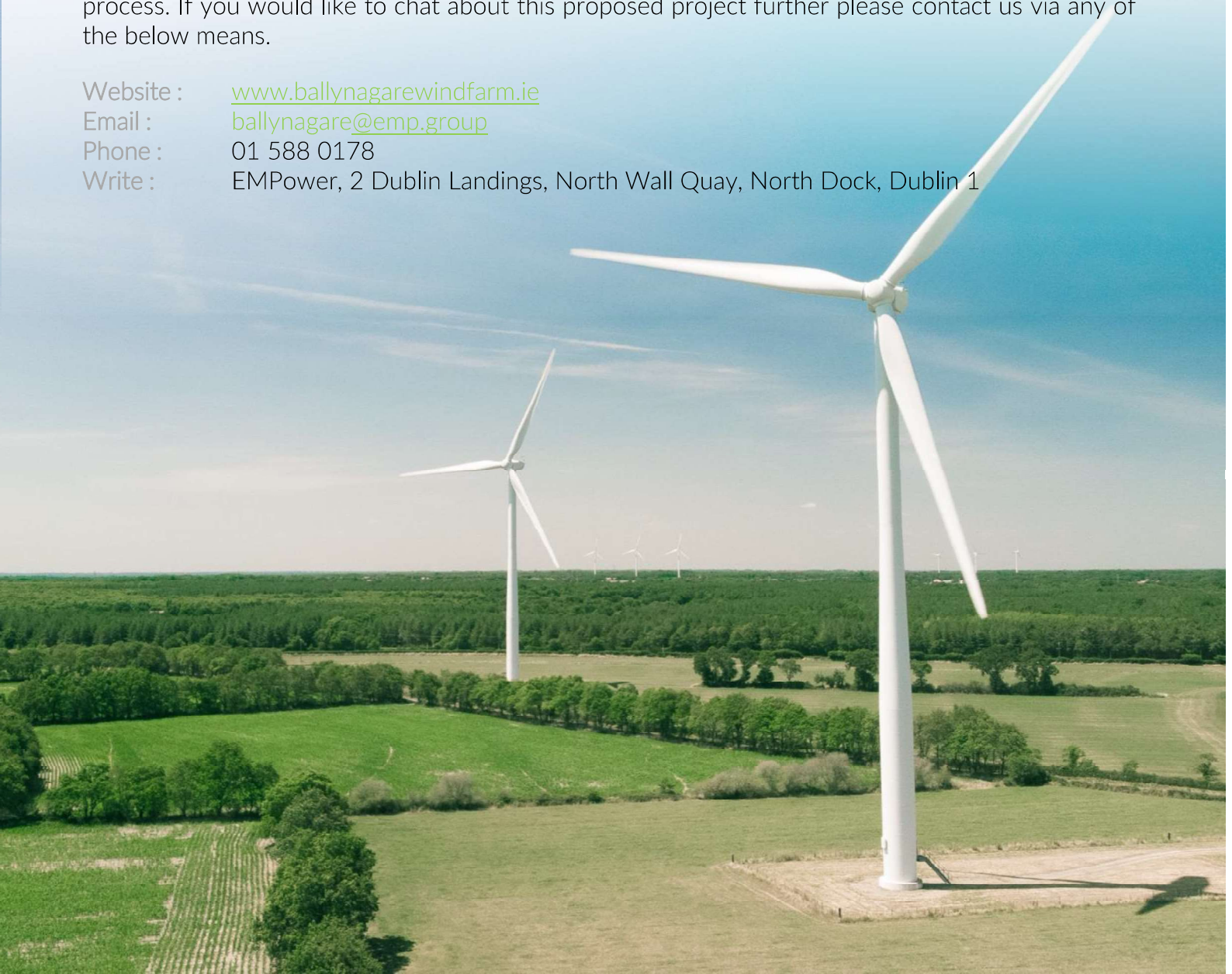
We welcome conversation, engagement and interaction with you on any aspect of how we are progressing the Ballynagare project proposal.

As previously communicated via project webinars and newsletters, EMPower intend to submit the planning application for the proposed Ballynagare Wind Farm project over the coming weeks. We will place notice of this in the Kerryman newspaper as well as posting project updates on the project website to further inform interested stakeholders of this milestone. Following this, an opportunity for the public to comment further on this planning application will also be available via the planning process. All submitted planning documentation will be available on the Ballynagare project website for public viewing.

There will also be a dedicated On-line Project Community Consultation room launched over the coming weeks where you can view further detailed project information including an interactive photo viewer depicting the project as it would look if built out. Once launched, access will be available through our project website at www.ballynagarewindfarm.ie.

We will remain contactable through phone, email and by post throughout this planning application process. If you would like to chat about this proposed project further please contact us via any of the below means.

Website : www.ballynagarewindfarm.ie
Email : ballynagare@emp.group
Phone : 01 588 0178
Write : EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1



Reference 2.1 – Letter to Local Residents, Nov. 2020

EMPOWER
2 Dublin Landings, North Wall Quay
North Dock, Dublin D01 V4A3
E: info@emp.group
T: +353 (0)1 588 0178

RE: Proposed Wind Farm Development at Ballynagare

Dear Resident,

EMPower (EMP) is an international wind energy developer, managing a development portfolio of over 700MW in Europe and Africa. Founded by three Irish directors, our goal is to support Ireland's climate objectives through the development of appropriately located, clean, indigenous energy infrastructure.

We are currently preparing a proposal to develop a 10-turbine wind farm in the townlands of Ballynagare, Dysert, Dysert Marshes and Curraghcroneen, Co. Kerry. This project is proposed be 56 MW in capacity and would produce enough renewable electricity to power 33,000 Irish homes per year. Our intention is to submit a Strategic Infrastructure Development planning application to An Bord Pleanála in Q2 2021, as this is a legal requirement for wind farm applications of this scale.

Ballynagare Wind Farm will also provide a community fund calculated in accordance with the Renewable Electricity Support Scheme (RESS) Terms and Conditions at €2 per MWh of electricity produced by the project. This is to be made available to the local community for the duration of the RESS (15 years). The average capacity factor of wind energy projects in Ireland is 28.3%. Using this efficiency figure as an example, and a capacity of 56 MW, the community benefit fund would amount to an average of €277,657 per annum. The actual fund will vary around the average from year to year, depending on wind conditions. Current on-site wind measurements suggest that Ballynagare will be capable of achieving an above average capacity factor, and therefore a larger community fund.

As a component of this fund, an annual payment of **€1,000** will be provided to each household within 1km of any Ballynagare Wind Farm turbine. An additional annual payment of **€500** will be provided to each household between 1km and 1.5km of any Ballynagare Wind Farm turbine. If you would like to enquire as to the distance of your home from this project, please feel free to contact us at info@emp.group.

Local not-for-profit enterprises, clubs, and societies will also be eligible to receive funding from the community benefit scheme, as is further detailed in the enclosed Community Consultation Leaflet. We would be grateful for your suggestions of projects that you believe should be supported by this fund.

As part of our public consultation campaign, we had scheduled house-calls to all residents within 2km of the project over the summer and autumn of 2020. Unfortunately, due to public health concerns regarding COVID-19, this was not possible. The safety of the public and our staff is of paramount importance to us.

We will aim to host a physical event and offer home visits upon request once health guidelines allow it. In the interim, in order to provide project information in an interactive manner, **we will host a live webinar on Wednesday 2nd December from 7-8pm. You can register for this event at www.ballynagarewindfarm.ie.**

Our project website (www.Ballynagarewindfarm.ie) will be updated regularly with reports as they are made available and the final EIA will be published for comments prior to submission. You may submit comments through the website, write to us at EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1, or alternatively, you can email us directly at info@emp.group.

We look forward to hearing from you.

Yours Sincerely,

Alexander Kelly – Project Manager EMPower Group

EMPOWER is a registered trading name of EMP Energy Limited, a private limited company registered in Ireland under company number 630312. **Directors:** Diarmuid Anthony Twomey, Iñigo Sabater Eizaguirre, Ingmar Wilhelm, Vimal Vallabh, Seán mac Cann. **Registered office:** 2 Dublin Landings, North Wall Quay, North Dock, Dublin D01 V4A3.

Reference 2.2 – Letter & FAQ to Local Residents, Mar. 2021

EMPOWER
2 Dublin Landings, North Wall Quay
North Dock, Dublin D01 V4A3
E: info@emp.group
T: +353 (0)1 588 0178

14 March 2021

Dear Resident,

EMPower is pleased to advise you that we will be hosting our second Public Consultation Webinar for the proposed Ballynagare Wind Farm on Wednesday the 24th March 2021 between 7pm and 8pm.

You can register for the Webinar at the project website, www.ballynagarewindfarm.ie.

EMPower is an Irish wind energy developer, managing a development portfolio of over 700MW in Europe and Africa. Founded by three Irish directors, our goal is to support Ireland's climate objectives through the development of appropriately located, clean, indigenous energy infrastructure.

We are currently preparing a proposal to develop a 10-turbine wind farm on the townlands of Ballynagare, Dysert, Dysert Marshes and Curraghcroneen, Co. Kerry. This wind farm would be up to 60 MW in capacity and would produce enough renewable electricity to power over 35,000 Irish homes per year[1]. Our intention is to submit a Strategic Infrastructure Development planning application to An Bord Pleanála during the summer of 2021, as this is a legal requirement for wind farm applications of this scale.

Throughout our consultation process, we have received numerous comments and queries from members of the local community, through email, phone calls and our Public Consultation Webinar. We would like to thank everyone who has taken the time to share their views to date. As a result of the above mentioned conversations we have compiled the following Q&A document in order to address queries raised and also to provide additional information regarding wind energy.

Where can I access the Webinar presentation?
The webinar presentation slides and video are uploaded to www.ballynagarewindfarm.ie.

Why is Kerry County Council not the planning authority for this project?
The proposed Ballynagare Wind Farm project will be submitted to An Bord Pleanála as a legal requirement under the Planning and Development Act 2010. Given that the proposed Ballynaagre Wind Farm will be 60 MW in capacity, it is categorised as strategic infrastructure and belongs to the class of development described as:
"An installation for the harnessing of wind power for energy production (a wind farm) with more than 25 turbines or having a total output greater than 50 megawatts." (Planning and Development Act, 2010) We initially consulted with Kerry County Council in 2019 but were directed to submit to An Bord Pleanála for the above reason.

How confident are you of this project going ahead?
Every precaution is being taken to address and where possible mitigate all negative environmental and social impacts of the proposed Ballynagare project to an acceptable level. From this perspective, we are confident that we are presenting a project worthy of receiving a planning permit from the relevant authority. However, there has historically been a high refusal rate for wind energy projects in Ireland, so success can never be guaranteed in this process.

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T: +353 (0)1 588 0178

[1]https://www.iwea.com - 1MW of wind capacity can provide enough electricity to supply approximately 650 homes

How are you addressing local traffic management?
There will be a Traffic Management Plan included in the Environmental Impact Assessment, identifying all intended and unintended consequences of this development on local traffic flow. Mitigation strategies will be proposed to ensure the minimal possible impact is incurred to local road users. It is a common planning grant condition for a project of this nature that local roads will be upgraded to an acceptable standard prior to construction and reinstated to this standard post construction.

Will bog plot owners have access to the Ballynagare bog during the construction and operational phases?
During construction of the wind farm project, access into and through the Bog will remain open to the general public and plot owners, except for in areas where construction is actively taking place. EMPower will never plan construction activities on a plot without securing agreement with the landowner.
The areas surrounding the turbines, hardstands, blade set down areas, substation, met mast, site compounds and peat deposition areas will be securely fenced for the duration of the 18-month construction period for health and safety purposes.

In areas where existing access roads are to be upgraded, alternative access will be provided where possible. These upgrades will take place over a 3-month period and will be scheduled so as not to interfere with access during peat harvesting season. This will be a temporary measure and is driven by health and Safety legislation and requirements. Once construction works are completed, full access will be re-established, and at that point in time there will be a new and improved road network throughout the bog along with new improved access points from local roads. Prior to commencement of the works the applicant will engage with all stakeholders to minimise disruption and to provide any alternative access where possible.

Outside of the proposed development footprint, it is not envisioned that land use activities would be adversely impacted.

How near is the nearest dwelling to any one of these Turbines?
The nearest dwelling will be at least 680m from a turbine at the proposed Ballynagare Wind Farm.

What is the Renewable Electricity Support Scheme and auction process?
The Renewable Electricity Support Scheme (RESS) provides support to renewable electricity projects in Ireland. Renewable electricity is a central element of our action on climate disruption as set out in the Programme for Government, the Climate Action Plan 2019, and the National Energy and Climate Plan 2021-2030. The RESS Scheme ensures that we are on a pathway to meet our ambitious climate targets and lays the foundations of a thriving and cost effective renewable electricity market. This will support the growth of the green economy, create sustainable work opportunities, and ultimately benefit the consumer as renewables become more cost effective.

The first RESS auction was awarded in September 2020, with the second auction planned for some time in 2021. If successful in its permitting and grid connection applications, the proposed Ballynagare Wind Farm project will aim to bid into the third or fourth RESS auction in 2023.

How will the community benefit scheme be allocated?
If constructed, Ballynagare Wind Farm will provide a community fund of approximately €297,490 per year on average, to be made available to the local community for the duration of the

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Renewable Electricity Support Scheme (15 years). The total fund is calculated as €2/MWh of electricity produced by the project, and as such, may vary depending on the final permitted capacity and generation performance of the project.

As a component of this fund, an annual payment of €1,000 will be provided to each household within 1km of any Ballynagare Wind Farm turbine. An additional annual payment of €500 will be provided to each household between 1km and 1.5km of any Ballynagare Wind Farm turbine. If you would like to enquire as to the distance of your home from this project, please feel free to contact us at info@emp.group.

Local not-for-profit enterprises, clubs, and societies will also be eligible to receive funding from the community benefit scheme. More information regarding the planned allocation can be found on the project website (www.ballynagarewindfarm.ie).

It is ultimately EMPower's belief that the allocation of the community fund should, while adhering to the Terms and Conditions of the RESS, be directed primarily by the community members. For this reason, there will be further consultation regarding the allocation and administration of the community benefit fund and a local working group established before it is finalised.

What happens after the Renewable Electricity Support Scheme? Does the community fund continue?
The 2 €/MWh community fund, amounting to an approximate average of €297,000 annually, will run for the duration of the Renewable Electricity Support Scheme, which will be 15 years. After this scheme is completed, Ballynagare Wind Farm Limited will revise this fund based on market conditions at the time and establish a new fund for the remaining years of the project.

Will the 2 €/MWh RESS community benefit fund increase over the 15 years in line with inflation?
The community fund is designed to be linked to the performance of the wind farm, in that for every MWh the wind farm receives revenue for, it contributes €2 to the community fund. Given that the revenue the wind farm will receive, as per the RESS Terms and Conditions, does not increase in line with inflation, neither will the contribution to the community fund.

What happens when/if the wind farm is sold to private holders, then what will happen to the community benefit scheme payments?
The community fund is a condition of the Renewable Electricity Support Scheme, and therefore, no matter who owns the project, the project will be required to pay this community fund of 2 €/MWh for the duration of the scheme.

Are any annual payments received taxable?
To EMPower's knowledge, annual near neighbour payments will be taxable as income tax. However, please seek your own financial and legal advice regarding this point.

Why hasn't anybody from EMPower visited my home to consult face to face?
We had planned to carry out door to door visits to all households within 1.5km of the project but in order to comply with public health guidelines surrounding COVID-19, we have as yet been unable to complete these visits. Instead, we have endeavoured to consult with the local community through letter drops to all households within 1.5km, as well as public consultation webinars and individual communication over email and phone calls.

Who will be developing the wind farm?
EMPower are the sole developers and owners of the proposed Ballynagare Wind Farm. EMPower is owned by EMP Holdings Limited, Wind Power Invest A/S and GGE Ireland Limited.

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What is the make and model of the turbine proposed?
If the project is successful, the final make and model of the turbine will be finalised post planning through a competitive tender process. It will not be greater than 170m in overall tip height. For the purpose of the environmental impact analysis, "greatest likely impact scenarios" are taken from a number of different turbines including the Vestas V150 6.0 MW model.

Why have you had a monitoring station in the Ballynagare Bog for a number of months prior to the Webinar in December 2020?
The temporary wind measurement device which was installed at Ballynagare served to confirm that there was sufficient wind resource at this location to warrant proposing a project here. Before this was confirmed, the EMPower had not made a decision to propose any project and so had no information with which to consult.

Are any further wind farm expansion plans being considered in the area?
No. EMPower are not considering further expansion of the Ballynagare Wind Farm, or of developing new wind farms in the locality.

How do I find out if my plot of bog will be affected by the proposed windfarm?
EMPower will contact and seek agreement from all plot owners that are likely to experience direct effects from construction activities associated with the proposed wind farm.

How is the setback distance of turbines from housing calculated?
The setback distance to housing will be 4 x tip height of turbines, in line with the proposed Draft Wind Energy Development Guidelines 2019.

Has site access route been considered?
A number of site access options are currently being considered. Our intention is to select the least impact, technically feasible approach and mitigate any negative impacts to an acceptable level before planning submission. The Traffic Management Plan will form a key document in this regard.

Is battery storage needed?
EMPower do not plan to apply for battery storage infrastructure as part of this project's planning submission.

Have specific flora and fauna in the area, such as the Whooper Swan, been considered by EMPower in your assessments?
The EIA studies being undertaken at the moment have regard to likely impacts on all flora and fauna in the local area, particularly those considered significant or protected. We will be taking every care to mitigate through design where possible, as well as other methods, any negative impacts that would likely due to the development of this wind farm. To an acceptable level

What is the lifetime of a wind project and what happens to the wind farm at the end of its life?
Our intention is to apply for a 30-year planning permission at Ballynagare Wind Farm. When the operation lifetime of the project comes to an end, there are two possibilities. The project can enter into an entirely new planning process to seek consent to repower the project. This process will be subject to the planning legislation at that time. Alternatively, it can be fully decommissioned, whereby the turbines and supporting infrastructure is disassembled and removed, and the land is reinstated to its original condition. Before construction begins, a decommissioning bond is established to ensure funding is always available to decommission the project and reinstate the land.

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What are the standards and methods for shadow flicker control?
Ballynagare Wind Farm will be observing a zero-tolerance limit for shadow flicker impacts on local residences. In order to prevent shadow flicker occurring, the times of day of potential occurrence have been identified. This approach is in line with the Draft 2019 Revised Wind Energy Development Guidelines.
The correct operation of the installed shadow flicker control measures will ensure that there will be no impact from shadow flicker. The operation and performance of the shadow flicker control measures will be monitored on an ongoing basis.

What has wind energy cost the Irish consumer?
In January 2019, management and research consultancy, Baringa, conducted a financial impact analysis for end consumers of wind generation in Ireland over the period 2000-2020. The analysis indicated that the deployment of 4.1 GW of wind generation capacity in Ireland between 2000 and 2020 will result in a total net cost to consumers, over 20 years, of €0.1bn (€63 million to be exact), which equates to a cost of less than €1 per person per year.
(Source: Baringa - https://www.iwea.com/images/files/baringa-wind-for-a-euro-report-january-2019.pdf)
In the near future, as wind energy reaches cost competitiveness with new and existing gas fired plants, there will be a net financial benefit to electricity consumers for each turbine installed, in addition to all of the environmental and health benefits.

Do wind farms effect house prices?
Research from around the world has shown that wind farms do not impact on house prices. In Britain, the Centre for Economics and Business Research (CEBR), found that wind turbines did not effect property sale prices. In the United States, researchers supported by the US Department of Energy (2014) also reached this conclusion.
(Source: CEBR - https://cdn.ymaws.com/www.renewableuk.com/resource/resmgr/publications/reports/ruk-cebr-study.pdf)
(Source: Hoen et al - https://emp.lbl.gov/sites/all/files/lbnl-6362e.pdf)
(Source: ESB - https://www.esb.ie/our-businesses/generation-energy-trading-new/wind-energy/wind-energy-frequently-asked-questions)

Why not site wind turbines offshore? Are offshore turbines more environmentally friendly?
The urgent need to respond to climate change means that we'll need to use as many renewable resources as quickly as possible, including both onshore and offshore wind. At present onshore wind is one of the most economically competitive of the renewable technologies. Due to the technical hurdles of offshore construction and connection to the national grid, there is unlikely to be any offshore wind projects competing in the initial rounds of the RESS auctions. When projects and supporting grid infrastructure are ready, offshore wind will compete on price with other renewable technologies and the most economic solution will succeed.
(Source: EWEA - http://www.ewea.org/wind-energy-basics/faq/?tx_irfaq_pi1%5Bcat%5D=2)

There is no consensus among peer reviewed literature to suggest that offshore wind turbines are more environmentally friendly than onshore turbines. Both technologies create substantially less environmental damage than conventional thermal electricity generation through long term climate change mitigation.

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Thank you for participating in the consultation process for the proposed Ballynagre Wind Farm thus far. We look forward to continuing the consultation throughout the planning process and hopefully beyond.

If you have any further questions, please feel free to contact us at the following:

Email
info@emp.group

Telephone
01 588 0178

Post
EMPower
2 Dublin Landings
North Wall Quay
North Dock
Dublin 1

We look forward to engaging with you at the Public Consultation Webinar on the 24th March.

Kind regards,

Alexander Kelly

Project Manager
Community Liaison Officer

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Reference 2.3 – Letter to Local Residents, Sep. 2021

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31/08/2021

Re: Proposed Ballynagare Wind Farm in the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, and Monument, County Kerry.

Dear Resident,

As communicated via previous project newsletters and webinars, EMPower are actively exploring the potential for a wind farm development opportunity in the Ballynagare area of Co. Kerry.
The Study Area for the proposed project is located approximately 2km north of the village of Lixnaw and approximately 8.8km southwest of the town of Listowel. You will find more information on EMPower and this proposed project at www.ballynagarewindfarm.ie.

The project team are now beginning to conclude the project's scoping phases with statutory and non-statutory consultees. This will inform the proposed project's final design.

The project team will host another project specific live webinar on Wednesday 09th September from 7-8pm. You can register for the event at www.ballynagarewindfarm.ie.

This Webinar will detail elements of the ongoing project design process and members of the project team will be available to talk through any aspect of the project proposal which you would like to discuss further.

We commit to distributing future project information over the coming weeks as the final design proposal takes shape and as we approach a project planning submission to Kerry County Council. This will set out some more detailed information on the design process undertaken and also follow up on some of the questions and queries we have received to date.

We will also initiate an online community consultation room over the coming weeks. This community consultation room will give you the opportunity to interact with much more project information including the visual representations prepared for the proposed project.

We will continue to make every effort to ensure that we provide you with all the information you need in order to fully understand the details of this proposed project as it progresses.

We would welcome the opportunity to discuss any aspect of the proposed project with you so please do make contact with the Project Team using any of the contact details below if there are any areas of the proposed project you wish to discuss further.

Yours Sincerely

Diarmuid Twomey,
EMPower Managing Director

Email :	ballynagare@emp.group
Website :	www.ballynagarewindfarm.ie
Phone :	01 588 0178
Write :	EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1.

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Reference 3.1 – Public Consultation Webinar No.1 Slides

Proposed Ballynagare Wind Farm
Public Consultation Webinar



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Ballynagare Wind Farm Proposal

EMPower

- Company Introduction
- Wind Farm Design
- Community Fund
- Q&A
- EIA Activities
- Q&A
- Conclusion



Company Introduction

EMPower

95 Years

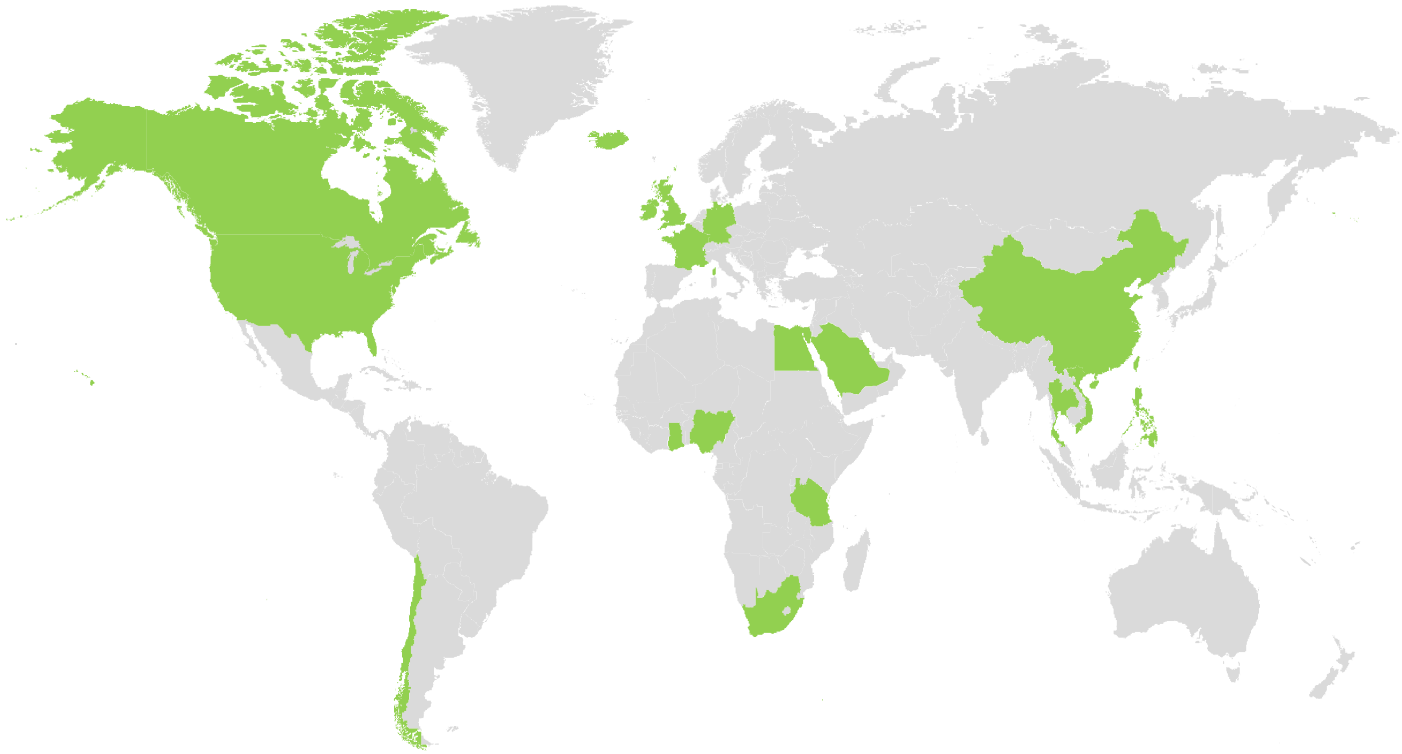
Combined Experience of EMPower Management Team in Renewable Energy

+700 MW

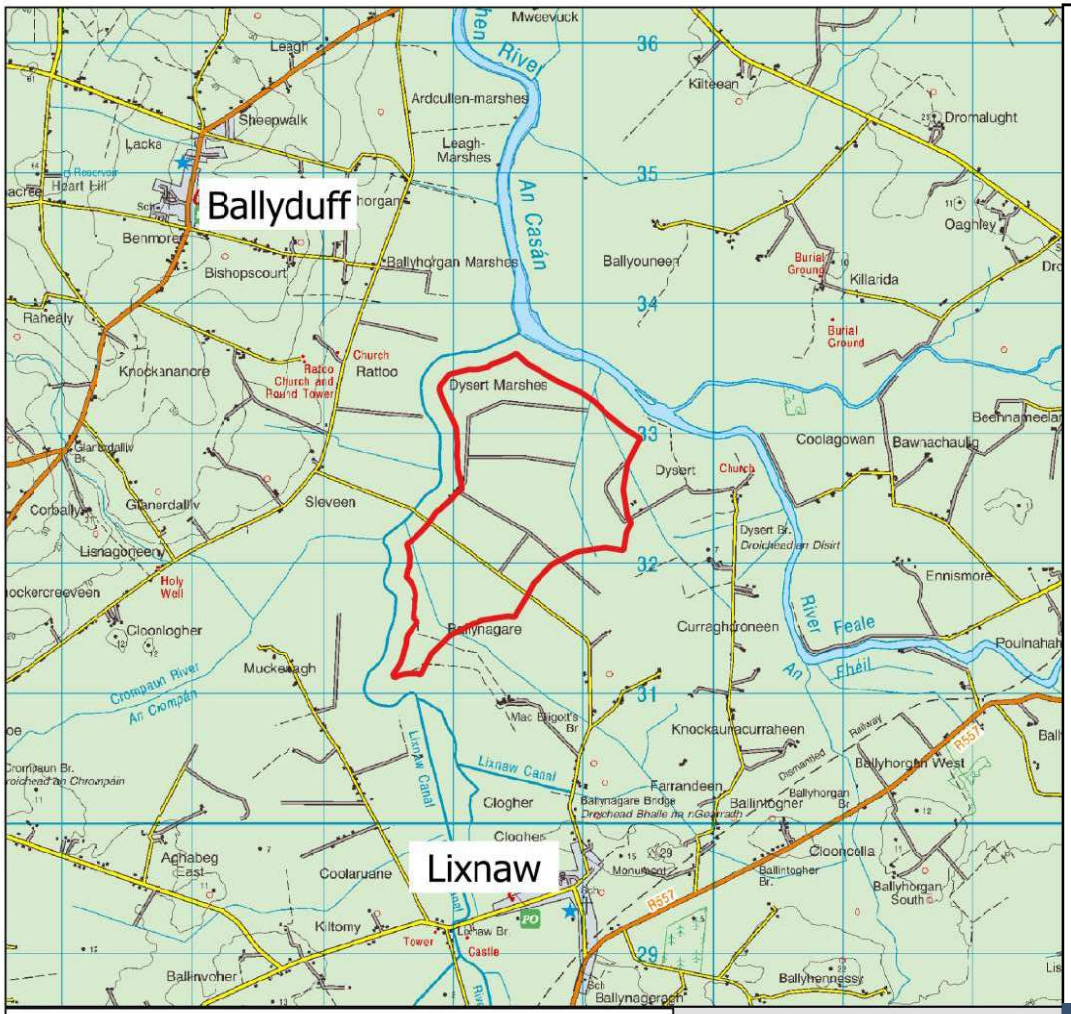
Wind Energy Capacity Currently Under Development By EMPower

5 Continents

Combined Geographical Experience of EMPower Team in Renewable Energy



Project Introduction



Proposed Ballynagare Wind Farm

-

Ballynagare, Dysert, Dysert Marshes and Curraghcroneen in Co. Kerry

-

Up to 10 Turbines

-

Estimated 56 MW

-

Tip height of 165m to 170m

-

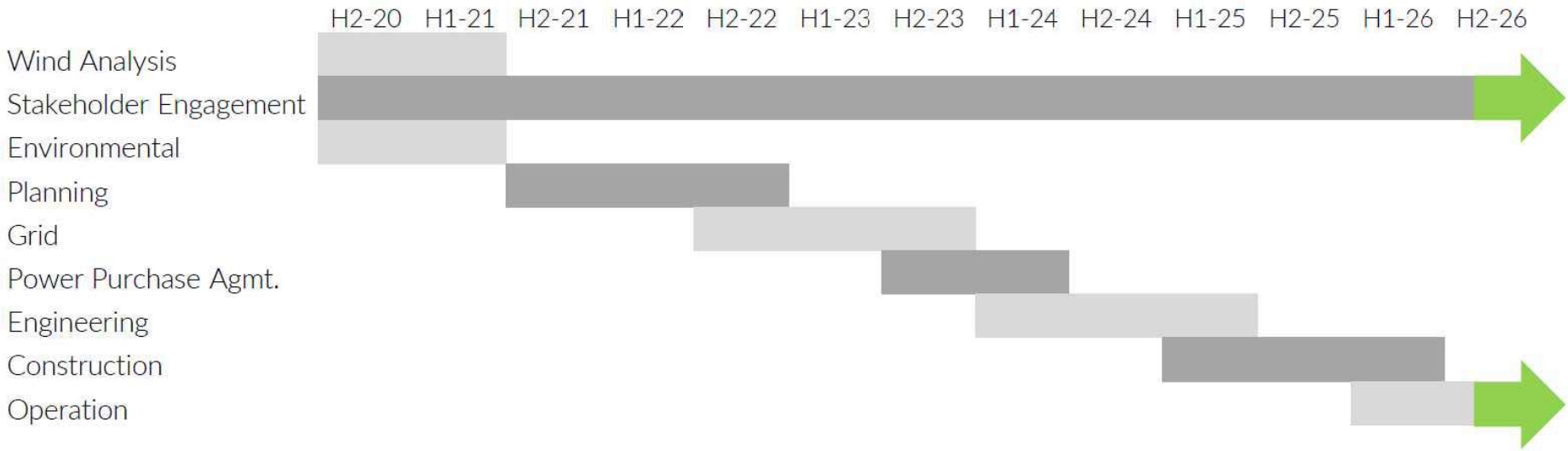
Enough clean electricity to power over 33,000 Irish homes

-

Estimated community benefit fund of €277,657 per annum

Proposed Project Schedule

Planning Submission to An Bord Pleanala (Strategic Infrastructure Development)	Summer 2021
Grid Connection Submission	Summer 2022
Renewable Electricity Support Scheme Submission	Summer 2023
Construction Commences	Spring 2025



Energy Targets in Ireland

EMPower

Table 7.5 Potential Metrics to Deliver Abatement in Electri

Key Metrics	2017	2025 Based on MACC	2030 Based on MACC
Share of Renewable Electricity, %	~30%[20]	52%	70%
Onshore Wind Capacity, GW	~3.3	6.5	8.2
Offshore Wind Capacity, GW	NA	1.0	3.5
Solar PV Capacity, GW	NA	0.2	0.4
CCGT Capacity, GW	~3.6	5.1	4.7

70%
Renewables by 2030

8.2 GW
Onshore wind by 2030

Source – Department of Communications, Climate Action and Environment
Climate Action Plan 2019
Marginal Abatement Cost Curve (MACC) Analysis

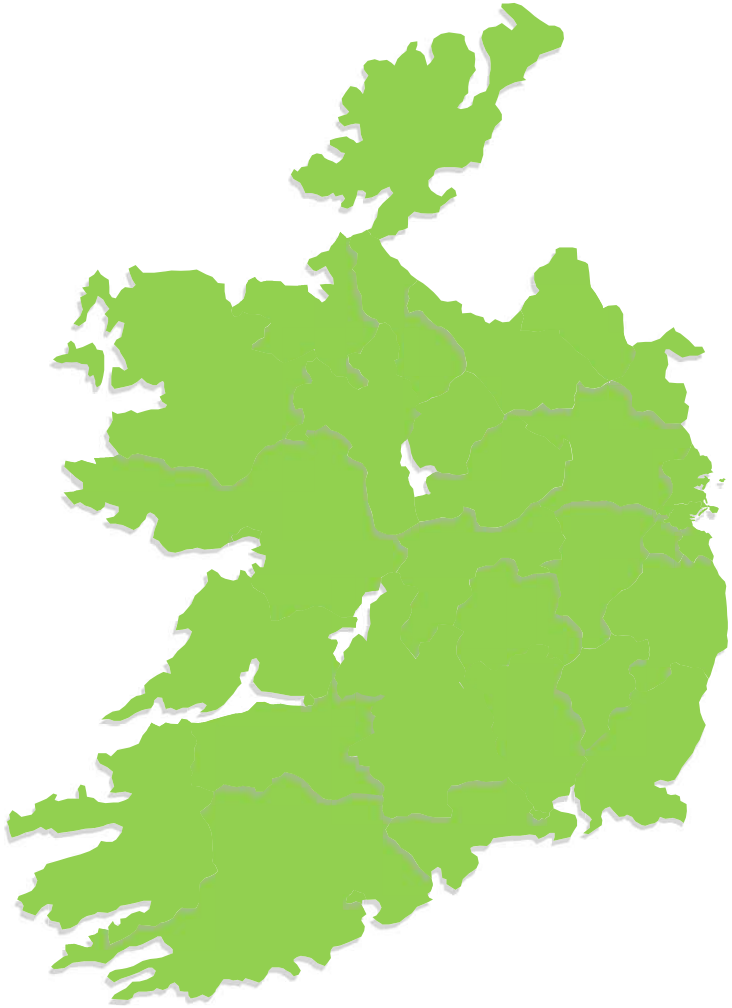
Site Screening

EMPower

Grid | Wind | CDP | SACs | Housing | Capacity | Land

Screening analysis performed on the entire Republic of Ireland incorporating constraints such as:

- Wind speed
- Grid connection
- Environmental Designations
- Culture and heritage
- Tourism
- County Development Plans
- Existing, planned and permitted projects
- Housing



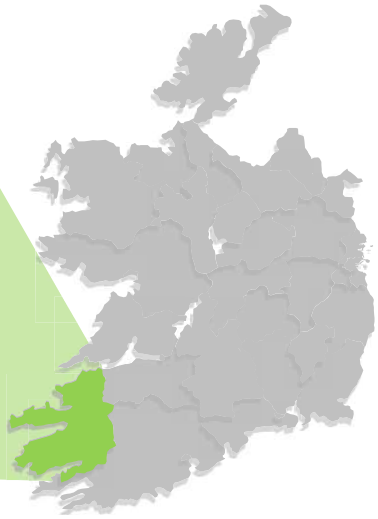
Site Screening

EMPower

Grid → Wind → CDP → SACs → Housing → Capacity → Land



Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

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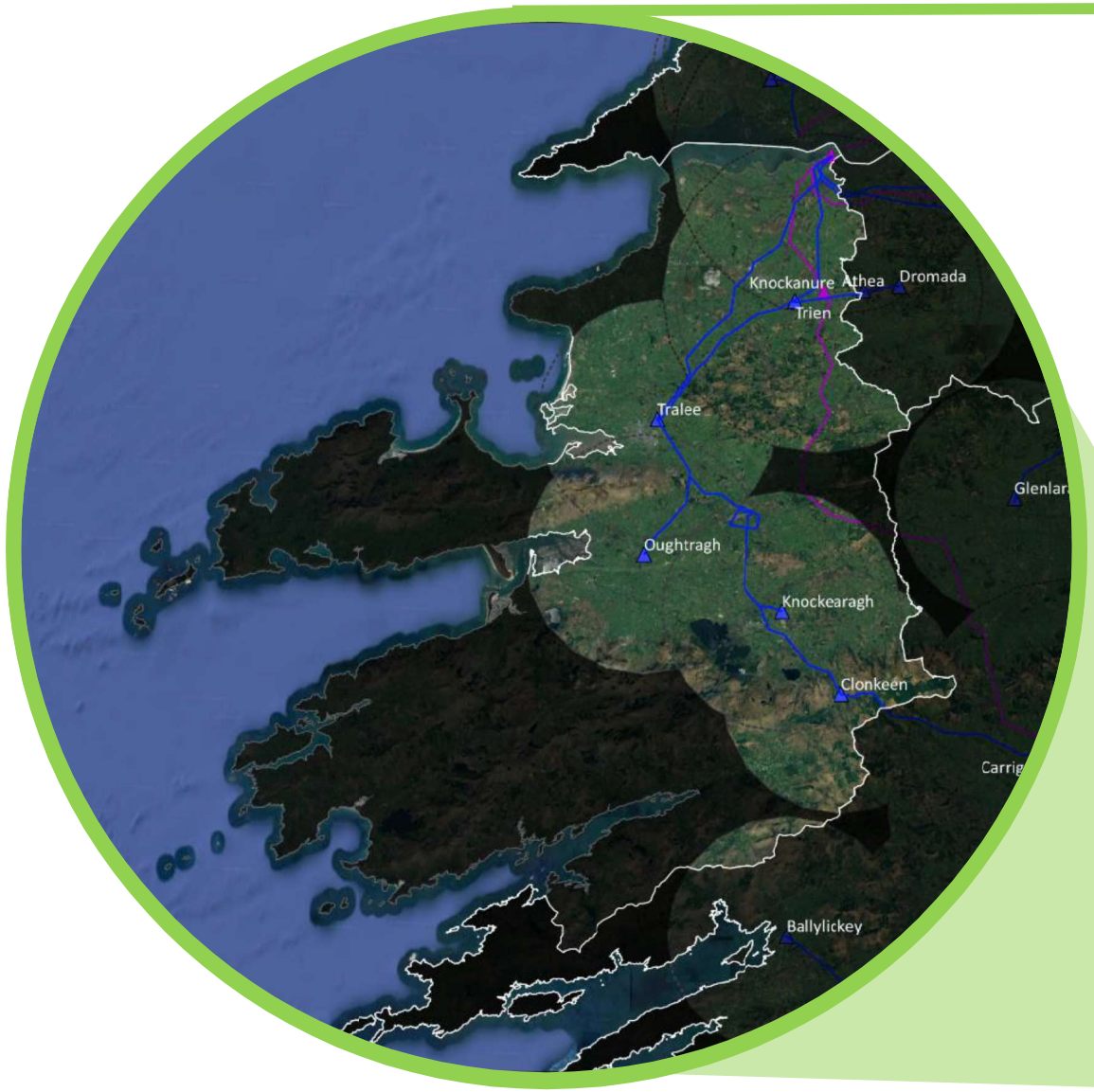
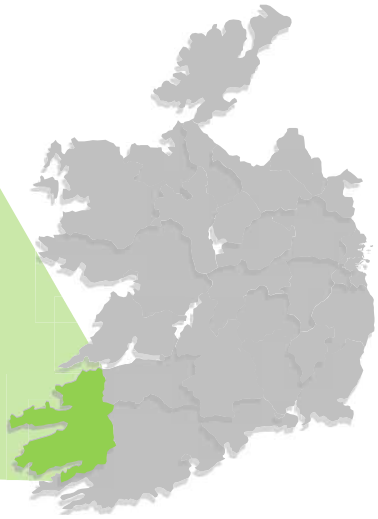
Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- 220kV Line
- 220kV Substations
- 110kV Substations
- 110kV Line
- Areas Outside Economic Distance of Grid

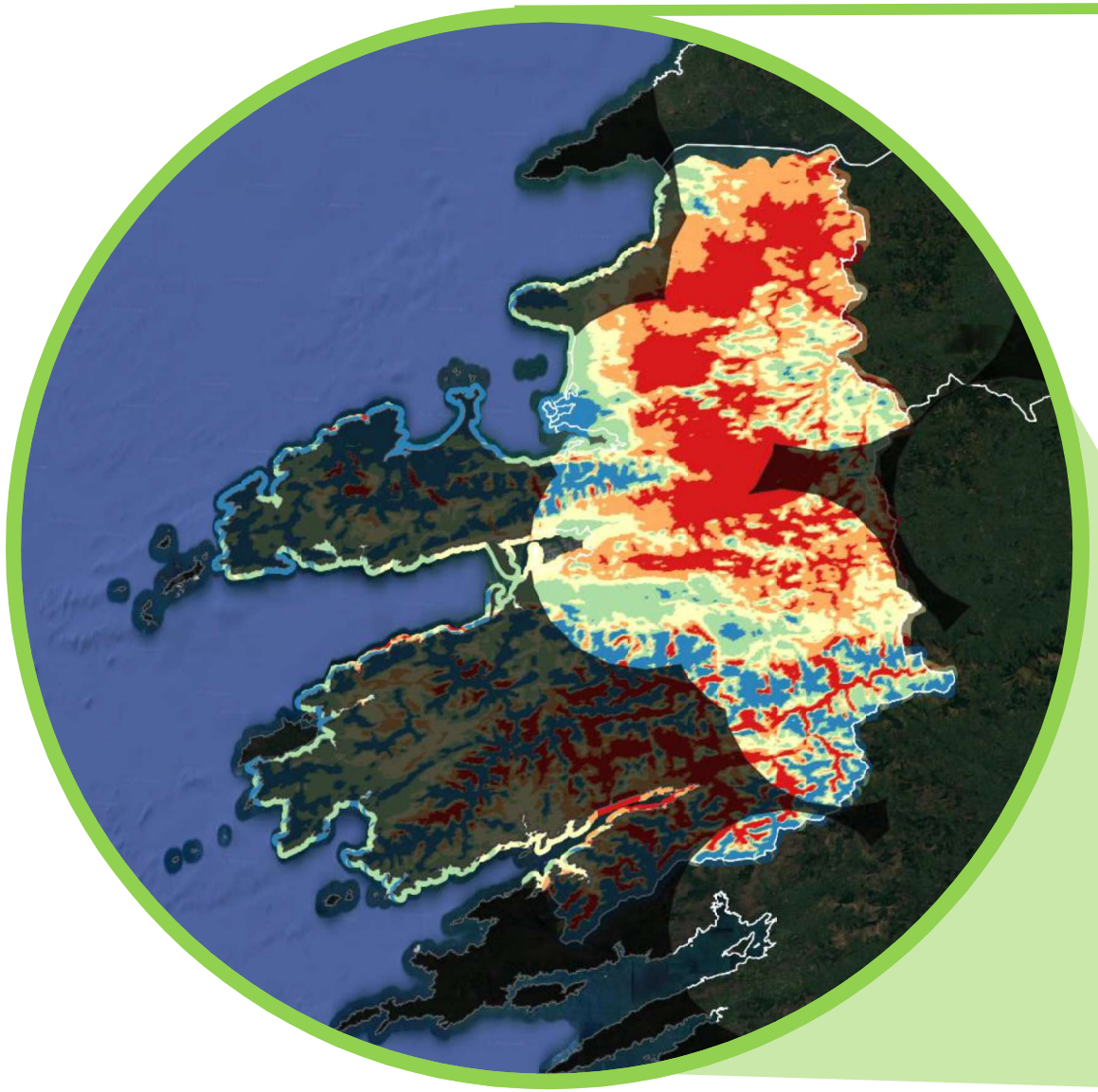
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

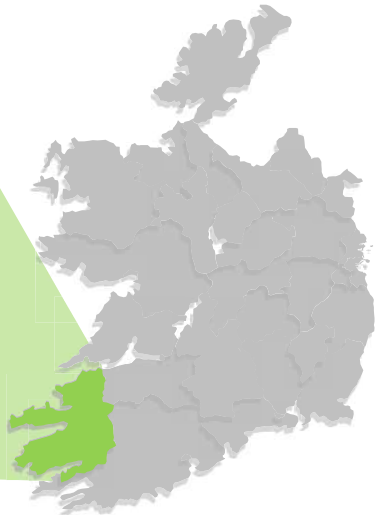
Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- 220kV Line
- 220kV Substations
- 110kV Substations
- 110kV Line
- Areas Outside Economic Distance of Grid

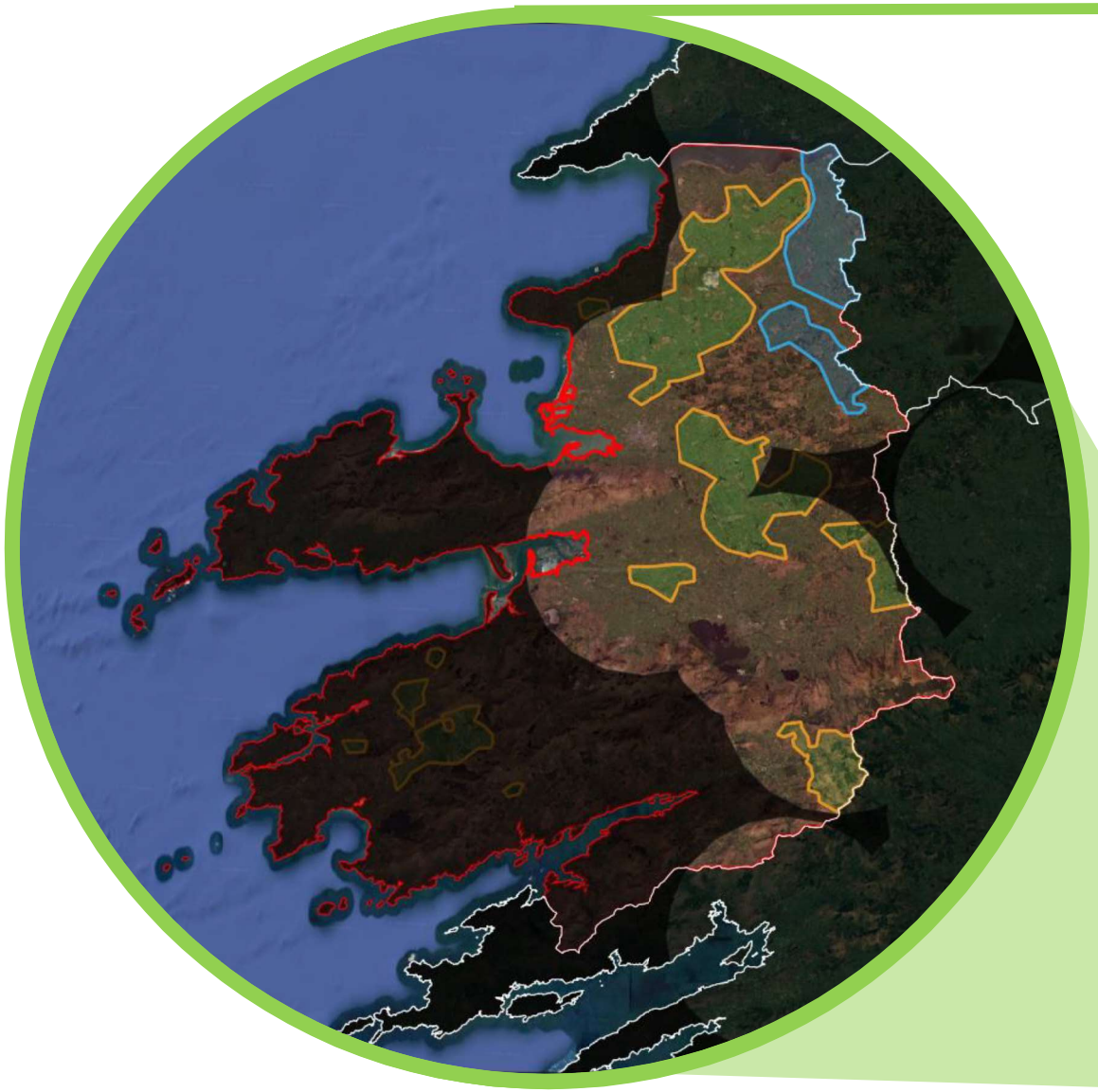
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

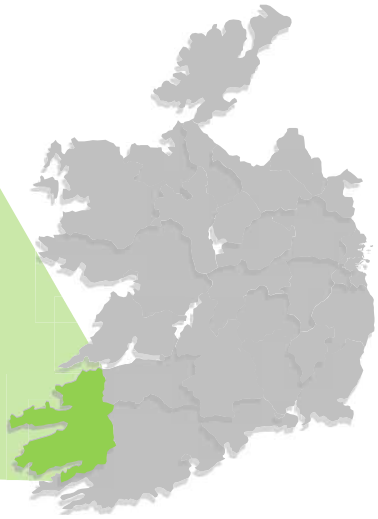
Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- 220kV Line
- 220kV Substations
- 110kV Substations
- 110kV Line
- Areas Outside Economic Distance of Grid
- Kerry Strategic
- Kerry OTC
- Kerry Unsuitable

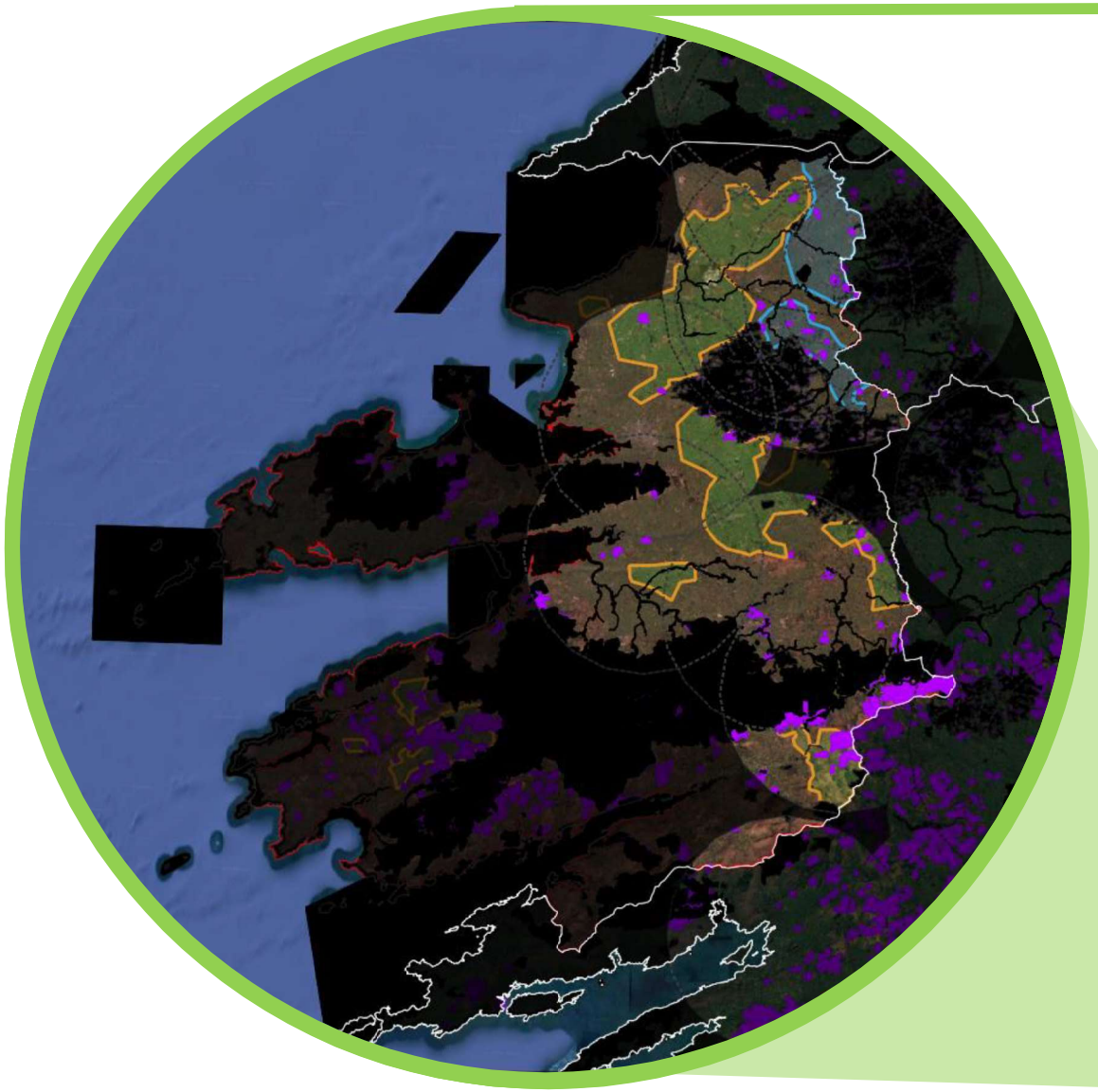
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

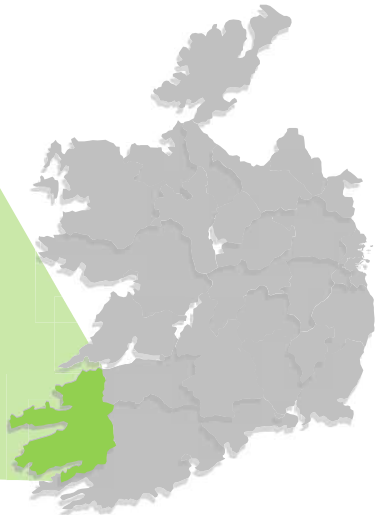
Grid → Wind → CDP → SACs → Housing → Capacity → Land



Legend

- Kerry Strategic
- Kerry OTC
- Kerry Unsuitable
- Environmental Designations
- Coillte Land

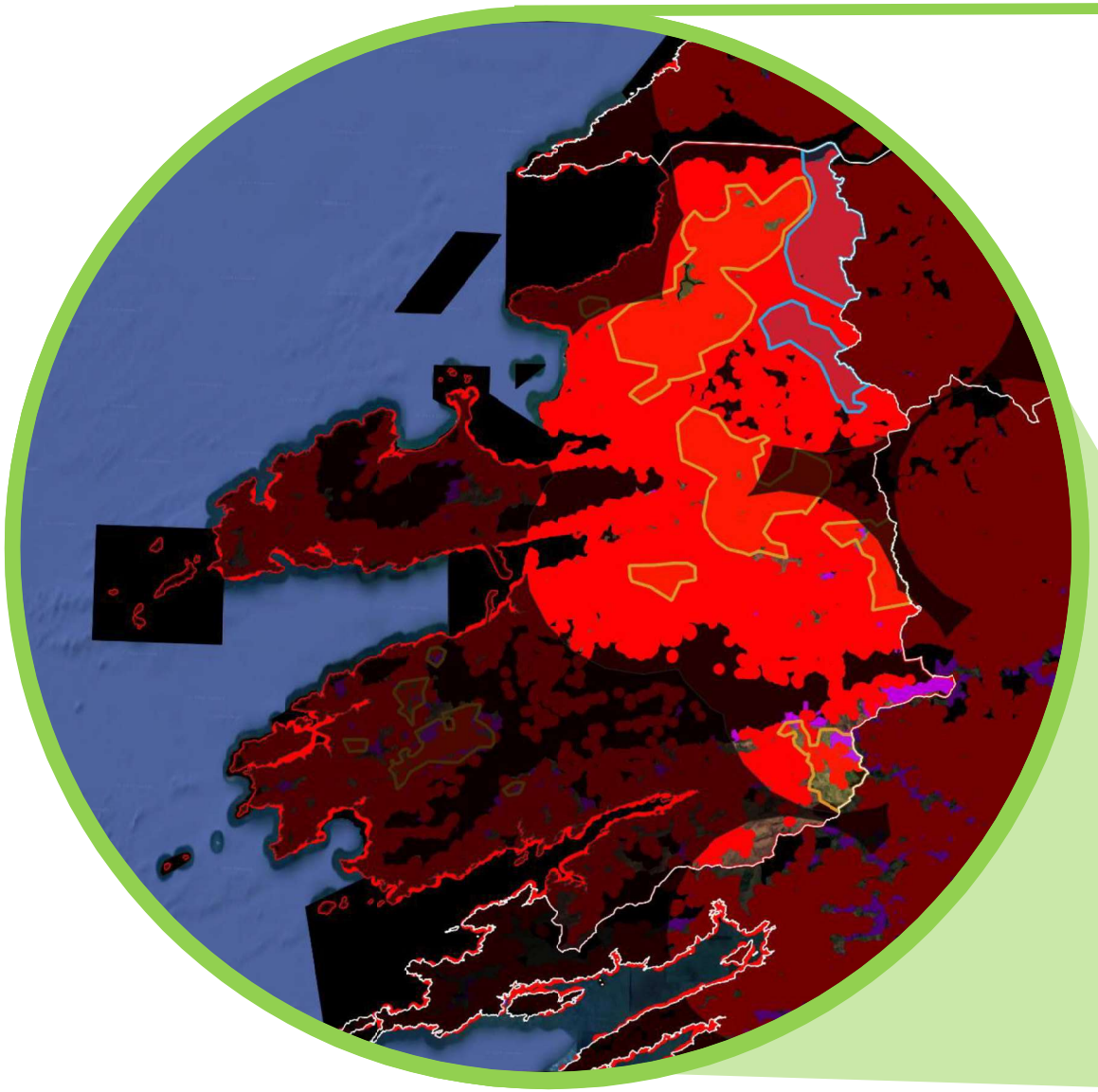
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

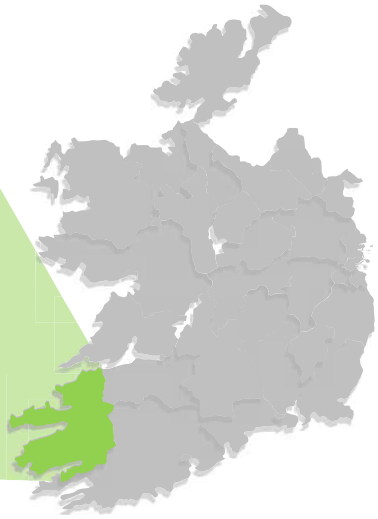
Grid → Wind → CDP → SACs → Housing → Capacity → Land



Legend

- Kerry Strategic
- Kerry OTC
- Kerry Unsuitable
- Environmental Designations
- Coillte Land
- 700m Buffers on Residential and Commercial Buildings

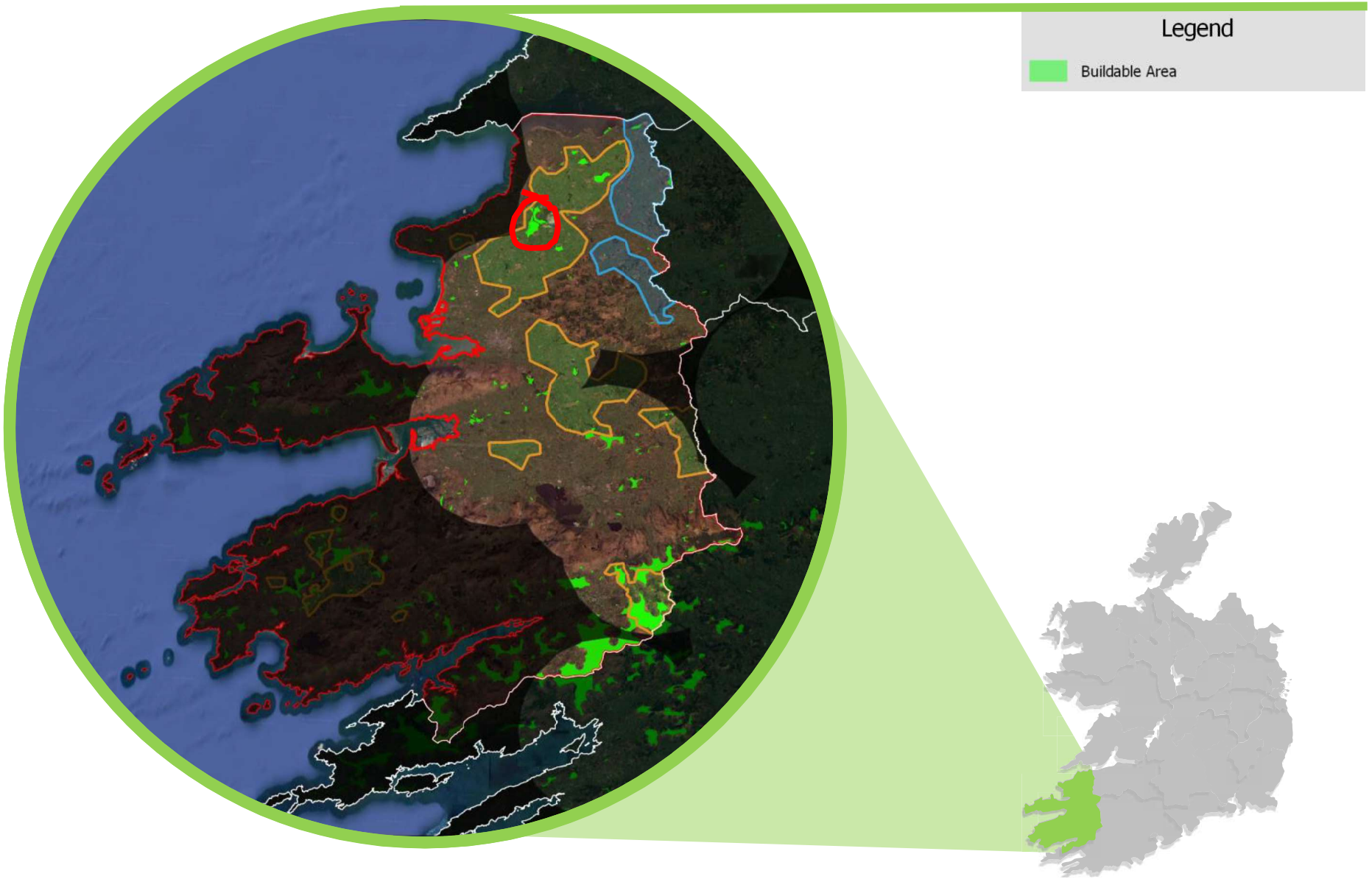
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

Grid → Wind → CDP → SACs → Housing → Capacity → Land



Site Screening

EMPower

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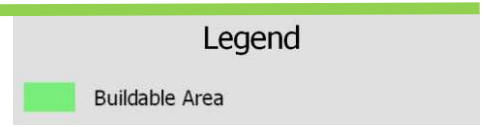
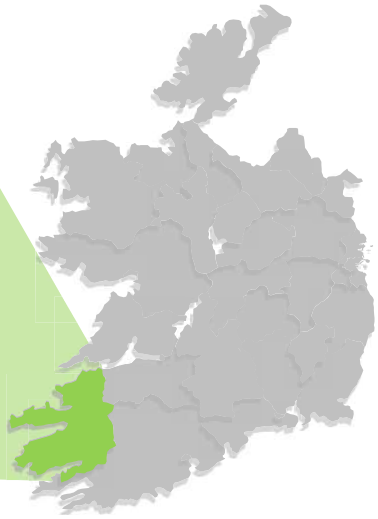
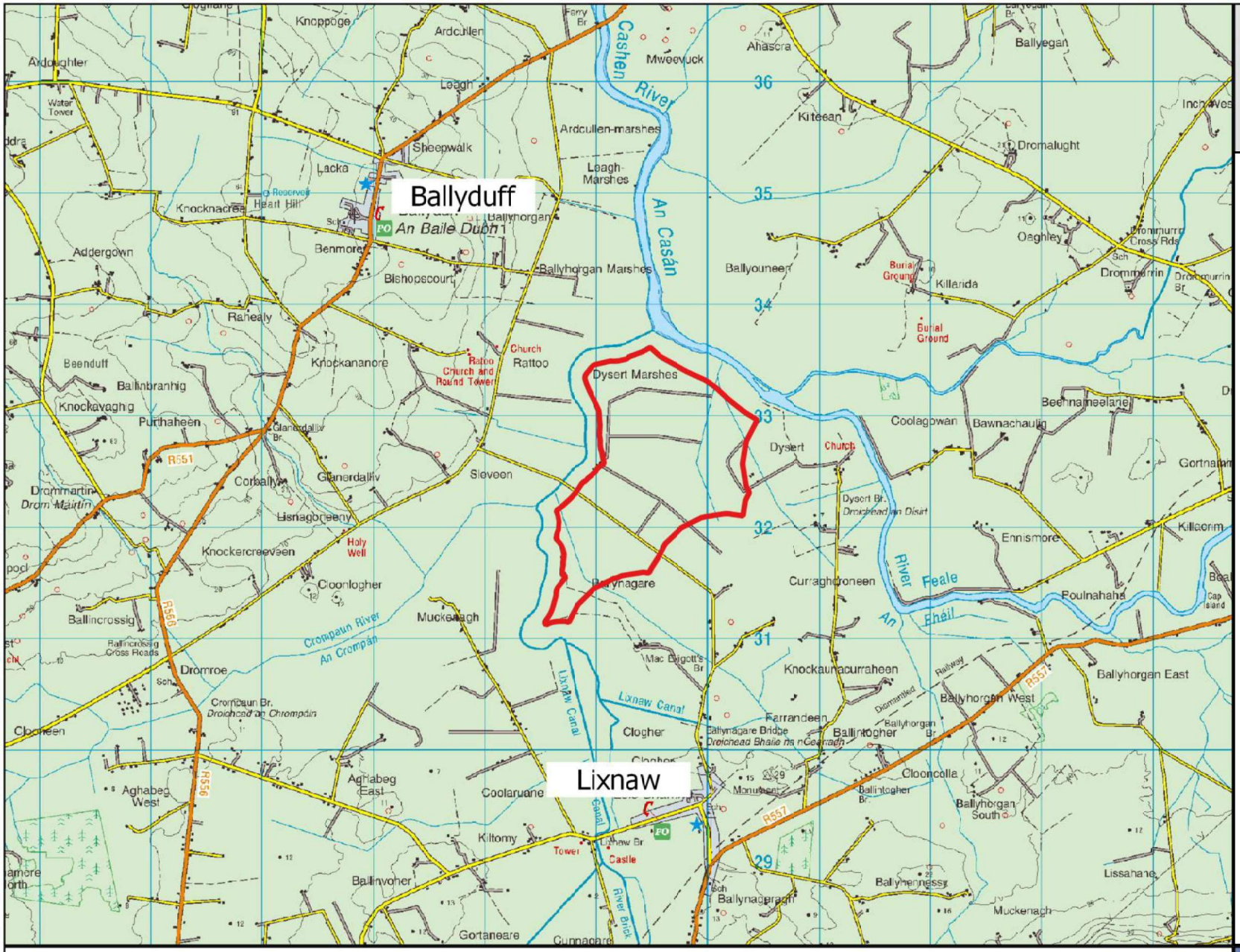






Legend

Ballynagare Buildable Area

Proposed Ballynagare Wind Farm

-

Ballynagare, Dysert, Dysert Marshes and Curraghcroneen in Co. Kerry

-

Up to 10 Turbines

-

Estimated 56 MW

-

Tip height of 165m to 170m

-

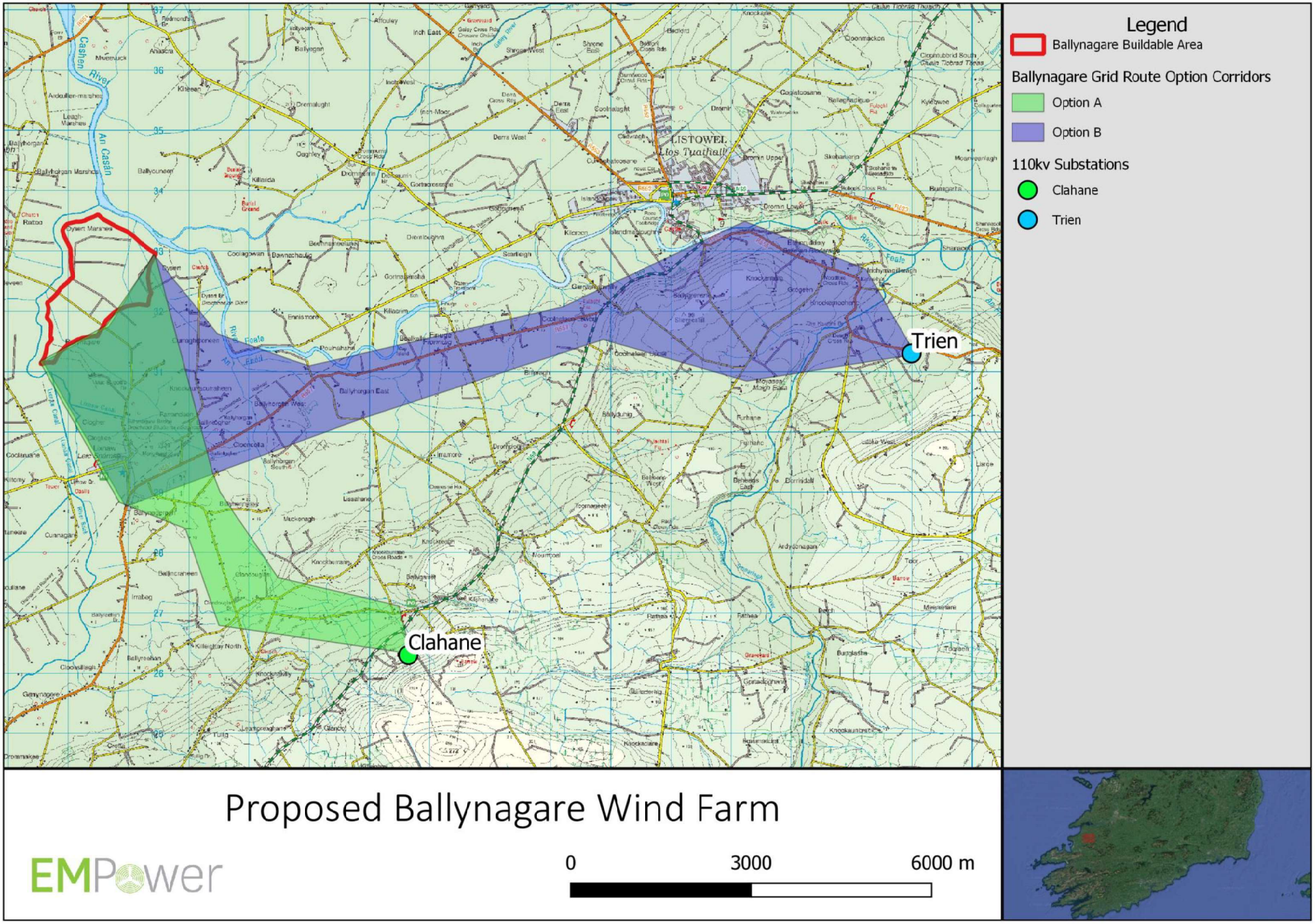
Enough clean electricity to power over 33,000 Irish homes

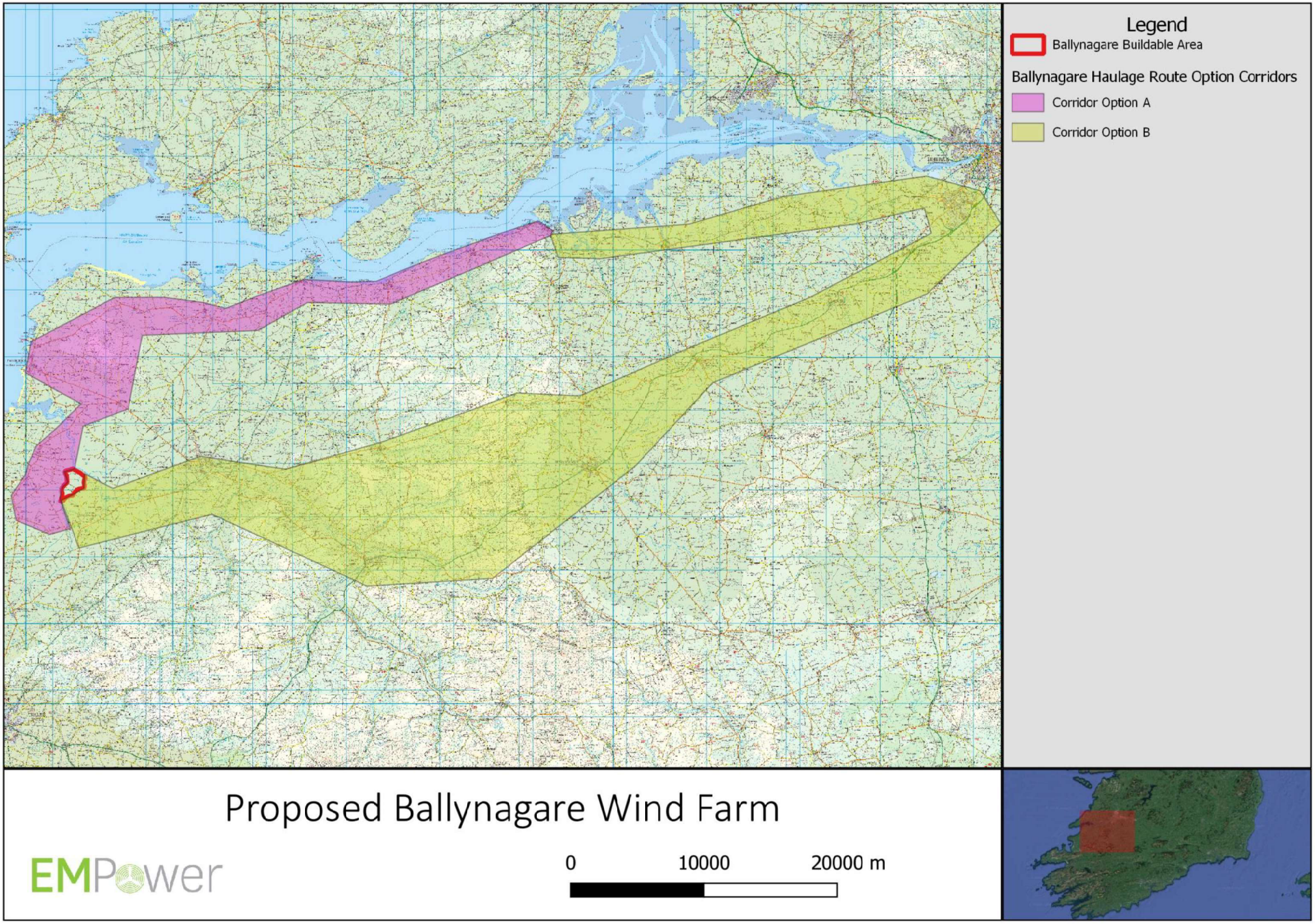


Proposed Ballynagare Wind Farm

EMPower

0 2000 4000 m


Legend
Ballynagare Buildable Area
Ballynagare Grid Route Option Corridors
Option A
Option B
110kv Substations
Clahane
Trien
Trien
Clahane
LISTOWEL
Lios Tuathail
Proposed Ballynagare Wind Farm
EMPower
0
3000
6000 m


Legend
Ballynagare Buildable Area
Ballynagare Haulage Route Option Corridors
Corridor Option A
Corridor Option B
Proposed Ballynagare Wind Farm
EMPower
0
10000
20000 m

Community Benefits

EMPower

Renewable Electricity Support Scheme (RESS)
High Level Design

95
Direct jobs in construction phase

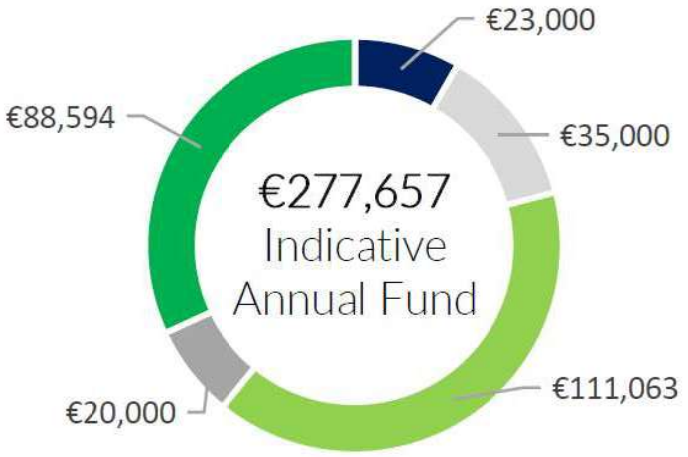
22
Highly skilled jobs over project lifetime

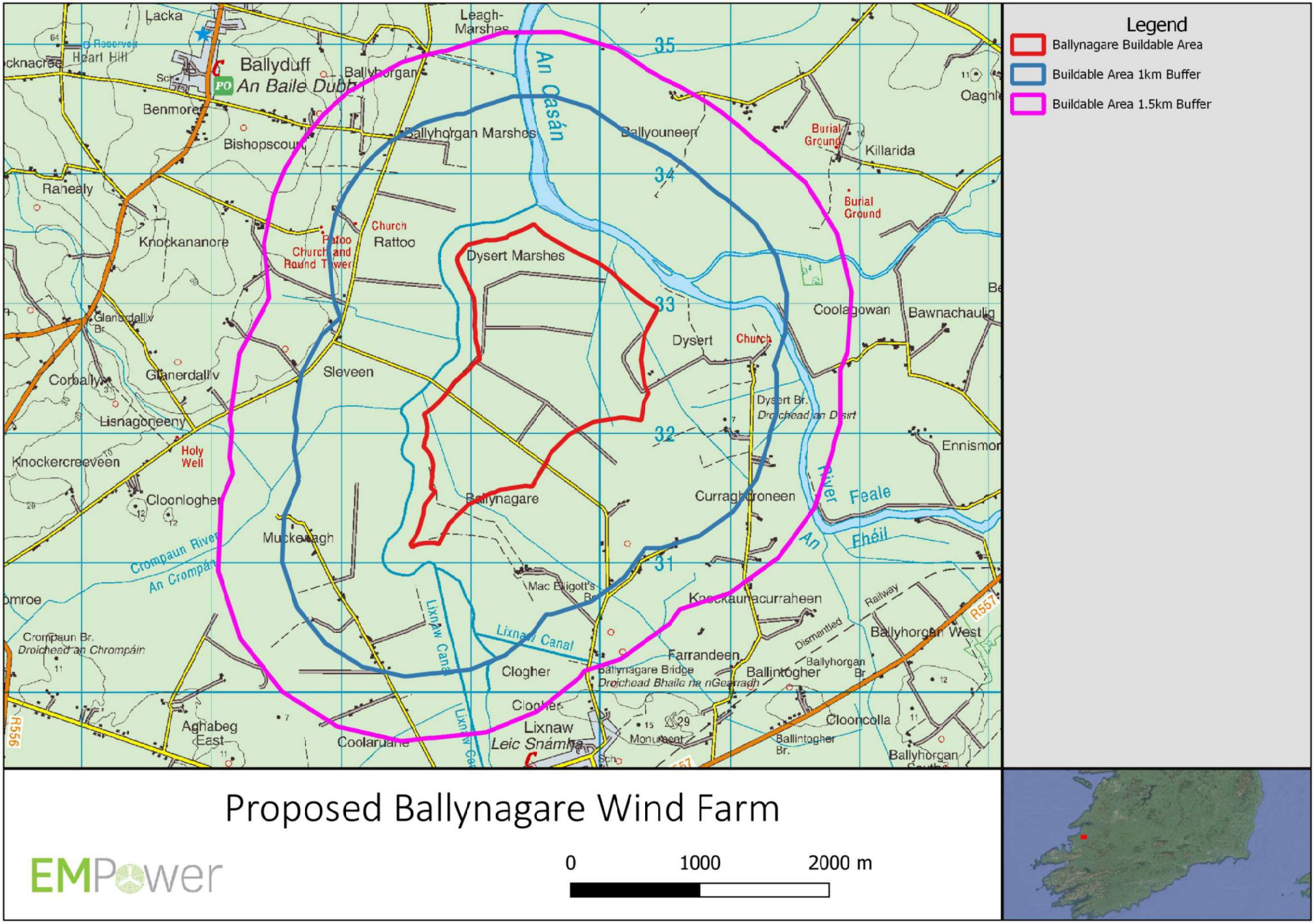
€ 61.8 million
Investment in Irish infrastructure

€ 4.2 million
Total Indicative Community Fund Contribution

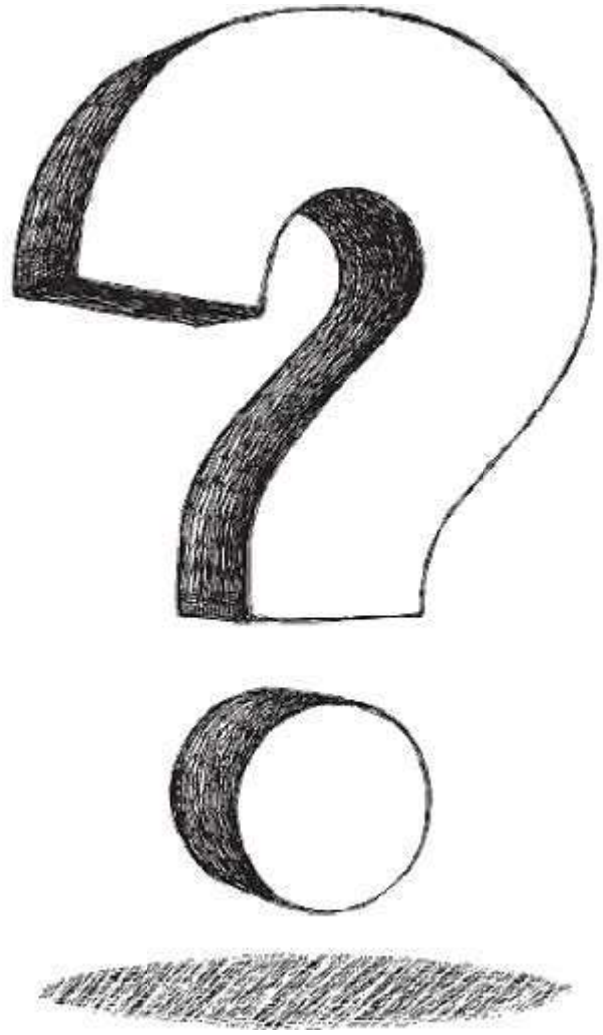
€ 10.1 million
County Council Rates Contribution

Ballynagare Indicative Community Fund Allocation




Legend
Ballynagare Buildable Area
Buildable Area 1km Buffer
Buildable Area 1.5km Buffer
Proposed Ballynagare Wind Farm
EMPower
0
1000
2000 m
Ballyduff
An Baile Dubh
Ballyhorgan
Ballyhorgan Marshes
Ballyouneen
Killarida
Burial Ground
Rattoo
Church
Rattoo Church and Round Tower
Dysert Marshes
Dysert
Coolagowan
Bawnachaulig
Knockananore
Raheally
Benmore
Bishopscourt
Sleveen
Glanerdalliv
Corbally
Lisnagoneeny
Knockercreeveen
Holy Well
Cloonlogher
Muckenagh
Ballynagare
Curraghroneen
Dysert Br.
Droichead an Dísirt
Ennismore
River Feale
An Fhéil
Crompaun River
An Crompán
Crompaun Br.
Droichead an Chrompáin
Mac Elligott's Br.
Knockaunacurraheen
Lixnaw Canal
Clogher
Farrandeen
Ballynagare Bridge
Droichead Bhaile na nGearradh
Ballintogher
Ballyhorgan West
Dismantled Railway
R557
R556
Aghabeg East
Coolaruane
Lixnaw
Leic Snámha
Monument
Clooncolla
Ballintogher Br.
Ballyhorgan
Leagh-Marshes
An Casán
Heart Hill
Lacka
Reservoir
35
34
33
32
31

Question Time



Hydrology





Ornithology

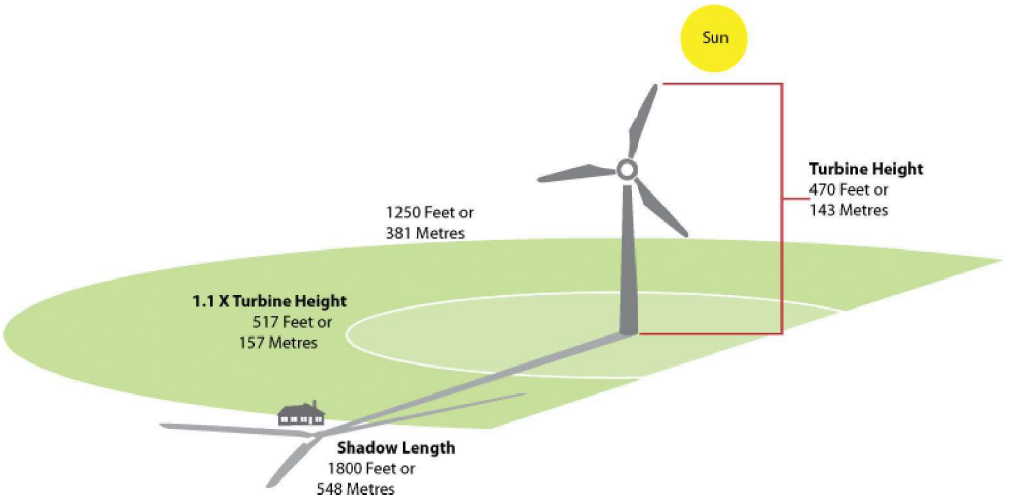
Population & Human Health





Biodiversity

Shadow Flicker





Sound

Construction and Civil Engineering



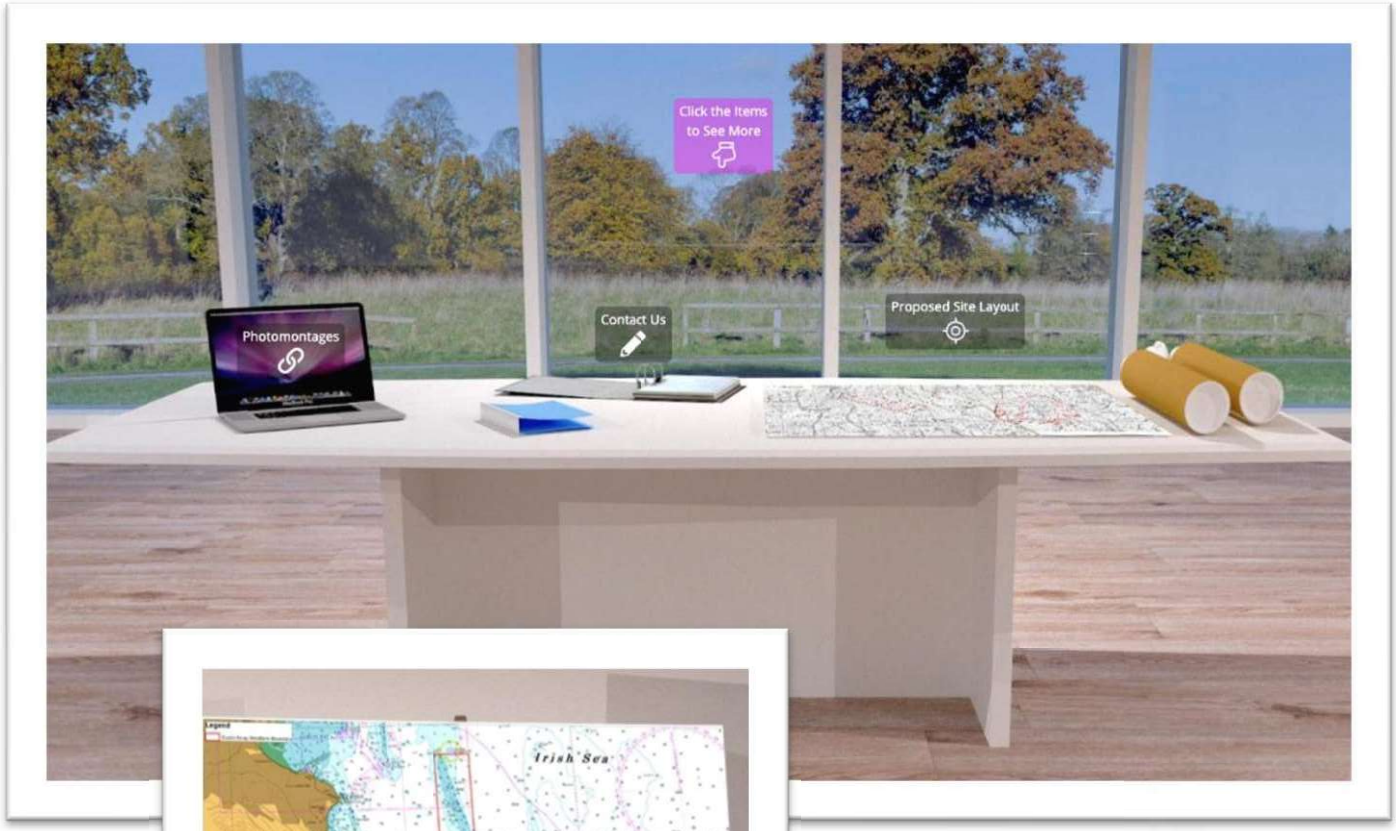


Archaeology

Landscape and Visuals



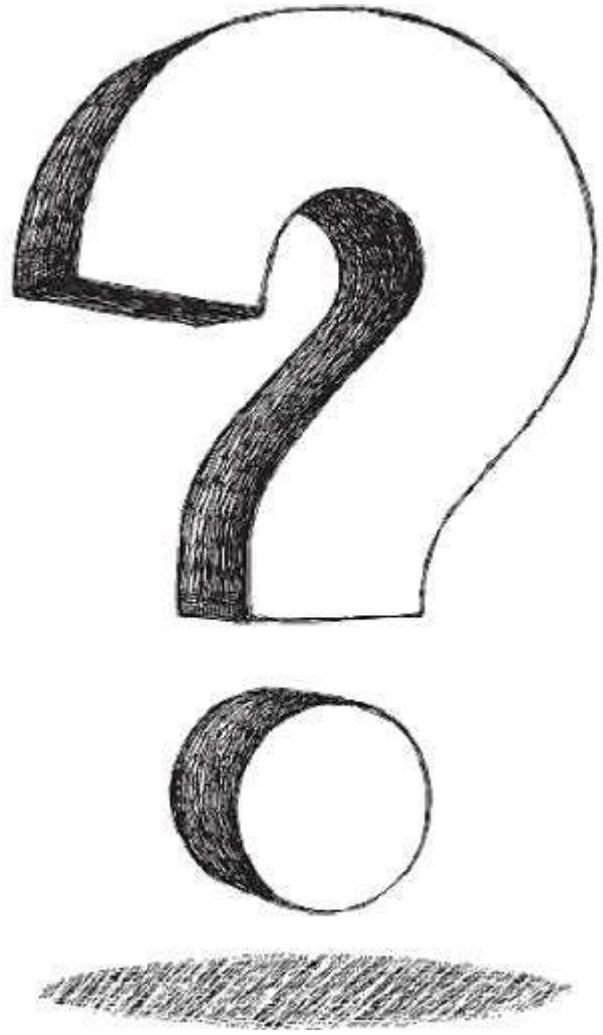
Virtual Consultation Room







Question Time



Conclusion

- Proposed Ballynagare Wind Farm
  - Up to 10 turbines
  - Estimated 56 MW
  - 33,000 Irish homes powered
- Community Fund
  - Average €277,657 per year
  - €1,000 per year (households <1km)
  - €500 per year (households >1km <1.5km)
  - Fund focused on Ballyduff and Lixnaw Villages
- Next Steps
  - Virtual consultation room
  - Submission for planning in Summer 2021



Get in Touch
A : EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1
E : info@emp.group
T : 01 588 0178

Reference 3.2 – Public Consultation Webinar No.2 Slides

Proposed Ballynagare Wind Farm
Public Consultation Webinar



EMPower

Ballynagare Wind Farm Proposal

EMPower

- Company Introduction
- Wind Farm Design
- Community Fund
- Q&A
- EIA Activities
- Q&A
- Conclusion



Company Introduction

EMPower

95 Years

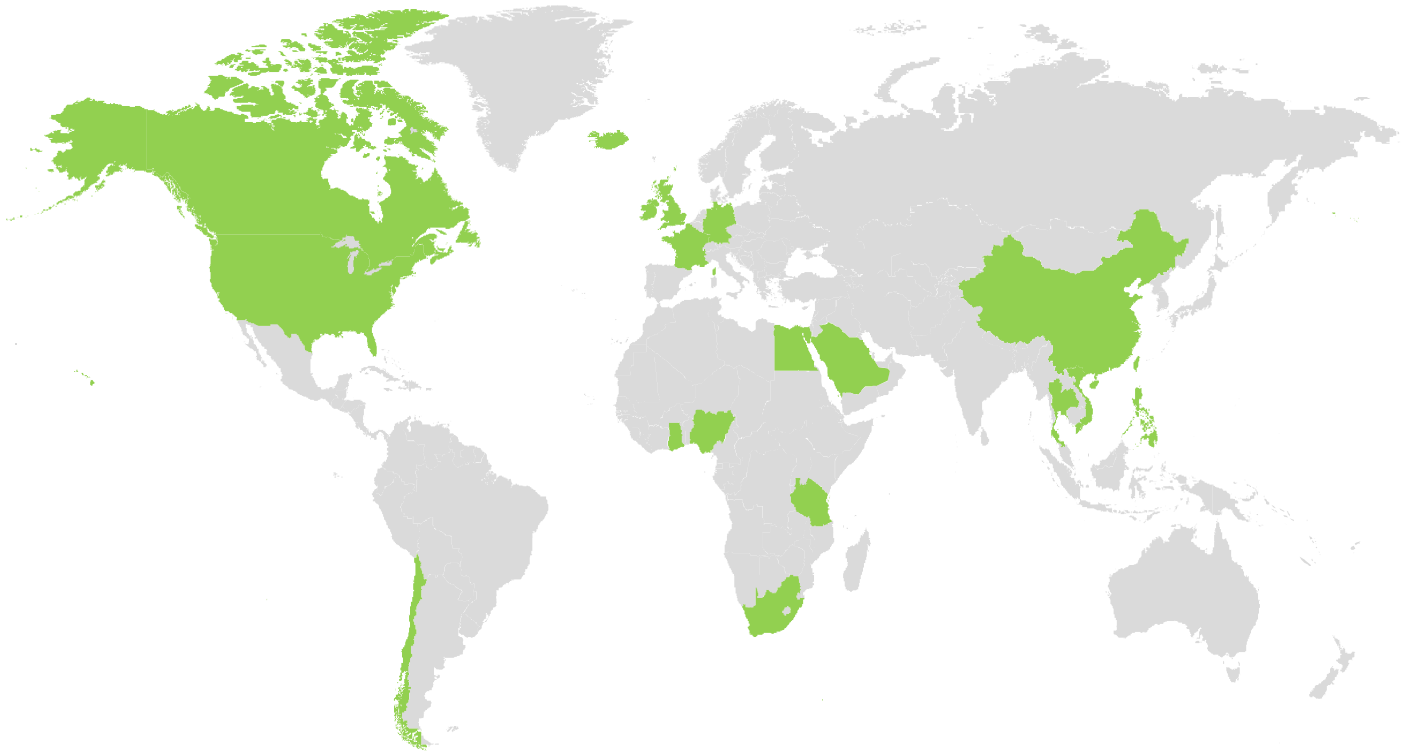
Combined Experience of EMPower Management Team in Renewable Energy

+700 MW

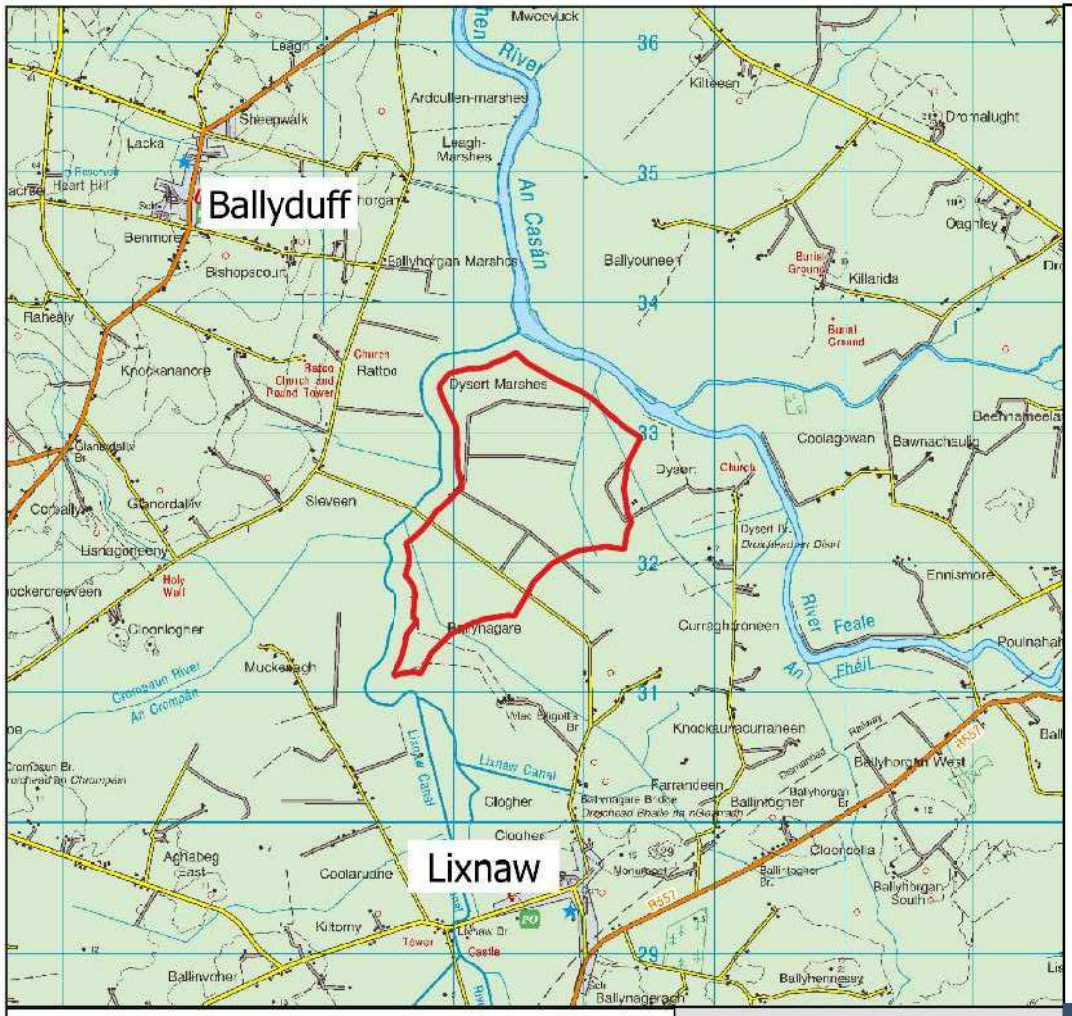
Wind Energy Capacity Currently Under Development By EMPower

5 Continents

Combined Geographical Experience of EMPower Team in Renewable Energy



Project Introduction



Proposed Ballynagare Wind Farm

-

Ballynagare, Dysert, Dysert Marshes and Curraghcroneen in Co. Kerry

-

Up to 10 Turbines

-

Estimated 60 MW

-

Tip height of up to 170m

-

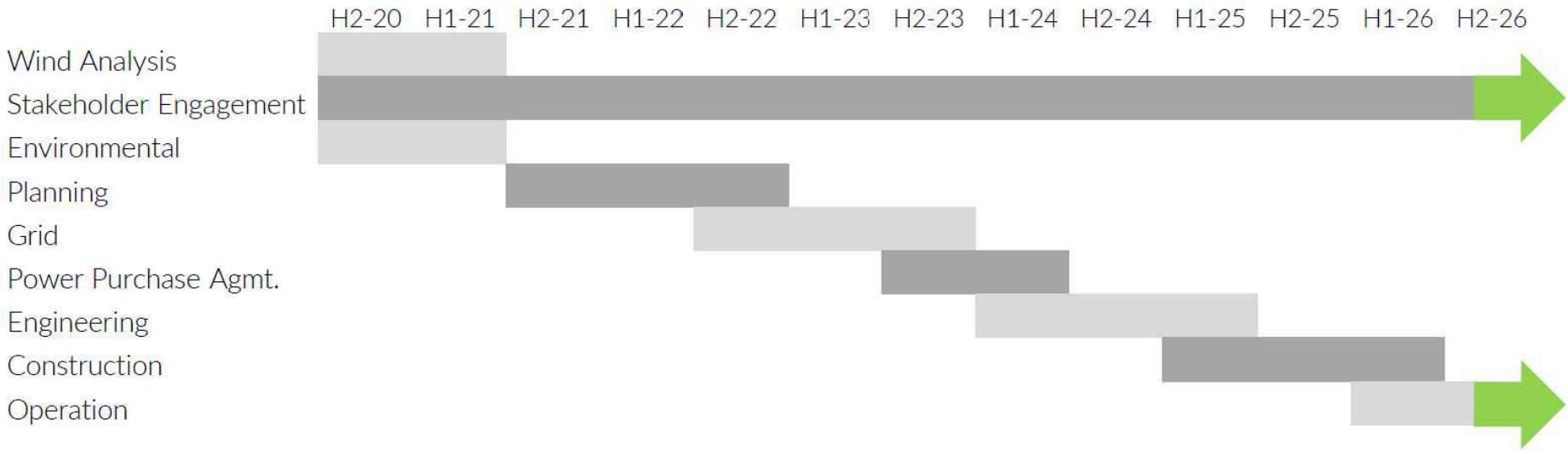
Enough clean electricity to power over 35,000 Irish homes

-

Estimated community benefit fund of €297,490 per annum

Proposed Project Schedule

Planning Submission to An Bord Pleanala (Strategic Infrastructure Development)	Summer 2021
Grid Connection Submission	Summer 2022
Renewable Electricity Support Scheme Submission	Summer 2023
Construction Commences	Spring 2025



Energy Targets in Ireland

EMPower

Table 7.5 Potential Metrics to Deliver Abatement in Electri

Key Metrics	2017	2025 Based on MACC	2030 Based on MACC
Share of Renewable Electricity, %	~30%[20]	52%	70%
Onshore Wind Capacity, GW	~3.3	6.5	8.2
Offshore Wind Capacity, GW	NA	1.0	3.5
Solar PV Capacity, GW	NA	0.2	0.4
CCGT Capacity, GW	~3.6	5.1	4.7

70%
Renewables by 2030

8.2 GW
Onshore wind by 2030

Source – Department of Communications, Climate Action and Environment
Climate Action Plan 2019
Marginal Abatement Cost Curve (MACC) Analysis

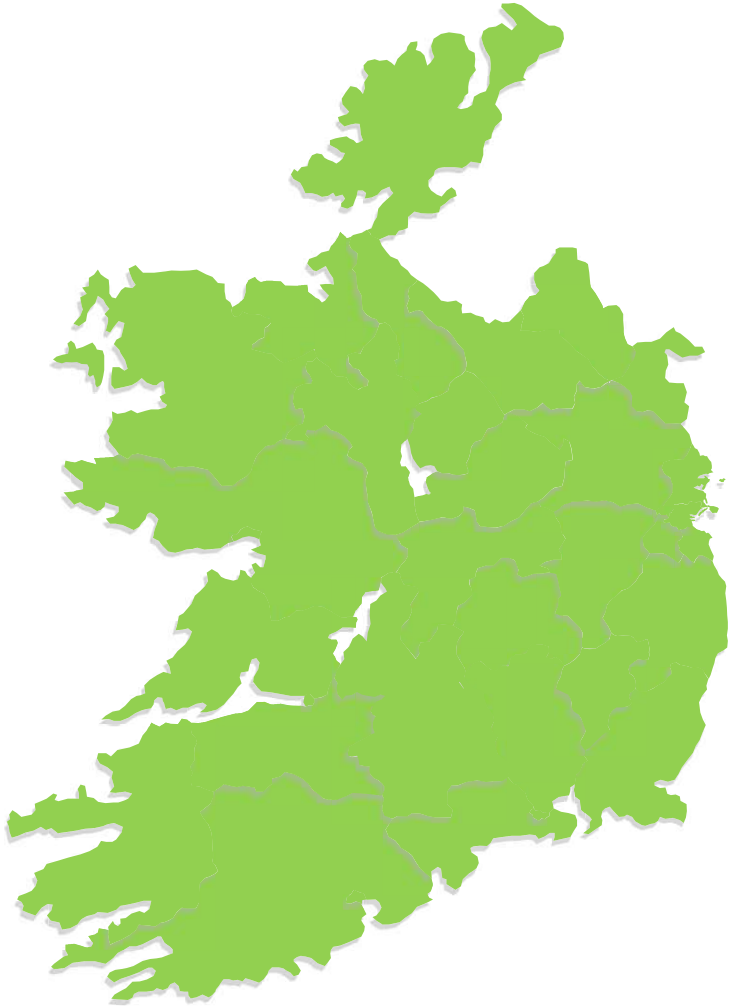
Site Screening

EMPower

Grid | Wind | CDP | SACs | Housing | Capacity | Land

Screening analysis performed on the entire Republic of Ireland incorporating constraints such as:

- Wind speed
- Grid connection
- Environmental Designations
- Culture and heritage
- Tourism
- County Development Plans
- Existing, planned and permitted projects
- Housing



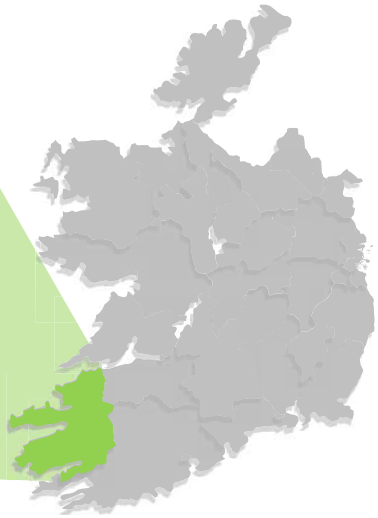
Site Screening

EMPower

Grid → Wind → CDP → SACs → Housing → Capacity → Land



Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

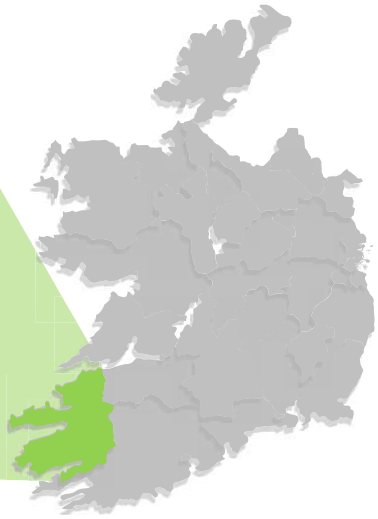
Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- 220kV Line
- 220kV Substations
- 110kV Substations
- 110kV Line
- Areas Outside Economic Distance of Grid

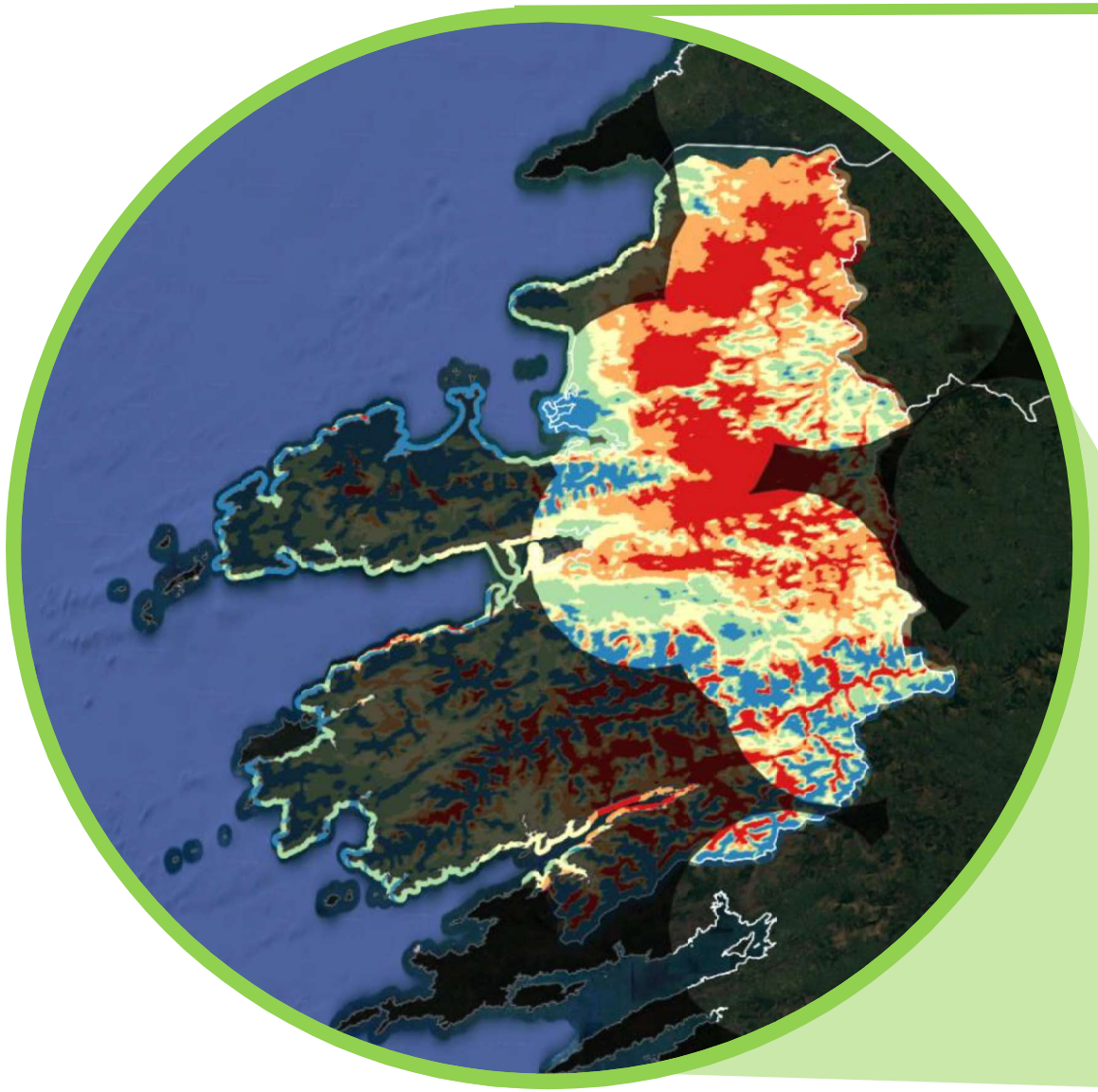
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- 220kV Line
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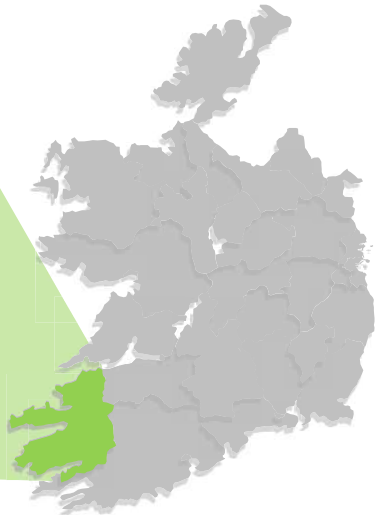
- 110kV Substations
- 110kV Line
- Areas Outside Economic Distance of Grid

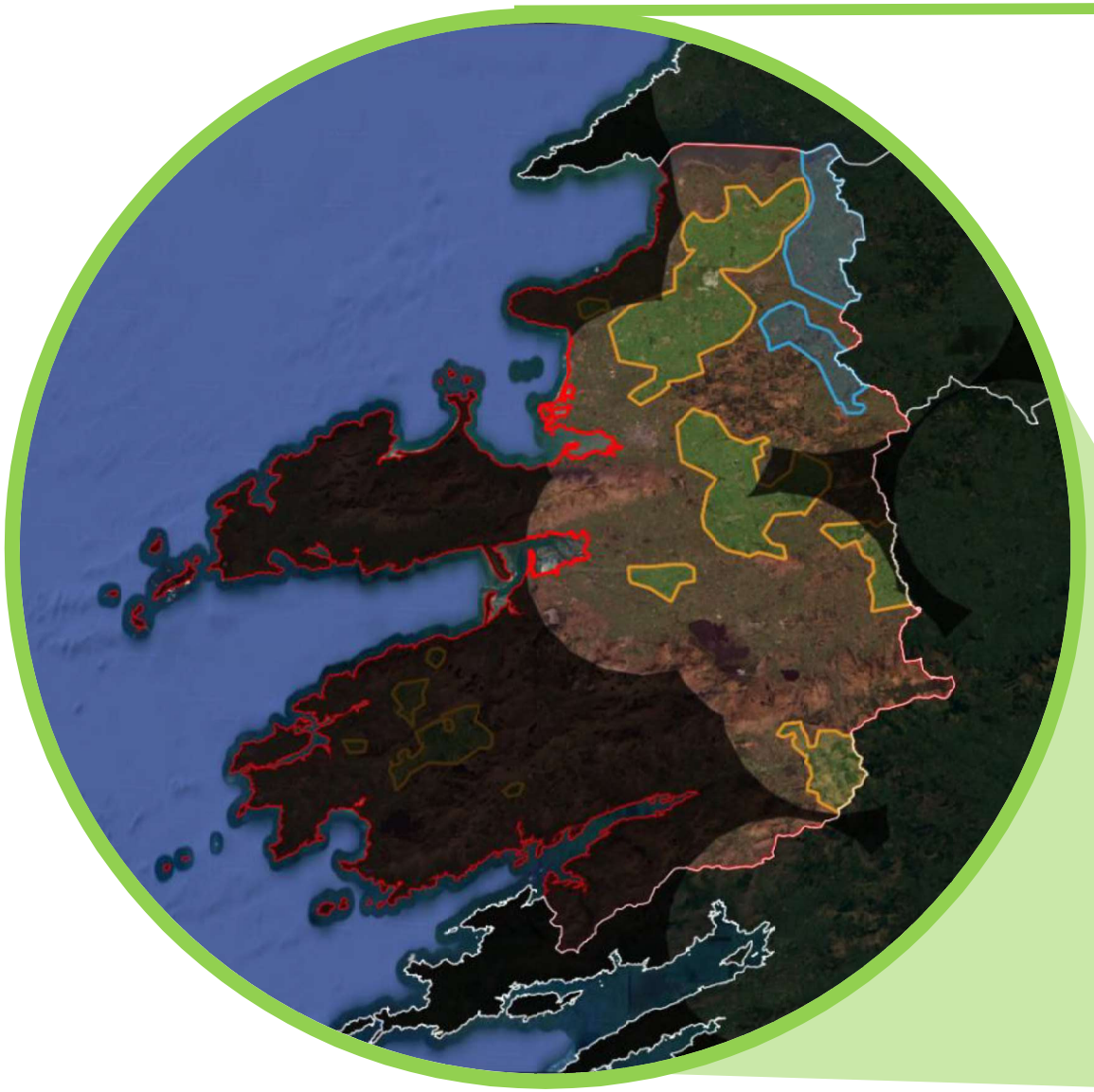
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

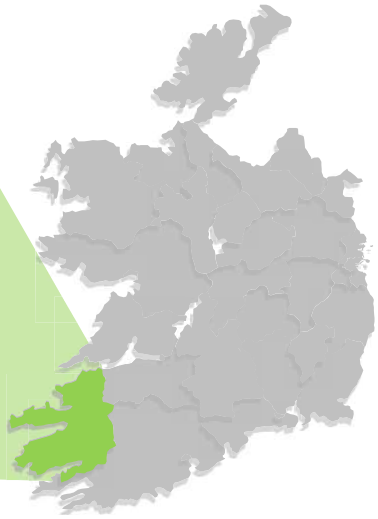
Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- 220kV Line
- 220kV Substations
- 110kV Substations
- 110kV Line
- Areas Outside Economic Distance of Grid
- Kerry Strategic
- Kerry OTC
- Kerry Unsuitable

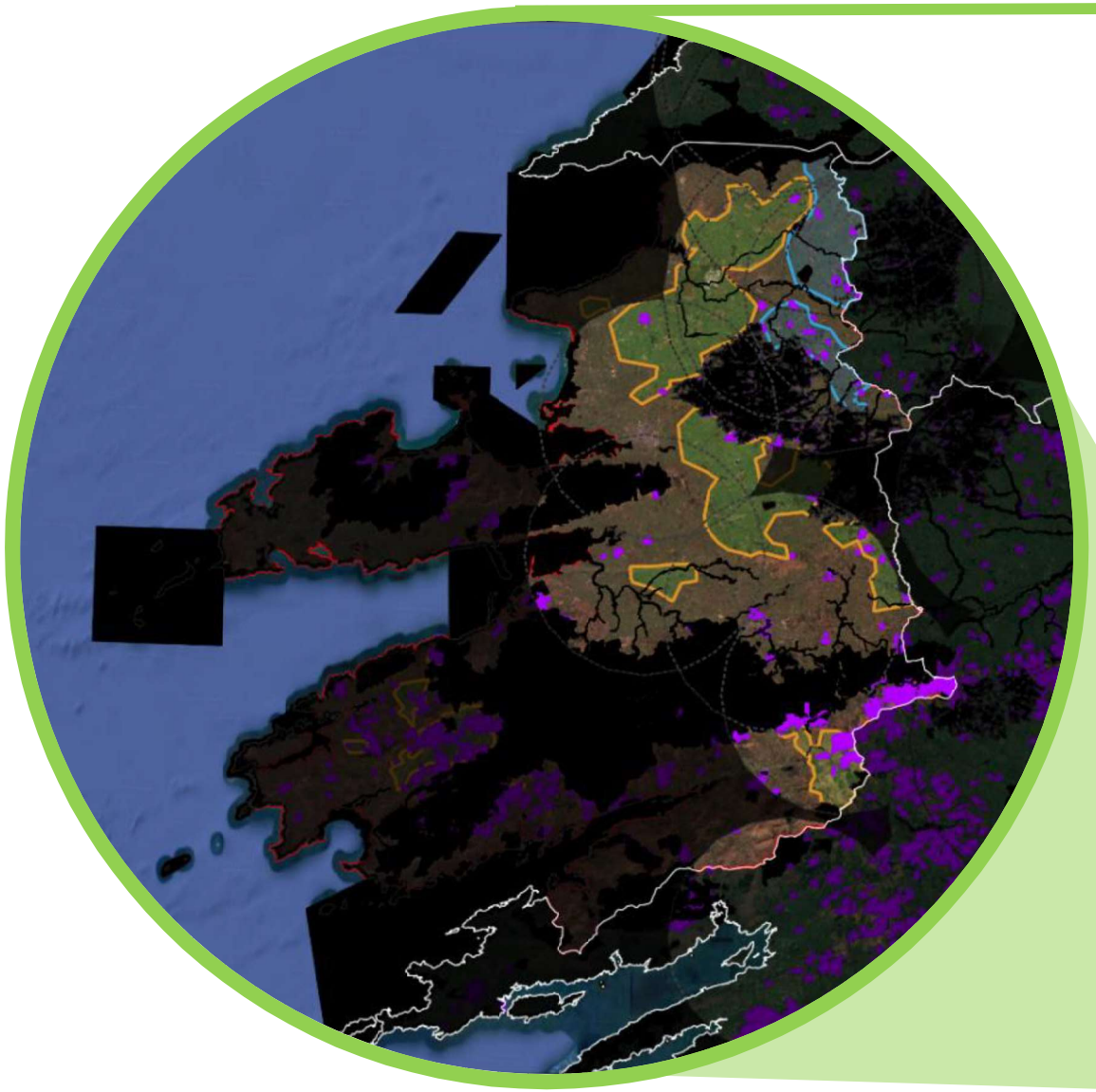
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

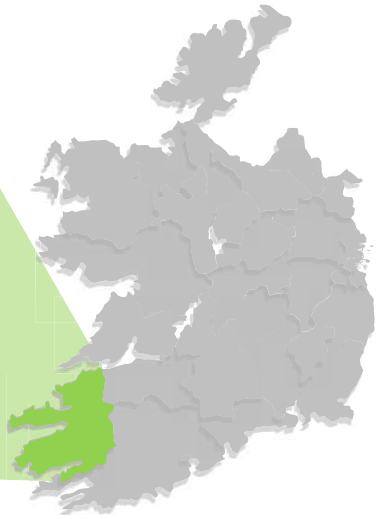
Grid | Wind | CDP | SACs | Housing | Capacity | Land



Legend

- Kerry Strategic
- Kerry OTC
- Kerry Unsuitable
- Environmental Designations
- Coillte Land

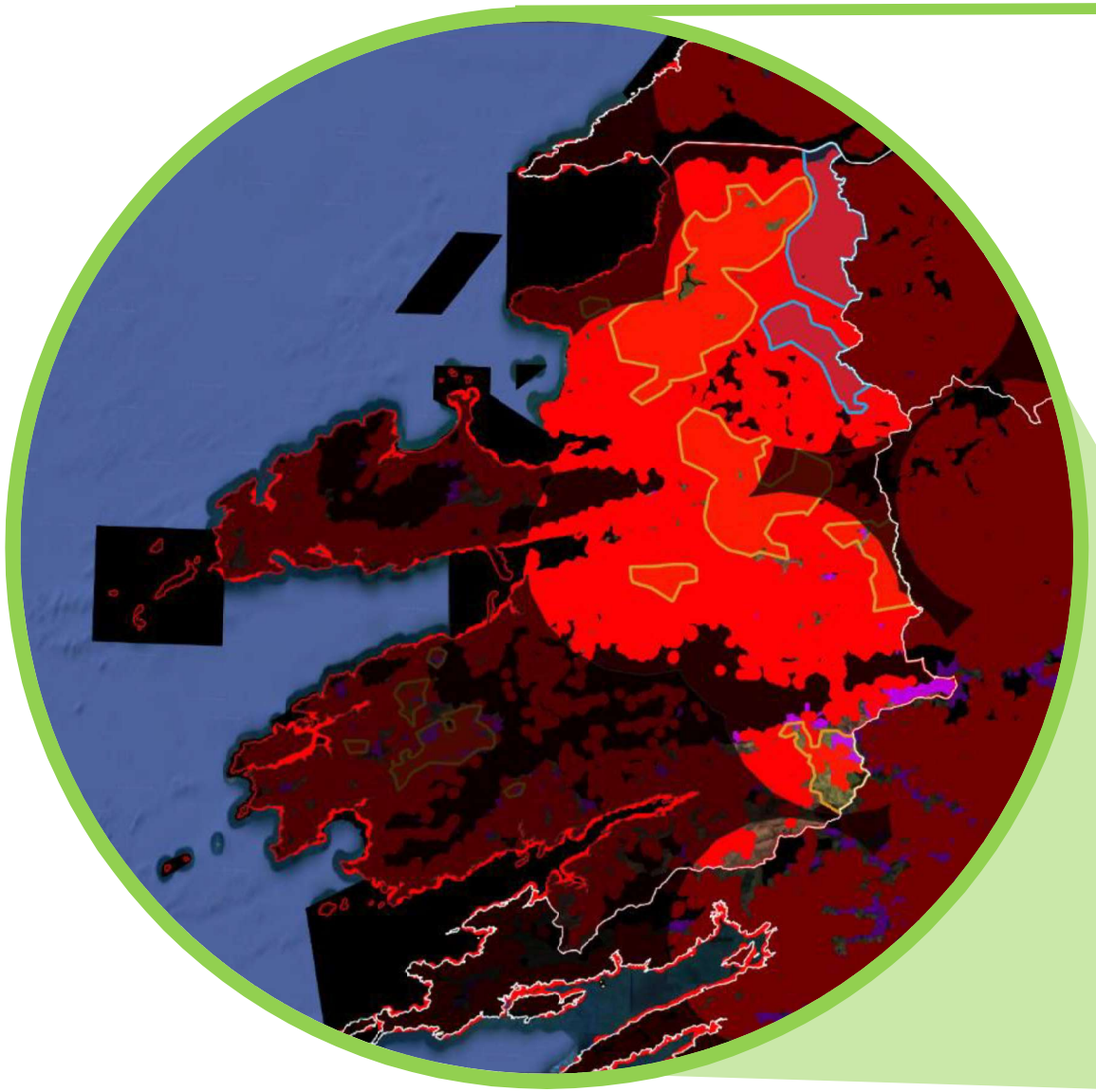
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

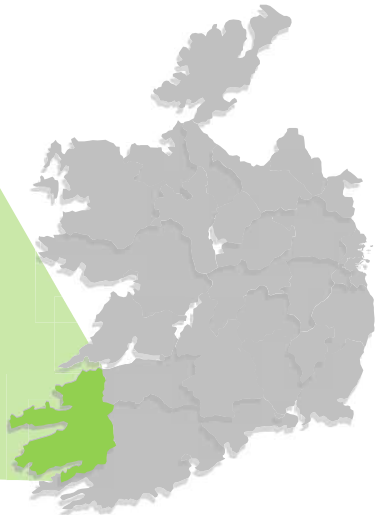
Grid → Wind → CDP → SACs → Housing → Capacity → Land



Legend

- Kerry Strategic
- Kerry OTC
- Kerry Unsuitable
- Environmental Designations
- Coillte Land
- 700m Buffers on Residential and Commercial Buildings

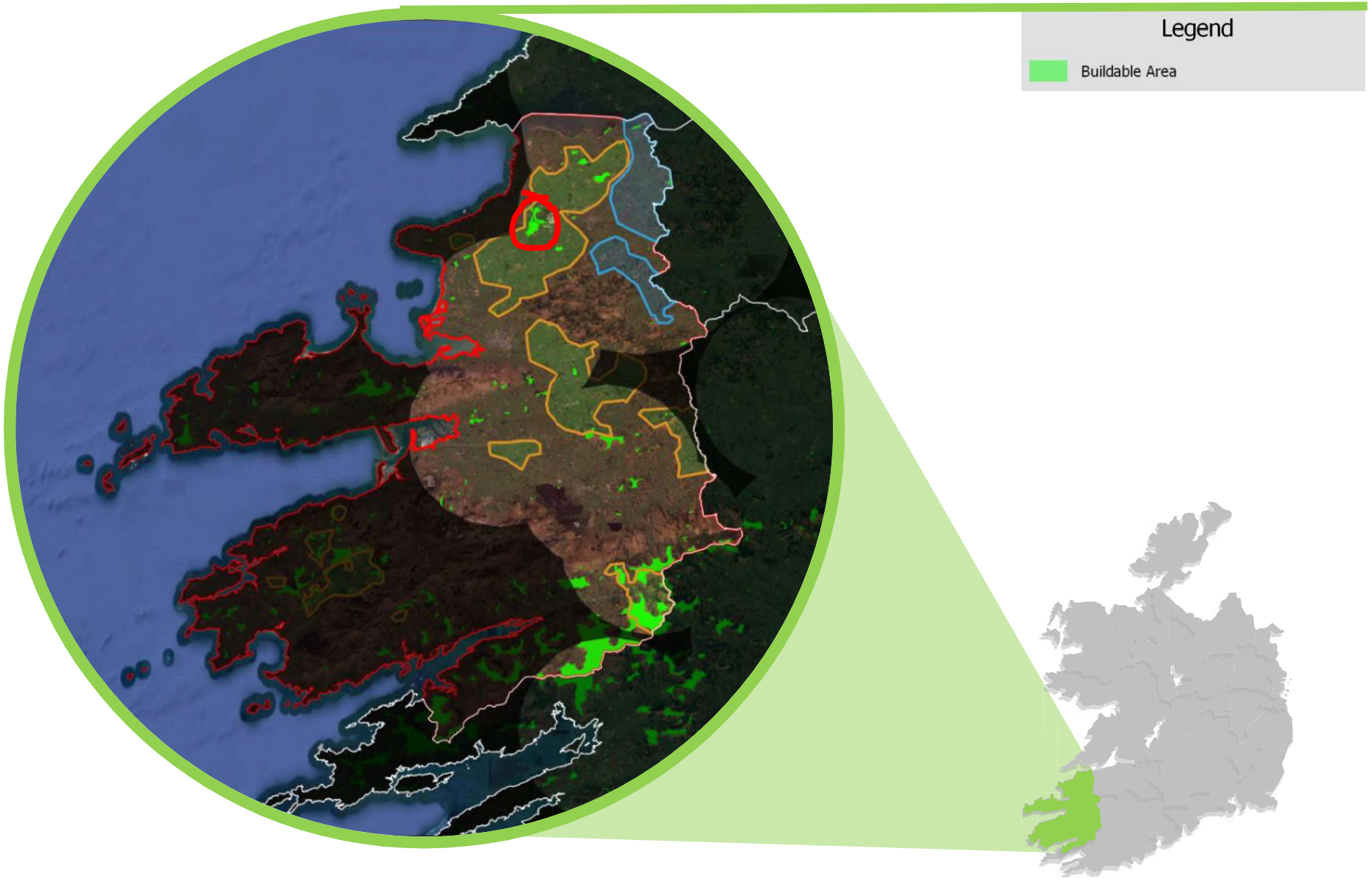
Screening analysis performed on the entire Republic of Ireland. Example of County Kerry shown.



Site Screening

EMPower

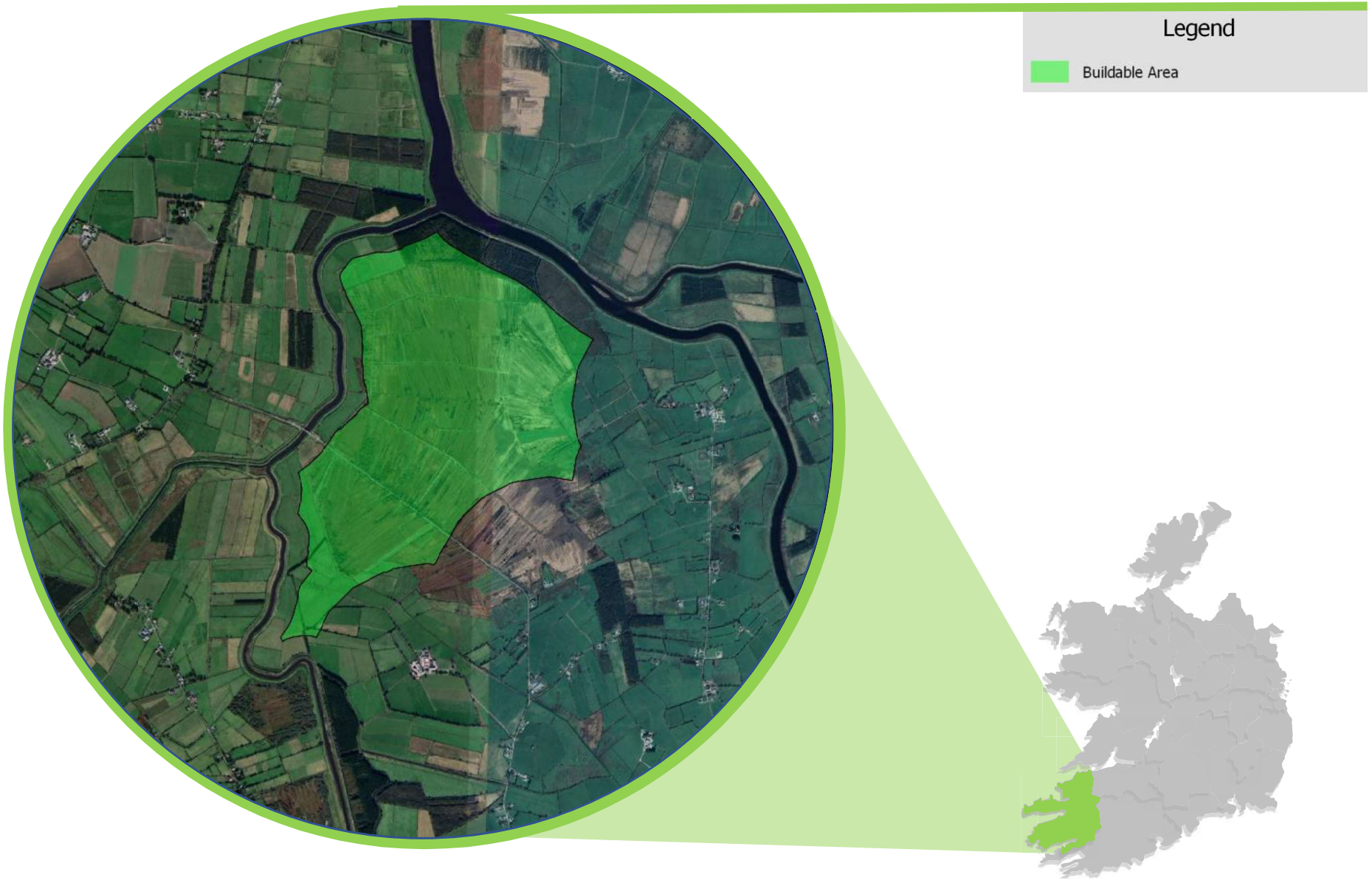
Grid → Wind → CDP → SACs → Housing → Capacity → Land



Site Screening

EMPower

Grid → Wind → CDP → SACs → Housing → Capacity → Land



Wind Farm Design

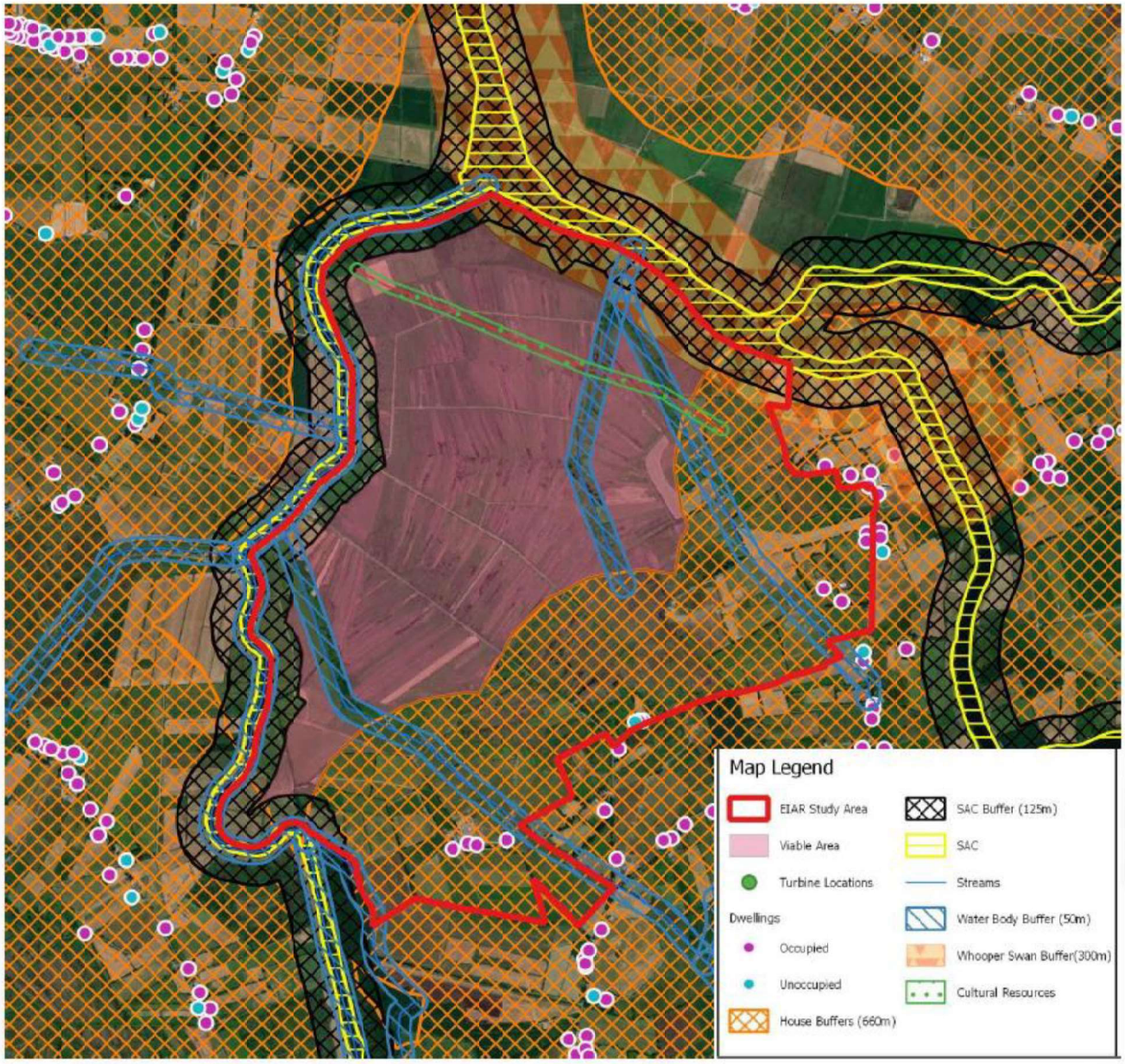
EMPower

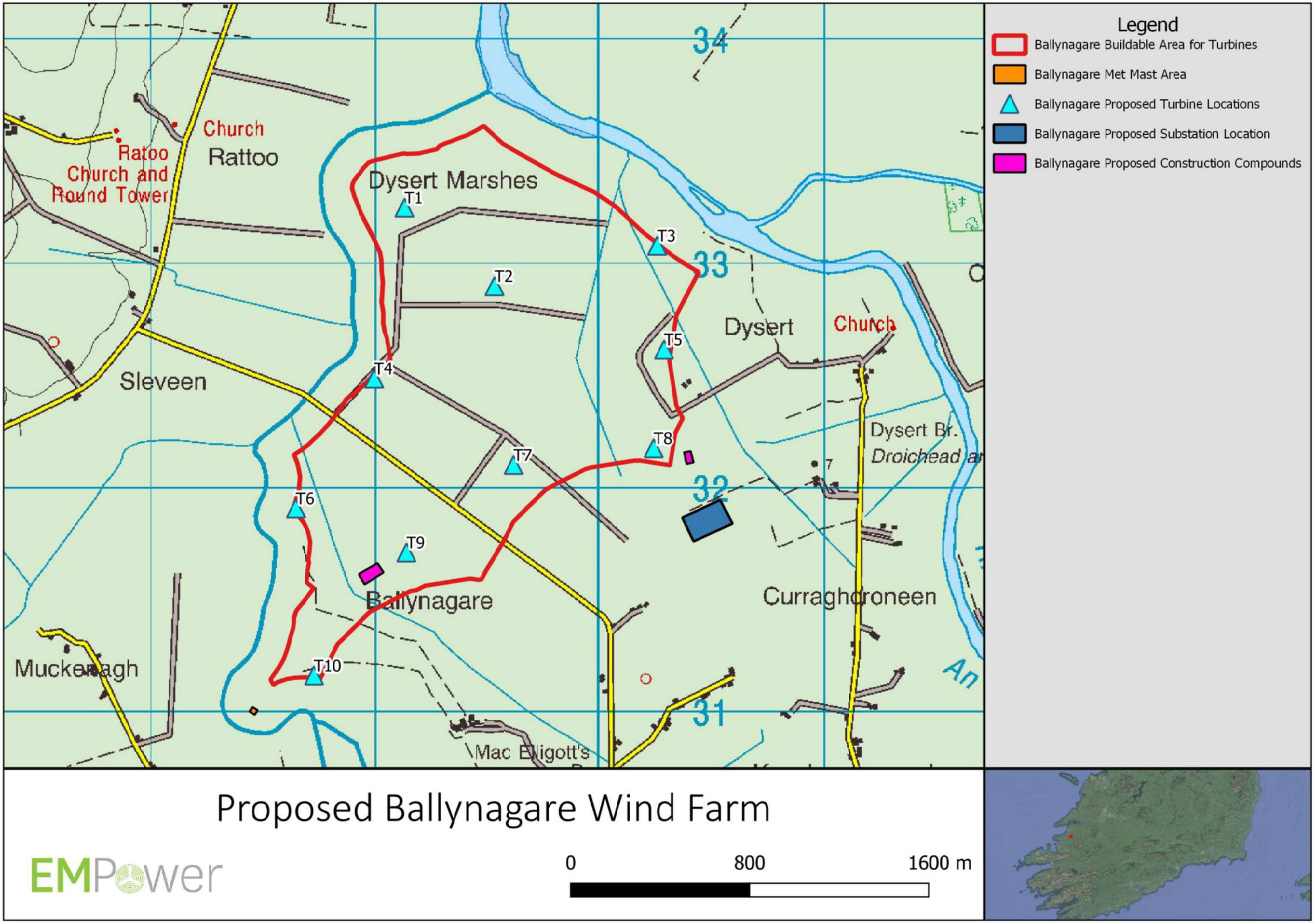
MKO Planning and Environmental Consultants

Project Design/Constraints

- Development site is located in an area deemed 'Open to Consideration' in the extant Development Plan.

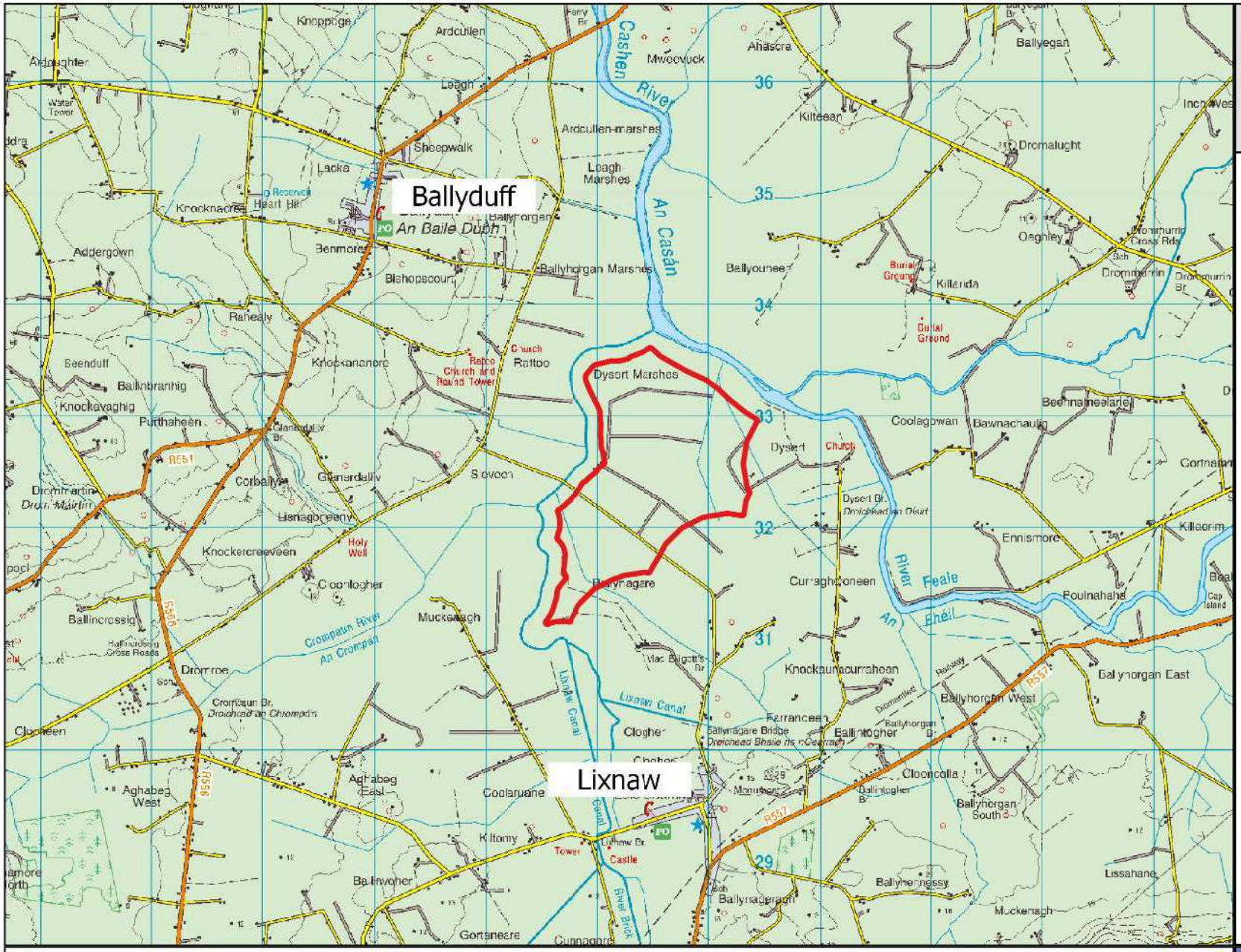
- Constraints include:
  - SAC and buffer
  - Water body
  - Dwellings
  - Landownership
  - Cultural Heritage





Proposed Ballynagare Wind Farm

EMPower


Ballyduff
Lixnaw
Cashen River
An Casán
River Feale
An Fheil
Dysert Marshes
Ballynagare
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Lixnaw Canal
Crompaun River
An Crompán
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Ballyhorgan East
Ennismore
Foulnahahe
Coolagowan
Bawnachaulig
Killorim
Ballynagare Bridge
Dysert Church
Burial Ground
Holy Well
Tower Castle
Lixnaw Br.
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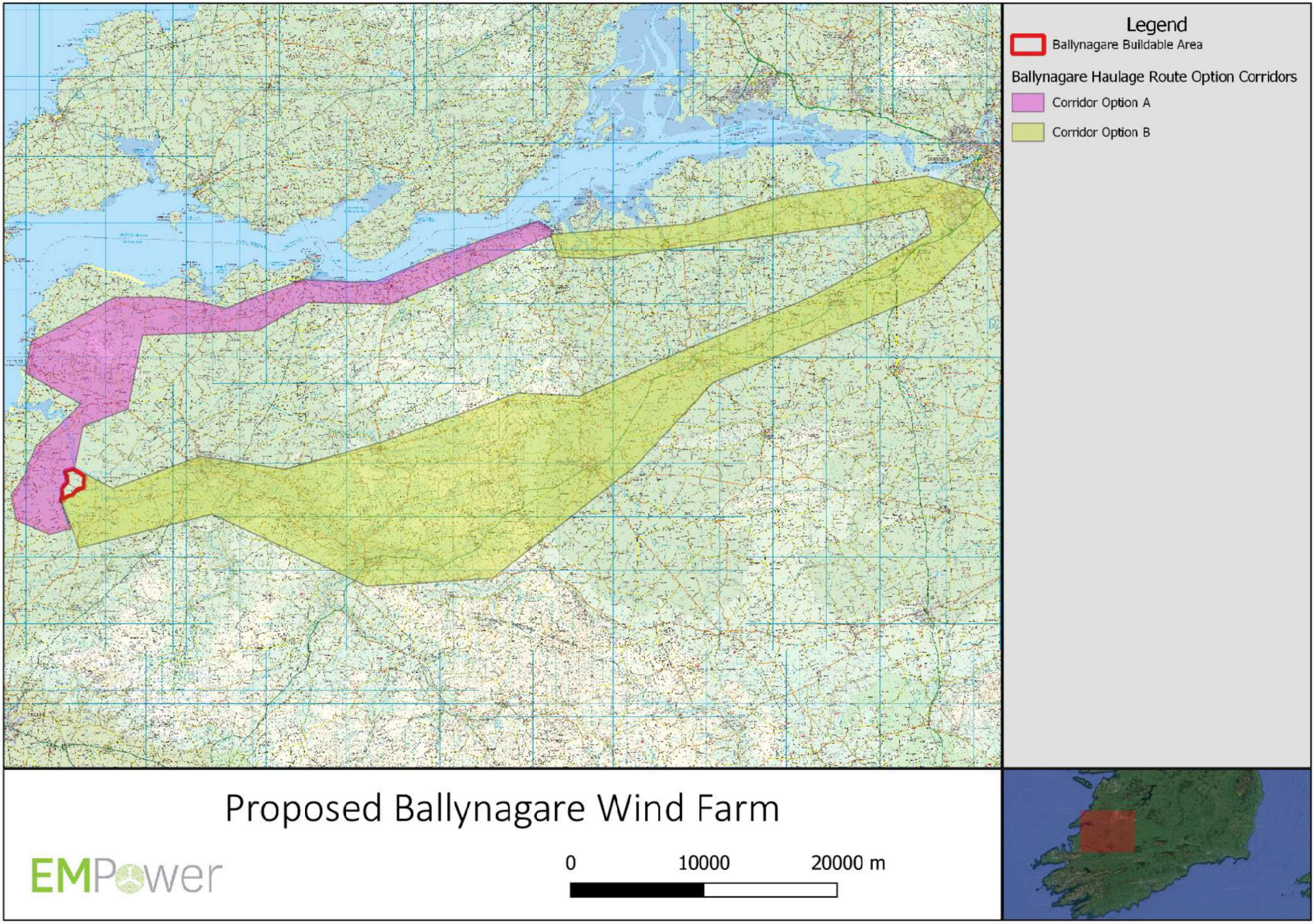
Clooncolla
Ballyhorgan South
Ballyhennessy
Lissahane
Muckenagh
Ballynagerragh
Gortaneare
Cunnagore
Aghabeg West
Aghabeg East
Coolaruane
Kiltomy
Ballinvoher
Clooneen
Dromroe
Ballincrossig
Corbally
Glanerdalliv
Lisnagoreeny
Knockereereveen
Coomlogher
Muckeagh
Purthaheen
Knockavaghig
Ballinbranhig
Beendulf
Raheaty
Knockananore
Rattoo
Church and Round Tower
Bishopscourt
Benmore
Addergown
Knocknacree
Heart Hill
Lacka
Sheepwalk
Ardcullen-marshes
Ardcullen
Knoppoge
Ardnaghter
Mweenluck
Ahascra
Ballyegan
Killeegan
Dromalught
Oaghley
Ballyouneen
Killarida
Dromnurrin
Dromnurrin Cross Rds
Dromnurrin Br.
Beennaheglarig
Cornadarragh
Dromartin
Drom Mártin
Cromcaun Br.
Droichead an Chrompáin
Ballinlogher Br.
Ballyhorgan Br.
Dysert Br.
Droichead an Diseart
Ballynagare Bridge
Droichead Bhaile na Gcearrach
Mac Elligott's Br.
Railway
Ferranceen
Cloghe
Chothes
Mountain
Tower Castle
Lixnaw Br.
River Brick
Canal



Ballynagare Wind Farm - Grid Route Options

EMPower


Legend
Ballynagare Buildable Area
Ballynagare Haulage Route Option Corridors
Corridor Option A
Corridor Option B
Proposed Ballynagare Wind Farm
EMPower
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10000
20000 m

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EMPower

95
Direct jobs in construction phase

22
Highly skilled jobs over project lifetime

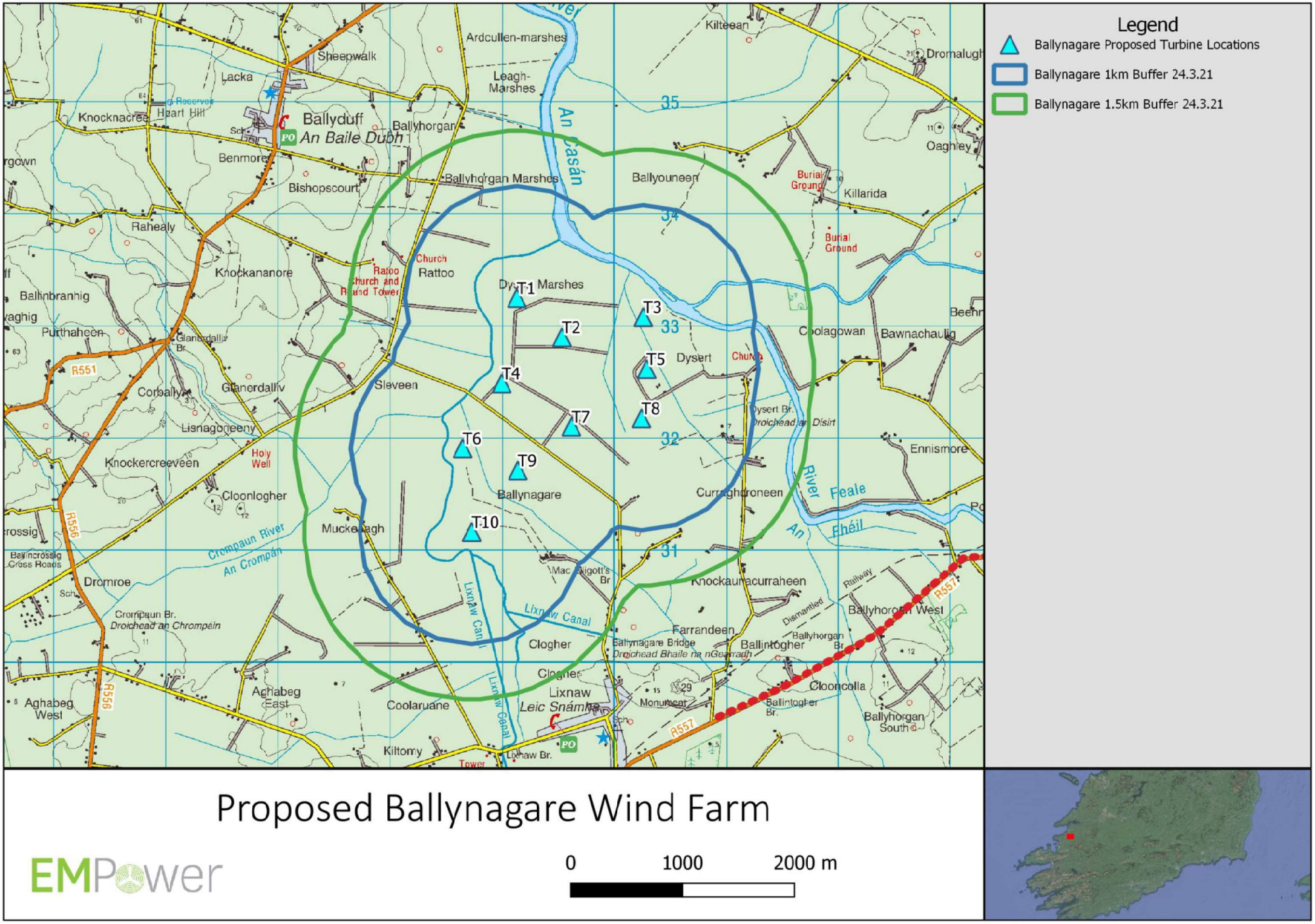
€61.8 million
Investment in Irish infrastructure

€4.46 million
Total indicative Community Fund Contribution

€10.1 million
County Council Rates Contribution

Renewable Electricity Support Scheme (RESS)
High Level Design




Legend
Ballynagare Proposed Turbine Locations
Ballynagare 1km Buffer 24.3.21
Ballynagare 1.5km Buffer 24.3.21
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
Ballynagare
Ballyduff
An Baile Dubh
Lacka
Sheepwalk
Knocknacree
Heart Hill
Benmore
Bishopscourt
Ballyhorgan
Ballyhorgan Marshes
Ardcullen-marshes
Leagh-Marshes
Kilteean
Dromalugh
Oaghley
Ballyouneen
Killarida
Burial Ground
Raheally
Knockananore
Rattoo
Rattoo Church and Round Tower
Church
Ballinbranhig
Purthaheen
Glanerdalliv Br.
Glanerdalliv
Corbally
Sleveen
Dysert
Dysert Br.
Droichead an Disirt
Coolagowan
Bawnachaulig
Lisnagoneeny
Holy Well
Knockercreeveen
Cloonlogher
Ennismore
Curraghcroneen
River Feale
An Fhéil
Crompaun River
An Crompán
Ballincrossig Cross Roads
Dromroe
Crompaun Br.
Droichead an Chrompáin
Mucklagh
Mac Digott's Br
Knockaunacurraheen
Railway
Dismantled
Ballyhorgan West
Lixnaw Canal
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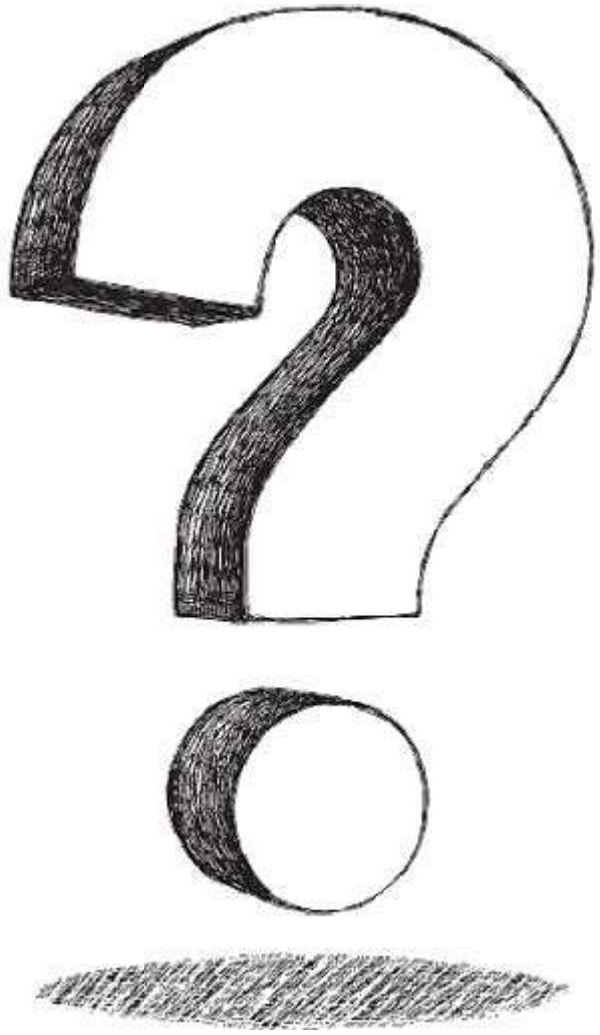
Ballynagare Bridge
Droichead Bhaile na nGearradh
Ballintogher
Ballyhorgan Br.
Clogher
Lixnaw
Leic Snámha
Monument
Cloncolla
Ballintogher Br.
Ballyhorgan South
Aghabeg West
Aghabeg East
Coolaruane
Kiltomy
Lixnaw Br.
Tower
R551
R556
R557
35
34
33
32
31
29
Proposed Ballynagare Wind Farm
EMPower
0
1000
2000 m

Question Time



Hydrology





Ornithology

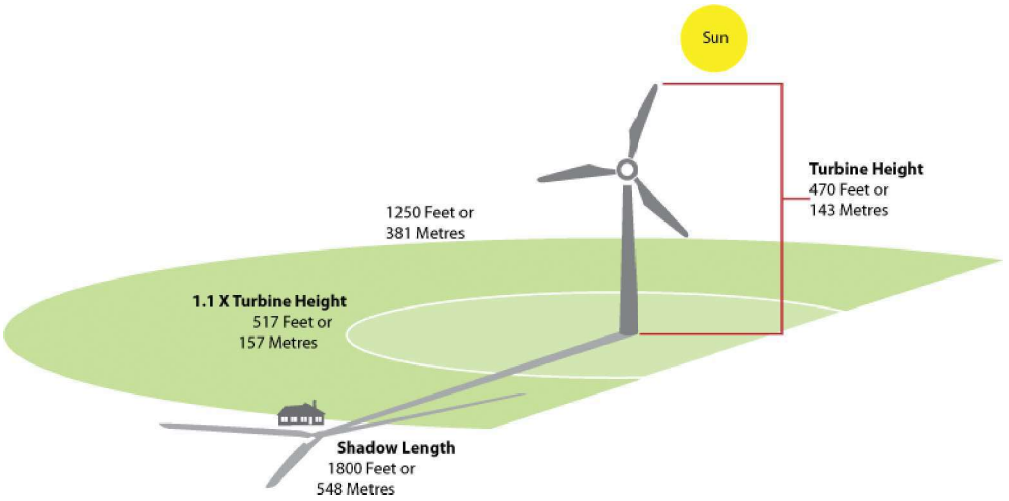
Population & Human Health





Biodiversity

Shadow Flicker





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Construction and Civil Engineering

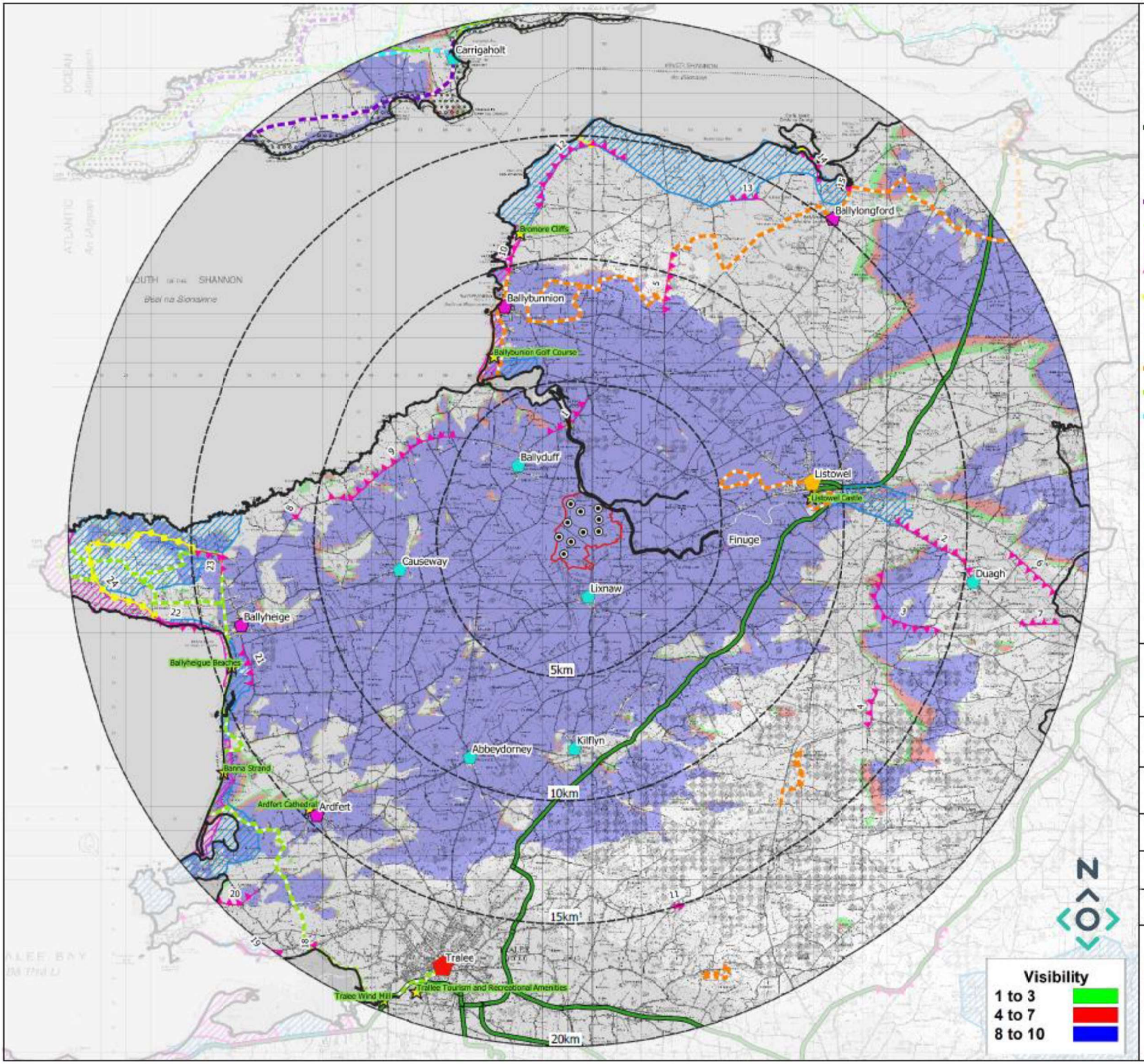




Archaeology

Landscape and Visuals





Map Legend

- Site Boundary
- Ballynagare Turbine Locations
- County Boundary
- National Roads
- Tourism Designations
- Co. Clare Heritage Landscapes
- Co. Clare - Loop Head Heritage Trail
- Co. Clare Scenic Routes
- Co. Kerry Landscape Character Areas
- Co. Kerry Scenic Routes- 1 way
- Co. Kerry Scenic Routes - 2 way
- Co. Kerry Primary Special Amenity Area
- Co. Kerry Secondary Special Amenity Area
- Co. Kerry Walking Trails
- North Kerry Way
- Wild Atlantic Way

Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village
- Settlement
- Small Village

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Drawing Title: ZTV and Landscape Baseline

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
AW	TB
Project No. 200512	Drawing No. Figure 13.5
Scale 1:150000	

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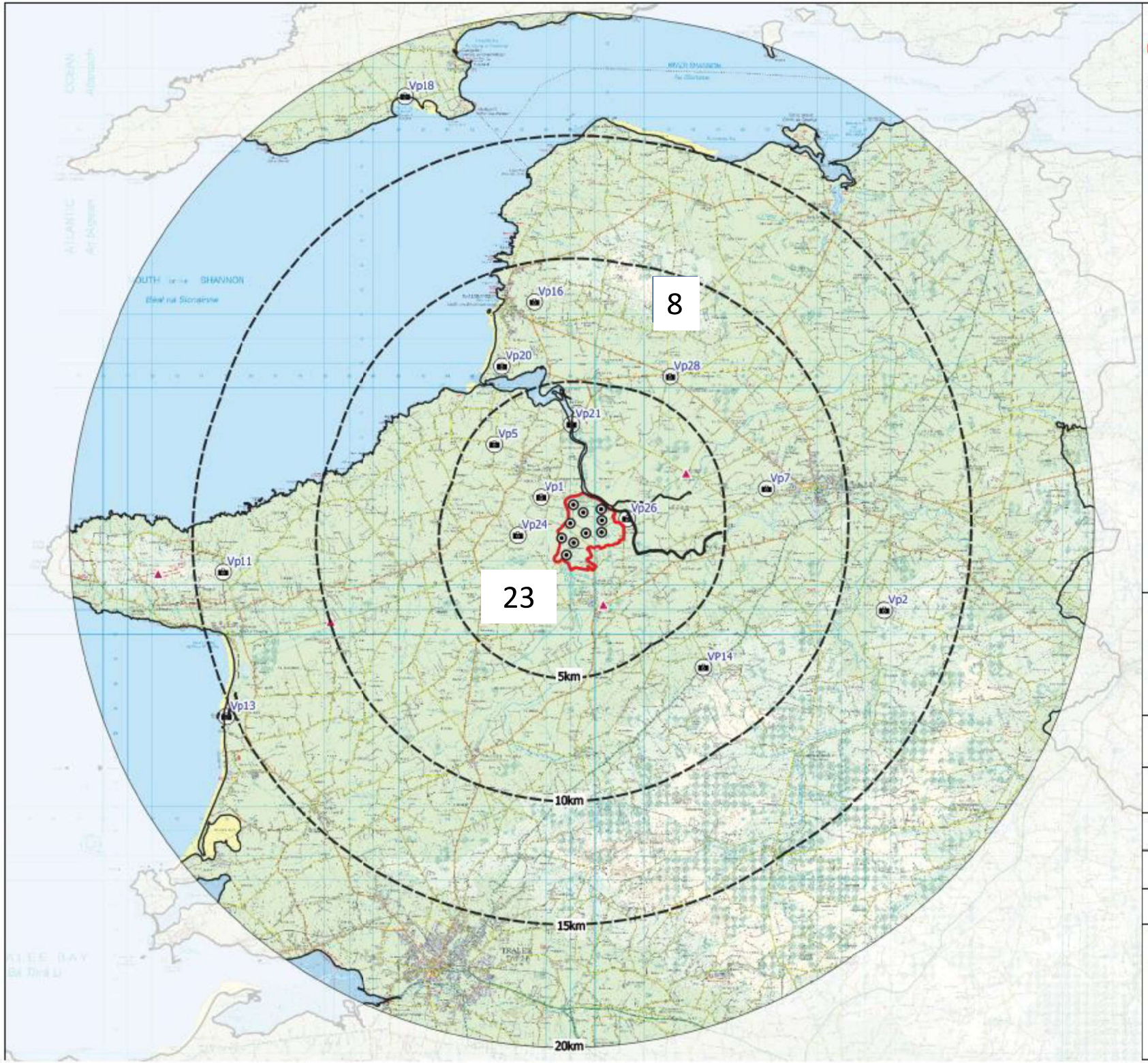
email:info@mkoireland.ie
Website: ww.mkoireland.ie



Map Legend

- Site Boundary
- Ballynagare Turbine Locations
- County Boundary
- Viewpoint Locations
- No Visibility Viewpoints

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Drawing Title	Chosen Viewpoints
Project Title	Ballynagare Wind Farm
Drawn By: AW	Checked By: TB
Project No.: 200512	Drawing No.: Figure 13.10
Scale: 1:50000	Date:

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email:info@mkoireland.ie
Website: ww.mkoireland.ie

Environmental Impact Assessment

EMPower

View Point 8

Farranastack

Photomontage 8

View Point: View from local road off the R553 in the townland of Farranastack, approximately 8.7 km northeast of the nearest turbine. Designated as Scenic Route 5.

View point grid reference	E 492,953 N 641,450
Date of image taken	05.11.2020
Time of image taken	4:34pm
View point elevation	150m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	200°
Horizontal extent of proposed turbines	9°
Distance to nearest proposed turbine	8.7km (T3)
Number of proposed turbines visible	x/10
Turbine Hub Height	92.5m
Turbine Tip Height	170m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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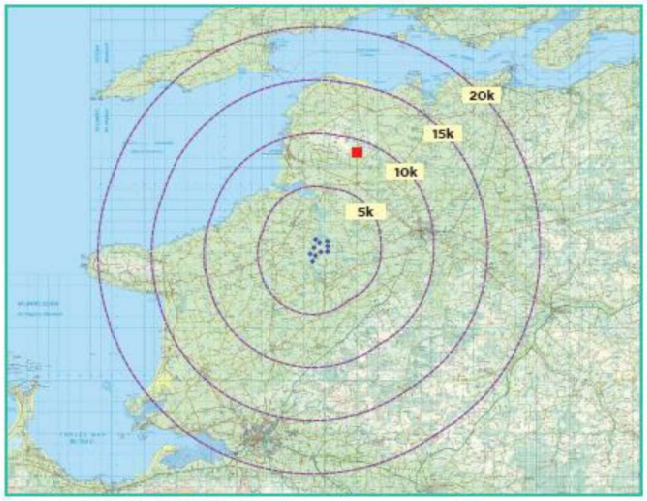


View point relative to 20km radius.


View point relative to wind farm site

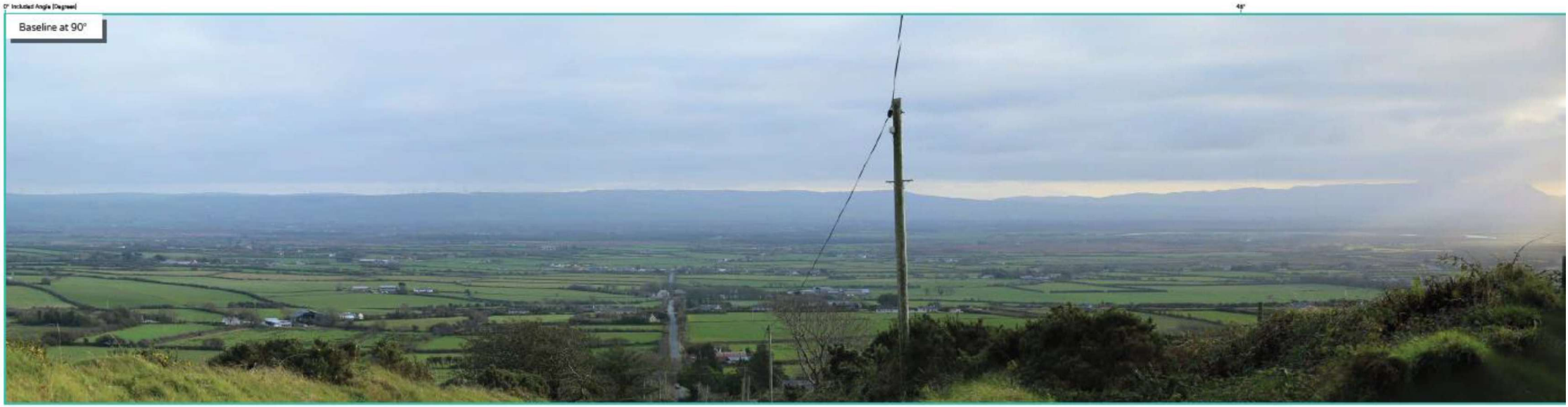
90° View Extent

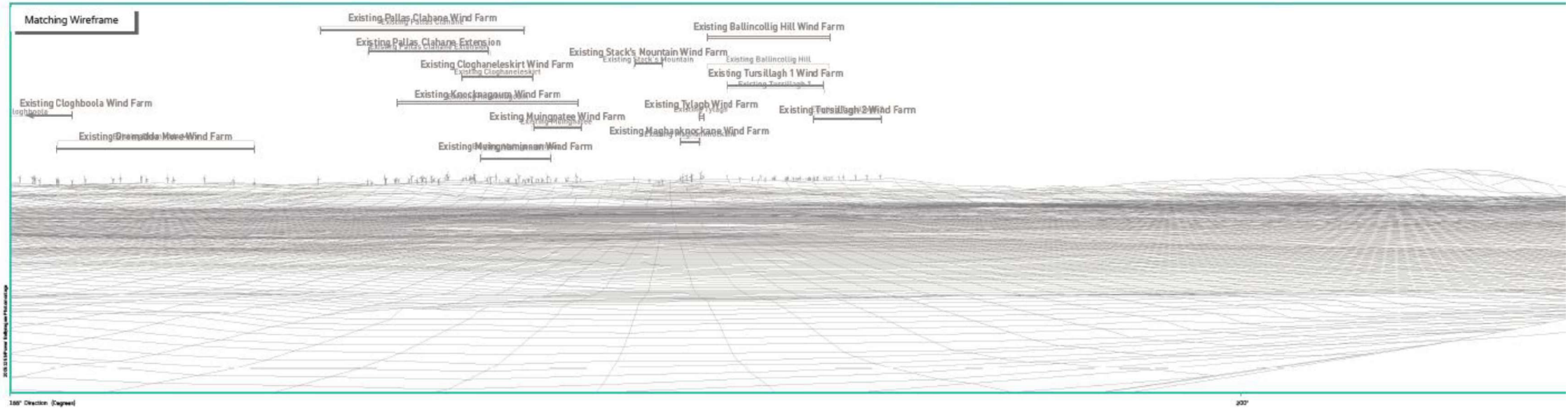


53.5° View Extent

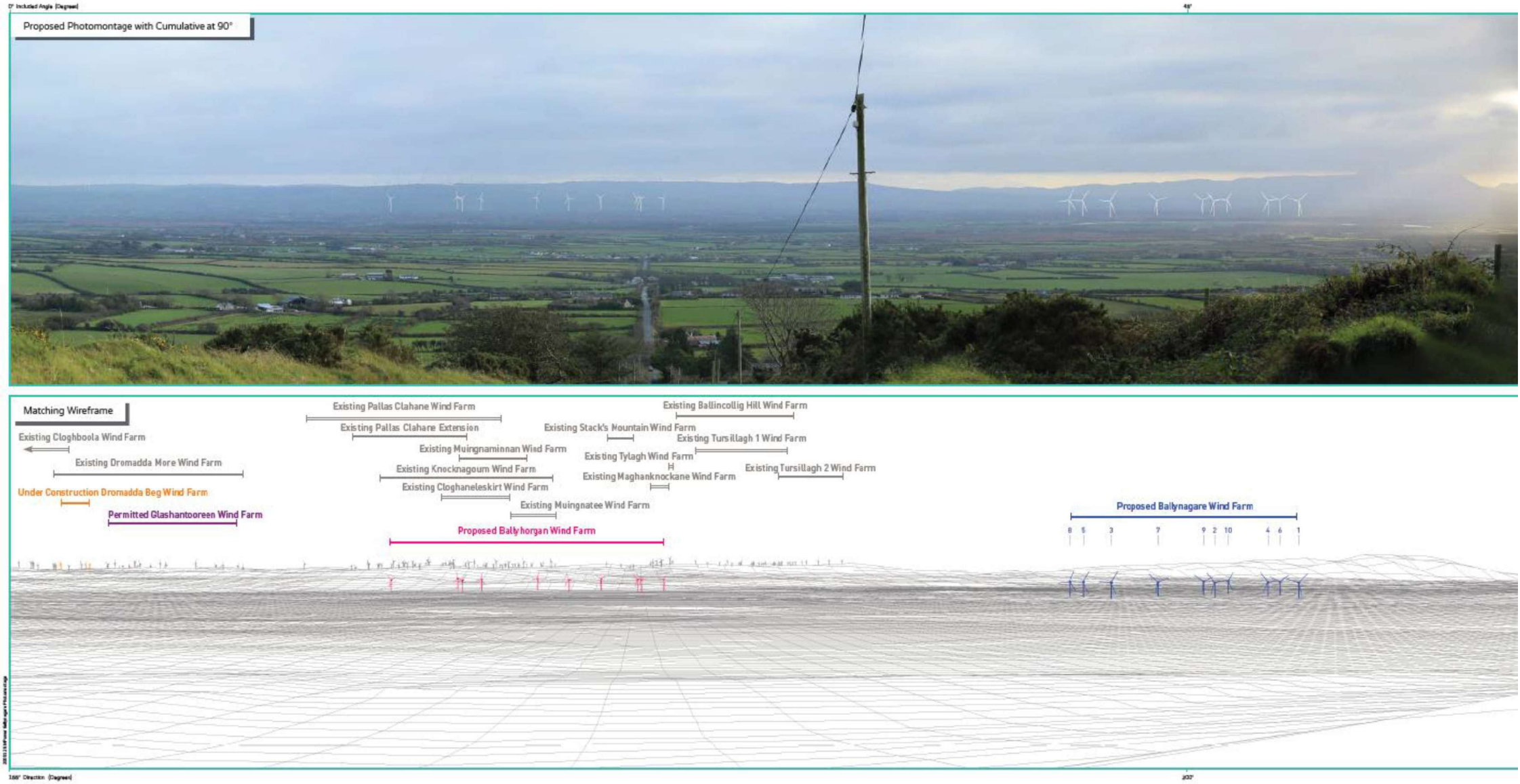
Environmental Impact Assessment

EMPower





Environmental Impact Assessment



Environmental Impact Assessment

EMPower

View Point 23 Aghabeg East

Photomontage 23

View Point: View from the Ballyduff local road in the townland of Aghabeg East, approximately 2.6 km southwest from the nearest turbine.

View point grid reference	E 486,942 N 629,466
Date of image taken	05.11.2020
Time of image taken	10:55am
View point elevation	10m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	40°
Horizontal extent of proposed turbines	21°
Distance to nearest proposed turbine	2.6km (T10)
Number of proposed turbines visible	x/10
Turbine Hub Height	92.5m
Turbine Tip Height	170m
Turbine Rotor Diameter	155m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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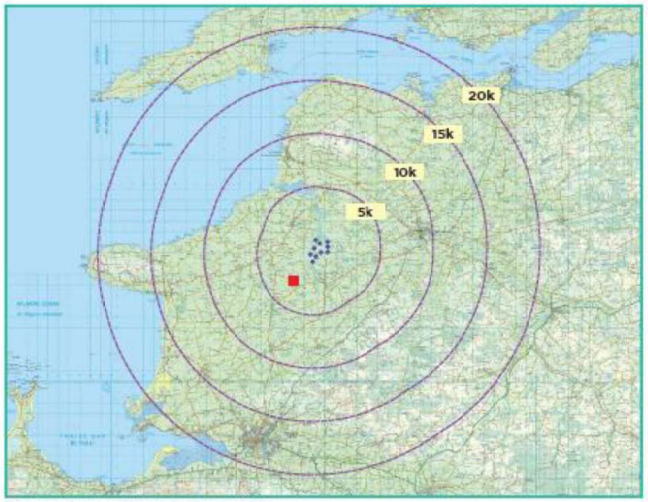
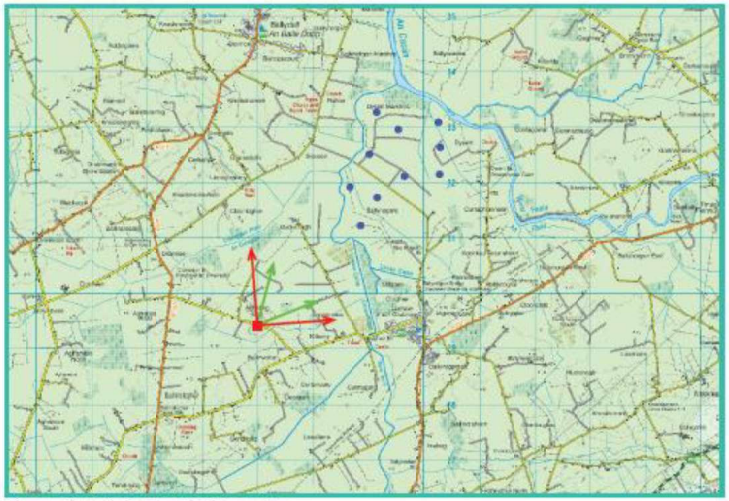


View point relative to 20km radius.


View point relative to wind farm site

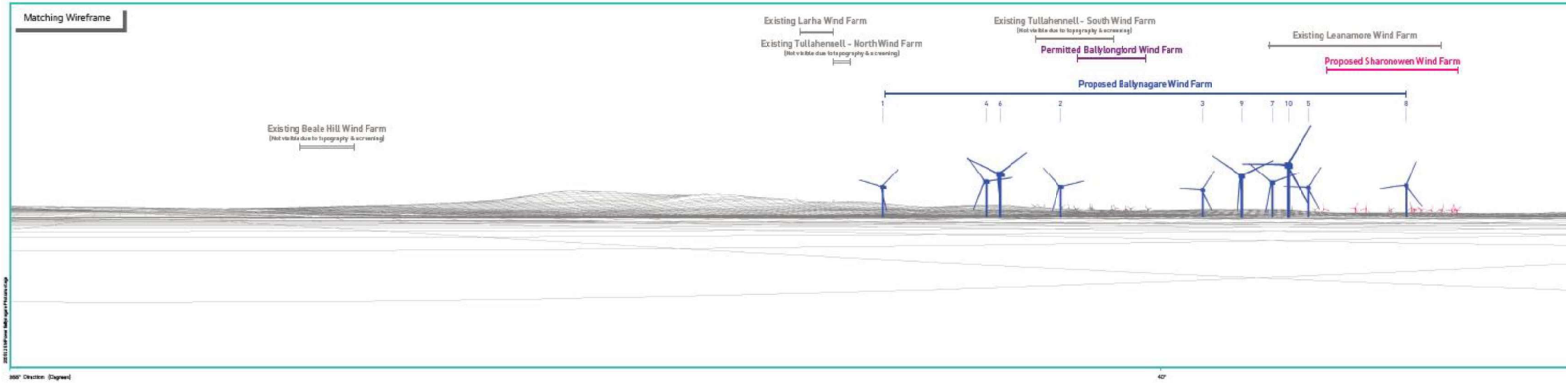
90° View Extent



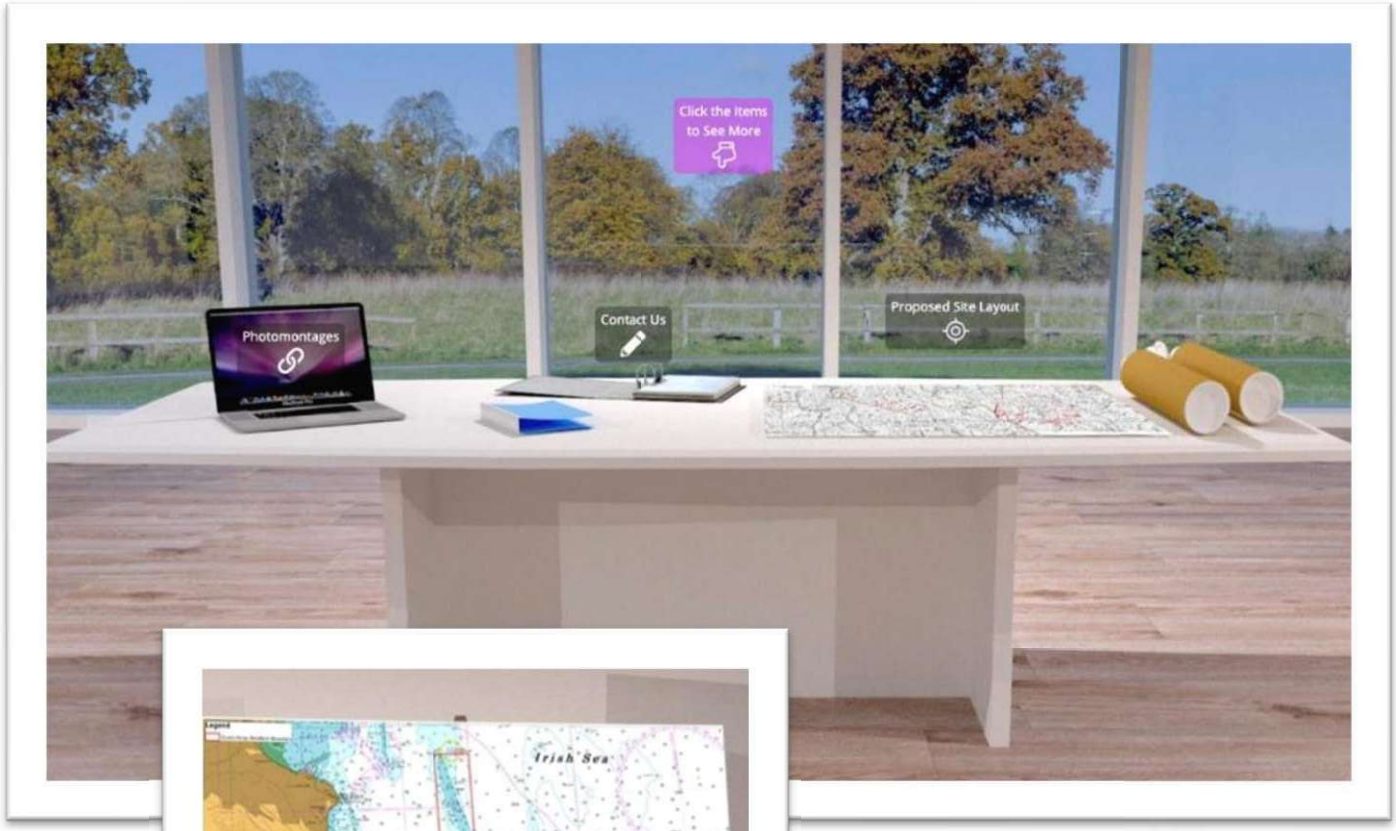
53.5° View Extent

Environmental Impact Assessment

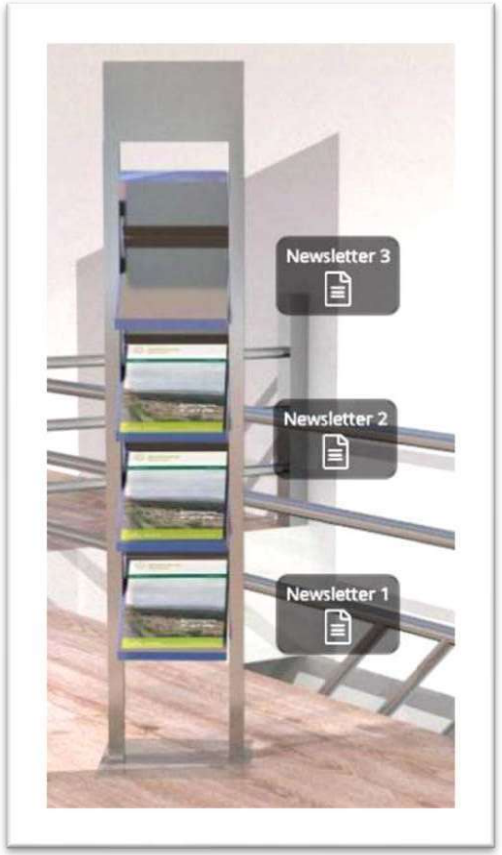




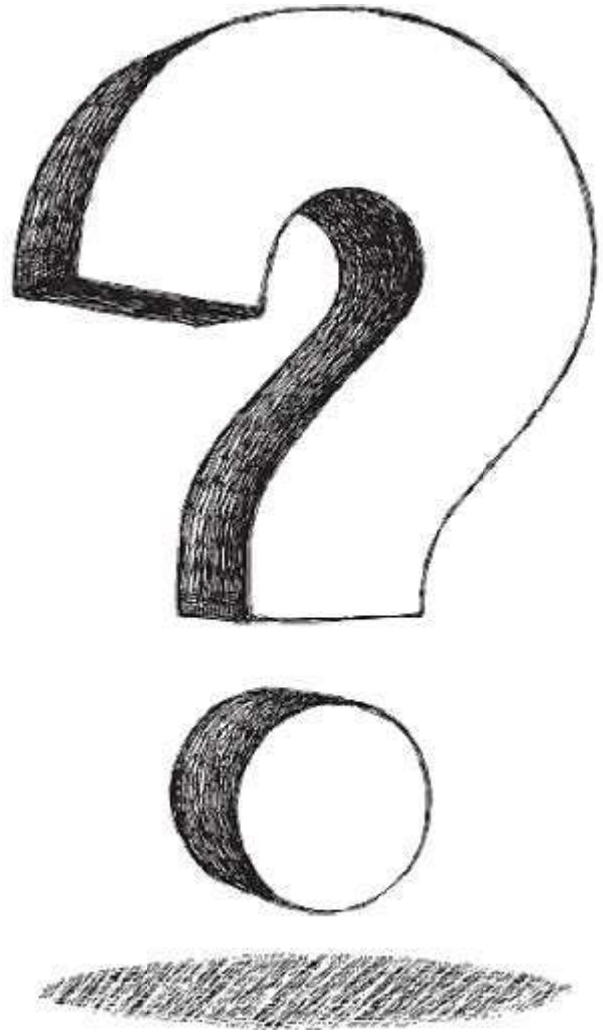
Virtual Consultation Room







Question Time



Conclusion

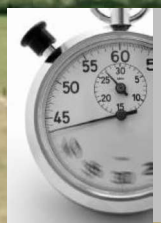
- Proposed Ballynagare Wind Farm
  - Up to 10 turbines
  - Estimated 60 MW
  - 35,000 Irish homes powered
- Community Fund
  - Average €297,000 per year
  - €1,000 per year (households <1km)
  - €500 per year (households >1km <1.5km)
  - Fund focused on Ballyduff and Lixnaw Villages
- Next Steps
  - Virtual consultation room
  - Submission for planning in Summer 2021



Get in Touch
A : EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1
E : info@emp.group
T : 01 588 0178

Reference 3.3 – Public Consultation Webinar No.3 Slides

Proposed Ballynagare Wind Farm
3rd Public Consultation Webinar – September 2021



We will begin shortly. We are allowing people a few extra minutes to dial in…

EMPower

Ballynagare Wind Farm Proposal

EMPower

- Company Introduction
- Wind Farm Design
- Community Fund
- Q&A
- EIA Activities
- Q&A
- Conclusion



Company Introduction

EMPower

95 Years

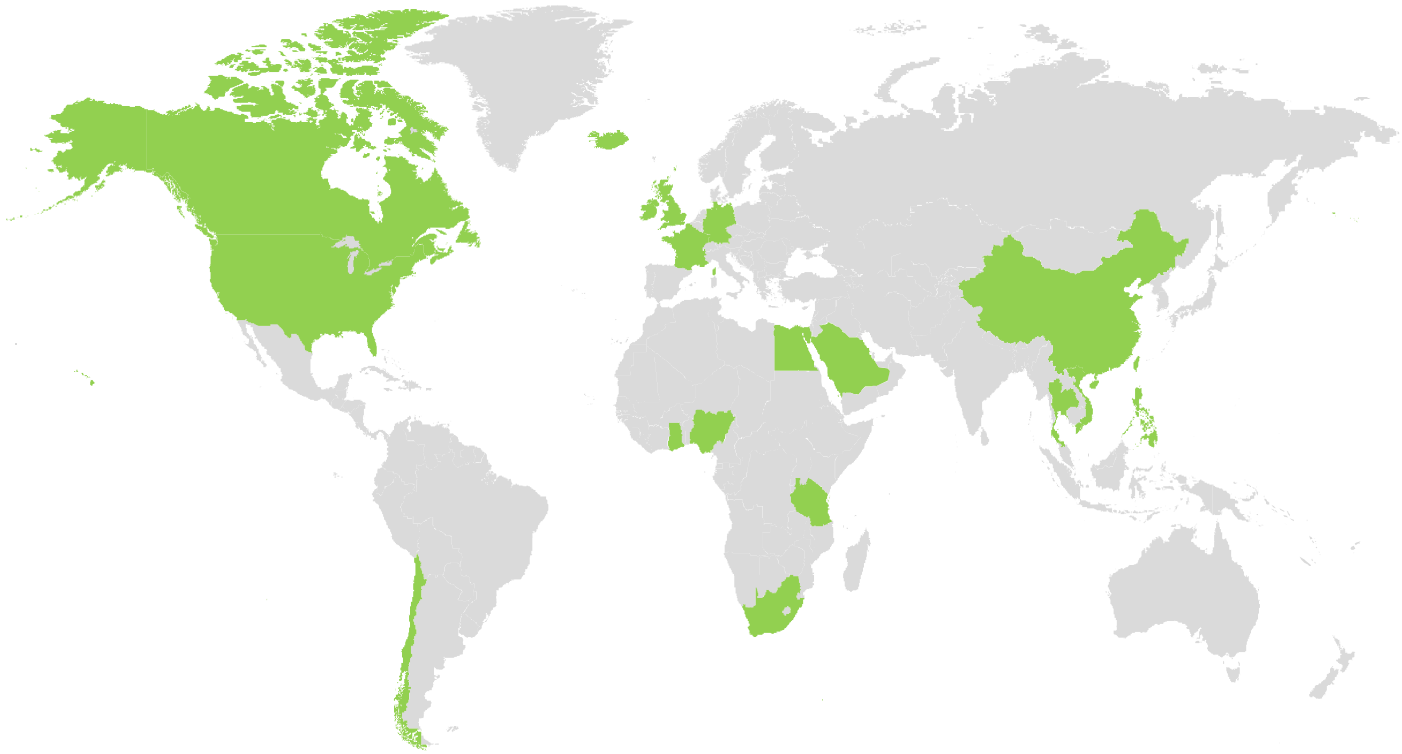
Combined Experience of EMPower Management Team in Renewable Energy

+700 MW

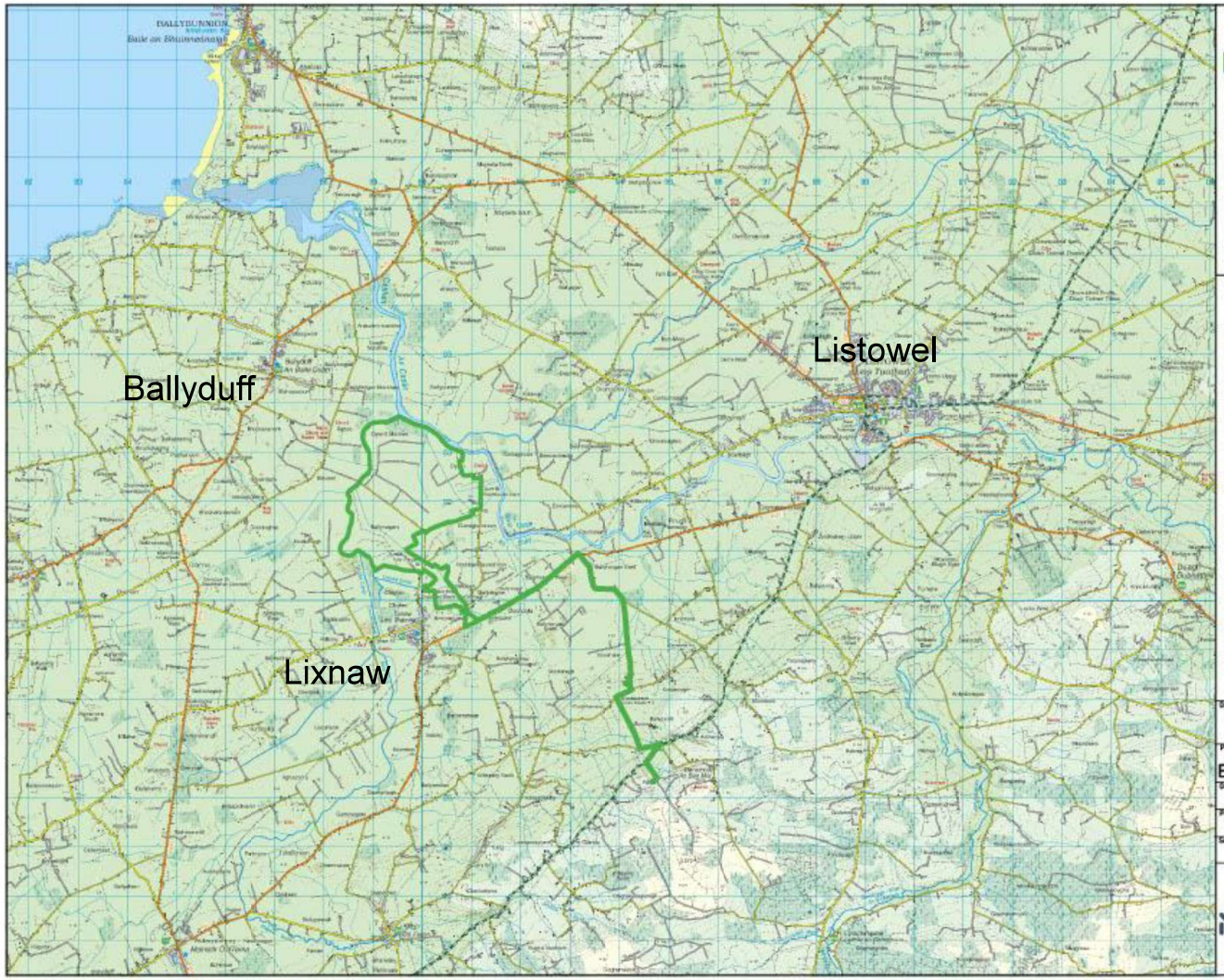
Wind Energy Capacity Currently Under Development By EMPower

5 Continents

Combined Geographical Experience of EMPower Team in Renewable Energy



Project Introduction



Proposed Ballynagare Wind Farm

7 Turbines

42 MW

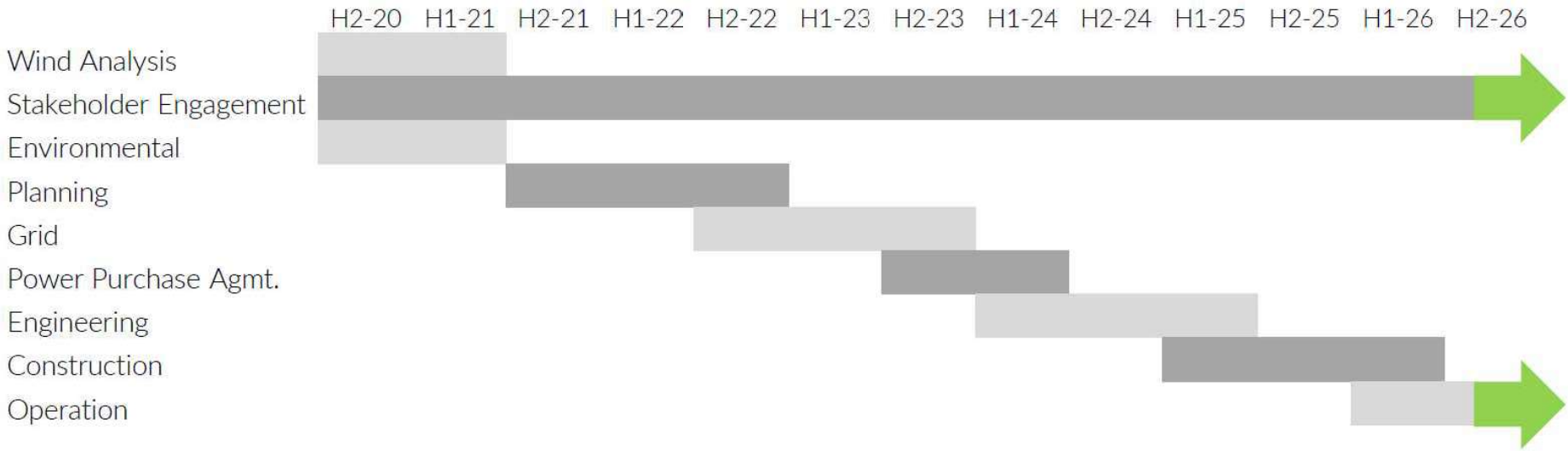
170m
Tip Height

24,000 Irish home powered

€3.1 million
Total Community Fund

Proposed Project Schedule

Planning Submission to Kerry County Council	October 2021
Grid Connection Submission	Autumn 2022
Renewable Electricity Support Scheme Submission	Summer 2023
Construction Commences	Spring 2025



Energy Targets in Ireland

EMPower

Table 7.5 Potential Metrics to Deliver Abatement in Electri

Key Metrics	2017	2025 Based on MACC	2030 Based on MACC
Share of Renewable Electricity, %	~30%[20]	52%	70%
Onshore Wind Capacity, GW	~3.3	6.5	8.2
Offshore Wind Capacity, GW	NA	1.0	3.5
Solar PV Capacity, GW	NA	0.2	0.4
CCGT Capacity, GW	~3.6	5.1	4.7

70%
Renewables by 2030

8.2 GW
Onshore wind by 2030

Source – Department of Communications, Climate Action and Environment
Climate Action Plan 2019
Marginal Abatement Cost Curve (MACC) Analysis

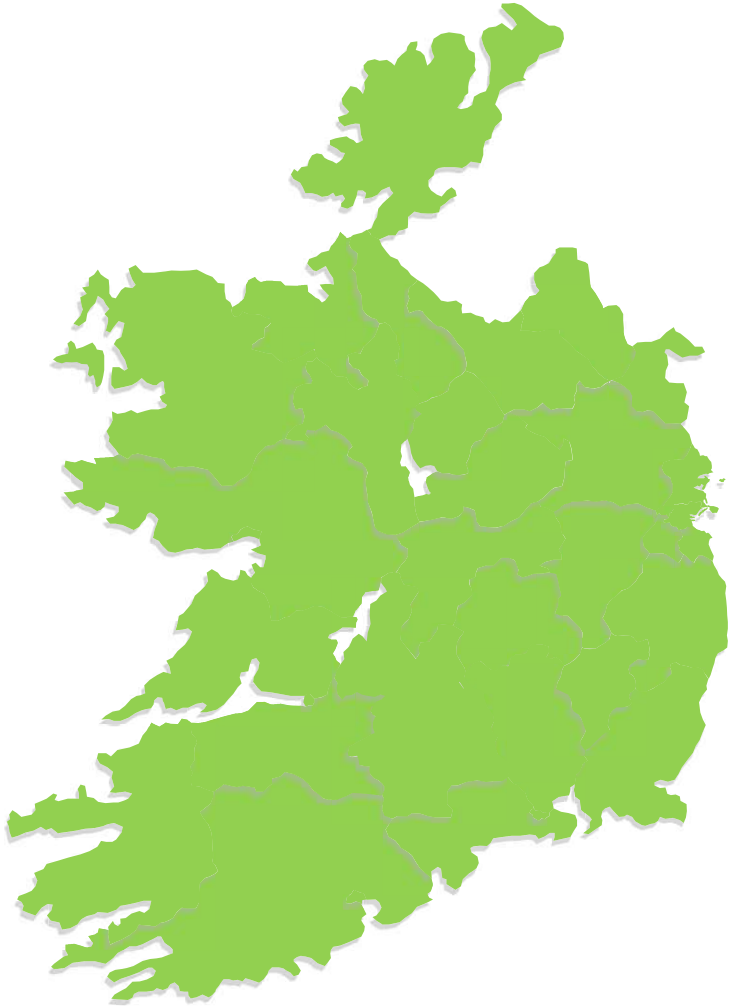
Site Screening

EMPower

Grid | Wind | CDP | SACs | Housing | Capacity | Land

Screening analysis performed on the entire Republic of Ireland incorporating constraints such as:

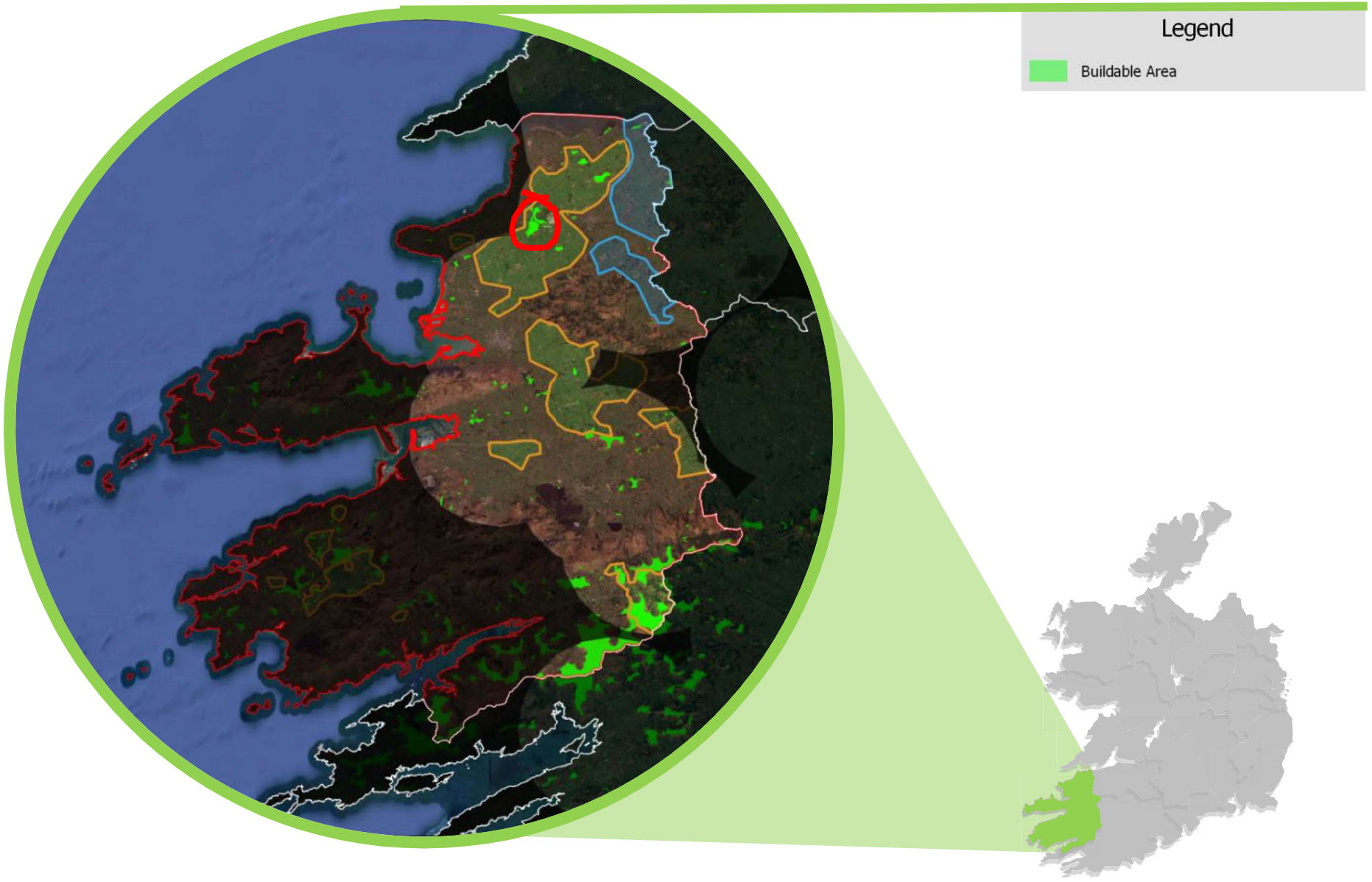
- Wind speed
- Grid connection
- Environmental Designations
- Culture and heritage
- Tourism
- County Development Plans
- Existing, planned and permitted projects
- Housing



Site Screening

EMPower

Grid → Wind → CDP → SACs → Housing → Capacity → Land

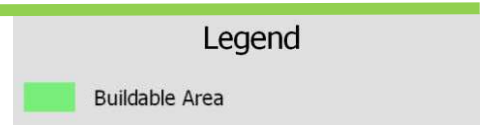


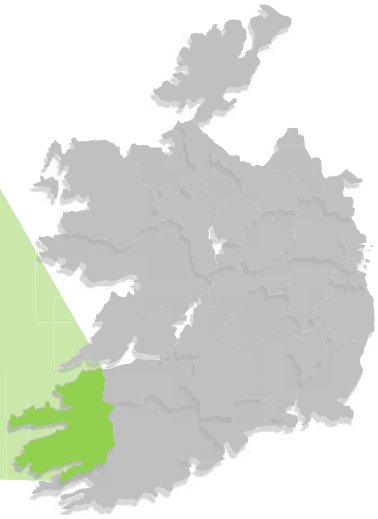
Site Screening

EMPower

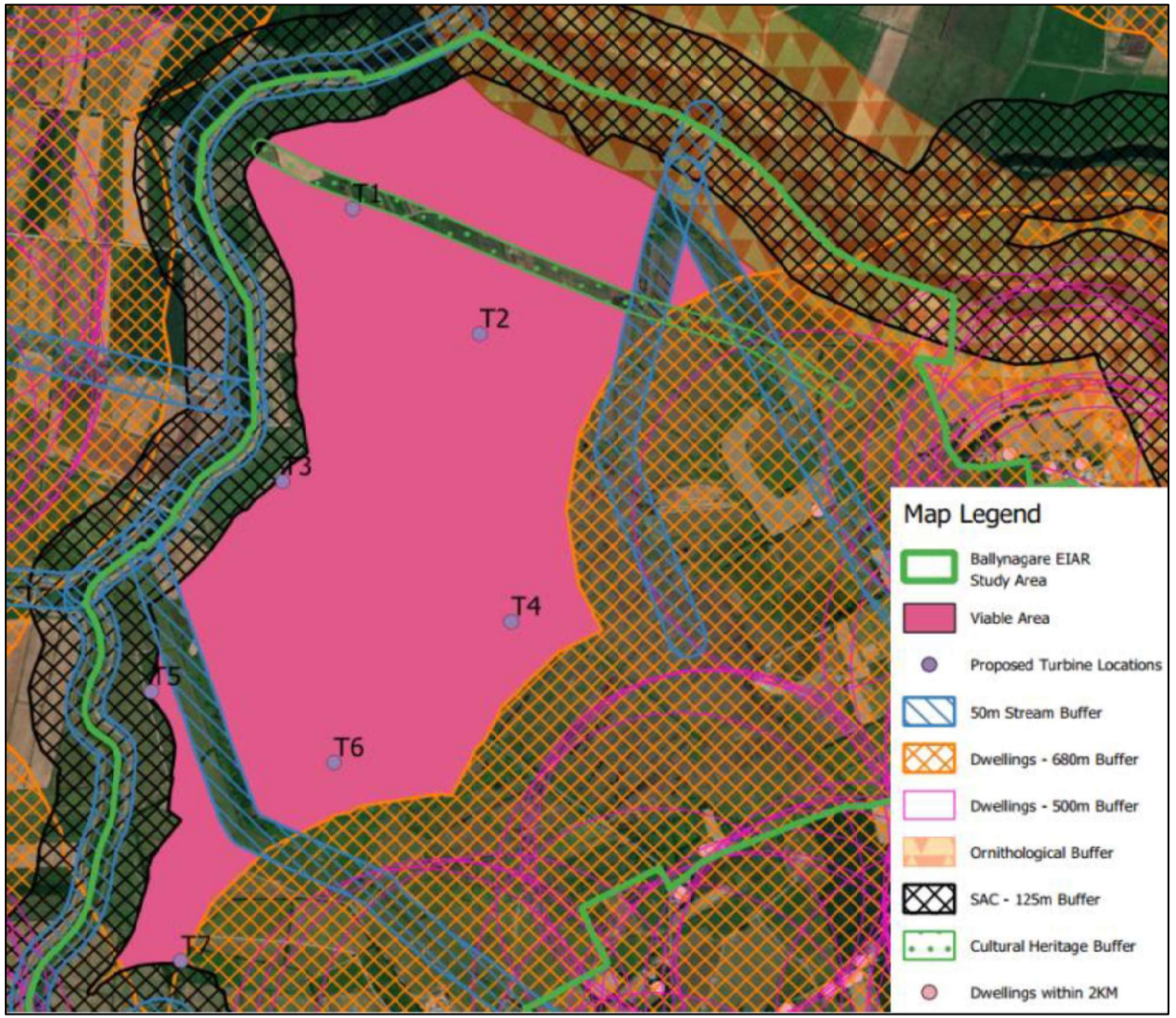
Grid → Wind → CDP → SACs → Housing → Capacity → Land







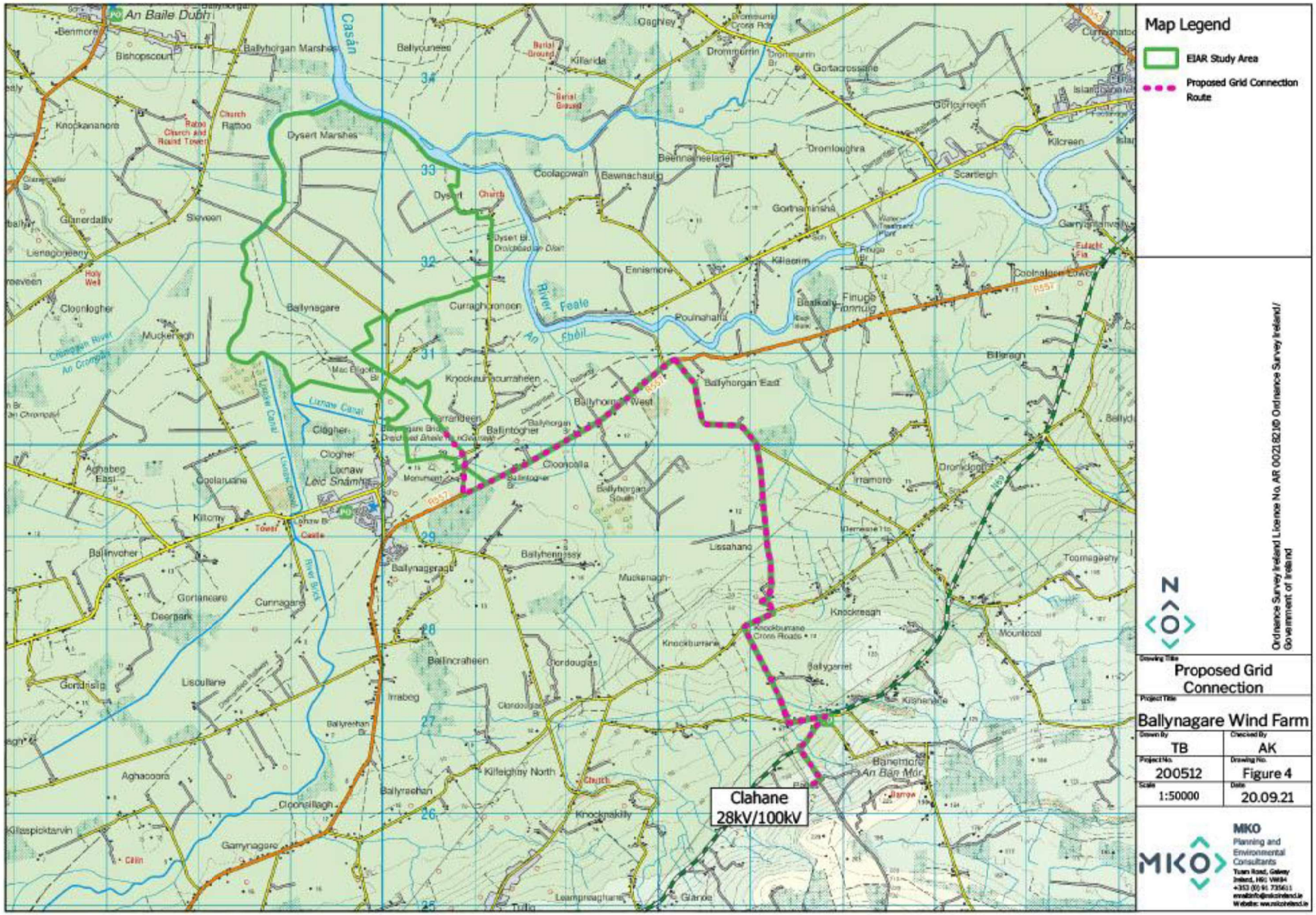
Detailed Constraints Analysis



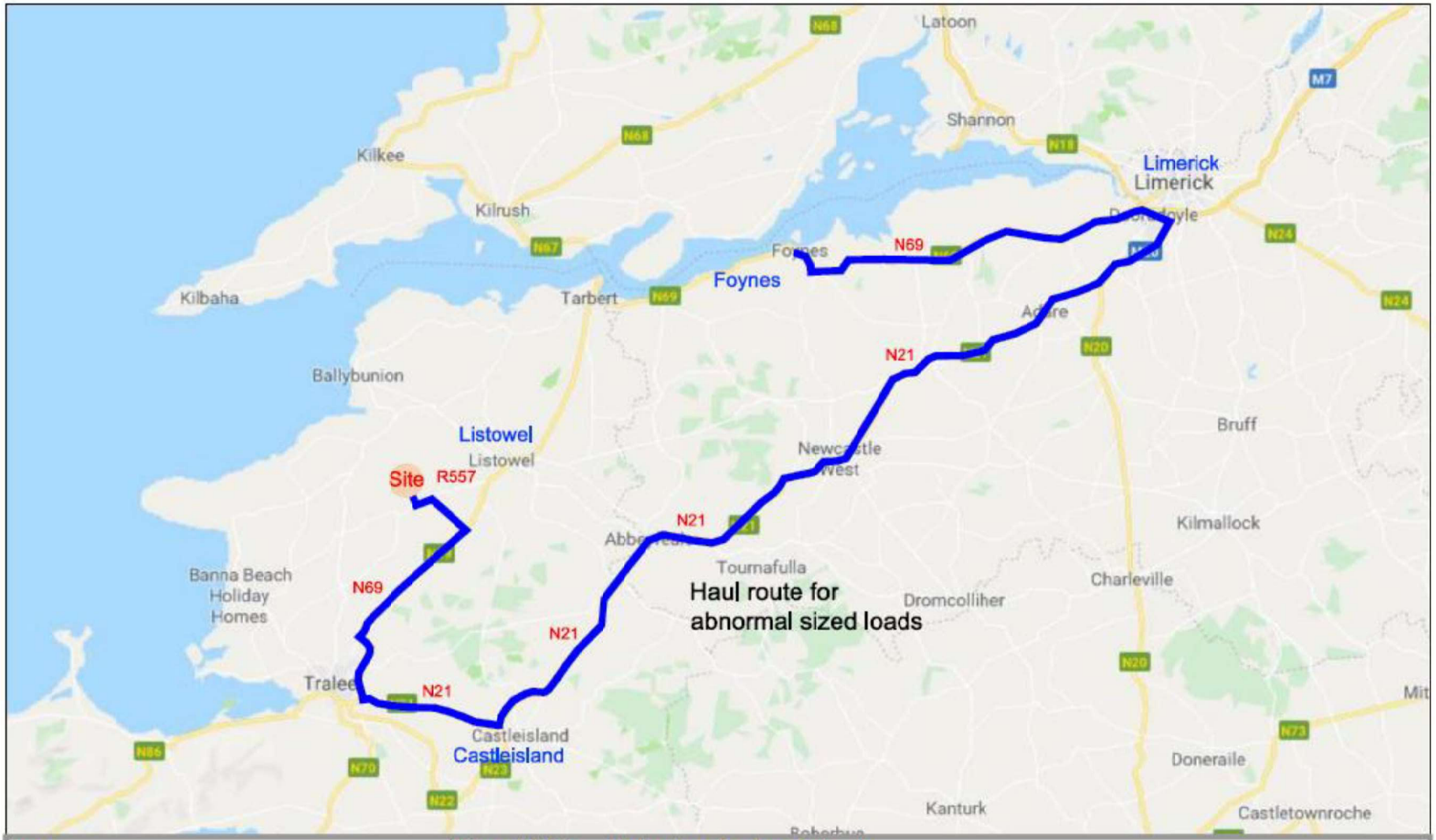
Proposed Ballynagare Layout



Grid Connection Route



Haulage Route



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

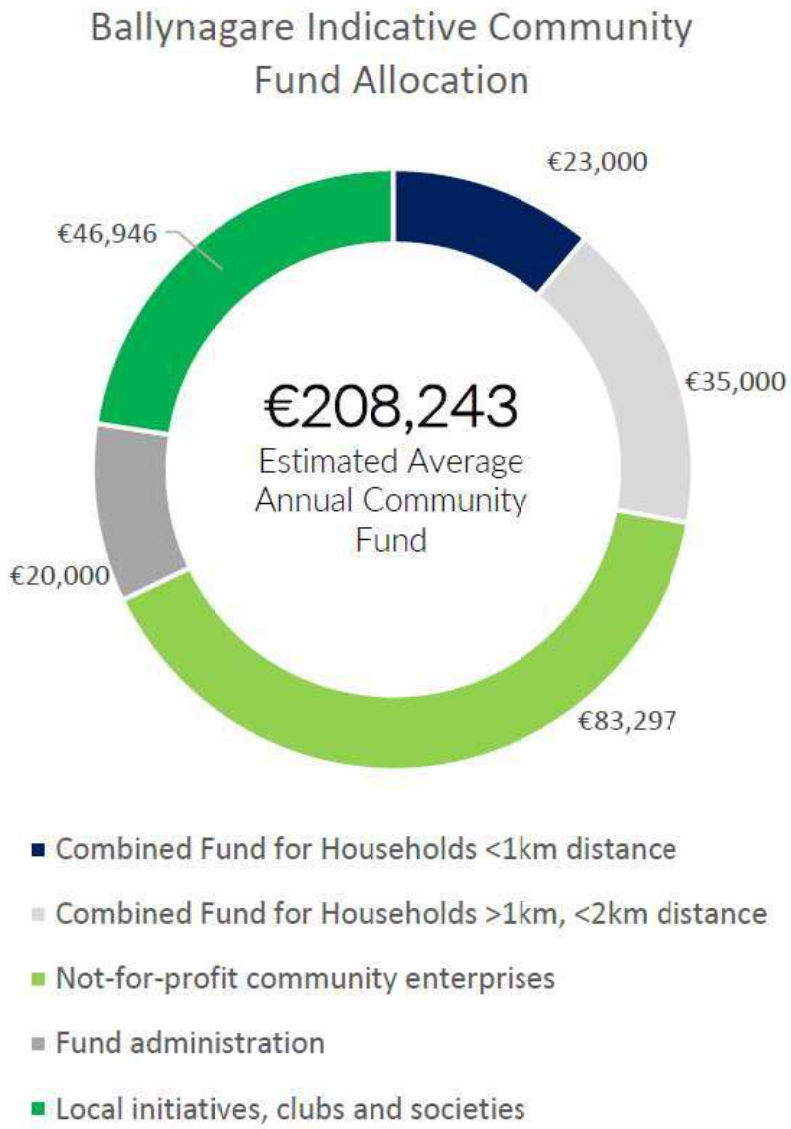
Figure A14.2.1 Haul route, national road network

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Windfarm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 16.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Community Benefits

EMPower



71
Direct jobs in construction phase

17
Highly skilled jobs over project lifetime

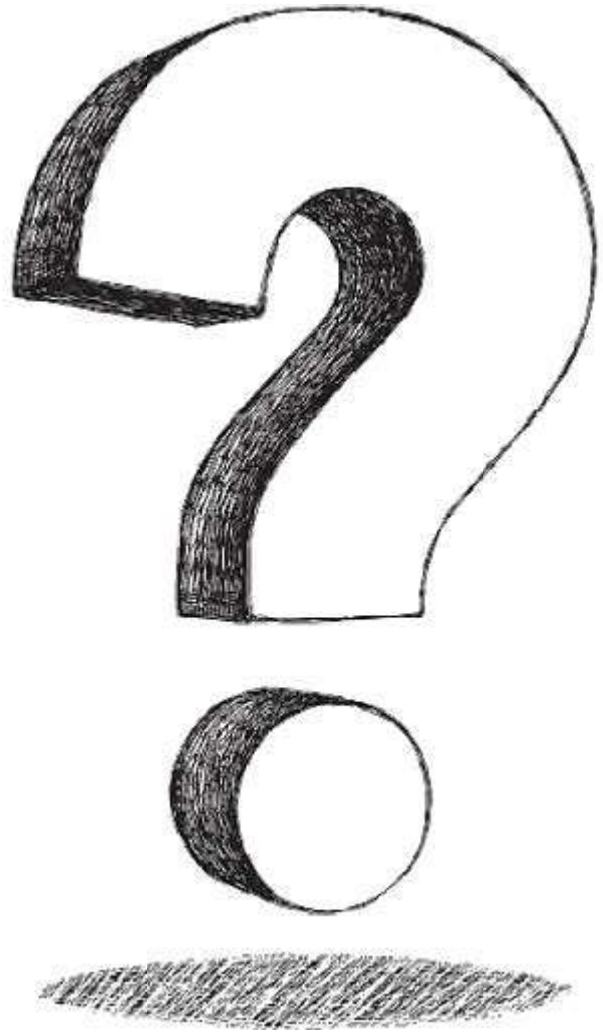
€ 46.2 million
Investment in Irish infrastructure

€ 3.1 million
Total Community Fund Contribution

€ 10.1 million[2]
County Council Rates Contribution

Renewable Electricity Support Scheme (RESS)
High Level Design

Question Time



MKO Company Introduction

EMPower

- MKO delivers challenging and complex planning and environmental projects for our clients.

- Our team of approx. 100 professionals working across 6 specialist teams
- Planning, Environmental, Ornithology, Ecology, Estates & Project Management, Land Solutions

- We operate across a range of sectors, including:
- Renewable energy
- Residential
- Commercial
- Health
- Retail
- Amenity











Sequence of Services



Proposed Planning Submission

- **Strategic Infrastructure Development** – 25 wind turbines or a total output of 50 megwatts; Engagement with An Bord Pleanála required
- **Submission to Kerry County Council -** Planned Submission Date October 2021
- **Planning Description**
  - Construction of 7 no. wind turbines with the following maximum and minimum parameters:
    - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
    - Hub height of 95m
    - Rotor diameter in the range of 150m maximum to 149m minimum
  - Turbine hardstand areas;
  - Provision of 1 no. permanent meteorological mast with a maximum height of 110 metres
  - Upgrade of existing roads and access junctions
  - Provision of new site entrances, roads and hardstand areas
  - 2 no. peat storage areas
  - 2 no. construction compounds
  - 1no. borrow pit
  - All site drainage works
  - 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
  - All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
  - Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
  - All ancillary site and ground works, apparatus and signage

Hydrology





Ornithology

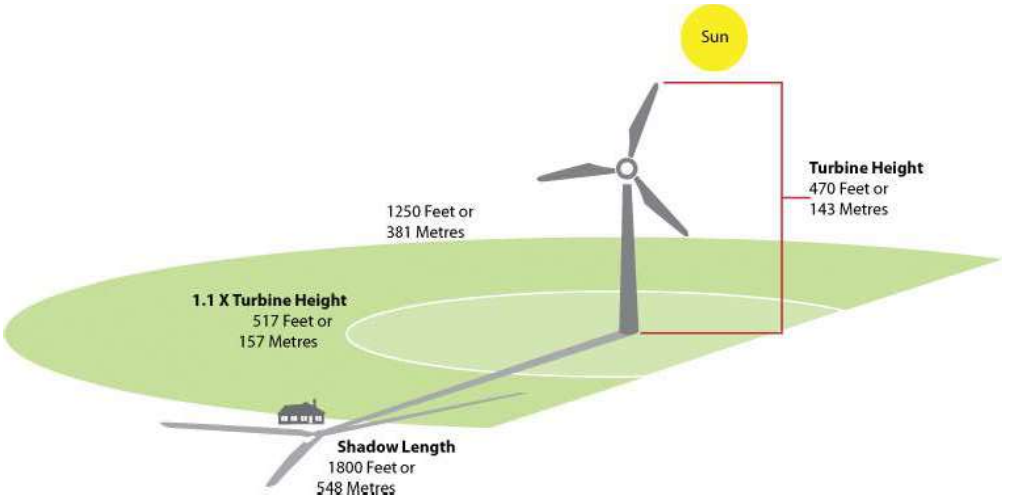
Population & Human Health





Biodiversity

Shadow Flicker





Sound

Construction and Civil Engineering





Archaeology

Landscape and Visuals



View Point 1

Clooneagh

Photomontage 1

View Point: View from the Rattoo Church and Round Tower in the townland of Clooneagh, approximately 1.3 km northeast from the nearest turbine.

View point grid reference	E 487,776 N 633,611
Capture Date of image taken	05.11.2020
Time of image taken	2:30pm
View point elevation	17m
Angle of Views	90° / 53.5°
View Direction (mage Centre)	128°
Horizontal extent of proposed turbines	59°
Distance to nearest proposed turbine	1.3km (T1)
Number of proposed turbines visible	7/7
Turbine Hub Height	95m
Turbine Tip Height	170m
Turbine Rotor Diameter	150m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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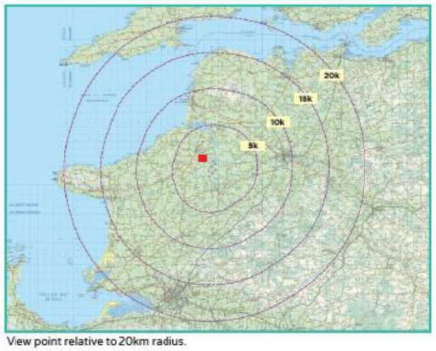
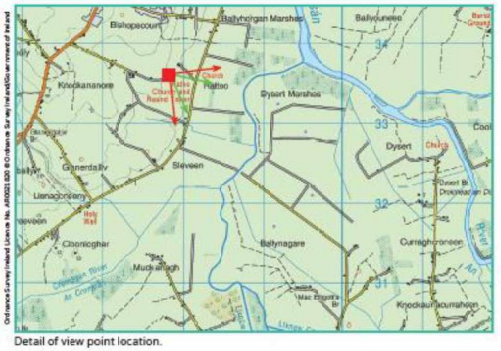


View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Proposed Ballynagare Wind Farm

Wireframe Legend

Proposed Ballynagare Wind Farm in Blue

Permitted Wind Farms in Purple

Existing Wind Farms in Grey

Under Construction Wind Farms in Orange

Other Proposed Wind Farms in Pink

Prepared by

MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 5611
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

90° View Extent

Key Image at 120°

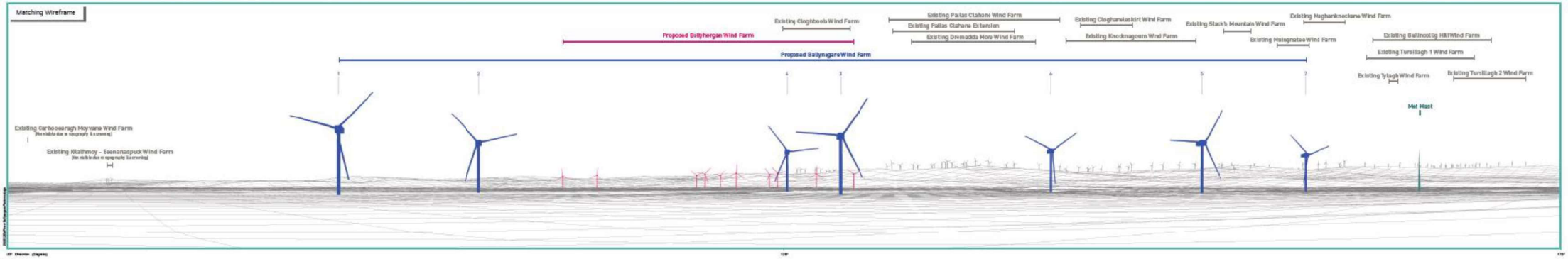


53.5° View Extent

Proposed Photomontage with Cumulative at 90°



Matching Wireframe



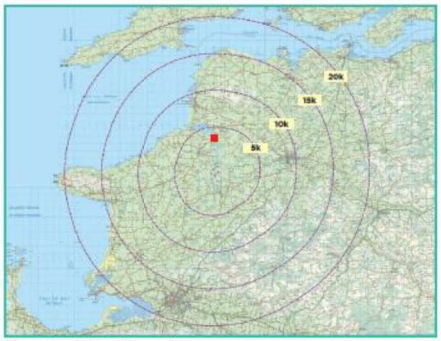
View Point 3

Derryco

Photomontage 3

View Point: View from R551 and Wild Atlantic Way in the townland of Derryco, approximately 3.2 km north of the nearest turbine. Designated as Scenic Route 1 (Ferry Bridge).

View point grid reference	E 489,030 N 636,566
Capture Date of image taken	05.11.2020
Time of image taken	3:11pm
View point elevation	8m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	173°
Horizontal extent of proposed turbines	25°
Distance to nearest proposed turbine	3.2km (T1)
Number of proposed turbines visible	7/7
Turbine Hub Height	95m
Turbine Tip Height	170m
Turbine Rotor Diameter	150m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
Map Licence	©Copyright of Ordnance Survey Ireland. All Rights Reserved; License No: AR 0021820



View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

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Map Legend

- Area shown in 90° view
- Area shown in 53.5° view
- View Point
- Proposed Ballynagare Wind Farm

Wireframe Legend

- Proposed Ballynagare Wind Farm in Blue
- Permitted Wind Farms in Purple
- Existing Wind Farms in Grey
- Under Construction Wind Farms in Orange
- Other Proposed Wind Farms in Pink

Prepared by
MKO
Planning & Environmental Consultants
Tuam Road, Galway.

Tel: (091) 73 96 11
E-mail: info@mkoireland.ie
Website: www.mkoireland.ie

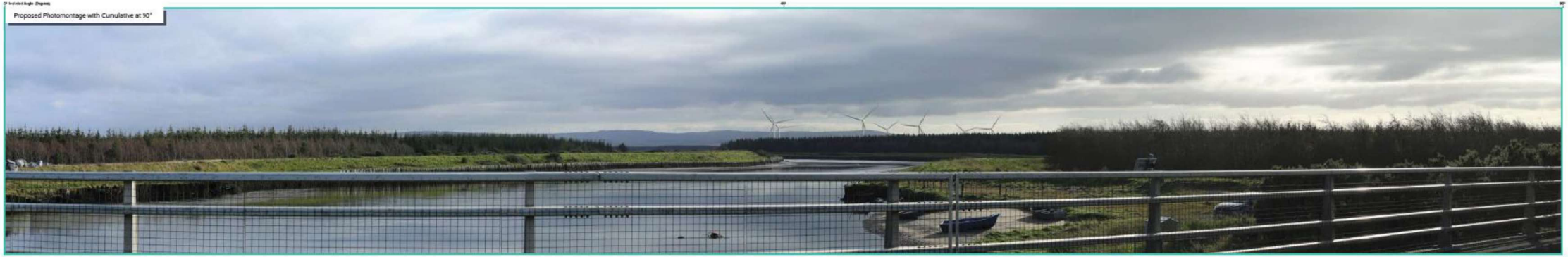
90° View Extent

Key Image at 120°

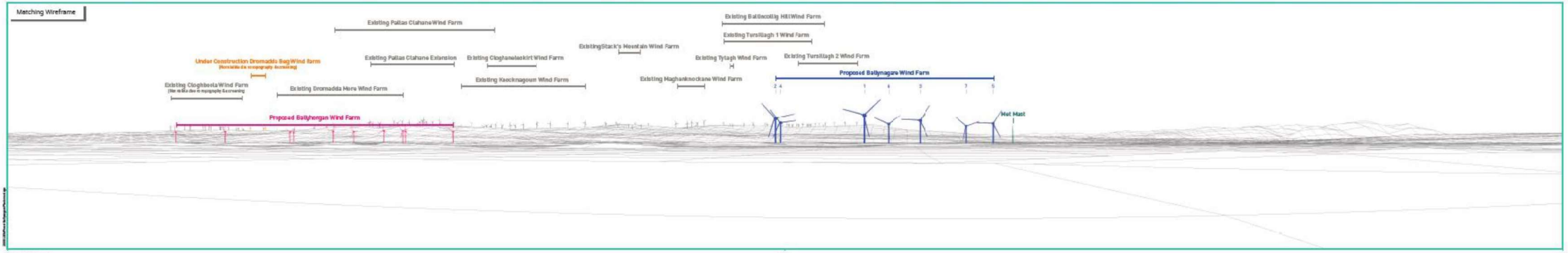


53.5° View Extent

Proposed Photomontage with Cumulative at 90°



Matching Wireframe



View Point 9

Dysert

Photomontage 9

View Point: View from local road off the R557 in the townland of Dysert, approximately 1.3 km east from the nearest turbine.

View point grid reference	E 431,284 N 632,737
Capture Date of image taken	06.11.2020
Time of image taken	11:45am
View point elevation	8m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	264°
Horizontal extent of proposed turbines	46°
Distance to nearest proposed turbine	1.3km (T2)
Number of proposed turbines visible	4/7
Turbine Hub Height	95m
Turbine Tip Height	170m
Turbine Rotor Diameter	150m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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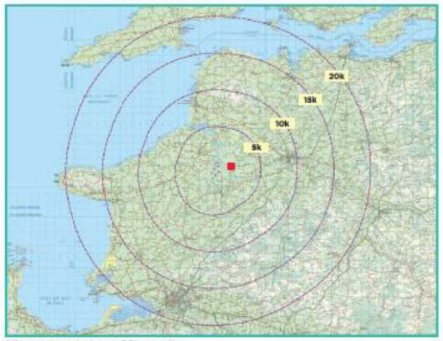

View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

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Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Proposed Ballynagare Wind Farm

Wireframe Legend

Proposed Ballynagare Wind Farm in Blue
Permitted Wind Farms in Purple
Existing Wind Farms in Grey
Under Construction Wind Farms in Orange
Other Proposed Wind Farms in Pink

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MKO
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Website: www.mkoireland.ie

90° View Extent

Key Image at 120'

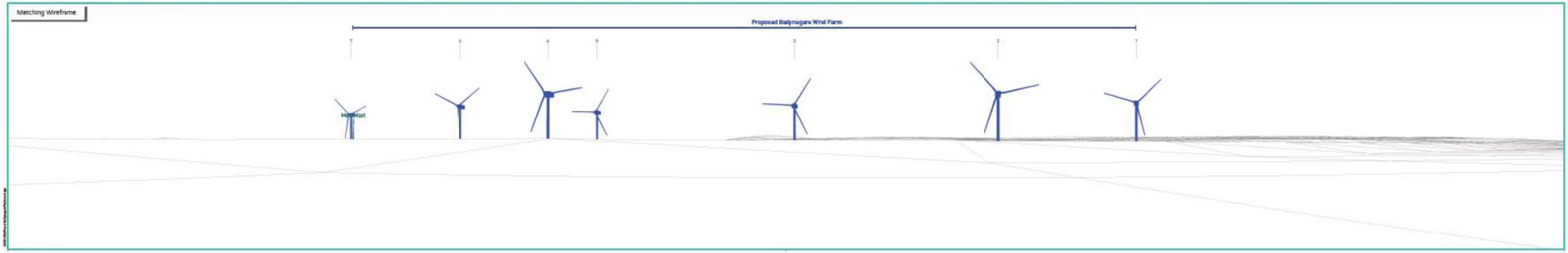


53.5° View Extent

Proposed Photomontage with Cumulative at 90°



Matching Wireframe



View Point 11

Rathea

Photomontage 11

View Point: View from local road just off the R555 in the townland of Rathea, approximately 12.5 km west of the nearest turbine. Designated as Scenic Route 3.

View point grid reference	E 501,731 N 629,013
Capture Date of image taken	06.11.2020
Time of image taken	10:54am
View point elevation	113m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	284°
Horizontal extent of proposed turbines	10°
Distance to nearest proposed turbine	12.5km (T4)
Number of proposed turbines visible	7/7
Turbine Hub Height	95m
Turbine Tip Height	170m
Turbine Rotor Diameter	150m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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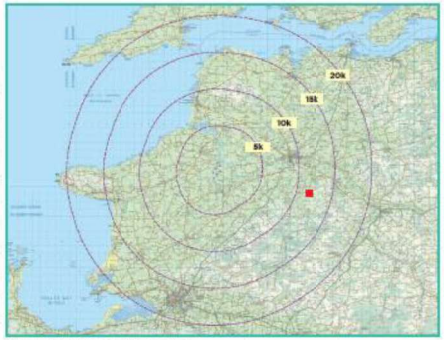
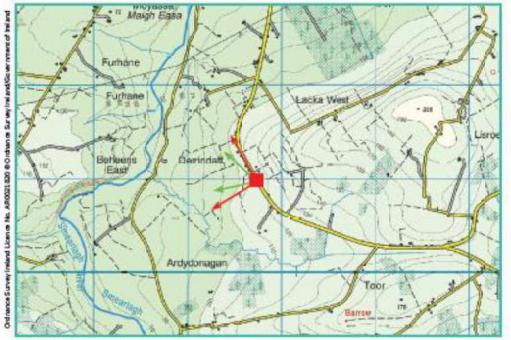


View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

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Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Proposed Ballynagare Wind Farm

Wireframe Legend

Proposed Ballynagare Wind Farm in Blue
Permitted Wind Farms in Purple
Existing Wind Farms in Grey
Under Construction Wind Farms in Orange
Other Proposed Wind Farms in Pink

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Website: www.mkoireland.ie

90° View Extent

Key Image at 120°

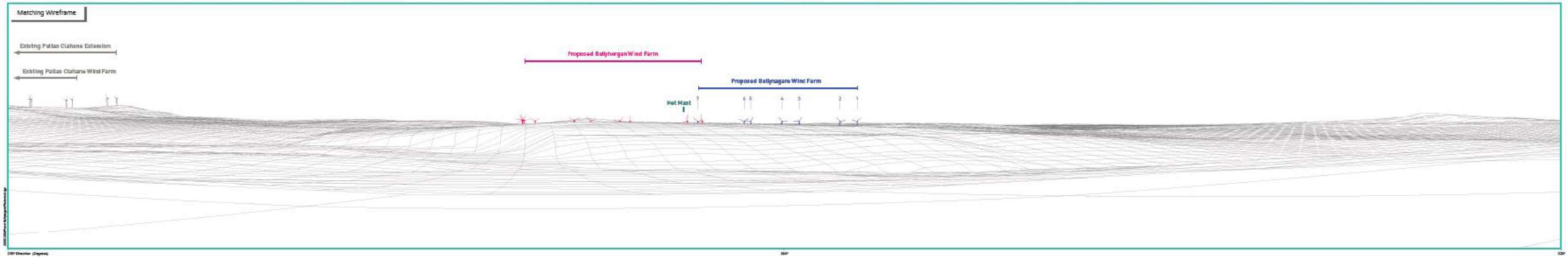


53.5° View Extent

Proposed Photomontage with Cumulative at 90°



Matching Wireframe



View Point 14

Aghabeg East

Photomontage 14

View Point: View from the Ballyduff local road in the townland of Aghabeg East, approximately 2.6 km southwest from the nearest turbine.

View point grid reference	E486,942 N 629,466
Capture Date of image taken	05.11.2020
Time of image taken	10:55am
View point elevation	10m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	40°
Horizontal extent of proposed turbines	21°
Distance to nearest proposed turbine	2.5km (T7)
Number of proposed turbines visible	7/7
Turbine Hub Height	95m
Turbine Tip Height	170m
Turbine Rotor Diameter	150m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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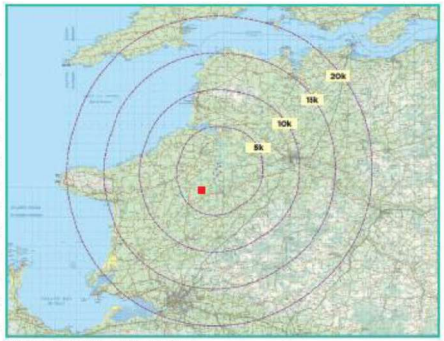

View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

Map Legend

- Area shown in 90° view
- Area shown in 53.5° view
- View Point
- Proposed Ballynagare Wind Farm

Wireframe Legend

- Proposed Ballynagare Wind Farm in Blue
- Permitted Wind Farms in Purple
- Existing Wind Farms in Grey
- Under Construction Wind Farms in Orange
- Other Proposed Wind Farms in Pink

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90° View Extent

Key Image at 120°

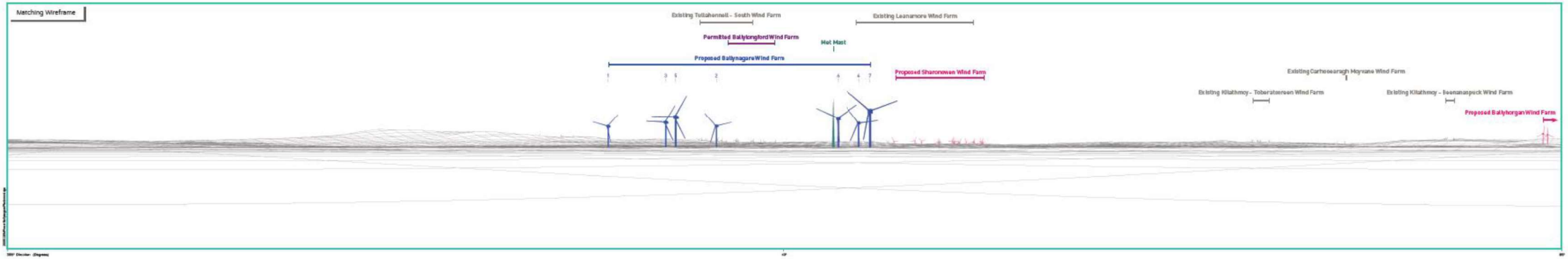


53.5° View Extent

Proposed Photomontage with Cumulative at 90°



Matching Wireframe



View Point 15

Ballinprior

Photomontage 15

View Point: View from Banna Strand in the townland of Ballinprior, which is also located in an area of Secondary Special Amenity and along the North Kerry Way, approximately 15.3 km northwest from the nearest turbine.

View point grid reference	E 474,982 N 624,700
Capture Date of image taken	05.11.2020
Time of image taken	11:37am
View point elevation	10m
Angle of Views	90° / 53.5°
View Direction (Image Centre)	61°
Horizontal extent of proposed turbines	6°
Distance to nearest proposed turbine	15.3km (T10)
Number of proposed turbines visible	7/7
Turbine Hub Height	95m
Turbine Tip Height	170m
Turbine Rotor Diameter	150m
Camera	Canon EOS 600D with 1.5x sensor
Lens	35mm prime. Equivalent zoom range 52.5mm
Tripod	Manfrotto 190X extended to approx 1.65m.
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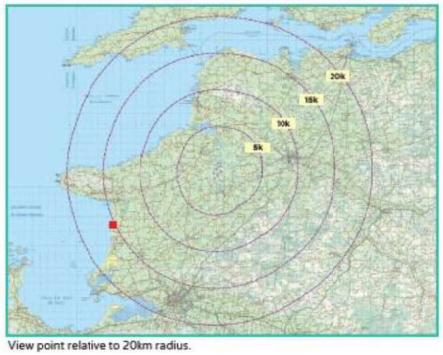
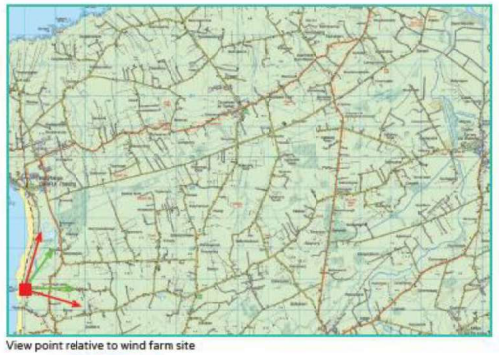


View point relative to 20km radius.


View point relative to wind farm site



Detail of view point location.

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Map Legend

Area shown in 90° view

Area shown in 53.5° view

View Point

Proposed Ballynagare Wind Farm

Wireframe Legend

Proposed Ballynagare Wind Farm in Blue
Permitted Wind Farms in Purple
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90° View Extent

Key Image at 120°

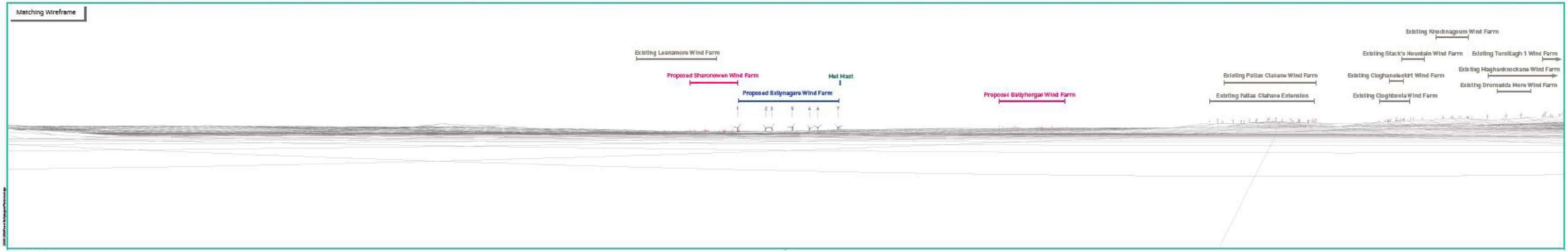


53.5° View Extent

Proposed Photomontage with Cumulative at 90°



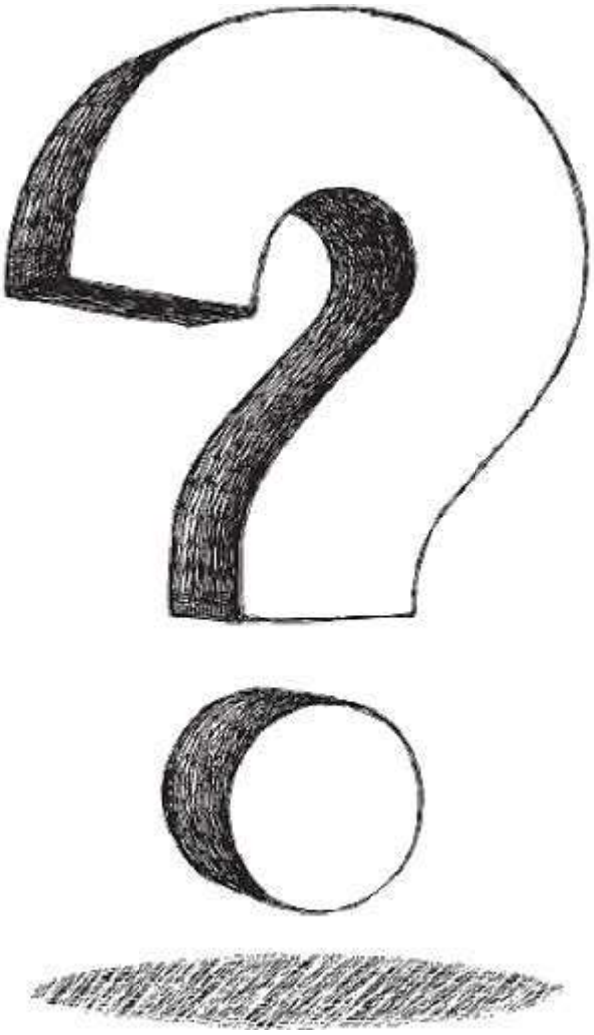
Matching Wireframe



Virtual Consultation Room



Question Time



Conclusion

- Proposed Ballynagare Wind Farm
  - 7 turbines
  - Estimated 42 MW
  - 24,700 Irish homes powered
- Community Fund
  - Average €208,243 per year
  - €1,000 per year (households <1km)
  - €500 per year (households >1km <1.5km)
  - Fund focused on Ballyduff and Lixnaw Villages
- Next Steps
  - Virtual consultation room
  - Submission for planning in October 2021



Get in Touch
A : EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1
E : ballynagare@emp.group
T : 01 588 0178

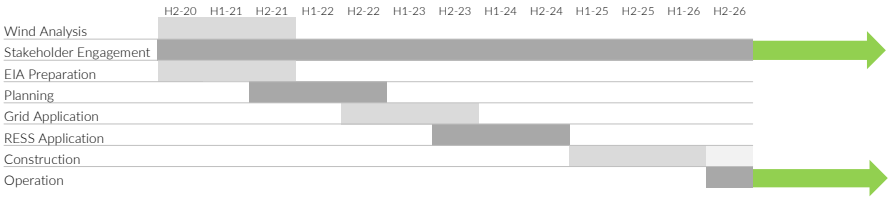
Reference 4.1 – Virtual Public Consultation Room Materials

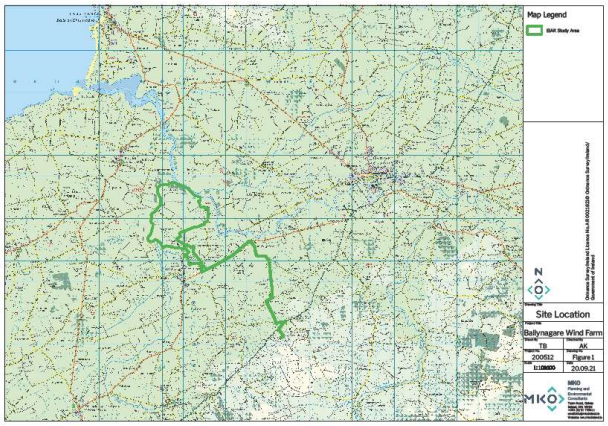
EMPower

Ballynagare Wind Farm Proposal

The Study Area for The proposed Ballynagare Wind Farm project is located approximately 2km north of the village of Lixnaw and approximately 8.8km southwest of the town of Listowel, Co. Kerry on lands contained within the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, and Monument.
The final project footprint will be approximately X acres. Subject to environmental impact assessment and planning permission EMPower are proposing a 7 wind turbine project, at a proposed hub height of 95 metres and proposed blade tip height of 170 metres. The proposed Ballynagare project will be capable of providing enough clean, affordable, indigenous energy to power over 33,000 Irish homes. The project is proposing an underground cable to connect to the electricity network. The proposed projects Study Area is identified in the Kerry County Development Plan as a "preferred zone" for wind energy development.

7 Turbines
42MW
Onsite 38Kv Substation
Metrological Mast





Who We Are

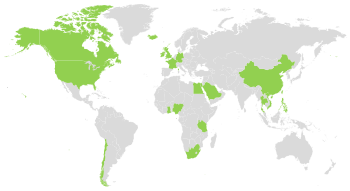
EMPower was established to serve the growing Irish electricity demand while creating the minimum environmental, ecological and social impact. Our vision is to provide low carbon, ecologically non-invasive, affordable energy to facilitate Ireland's expanding economy and sustainable energy targets.

EMPower is a private limited company owned by GGE Ireland Limited, Wind Power Invest A/S and EMP Holdings Limited. We are currently preparing planning documents including a comprehensive Environmental Impact Assessment Report for a planning submission to Kerry County Council, in Q4 2021. This is a legal requirement for all proposed wind energy applications which are being designed to generate below 50MW of energy.

Our primary business is the development of appropriately positioned and scaled greenfield wind energy power plants. EMPower will utilise the considerable international project development experience of our management team, coupled with the market leading technical expertise of our partners, to deliver clean energy assets in a cost effective and environmentally responsible manner.

EMPower is headquartered in Dublin with over 700 MW in development in Europe and Africa. EMPower's senior management team has a combined 95 years' experience delivering projects from conception to operation across five continents. The senior management team comprises five Irish professionals, highly experienced in the fields of renewable energy project management, corporate legal, finance and wind measurement.

EMPower commenced project development in Ireland in 2018 following the government announcement of the Renewable Energy Support Scheme (RESS) and Ireland's revised emissions target of 70% renewables by 2030. This will require an additional 4,000 MW of new onshore wind to be installed by 2030.



95 Years

Combined Experience of EMPower Management Team across 5 continents

Why Ballynagare?

- Land is not subject to environmental designation
- Land is designated as ""preferred zone"" for wind development in the Kerry County Development Plan
- High Wind Speeds
- Available nearby grid capacity.

What We Do

EMP follows Equator Principles and IFC Performance Standards throughout all stages of development in order to ensure the protection of our local ecology and communities. In selecting a suitable Study Area, we examine housing density, wind resource, land use, topography, ecology, archaeology, cultural heritage, and existing infrastructure (roads and electricity grid). Once a feasible Study Area is identified, development may progress with the establishment of land agreements and more thorough investigations such as wind measurement, an environmental and social impact assessment and a grid integration study. Upon completion of all required studies, and assuming all relevant permits are secured, a typical construction period for a project such as Ballynagare would typically last for 12-18 months.

Commercial wind farms today are proposing an operating lifetime of 30 - 35 years, after which they can be decommissioned, restoring the landscape to its original condition.

- Land Agreements
- Environmental Analysis
- Wind Analysis
- PPA (RESS Auction)
- Grid Connection (ECP)
- Construction
- Operation
- Decommission

EMPower

Environmental Impact Assessment

EMPower have commissioned an ongoing Environmental Impact Assessment (EIA) for the proposed Ballynagare project to assess what effects the project might have on the local human and ecological environment. EMPower are the primary project management contacts during these assessments and the company will engage with the key stakeholders at every stage of this research to ensure we keep the local community and all interested stakeholders up to date with accurate project information. The results of all these assessments will form part of the publicly available Environmental Impact Assessment Report (EIAR) and the planning submission to the consenting authority. The following studies will be conducted as part of this process.



Population and Human Health

The Population and Human Health assessment includes the processes of analysing, monitoring and managing the intended and unintended consequences, both positive and negative, of planned interventions (e.g. a wind farm project) on the local human population. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment.

This will include the following activity at a minimum:

- identify interested and affected people;
- collect baseline data (social profiling) to allow evaluation and audit of the impact assessment process and the planned intervention itself;
- give a rich picture of the local historical and cultural context
- predict (or analyse) likely impacts and how different stakeholders are likely to respond;
- recommend mitigation and coping measures;
- describe potential conflicts between stakeholders and advise on resolution processes;



Biodiversity

A detailed biodiversity, flora and fauna study will be conducted in order to understand the current biological conditions present within the Study Area, as well as the likely impacts of such a development on surrounding environments. Surveys include habitat mapping and targeted sampling of flora and non-avian fauna at a variety of survey points within different identified habitats within the proposed projects Study Area as well as additional survey points along the transmission corridor. Timed species counts can be used to record resident fauna species at each survey point.

Plant species will be recorded using baseline study investigations and any protected or endangered species will be noted. The final site design will avoid any sensitive habitats and mitigate by design where possible.



Ornithology

The Royal Society for the Protection of Birds (RSPB) states that wind power has the greatest potential to make a significant difference in mitigating climate change in the coming decade as: 'it is the most advanced and widely available of the new renewable technologies. RSPB insists that wind farm proposals that may affect sensitive bird populations or their habitats are subject to rigorous environmental assessment before development is permitted and that the effects of any approved developments are monitored before and after a projects construction.

Impacts of wind farms on bird populations can occur through collisions, habitat loss, avoidance/barrier effects, disturbance displacement or exclusion, e.g. from breeding grounds or foraging areas. For this reason, EMPower take the utmost due care and diligence to ensure that any proposed wind turbines are positioned to cause the minimum possible impact to the native birds well being and habitat. In line with industry best practice, EMPower will be conducting a minimum of 2 years bird surveys prior to submission of a any planning application.

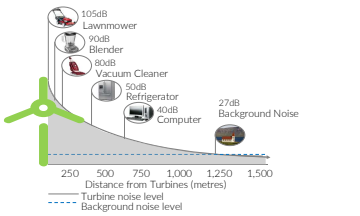


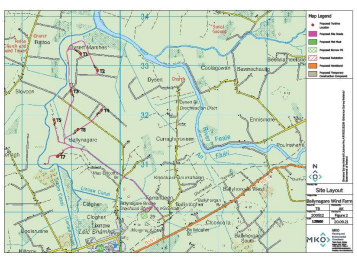
Noise & Vibration

The evolution of wind farm technology over the past decade has rendered mechanical noise from turbines almost undetectable with the main sound being the aerodynamic 'swoosh' of the blades passing the tower. However, strict guidelines on wind turbines and noise emissions remain to ensure the protection of residential amenity.

Noise assessments that will be undertaken as part of the EIA and will comply with the wind farm planning guidelines. Independent noise consultants will undertake a noise assessment to consider the impact of proposed turbine positions on the surrounding area, in particular on nearby residential properties. Measurements of background noise will be taken from the closest dwellings to the Study Area, allowing wind farm noise emissions to be simulated based on the background levels measured combined with turbine noise emissions. All windfarms must meet a maximum night time noise limit as per the planning guidelines, which is currently set at 43db.

The final EIA will include a report describing the findings of the noise assessment and any impact on local dwellings from the proposed wind farm. This final report and research will be available for review by any member of the public.





Water & Hydrology

Hydrology and hydrogeology refers to the study of how water flows under and through the landscape. A desktop survey to establish the baseline conditions within and adjacent to the Study Area will be undertaken. Following this desktop survey, field visits will confirm a number of these findings and inform any required actions or mitigation strategies for the various stages of the proposed project's development, most notably construction. The final project design will minimise the risk of construction materials disturbing local water courses, streams and rivers in the proposed project's vicinity.



EMPower

Environmental Impact Assessment

Landscape and Visual

A landscape and visual impact assessment will be carried out to ascertain the visual impact of the proposed Ballynagare project on the surrounding landscape and community. This is initially a desk based assessment with subsequent project area visits by a qualified landscape consultant who photographs the local landscape. A zone of theoretical visibility (ZTV) is then produced outlining which project elements will be visible from various areas of the local landscape. Photo-montages are also produced from key areas identified in the ZTV to show what the proposed project will look like once constructed. An example of a typical photomontage is presented below. EMPower will design the wind farm to minimise the visual impact of the project on surrounding residents.

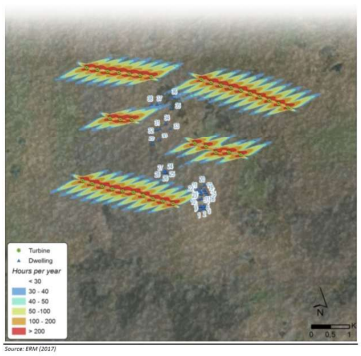




Shadow Flicker

Shadow flicker is the name given to a phenomenon caused when the rising or setting sun is behind a wind turbines rotating blades, casting a moving shadow over a small opening in a building such as a window. This creates a flickering effect within the building. Best practice states that properties located ten rotor diameters from a wind turbine are not affected so potential impact is restricted to the immediate vicinity of a project.

The current Irish planning regulations has a zero limit tolerance for shadow flicker occurrence, to protect local residential properties. A shadow flicker assessment is carried out to demonstrate the potential for occurrence, and the wind farm layout can be modified to design out the risk of occurrence. Additionally where there is potential for occurrence, software can be installed which identifies when shadow flicker is occurring, and the wind turbine is shut down for a period of time, therefore mitigating the effect. Employing this mitigation measure ensures that no residents living near the wind farm experience shadow flicker.



Source: EMM (2017)

Cultural and Archaeological

This study will include the identification of significant archaeological, architectural and cultural heritage constraints within the Study Area and surrounding lands (within 1km). A local archaeologist will conduct a desk based assessment followed by field inspections to identify and categorise all significant archaeological sites found within the Study Area. A report describing the findings of the archaeological survey and possible impact from the proposed wind farm project will be produced as part of this EIA research and will be available for review by the public.



Civil Engineering

Civil engineering will be a major part of this proposed project as we move from planning to construction. On commencing the planning work on the site, the civil engineers must review and implement methods, processes and mitigation measures outlined in the EIA as part of their planning and construction work. The Environmental Protection Agency (EPA) will require that their recommendations and mitigation measures for the construction of the proposed project, outlined in the EIA guidelines, will be implemented and followed as part of the civil engineering work. The main areas of civil engineering for the proposed project are;

- Project design
- Geotechnical and Study Area investigations
- Turbine foundation and crane pad construction
- Cable installation
- Sediment and erosion control measures
- Traffic Impact Assessment for the construction phase of the proposed project
- Wind turbine equipment assembly and construction
- Commissioning of the wind turbines
- Project clean-up and restoration.



EMPower

Wind Energy in Ireland

Current Situation

Wind energy is currently the largest contributing resource of renewable energy in Ireland. It is both Ireland's largest and cheapest renewable electricity resource. At present the Republic of Ireland has over 250 operational onshore wind farms consisting of 1,278 turbines. In Q1 2019, wind energy provided 37% of the state's electricity demand and had a total installed capacity of 3,700 MW (IWEA, 2019). This is enough to power 2.2 million Irish homes and accounts for the second largest source of electricity generation in Ireland after natural gas. Ireland is one of the leading countries in the deployment of wind energy and 3rd place worldwide in 2018, after Denmark and Uruguay.

3.7 GW

Enough power for 2.2 million Irish homes in 2019

National Goals

In June 2019, the government published the Climate Action Plan 2019, which sets out Ireland's proposed pathway to 2030. This Plan is also consistent with a net zero carbon emissions target by 2050. The Plan commits to increasing Ireland's renewable share in electricity from 32% in 2018 to 70% by 2030, which will involve the addition of 12 GW of renewable electricity generation. In the (SEAI) techno-economic analysis referred to in the Climate Action Plan, onshore wind is identified as the most cost-effective energy source, accounting for 8.2 GW, or two thirds of additional renewable generation being targeted by the government for 2030.

32%
2018
Renewable Electricity Share

70%
2030
Renewable Electricity Share

RESS Auction

The new Renewable Electricity Support Scheme (RESS), announced in July 2018, will help deliver Ireland's contribution to our national and EU-wide binding renewable energy targets. The scheme is based on competitive, technology neutral auctions in which renewable energy projects compete with one and other for contracts. This ensures minimum cost to the consumer. One of RESS' key objectives is to increase community participation, as well as community benefits, some of which are highlighted below. The first RESS auction began in late 2019 with subsequent auctions scheduled over the coming years

- **250 Operational Wind Farms in Ireland.**
- **1,278 wind Turbines.**
- **3,700 MW of Installed Capacity.**
- **Displaced 2.7 million tonnes of CO_2 emissions in 2017**



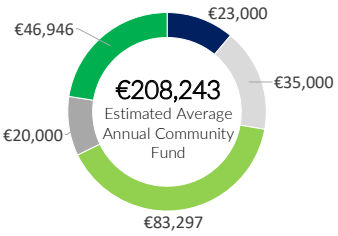
Ballynagare Community Benefit Fund

The proposed Ballynagare Wind Farm will require a €46.2million investment and will provide sustainable, low carbon energy generation infrastructure to meet Ireland's growing demands. The development benefits to the local community include significant investment in local infrastructure such as roads and electrical systems, local job creation, and a contribution of €10.1 million in county council rates over the project lifetime.

The proposed Ballynagare Wind Farm will also provide a community fund of approximately €208,243 per year, to be made available to the local community for the duration of the Renewable Electricity Support Scheme (15 years). The total fund is calculated as €2 per every Mega Watt Hour (MWh) of electricity which is produced by the project once commissioned. Therefore the eventual fund may vary slightly depending on the final permitted project capacity and generation performance of the project. 40% of the fund, amounting to approximately €83,297 per year, will be allocated to not-for-profit community enterprises, with an emphasis on low-carbon initiatives. An annual minimum payment of €1,000 will also be provided to each household within 1km of any constructed wind turbine which forms part of this proposed Ballynagare Wind Farm project. An annual minimum payment of €500 will be provided to each household located between 1km and 2km of a constructed Ballynagare wind turbine. The balance of the fund is proposed to be allocated to clubs, societies and other worthy local causes successful in the annual application process. We welcome any suggestions from the community on suitable local projects that could be supported under this initiative.

As well as these direct financial benefits, The proposed Ballynagare Wind Farm will provide local job creation, expected to total 71 direct jobs and 81 indirect jobs created during construction. Additionally 17 highly skilled local jobs will be sustained throughout of lifetime of the project. (SEAI, 2015)

Ballynagare Indicative Community Fund Allocation



- Combined Fund for Households <1km distance
- Combined Fund for Households >1km, <2km distance
- Not-for-profit community enterprises
- Fund administration
- Local initiatives, clubs and societies

€ 46.2 million
Infrastructure Investment

€ 3.1[1] million
Community Fund

€ 10.1[2] million
County Council Rates Contribution

81
Indirect jobs in construction phase

71
Direct jobs in construction phase

17
Highly skilled jobs over 25 year operations

1 – Over 15 year RESS contract
2 – Estimated €8,000 per mega watt installed for 30 year project lifespan



EMPower

Wind Energy in Ireland

Current Situation

Wind energy is currently the largest contributing resource of renewable energy in Ireland. It is both Ireland's largest and cheapest renewable electricity resource. At present the Republic of Ireland has over 250 operational onshore wind farms consisting of 1,278 turbines. In Q1 2019, wind energy provided 37% of the state's electricity demand and had a total installed capacity of 3,700 MW (IWEA, 2019). This is enough to power 2.2 million Irish homes and accounts for the second largest source of electricity generation in Ireland after natural gas. Ireland is one of the leading countries in the deployment of wind energy and 3rd place worldwide in 2018, after Denmark and Uruguay.

3.7 GW

Enough power for 2.2 million Irish homes in 2019

National Goals

In June 2019, the government published the Climate Action Plan 2019, which sets out Ireland's proposed pathway to 2030. This Plan is also consistent with a net zero carbon emissions target by 2050. The Plan commits to increasing Ireland's renewable share in electricity from 32% in 2018 to 70% by 2030, which will involve the addition of 12 GW of renewable electricity generation. In the (SEAI) techno-economic analysis referred to in the Climate Action Plan, onshore wind is identified as the most cost-effective energy source, accounting for 8.2 GW, or two thirds of additional renewable generation being targeted by the government for 2030.

32%
2018
Renewable Electricity Share

70%
2030
Renewable Electricity Share

RESS Auction

The new Renewable Electricity Support Scheme (RESS), announced in July 2018, will help deliver Ireland's contribution to our national and EU-wide binding renewable energy targets. The scheme is based on competitive, technology neutral auctions in which renewable energy projects compete with one and other for contracts. This ensures minimum cost to the consumer. One of RESS' key objectives is to increase community participation, as well as community benefits, some of which are highlighted below. The first RESS auction began in late 2019 with subsequent auctions scheduled over the coming years

- **250 Operational Wind Farms in Ireland.**
- **1,278 wind Turbines.**
- **3,700 MW of Installed Capacity.**
- **Displaced 2.7 million tonnes of CO_2 emissions in 2017**



Ballynagare Community Benefit Fund

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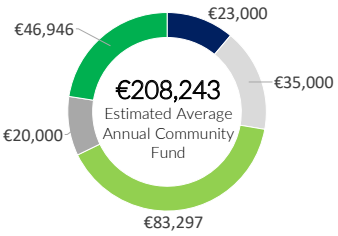
Ballynagare Indicative Community Fund Allocation



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Wind Energy FAQ

What are a turbine's lifetime emissions?
Wind energy emits no toxic substances such as mercury and air pollutants like smog-creating nitrogen oxides, acid rain-forming sulphur dioxide and particulate deposits. These pollutants can trigger cancer, heart disease, asthma and other respiratory diseases, can acidify terrestrial and aquatic ecosystems, and corrode buildings. Wind energy creates no waste or water pollution. Unlike fossil fuel and nuclear power plants, wind technology uses very little water to produce electricity. Given the fact that water scarcity is pressing and will be exacerbated by climate change and population growth, wind energy is key to preserving water resources. (Source: EWEA)

In 2014, the Intergovernmental Panel on Climate Change (IPCC) compared the lifetime CO2 equivalent [CO2(e)] emissions of all major energy technologies in operation worldwide. Onshore wind energy was found to have the lowest mean lifecycle emissions of all sources at 11 grams CO2(e) per kWh. In comparison nuclear energy had 12 grams CO2(e) per kWh, utility solar PV had 48 grams CO2 (e) per kWh and combined cycle natural gas had 490 grams CO2(e) per kWh. (Source: IPCC)

How efficient is wind energy?
Wind turbines produce electricity approximately 85% of the time. The other 15% of the time they are not turning for reasons, such as: very low wind speeds, very high wind speeds, and maintenance/repair work. After six to seven months, a wind turbine will have produced as much energy as it has consumed constructing it. (Source: ESB)

The output of a wind turbine depends on the turbine's size and the wind's speed through the rotor. A wind turbine with a net capacity factor of 35% and a capacity of 4.2 MW can produce more than 12,800 MWh in a year – enough to supply approximately 3,000 average Irish households. (Source: Eirgrid)

What happens when the wind stops blowing?
The power grid operator constantly matches the electricity generation available to electricity demand. No power plant is 100% reliable, and the electricity grid is designed to cope with power plants shutting down unexpectedly, and times when the wind is not blowing. Wind is variable, but predictable. Wind farm sites are chosen after careful analysis of wind patterns. This enables a forecast of output to be made - information which can be made available to the network operators who will distribute the electricity.

In the future, once a truly European electricity grid has been constructed, wind-powered electricity will be able to be traded between EU countries to balance out supply and demand even more easily. Other renewables such as solar will also form part of this electricity exchange.
(Source: European Wind Energy Association)

Do wind farms make noise?
It is the duty of EMPower to demonstrate during the planning process noise levels of our turbines will not adversely affect local residents. The studies completed during this period will be used to design each new wind farm so noise levels at nearby residential homes do not exceed national planning guidelines. Currently in Ireland and the United Kingdom, guidelines in relation to wind turbine noise levels are set at: "35 and 45 decibels dependant on the time of day and the level of background noise", in line with international best practices.

Do wind turbines create harmful health impacts?
Concerns over impacts on health from wind farms are usually raised in relation to noise, shadow flicker, infrasound or vibration. In general, the evidence suggests that there are no direct health impacts from wind turbines, however what is recognised is that annoyance causes health impacts and wind farms can cause annoyance, most often when people do not like wind farms.

In response to a Parliamentary Question in May 2014, the European Commission stated 'The Commission keeps a continuous watch on the possible impacts of wind turbines on health and well-being, taking into account the results from on-going projects and other sources. So far there has been no scientific evidence of lasting impacts, but there is recognition, also in industry, of public perception of impacts and nuisance.'
(Source: Friends of the Earth Ireland)

Do wind farms produce harmful infrasound?
Infrasound, sometimes referred to as low-frequency sound, is generally regarded as sound that is lower in frequency than 20 Hz or cycles per second. Infrasound is an frequently present element of the natural and man-made environment. It is produced by sources such as sea waves, rainfall, animals, vehicle traffic, buildings, appliances and indeed, wind turbines, to name a few.

The overwhelming consensus in peer reviewed scientific literature, much of which is readily available on the internet, is that there is no sound evidence to indicate infrasound caused by wind turbines creates harmful health impacts. In 2016, the Ministry for the Environment, Climate and Energy of the Federal State of Baden-Wuerttemberg in Germany published an investigation into infrasound produced from wind turbines.

"Infrasound is caused by a large number of different natural and technical sources. It is an everyday part of our environment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound levels generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range. The measurement results of wind turbines also show no acoustic abnormalities for the frequency range of audible sound. Wind turbines can thus be assessed like other installations according to the specifications of the TA Lärm (noise prevention regulations). It can be concluded that, given the respective compliance with legal and professional technical requirements for planning and approval, harmful effects of noise from wind turbines cannot be deduced."

Similar conclusions have also been reached by British Wind Energy Association/Renewables UK (2005), Sydney University
Medical School (2013), Massachusetts Institute of Technology (MIT) (2014) and The Quebec National Institute of Public Health (2015), to name a few.

Do wind farms require pylons or overhead transmission lines?
No. EMPower wind farms involve the installation of no electrical pylons or overhead transmission lines. Instead, all transmission lines will be buried out of sight in the form of underground cables. EMPower will endeavour to create minimum visual and ecological impact by locating these transmission lines along existing public roads and access tracks where possible.

Will local residents be affected by shadow flicker?
Shadow flicker refers to the effect of the sun (low on the horizon) shining through the rotating blades of a wind turbine, casting a moving shadow. Present planning guidelines require that any possible effects of shadow flicker are mitigated entirely by installing solar sensors on the turbine which slow or shut down the turbine during times of possible shadow flicker. Therefore, no residents will be affected.

Do wind farms effect house prices?
Several studies from the United Kingdom by The Centre for Economics and Business Research (CEBR), The Institute of Chartered Surveyors, The House of Commons Library and Renewable UK conclude wind farms have little or no impact on property values.

Do wind turbines create harmful electro-magnetic fields (EMF)?
No. Wind turbines are not considered a significant source of EMF exposure since emission levels around wind farms are low. The overwhelming scientific evidence is that there is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the immediate vicinity of wind turbines are regularly lower than those produced by many common household electrical devices and are well below any existing regulatory guidelines with respect to human health. (Source: Chief Medical Officer of Health of Ontario)

What is the future of wind energy, globally and in Ireland?
Wind energy is among the fastest growing energy sources globally. According to IRENA, in 2018, the world added over 49,000 MW of wind capacity, representing a 9.5% annual increase. In the same year, wind accounted for 44% of all new power installations across Europe – more than any other technology. By 2030, wind is predicted to serve a quarter of the EU's electricity needs and be the backbone of Europe's energy system (Sources: IRENA, EWEA)

The Climate Action Plan to Tackle Climate Breakdown, issued by the Department of Communications, Climate Action and Environment (DCCAE) in June 2019, commits Ireland to supplying 70% of our electricity needs from renewable sources by 2030. According to this paper, this is likely to involve the addition of over 12 GW of renewable capacity, of which the government recommends that 8.2 GW, or 68%, should be onshore wind. This recommendation is based on their Marginal Abatement Cost Curve (MACC) analysis, showing wind energy to be Ireland's most economic solution to our energy targets and a vital component in the future of Irish energy. (Source: DCCAE)

Are wind farms a blot on the landscape?
Some people find wind farms unacceptably intrusive in our much loved countryside. Others see them as graceful structures, generating local civic pride – unlike electricity pylons, for example, which we have lived with for decades. It's a highly subjective judgement. Climate change – unless tackled effectively now – is far more likely to have a severe and widespread impact on the landscape in the longer term. Our willingness to save energy and reduce our dependence on traditional means of power generation will help to safeguard the landscape for the use and enjoyment of future generations.
(Source: UK Sustainable Development Commission)

Aren't wind farms unpopular?
No. This is a common misconception resulting from the disproportionate coverage generated by opposition groups. An opinion poll conducted by Interactions Research and commissioned by IWEA in November 2018 discovered the following:

- 83% in favour of the use of wind power (54% strongly in favour)
- 81% of rural residents favour the use of wind power (55% strongly in favour, up 12 points since 2017)
- 87% say Ireland should promote an indigenous source of energy and not rely on imported fossil fuels (56% strongly in favour, up 11 points since 2017)
- 80% would choose renewables over fossil fuels to power their homes (up 10 points since 2017)
- 82% see reduced CO2 emissions as a benefit of wind power (up 8 points since 2017)
- 77% see cheaper electricity as a benefit of wind power (up 9 points since 2017)
- 55% are in favour of a wind farm set up in their local area – up 9 points since last year (46%)

Do wind turbines harm animals, birds and marine life?
Leading environmental and nature conservation groups like Birdlife, WWF, Greenpeace, Friends of the Earth, and Scottish National Heritage Trust support appropriately planned wind energy. Birdlife recently stated that climate change was the single largest threat to birds and wind and renewables were a clear solution to climate change.

Wind farms are always subject to an Environmental Impact Assessment to ensure that their potential effect on the immediate surroundings, including fauna and flora, are carefully considered before construction is allowed to start. Deaths from birds flying into wind turbines represent only a tiny fraction of those caused by other human-related sources such as vehicles and buildings.
A 2012 study carried out in the UK (Pearce- Higgins et al.) concluded that a large majority of species can co-exist or thrive with wind farms once they are operating (Source: Journal of Applied Ecology).

According to the Greening Blue Energy study, "Including both on and offshore facilities, estimated rates of mortality for different bird species range from 0.01 to 23 mortalities per turbine per year" (Drewitt & Langston, 2005). It has been estimated that wind turbines in the US cause the direct deaths of only 0.01-0.02% of all of the birds killed annually by collisions with man-made structures and activities.

Contact Us

EMPower integrate all project comments and suggestions from interested Stakeholders into the design processes for our projects where possible. This can include input from Statutory or non-Statutory Consultees, individual community members or larger community groups.

McCarthy Keville O'Sullivan, the lead environmental consultant working on the proposed Ballynagare Wind Farm project, consider all such comments and integrate them into the ongoing studies and assessments which produce the final project design.

To discuss this proposed project further you can contact us on any of the following :

Email: info@emp.group **Website:** **www.ballynagarewindfarm** **Telephone:** 01 588 0178

Post: EMPower, 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1.

The Team

EMPower

EMPower is an Irish based international wind energy developer with over 700 MW in development in Europe and Africa. Our senior management team has a combined 95 years' experience delivering projects from conception to operation across five continents.

EMPower is a private limited company owned by GGE Ireland Limited, Wind Power Invest A/S and EMP Holdings Limited. The senior management team comprises five Irish professionals, vastly experienced in the fields of renewable energy project management, corporate legal, finance and wind measurement.

Our vision is to provide low carbon, ecologically non-invasive, affordable energy to facilitate Ireland's expanding economy and sustainable energy targets.

MKO

Specialist environmental and planning consultancy

info@mkoireland.ie

McCarthy Keville O'Sullivan Ltd (MKO) are the appointed environmental consultants carrying out the Environmental Impact Assessment (EIA) for the proposed Ballynagare Wind Farm project.

MKO is a company of over 100 staff comprising a number of departments including Planning, Environment, Ecology, Ornithology & Project Management. MKO are a long-established business based in Galway city with staff nationwide and are renowned in our field of expertise. MKO are formally registered with the National Standards Authority of Ireland.

MKO will be preparing the Ballynagare Wind Farm Environmental Impact Assessment Report (EIAR) in accordance with Irish and International best practice guidelines, the requirements of the EIA Directive and principles of sustainability. This best practice approach guarantees a comprehensive assessment of any likely significant effects of this proposed Ballynagare Wind Farm project on the receiving environment.

Reference 5.1 – Public Consultation Advertisements

CLASSIFIEDS

TELEPHONE 066 7145500 EMAIL classifieds@kerryman.ie

IN MEMORIAM



O'SULLIVAN
Sixth Anniversary
In loving memory of Edward Gerard O Sullivan, Banemore, Listowel, who died on 28th November 2014.

Happy memories keep forever,
Of days when we were all together,
They bring a smile, often a tear,
And always a wish that you were here.
Sadly missed by his Wife Margaret, Daughter Karen, Sister Nora, Son-in-law Hugh, Grandchildren Katelyn & Ellen, Nephews, Nieces, extended Family & Friends.



REIDY
5th Anniversary

In loving memory of Joe Reidy late of Tullig North, Castleisland who died on 29th November 2015. Rest in Peace.

Always in our thoughts and prayers.

Always remebered by your Wife Mary, Son JJ, Daughter Doreen and husband Diarmuid, Daughter Margaret & Fiance Vincent.

Anniversary Mass will take place at 6:15p.m. on Saturday 28th November in Castleisland Church



Twentieth Anniversary of Fr. Slavko Barbaric O.F.M. November 24th 2000.
Fr. Slavko spent many years in Medjugorje. Bosnia Hercegovina, tending to parishioners and the numerous pilgrims who visited this Marian shrine, He visited St. John's Church, Tralee in the 1980's. This charismatic priest gave tirelessly of himself to help the sick , the elderly and those afflicted with drug addiction to rehabilitate their lives. He wrote many books and his simple philosophy was to always" pray with the heart."
For further information refer to Medjugorje.hr/English Hvaljen Isus i Marija.

LEGAL NOTICES

EMPower

NOTICE OF PUBLIC CONSULTATION

EMPower, a company with an address at 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1, is investigating the potential to develop a windfarm on the townlands of Ballynagare, Curraghcroneen, Dysert and Dysert Marshes in Co. Kerry. As part of our community consultation campaign, we are hosting a webinar at 7pm on Wednesday 2nd December 2020 in order to engage with local residents while observing public health guidance and restrictions surrounding COVID-19. The webinar will last for one hour and we would be grateful for your feedback on any issues you would like to raise regarding the wind farm and the community fund allocation. You can register and find project information at our website, www.ballynagarewindfarm.ie.

EM Power, 2 Dublin Landings, North Wall Quay, North Dock, Dublin D01 V4A3, Ireland

PLANNING

KERRY CO COUNCIL Michael and Marion Pead intend to apply for permission for the development of Parkgarriff, Claddanure West, Kenmare, Co. Kerry The development will consists of the installation of a solar panel system to the roofs of outbuildings built in 2013. Parkgarriff house is listed as a protected structure (RPS KY 093060) in the record of archaeological monuments and protected structures. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy at the offices of the Planning Authority at County Buildings, Rathass, Tralee, during its public opening hours: Monday to Friday 9.00a.m. to 5.00 p.m. A submission or observation in relation to the application may be made in writing to the Planning Authority on payment of the prescribed fee or •20 within the period of 5 weeks beginning on the date of receipt by the Authority of the application, and such submissions and observations will be considered by the Planning Authority in making a decision on the application. The Planning Authority may grant permission subject to or without conditions, or may refuse to grant permission.

PLANNING

KERRY COUNTY COUNCIL PLANNING AUTHORITY We, Euronet 360 Finance Ltd. (Irish Branch) intend to apply for permission for development at this site: Perrozzi Family Restaurant, Main Street, Ballybunion, Co. Kerry. The development will consist of the installation of an ATM machine to the existing shop front to the South elevation. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the planning authority at County Buildings, Rathass, Tralee, during its public opening hours: Monday to Friday 9.00a.m.- 5.00p.m.. A submission or observation in relation to the application may be made in writing to the planning authority on payment of the prescribed fee of •20.00 within the period of 5 weeks beginning on the date of receipt by the authority of the application, and such submissions or observations will be considered by the planning authority in making a decision on the application. The planning authority may grant permission subject to or without conditions, or may refuse to grant permission.

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PLANNING

KERRY COUNTY COUNCIL: We, at Architectural Design and Development Limited (068) 44242, www.architectural.ie [Members of Engineers Ireland] on behalf of Linda Kearin wish to apply to Kerry County Council for Planning Permission to construct a single storey dwelling house with a site entrance, a wastewater treatment system comprising of a mechanical aeration unit, intermittent filter & soil polishing filter and all associated site works at Knocknaboola, Killorglin, Co. Kerry. THE PLANNING APPLICATION MAY BE INSPECTED OR PURCHASED AT A FEE NOT EXCEEDING THE REASONABLE COST OF MAKING A COPY, AT THE OFFICES OF THE PLANNING AUTHORITY DURING ITS PUBLIC OPENING HOURS AND THAT A SUBMISSION OR OBSERVATION IN RELATION TO THE APPLICATION MAY BE MADE TO THE AUTHORITY IN WRITING ON PAYMENT OF THE PRESCRIBED FEE WITHIN THE PERIOD OF 5 WEEKS BEGINNING ON THE DATE OF RECEIPT BY THE AUTHORITY OF THE APPLICATION.

KERRY COUNTY COUNCIL: We, at Architectural Design and Development Limited (068) 44242, www.architectural.ie [Members of Engineers Ireland] on behalf of Linda Kearin wish to apply to Kerry County Council for Planning Permission to construct a single storey dwelling house with a site entrance, a wastewater treatment system comprising of a mechanical aeration unit, intermittent filter & soil polishing filter and all associated site works at Knocknaboola, Killorglin, Co. Kerry. THE PLANNING APPLICATION MAY BE INSPECTED OR PURCHASED AT A FEE NOT EXCEEDING THE REASONABLE COST OF MAKING A COPY, AT THE OFFICES OF THE PLANNING AUTHORITY DURING ITS PUBLIC OPENING HOURS AND THAT A SUBMISSION OR OBSERVATION IN RELATION TO THE APPLICATION MAY BE MADE TO THE AUTHORITY IN WRITING ON PAYMENT OF THE PRESCRIBED FEE WITHIN THE PERIOD OF 5 WEEKS BEGINNING ON THE DATE OF RECEIPT BY THE AUTHORITY OF THE APPLICATION.

KERRY COUNTY COUNCIL We, Rolanda Rice & Seamus Cantillon, intend to apply to Kerry County Council for planning permission for construction of a livestock underpass, effluent holding tank and all associated siteworks at Kilgulbin West & Kilgulbin East, Ardfert, Co. Kerry. The planning application may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy. at the offices of the Planning Authority during its public opening hours and a submission or observation in relation to the application may be made to the Authority in writing on payment of the prescribed fee of •20 within the period of 5 weeks beginning on the date of receipt by the Authority of the application. The Planning Authority may grant permission subject to or without conditions, or may refuse to grant permission.

BUSINESS ZONE

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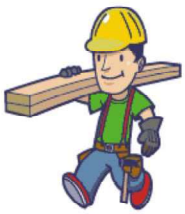

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COMHAIRLE CONTAE CHIARRAÍ
KERRY COUNTY COUNCIL

NOTICE TO OWNERS AND OCCUPIERS
ROADS ACT 1993

ROADSIDE TREES, DITCHES & HEDGES

Kerry County Council wishes to give notice that under the terms of the Roads Act, 1993, landowners and occupiers of land are obliged to take all reasonable care to ensure that the trees, ditches, hedges and other vegetation growing on their land are not or could not become a danger to people using or working on a public road.

Examples of hazards might be dead or dying trees, ditches or hedges interfering with traffic, blocking footpaths, obscuring road signs or obscuring a view of the road ahead.

You are required to fell, cut, log, trim or remove such trees, ditches and hedges - **for a distance of 1 metre horizontally and 5 metres vertically from the edge of the road.** Adequate signposting should be provided and the Council and Gardaí notified before works commence.

Hedgecutting operations, as far as possible, should only be undertaken outside the critical nesting period of 1st March to 31st August.

LIABILITY FOR DAMAGE OR INJURY RESULTING FROM SUCH HAZARDS WILL REST WITH THE LANDOWNWER/OCCUPIER

JAPANESE KNOTWEED

When cutting your hedges this year, please be aware of the invasive species Japanese Knotweed (JK) Fallopia Japonica.

If you do find Japanese Knotweed on your property, the most important thing that you can do is prevent any further spread of the species. **Do not strim, cut, flair or chip the plants.** Tiny fragments can regenerate new plants and cause the Japanese Knotweed to spread. It is also advised not to dig, move or dump soil which may contain plant material as this will contribute to its spread.

Report it! The location and extent of the infestation should be reported to your local Municipal District Office/Area Office.

DUTY TO FACILITATE DRAINAGE OF WATER FROM PUBLIC ROADS

Landowners/occupiers are also reminded of their duty under the Roads Act, 1993 to facilitate the drainage of water from public roads and also to prevent water, soil or other matter from flowing or falling onto public roads especially at entrances to fields and farmyards.

FAILURE TO COMPLY WITH THESE OBLIGATIONS IS AN OFFENCE LIABLE TO PROSECUTION

UNAUTHORISED ADVERTISING ON PUBLIC ROADS

Please take notice that it is an offence under Section 71 of the Roads Act, 1993 to erect, place or retain on a public road, a sign, vehicle including a vehicle with 'For Sale' signs, or other structure or thing used for the purposes of advertising, the sale of goods, the provision of services or other similar purpose without lawful authority or the consent of the Roads Authority.

THIS INCLUDES PLACING VARIABLE MESSAGE SIGNS ON PUBLIC ROADS, FOOTPATHS OR HARD SHOULDERS FOR THE PURPOSE OF ADVERTISING EVENTS

Kerry County Council may without notice arrange for the removal and storage of any such unauthorised signs, vehicles or other structures or things and may recoup the removal and storage costs from the person claiming the unauthorised item. In certain circumstances, following a period of storage, the Council may arrange for the disposal of the unauthorised item.

The person who erects, places or retains the sign or advertisement and the person on whose behalf the sign or advertisement is exhibited shall be guilty of an offence and is liable to prosecution.

FURTHER INFORMATION

Further information outlining the obligations placed on landowners and occupiers under the Roads Act, 1993 is available at the address below:-

---

FÓGRA D'ÚINÉIRÍ AGUS D'ÁITITHEOIRÍ
ACHT NA mBÓITHRE 1993

CRAINN, CLAÍOCHA & FÁLTA COIS BÓTHAIR

Ba mhaith le Comhairle Chontae Chiarraí fógra a thabhairt go bhfuil sé d'oibleagáid ar úinéirí agus áititheoirí talún, faoi théarmaí Acht na mBóithre, 1993, gach cúram réasúnach a ghlacadh chun a chinntiú nach bhfuil na crainn, claíocha, fálta agus an fásra eile atá ag fás ar a gcuid talún ina gcontúirt do dhaoine ag úsáid nó ag obair ar bhóthar poiblí ná nach bhféadfaidís a bheith ina gcontúirt dóibh siúd.

Is iad roinnt de na guaiseacha a d'fhéadfadh a bheith i gceist ná crainn mharbha nó crainn ag fáil bháis, claíocha nó fálta atá ag cur isteach ar an trácht, ag cur bac ar chosáin, ag folú comharthaí tráchta nó ag folú an amhairc den bhóthar amach rompu.

Ceanglaítear ort crainn, claíocha agus fálta dá leithéid a leagan, a ghearradh, Iománaíocht a dhéanamh, iad a bhearradh nó iad a bhaint - **faid 1 méadar cothrománach agus 5 méadar ingearach ó imeall an bhóthair.** Ba chóir cuaillí eolais leordhóthanacha a chur ar fáil agus ba chóir an Chomhairle agus na Gardaí araon a chur ar an eolas sula gcuirfear tús leis na hoibreacha.

A mhéid is féidir, ba chóir oibreacha bearrtha fálta a dhéanamh lasmuigh den tréimhse neadacháin chriticiúil ón 1 Márta go dtí an 31 Lúnasa.

BEIDH ÚINÉIR/ÁITITHEOIR NA TALÚN FAOI DHLITEANAS I LEITH AON DAMÁISTE NÓ AON GHORTÚ A BHFUIL GUAISEACHA DÁ LEITHÉID FREAGRACH AS

GLÚINEACH BHIORACH

Nuair atá tú ag gearradh tor i mbliana, bí fíor chúramach leis an speiceas ionrach, an Ghlúineach Bhiorach (GB) Fallopia Japonica

Má faigheann tú glúineach bhiorach ar do chuid talún, is é an rud is tábhachtaí a dhéanamh ná gan ligint don speiceas leathadh amach níos faide. **Ná dein na plandaí a struimeáil, a bhaint, a shúisteáil ná a shlisniú.** Is féidir le píosaí beaga bídeacha den phlanda iad féin a athnuachan agus bíonn sé níos deacra fós an fhadhb a choimeád faoi smacht. Moltar gan cré a rómhar, a bhogadh ná a dhumpáil mar go bhféadfadh ábhar den phlanda a bheith ann a scaipfeadh a thuilleadh é.

Cuir scéal chugainn! Is cóir láthair agus leathadh an fhínithe a chur in iúl don Oifig Ceantair/Bardasach áitiúil.

DUALGAS CHUN DRAENÁIL UISCE Ó BHÓITHRE POIBLÍ A ÉASCÚ

Cuirtear i gcuimhne d'úinéirí/áititheoirí talún freisin go bhfuil dualgas orthu faoi Acht na mBóithre, 1993 dreanáil uisce ó bhóithre poiblí a éascú, agus cosc a chur ar uisce, ithir nó ábhar eile rith ar nó titim ar bhóithre poiblí go háirithe ag bealaí isteach chuig páirceanna agus clóis feirme.

MURA gCOMHLÍONFAR NA hOIBLEAGÁIDÍ SEO IS CION É AGUS DLÍFEAR AN DUINE FREAGRACH A IONCHÚISEAMH

FÓGRAÍOCHT NEAMHÚDARAITHE AR BÓITHRE POIBLÍ

Tabhair faoi deara, le do thoil, gur cion é faoi Alt 71 d'Acht na mBóithre, 1993 comhartha, feithicil ag cuimsiú feithicil le comharthaí 'Ar Díol' nó struchtúr nó ní eile a úsáidtear chun críocha fógraíochta, díolta earraí, soláthair seirbhísí nó chun críche comhchosúla eile a thógáil, a shuí nó a choinneáil ar bhóthar poiblí gan údarás dleathach nó gan toiliú an Údaráis um Bóithre.

ÁIRÍTEAR ANSEO COMHARTHAÍ LE TEACHTAIREACHTAÍ ATHRAITHEACHA AR BHÓITHRE POIBLÍ, COSÁIN NÓ AR CHRUA GHRUANNA DO CHUSPÓIR IMEACHTAÍ A FHÓGAIRT

Féadfaidh Comhairle Chontae Chiarraí socrú a dhéanamh do bhaint agus stóráil aon chomharthaí, feithiclí nó struchtúir nó nithe eile neamhúdaraithe gan fógra a thabhairt agus féadfaidh said na costais i gceist lena mbaint agus lena stóráil a fháil ar ais ón duine is leis nó léi an ní neamhúdaraithe. I gcúinsí áirithe, i ndiaidh tréimhse stórála, féadfaidh an Chomhairle socrú a dhéanamh do dhiúscairt an ní neamhúdaraithe.

Beidh an duine a thógfaidh, a shuífidh nó a choinneoidh an comhartha nó fógra agus an duine a bhfuil an comhartha nó fógra ar taispeáint ar a s(h)on ciontach i gcion agus dlífear iad a ionchúiseamh.

TUILLEADH EOLAIS

Tá tuilleadh eolais faoi oibleagáidí úinéirí agus áititheoirí talún faoi Acht na mBóithre, 1993 ar fáil ag an seoladh thíos:-

Kerry County Council, Roads, Transportation & Marine Department, County Buildings, Tralee, County Kerry/
Comhairle Contae Chiarraí, Roinn na mBóithre, Iompair & Mara, Áras an Chontae, Trá Lí, Contae Chiarraí
Guthán/Tel (066) 7183588
Ríomhphost/Email: roads@kerrycoco.ie

Siniú: Padraig Corkery
Senior Executive Officer/Feidhmeannach Sinsearach
Corporate Affairs/Gnóthaí Corparáideacha

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PUBLIC NOTICES | PUBLIC NOTICES

EMPower

NOTICE OF PUBLIC INFORMATION EVENT

EMPower, a company with an address at 2 Dublin Landings, North Wall Quay, North Dock, Dublin 1, is investigating the potential to develop a windfarm on the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, and Monument, County Kerry. As part of our community consultation campaign, we are hosting a webinar from 7pm – 8pm on Wednesday 29th September 2021.

This Webinar will detail elements of the ongoing project design process and members of the project team will be available to talk through any aspect of the project proposal that you would like to discuss further. We would be grateful for your feedback on any issues you would like to raise regarding the wind farm and the community fund allocation. You can register and find project information at our website, **www.ballynagarewindfarm.ie.**

EM Power, 2 Dublin Landings, North Wall Quay, North Dock, Dublin D01 V4A3, Ireland

APPOINTMENTS

COMHAIRLE CONTAE CHIARRAÍ
KERRY COUNTY COUNCIL

Applications are invited for employment as:

VALUATION SURVEYOR
SOCIAL HOUSING AND RELATED PROGRAMMES
SUIRBHÉIR LUACHÁLA
TITHÍOCHT SHÓISIALTA AGUS CLÁIR CEANGAILTE
SALARY: €50,534 – €70,245

TENANCY MANAGEMENT OFFICER
OIFIGEACH BAINISTÍOCHTA TIONÓNTACHT
SALARY: €43,633 – €52,401

Offers of appointment to persons who are not serving local authority employees will be based on the minimum of this scale. Where the person being appointed is a serving local authority employee, normal starting pay rules will apply.

The rate of remuneration may be adjusted from time to time in line with Government pay policy.

Application Forms and Candidate Information Booklets may be obtained on the Kerry County Council web-site www.kerrycoco.ie

Please refer to the relevant Candidate Information Booklets for details in relation to the application process for these competitions.

The latest date for receipt of completed application forms is
5.00 p.m. on Thursday, 08 April 2021

Ba cheart go mbeadh foirmeacha líonta istigh tráth nach déanaí ná
5.00 i.n. ar an Déardaoin, Bú Aibreán 2021

Kerry County Council is an Equal Opportunities Employer
Is Fostaitheoir Comhdheiseanna í Chomhairle Contae Chiarraí

New Altro fertiliser spreaders
8 cwt and 12 cwt all
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prices start from **€2250** for 8 cwt
Contact 087 9529711



HOLSTEIN/FRIESIAN BULLS
Suitable Holstein/Friesan breeding bulls off Coolnasoon Art, dams VG88, 5.21 fat, 4.08 protein, 870 kgs of solids.
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EMPower

NOTICE OF PUBLIC INFORMATION EVENT

EMPower, a company with an address at 2 Dublin Landings, North Wall Quay, Dublin 2 are investigating the potential to develop a windfarm on the townlands of Ballynagare, Dysert, Dysert Marshes and Curraghcroneen in Co. Kerry.
As part of our community consultation campaign, we are hosting a webinar at 7pm on Wednesday the 24th March 2021 in order to engage with local residents while observing public health guidance and restrictions surrounding COVID-19.
The webinar will last for one hour.
We would be grateful for your input on the project's design process or on any aspect of the proposed wind farm and community fund allocation. You can register and find project information at our website, www.ballynagarewindfarm.ie

EM Power, 2 Dublin Landings, North Wall Quay, North Dock, Dublin D01 V4A3, Ireland

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COMHAIRLE CONTAE CHIARRAÍ
KERRY COUNTY COUNCIL

FÓGRA RÁTA A BHEITH DÉANTA

LEIS SEO FÓGRAÍTEAR gur ghlac Comhairle Contae Chiarraí mar is cóir leis an Ráta Bliantúil ar mhaoin inrátaithe i limistéar rátála Chomhairle Contae Chiarraí.

Is é €79.25 an Ráta Bliantúil Luachála do Ghnáthchaiteachas Chomhairle Contae Chiarraí don bhliain sheirbhíse dar gcríoch 31 Nollaig, 2021.

Is féidir le héinne an Leabhar Rátaí a iniúchadh dá bhrí sin, ag An Roinn Ioncaim, Comhairle Contae Chiarraí, Halla Cuimneacháin Uí Ághais, Sráid Denny, Trá Lí, le linn uaireanta oifige. ***De réir na dtreoirlínte sláinte poiblí le linn srianta leibhéal 5, fannan ár n-oifigí dúnta don phobal.***
Mar gheall ar Shrianta Covid, más mian leat an Leabhar Rataí a iniúchadh, déan teagmháil linn ar 066 7162100 chun coinne a shocrú. Beidh an ráta luaite le híoc ó dháta foilsithe an fhógra seo agus ina dhiaidh sin.

Faoi Roinn 7(1) de Acht Rialtais Áitiúil (Forálacha Airgeadais), 1978, is féidir le héinne atá míshásta de bharr teip údarás rátaithe liúntas a thabhairt do/dí faoin Acht, nó go gcreideann sé/sí go bhfuil siad i dteideal liúntas eile seachas sin dáilte orthu, iarratas a dhéanamh i scríbhinn ar an údarás rátaithe, taobh istigh de dhá mhí de dháta Déanta an Ráta, an liúntas cuí a cheadú.

Sa chás ná claoitear leis an iarratas, taobh istigh de 28 lá, is féidir leis an duine taobh istigh de cheithre mhí de dháta Déanta an Ráta, iarratas a dhéanamh ar an gCúirt Dúiche go ndéanfaí an ráta cuí. Deineadh an Ráta thuas ar an **10ú Márta 2021.** Ní mór aon iarratas ina leith, faoi Roinn 7(1) de Acht Rialtas Áitiúil (Forálacha Airgeadais) 1978, a bheith déanta go dtí Comhairle Contae Chiarraí faoi **13ú Bealtaine, 2021.** Ní mór aon iarratas go dtí an Chúirt Dúiche faoi na forálacha céanna a bheith déanta faoi **16ú Iúil, 2021.**

Comhairle Contae Chiarraí,
An Roinn Ioncaim, Halla Cuimneacháin Uí Ághais, Sráid Denny, Trá Lí.
Dar dáta 17ú lá de Márta, 2020.

Padraig Corkery
Feidhmeannach Sinsearach
Gnóthaí Corparáideacha

NOTICE OF RATE HAVING BEEN MADE

NOTICE IS HEREBY GIVEN that Kerry County Council has duly made the Annual Rate on the property rateable in the rating area of Kerry County Council.

The Annual Rate on Valuation for the Ordinary Expenditure for Kerry County Council for the service year ending 31st December, 2021, is €79.25.

The Rate Book may be inspected by any person affected thereby at Revenue Department, Kerry County Council, Ashe Memorial Hall, Denny St., Tralee, during office hours. **Please note that in accordance with public health guidance during level 5 restrictions, our offices remain closed to the public.**
Due to Covid Restrictions if you wish to inspect the Rate Book please ring 066 7162100 to arrange an appointment. The said Rate will be payable from and after the publication of this Notice.

Under Section 7 (1) of the Local Government (Financial Provisions) Act, 1978, any person, who is aggrieved at the failure of a rating authority to make him/her an allowance under that Act or who believes that he/she is entitled to a different allowance to that made to him/her, may within 2 months of the date of the Making of the Rate, request the rating authority in writing to grant the appropriate allowance.

In case the request is not complied with, within 28 days, the person may, within 4 months of the date of the Making of the Rate, apply to the District Court to have the appropriate allowance made. The above Rate was made on **10th March, 2021.** Any request in respect of it under Section 7 (1) of the Local Government (Financial Provisions) Act, 1978, must therefore be made to Kerry County Council not later than the **13th May, 2021.** Any application to the District Court under the same Provision must be made not later than the **16th July, 2021.**

Kerry County Council,
Ashe Memorial Hall, Denny St., Tralee.
Dated this 17th March, 2021.

Padraig Corkery
Senior Executive Officer
Corporate Affairs

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IN MEMORIAM

MCCARTHY
16th Anniversary



In loving memory of Assumpta a wonderful wife and caring mother who died on 5th October 2005.

A silent thought,
A quiet prayer,
For a special person,
In God's care.

Always loved and sadly missed by your loving husband Patrick, daughters Elisa, Michelle, Jessica, Allana and Katie, sons Johnny, Patrick Jnr, Tommy and William.

Anniversary Mass Sunday 31th October at 11:30am in Churchill.

MCKENNA
22nd & 27th Anniversaries

In loving memory of our dear parents Sheila & Jeremiah Ballinclogher Lixnaw who died on June 11th 1994 & October 10th 1999.

Always in our
thoughts and prayers

Always remembered by your loving family.

O'CONNOR
13th & 4th Anniversaries



In loving memory of Ann O'Connor, Droum, Headford, Killarney, Co. Kerry whose 13th Anniversary was on 26th February 2021 and her husband Con whose 4th Anniversary is on 13th October 2021.

Will those who think of us today
A little prayer to Jesus say

O Mary conceived without sin
Pray for us who have
recourse to thee
O lady of Lourdes pray for us.

Mass for Ann and Con is in Barrauff Church on Friday 8th October at 7.30p.m.

O'CONNOR
2nd Anniversary



In loving memory of Murt O' Connor, Dooks Mountain, Glenbeigh, Co. Kerry, who died on the 9th October 2019. Aged 82 years.

Time will pass
and fade away
But memories of you
will always stay.

Lovingly remembered by all his family.

May he rest in peace.

O'CONNOR
5th Anniversary



In loving memory of Betty O'Connor (nee Falvey). "St. Martha's". Lissereen, Abbeydorney, who died on 13th October, 2016
Rest In Peace

A special day, another year,
A loving thought, a silent tear,
A little prayer to keep in touch,
To the Mom we miss
And love so much.

Fondly remembered by John, Catherine, Michael & Áine, and their families.

Anniversary Masses on Sunday, 10th October in Abbeydorney Church at 10 a.m. and on Tuesday, 12th October, in St. John's Church, Tralee, at 6.10 p.m.

QUINLAN
Anniversaries



In loving memory of Bertie and Mary Quinlan, Currans.

Always so thoughful, loving and
kind,
A beautiful memory that they left
behind

Loved and remembered always by your loving family.

O'SHEA
30th and 17th Anniversaries



In loving memory of our much loved parents, grandparents and great-grandparents, John and Sheila O'Shea (nee Brosnan), late of St. Brendan's Park

As each day dawns,
we think of you
As each night falls,
we pray for you
Throughout our lives,
no matter where
In our hearts,
you are always there

Missed and always loved and remembered by your children Neilus, Jerry, Katheryne, Margaret and Helena, your grandchildren, great-grandchildren, and sister Margaret.

SUGRUE
2nd Anniversary



In loving memory of Eileen Sugrue Comane, Glenbeigh who died on the 7th of October 2019.

Time may pass and fade away,
But silent thoughts and memories
stay,
No longer in our hearts to share,
But in our hearts you are always
there.

Lovingly remembered by your family and friends.

Anniversary Mass Friday 8th October in St. James Church, Glenbeigh.

The Kerryman

offers sympathetic guidance and a personal service when placing your In Memoriam notice.

Contact: 066-7145500.
Costs: 57 cents per word
Cross €3-00
Photo Colour or
Black & White €8-00.

BARRY
10th Anniversary



In loving memory of Gerald Barry, late of Toorngeehy, Listowel, who died on 13th October 2011

Time may pass and fade away
But silent thoughts and memories
stay,
No longer in our lives to share
But in our hearts you are always
there

Lovingly remembered by your wife Carmel and family

Gerald's anniversary Mass will be Sunday October 10th at 930AM in Rathea Church.

HARNETT
4th Anniversary



Treasured memories of a dear brother Dee Harnett, late of Kilconlea, Abbeyfeale who passed away on the 4th of October 2017.

The gates of heaven opened wide
The angels lined up side by side
A special guest was on the way,
The day God took you away.
Our loss is Heaven's gain
But in our hearts you
will always remain.

Sadly missed by Sean and Sile.

HORAN
7th & 25th Anniversaries



In loving memory of Chrissie and Davey Horan, Coom, Cordal, Castleisland

Memories are precious
They don't fade away
We think of you always.
Not just on this day.

Always remembered by your loving family.

Mass will be offered for all the deceased members of the Horan family in Castleisland Church on Sunday 10th Octboer at 11.30am

O'CONNOR
6th Anniversary



In loving memory of Joseph (Joe) O'Connor, Kilbaha, Moyvane, who died 6th October, 2015

HUSBAND
Your presence I miss
Your memory I treasure
Loving you always
Forgetting you never.

Love always your wife Mary.

DAD
Find the softest pillow Lord
To rest his head upon
Put a kiss upon his cheek
And tell him who its from

Loved forever your daughter Bridie and son-in-law Jim.

GRANDAD JOE
Every day we wonder why
You were taken high up to the sky
There are so many things
we want to say
That every night we sit and pray,
hoping you can hear us say
We miss you and love you
But we know you are watching us
Up above where angels lie
You're in our hearts
And will always stay,
Forever we will think of you

Love your grandaughter Linda great granchildren Katelyn, Rachel and Laythan.

Anniversary Mass on Tuesday October 12th at 7:30pm in the Church of the Assumption, Moyvane.

PLANNING

Kerry County Council Ballynagare Wind Farm Limited intend to apply to Kerry County Council for planning permission for a wind energy development on land at Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas. The development comprises: • Construction of 7 no. wind turbines with the following maximum and minimum parameters: o Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum o Hub height of 95m o Rotor diameter in the range of 150m maximum to 149m minimum • Turbine hardstand areas • Provision of 1 no. permanent meteorological mast with a height of 110 metres • Upgrade of existing roads and access junctions • Provision of new site entrances, roads and hardstand areas • 2 no. temporary peat storage areas • 2 no. temporary construction compounds • 1 no. borrow pit • All site drainage works • 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank • All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation • Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas • All ancillary site and ground works, apparatus and signage The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm. The application is accompanied by a Natura Impact Statement (NIS) and Environmental Impact Assessment Report (EIAR). The planning application, the NIS and the EIAR may be inspected or purchased at a fee not exceeding the reasonable cost of making a copy, at the offices of the planning authority during its public opening hours and a submission or observation in relation to the application may be made to the authority in writing, on payment of the prescribed fee, within the period of 5 weeks beginning on the date of receipt of the authority of the application.

KERRY CO COUNCIL: We, at Architectural Design and Development Limited (068) 44242, www.architectural.ie [Members of Engineers Ireland] wish to apply to Kerry County Council for Retention Permission to retain a dwelling house, site entrance, a septic tank, Bord na Mona boxes, all within revised site boundaries and all associated works at Inchinapoagh, Brosna, Tralee, Co. Kerry on behalf of Mary and Mike McAuliffe. THE PLANNING APPLICATION MAY BE INSPECTED OR PURCHASED AT A FEE NOT EXCEEDING THE REASONABLE COST OF MAKING A COPY, AT THE OFFICES OF THE PLANNING AUTHORITY DURING ITS PUBLIC OPENING HOURS AND THAT A SUBMISSION OR OBSERVATION IN RELATION TO THE APPLICATION MAY BE MADE TO THE AUTHORITY IN WRITING ON PAYMENT OF THE PRESCRIBED FEE WITHIN THE PERIOD OF 5 WEEKS BEGINNING ON THE DATE OF RECEIPT BY THE AUTHORITY OF THE APPLICATION.

APPENDIX 4.1

SITE LAYOUT PLANNING DRAWINGS (A4)


Ballyduff
An Baile Dubh
Lisselton
Lios Eiltín
Ballydonohoe
Ballyconry
Toohana
Moybella North
Moybella South
Ballyloughran
Curraghweesha
Loughanes
Rathroe
Ahimma
Killehenny
Ballyeagh
Graveyard
Kilmulhane
Island Sack Little
Island Sack
Dunferris
Rahoonagh
Lisladraun
Gortagurrane
Mweevoo
Derryco
Church
Ayle
Museum
Moneycashen
Kilmore
Cillín
Quay
Cloghane
Knoppoge
Ardcullen
Ardcullen-marshes
Ferry Br.
Redmond's Br.
Ahascra
Mweevuck
Leagh
Leagh-Marshes
Sheepwalk
Lacka
Ardoughter
Clashmelcon
Slievawaddra
Water Tower
Reservoir
Heart Hill
Knocknacree
Ballyhorgan
Benmore
Bishopscourt
Ballyhorgan Marshes
Addergown
Ardagh
Rahealy
Beenduff
Knockananore
Ballinbranhig
Knockavaghig
Purthaheen
Tullaghna
Ballinglanna
Drommartin
Drom Máirtín
Corballyv
Glanerdalliv
Glanerdalliv Br.
Sleveen
Lisnagoneeny
Knockercreeveen
Blackpool
Farran
Holy Well
Cloonlogher
Ballincrossig
Ballincrossig Cross Roads
Muckeragh
Dromkeen East
Fulacht Fia
Dromroe
Causeway
An Tóchar
Dromkeen West
Graveyard
Clooneen
Crompaun Br.
Droichead an Chrompáin
Crompaun River
An Crompán
Aghabeg West
Aghabeg East
Drehidaclare Br.
Slievebwee
Aghamore North
Aghamore Ho.
Ballynorig East
Aghamore South
Fulachtaí Fia
Kilcooly
Killahan
Church
Ballinclogher
Ballinclogher Cross Roads
Standing Stone
Drehidnamanagh Br.
Gortdrislig
Granshagh
Tonaknock
Derryvrin
Castle
Ballymacaquim
Ballyhenry
Aghacoora
Killaspicktarvin
Cloonsillagh
Ballyreehan
Ballyreehan Br.
Irrabeg
Kilfeighny North
Knocknaklily
Pallas
Barrow
Banemore
An Bán Mór
Kilshenane
Rathe
Ballygarret
Clondouglas
Clondouglas Br.
Ballincraheen
Knockburrane
Knockburrane Cross Roads
Knockreagh
Mountcoal
Muckenagh
Ballyhennessy
Ballynagragh
Lissahane
Demesne Ho.
Toornageehy
Irramore
Dromclogh
Ballyhorgan South
Ballyhorgan West
Ballyhorgan East
Ballyhorgan Br.
Ballyduhig
Billeragh
Coolnaleen Upper
Coolnaleen Lower
Garryantanvally
Finuge
Fionnúig
Finuge Br.
Killacrim
Ennismore
Poulnahalia
Bealkelly
Cap Island
Curragheroneen
Knockaunacurraheen
Farrandeen
Ballintogher
Ballintogher Br.
Cloonacolla
Ballynagare
Ballynagare Br.
Droichead Bhaile an nGearrach
Mac Elligott Br.
Clogher
Lixnaw
Leic Shámhe
Lixnaw Canal
Lixnaw Br.
Lixnaw Castle
Tower
Monument
Ballinvoher
Gortaneare
Deerpark
Cunnagare
River Brick
Liscullane
Dismantled Railway
Ballyreehan Br.
Ballyreehan
Cloonsillagh
Aghacoora
Ballyhenry
Tonaknock
Derryvrin
Granshagh
Gortdrislig
Drehidnamanagh Br.
Standing Stone
Ballinclogher Cross Roads
Ballinclogher
Aghamore South
Aghamore Ho.
Fulachtaí Fia
Kilcooly
Killahan
Church
Castle
Ballymacaquim
Ballynorig East
Aghamore North
Slievebwee
Drehidaclare Br.
Graveyard
Causeway
An Tóchar
Dromkeen West
Dromkeen East
Fulacht Fia
Dromroe
Crompaun Br.
Droichead an Chrompáin
Crompaun River
An Crompán
Ballincrossig
Ballincrossig Cross Roads
Muckeragh
Cloonlogher
Holy Well
Knockercreeveen
Blackpool
Farran
Lisnagoneeny
Corballyv
Glanerdalliv
Glanerdalliv Br.
Sleveen
Drommartin
Drom Máirtín
Tullaghna
Ballinglanna
Purthaheen
Knockavaghig
Ballinbranhig
Beenduff
Knockananore
Rahealy
Rattoo
Church
Rattoo Church and Round Tower
Bishopscourt
Ballyhorgan Marshes
Addergown
Ardagh
Benmore
Knocknacree
Heart Hill
Reservoir
Water Tower
Slievawaddra
Lacka
Sheepwalk
Leagh
Leagh-Marshes
Ardcullen-marshes
Ardcullen
Ferry Br.
Ardoughter
Clashmelcon
Knoppoge
Cloghane
Museum
Ayle
Derryco
Church
Mweevuck
Ahascra
Redmond's Br.
Ballyconry
Toohana
Gortagurrane
Island Sack
Mweevoo
Island Sack Little
Dunferris
Rahoonagh
Lisladraun
Moybella South
Moybella North
Ballyloughran
Curraghweesha
Loughanes
Rathroe
Ahimma
Killehenny
Ballyeagh
Graveyard
Kilmulhane
Church
Lisselton
Lios Eiltín
Ballydonohoe
Coolard
Ballydonohoe Br.
Droichead Bhaile Uí Dhonnchú
Holy Well
Carhoonaknock
Shrone Br.
Moated Site
An Ghaille
Garryard
Graveyard
Affouley
Inch East
Galley Cross Rds
Crosaire Ghaille
Galley River
Inch Br.
Ballyegan Br.
Ballyegan
Shrone West
Shrone East
Bedford Cross Rd
Burntwood Cross Rds
Inch West
Derra Cross Rds
Derra East
Coolnalaght
Inch-Moor
Dromalught
Derra West
Clievragh
Oaghley
Drommurrin Cross Rds
Drommurrin
Drommurrin Br.
Gortacrossane
Curraghatoosane
Islandgannivan
Footbridge
Race Course Footbridge
Islandmacloughry
Kilcreen
Gortcurreen
Dromloughra
Beennameelane
Scartleigh
Coolagowan
Bawnachaulig
Killarida
Burial Ground
Ballyouneen
Dysert
Church
Dysert Br.
Droichead an Disirt
Gortnaminsha
Water Treatment Plant
Sleveen Marshes
Rattoo
Church
Rattoo Church and Round Tower
Ballinbranhig
Knockavaghig
Purthaheen
Tullaghna
Ballinglanna
Drommartin
Drom Máirtín
Corballyv
Glanerdalliv
Glanerdalliv Br.
Sleveen
Lisnagoneeny
Knockercreeveen
Blackpool
Farran
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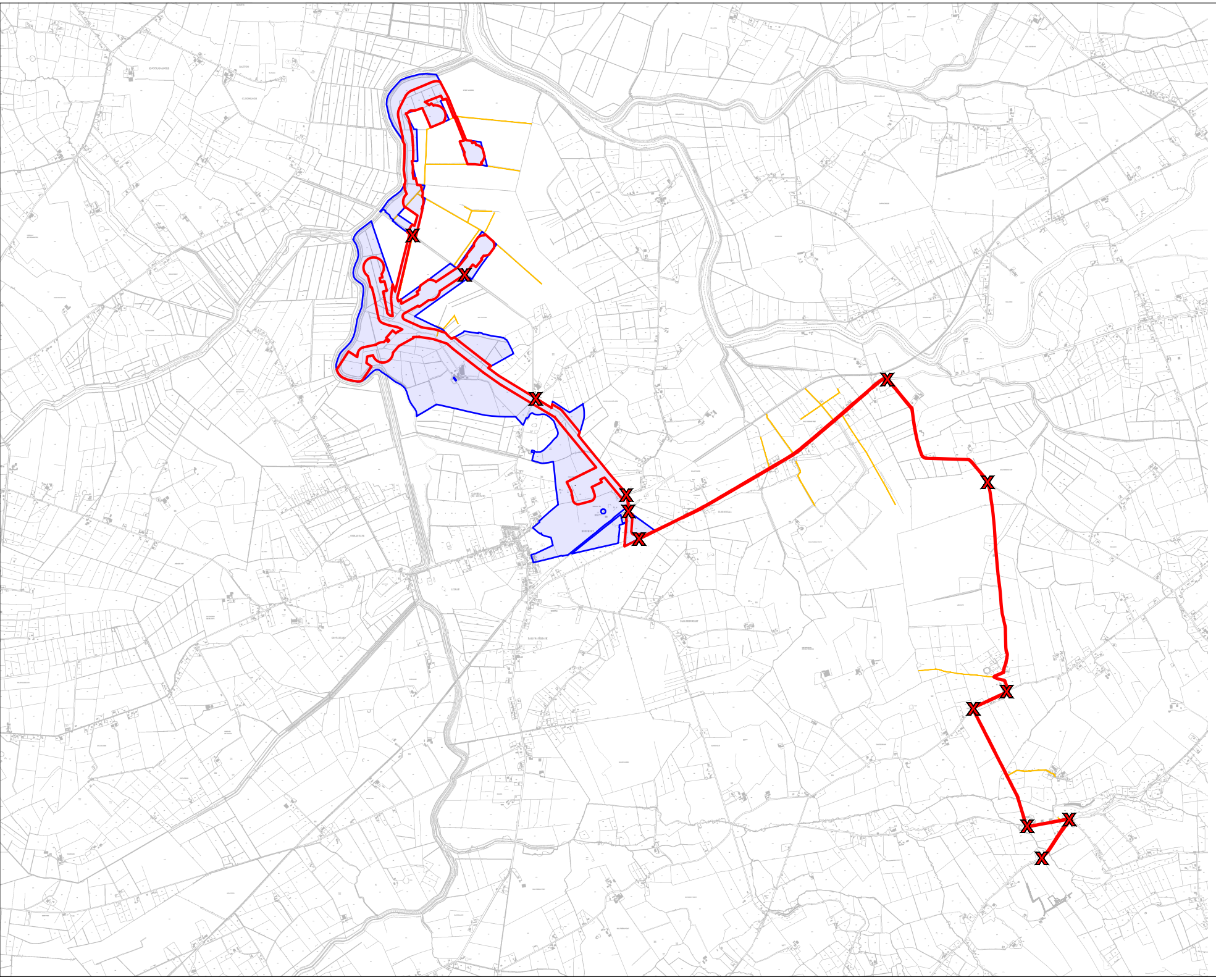
Ballincrossig
Ballincrossig Cross Roads
Muckeragh
Dromkeen East
Fulacht Fia
Dromroe
Causeway
An Tóchar
Dromkeen West
Graveyard
Clooneen
Crompaun Br.
Droichead an Chrompáin
Crompaun River
An Crompán
Aghabeg West
Aghabeg East
Drehidaclare Br.
Slievebwee
Aghamore North
Aghamore Ho.
Ballynorig East
Aghamore South



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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Landowners Boundary
- Site Notice
- Wayleave

N

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DRAWING TITLE:

Site Location Map

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 02
SCALE: 1:30,000 @ A3	DATE: 23.11.2021

OS SHEET No:
5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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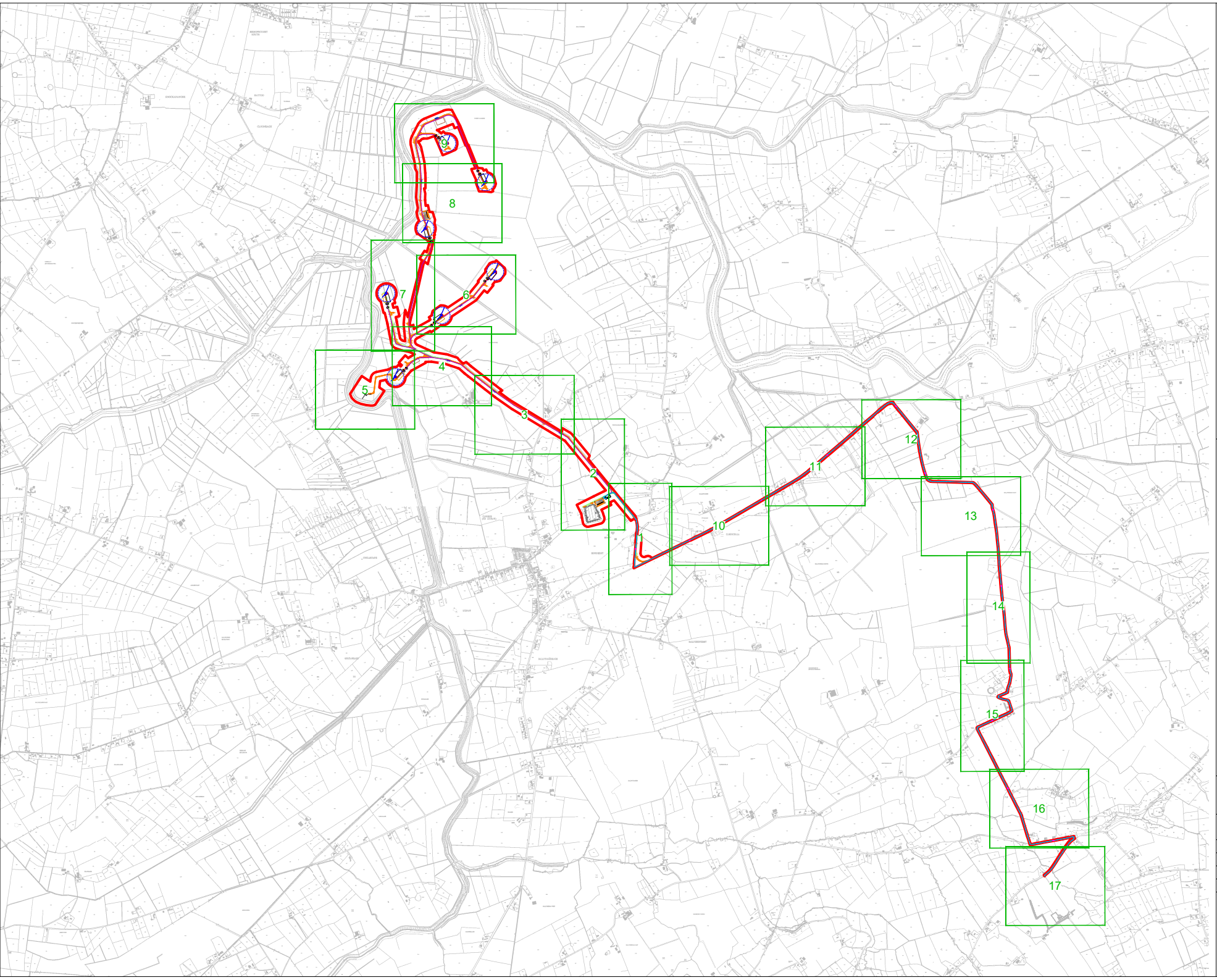

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Borrow Pit

N

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DRAWING TITLE:

Site Layout Key Plan

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 03
SCALE: 1:15,000 @ A1	DATE: 23.11.2021

OS SHEET No:
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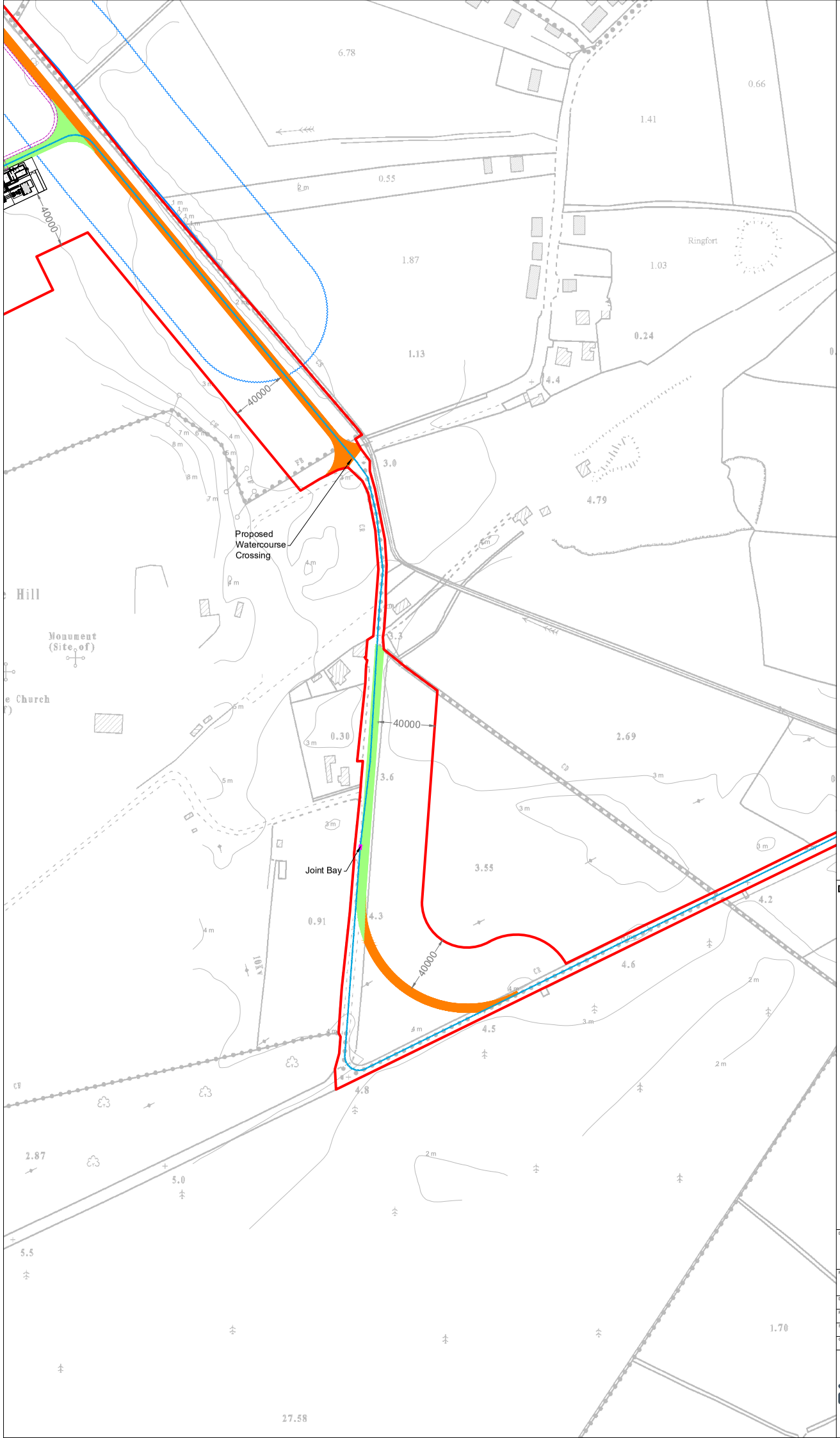

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- Grid Connection Route
- River/Stream
- River/Stream 50m Buffer
- Joint Bay

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DRAWING TITLE:
Site Layout Sheet 1 of 17

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 04
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No.: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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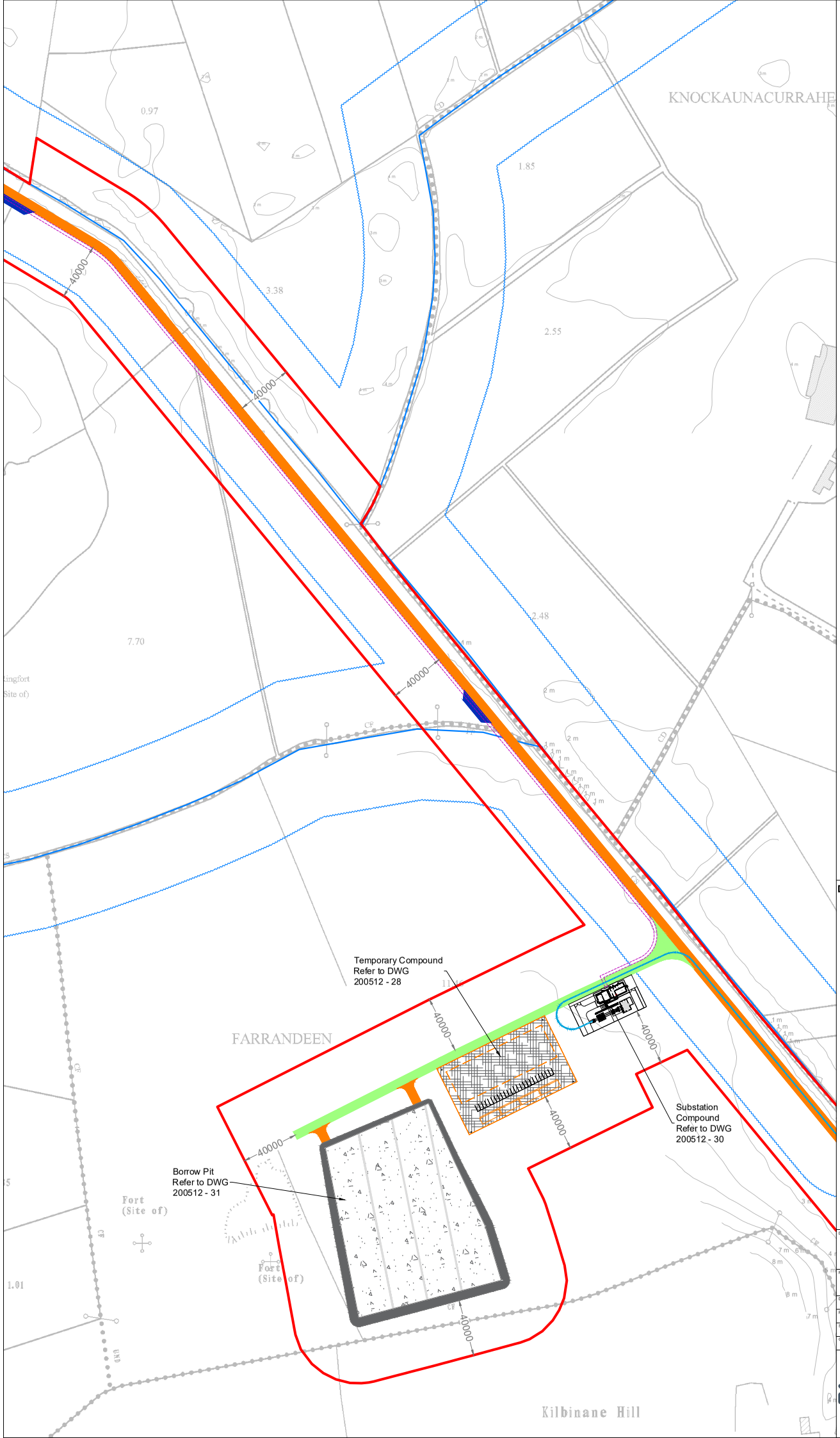

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Proposed Passing Bay
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Borrow Pit

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DRAWING TITLE:

Site Layout Sheet 2 of 17

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No: 200512	DRAWING No: 200512 - 05
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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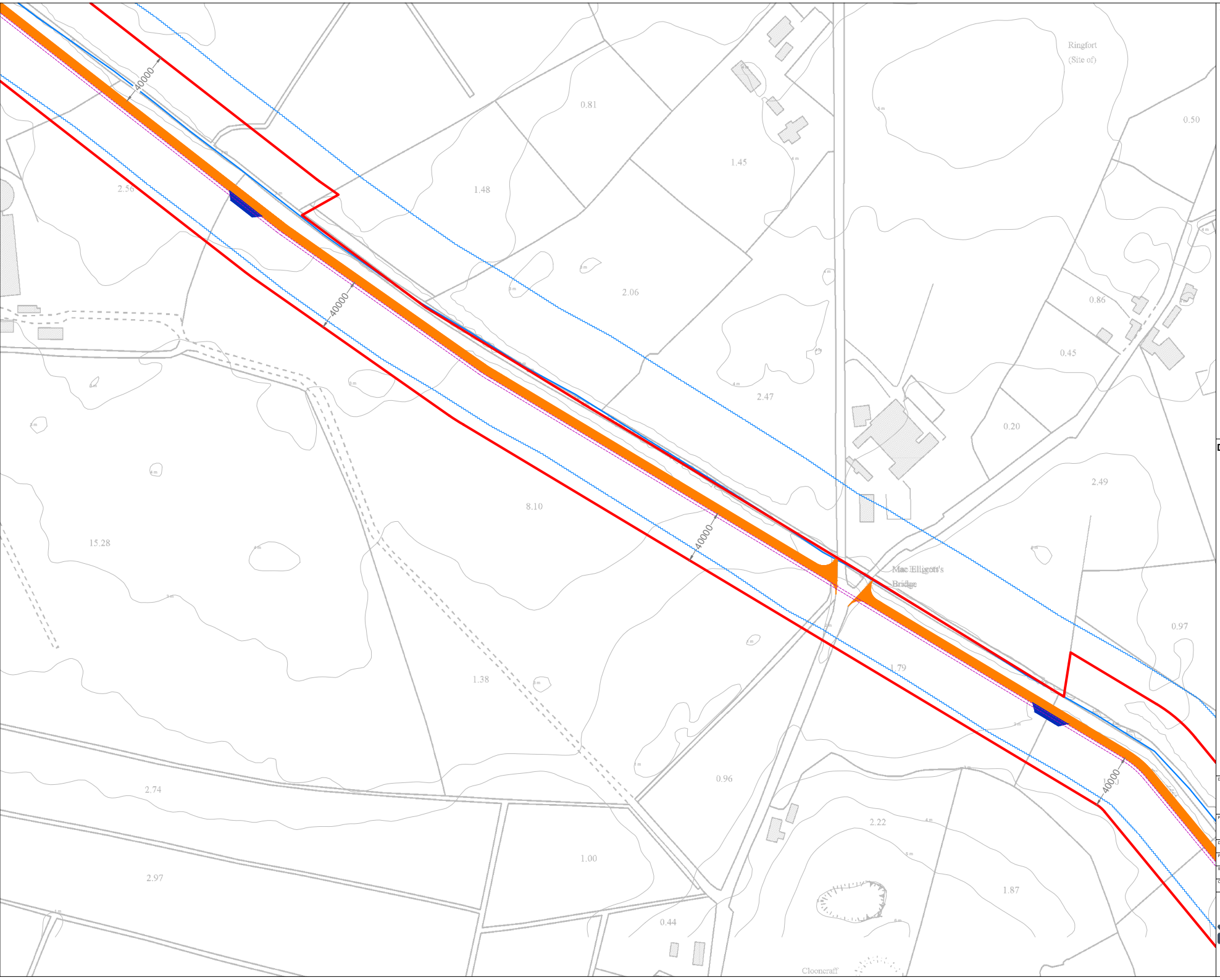

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Proposed Passing Bay
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer

N

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DRAWING TITLE:

Site Layout Sheet 3 of 17

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 06
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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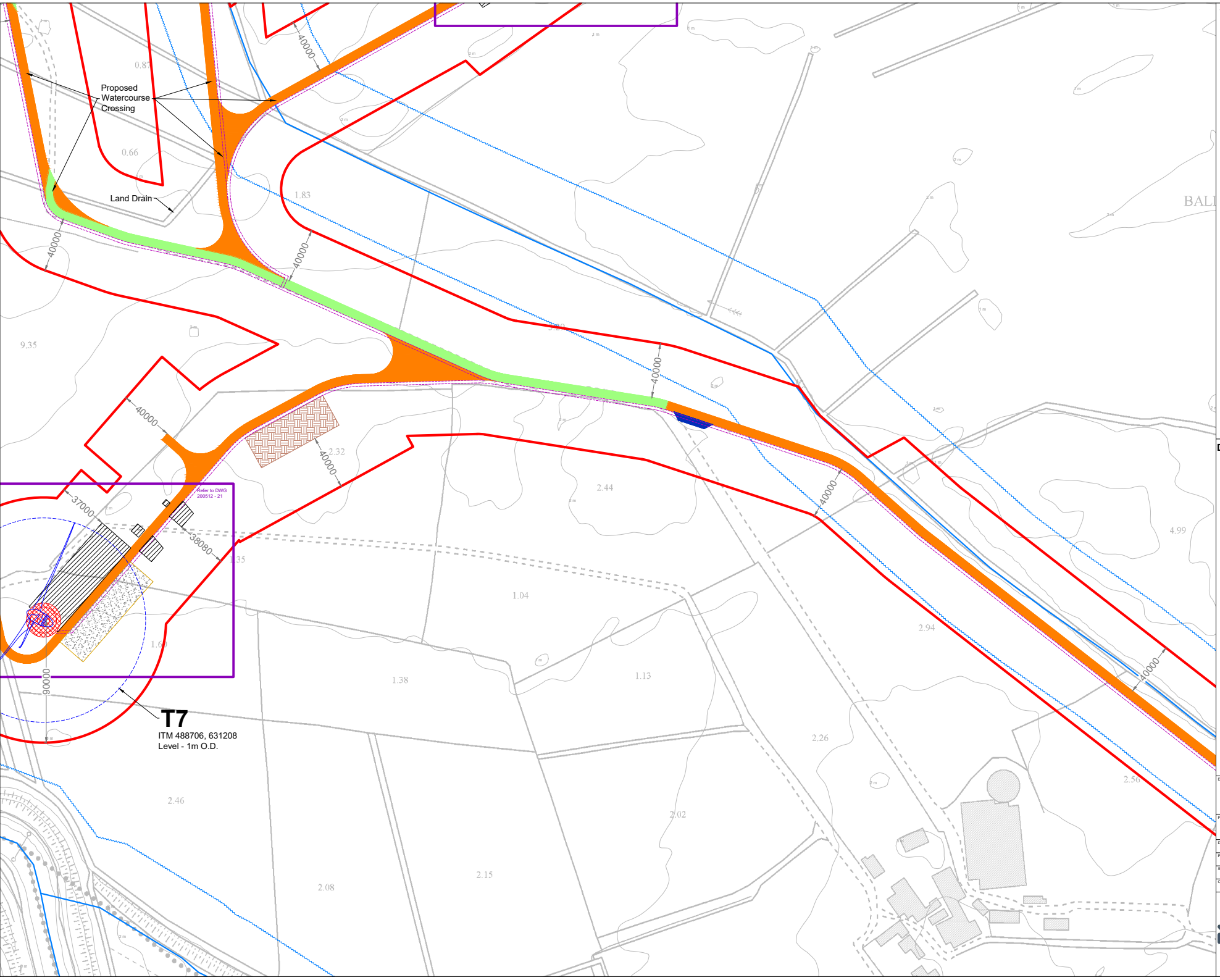

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Proposed Passing Bay
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Peat Repository

N

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DRAWING TITLE:
Site Layout Sheet 4 of 17

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 07
SCALE: 1:2,500 @ A3	DATE: 23.11.2021
OS SHEET No: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337	

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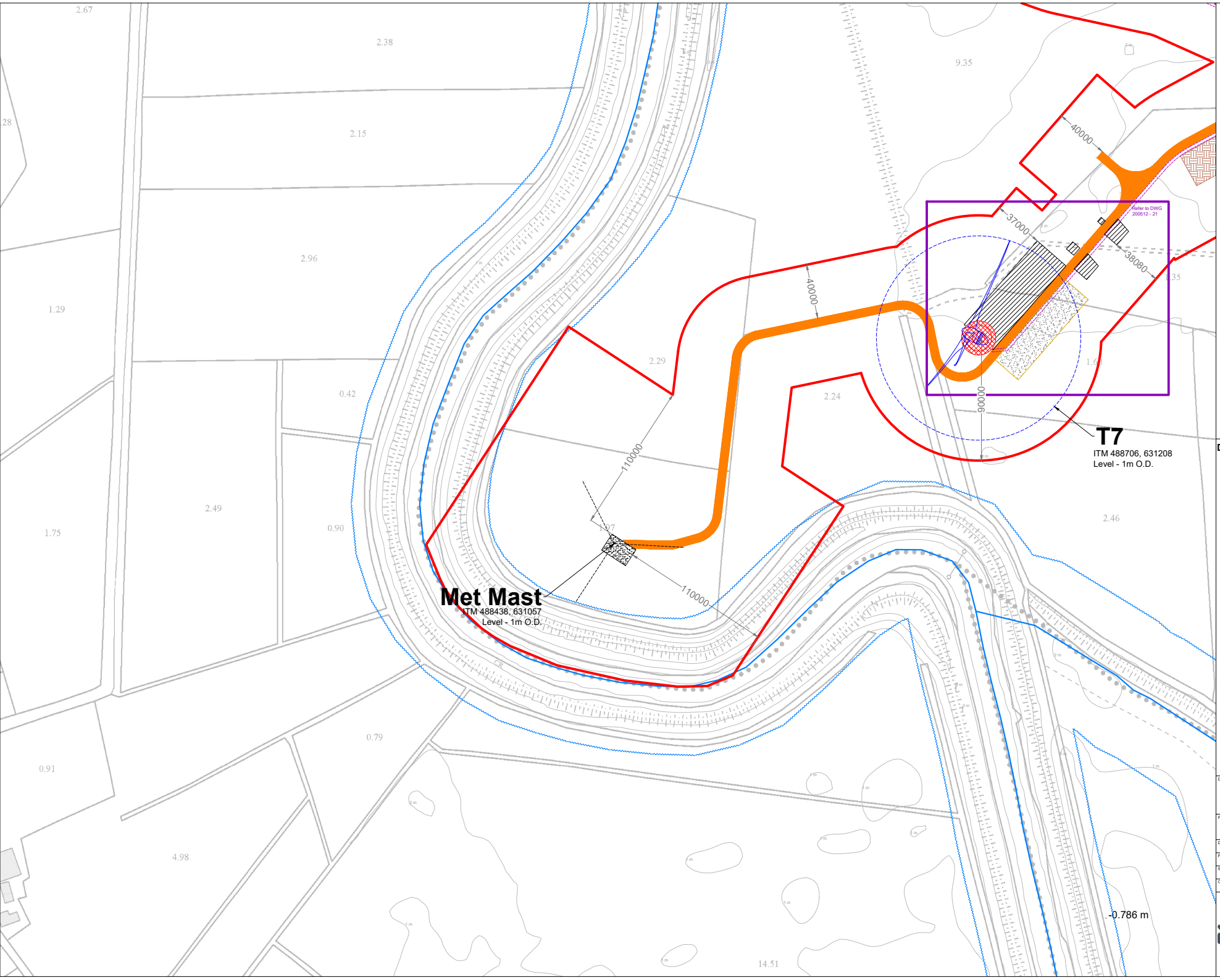

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area

N

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DRAWING TITLE:
Site Layout Sheet 5 of 17

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 08
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No.: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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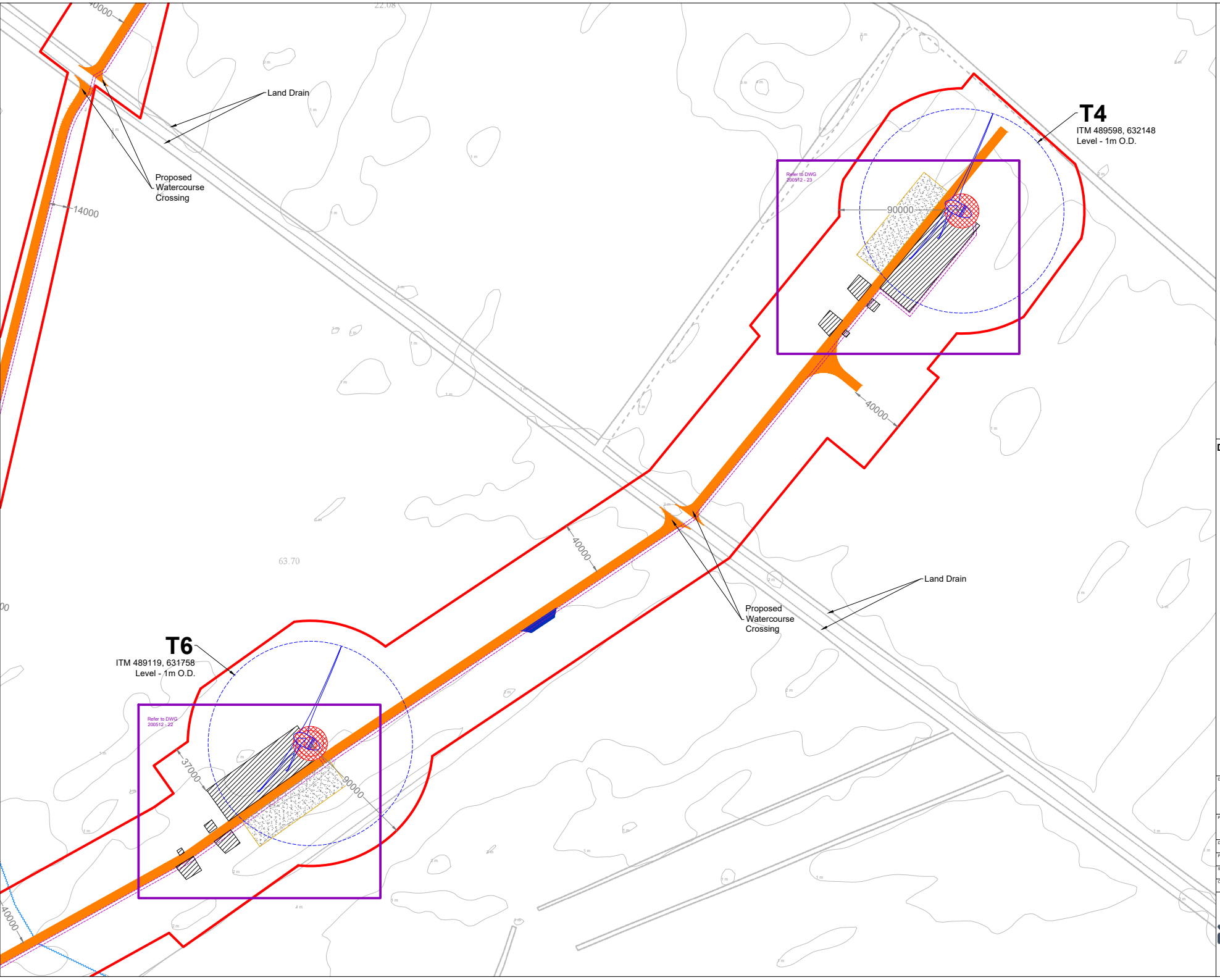

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Proposed Passing Bay
- Electrical Cable Trench
- River/Stream 50m Buffer
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area

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DRAWING TITLE:
Site Layout Sheet 6 of 17

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 09
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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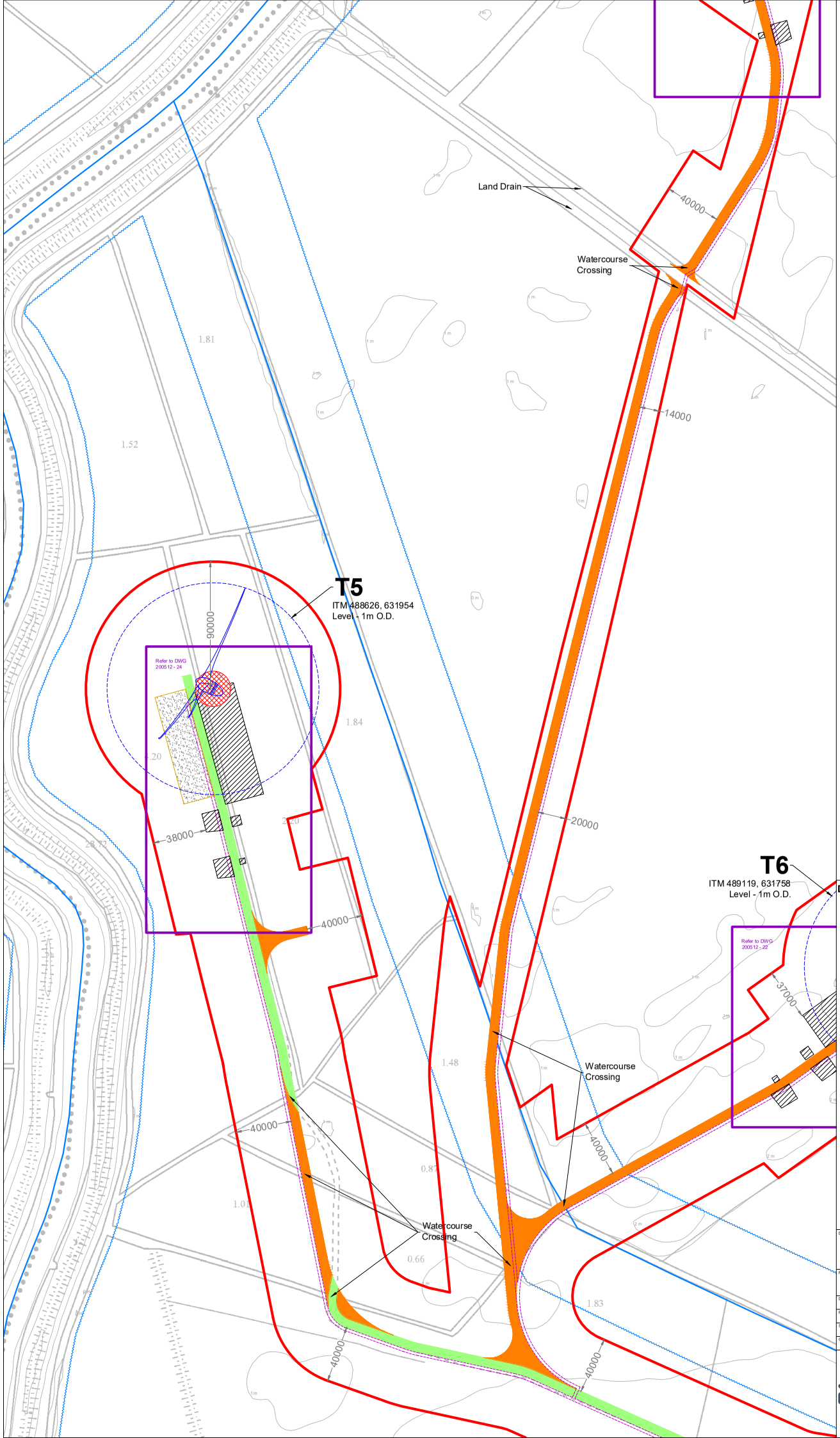

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area

N

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DRAWING TITLE:
Site Layout Sheet 7 of 17

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 10
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No.: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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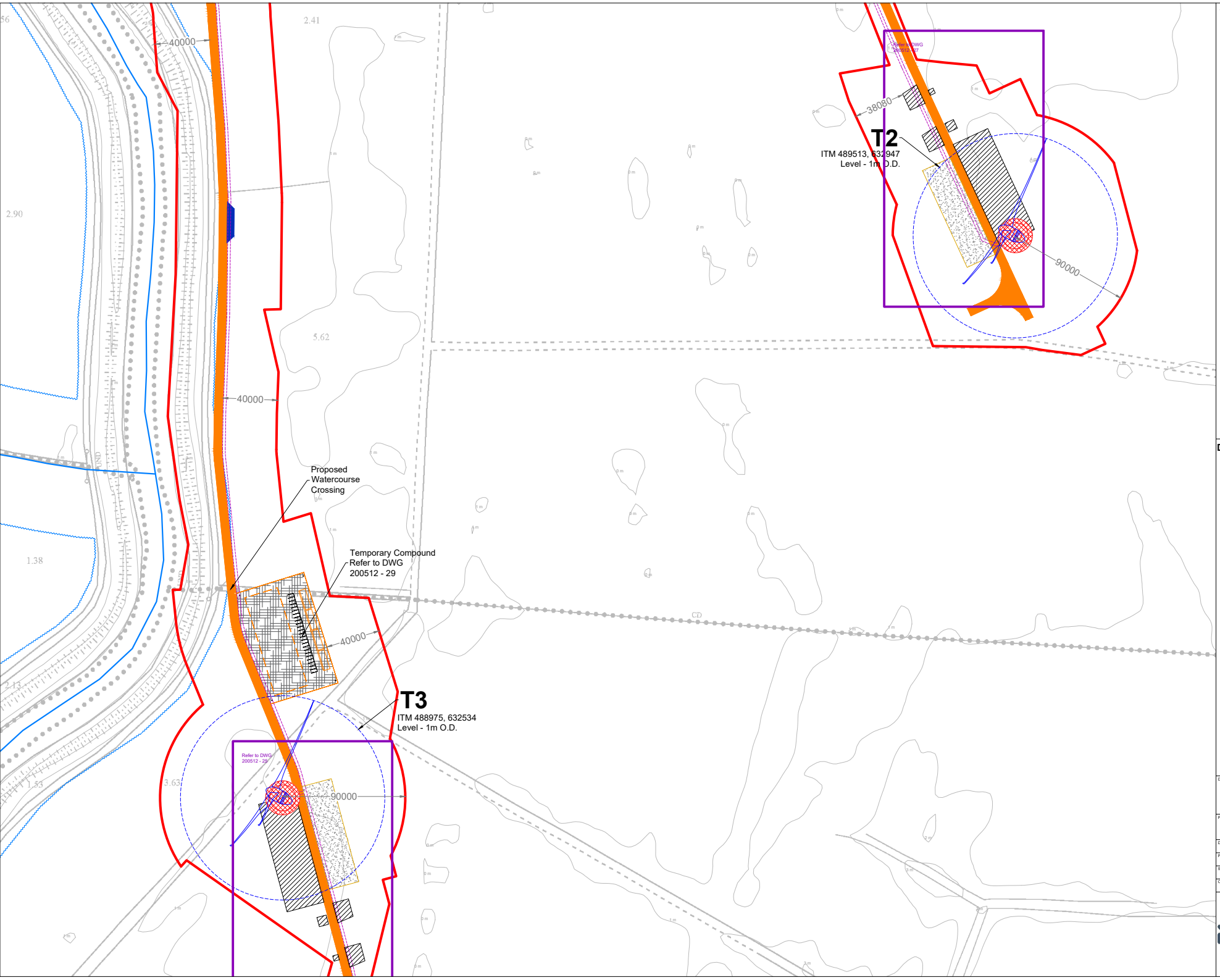

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Proposed Passing Bay
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area

N

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DRAWING TITLE:
Site Layout Sheet 8 of 17

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY:	CHECKED BY:
Joseph O Brien	Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 11
SCALE: 1:2,500 @ A3	DATE: 23.11.2021

OS SHEET No: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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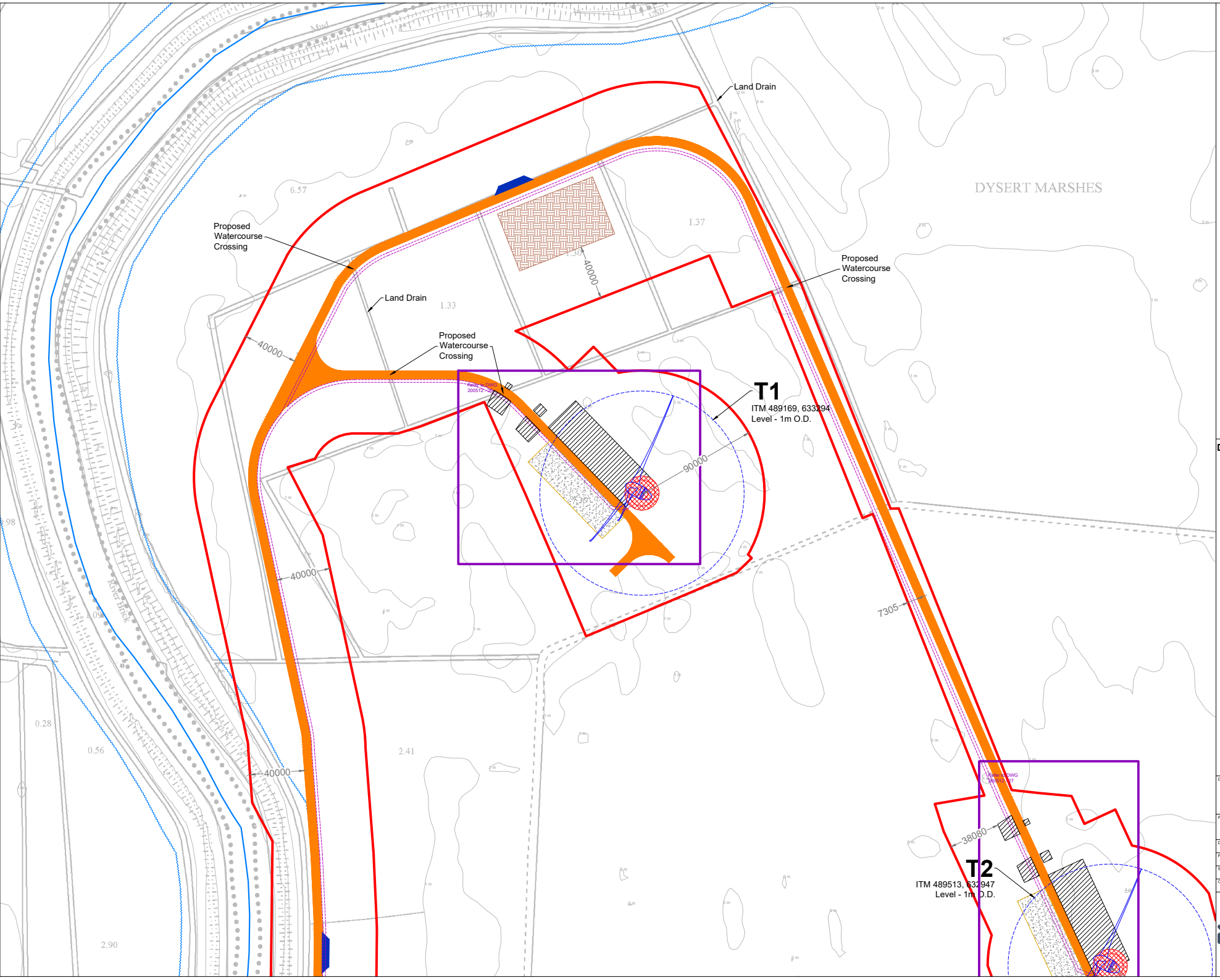

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Proposed Passing Bay
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Soft Levelled Area
- Crane Pad Hardstanding Area
- Turbine Foundation
- Turbine Sweep Area
- Peat Repository

N

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PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

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Drawing Legend

- Planning Application Boundary
- Grid Connection Route
- Joint Bay

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PROJECT TITLE:
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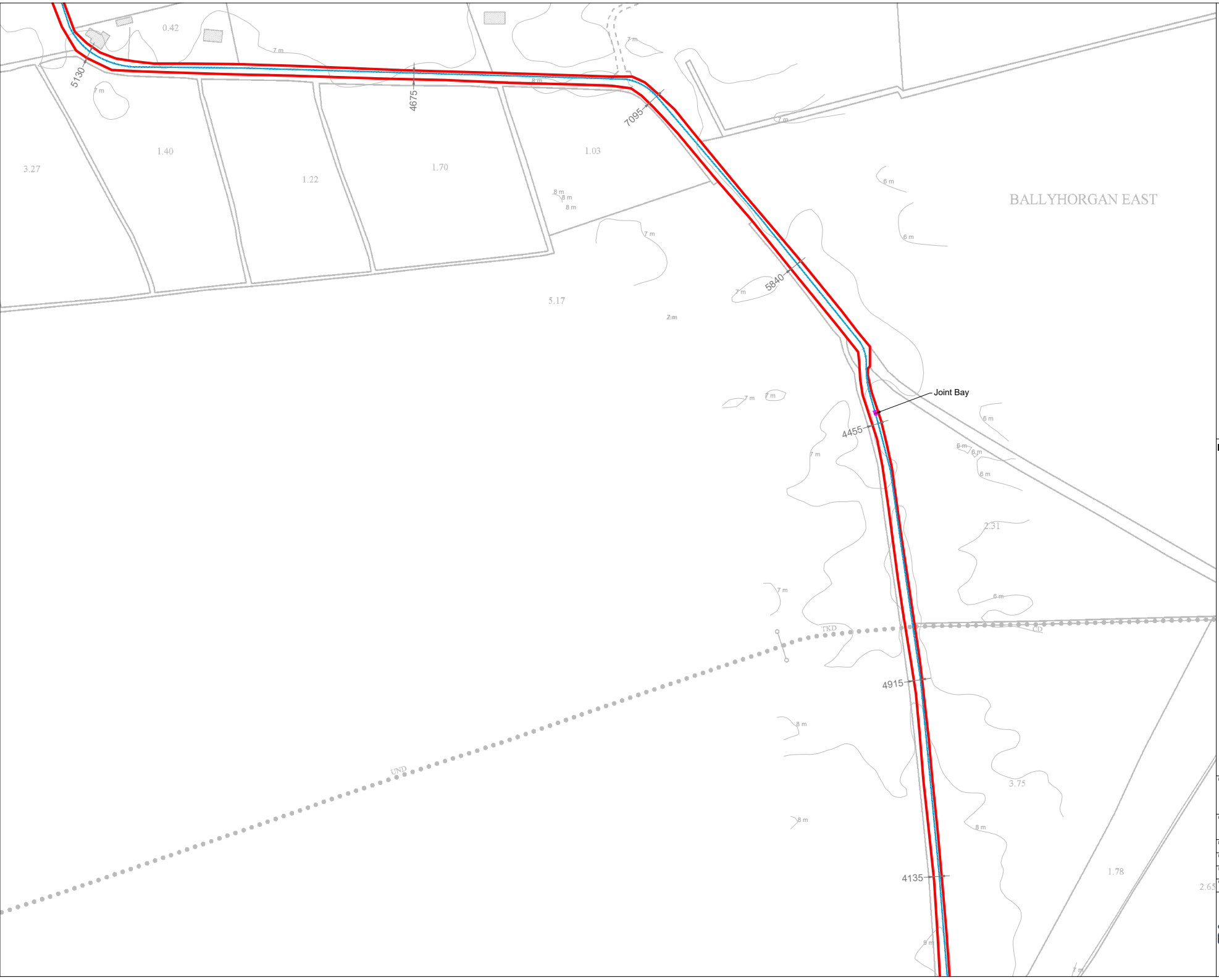

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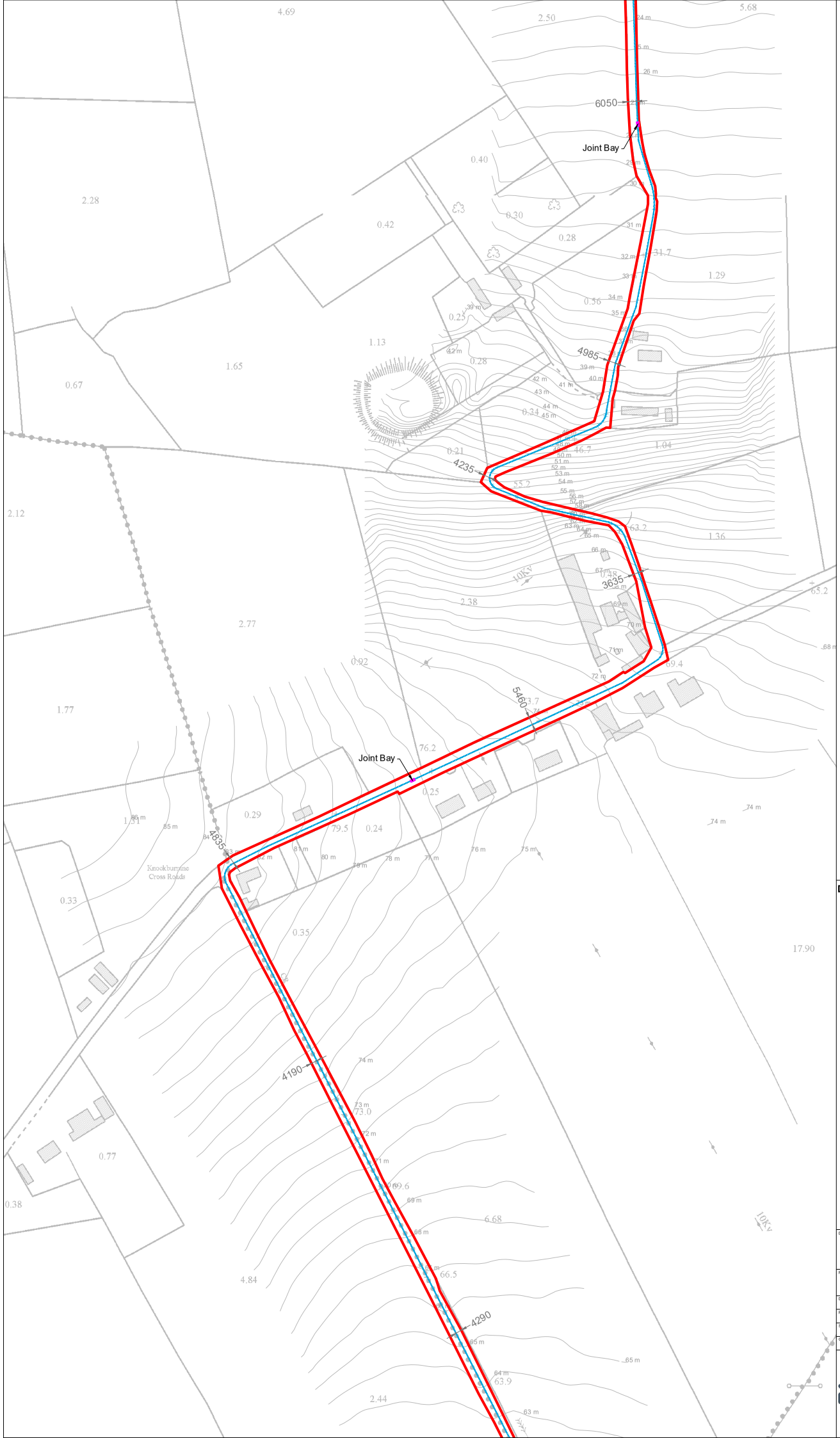

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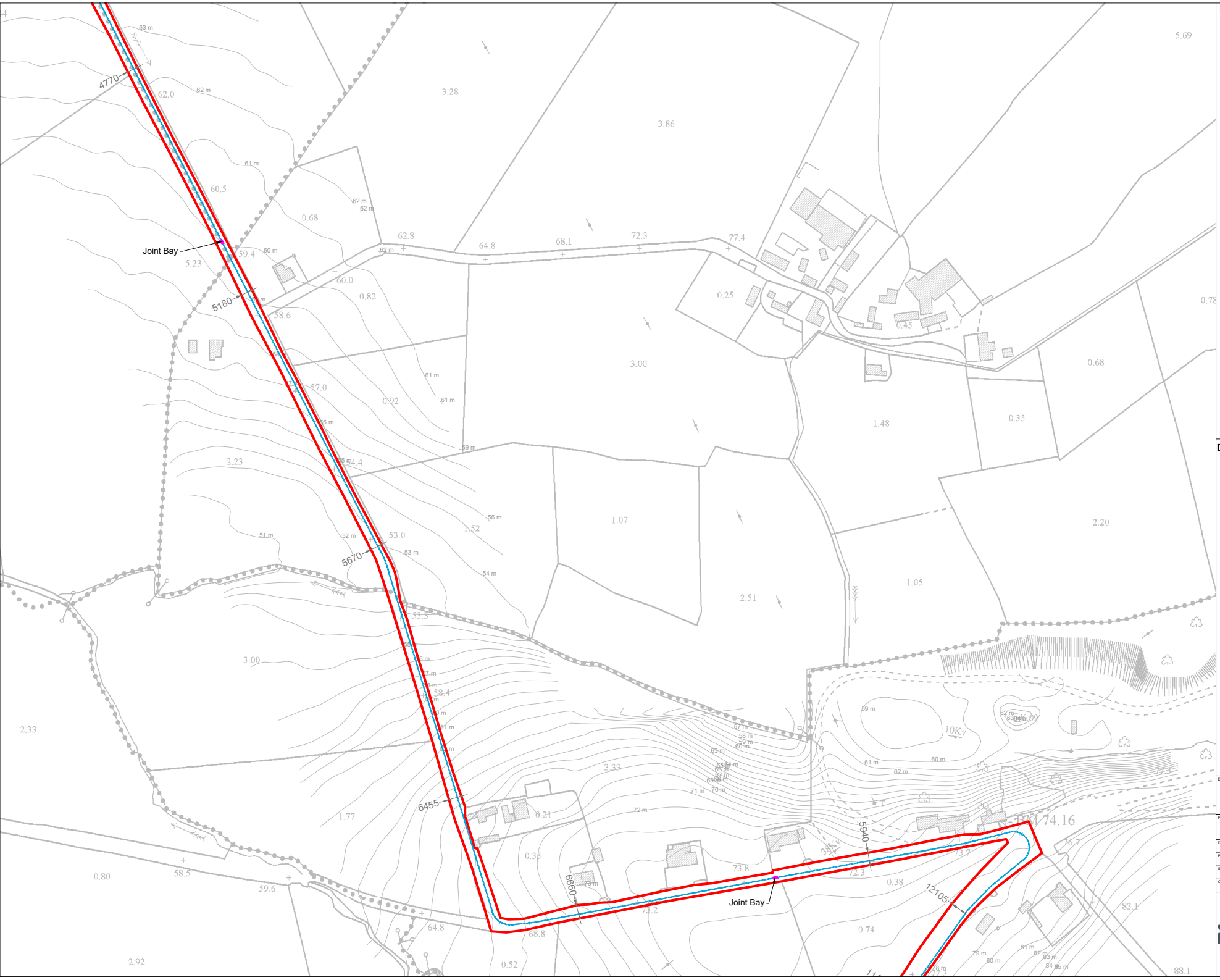

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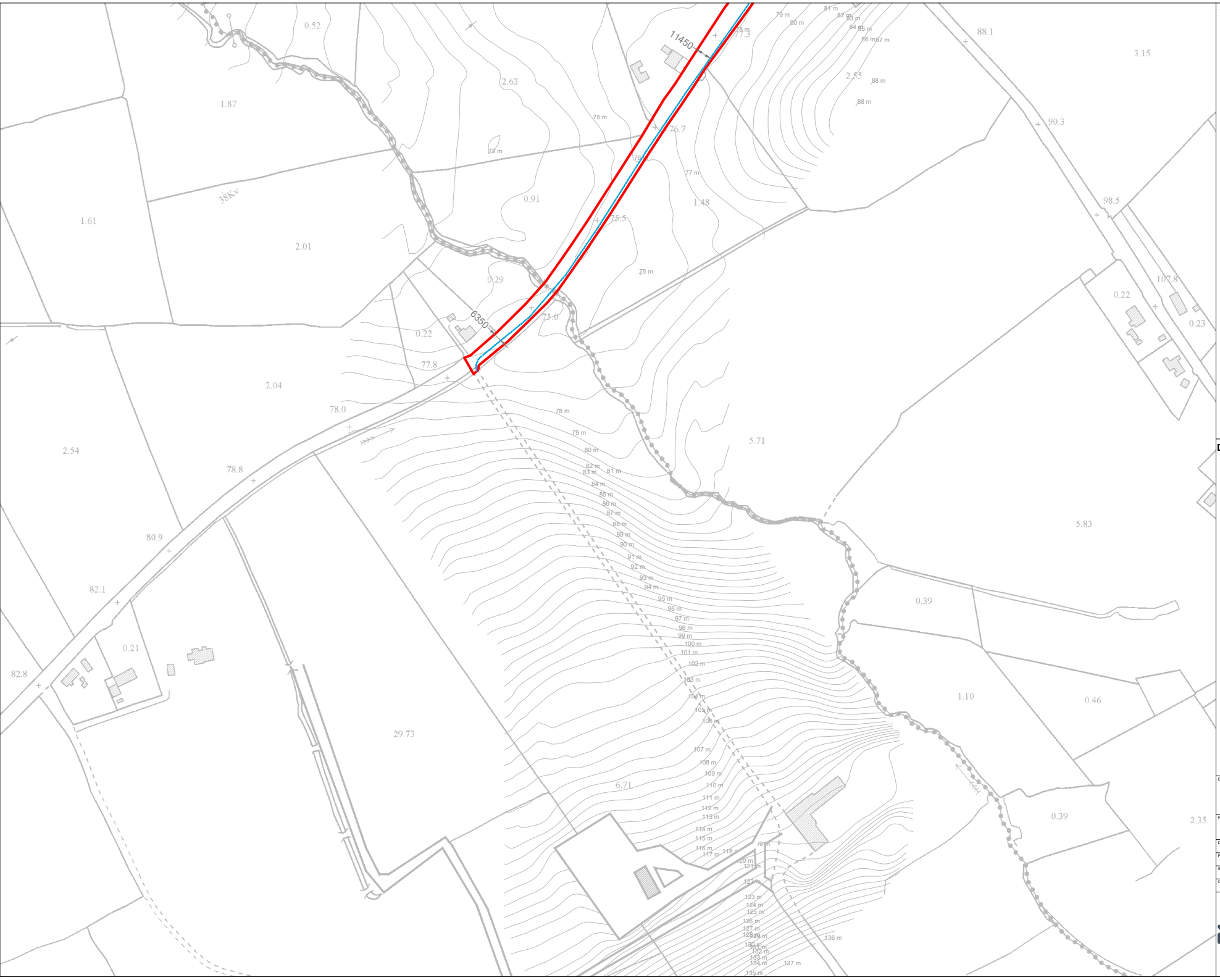

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Drawing Legend

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- Grid Connection Route

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APPENDIX 4.2

CONSTRUCTION AND ENVIORNMENTAL MANAGEMENT PLAN

Planning and Environmental Consultants

Construction & Environmental Managemental Plan

Ballynagare Wind Farm



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1. INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by MKO on behalf of Ballynagare Wind Farm Ltd. who intend to apply to Kerry County Council for planning permission to construct a renewable energy development and all associated infrastructure in the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, Monument, and adjacent townlands in County Kerry.

The CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR) and by the Natura Impact Statement ('NIS') which will accompany the planning application for the Proposed Development to be submitted to the competent authorities. Should the project secure planning permission, the CEMP will be updated, in line with all conditions and obligations which apply to any grant of permission. The CEMP should be read in conjunction with the EIAR and planning drawings. The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during the construction phase of the Proposed Development.

Triggers for amendments to the CEMP will include:

- When there is a perceived need to improve performance in an area of environmental impact;
- As a result of changes in environmental legislation applicable and relevant to the project;
- Where the outcomes from auditing establish a need for change;
- Where Work Method Statements identify changes to a construction methodology to address high environmental risk; and
- As a result of an incident or complaint occurring that necessitates an amendment.

This CEMP identifies the key planning and environmental considerations that must be adhered to and delivered during site construction and operation. The Contractor, as appointed by the Project Developer, will be required to implement all of the requirements set out in this CEMP. The CEMP may be updated and revised throughout the construction phase of the project, but all future iterations must meet or exceed the standards and requirements set out in this document and the Project Developer must be satisfied that all requirements set out in this document can and will be implemented in full by the appointed contractor.

The CEMP to be prepared by the appointed contractor will be a single, amalgamated document that can be used during the construction phase of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer and contractors alike. The CEMP may evolve over further iterations as the construction works progress, but at all times must meet or exceed the standards and requirements set out in this document. It will be the contractor's current version of the CEMP, which at any point in time, will guide the construction activities on site and the implementation of which will be audited by an Environmental Clerk of Works (ECoW).

1.1 Scope of the Construction and Environmental Management Plan

This report is presented as a guidance document for the construction phase of the proposed Ballynagare Wind Farm including connection to the national grid and junction accommodation works along the turbine delivery route. Where the term 'site' is used in the CEMP it refers to all works associated with the wind farm development including the grid connection, road junction and enabling

works. The CEMP outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner.

The report is divided into nine sections, as outlined below:

Section 1 provides a brief introduction as to the scope of the report.

Section 2 outlines the site and project details, detailing the targets and objectives of this plan along with providing an overview of anticipated construction methodologies that will be adopted throughout the project.

Section 3 sets out details of the environmental controls on site which looks at noise and dust controls. Site drainage measures, peat management and a waste management plan are also included in this section.

Section 4 sets out a fully detailed implementation plan for the environmental management of the project outlining the roles and responsibilities of the project team. A water quality monitoring plan is also included in this section.

Section 5 outlines the Emergency Response Plan to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

Section 6 consists of a summary table of all mitigation proposals to be adhered to during the implementation of the project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.

Section 7 consists of a summary table of all monitoring requirements and proposals to be adhered to during the implementation of the project, categorised into the following three separate headings; 1) Pre-commencement measures, 2) Construction-phase measures, and 3) Operational-phase measures.

Section 8 sets out an anticipated programme for the timing of the works.

Section 9 outlines the proposals for reviewing compliance with the provisions of this report.

2. SITE AND PROJECT DETAILS

2.1 Site Location and Description

The site of the proposed development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas, Co. Kerry. The proposed wind farm will comprise of the provision of a total of 7 no. wind turbines, with a maximum ground to top blade tip height of up to 170m, upgrading of existing and provision of new internal access roads. The proposed wind farm development will connect to the Nation Grid via a new grid connection to the existing Clahane substation via underground 38 kV cable.

The proposed development Study Area measures approximately 611 hectares . The Irish Grid Reference co-ordinates for the approximate centre of the site are (E89700, N132200). The town of Listowel is located approximately 9 km east of the proposed development site. The village of Lixnaw is located approximately 2 km south of the proposed development site.

Junction accommodation works will be required at 8 locations as further discussed in Section 2.3 below and Section 14 of the EIAR.

The proposed project layout is presented in Site Layout Drawings included with the application.

2.1.1 Description of the Development

During the construction phase of the project, civil works will include: excavation and construction of reinforced concrete turbine foundations; access road construction and widening of existing access roads; construction of a temporary compound; upgrading existing and installation of new watercourse crossings; construction of underground cabling; and, a permanent meteorological mast.

The design life of the project is expected to be 35 years.

The key components of the wind farm include the following:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
    - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
    - Hub height of 95m
    - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation

- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The proposed site layout showing individual elements of the development is shown in Figure 2-1 and Figure 2-2 and in the Site Layout Drawings.

2.1.1.1 Site Access

There are seven proposed site entrances into the site from the local roads in the area. The site will be accessed from the R557 via the local roadtravelling north from the R557 in the townland of Monument to the east of Lixnaw.. Initially the site is accessed via a new site entrance by turning northwest off this local road (and it is from this new entrance that substation site, southern construction compound, and borrow pit are accessed). The wind farm access road then crosses the existing Clogher Road from Lixnaw to Ballyduff to the north of the village of Lixnaw. The second and third site proposed site entrances are on the either side of this local road. These site entrances facilitate the crossing of the local road and will provide access to turbines 5, 6 and 7. Once the construction phase is complete it is intended that the third site entrance will become the main entrance for the wind farm.

The location of these entrances is shown on the site layout drawing in Figure 2-1. The proposed layout of the site entrances is shown on Figures 4-19 to 4-22 of the EIAR..

2.2 Targets and Objectives

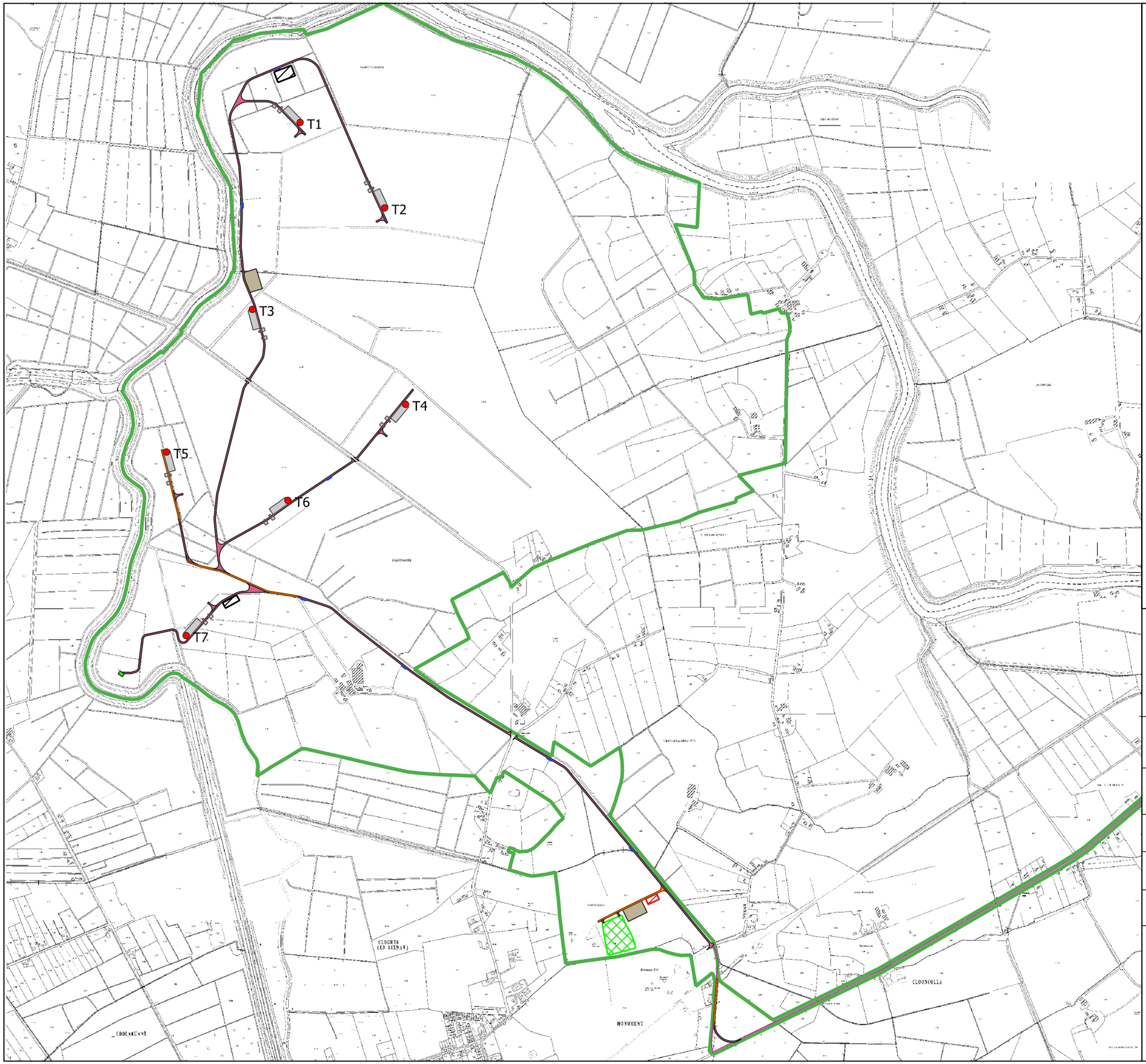
The following key targets and objectives will inform the final detailed design should the proposed development secure planning permission and proceed to the construction phase. This includes consideration of the buildability of the designs that emerge:

- Adopt a sustainable approach to construction and, ensure sustainable sources for materials supply where possible;
- Keeping all watercourses free from obstruction and debris;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Correct fuel storage and refuelling procedures to be followed;
- Air and noise pollution prevention to be implemented;
- Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Good waste management and house-keeping to be implemented;
- Using recycled materials if possible, e.g. excavated stone, soil and subsoil material;
- Avoidance of vandalism;
- Monitoring of the works and any adverse effects that it may have on the environment and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Keep impact of construction to a minimum on the local environment, watercourses and wildlife;
- Comply with all relevant water quality legislation;
- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the Environmental Impact Assessment Report (EIAR) and associated planning documentation;
- Ensure construction works and activities are completed in accordance with any planning conditions for the development;

- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;
- Ensure construction works and activities have minimal impact on the Natural Environment;



Map Legend

- EIAR Study Area Boundary
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

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Drawing Title

Proposed Site Layout

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
TB	MW
Project No. 200512	Drawing No. Figure 2.1
Scale 1:15000	Date 2021.10.13

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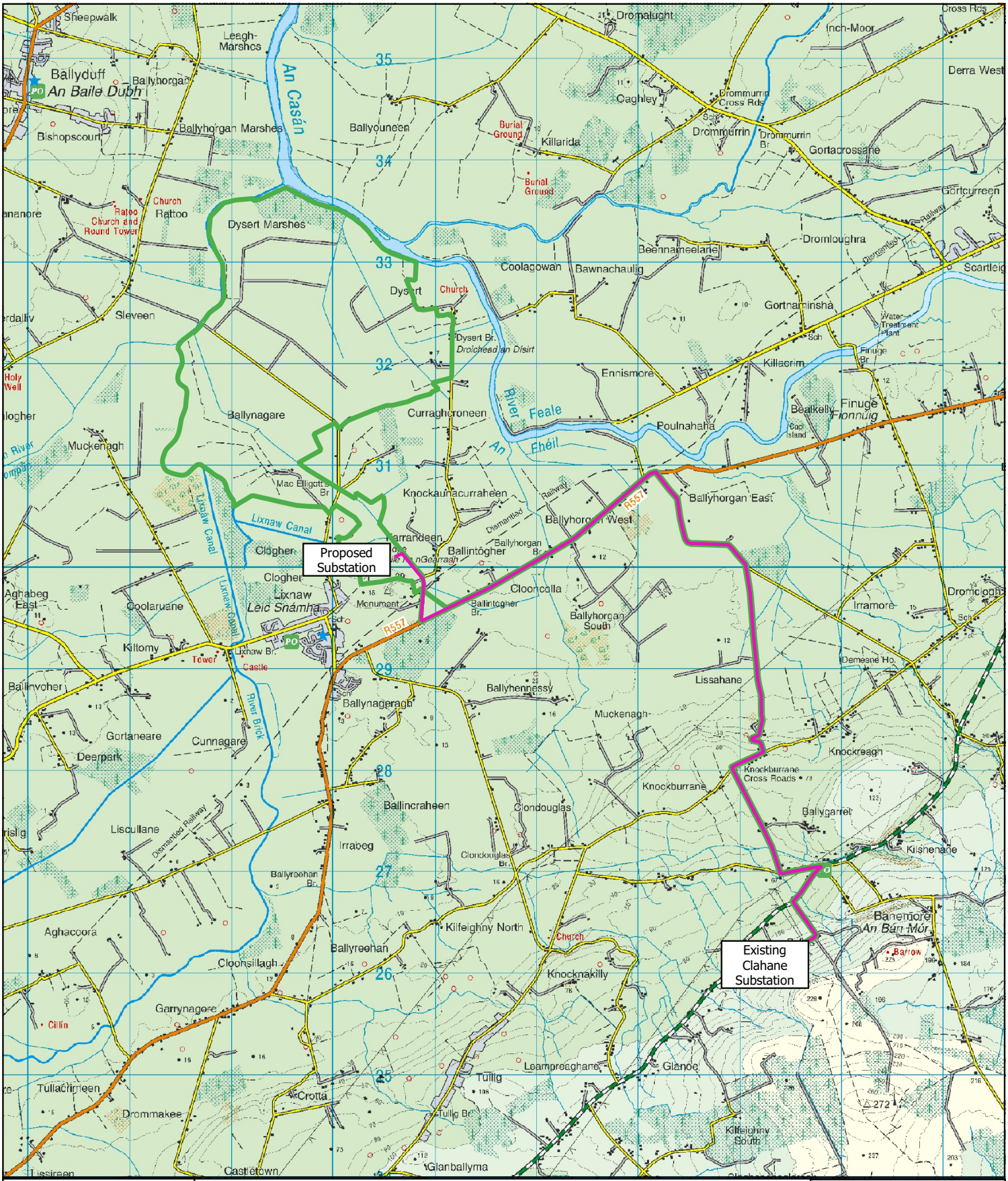

Map Legend

- EIAR Study Area
- Proposed 38kV Grid Connection

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Drawing Title: Grid Connection Route

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
TB	LW
Project No.	Drawing No.
200512	Figure 2.2
Scale	Date
1:50000	30.09.21

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2.3 Overview of the Proposed Construction Methodology

2.3.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase of the Proposed Development. The main contractors will comply with this CEMP and any revisions made to this document throughout the construction phase. An overview of the anticipated Construction Methodologies is provided below.

2.3.2 Overview of Proposed Construction Methodology

The EIAR includes construction methodologies for various elements of work to be undertaken as part of the project. These construction methodologies are reproduced in the following sub-sections but will be superseded by an appointed contractor's construction method statements, which will form part of the CEMP. The contractor's construction method statements will be prepared to take account of the detailed engineering, geotechnical and detailed drainage design which will be prepared prior to commencement of construction and all requirements of this CEMP.

The proposed anticipated construction methodology is summarised under the following main headings:

- Temporary Construction Compound;
- Borrow Pit;
- Drainage System;
- Upgrade of Existing Roads;
- New Site Access Roads;
- Turbine Foundations and Anemometry Mast Foundations;
- Crane Hardstands;
- Electricity Substation and Control Building;
- Temporary Peat Storage Areas
- Cable Trenching;
- Watercourse Crossings;
- Grid Connection;
- Turbine Delivery Route Accommodation Works; and,
- Site Reinstatement

2.3.2.1 Temporary Construction Compound

The proposed site temporary construction compound will be centrally located in the site, adjacent to the proposed substation, between proposed locations of turbines no. 5 and no. 7. The location of the construction compound is shown on the site layout drawings in Figure 2-1 The construction compound will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors.

The compound will typically be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs, and associated settlement ponds will be installed around the perimeter (refer to Section 3.2 below & EIAR Section 4.6);
- The compound will be established using a similar technique as the construction of the excavated site tracks as discussed below;
- Where required, a layer of geogrid will be installed, and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;

- Areas within the compound will be constructed as site roads and used as vehicle hard standings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc.;
- If necessary the compound will be fenced and secured with locked gates, although fencing would only be utilised where significant risk of danger to third parties or vandalism is envisaged;
- Upon completion of the project the compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required;
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase; and,
- The water supply to the site will be from a temporary water storage tank which will be filled using a mobile water tank which will source water locally as required.

2.3.2.2 Borrow Pit

The proposed development will comprise one proposed borrow pit, to be located in the south of the site, south of turbines no. 4 and 5, as shown in Figure 2-1. The borrow pit will typically be excavated and backfilled as follows:

- The area to be used for the both borrow pit will be marked out at the corners using ranging rods or timber posts. Drainage runs, and associated settlement ponds will be installed around the perimeter;
- The initial borrow pit excavation will involve removal of peat (if present) and mineral soil to the top of bedrock. These materials will be stored temporarily or placed around the borrow pit to form berms to prevent surface water inflow to the borrow pit excavation;
- Interceptor drainage ditches will be excavated on all sides of the borrow pit to catch surface water runoff, and direct it to downstream re-distribution locations;
- The bedrock material will be extracted from the borrow pit and stockpiled or used as required;
- The use of material won from the borrow pit will be sequential with new road construction or turbine base formations;
- Temporary stockpiling of aggregates will be required to accommodate the cut and fill operations within the borrow pit, and the progression of access roads and turbine excavations;
- As the borrow pit excavation progress and become deeper, surface water and groundwater ingress will be removed via pumping to settlement ponds, and re-distribution locally across natural vegetated areas. Where required, additional specialist water treatment measures will be employed to ensure no deterioration in downstream water quality occurs;
- When extraction ceases within the borrow pit, the uphill face of the rock will be stepped, and deposits of soil will be placed which will assist in the re-vegetation of the rock face; and,
- The extraction area of the borrow pit will have to be permanently secured and a stock-proof fence will be erected around the borrow pit to prevent access to these areas as well as the installation of appropriate health and safety signage.

2.3.2.3 Drainage System

The early establishment of temporary drainage facilities will reduce the risk of pollution problems during construction. In addition, construction operations will adopt best working practices. The development of the site will need to be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other

drainage features as each development phase progresses. They will therefore need to be designed with sufficient flexibility to respond to an early phase of limited incoming flow during the construction phase.
Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated, and settlement ponds constructed to eliminate any suspended solids within surface water running off the site. Surface water management and drainage design is dealt with in Section 3.2 below and Section 4.6 of the EIAR.

2.3.2.4 Upgrade of Existing Roads

It is proposed to utilise the existing road network as much as possible with approximately 1.75 km of existing roadway requiring upgrade. These roads will require upgrading which will entail widening of the roadway to a total running width of approximately 6.0 m, with wider sections at corners and on the approaches to turbine locations, and the laying of a new surface dressing on the existing section of roadway where necessary. The road widening will generally be undertaken as follows:

- If it is considered that the current road formation level is adequate to support required bearing, then no upgrade or widening works will be completed;
- Otherwise, where required, the subsoil in the existing road verge will be excavated down to a suitable formation layer of rock and the spoil deposited in the peat reinstatement areas;
- Well-graded imported granular fill or material won from the borrow pits will be spread and compacted to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used. These layers of granular fill will be brought to the same level as the top of the existing paved surface;
- A layer of geo-grid will be installed directly onto the top of the granular fill layer and the existing road surface where required and a layer of finer well graded stone for the running surface will be laid on the geo-grid and compacted;
- Prior to any works commencing on the upgrade of existing roads, the requirement for additional roadside drainage will be considered by the Project Hydrologist in line with the proposals outlined in Section 4.1.4 below; and,
- Where road widening is required in an area where the peat depth is greater than 1.5 m, it will be necessary to complete the road upgrade using a floating road methodology as detailed in Section 2.3.2.5 that follows.

2.3.2.5 New Site Access Roads

New roadway will be required in areas where existing roads are not already present, or where existing sections are too steep or otherwise unsuitable for the required purpose in the case of the proposed development. Maximum use has been made of the existing machine tracks and fire breaks within areas of forestry to ensure that the felling area required to make way for proposed new site roads is kept to a minimum. There are approximately 5.39 km of new access roads to be constructed at the site. It is also proposed to construct 0.29 km of new farm track link roads between turbines no. 4 and no. 5.

In a number of areas across the site, floating roads will be required where peat depths exceed c1.5m. Floating roads will be constructed using either a lightweight construction methodology which includes the use of layers of brash and lumber either side of a geogrid membrane where required and capped with suitable stone material or the use of geogrid capped with a stone material

The new access roads will be constructed as follows:

- Establish alignment of the new site roads from the construction drawings and mark out the centre lines with ranging rods or timber posts;

- The road layout has been designed to avoid or limit the number of crossings of natural watercourses;
- Where existing culverts are to be upgraded or extended, the works will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland (IFI);
- The access tracks will be of single-track design with an overall width of 6 m. There will be some local widening on the bends, junctions and around turbine bases for the safe passage of large vehicles;
- The excavated road section will, where practicable have turf stripped over the area of the excavation and stored growing side up for reuse. This area will be oversized to facilitate the excavated subsoil material. The subsoil material will subsequently be capped with topsoil to form an earth bund around the peat reinstatement areas identified;
- All peat and overburden excavated will be used as part of the borrow pit restoration or in reinstatement areas. Topsoil will be temporarily stockpiled locally for reuse for landscaping the backfill placed above the foundations;
- The subsoil will be excavated down to a suitable formation layer of either firm clay or bedrock;
- Where floating roads are to be constructed, the subsoil will not be excavated but a layer of geo-grid or layers of brash and lumber will be laid directly on to the peat surface.
- For both excavated and floating roads, the road will be constructed using well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used;
- All new roadways will be constructed with a camber to aid drainage of surface water;
- Batters will generally be sloped to between 1:1 and 1:2 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species. Design slopes will be informed by the Geotechnical Engineer;
- At bends or steep inclines from the roads, reflective snow poles will be erected to warn traffic on dark mornings and evenings that there is a turn in the road or a sharp incline beyond the site road; and
- All rock won from the borrow pit areas that are to be used in road construction on site will be tested in accordance with the relevant standard (*BS 812-111:1990 Testing aggregates. Methods for determination of ten percent fines value.*)

In addition, where floating roads are required, the following measures will be adopted as part of the construction methodology:

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than three metres.
- Floating road construction will be to the line and level requirements as per detailed engineering design.
- Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road to be in accordance with appropriate design from the designer.
- The typical make-up of the new floated access road is 500 to 750mm of selected granular fill with 2 no. layers of geogrid.
- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.
- Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone on to the peat shall not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a ten metres length of constructed floating road.

- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a ten metre length of constructed floating road.
- Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

2.3.2.6 Turbine and Anemometry Mast Foundations

The wind turbines and anemometry mast foundations will be a reinforced concrete base designed to the appropriate standards (*BS EN 1992-1-1:2004+A1:2014 Eurocode 2: Design of Concrete Structures*). Foundation loads will be provided by wind turbine and mast supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation using a bolt assembly which shall be cast into the concrete. The anemometry mast is typically a free-standing structure which is also anchored to the reinforced concrete foundation or could be supported by guyed wires radiating out 51 metres in three directions from the tower. It is anticipated that the foundations for both the turbines and the anemometry mast will be either ground bearing foundations and that the formation level of the turbine foundations will be on the lower mineral subsoil or bedrock. Bases will measure approximately 21 m in diameter. They will likely be formed 1 m below the base of the peat layer on stiff subsoil material or bedrock, or at a suitable level directed by the Geotechnical Engineer/Designer. The foundations will be constructed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;
- Where practical, the turf will be stripped over the area of the excavation and stored growing side up for reuse, the subsoil will be excavated and stored to one side for reuse during the landscaping around the finished turbine;
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- All groundwater and surface water arising from turbine base excavation will be pumped to the dirty water system and treated in settlement ponds, and/or specialist treatment systems, prior to discharge from the works area;
- Soil excavation shall be observed by a qualified archaeologist in accordance with a scheme of archaeological monitoring, in order to identify any significant remains as they come to light;
- At excavated turbine bases the excavation will be raised to formation level by compacted layers of well graded granular material will be spread and compacted to provide a hard area for the turbine foundation; and,
- Where an excavated turbine base cannot be used due to the depth of peat, a piled foundation using reinforced concrete piles will be installed.

Ground bearing reinforced concrete bases will be completed as follows:

- A layer of concrete blinding will be laid approximately 75 mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. The concrete should be protected from rainfall during curing and all surface water runoff from the curing concrete should be prevented from entering surface water drainage directly;
- High tensile steel reinforcement will be fixed in accordance with the designer's drawings and schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools;
- Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required;

- The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base. These checks will be passed to turbine manufacturer for their approval;
- Concrete will be placed using a concrete pump and compacted when in the forms using vibrating pokers to the levels and profile indicated on the drawings. Upon completion of the concreting works the foundation base will be covered and allowed to cure;
- Steel shutters will be used to pour the circular chimney section;
- Earth wires will be placed around the base;
- The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the vegetable soil set aside during the excavation. A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance; and,
- Soil, rock, and other materials excavated during construction shall not be left stockpiled on-site following completion of works. Excavated areas shall be appropriately restored within three months of the date of commissioning of the wind farm.

Reinforced concrete piled foundations will be completed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices.
- A piling platform for the piling rig will be constructed. This can be done in two ways depending on the bearing capacity of the underlying soil.
    - The first method is to lay geo-textile on the existing surface and a stone layer will then be placed on top of the geo-textile by an excavator and compacted in order to give the platform sufficient bearing capacity for the piling rig.
    - The second method is to excavate the soils to a suitable intermediate mineral subsoil and backfill to the formation level.

- The piling rig, fitted with an auger, will then bore through the soft material with a sleeve fitted around the auger to prevent the sidewalls of the peat from collapsing. The borehole is then extended to a suitable depth into the subsoil/bedrock.
- When the auger and the sleeve are removed high tensile steel cages will be lowered into the boreholes. These steel cages will extrude above the level of the top of the concrete pile.
- As the auger is removed concrete is pumped into the borehole.
- Reinforcing steel on the top of the pile will tie to the foundation base steel.

The procedure for standard excavated reinforced concrete bases as outlined above can be applied from here.

2.3.2.7 Crane Hardstands

All crane pads will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads and will measure approximately to the turbine manufacturer's requirements. Where an excavated crane hardstand cannot be used due to the depth of peat, the hardstand will be supported by using reinforced concrete piles as per the methodology outlined for piled turbine foundations summarised above. The position of the crane pads varies between turbine locations depending on topography, position of the site access road, and the proposed turbine position.

2.3.2.8 Electricity Substation and Control Building

An electricity substation and associated control building are proposed to be constructed within the site, adjacent to the existing access road, as shown in Figure 2-1. The substation and control buildings will be constructed by the following methodology:

- The area of the buildings will be marked out using ranging rods or wooden posts and the soil stripped and removed to a temporary placement area for later use in landscaping. No material will be removed from site and the temporary placement areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- The dimensions of the substation area will be set to meet the requirements of the ESB and the necessary equipment to safely and efficiently operate the wind farm;
- The foundations will be excavated down to the level indicated by the Project Engineer. The foundations will be shuttered and poured with reinforced concrete. An anti-bleeding admixture will be included in the concrete mix;
- The substation will be constructed with masonry blockwork. The block work walls will be built up from the footings to damp-proof course (DPC) level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables and internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- Concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, slated and sealed against the weather;
- Due to the specific nature of the proposed development there will be a very small water requirement for occasional toilet flushing and hand washing, and therefore the water requirement of the proposed development does not necessitate a potable source. It is proposed to harvest rainwater from the building roofs.
- The electrical equipment will be installed and commissioned;
- Perimeter fencing will be erected around the substation and control building compound area;
- All wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank which will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying; and,
- The construction and components of the substation will be to ESB or EIRGRID specifications;

2.3.2.9 Temporary Peat Storage Areas

The total estimated volume of peat to be excavated during the construction phase of the proposed development is 71,127m^3. Selected areas, within the site have been chosen as peat repository areas. The volume of excavated peat and overburden will be managed as outlined below:

- Excavators will remove the peat from the permanent development footprint areas i.e. excavated roads, hardstanding areas and turbine foundation areas.
- Temporary, sealed stockpiling areas, located adjacent to the hardstanding areas and turbine foundation areas, will be chosen following onsite discussions between the construction site manager, an ecologist, a geotechnical engineer and hydrologist.
- The excavators will move the excavated peat to the designated temporary stockpiling areas within the construction and soft levelled areas.
- The temporary stockpiling areas will be surrounded by silt fences to ensure sediment-laden run-off does not occur.

- The excavated peat will remain in these areas over a period of time until the volume of the peat has reduced as the water drains out of the mounded peat.
- The excavators will then load the peat directly into dump trucks, to transport the peat to the nearest peat repository area.
- The material will be backfilled into the peat reinstatement areas and will be spread evenly across the area.

This method of managing the volume of surplus peat and other overburden material will ensure that no excavated material will be left on-site, adjacent to access roads and turbine locations, following the completion of the construction works.

2.3.2.10 Cable Trenching

The transformer in each turbine is connected to the substation through a network of buried electrical cables. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the substation compound. The ground is trenched typically using a mechanical digging machine. The top layer of soil is removed and saved so that it is replaced on completion. The cables are bedded with suitable material unless the ground conditions are such that no bedding is required. The depth of the cables are to meet all national and international requirements and will generally be up to 1.3 m below ground level depending on the ground conditions that are encountered. A suitable marking tape is installed between the cables and the surface. On completion the ground will be reinstated as per its original condition as outlined in Figure 4-11 of the EIAR. The route of the cables will generally follow the access tracks to each turbine location.

2.3.2.11 Grid Connection

A proposed connection to the national electricity grid will be made via an underground 38 kV electricity cable originating from the Ballynagare Wind Farm, running 7km southeast to the existing Clahane electricity substation in the townland of Pallas, Co. Kerry. The exact position of the cable/ joint bays within the road curtilage will be subject to ESB/ Eirgrid and Kerry County Council approval and a Road Opening Licence will be obtained.

The installation of the underground electrical cable will be completed using the following construction methodologies:

2.3.2.11.1 *Parallel Road Excavations in Road and in Grass Margin*

The grid connection route generally follows the existing road corridor. The cabling works are summarised as follows:

- The area where excavations are planned will be surveyed and all existing services will be identified.
- All relevant bodies i.e. ESB, Kerry County Council etc. will be contacted and all drawings for all existing services sought.
- A traffic management plan will be set up prior to any works commencing.
- A road opening license will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- Excavation permit will be completed and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A 13 tonne rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks document, *Specification for the Installation of Ducts and Structures for Underground Power Cables and Communications Cables.*
- The 33 kV and 38 kV trench material build-up is designed to the *Functional Specification for the Installation of Ducts and Ancillary Structures for 38kV Underground Power Cables and Associated Communications Cables for Contestable Projects,* No. 18150. The

20 kV trench material build-up is designed to comply with the *Functional Specification for the Installation of Ducts and Ancillary Structures for 20kV Underground Power Cables and Associated Communications Cables for Contestable Projects*, No.18152.

- Where rock is encountered and requires removal, it will be done so using a hydraulic rock breaker. Blasting will not be used as a means of rock extraction on the grid connection works.
- All excavated material not used for backfilling will be removed to the on-site peat repositories, or to an approved landfill, or if suitable, stockpiled and reused where appropriate.
- All excavated material not used for backfilling will be removed from site using trucks.
- The trench depth is specified at 1220 mm and trench support will not be required, however where depths exceed 1250 mm trench support will be installed, or the trench sides will be benched or battered back where appropriate.
- Any ingress of ground water will be removed from the trench using submersible pumps.
- A silt filtration system will be used to prevent contamination of any watercourse.
- Once the trench has been excavated a base layer of lean concrete mix with a tested compression strength of at least 15 Newton per square millimeter (N/mm^2), to cement bound material category 4 (CBM4) will be installed and compacted. All concrete will be offloaded directly from the concrete truck directly into the trench.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure the trefoil ducts together (at 3 m centres).
- Once the trefoil ducts have been installed couplers will be fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions the end of the trefoil ducts will be shimmed up off the bed of the trench to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected.
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The as-built location of the ducting will be surveyed using a total station/GPS.
- 15 N/mm^2 CBM4 concrete will be carefully installed so as not to displace the ducting to the underside of the communications duct and compacted as per approved detail.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the trefoil ducting.
- ESB red marker board will be fitted above the trefoil ducting.
- The Communication duct will be fitted and kept to one side of the trench ensuring that the minimum cover is achieved and 15 N/mm^2 CBM4 concrete will be placed to the specified cover and compacted, see Plate 2-1.
- ESB red marker board will be installed and the remainder of trench will be backfilled in two compacted layers with approved material (lean mix concrete/clause 804).
- Yellow marker tape will be installed as per approved detail specifications, 300 mm maximum below finished road/ground level.
- Topsoil will be permanently reinstated where required or clause 804 stone used to finish the trench on grass margins where appropriate to give a more trafficable surface.
- Road finish: Where the cable route runs within the carriageway of a road the excavated area will be resurfaced and finished to the requirements of the relevant Roads Authority.

The contractor will ensure that there are no open excavations at the end of each working day with all trenches backfilled accordingly. Any works areas which have to be secured with will be done so using mobile security fencing which will be erected to secure the works and prevent the general public enter the works area during the works as well as outside normal working hours. It is not proposed to use hoarding as a means of securing the works area.



Plate 2-1 View of concrete cover in cable trench

2.3.2.11.2 Existing Underground Services

Any underground services encountered along the route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300 mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations, an additional layer of marker tape will be installed between the communications layer and yellow top-level marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35 N/mm^2 concrete surrounding the ESB ducts where adjacent services are within 600 mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

2.3.2.11.3 Joint Bays

Joint bays are pre-cast concrete chambers where lengths of cable ducting will be connected. They will be located at various points along the ducting route approximately every 600-1200 m. Where possible joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction, the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed, they will be backfilled temporarily until cables are being installed.

2.3.2.11.4 Watercourse / Culvert Crossing – Grid Connection Cable Route

There are a total of 5 no. watercourse crossings on the grid connection cable route, the rest of the crossings on the proposed cable route are classified as minor culverts. Construction methodologies have been proposed to eliminate the need for instream works.

A list of the stream crossings along the grid connection route and the proposed crossing method at each location is provided in Table 2-1 below.

2.3.2.11.5 Piped Culvert Crossings over Culvert– Option 1

Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where sufficient cover exists above the culvert, the trench will be excavated above the culvert and the ducts will be installed in the trefoil arrangement passing over the sealed pipe where no contact will be made with the watercourse. This method of duct installation is further detailed in Drawing no 05801-DR-119 of the Planning Application Drawings.

2.3.2.11.6 Piped Culvert Crossings under Culvert – Option 2

Where the culvert consists of a socketed concrete or sealed plastic pipe where sufficient cover over the culvert does not exist to accommodate the cable trench, a trench will then be excavated beneath the culvert and cable ducts will be installed in a flatbed arrangement under the sealed pipe.

If these duct installation methods cannot be achieved or utilised, the ducts will be installed by alternative means as set out in the following sections. This method of duct installation is further detailed Drawing no 05801-DR-116 of the Planning Application Drawings.

2.3.2.11.7 Flatbed Formation over Culverts – Option 3

Where cable ducts are to be installed over an existing culvert/bridge where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert or the depth that can be achieved in the deck of a bridge structure. The ducts will be laid in this trench in a flatbed formation over the existing culvert/bridge and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification.

After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench.

Where a bridge or culvert has insufficient deck cover to fully accommodate the required ducts, the ducts can be laid in a flatbed formation partially within the existing road make up. Where this option is to be employed, the ducts will also be encased in steel with a concrete surround as per Eirgrid and/or ESB Networks specifications. In order to achieve cover over these ducts and restore the carriageway of the road, it may be necessary to locally raise the pavement level to fully cover the ducts. The increase road level will be achieved by overlaying the existing pavement with a new wearing course as required. Any addition of a new pavement will be tied back into the existing road pavement at grade. After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This method of duct installation is further detailed in Drawing no 05801-DR-117 of the Planning Application Drawings.

The flatbed formation methodology will also be used at bridge structures where there is an existing footpath. The cables will be installed in the same flatbed arrangement where the existing footpath will be excavated to allow for the installation of the cables. The footpath will be reinstated after cable ducts have been installed. Where there is no existing footpath, it is proposed to install a footpath to encase the cable ducts after they have been laid in the flatbed formation.

2.3.2.11.8 Horizontal Directional Drilling – Option 4

In the event that none of the above methods are appropriate, directional drilling will be utilised.

The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, will be utilised for the horizontal directional drilling at watercourse/culvert crossings listed below. The launch and reception pits will be approximately 2m wide, 3m long and 1 m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the

operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ (environmentally friendly product (not toxic to aquatic organisms)) and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse effects arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved licensed waste facility.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Drawing no 05801-DR-130 of the Planning Application Drawings.

Table 2-1 Grid Connection Stream Crossing Methodology

Crossing no.	Type and size	Cover from road level to top of culvert/bridge	Maximum depth of trench from road level under watercourse	Description	Watercourse Crossing Option	Extent of In-stream Works
1	1500mm high stone singe arch bridge	200mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
2	1500mm high stone arch bridge	0 mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of	Option 4	None. No in-stream works required.

				directional drilling which will ensure that no contact will be made with the watercourse during the works.		
3	500mm internal Ø concrete pipe	<200mm	n/a	Due to the lack of cover over the existing pipe, the cable will be installed under the existing pipe. No contact will be made with the watercourse during the works.	Option 2	None. No in-stream works required.
4	1500mm high stone arch bridge	290mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
5	2000mm high stone arch bridge	350mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.

Prior to any works commencing a dilapidation survey will be conducted of the entire route, photographing and noting any existing damage or defects to structure or road surfaces. A copy of this survey will be submitted to Kerry County Council prior to works commencing.

Communication with the public, local residences and businesses along the route will be an important responsibility of the Project Supervisor. Keeping all affected parties up to date and informed both shortly prior and during the construction period at all times. Two to three weeks before any work commencing reasonable efforts will be made to inform all affected parties of the oncoming works.

Signage will be erected in the weeks prior to any works commencing along and on adjacent roads to the route notifying the public of the forthcoming construction. Contact details for the contractor and details of license will also be posted along the cable route during construction.

Every effort will be made to minimise the impact of the above works on local residences and traffic. Consideration will also be given to the agricultural community and works will be organised and sequenced so as not to inconvenience any such activities. Additional construction health and safety measures include the following:

- All personnel will be inducted and made familiar with the method statements, risk assessments and traffic management plans involved.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate Construction Skills Certification Scheme (CSCS) training.
- All personnel on-site will be required to have a current Solas Safe Pass training card.
- Fire extinguishers and first aid supplies will be available in the work area.
- The roadway will be maintained in a clean condition at all times.
- Helmets, high visibility clothing, and safety footwear will be worn at all times.
- A competent foreman will be on site at all times.
- Excavations are back filled at the end of each working day.
- The trench will not be over-crowded.
- Unauthorised access will be monitored and prevented.
- Pipe work will be lifted into position manually.
- Hand dig will be used to expose any services detected during the survey.

2.3.2.12 Watercourse / Culvert Crossing on the Wind Farm Site

There will be a total of 20 no. culverts within the wind farm site. There will be 17 new water-crossings constructed and three existing water-crossing which will be upgraded. Two of the new water-crossings will cross natural watercourses and the remaining new water-crossings will cross man-made agricultural drains. The locations of all the water-crossing points are shown in Figure 2-3.

The existing water-crossing will be upgraded by extending the water-crossing infrastructure that is already in place. The length of extensions to existing water-crossings will be kept as short as is practically possible so as to minimise any impact on the watercourse channel.

The 11 new water-crossing points have been assessed in terms of ecological value, watercourse type and channel width. Based on the findings of these assessments, one of three proposed culvert types have been chosen for the construction or upgrade of the water-crossing at each point. The three types of water-crossing are as follows:

Watercourse Crossing Type 1

At a proposed new water-crossing point, where the channel width is a minimum of one metre, a pre-cast, three sided, 'bottomless' box culvert. This type of culvert minimises the impact on the watercourse

channel by leaving the bed of the channel unaltered which will maintain its ecological integrity. Depending on the width of the channel, the three-sided, 'bottomless' box culverts, of a standard size, can be used in series if required.

Watercourse Crossing Type 2

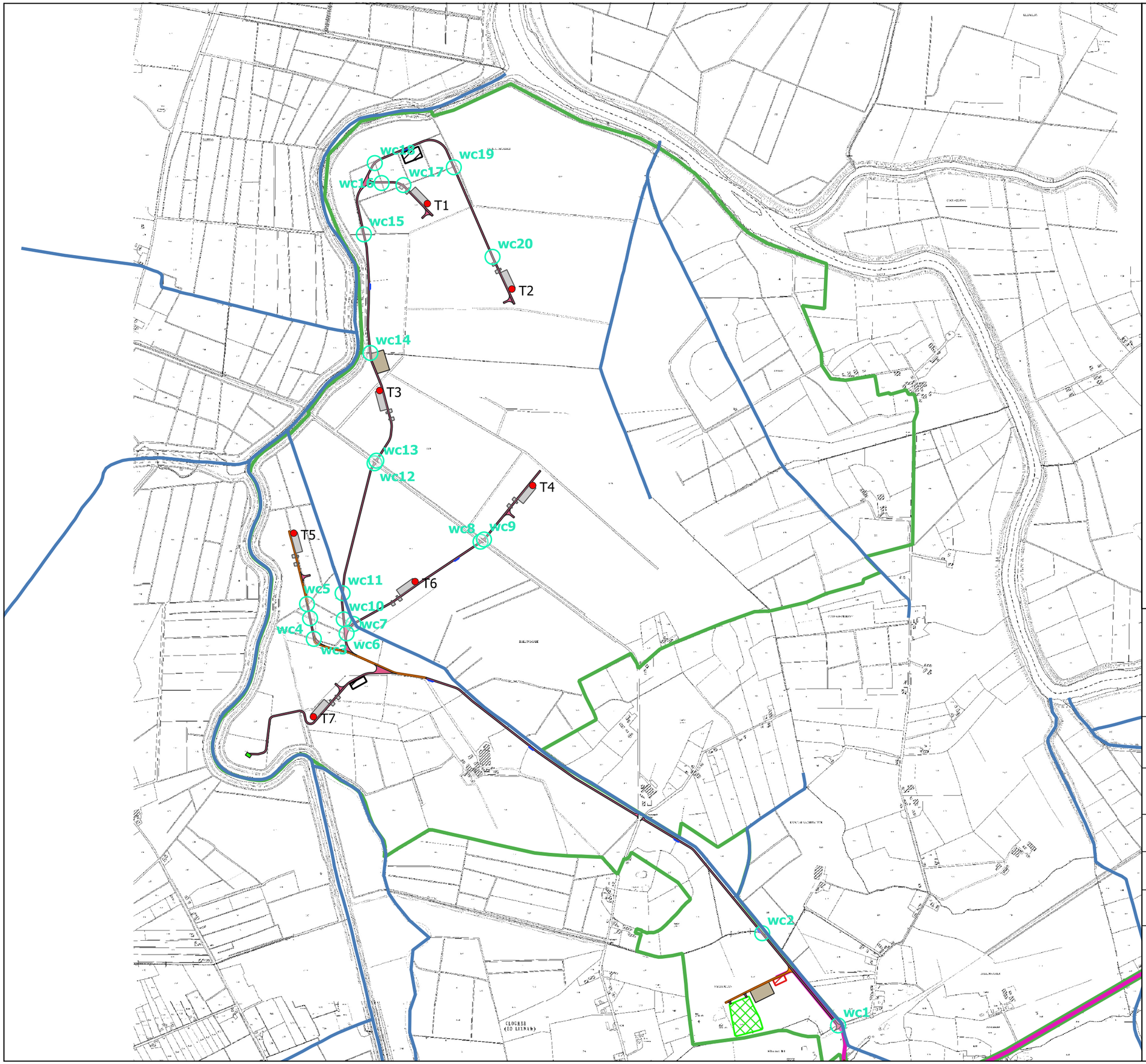
At a proposed new water-crossing point, where the channel width is less than one metre, a piped culvert will be used to construct the water-crossing. The culvert will be installed using the guidelines set out in the IFI's Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters so as to minimise impacts on the watercourse channel.

Watercourse Crossing Type 3

The existing water-crossings are all culverted by pipe culverts. Where upgrades and widening of the existing roads are taking place, these culverts will be lengthened using the same type of pipe culvert that is already in place. All three watercourse crossing types are illustrated in Appendix 4-3 of the EIAR.

Table 2-2, below, lists all of the on-site water-crossing points, as per Figure 2-3. The table outlines the location of the water-crossing points, whether it is an existing or new water-crossing, the status of the watercourse at each point, the width of the watercourse channel at each point, the type of culvert to be used and proposed action at each water-crossing point.

Where any new culverts of existing watercourses are proposed, they will be the subject of consent applications to the Office of Public Works under Section 50 of the Arterial Drainage Act, 1945.



Map Legend

- EIAR Study Area Boundary
- Water Course crossings
- Streams
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

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Drawing Title

Proposed Water Crossing Locations

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
TB	MW
Project No.	**Drawing No.**
200512	Figure 2.3
Scale 1:15000	**Date** 2021.10.13

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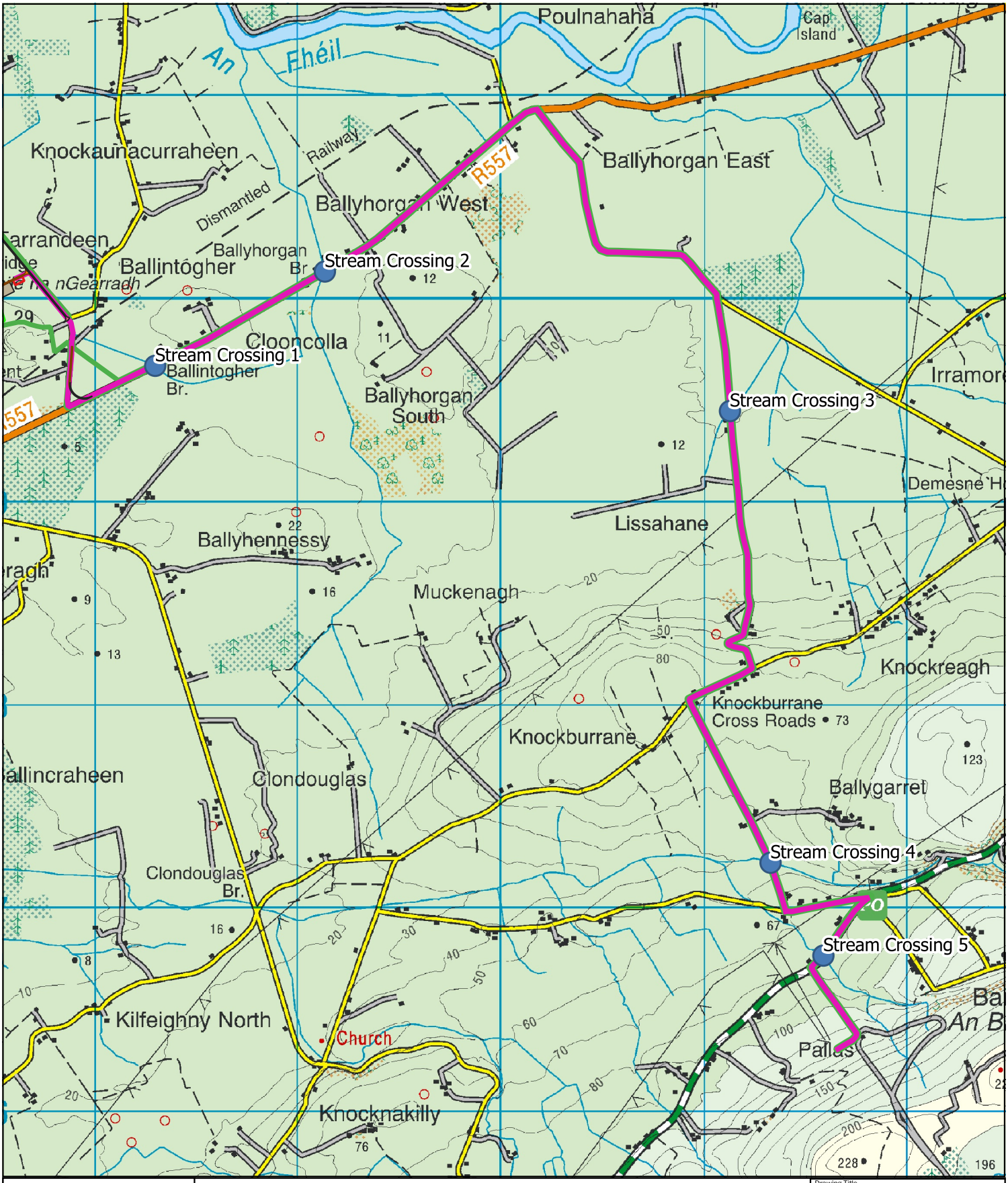

Map Legend

- EIAR Study Area
- Proposed 38kV Grid Connection
- Proposed Stream Crossings
- Proposed Substation

N

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Drawing Title	Grid Connection Stream Crossings
Project Title	Ballynagare Wind Farm
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 2.4
Scale: 1:25000	Date: 30.09.21

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Table 2-2 On-site Watercourse Crossing Locations

Water Course ID	Easting	Northing	Existing/ Proposed New	Stream / Drain	Channel Width (m)	Culvert Type	Proposed Action
WC1	488829	631604	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing
WC2	490531	630328	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing
WC3	488707	631525	Existing	drain	0.5	Type 3	Extension to existing pipe culvert.
WC4	488692	631608	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing
WC5	488680	631666	Existing	drain	1.2	Type 3	Extension to existing pipe culvert.
WC6	488841	631547	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC7	488868	631585	Proposed New	stream	2.0	Type 1	Construct new watercrossing.
WC8	489385	631920	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC9	489400	631929	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC10	488829	631604	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing.
WC11	488824	631710	Proposed New	stream	2.0	Type 1	Construct new watercrossing.
WC12	488954	632239	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC13	488962	632249	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC14	488937	632687	Proposed New	drain	.75	Type 1 /2	Construct new watercrossing.
WC15	488911	633169	Existing	drain	1.0	Type 3	Extension to existing pipe culvert.
WC16	488983	633378	Proposed New	drain	1.5	Type 1 /2	Construct new watercrossing.
WC17	489072	633370	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing.
WC18	488955	633459	Proposed New	drain	1.5	Type 1 /2	Construct new watercrossing.
WC19	489277	633442	Proposed New	drain	1	Type 1/2	Construct new watercrossing.
WC20	489434	633078	Proposed New	drain	1	Type 1 /2	Construct new watercrossing.

2.3.2.13 Transport Route Accommodation Works

Turbine delivery route accommodation works are required at various locations as outlined in Section 14 of the EIAR. Required works along the transport route are minor and are all located within the

existing road corridor. The construction methodology of the turbine delivery accommodation works is outlined as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- Any excess excavated overburden will be removed from the works area to the on-site peat management areas or a licensed tip or, if suitable, stockpiled and reused for backfilling where appropriate.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation, if required.
- The competent stratum will be overlain with granular fill sourced from the on-site borrow pit or local quarries.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The temporary accommodation areas along the turbine delivery route will only be used by the turbine delivery/abnormal load vehicles and other vehicles associated with the delivery process.
- The temporary accommodation areas when not in use will be cordoned off from the public road, using bollards, where boundary walls, hedgerows or ditches have been removed.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular surface of the accommodation works location will remain in place. All kerbing, barriers and boundary fencing will be reinstated.

Leaving the granular fill and final surface running layer in place within the accommodation areas will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase). Should this be required the boundary treatments will again be temporarily removed and managed as set out above.

2.3.3 Decommissioning

The design life of the wind farm is 35 years after which time decommissioning will occur, unless planning permission is granted to extend the duration of operation. At the end of the design life of the wind farm, or if the operations at the wind farm cease for a period of greater than one year, the turbines, met mast and all their associated above ground components will be dismantled and removed from site. The turbine foundations will be covered with soil to facilitate re-vegetation. The management of waste materials arising from the decommissioning of the development is outlined in the Waste Management Plan (Section 3 below).

Site roadways could be used for purposes other than operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site roads in-situ for future use. If the roads are not required in the future, they could be removed. Underground cables will be removed, and the ducting left in place.

A full reinstatement plan will be submitted to Kerry County Council three months prior to decommissioning.

3. ENVIRONMENTAL MANAGEMENT

3.1 Introduction

This CEMP has been prepared and presented as a standalone document and includes all drainage measures required to construct the proposed wind farm development. The drainage proposals will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles set out here and will also be in full compliance with the planning consent and mitigation measures as presented in the EIAR, NIS, and all other relevant planning documents. The following sections give an overview of the drainage design, dust and noise control measures and a waste management plan for the site.

3.2 Protecting Water Quality

3.2.1 Environmental Management in the Construction Phase

Timing of civil works (road construction, excavation, rock-breaking, etc.) can significantly influence the potential impact upon the freshwater environment. Operations during wetter periods of the year pose a greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snow events. Traditionally, construction activity undertaken during the drier summer months would result in less erosion and siltation. Construction activities in the hydrological buffer zones shall be avoided during or immediately after a prolonged or intense rainfall event. Work will cease entirely near watercourses when it is evident that uncontrolled discharge is occurring. Given that this site has a largely established road network and existing watercourse crossing points, the impacts on watercourses are expected to be minimal.

3.2.2 Site Drainage Design

The site drainage features for this site have been outlined in Section 4.6 of the EIAR and are further developed in this section of the CEMP. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. No routes of any natural drainage features will be altered as new watercourse crossings are kept to a minimum to facilitate the proposed development. Turbine locations and associated roadways were originally selected to avoid natural watercourses and existing roads are to be used wherever possible. The proposed development has, where possible, been kept a minimum of 50 m from natural watercourses. Where there is infrastructure proposed within 50 metres of a natural watercourse, stringent drainage measures will be put in place to ensure the protection of the water quality of the natural watercourse. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. Buffer zones around the existing natural drainage features have informed the layout of the proposed development.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

3.2.3 Legislation and Best Practice Guidance

The drainage design has been prepared based on experience of the project team of other wind farm developments in peat-dominated environments, and a number of best practice guidance documents.

There is no specific guidance document that deals with drainage management and water quality controls for wind farm developments. However, a selection of good practice approaches have been adopted in preparation of this CEMP, and these are taken from the various best practice guidance documents listed below. These relate to infrastructure and operational works on forested sites, forest road design, water quality controls for linear projects, forestry road drainage and management of geotechnical risks. To achieve best practice in terms of water protection through construction management all drainage management is prepared in accordance with guidance contained in the following documents:

- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Department of Environment, Heritage and Local Government (2006): Wind Energy Development Guidelines for Planning Authorities;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016);
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- Scottish Natural Heritage (2010): Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) (2006): Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (CIRIA C532, 2006).
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

3.2.4 Site and Drainage Management

The proposed site drainage features for this site are outlined in Section 4.6 of the EIAR. As this CEMP is a working document and is presented as an Appendix to the EIAR, the detailed drainage measures are not included in this document. When the final CEMP report is prepared and presented as a standalone document, all drainage measures will be included in that document. The drainage proposals will be developed further prior to the commencement of construction. The following sections give an

outline of drainage management arrangements in terms of pre-construction, construction and operational phases of the Proposed Development.

3.2.4.1 Pre-Construction Drainage

There is an existing drainage network across the site with runoff drains relatively freely to local watercourses and streams. This existing drainage system will continue to function as it is during the pre-construction phase. However, prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

Drainage and associated pollution control measures will be implemented onsite before the main construction works commence. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.

3.2.4.2 Construction Phase Drainage

The Project Hydrologist/Design Engineer will complete a site drainage plan before construction commences and will attend the site to set out and assist with micro siting of proposed drainage controls as outlined in Section 4.6 of the EIAR. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site. Drainage infrastructure will include:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/roadside drains will be maintained to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment and channel it to stilling ponds for sediment settling;
- Check dams will be maintained at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period.
- A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.

Best practice and practical experience on other similar projects suggests that in addition to the drainage plans that are included in the EIAR, there are additional site-based decisions and plans that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. The mechanisms for interaction between these are outlined within Section 4 of this CEMP.

In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined in Section 6 below and to ensure protection of all watercourses.

3.2.4.3 Operational Phase Drainage

The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described above and in Section 4.6 of the EIAR.

The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.

3.2.4.4 Preparative Site Drainage Management

The materials and equipment necessary to implement the drainage measures outlined above will be brought on-site in advance of any works commencing.

An adequate quantity of straw bales, clean stone, terram, wooden stakes, etc. will be kept on site at all times to implement the drainage mitigation measures as necessary. The drainage measures outlined below will be installed prior to, or at the same time as the works they are intended to drain.

3.2.4.5 Pre-emptive Site Drainage Management

The works programme for the groundworks element of the construction phase will take account of weather forecasts and predicted rainfall in particular. The site Construction Manager/Site Supervisor is responsible for making the decision to postpone or abandon works. Large excavations, large movements of overburden or large-scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

3.2.4.6 Reactive Site Drainage Management

The final drainage design prepared for the site has provided for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the Environmental Clerk of Works (ECoW) on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to situation on the ground as a particular time.

In the event that works are giving rise to siltation of watercourses, the ECoW or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

3.2.4.7 Rainfall Forecasting and Monitoring

Accurate forecasting and monitoring of rainfall is critical to the successful pre-emptive and reactive site drainage management as outlined in the subsections above.

Rainfall forecasts will be obtained for the nearest forecast reference point available via the www.yr.no weather forecasting website.

Construction personnel will be required to check the forecasted rainfall for the days ahead and plan for or suspend planned works accordingly. The forecasted rainfall should be recorded for reference and comparison with the rainfall levels to be recorded on-site.

Actual rainfall will be monitored on site, ideally via an automated rain gauge with regular recording intervals recommended by the Project Hydrologist and a means of alerting the construction personnel of rainfall trigger levels. The recorded rainfall data should be available on site at all times for review by the ECoW, Project Hydrologist or any regulatory authorities. The appointed contractor will be required to outline their proposed means of recording rainfall on site to the satisfaction of the ECoW and the Project Hydrologist prior to commencement of works.

3.3 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded and backfilled with the appropriate materials before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation and in the case of the proposed development, would be transported to one of the on-site borrow pits or used for landscaping and reinstatements of other areas elsewhere on site. Silt bags will be used where small to medium volumes of water need to be pumped from excavations.

On steeper slopes, silt fences, as detailed in Section 4.6 of the EIAR will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

3.4 Refuelling, Fuel and Hazardous Materials Storage

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling should occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site and will be towed around the site by a 4x4 vehicle to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the dumpers, excavators, etc. that will be used during construction. The 4x4 vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction. The

bunded area will be roofed to prevent the ingress of rainwater and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical substation will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used should be regularly inspected for leaks and fitness for purpose; and, an emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan.
- Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.

The emergency response plan for the construction phase has been provided with this CEMP (Section 5) which sets out the procedure for dealing with accidental spillages will be maintained throughout the construction phase of the Proposed Development.

3.5 Cement Based Products Control Measures

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 3-1 below. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is taken off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

The 50 m wide river buffer zone and 10 m existing artificial drainage buffer will be emplaced for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert construction and access road construrction. The buffer zone will:

- Prevent any cement-based products accidentally entrained in the construction phase drainage system entering directly into watercourses, achieved in part by ending drain discharge outside the 50 m buffer zone and allowing percolation across the vegetation of the buffer zone;
- Provide a buffer against accidental direct pollution of surface waters by any pollutants, or by pollutants entrained in surface water run-off.




Plate 3-1 Typical concrete wash out areas

3.6 Peat Stability Management

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

3.6.1 General Recommendations for Good Construction Practice

The peat stability assessment carried out at the site indicates that there is insignificant risk of peat failure, although drainage mitigation measures would be required to prevent the build-up of water in the peat and reduce the risk of failure (GDG, 2021, EIAR Appendix 8-1).

The following issues incorporated into the construction phase of the project will assist in the management of the risks for this site (GDG, 2021, EIAR Appendix 8-1).

- Appointment of experienced and competent contractors;
- The site should be supervised by experienced and qualified personnel;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report readings from peat stability monitoring systems;
- Revise and amend the Geotechnical Risk Register as construction progresses.
- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- All excavation shall be suitably supported to prevent collapse and development of tension cracks.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions.

- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by the contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc.).

3.6.1.1 Peat and Spoil Usage in Restoration of Borrow Pit

Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pit. All temporary storage areas will be upslope of founded roads/hardstands and will be inspected by a suitably qualified person before material is stored in the area.

Once the required volume of rock has been extracted from the borrow pit areas, it is intended to reinstate these areas with any surplus peat and overburden excavated from the works areas of the Proposed Development.

The general construction methodology for the construction of the borrow pits, as presented in the Peat & Spoil Management Plan in Appendix 8-1 of the EIAR, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

As rock is being extracted from the borrow pit, upstands of rock will be left in place, depending on the type of rock, to act as intermediate retaining buttresses. Where this is not achievable, stone buttresses will be constructed within the borrow pit. The upstands or buttresses will form individual restoration areas within the borrow pit which will be filled once the required volume of rock has been extracted from each individual area. The buttresses will be wide enough to allow construction traffic access for the tipping of peat and spoil into the individual cells.

A temporary access track will be placed around the perimeter of the borrow pit area to allow for the tipping of material over the edge of the borrow pit area. The placement of peat and spoil within the borrow pits will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

The following particular recommendations/best practice guidelines for the placement of peat & in borrow pits should be considered and taken into account during construction.

- The borrow pits will be enclosed depressions and drainage from these areas will be managed effectively using temporary pumping arrangements and settlement ponds.
- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds (settlement ponds) may be required at the lower side/outfall location of the borrow pits.
- The settlement ponds at the borrow pits will be designed to allow 24hr retention.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pits may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

3.7 Dust Control

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e. soil, sand, peat, etc. and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures to control dust include:

- Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.
- All plant and materials vehicles shall be stored in dedicated areas (on-site).
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.
- The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-2). The CEMP includes dust suppression measures.

3.8 Noise Control

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the site. Proposed measures to control noise include:

- Diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts;
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All construction plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations;
- Regular maintenance of plant will be carried out in order to minimise noise emissions. Particular attention will be paid to the lubrication of bearings and the integrity of silencers;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works;
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers;
- Machines, which are used intermittently, will be shut down during those periods when they are not in use;
- Training will be provided by the ECoW to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation; and,
- Local areas of the haul route will be condition monitored and maintained if necessary.

3.9 Invasive Species Management

A baseline invasive species survey will be carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) by a suitably qualified ecologist. If the presence of such species is found at or adjacent to the site, particularly in areas where its excavation may be required, an invasive species management plan will be prepared for the site to prevent the introduction or spread of any invasive species within the footprint of the works. An invasive species management plan, if required, will set out best practice control methods as summarised in the following sections.

3.9.1 Good Practice on Site Management

Careful preparation of the site and planning of the works is crucial for the successful treatment of invasive species. The below list of guidelines, which is not exhaustive, shall be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Should any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate against the risk.

3.9.2 Establishing Good Site Hygiene

The following measures are proposed to establish good site hygiene to ensure the control of any potential spread of invasive species during construction works:

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected.

- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- An ECoW/suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

Plant and equipment which is operated within an area for the management of materials in contaminated areas should be decontaminated prior to relocating to a different works area. The decontamination procedures should take account of the following:

- Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it.
- Decontamination will only occur within designated wash-down areas.
- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

3.10 Waste Management

This section of the CEMP provides a Waste Management Plan (WMP) which outlines the best practice procedures during the excavation and construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage. Disposal of waste will be seen as a last resort.

3.10.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Department of the Environment provides a document entitled, *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*. It is important to emphasise that no demolition will take place at this site however, this document was referred to throughout the process of completing this WMP.

3.10.2 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing waste in the following order:

Prevention and Minimisation

The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste

Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste

There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

3.10.3 Construction Phase Waste Management Plan

3.10.3.1 Description of the Works

The proposed development will involve the construction of 10 turbines, associated new site roads and upgrade of some existing roads, a substation and control building and an anemometry mast.

The proposed turbines will be manufactured off site and delivered to site where on-site assembly will occur.

The turbine and anemometry mast foundations will consist of stone excavated from the onsite borrow pit and a concrete base which will contain reinforcing steel. These concrete foundations will be shuttered with steel formwork specifically designed for the works and re-usable off site on similar projects.

The substation and control buildings will be constructed on a concrete foundation with the buildings constructed with concrete masonry blocks with a timber roof structure and roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The site roads will be constructed with rock won from the onsite borrow pit.

The waste types arising from the construction phase of the proposed development are outlined in Table 3-2 below.

Table 3-1 Expected Waste Types Arising during Construction Phase

Materials Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, rock, blocks	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	PVC frames, electrical fittings	17 02 03
Plastic packaging	Packaging with new materials	15 01 02
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03

Hazardous wastes that may occur on site during the construction phase of the proposed development may include oil, diesel fuel, chemicals, paints, preservatives etc. All hazardous wastes will be stored in bunded containers/areas before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes to ensure that contamination does not occur.

3.10.3.2 Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

- Ordering of materials should be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

3.10.3.3 Waste Arising from Construction Activities

All waste generated on site that will be contained in waste skips at a waste storage area on site. This waste storage area will be kept relatively tidy with the various waste skip clearly labelled to indicate the allowable material to be disposed of therein.

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation. Therefore, all wastes streams generated on site will be deposited into a single skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited in the on-site skip and subsequently transferred to the MRF.

It is not envisaged that there will be any waste material arising from the materials used to construct the road as only the quantity of stone necessary will be excavated from the borrow pit on an 'as needed' basis.

Site personnel will be instructed at induction that no under no circumstances can waste be brought to site for disposal in the on-site waste skip. It must also be made clear that the burning of waste material on site is forbidden.

3.10.3.4 Waste Arising from Decommissioning

The lengthy time frame between the completion of the construction phase and decommissioning will result in the only materials remaining on site at that time are likely to be turbines and associated cabling and crushed stone used in construction of roads, hardstand, foundations etc.

The waste types arising from the decommissioning of the development are outlined in Table 3-3 below.

Table 3-2 Expected Waste Types Arising During Decommissioning

Materials Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert Materials	Crushed stone	17 05 04

3.10.4 Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Concrete can be reused as aggregate for roads cable trench backfilling material.
- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Excavated peat will be reused for reinstatement of the areas around turbine foundations and adjacent to site roads.

3.10.5 Recycling

If a certain type of construction material cannot be reused on site, then recycling is the most suitable option. The opportunity for recycling on site will be restricted to the associated packaging from the wind turbines.

All waste that is produced during the construction phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The low volume of such material that is anticipated to be generated at the proposed development is the justification for adopting this method of waste management.

3.10.6 Implementation

3.10.6.1 Roles and Responsibilities for Waste Management

Prior to the commencement of the proposed development a member of the on-site construction management staff will be assigned the role of Construction Waste Manager. The Construction Waste Manager will be in charge of the implementation of the objectives of the WMP, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the proposed development adheres to the WMP.

3.10.6.2 Training

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the WMP. All employees working on site during the construction phases of the project will be trained in materials management and thereby, should be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery; and,
- Identify and liaise with waste contractors and waste facility operators.

3.10.6.3 Record Keeping

The WMP will provide systems that will enable all arising, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arising against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site of the proposed development. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and EWC Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material

- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Weight of Material
- Site Address of Destination Facility

3.10.6.4 Waste Management Plan Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy should always be employed when designing the plan to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

This preliminary WMP has been prepared to outline the main objectives that are to be adhered to for the preparation of a more detailed WMP to be completed after the planning phase of the proposed development.

4. ENVIRONMENTAL MANAGEMENT IMPLEMENTATION

4.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or ECoW are the project focal point relating to construction-related environmental issues.

In general, the ECoW will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The ECoW will act as the point of contact on environmental matters and liaising with Kerry County Council and other statutory bodies as required.

The ECoW will report directly to the Site Supervisor/Wind Farm Construction Manager. A Project Ecologist, Project Hydrologist and Project Geotechnical Engineer will visit the site regularly and report to the Site ECoW. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is provided in Figure 4-1 below.

Any requirement of the granted permission, for the works to be supervised by an engineer with professional indemnity insurance, who upon completion of the works, including site stability, shall certify the said works, will be adhered to. Such an engineer will be appointed to oversee and supervise the construction phase of the project.

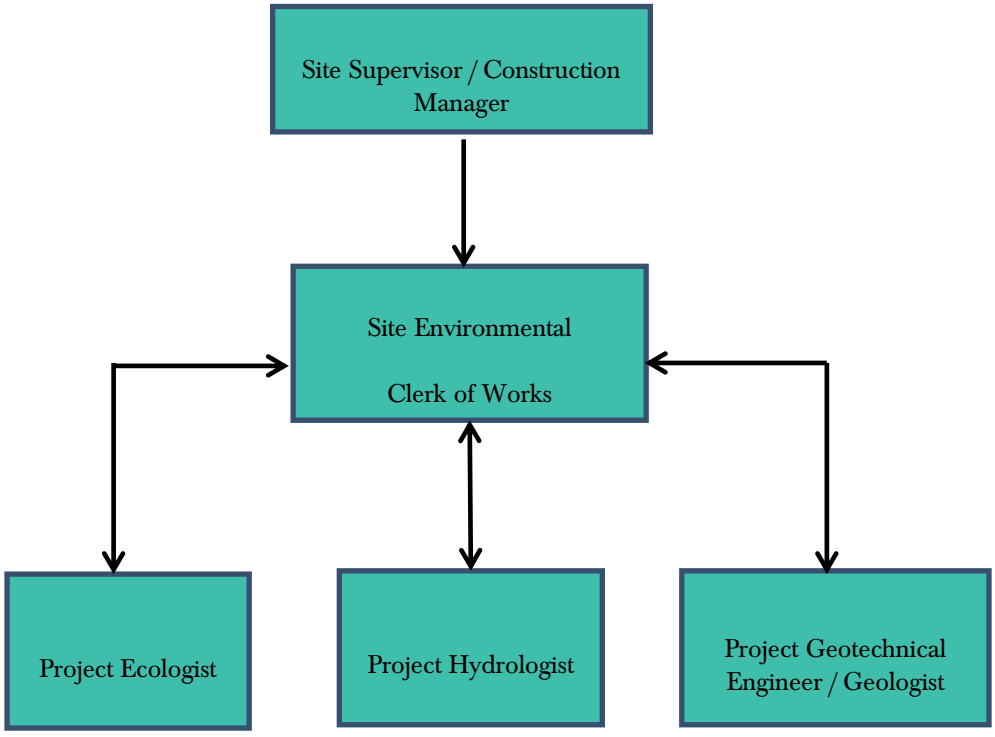


Figure 4-1 Construction Phase Environmental Management Roles

4.1.1 Wind Farm Construction Manager

The Construction Manager will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;
- Take advice from the Site Engineer and ECoW legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,
- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

4.1.1.1 Site Engineer

The main contractor will engage a qualified site engineer who will have input into the environmental management of the site. The proposed engineer has extensive experience in the construction of wind farms in Ireland and has fulfilled an environmental management role as part of those projects.

The Site Engineer will report to the Construction Manager and liaise with the ECoW. The responsibilities and duties of the Site Engineer will include the following:

- Undertake inspections, including visual inspections at watercourse crossings, and reviews to ensure the works are carried out in compliance with the CEMP;
- Advise site management/contractor/sub-contractors regarding:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;

4.1.2 Site Environmental Clerk of Works

The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Site ECoW, and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.

The ECoW will report to the Construction Manager. The responsibilities and duties of the ECoW will include the following:

- Preparation of the CEMP and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required environmental monitoring;

- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Changes in legislation and legal requirements affecting the environment;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure proper mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist and Project Geotechnical Engineer to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;
- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,
- Identify environmental training requirements and arrange relevant training for all levels of site-based staff/workers.

The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.

4.1.3 Project Ecologist

The Project Ecologist will report to the ECoW and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the wind farm. The Project Ecologist will not be full time on site but will visit the site at least once a month during construction.

The responsibilities and duties of the Project Ecologist will include the following:

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with ECoW, oversee and provide advice on all relevant ecology mitigation measures set out in the planning documents for the proposed development;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority; and,
- Complete a pre-commencement invasive species survey at the site.

4.1.4 Project Hydrologist

The Project Hydrologist will report to the ECoW and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction. A qualified hydrologist from Malachy Walsh & Partners with experience working on wind farm projects will perform the role of Project Hydrologist.

The responsibilities and duties of the Project Hydrologist will include the following:

- Assist in compiling a detailed drainage design before construction commences and attend the site to set out and assist with micro siting of drainage controls. This will be completed over several site visits at the start of the construction phase;
- Review and input to the final construction phase CEMP in respect of drainage and water quality management;
- Following the initial stage of drainage construction regular site visits will be required, at least once a month, to complete hydrological and water quality audits and reviews and report any issues noted to the Site Supervisor/Construction Manager; and,
- Complete ongoing inspection and monitoring of the development, particularly in areas of drainage control, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR and all relevant planning documents.

4.1.5 Project Geotechnical Engineer / Geologist

The Geotechnical Engineer or Project Geologist will report to the ECoW and is responsible for inspection and review of geotechnical aspects associated with construction of the wind farm. The Geotechnical Engineer will not be full time on site but will visit site at least once a month during construction phase.

The responsibilities and duties of the Geotechnical Engineer or Geologist will include the following:

- Visit site regularly, or at least once a month during the construction phase, to complete geotechnical audits and reviews and report any issues to the Site Supervisor/Construction Manager;
- Ensuring that identified hazards are listed in the Geotechnical Risk Register and that these are subject to ongoing monitoring;
- Set up and review the readings of the peat stability monitoring system and,
- Ongoing inspection and monitoring of the development, particularly in areas of peatland and at the borrow pit, and peat reinstatement areas, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR and all relevant planning documents.

4.2 Environmental Awareness and Training

4.2.1 Environmental Induction

The Environmental Induction will be integrated into the general site induction on a case by case basis for each member of staff employed on-site depending on their assigned roles and responsibilities on site. Where necessary, the Environmental Induction will as a minimum include:

- A copy of the Environmental Management Site Plans and discussion of the key environmental risks and constraints;
- An outline of the CEMP structure;

- A discussion of the applicable Works Method Statement;
- The roles and responsibilities of staff, including contractors, in relation to environmental management; and,
- An outline of the environmental Incident Management Procedure.

4.2.2 Toolbox Talks

Toolbox talks will be held by the ECoW/Construction Manager at the commencement of each day, or at the commencement of new activities. The aims of the toolbox talks are to identify the specific proposed work activities that are scheduled for that day. In addition, the necessary work method statements and sub plans would be identified and discussed prior to the commencement of the day's activities. The toolbox talks will include training and awareness on topics including:

- On-site Ecological Sensitivities
- Buffers to be upheld – watercourses, archaeology, ecology
- Sediment and Erosion Control
- Good site practice
- On-site Traffic Routes and Rules
- Keeping to tracks – vehicle rules
- Strictly adhering to the development footprint
- Fuel Storage
- Materials and waste procedures

Site meetings would be held on a regular basis involving all site personnel. The objectives of a site meeting is to discuss the coming weeks proposed activities and identify the relevant work method statements and sub-plans that will be relevant to that week's activities. Additionally, any non-compliance identified during the previous week would also be discussed with the aim to reduce the potential of the same non-compliance reoccurring.

5. EMERGENCY RESPONSE MEASURES

An Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

5.1 Emergency Response Procedure

The Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency. The site ERP includes details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP will require updating and submissions from the contractor and/ or the Project Supervisor Construction Stage (PSCS), and suppliers, as the project progresses. Where sub-contractors that are contracted on-site are governed by their own emergency response procedure, a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's ERP within this within this document.

This is a working document that requires updating throughout the various stages of the project.

5.1.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 6-1. In a situation where the Site Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command by the Construction Manager outlined in Figure 5-1. This will be updated throughout the various stages of the project.

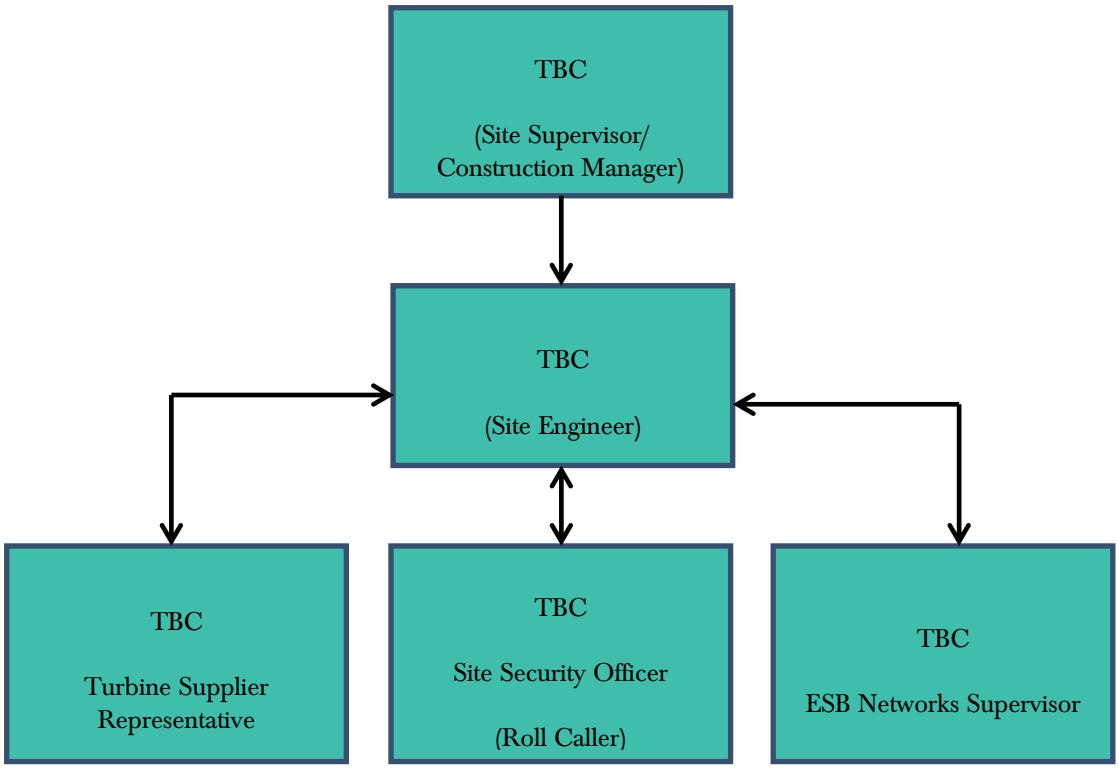


Figure 5-1 Emergency Response Procedure Chain of Command

5.1.2 Initial Steps

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 5-1 Hazards Associated with Potential Emergency Situations

Hazard	Emergency Situation
Construction vehicles: dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/ portable tools	Entanglement, amputation or electrical shock associated with portable tools.
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services.
Fire	Injury to employee through exposure to fire or smoke.
Falls from heights including falls from scaffold towers, scissor lifts, and ladders.	Injury to employee after a fall from a height.
Sickness	Illness unrelated to site activities of an employee e.g. heart attack, loss of consciousness, seizure.

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 5-1 the Site Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog horn that activates an emergency evacuation on the site. The Site Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare **and if there are no injured personnel at the scene that require assistance.** The Site Manager will be required to use his own discretion at that point. In the case of fire, the emergency evacuation of the site should proceed, without exception. The site evacuation procedure is outlined in Section 5.1.3.
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone if he is unable to do so. If delegating the task, ensure that they follow the procedures for contacting the emergency services as set out in Section 5.2.1.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks, the numbers for which are provided in Section 5.2.2.
- Contact the next of kin of any injured personnel where appropriate. The procedure for this is outlined in Section 5.2.3.

5.1.3 Site Evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or fog horn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Manager when all personnel have been accounted for. At this time, the Site Manager will decide the next course of action which be determined by the situation that exists at that time. The Site Manager will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills.

5.1.4 Excessive Peat Movement

Where there is excessive peat 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.

- All construction activities shall cease within the affected area.
- Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
- Re-commencement of limited construction activity shall only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.

5.1.5 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.

- On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- Where considered possible action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement 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.
- For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

5.1.6 Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the project. Oil/ fuel spillages are one of the main environmental risks that will exist on the site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident.

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The ECoW will notify the appropriate regulatory body such as Kerry County Council, National Parks and Wildlife Service (NPWS), Inland Fisheries Ireland (IFI), Department of Communications, Climate Action and Environment (DCCAE) and Department of Housing, Planning and Local Government (DHPLG) if deemed necessary.

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The ECoW must be immediately notified.
- If necessary, the ECoW will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site e.g. Special Protection Area (SPA) or Special Area of Conservation (SAC), the ECoW will liaise with the Project Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the ECoW will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the ECoW and the Main Contractor. These records will be made available to the relevant authorities if required.

The ECoW will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate.

5.2 Contacting the Emergency Services

5.2.1 Emergency Communications Procedure

In the event of requiring the assistance of the emergency services the following steps should be taken:

Stay calm. It is important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, is an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.

Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but do not get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for any reason you are disconnected, at least emergency crews will know where to go and how to call you back.

Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.

If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.

Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There is a good chance, however, that emergency services are already being sent while you are still on the line.

Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you do not understand.

Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.

Do not hang up the call until directed to do so by the call taker.

Due to the remoteness of the site it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.

5.2.2 Contact Details

A list of emergency contacts is presented in Table 5-2. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 5-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999 / 112
Hospital – Listowel Community Hospital	068 21022
Doctor - TBC	TBC
ESB Emergency Services	1850 372 999
Bord Gáis Emergency	1850 20 50 50
Gardaí –Listowel Garda Station	068 50820
Project Health and Safety Officer –TBC	TBC
Health and Safety Authority (HSA)	1890 289 389
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDP): TBC	TBC
Developer / Client – Stacks Mountain Windfarm Ltd.	TBC

5.2.3 Procedure for Personnel Tracking

All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative becoming in an emergency situation where serious injury has occurred and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

5.3 Induction Checklist

Table 5-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 5-3 Emergency Response Plan Items Applicable to the Site Induction Process

ERP Items to be included in Site Induction Status	Status
All personnel will be made aware of the evacuation procedure during site induction.	
Due to the remoteness of the site it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any	

ERP Items to be included in Site Induction Status	Status
such arrangement or requirement if applicable.	
All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

6. MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIAR and all other relevant documents submitted as part of the planning permission application issued to Kerry County Council and ABP.

This section of the Construction and Environmental Management Plan groups together all of the mitigation measures presented in the EIAR. The mitigation measures are presented in Table 6-1 below.

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits.

Table 6-1 Site Preparation and Mitigation Measures

Ref. No.	Reference Location	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase				
MM1	EIAR Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007. Information on the appointed permitted contractor and evidence of a maintenance contract will be submitted to the Planning Authority prior to any construction works taking place.		
MM2	EIAR Section 4	All site activities will be provided for in an Environmental Management Plan, prepared prior to the commencement of any operations onsite. The environmental management plan will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in the EIAR and will set out the monitoring and inspections procedures and frequencies.		
MM3	EIAR Section 4 CEMP Section 4	An ECoW will oversee the site works and implementation of the Environmental Management Plan and provide on-site advice on the mitigation measures as necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM4	EIAR Section 4	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.		
MM5	CEMP Section 3	The Project Hydrologist/Design Engineer will assist in preparing a site drainage plan before construction commences.		
MM6	CEMP Section 3	All materials and equipment necessary to implement the drainage mitigation measures will be brought on-site in advance of any works commencing. The drainage measures outlined in the EIAR will be installed prior to, or at the same time as the works they are intended to drain. An adequate amount of clean stone, silt fencing, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary.		

MM7	CEMP Section 3	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts and predicted rainfall in particular.		
MM8	CEMP Section 3	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.		
MM9	EIAR Section 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site Environmental Clerk of Works or the supervising hydrologist.		
MM10	EIAR Section 4 CEMP Section 3	Culverts will be installed at locations where streams or natural drainage channels cross the new access track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM11	EIAR Section 4 CEMP Section 3	All materials and equipment necessary to implement the drainage mitigation measures will be brought on-site in advance of any works commencing. The drainage measures outlined in the EIAR will be installed prior to, or at the same time as the works they are intended to drain. An adequate amount of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary.		
MM12	EIAR Section 4 CEMP Section 3	The works programme for the ground works part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		

MM13	EIAR Section 4 CEMP Section 3	The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.		
MM14	EIAR Section 4	All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at a minimum of 50 metres distance from natural watercourses, or directly into artificial drainage ditches but only after silt traps, check dams and/or stilling ponds have been added to these drainage ditches.		
MM15	EIAR Section 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Where sections of woody vegetation are removed for the purposes of the junction and road upgrades, these will be replaced with suitable hedge/tree species which are common in the local context		
MM16	EIAR Section 7	Works will commence outside the bird nesting season (1st of March to 31st of August inclusive).		
MM17	EIAR Section 6, 7	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Act.		
MM18	EIAR Section 6 CEMP Section 3	A pre-construction invasive species survey will be undertaken a part of the proposed project. This will provide updated data in advance of any construction given the intervention time period between the original survey work and any future grant of permission/ construction. Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere.		

MM19	EIAR Section 4 CEMP Section 9	The procedures for the implementation of the mitigation measures outlined in such an EMP and their effectiveness and completion is typically audited by way of an Environmental Management Plan Audit Report. The EMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation and any further mitigation measures proposed during the detailed design stage and allows them to be audited on a systematic and regular basis.		
MM20	EIAR Section 12	Two Bridges (CH8 and CH9) Poulboy Bridge and MacElligot's Bridge are adjacent to the proposed road which extends in a south-easterly direction to the proposed borrow pit and substation. No impacts to the bridges are anticipated.		
MM21	EIAR Section 12	▪ Pre-development testing (licensed by the National Monuments Service - NMS) in areas where peat depths allow a meaningful investigation. Testing should only be undertaken in areas where ground disturbance will take place as part of the development. For example, if roads are proposed to be floated, testing would not be required. Where peat depths become a limitation to testing, monitoring at the construction stage should be undertaken. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated. ▪ Licensed archaeological monitoring of the proposed roads, internal cable, passing bays and entrances during the construction phase of the development should be undertaken. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided, where relevant. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.		
Construction Phase				

Construction Management				
MM22	EIAR Section 4 CEMP Section 3	On-site refuelling will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm development. The 4x4 towing vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction when not in use.		
MM23	EIAR Section 4 CEMP Section 3	No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Only ready-mixed concrete will be used during the construction phase, with all ready-mixed concrete being delivered from local batching plants in sealed concrete delivery trucks.		
MM24	EIAR Section 4 CEMP Section 3	No washing out of any plant used in concrete transport or concreting operations will be carried out onsite. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be directed back to their batching plant for washout.		
MM25	EIAR Section 4	No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.		
MM26	EIAR Section 4	Clearly visible signs in prominent locations will be placed close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site		
MM27	EIAR Section 4	All concrete used in the construction of turbine bases will be poured directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be poured from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.		

MM28	EIAR Section 4	Main pours will be planned days or weeks in advance. Large pours will be avoided when prolonged periods of heavy rain are forecast.		
MM29	EIAR Section 4	Concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete.		
MM30	EIAR Section 4	Excavations will be sufficiently dewatered before concreting begins. Dewatering will continue while concrete sets.		
MM31	EIAR Section 4	Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain.		
MM32	EIAR Section 4	Surplus concrete after completion of a pour will be used elsewhere at suitable locations around the site where it is required.		
MM33	EIAR Section 4 CEMP Section 3	If necessary, water will be taken from settlement ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression.		
MM34	CEMP Section 3	All construction related traffic will have speed restrictions on un-surfaced roads to 20 kph.		
MM35	CEMP Section 3	The following additional mitigation measures will be adopted to reduce the generation of dust associated with Borrow Pit activities ○ Compact, grade and maintain internal haul roads. This will ensure that the level of surface dust is kept do a minimum particularly when periods of dry weather occur. ○ Use water sprays as a dust suppression measure during periods of dry weather. ○ All crushing and screening equipment should be used within its design capacity with regular maintenance checks carried out.		

		○ The height from which material drops should be minimised to reduce dust generation. This is most relevant where rock is being processed to ensure crushed material is not dropping from a height which will increase the volume of dust generation. ○ Maintain speed limits on haul roads and reduce during dry spells where dust volumes are likely to be higher. Drilling equipment should be fitted with dust extractors and collectors if blasting is used as an extraction method.		
MM36	EIAR Section 4	A temporary screening berm will be installed at the perimeter of the borrow pit. This will reduce any potential impact from dust generation associated with rock extraction.		
MM37	EIAR Section 4	A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.		
MM38	EIAR Section 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan		
MM39	CEMP Section 2	Any area where excavations are planned will be surveyed and all existing services will be identified prior to commencement of any works. Liaison will be held with the relevant sections of the Local Authority including all the relevant area engineers to ensure all services are identified. Excavation permits will be completed and all plant operators and general operatives will be inducted and informed as to the location of any services.		
Drainage Design and Management				
MM40	EIAR Section 9 CEMP Section 3	Where possible, a 50-metre buffer zone will be maintained around watercourses during the windfarm construction. With the exception of access roads, road crossings of streams and associated culvert construction, no development infrastructure, vehicle or plant movement, construction activity or stock-piling of construction materials or construction waste will take place within this zone, and no vegetation will be removed from within this zone. Many of the proposed access roads cross mapped drains/streams requiring control measures, which are outlined further on		

		in this section. These control measures will be implemented at the proposed watercourse and drain crossings and where the roads run parallel and in close proximity to drains.		
MM41	EIAR Section 4 CEMP Section 3	Swales will be used to intercept and collect run off from construction areas of the site during the construction phase, and channel it to settlement ponds for sediment attenuation.		
MM42	EIAR Section 4 CEMP Section 3	Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. It will then be directed to areas where it can be re-distributed over the ground as sheet flow.		
MM43	EIAR Section 4 CEMP Section 3	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place when the interceptor drains are backfilled at the end of the construction phase to limit linear flow in the backfilled drain. The check dams will be installed at regular intervals along interceptor drains to restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. The spacing and frequency of the check dams will be dependent on the gradient of the interceptor drain or swale in which they are being installed.		
MM44	EIAR Section 4	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site. They will also be emplaced at end of swales carrying discharge from settlement ponds. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be re-concentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. No drains will discharge directly to surface waters.		

MM45	EIAR Section 4	Vegetation filters, that is areas of existing vegetation, accepting drainage water issuing from level spreaders as sheet flow, will remove any suspended sediment from water channelled via interceptor drains or any remaining sediment in waters channelled via swales and settlement ponds.		
MM46	EIAR Section 4	Settlement ponds, placed either singly or a pair in series, will buffer volumes of run-off discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to water courses. Settlement ponds will be designed to retain the volume associated with a 1 in 50-year return period rainfall event. The embankment that forms the sloped sides of the settlement ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the settlement ponds area.		
MM47	EIAR Section 4 EIAR Section 6	A siltbuster or similar equivalent piece of equipment will be available if required to filter any water pumped out of excavation areas, prior to its discharge to settlement ponds or swales. This includes turbine base excavations and borrow bit excavations. This water is likely to have a high sediment load and will be directed via swales to settlement ponds after treatment in the unit.		
MM48	EIAR Section 4 CEMP Section 3	Culverts will be installed at locations where streams or natural drainage channels cross the new access track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM49	EIAR Section 4	Silt fences will be installed along the routes of existing watercourses or drainage ditches where site roads pass over the watercourses, immediately downstream of the construction area. Silt fences will be installed along a level contour, so water does not pond more than 400 mm at any point. The silt fence will be trenched at least 500 mm into the ground and will be stretched tight between the posts. The fences will not be allowed to sag or break away from the fence posts. During the near stream construction work double silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase.		

MM50	EIAR Section 8	Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods will be implemented		
MM51	EIAR Section 4 CEMP Section 3	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		
MM52	EIAR Section 4 CEMP Section 3	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.		
MM53	EIAR Section 4 CEMP Section 2,3	Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets or sealed with the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur where appropriate.		
MM54	EIAR Section 9	A constraints zone will be identified and implemented at each crossing location during construction. The purpose of the constraint zone is to: ○ Avoid physical damage to surface water channels; ○ Provide a buffer against hydraulic loading by additional surface water run-off; ○ Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;		

		○ Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and, ○ Avoid storage of construction plant materials used during construction and chemicals or waste associated with temporary on–site sanitary facilities.		
Peat, Subsoils and Bedrock				
MM55	CEMP Section 3	General recommendation for good construction practice to minimise the risk of construction activity causing potential peat instability are outlined in Section 3.6 of the CEMP.		
MM56	EIAR Section 4 CEMP Section 2	Peat removed from turbine locations will be transported to the designated peat reinstatement areas.		
MM57	EIAR Section 4	Any excess mounded peat in temporary storage for long periods will be digger-bucket sealed and covered with polyethylene sheets or reseeded at the earliest opportunity.		
MM58	EIAR Section 4	In order to minimise runoff during the construction phase, stripping of peat should not take place during excessively dry weather (to prevent dust generation) or extremely wet periods (to prevent increased silt rich runoff).		
MM59	EIAR Section 4	Bog mats and brash mats will be used where necessary to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.		
MM60	EIAR Section 8 CEMP Section 3	The following issues incorporated into the construction phase of the project will assist in the management of the risks for this site (FT, 2020): • Appointment of experienced and competent contractors; • The site should be supervised by experienced and qualified personnel; • Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement);		

		• Prevent undercutting of slopes and unsupported excavations; • Maintain a managed robust drainage system; • Prevent placement of loads/overburden on marginal ground; • Set up, maintain and report findings from monitoring systems; • Ensure construction method statements are followed or where agreed modified/ developed; and, • Revise and amend the Geotechnical Risk Register as construction progresses.		
Flora and Fauna				
MM61	EIAR Section 7	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Acts 1976-2021		
MM62	EIAR Section 7	Construction works along the c. 0.2km section of the proposed cable route within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA will be undertaken outside the bird breeding season (1st of March to the 31st of August inclusive)		
MM63	EIAR Section 7	If bird breeding activity of species of conservation concern are identified during the works, the nest sites will be located, and no works shall be undertaken within 500m buffer in line with industry best practise.		
MM64	EIAR Section 6	Hedgerow will be replanted along an internal farm trackway within the proposed development site which will be of a greater length than that which will be lost and will ensure that there are no long-term negative effects. The additional planting will result in a biodiversity net gain.		
MM65	EIAR Section 6	The following measures will be undertaken for the avoidance of disturbance/displacement and direct mortality will be implemented during the construction phase of the proposed development: • An exclusion zone around the sett will be maintained for the duration of the construction works. No works will be undertaken within 100m of the sett. • All of the above works will be undertaken or supervised by an appropriately qualified ecologist. To protect individual badgers during the construction phase of the proposed development, all open excavations on site will be covered when not in use and backfilled as soon as possible. Excavations		

		will also be covered at night and any deep excavations left open will have appropriate egress ramps in place to allow mammals to safely exit excavations should they fall in.		
MM66	EIAR Appendix 6-2	Noise Disturbance During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (SI 359/1996). Lighting Disturbance Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. This will be achieved using lighting accessories, such as hoods, cowls, louvers and shields, to direct the light to the intended area only.		
MM67	EIAR Appendix 6-2	Bat Buffers Felling of coniferous plantation will be conducted during the construction phase to facilitate the required bat buffers surrounding turbines located within or at the edge of conifer forestry habitats.		
MM68	EIAR Section 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. The removal of wetland vegetation and clearance/cutting of hedges and trees will be undertaken outside the breeding season (i.e. outside of the 1st of March and the 31st of August) including along the cable route.		
MM69	CEMP Section 3	Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere. Best practice measures in relation to invasive species are described below: › All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere. › Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally. › Stands of Rhododendron will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. › Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.		

		› Any material that is imported onto any site will be verified by a suitably qualified ecologist to be free from any invasive species listed on the 'Third Schedule' of Regulations 49 & 50 of Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). This will be carried out by searching for rhizomes and plant material. The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority. The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads (NRA 2010).		
Noise				
MM70	EIAR Section 11	Equipment will be sensitively located, away from sensitive properties, taking account of local topography and natural screening.		
MM71	EIAR Section 11	All construction work will be restricted to the specified working hours. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.		
MM72	EIAR Section 11	Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.		
MM73	EIAR Section 11	The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to adhere to the following noise abatement measures: ○ No plant used on site will be proposed to cause an on-going public nuisance due to noise. ○ The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. ○ All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. ○ Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. ○ Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.		

		○ Any plant, such as generators or pumps, which is required to operate near any sensitive receptors before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. ○ Residents will be notified in advance of all blasting schedules. During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 12.10 using methods outlined in BS 5228 "*Noise and Vibration Control on Construction and open sites*".		
MM74	EIAR Section 11	All construction operations shall comply with guidelines set out in British Standard documents *'BS 5338: 'Code of Practice for Noise Control on Construction and Demolition Sites'* and *'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'.*		
Air Quality and Dust				
MM75	EIAR Section 4 CEMP Section 3 EIAR Section 10	○ All plant and materials vehicles shall be stored in dedicated areas (on-site). ○ Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. ○ Turbines and construction materials will be transported to the site on specified haul routes only. ○ The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary. ○ The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary. ○		
MM76	EIAR Section 10	All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.		
MM77	EIAR Section 10	In periods of extended dry weather, dust suppression may be necessary along haul roads and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, water will be taken from settlement ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust.		

		Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.		
Traffic				
MM78	EIAR Section 14	A comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the Proposed Development. For delivery of abnormal sized loads - The following are the main points to note for these deliveries which will take place after peak evening traffic: o The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised. o The deliveries will be made in consultation with the relevant Authorities and An Garda Síochána. o It is estimated that 64 abnormal sized loads will be delivered to the site, comprising 22 convoys of 3, undertaken over 22 separate nights. o These nights will be spread out over an approximate period of 11 weeks and will be agreed in advance with the relevant authorities o In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 3 vehicles. o There will also be two escort vehicles provided by the haulage company for each convoy.		
MM79	EIAR Section 14	A detailed **Traffic Management Plan (TMP)**, will be provided specifying details relating to traffic management and included in the CEMP prior to the commencement of the construction phase of the proposed development. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following:		

		• **Traffic Management Coordinator** – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management. • **Delivery Programme** – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site. • **Information to locals** – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided. • **A Pre and Post Construction Condition Survey** – Where required by the local authority, a pre-condition survey of roads associated with the proposed development can be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers. • **Liaison with the relevant local authority** - Liaison with the County Council and An Garda Síochána, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and “prior to commencement” status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for		

		the Project Developer/Contractor Site Manager as well as the Site Environmental Manager. › **Implementation of temporary alterations to road network at critical junctions** – at locations highlighted in section 14.1.8. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable. › **Identification of delivery routes** – These routes will be agreed with the County Council and adhered to by all contractors. › **Delivery times of large turbine components** - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage. › **Travel plan for construction workers** – While the assessment above has assumed the worst case in that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking. › **Additional measures** - Various additional measures will be put in place where appropriate in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is contained in Appendix 4-2 › **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.		
Cultural Heritage				
MM80	EIAR Section 12	A buffer zone of a minimum of 10m should be established between KE009-088– Road – unclassified togher and the hardstand for T1. No ground works or storage of peat/topsoil should take place within the buffer zone. The buffer zone should be defined by durable fencing for the duration of the construction phase of the project with 'Keep Out' signage placed on same		
Operational Phase				

MM81	EIAR Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007. Information on the appointed permitted contractor and evidence of a maintenance contract having been submitted to the Planning Authority prior to any construction works taking place.		
MM82	EIAR Section 4, 8, 9 NIS Section 5 CEMP Section 3, 5	The electrical substation will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;		
MM83	EIAR Section 5	An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM84	EIAR Chapter 6	To reduce the value of the habitat for bat species in the areas surrounding the turbines, a buffer of at least 50m between the tip of the blade and any trees or other tall vegetation that could provide high quality foraging habitat for bat species will be implemented.		
MM85	EIAR Chapter 5	Where daily or annual shadow flicker exceedances are experienced at buildings, a site visit will be undertaken to determine the level of occurrence, existing screening and window orientation. The shadow flicker prediction data will be used to select dates on which a shadow flicker event could be observed at one or multiple affected properties and the following process will be adhered to. In the event of shadow flicker being noted as occurring the details of the duration (times) of the occurrence will be recorded. In the event of an occurrence of shadow flicker exceeding guideline threshold values of 30 minutes per day at residential receptor locations, mitigation options will be discussed with the affected homeowner, including: › Installation of appropriate window blinds in the affected rooms of the residence; › Planting of screening vegetation;		

		› Other site-specific measures which might be agreeable to the affected party and may lead to the desired mitigation. If it is not possible to mitigate any identified shadow flicker limit exceedance locally using the measures detailed above, wind turbine control measures will be implemented.		
MM86	EIAR Chapter 5	Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.		
MM87	EIAR Chapter 5	An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM88	EIAR Section 11	Modern wind turbines can be programmed to run in reduced modes of operation (or low noise modes) to achieve the attenuation required in the specific wind conditions (i.e. wind speed and direction). Operating the turbines in reduced noise modes is generally referred to as curtailment. Should predicted exceedances be confirmed at the commissioning stage of the development, it is possible to mitigate for this through curtailment of turbine(s) in the relevant wind speed and directions. The curtailment strategy would ultimately be developed for the specific turbine technology installed on the site and the associated noise emissions at the various operational wind speeds. If necessary, a detailed curtailment strategy matrix will be developed at the detailed design stage in order to achieve the relevant noise criteria at all NSL's.		
MM89	EIAR Section 6	Blade Feathering Blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine. Bat Buffers		

		The required bat buffers surrounding turbines located within or at the edge of conifer forestry habitat will remain free from vegetation for the duration of the operational phase of the proposed development. <u>Bat Monitoring Plan</u> Post-construction bat monitoring will be undertaken for at least three years' post construction of the renewable energy development. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions. The results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment if deemed necessary following post construction monitoring. <u>Lighting</u> The applicant commits to the use of lights during operation in line with guidance that is provided in the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK and Dark Sky Ireland Lighting Recommendations. Exterior lighting will be designed to minimise light spillage by using directional accessories (Stone, 2013).		
MM90	EIAR Section 14	It is standard practice of 2RN to produce a Protocol Document for wind farm developments, which will be signed by the developer. The Protocol Document ensures that in the event of any interference occurring to television or radio reception due to operation of the wind farm, the required measures, as set out in the document, will be carried out by the developer to rectify this. The Protocol Document ensures that the appropriate mitigation is carried out in the event of unanticipated broadcast interference arising to television or radio reception as a result of the Proposed Development. In the event of interference occurring to telecommunications, the Department of the Environment, Heritage and Local Government Wind Farm Planning Guidelines (2006) state that these effects are generally easily dealt with by the use of divertor relay links out of line with the proposed wind turbines.		

7. MONITORING PROPOSALS

All monitoring proposals relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the Environmental Impact Assessment Report (EIAR).

This section of the Construction and Environment Management Plan groups together all of the monitoring proposals presented in the EIAR. The monitoring proposals are presented in Table 7-1 below.

By presenting the monitoring proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits.

Table 7-1 Monitoring Measures

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
Pre-Commencement Phase					
MX1	EIAR Section 4 CEMP Section 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site ECoW or the Project Hydrologist.	On going	Monthly	ECoW
MX2	CEMP Section 3	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.	As Required	Monthly	
MX3	EIAR Section 7	Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and all works areas, where access allows. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase. If it is found to be active during the construction phase, no works shall be undertaken within a disturbance buffer (Forestry Commission Scotland, 2006; Ruddock and Whitfield, 2007) in line with industry best practise. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied. During pre-commencment surveys, the whooper swan enhancement lands will be visited to confirm that there is suitable high quality foraging habitat for swans. The lands should comprise agricultural pasture with a sward height of 30cm or less. There should be no disturbance (including livestock) between the start of October until the migration of the swans in spring. Enhancement lands should be established prior to the commencement of construction activity.	Once	As Required	Project Ornithologist
Construction Phase					

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX4	EIAR Section 12	Archaeological monitoring of ground works (to include roads, substation, turbine hardstands, bases and cable trenching) will be undertaken at the construction phase of the development.	Once	As required	Project Archaeologist
MX5	CEMP Section 3	A system of peat monitoring will be implemented under the supervision of the project geotechnical engineer. This will include movement monitoring posts the findings of which will be reviewed by the geotechnical engineer.	Monthly or more frequently as required by construction programme	Monthly	Project Geotechnical Engineer
MX6	EIAR Section 4, 9	Check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.	As Required	As Necessary	ECoW
MX7	EIAR Section 4	A daily visual inspection of each settlement pond will be undertaken to identify when sediment are nearing capacity within the pond and sediment will be cleaned out as required. Settlement ponds will also be checked for anything else that might interfere with flows.	As Required	As Necessary	ECoW
MX8	EIAR Section 4	Settlement ponds will be inspected weekly and following significant rainfall events i.e. after events of >25mm rainfall in any 24-hour period. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose.	Weekly / As Required	As Necessary	ECoW
MX9	EIAR Section 4	All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.	Weekly / Monthly	As Necessary	ECoW
MX10	EIAR Section 4	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather,	As Required	As Necessary	ECoW / Project Hydrologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
	CEMP Section 3 & 4	ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.			
MX11	EIAR Section 9 CEMP Section 3	The plant used should be regularly inspected for leaks and fitness for purpose.	Before Use	As Necessary	Drivers / ECoW
MX12	EIAR Section 9	Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.	Weekly/ Monthly	As Necessary	ECoW
MX13	EIAR Section 9	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each watercourse and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based). This will be completed in consultation with the Fisheries Board.	Weekly, monthly and event based	As Necessary	ECoW / Project Hydrologist
MX14	CEMP Section 3	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.	As Required	As Necessary	ECoW
MX15	EIAR Section 7	Works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Any requirement for construction works to run into the subsequent breeding season following commencement will be subject to pre-construction bird surveys to confirm the absence of breeding birds.	Prior to the subsequent breeding season	As Necessary	Project Ornithologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX16	CEMP Section 3	Dust gauges to be put in place during the construction phase of the development to monitor dust emissions generated by the development of the wind farm.	Monthly	Quarterly	ECoW
MX17	CEMP Section 3	A Project Ecologist will be appointed. The responsibilities and duties of the Project Ecologist will include the following: › Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided. › Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development area. › Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise. › Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.	As required	As required	Project Ecologist
Operational Phase					
MX18	EIAR Section 6	Habitat condition monitoring will be undertaken during construction and in year 1 post construction to ensure that there are no negative effects on marsh fritillary habitat	As required	As required	
MX19	CEMP Section 3	Monthly sampling for laboratory analysis for a range of parameters adopted during pre-commencement and construction phases will continue for six months during the operational phase. The Project Hydrologist will monitor and advise on the readings being received from the testing laboratory.	Monthly	Monthly	
MX20	EIAR Section 7	A detailed post-construction Bird Monitoring Programme has been prepared for the operational phase of the proposed development (refer to EIAR	Years 1, 2, 3, 5, 10 and 15	Annually	Project Ornithologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
		Appendix 7-6 for further details). The programme of works will monitor parameters associated with collision, displacement/barrier effects and habituation during the lifetime of the project. Surveys will be scheduled to coincide with Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Monitoring measures are broadly based on guidelines issued by SNH (2009). The following individual components are proposed: • Monthly flight activity surveys: vantage point surveys • Targeted bird collision surveys: corpse searches with trained dogs • Hen harrier roost monitoring: hen harrier roost surveys • Whooper swan monitoring: enhancement land site visits and adjacent Ballyouneen I-WeBS site.	of the life of a wind farm		
MX21	EIAR Section 6	Post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity The results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment, to ensure that there are no significant residual effects on bat species	Monthly or as required	Years 1, 2 and 3 of the life of a wind farm	Project Ornithologist
MX22	EIAR Section 9	Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.	As Required	Weekly	ECoW
MX23	EIAR Section 11	Once the site is operational a Noise Compliance Monitoring Programme will be carried out by a suitable qualified noise consultant/engineer	Once	On completion of Programme	Project Noise Consultant

8. PROGRAMME OF WORKS

The construction phase will take approximately 24 months to complete from starting on site to the commissioning of the electrical system and export of electricity from site.

The EIAR stipulated that in the interest of breeding birds, construction would not commence during the breeding bird season, which runs from March to August.

Therefore, to comply with the above voluntary restrictions, construction could commence at any stage from September onwards to the end of February, so that construction activities are ongoing by the time the next breeding bird season comes around.

At this time, it is envisaged that construction will commence in the third quarter of 2022. This provisional start date is dependent on some final details relating to various factors such as grid connection and turbine supply but is the current projected start date that project team members are working towards.

The phasing and scheduling of the main construction task items are outlined in Figure 8-1 below, where September 2025 has been shown as the start date for construction activities.

ID	Task Name	Q3 2025	Q4 2025	Q1 2026	Q2 2026	Q3 2026	Q4 2026	Q1 2027	Q2 2027
1	Site Health and Safty								
2	Site Compounds								
3	Site Roads								
4	Turbine Hardstands								
5	Turbine Foundations								
6	Substation Construction and Electrical Works								
7	Backfilling and Landscaping								
8	Turbine Delivery and Erection								
9	Substation Commissioning								
10	Turbine Commisioning								

Figure 8-1 Indicative Construction Schedule

9. COMPLIANCE AND REVIEW

9.1 Site Inspections and Environmental Audits

Routine inspections of construction activities will be carried out on a daily and weekly basis by the ECoW and the Construction Manager to ensure all controls to prevent environmental impact, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this CEMP and all relevant planning documentation. Only suitably trained staff will undertake environmental site inspections.

9.2 Auditing

An Environmental audit will first be carried out prior to the construction phase of the development to ensure the implementation of pre-construction mitigation measures, completion of baseline studies and implementation of pre-construction felling mitigation measures. Further environmental audits will be carried on a monthly basis during the construction phase of the project and again after the commissioning of the wind turbines.

In contrast to monitoring and inspection activities, audits are designed to shed light on the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by the ECoW on behalf of the appointed contractor. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

An audit of compliance with the pre-commencement mitigation measures will be completed by the ECoW prior to the commencement of the construction phase of the development. An audit of compliance with the construction phase mitigation measures will be completed monthly during the construction phase. The findings of each audit will be documented by the ECoW in an audit report within the EMP for the site. The audit report will be made available to Kerry County council on request.

Once the wind farm is operational and turbines have been commissioned, a report of compliance with operational phase mitigation measures will be prepared.

9.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the CEMP.

9.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental occurrence on-site. Corrective actions will be implemented by the Construction Manager, as advised by the Site ECoW. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents, Exceedances; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions. The Corrective Action Notice will be held at the site offices.

If an environmental problem occurs on site that requires immediate action, direct communications between the Construction Manager and the Site ECoW will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

9.5 Construction Phase Plan Review

This CEMP will be updated and reviewed prior to commencement of construction, and every six months thereafter, during the construction phase of the project.

APPENDIX 4.3

PROPOSED WATER COURSE CROSSINGS

1. PROPOSED WATER COURSE CROSSINGS

1.1 Water-crossing Points

Across the site there will be seventeen new water-crossings constructed and three existing water-crossings which will be upgraded. Two of the new water-crossings will cross natural watercourses and the remaining fifteen of the new water-crossings will cross man-made agricultural drains.

The locations of all the water-crossing points are shown and labeled in Figure 1.1.

1.2 Water-crossing Types

The three existing water crossings will be upgraded by extending the water-crossing infrastructure that is already in place. The length of extensions to existing water-crossings will be kept as short as is practically possible so as to minimise any impact on the watercourse channel.

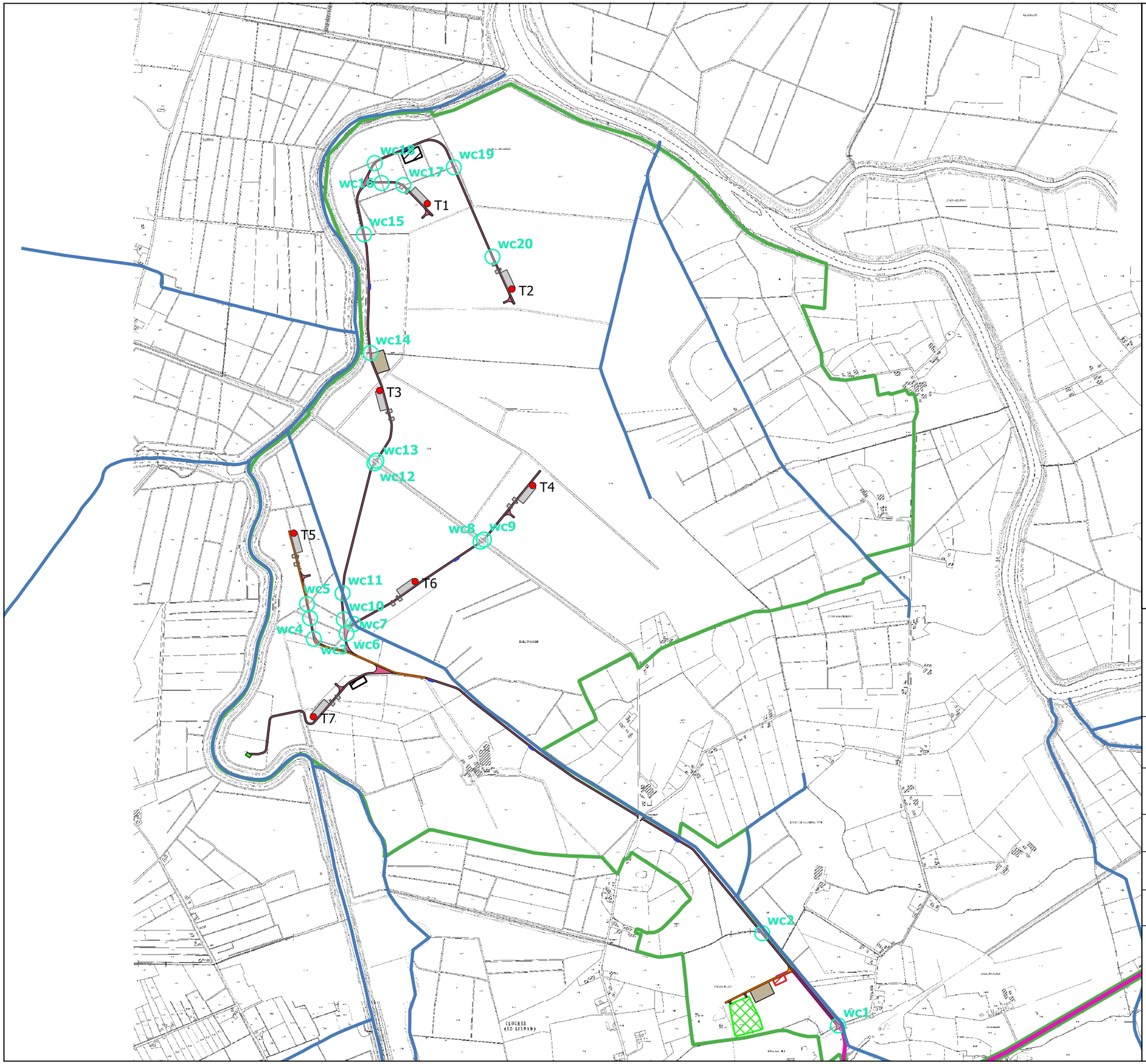
The seventeen proposed new water-crossing points have been assessed in terms of ecological value, watercourse type and channel width. Based on the findings of these assessments, one of three proposed culvert types has been chosen for the construction or upgrade of the water-crossing at each point. The three types of water-crossing are as follows:

- Type 1: At a proposed new water-crossing point, where the channel width is a minimum of one metre, a pre-cast, three sided, 'bottomless' box culvert. This type of culvert minimises the impact on the watercourse channel by leaving the bed of the channel unaltered which will maintain its ecological integrity. Depending on the width of the channel, the three-sided, 'bottomless' box culverts, of a standard size, can be used in series if required.
- Type 2: At a proposed new water-crossing point, where the channel width is less than one metre, a piped culvert will be used to construct the water-crossing. The culvert will be installed using the guidelines set out in the IFI's *Guidelines on Protection of Fisheries during Construction Works In and Adjacent to Waters* so as to minimise impacts on the watercourse channel.
- Type 3: The existing water-crossings are all culverted by pipe culverts. Where upgrades and widening of the existing roads are taking place, these culverts will be lengthened using the same type of pipe culvert that is already in place.

All three culvert types are illustrated in Figure 1.2.

Table 1.1, below, lists all of the water-crossing points, as per Figure 1.1. The table outlines the location of the water-crossing points, whether it is an existing or proposed new water-crossing, the status of the watercourse at each point, the width of the watercourse channel at each point, the type of culvert to be used and proposed action at each water-crossing point.

As stated in Chapter 4 of the EIAR, where any new culverts of existing watercourses are proposed, they will be the subject of consent applications to the Office of Public Works under Section 50 of the Arterial Drainage Act, 1945.



Map Legend

- EIAR Study Area Boundary
- Water Course crossings
- Streams
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

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Drawing Title

Proposed Water Crossing Locations

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
TB	MW
Project No.	**Drawing No.**
200512	Figure 1.1
Scale 1:15000	**Date** 2021.10.13

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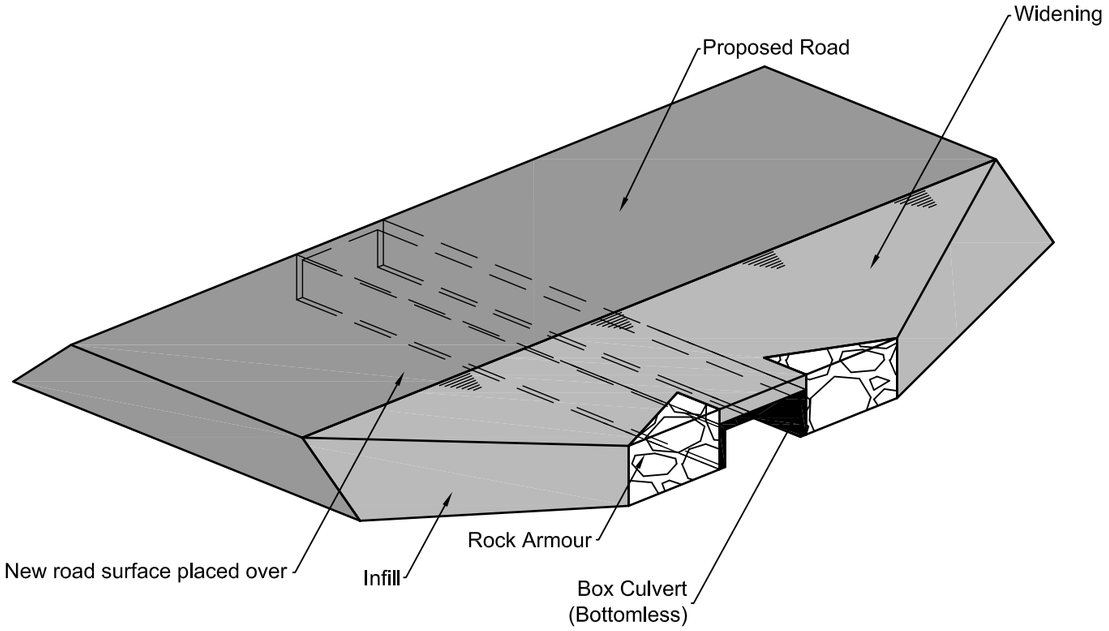
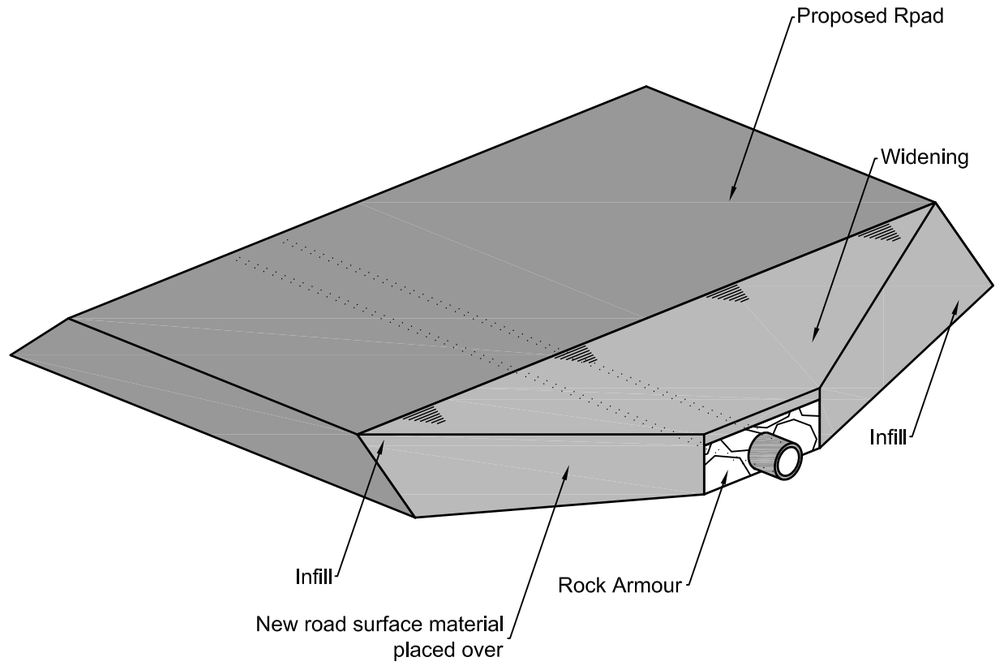
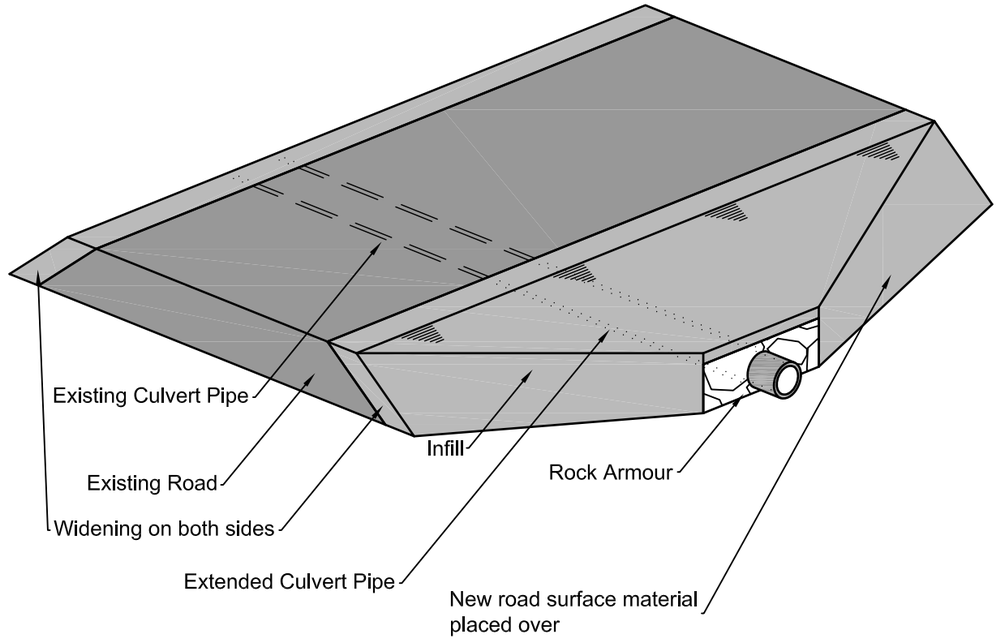
Type 1: 'Bottomless' Box Culvert



Type 2: Piped Culvert (proposed road)



Type 3: Piped Culvert (existing road)



DRAWING TITLE: Water-crossing types		DRAWING No.: Figure 1.2	
PROJECT TITLE: Ballynagare Wind Farm		PROJECT No.: 200512	
DRAWING / MODIFIED BY: Shane O Connor	CHECKED BY: Brian Keville	SCALE: N/A @ A3	DATE: 10.13.21

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Table 1.1 Proposed Water Crossings

Watercrossing ID	Easting	Northing	Existing/Proposed New	Stream/ Drain	Channel Width (m)	Culvert Type	Proposed Action
WC1	488829	631604	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing
WC2	490531	630328	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing
WC3	488707	631525	Existing	drain	0.5	Type 3	Extension to existing pipe culvert.
WC4	488692	631608	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing
WC5	488680	631666	Existing	drain	1.2	Type 3	Extension to existing pipe culvert.
WC6	488841	631547	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC7	488868	631585	Proposed New	stream	2.0	Type 1	Construct new watercrossing.
WC8	489385	631920	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC9	489400	631929	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC10	488829	631604	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing.
WC11	488824	631710	Proposed New	stream	2.0	Type 1	Construct new watercrossing.
WC12	488954	632239	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC13	488962	632249	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC14	488937	632687	Proposed New	drain	.75	Type 1 /2	Construct new watercrossing.
WC15	488911	633169	Existing	drain	1.0	Type 3	Extension to existing pipe culvert.

WC16	488983	633378	Proposed New	drain	1.5	Type 1 /2	Construct new watercrossing.
WC17	489072	633370	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing.
WC18	488955	633459	Proposed New	drain	1.5	Type 1 /2	Construct new watercrossing.
WC19	489277	633442	Proposed New	drain	1	Type 1/2	Construct new watercrossing.
WC20	489434	633078	Proposed New	drain	1	Type 1 /2	Construct new watercrossing.

APPENDIX 4.4

DRAINAGE DESIGN DRAWINGS (A4)

POLLUTION PREVENTION NOTES:

1. Site management proposals are intended to ensure protection against surface water and groundwater pollution, siltation and erosion.
2. Suitable drainage control measures should be in place at all times to prevent conveyance of significant volumes of silt to off site receiving watercourses.
3. Silty water can arise from dewatering excavations, erosion of exposed/disturbed ground, temporary stockpiles, plant and wheel wash, site roads/tracks, and disturbance of existing field drains and ditches.

Discharges

4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap, and via silt bag, at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material is to be stored within any surface water buffer zone, unless for designed proposed temporary storage areas.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
8. Vegetation will not be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where deep excavations are proposed cut-off drains will be use to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of exposed ground and temporary stockpiles open at any one time will be minimised, as far as practicable.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, preferably on an impermeable surface and away from field drains / ditches and watercourses / waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Care will be taken when completing concrete works on site to ensure no discharges occur.
16. Concrete wash water, and waste concrete will be managed appropriately on site.

If water pollution is identified the following steps would be adhered to:

STOP - work in the immediate area should be stopped and the source of the pollution identified.

CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

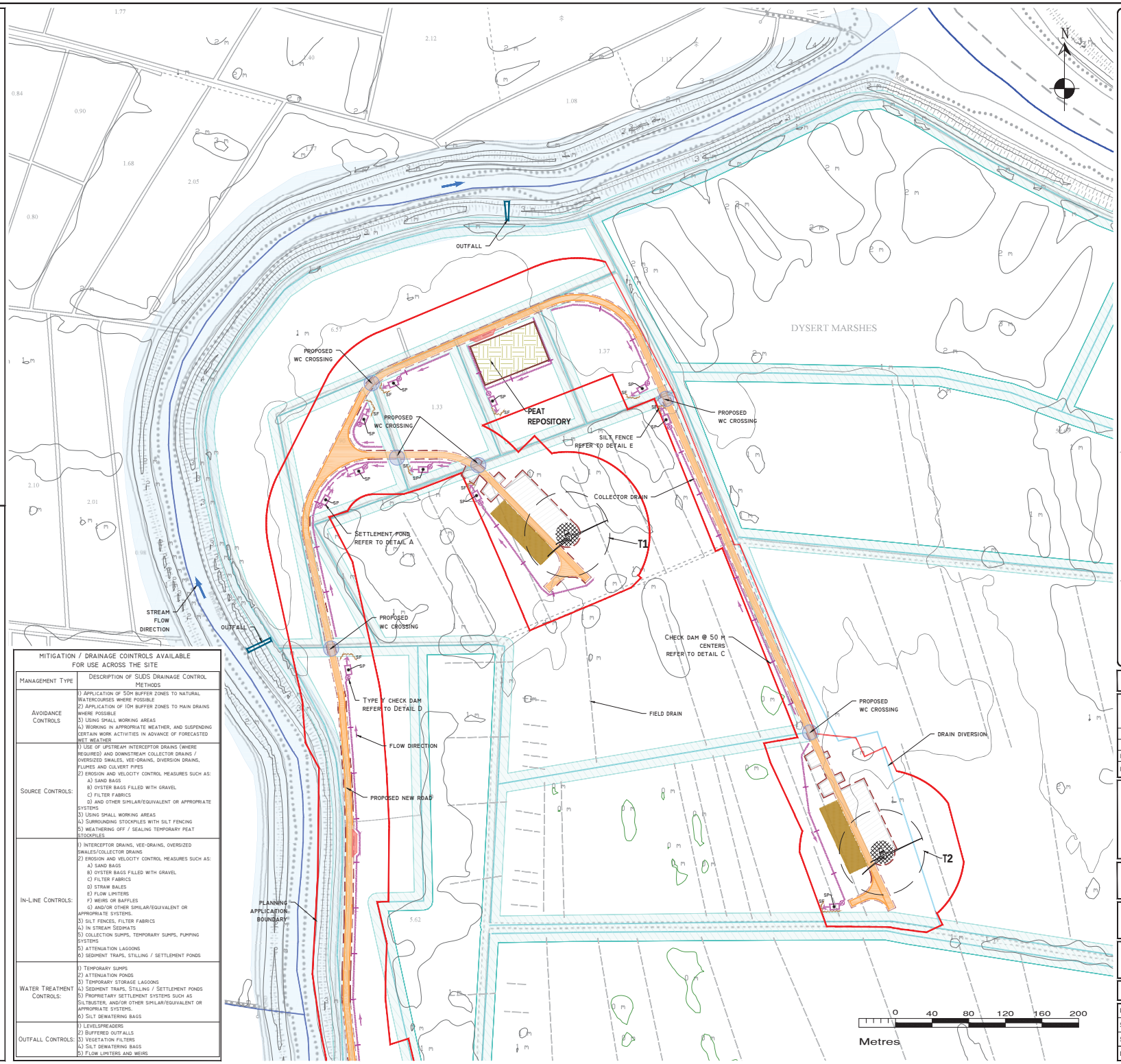
NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

DRAINAGE NOTES:

1. Roadway surfacing design and construction to Engineer's Specification.
2. Spare straw bales/silt fencing/ or similar, to be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences, straw bales / or similar or additional check dams at the problem areas. Mobile siltbuster system to be available on-site for use as required also.
3. SUDS system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of straw bales/silt fencing/or similar approved method or additional check dams and silt fences to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures should be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
5. Interceptor swales / existing ditches to be used to collect upstream surface water flows. Regular cross drains / discharge to field ditches/drains will be required to transfer / discharge surface water in interceptor drains to suitable field drain outfall points.
6. Drainage swales / ditches to be excavated adjacent to the access tracks. Regular cross drains to be located along access tracks to prevent excessive volumes of water collecting in the swales / ditches. Locations of cross drains to be agreed with the Engineer on site. Surface water will not be allowed to discharge directly into existing watercourses.
7. Where possible, a buffer zone of >10m to any existing watercourse will be required where over land discharges are proposed from access track swales / ditches.
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams should be installed to reduce flow velocities and provide source control of silt containment. Where necessary these have been designated in conjunction with settlement ponds and silt traps, prior to discharge.
10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depends on catchment area served. Sample pond sizes shown on Drawing D501.
11. Straw bales / or similar and silt fences to be used also around spoil heaps to mitigate silt runoff. silt fences may be removed when suitable vegetation cover is established.
12. Silt fences to be provide along edge of existing watercourse where works comes within <10m of edge of any ditch / ephemeral channels.
13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer (peat 'sod' or 'scraw') from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation should be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20- 40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100m stone on the downhill face of the check dam and by wrapping in geotextile.
16. Build up of silt levels at check dams to be removed and disposed of appropriately. Silt levels at check dams to be visually inspected as part of an ongoing drainage maintenance programme during the construction phase. Where check dams become clogged with silt or vegetation, stone check dam to be removed and replaced subsequent to the removal of silt.
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil fuel should be stored within bunded containment structures.
20. Silt bags will be used on site at field drain discharge locations, as necessary.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

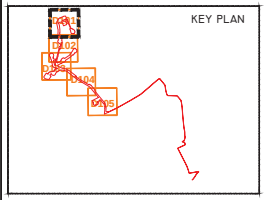
Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains (where required) and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: a) Sand bags b) Oyster bags filled with gravel c) Filter fabrics d) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) Weathering off / sealing temporary peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) Erosion and velocity control measures such as: a) Sand bags b) Oyster bags filled with gravel c) Filter fabrics d) Straw bales e) Flow limiters f) Weirs or baffles g) and/or other similar/equivalent or appropriate systems. 3) Silt fences, filter fabrics 4) In stream Sedimats 5) Collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Level spreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



DRAWING LEGEND :

- Existing Drainage
  - Rivers/Streams
  - Rivers/Streams 50m buffer
  - Drains
  - Drains 10m buffer
  - Diverted Drain
  - Field Drains (Existing)
  - Stream Flow Direction
- Proposed Drainage
  - Swales/Downstream Collector Drain
  - Direction of Flow
  - Silt Fences
  - Double Silt Fences
  - Settlement Pond - Level Spreader
  - Check Dam 'type A'
  - proposed culverts/bridges
  - TW Collector Ditch Culvert
  - Treated Water Discharge
  - SP Settlement Pond
  - Pumping Sump
  - ground slope direction
- Planning Application Boundary
- Existing ground surface intermediate contour (10 m interval)
- Existing ground surface major contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Turbine and swept area
- Turbine foundation
- Crane platform
- Proposed new access road
- Existing road proposed to be upgraded
- Passing bay
- Substation
- Construction compound
- Borrow pit
- Peat repository
- Met mast platform
- Cut and fill area

KEY PLAN



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Date	Description	Chkd	Signed

Revisions

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Client: MKO

Job: Ballynagare WF, Co. Kerry

Title: Proposed Drainage Layout

Figure No: D101

Drawing No: P1531-0-1021-A1-D101-00A	
Sheet Size: A1	Project No.: P1531-0
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 18/10/2021	Checked By: MG

POLLUTION PREVENTION NOTES:

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4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap, and via silt bag, at a minimum of 20m from nearest watercourse unless otherwise stated.
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7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
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Avoidance Controls	1) Application of 50m buffer zones to natural watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains (where required) and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) And other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) Weathering off / sealing temporary peat stockpiles
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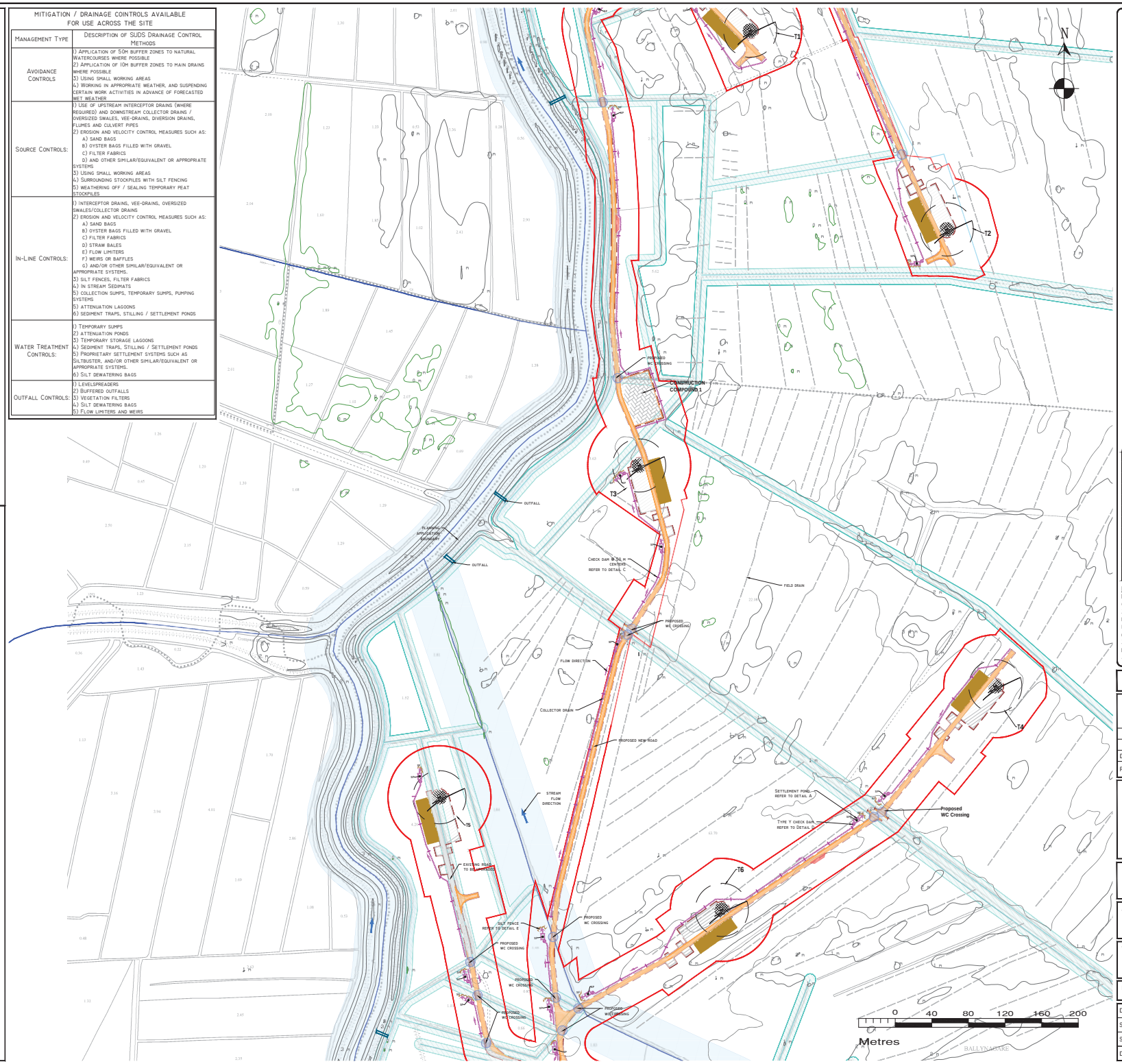
Water Treatment Controls:	1) Temporary sumps 2) Attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



DRAWING LEGEND :

- RIVERS/STREAMS
- RIVERS/STREAMS 50M BUFFER
- DRAINS
- DRAINS 10M BUFFER
- DIVERTED DRAIN
- FIELD DRAINS (EXISTING)
- STREAM FLOW DIRECTION

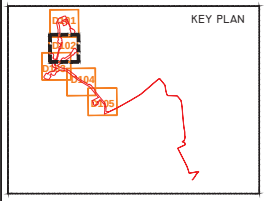
EXISTING DRAINAGE

- SWALES/DOWNSTREAM COLLECTOR DRAIN
- DIRECTION OF FLOW
- SILT FENCES
- DOUBLE SILT FENCES
- SETTLEMENT POND - LEVEL SPREADER
- CHECK DAM 'TYPE A'
- PROPOSED CULVERTS/BRIDGES
- COLLECTOR DITCH CULVERT
- TW TREATED WATER DISCHARGE
- SP SETTLEMENT POND
- PUMPING SUMP
- GROUND SLOPE DIRECTION

PROPOSED DRAINAGE

- PLANNING APPLICATION BOUNDARY
- EXISTING GROUND SURFACE INTERMEDIATE CONTOUR (10 M INTERVAL)
- EXISTING GROUND SURFACE MAJOR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- CRANE PLATFORM
- PROPOSED NEW ACCESS ROAD
- EXISTING ROAD PROPOSED TO BE UPGRADED
- PASSING BAY
- SUBSTATION
- CONSTRUCTION COMPOUND
- BORROW PIT
- PEAT REPOSITORY
- MET MAST PLATFORM
- CUT AND FILL AREA

KEY PLAN



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Revisions

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Client: MKO

Job: Ballynagare WF, Co. Kerry

Title: Proposed Drainage Layout

Figure No: D102

Drawing No: P1531-0-1021-A1-D102-00A	
Sheet Size: A1	Project No.: P1531-0
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 18/10/2021	Checked By: MG

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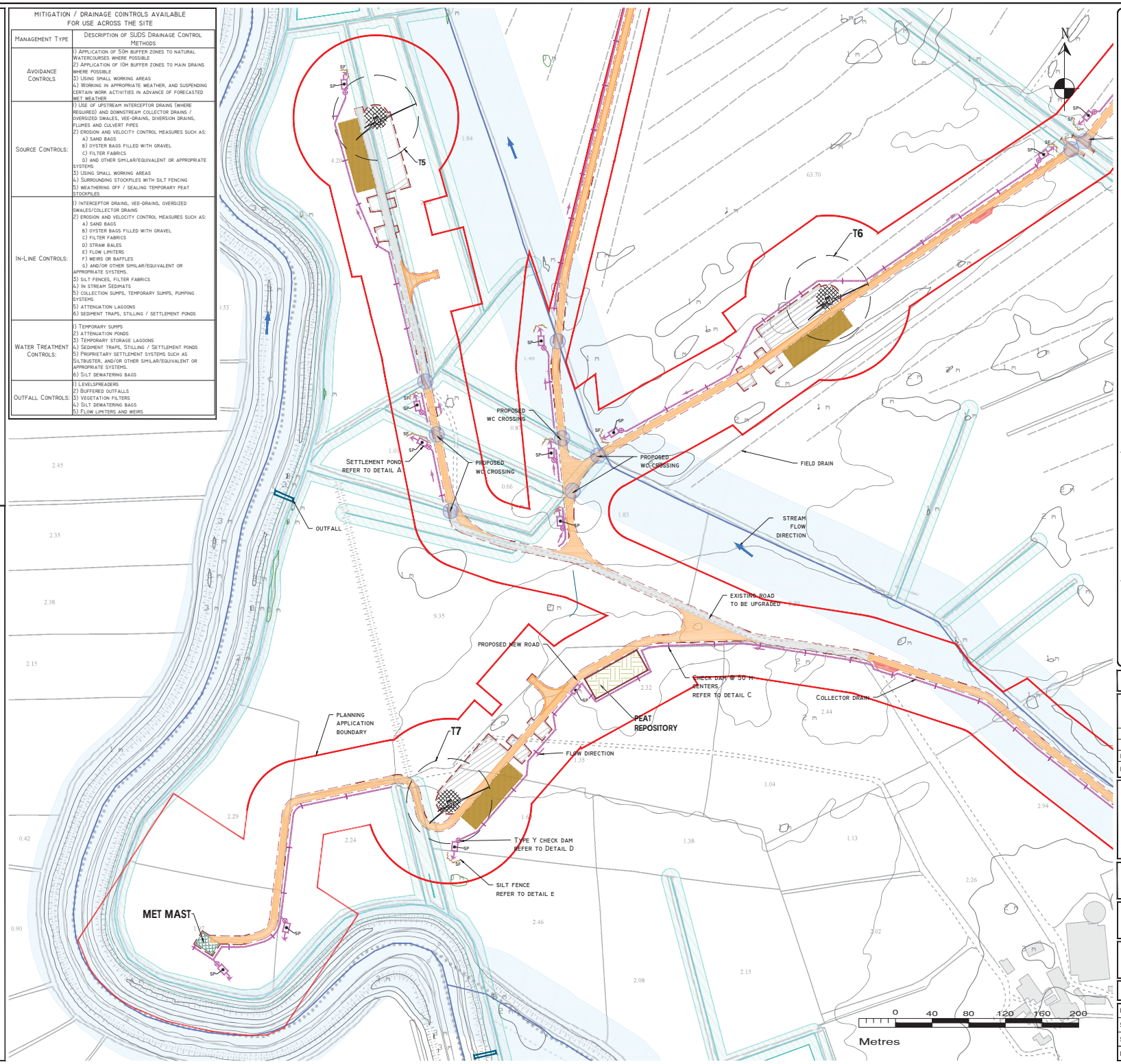


DRAWING LEGEND :

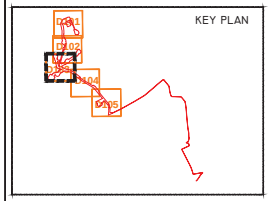
- Rivers/Streams
- Rivers/Streams 50m buffer
- Drains
- Drains 10m buffer
- Diverted drain
- Field drains (Existing)
- Stream flow direction

Existing Drainage

- Swales/Downstream Collector Drain
- Direction of flow
- Silt Fences
- Double Silt Fences
- Settlement pond - level spreader
- Check Dam 'Type A'
- Proposed culverts/bridges
- Collector Ditch Culvert
- TW Treated Water Discharge
- SP Settlement Pond
- Pumping Sump
- Ground slope direction

Proposed Drainage

- Planning Application Boundary
- Existing ground surface intermediate contour (10 m interval)
- Existing ground surface major contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Turbine and swept area
- Turbine foundation
- Crane platform
- Proposed new access road
- Existing road proposed to be upgraded
- Passing bay
- Substation
- Construction compound
- Borrow pit
- Peat repository
- Met mast platform
- Cut and fill area



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Revisions

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Client: MKO

Job: Ballynagare WF, Co. Kerry

Title: Proposed Drainage Layout

Figure No: D103

Drawing No: P1531-0-1021-A1-D103-00A	
Sheet Size: A1	Project No.: P1531-0
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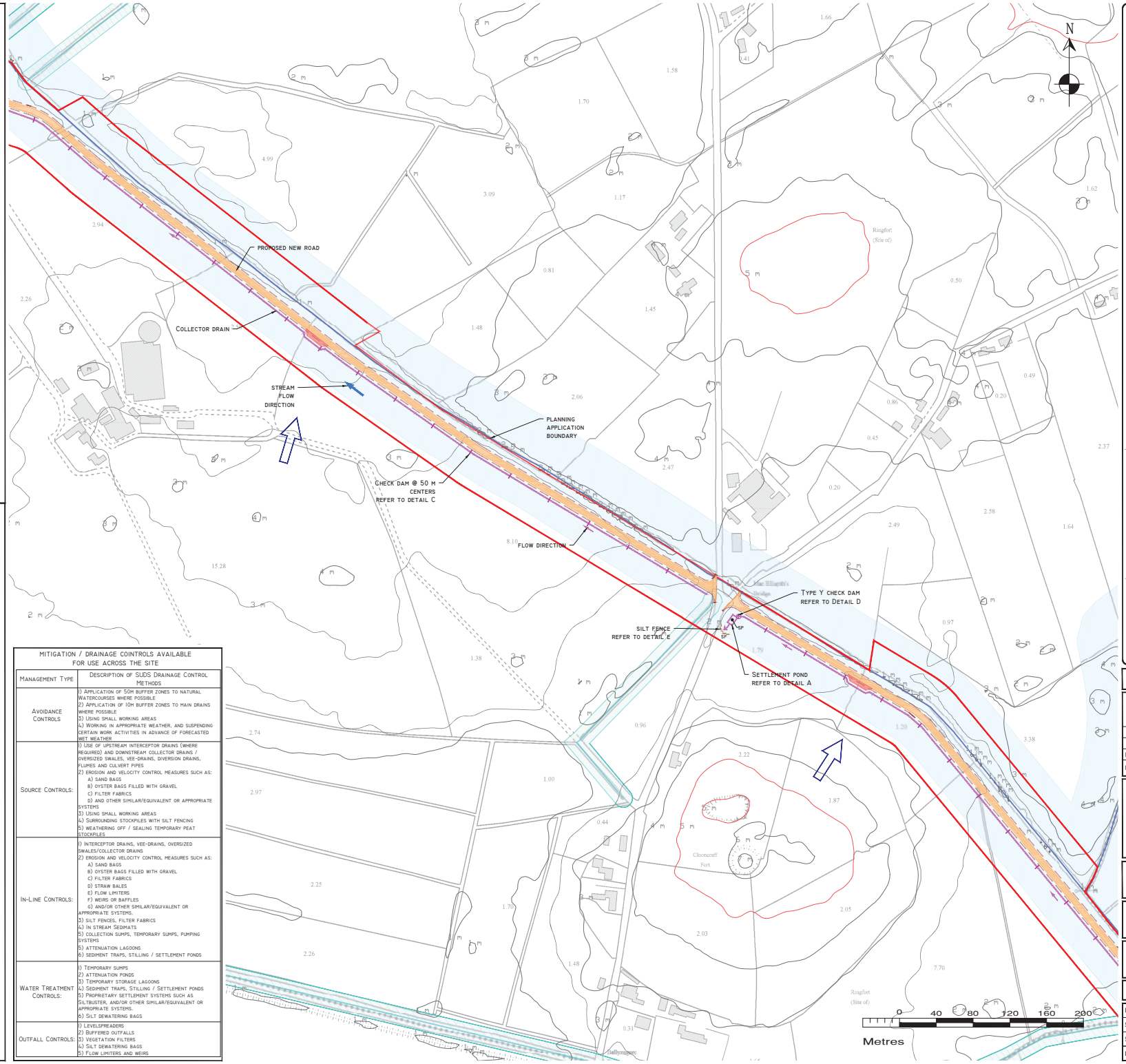
Source Controls:	1) Use of upstream interceptor drains (where required) and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) and other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) Weathering off / sealing temporary peat stockpiles
In-Line Controls:	1) Interceptor drains, vee-drains, oversized swales/collector drains 2) Erosion and velocity control measures such as: A) Sand bags B) Oyster bags filled with gravel C) Filter fabrics D) Straw bales E) Flow limiters F) Weirs or baffles G) and/or other similar/equivalent or appropriate systems. 3) Silt fences, filter fabrics 4) In stream Sedimats 5) Collection sumps, temporary sumps, pumping systems 5) attenuation lagoons 6) Sediment traps, stilling / settlement ponds
Water Treatment Controls:	1) Temporary sumps 2) attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



DRAWING LEGEND :

- RIVERS/STREAMS
- RIVERS/STREAMS 50M BUFFER
- DRAINS
- DRAINS 10M BUFFER
- DIVERTED DRAIN
- FIELD DRAINS (EXISTING)
- STREAM FLOW DIRECTION

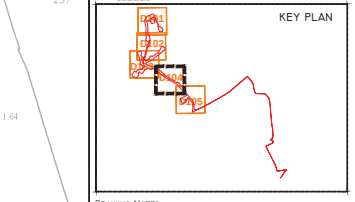
(Existing Drainage)

- SWALES/DOWNSTREAM COLLECTOR DRAIN
- DIRECTION OF FLOW
- SILT FENCES
- DOUBLE SILT FENCES
- SETTLEMENT POND - LEVEL SPREADER
- CHECK DAM 'TYPE A'
- PROPOSED CULVERTS/BRIDGES
- COLLECTOR DITCH CULVERT
- TW TREATED WATER DISCHARGE
- SP SETTLEMENT POND
- PUMPING SUMP
- GROUND SLOPE DIRECTION

(Proposed Drainage)

- PLANNING APPLICATION BOUNDARY
- EXISTING GROUND SURFACE INTERMEDIATE CONTOUR (10 M INTERVAL)
- EXISTING GROUND SURFACE MAJOR CONTOUR (5 M INTERVAL)
- EXISTING GROUND SURFACE MINOR CONTOUR (1 M INTERVAL)
- TURBINE AND SWEPT AREA
- TURBINE FOUNDATION
- CRANE PLATFORM
- PROPOSED NEW ACCESS ROAD
- EXISTING ROAD PROPOSED TO BE UPGRADED
- PASSING BAY
- SUBSTATION
- CONSTRUCTION COMPOUND
- BORROW PIT
- PEAT REPOSITORY
- MET MAST PLATFORM
- CUT AND FILL AREA

KEY PLAN



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Job: Ballynagare WF, Co. Kerry

Title: Proposed Drainage Layout

Figure No: D104

Drawing No: P1531-0-1021-A1-D104-00A	
Sheet Size: A1	Project No.: P1531-0
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 18/10/2021	Checked By: MG

POLLUTION PREVENTION NOTES:

1. Site management proposals are intended to ensure protection against surface water and groundwater pollution, siltation and erosion.
2. Suitable drainage control measures should be in place at all times to prevent conveyance of significant volumes of silt to off site receiving watercourses.
3. Silty water can arise from dewatering excavations, erosion of exposed/disturbed ground, temporary stockpiles, plant and wheel wash, site roads/tracks, and disturbance of existing field drains and ditches.

Discharges

4. Water containing silt will not be pumped directly to any natural watercourse. All discharges to be made over open ground or into existing field drain with silt trap, and via silt bag, at a minimum of 20m from nearest watercourse unless otherwise stated.
5. No excavated material is to be stored within any surface water buffer zone, unless for designed proposed temporary storage areas.
6. Pumped water will be directed into track side ditches and treated in settlement ponds and vegetation swales prior to overland discharge.
7. Pumping of clean water from excavations / or over-pumping in drains/ditches/streams will be completed in a manner that does not cause scour or erosion at the point of release/discharge. This will be done by reducing the flow velocities or by use of splash plates, and other similar discharge controls.
8. Vegetation will not be stripped from existing drains/ditches unless absolutely necessary.

Excavations

9. Where deep excavations are proposed cut-off drains will be use to reduce the amount of surface water entering the excavation. This will be the case around turbine base excavations.

Exposed Ground & Stockpiles

10. The amount of exposed ground and temporary stockpiles open at any one time will be minimised, as far as practicable.

Site tracks

11. Use of track side swales with check dams, and/or filtration check dams will reduce silt in runoff water as required.
12. Check dams to be inspected and cleaned regularly.

Refueling

13. Refuelling of mobile plant will be completed in designated refueling areas only, preferably on an impermeable surface and away from field drains / ditches and watercourses / waterbodies.
14. Spill kits and drip trays will be available on site for use as required.

Concrete

15. Care will be taken when completing concrete works on site to ensure no discharges occur.
16. Concrete wash water, and waste concrete will be managed appropriately on site.

If water pollution is identified the following steps would be adhered to:

STOP - work in the immediate area should be stopped and the source of the pollution identified.

CONTAIN - the source of the pollution should be bunded using a suitable method. Natural watercourses should be temporarily diverted around the source of pollution.

NOTIFY - The relevant authorities (Site Manager / Fisheries / NPWS / Local Authority etc.) should be notified immediately to ensure that measures can be implemented downstream to protect fisheries and other sensitive areas.

DRAINAGE NOTES:

1. Roadway surfacing design and construction to Engineer's Specification.
2. Spare straw bales/silt fencing/ or similar, to be stored on site. The level of silt in runoff during construction is to be monitored visually and excessive silt levels in any area to be temporarily managed by placing silt fences, straw bales / or similar or additional check dams at the problem areas. Mobile siltbuster system to be available on-site for use as required also.
3. SUDS system to be constructed prior to, or at the same time as the access tracks. Interim measures such as the placement of straw bales/silt fencing/or similar approved method or additional check dams and silt fences to be employed in all instances where work carried out to construct the access tracks is likely to cause adverse environmental effects through increased silt loadings being generated during the construction phase.
4. Suitable prevention measures should be in place at all times to prevent the conveyance of significant volumes of silt to receiving watercourses. See notes on pollution prevention.
5. Interceptor swales / existing ditches to be used to collect upstream surface water flows. Regular cross drains / discharge to field ditches/drains will be required to transfer / discharge surface water in interceptor drains to suitable field drain outfall points.
6. Drainage swales / ditches to be excavated adjacent to the access tracks. Regular cross drains to be located along access tracks to prevent excessive volumes of water collecting in the swales / ditches. Locations of cross drains to be agreed with the Engineer on site. Surface water will not be allowed to discharge directly into existing watercourses.
7. Where possible, a buffer zone of >10m to any existing watercourse will be required where over land discharges are proposed from access track swales / ditches.
8. Batters of all proposed swales / ditches to have a slope of between 1 : 1.5 to 1 : 2 depending upon depth of swale/ditch and will be left as cut to re-vegetate with local species.
9. Track side swales / ditches to be shallow with moderate gradients to prevent scouring. In steep areas check dams should be installed to reduce flow velocities and provide source control of silt containment. Where necessary these have been designated in conjunction with settlement ponds and silt traps, prior to discharge.
10. Settlement ponds to be constructed for silt removal at turbine bases and hard stand areas. Pond sizes depends on catchment area served. Sample pond sizes shown on Drawing D501.
11. Straw bales / or similar and silt fences to be used also around spoil heaps to mitigate silt runoff. Silt fences may be removed when suitable vegetation cover is established.
12. Silt fences to be provide along edge of existing watercourse where works comes within <10m of edge of any ditch / ephemeral channels.
13. Slopes of the swales / ditches to be vegetated or protected from erosion until vegetation has been established. Stripped vegetative layer ('peat 'sod' or 'scraw') from excavations to be stored locally and used to line slopes and base of swales / ditches or longitudinal mounds of vegetation swales at field drain discharge points.
14. Areas stripped of vegetation should be kept to a minimum.
15. Clean stone flow control check dams to be made of locally won / geologically similar well graded stone. Aggregate size for stone check dams to be typically 20- 40mm clean stone. On sloping sections of the access tracks, 40mm check dams to be protected from washing away through the placement of 100m stone on the downhill face of the check dam and by wrapping in geotextile.
16. Build up of silt levels at check dams to be removed and disposed of appropriately. Silt levels at check dams to be visually inspected as part of an ongoing drainage maintenance programme during the construction phase. Where check dams become clogged with silt or vegetation, stone check dam to be removed and replaced subsequent to the removal of silt.
17. Spacing and frequency of check dams will be dependent upon longitudinal gradient of swale.
18. Location of filtration check dams (if required) to be agreed on site with Engineer. Settlement ponds to be constructed in a manner where they may be easily infilled at a later date (post completion of the turbine base and hardstand construction). Only suitable materials excavated from the pond to be used to form part of the embankment around the pond.
19. Oil fuel should be stored within bunded containment structures.
20. Silt bags will be used on site at field drain discharge locations, as necessary.

MITIGATION / DRAINAGE CONTROLS AVAILABLE FOR USE ACROSS THE SITE

Management Type	Description of SUDS Drainage Control Methods
Avoidance Controls	1) Application of 50m buffer zones to natural watercourses where possible 2) Application of 10m buffer zones to main drains where possible 3) Using small working areas 4) Working in appropriate weather, and suspending certain work activities in advance of forecasted wet weather
Source Controls:	1) Use of upstream interceptor drains (where required) and downstream collector drains / oversized swales, vee-drains, diversion drains, flumes and culvert pipes 2) Erosion and velocity control measures such as: a) Sand bags b) Oyster bags filled with gravel c) Filter fabrics d) And other similar/equivalent or appropriate systems 3) Using small working areas 4) Surrounding stockpiles with silt fencing 5) Weathering off / sealing temporary peat stockpiles
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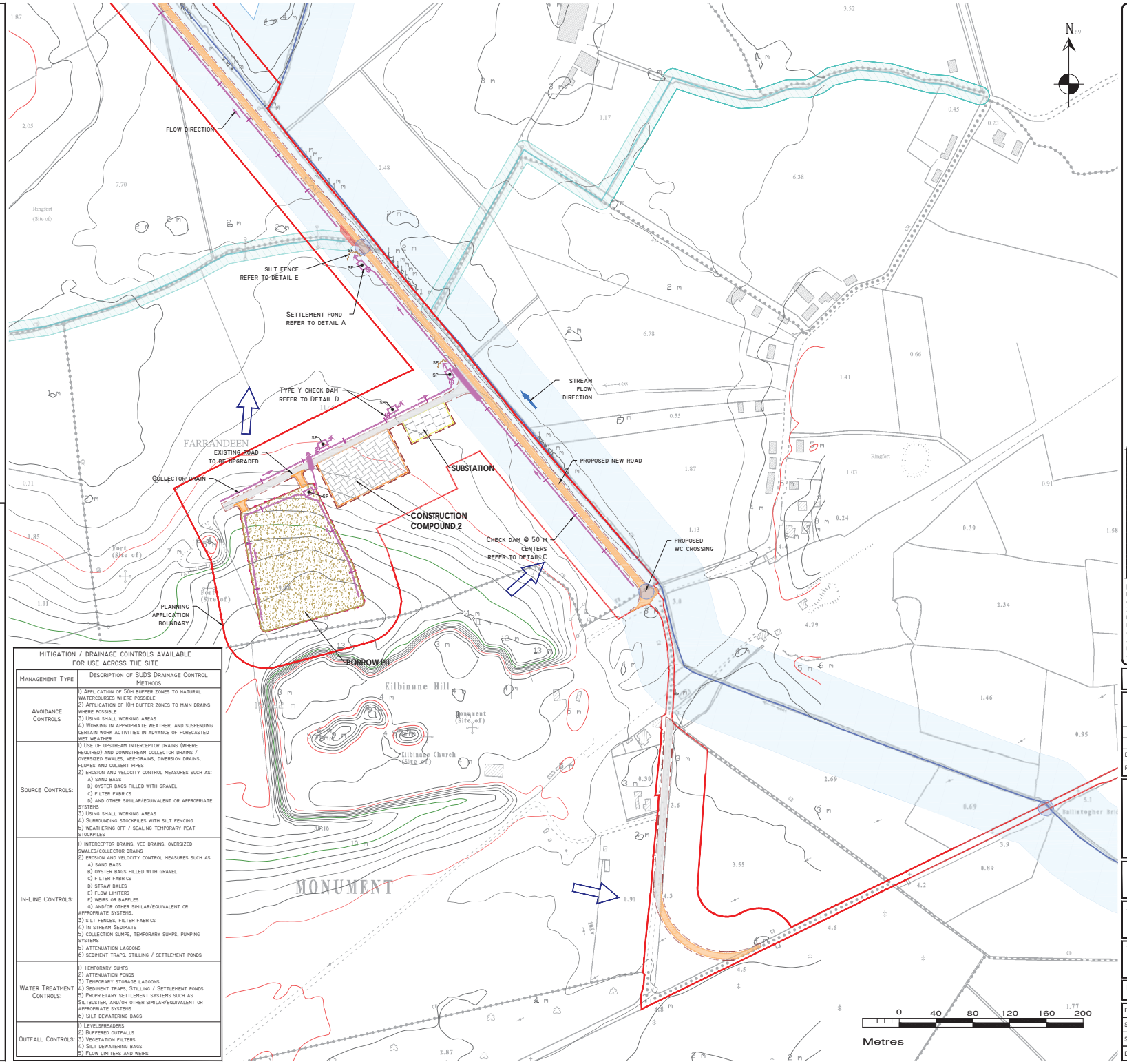
Water Treatment Controls:	1) Temporary sumps 2) Attenuation ponds 3) Temporary storage lagoons 4) Sediment traps, Stilling / Settlement ponds 5) Proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems. 6) Silt dewatering bags
Outfall Controls:	1) Levelspreaders 2) Buffered outfalls 3) Vegetation filters 4) Silt dewatering bags 5) Flow limiters and weirs



DRAWING LEGEND :

- Rivers/Streams
- Rivers/Streams 50m buffer
- Drains
- Drains 10m buffer
- Diverted drain
- Field drains (Existing)
- Stream flow direction

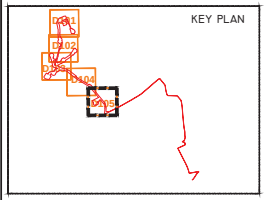
(Existing Drainage)

- Swales/Downstream Collector Drain
- Direction of Flow
- Silt Fences
- Double Silt Fences
- Settlement pond - level spreader
- Check Dam 'type A'
- Proposed culverts/bridges
- Collector Ditch Culvert
- TW Treated Water Discharge
- SP Settlement Pond
- Pumping Sump
- Ground slope direction

(Proposed Drainage)

- Planning Application Boundary
- Existing ground surface intermediate contour (10 m interval)
- Existing ground surface major contour (5 m interval)
- Existing ground surface minor contour (1 m interval)
- Turbine and swept area
- Turbine foundation
- Crane platform
- Proposed new access road
- Existing road proposed to be upgraded
- Passing bay
- Substation
- Construction compound
- Borrow pit
- Peat repository
- Met mast platform
- Cut and fill area

KEY PLAN



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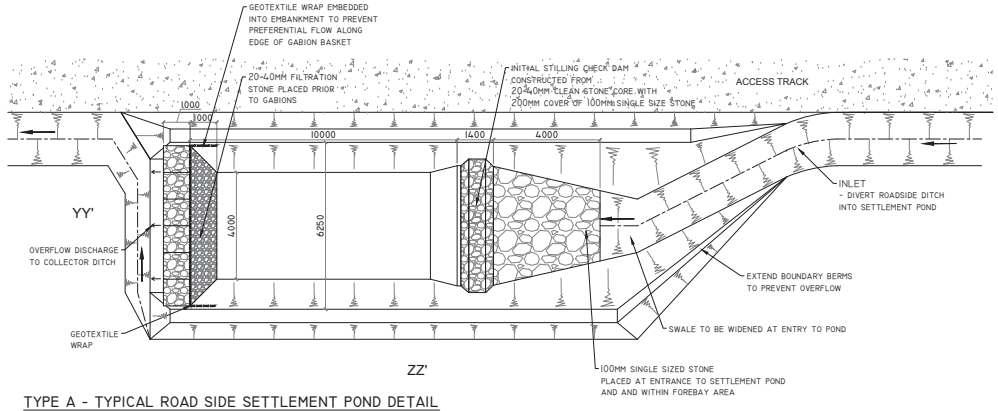
Job: Ballynagare WF, Co. Kerry

Title: Proposed Drainage Layout

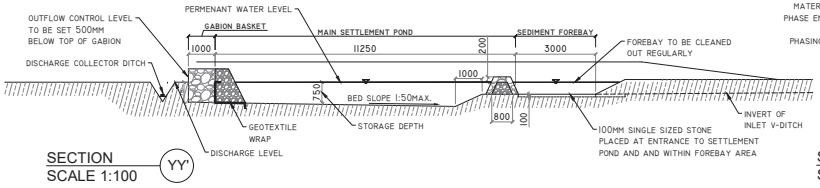
Figure No: DI05

Drawing No: P1531-0-1021-A1-D105-00A	
Sheet Size: A1	Project No.: P1531-0
Scale: 1:2,000 (A1)	Drawn By: MG/GD
Date: 18/10/2021	Checked By: MG

DETAIL A1



TYPE A - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
SCALE 1:200 (NOTE DIMENSIONS VARY DEPENDING ON CATCHMENT SIZE - SEE ATTACHED TABLE)



SECTION YY'
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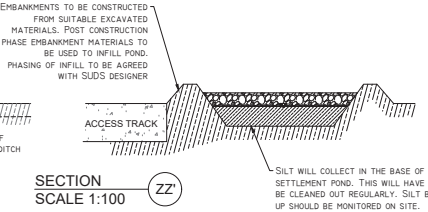

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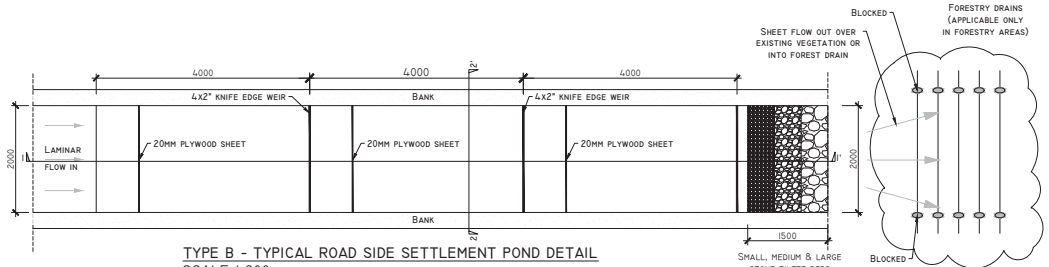

TYPE B - TYPICAL ROAD SIDE SETTLEMENT POND DETAIL
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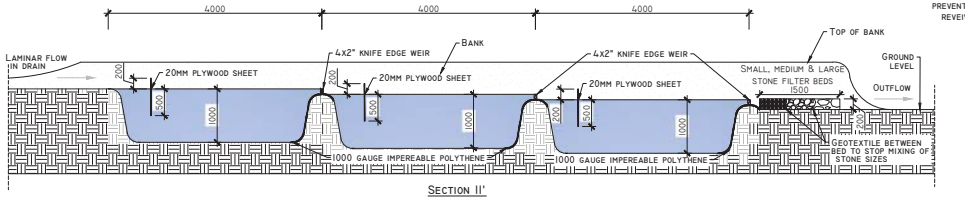
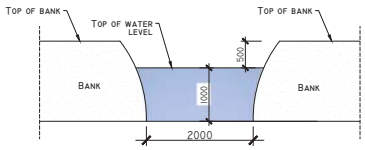
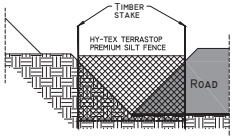


SECTION 11'



SECTION 22'

SEDIMENT FENCE/CHECK DAM DETAIL



DETAIL A2

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08/10/21	Planning	MG	MG

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Client: MKO

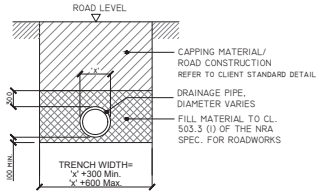
Job: BALLYNAGARE WF, CO. KERRY

Title: DRAINAGE DETAILS 1

Figure No: D501

Drawing No: P1531-0-1021-A1-D501-00A	
Sheet Size: A1	Project No.: P1531-0
Scale: as shown (A1)	Drawn By: MG/GD
Date: 18/10/2021	Checked By: M.G.

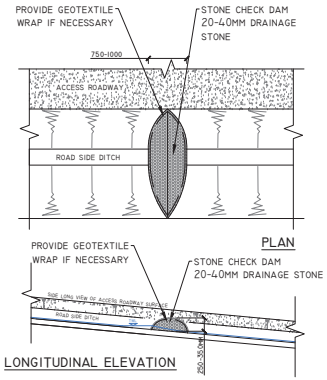
DETAIL B



'TYPE B' CULVERT - DRAINAGE CROSSING BENEATH EXCAVATED ROAD

SCALE 1:50

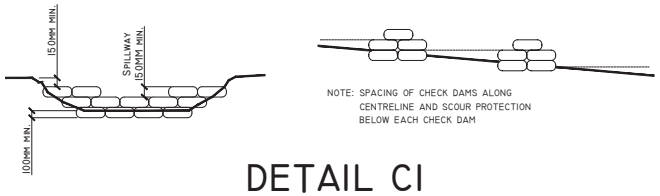
DETAIL C



LONGITUDINAL ELEVATION

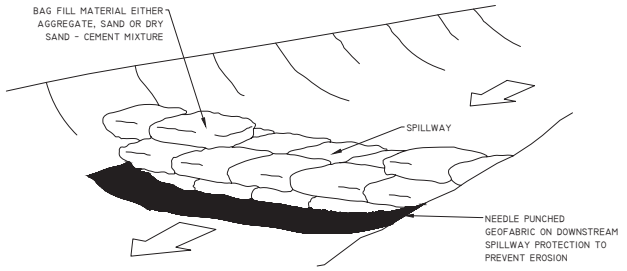
TYPE X - CHECK DAM DETAIL

SCALE 1:50



NOTE: SPACING OF CHECK DAMS ALONG CENTRELINE AND SCOUR PROTECTION BELOW EACH CHECK DAM

DETAIL CI



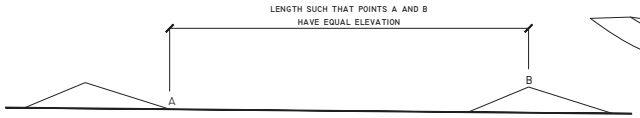
TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW
SAND FILLED BAG CONSTRUCTION

SCHEMATIC - NOT TO SCALE

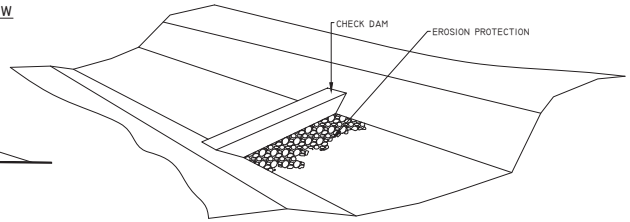
DETAIL C2

TEMPORARY CHECK DAM / SETTLEMENT POND OVERFLOW

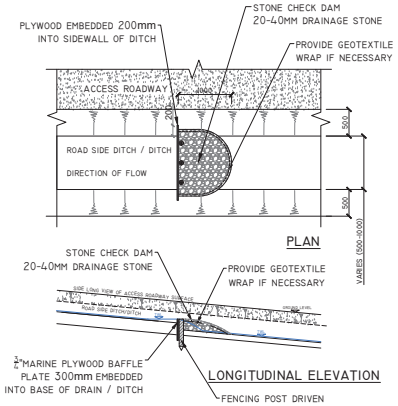
SCHEMATIC - NOT TO SCALE



ELEVATION



DETAIL D



TYPE Y - CHECK DAM DETAIL

SCALE 1:100

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Job: BALLYNAGARE WF, CO. KERRY

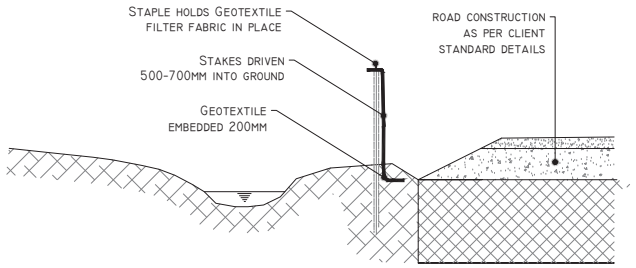
Title: DRAINAGE DETAILS 2

Figure No: D502

Drawing No: P1531-0-1021-A1-D502-00A

Sheet Size: A1	Project No.: P1531-0
Scale: as shown (A1)	Drawn By: MG/GD
Date: 18/10/2021	Checked By: M.G.

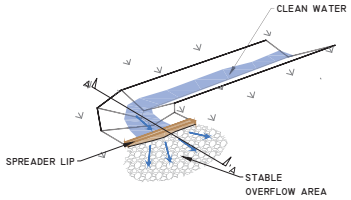
DETAIL E



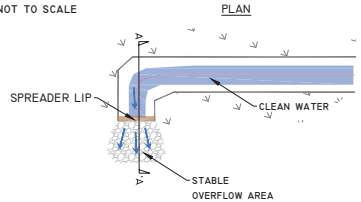
SILT FENCE FOR WATERCOURSE PROTECTION
SCALE 1:25

DETAIL G-1

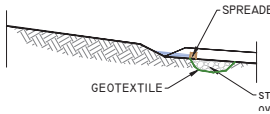
LEVEL SPREADER DETAIL
SCHEMATIC - NOT TO SCALE



PLAN



SECTION AA'



TEMPORARY CONCRETE WASH OUT PIT

SCALE 1:50

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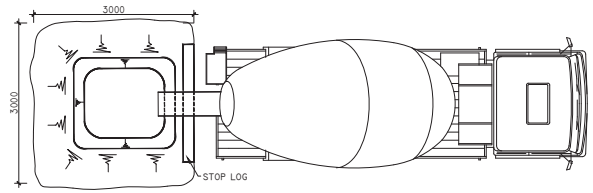

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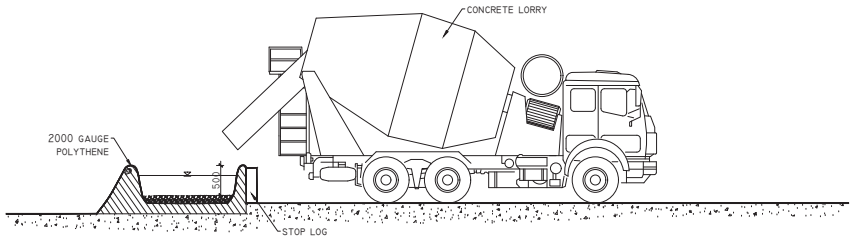

DETAIL F

DETAIL G-2

LEVEL SPREADER DETAIL
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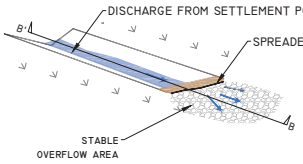

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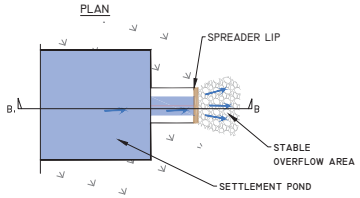

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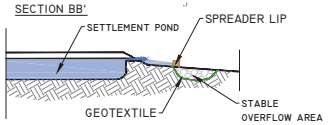

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APPENDIX 4.5

GRID CONNECTION CONSTRUCTION METHODS

OUTLINE CONSTRUCTION METHODOLOGY

Ballynagare Wind Farm 38kV Grid Connection

Document No: 05801-R01-00

Revision:	Author:	Checked:	Date:	Notes:
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1.0 Introduction

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during the construction of the proposed Ballynagare Wind Farm 38kV connection to the National Grid at ESB Clahane 110kV Substation, Co. Kerry.

The 38kV grid connection route will consist entirely of underground cables (UGC) which will be installed in a proposed private access track within private lands, the public road network and ESB Clahane 110kV Substation. The UGC works will consist of the installation of 4 No. ducts in an excavated trench to accommodate 3 no. power cables and 1 no. fibre communications cable.

This document is intended to be used as an aid to understand the methodologies to be employed during construction. In addition, this document is in outline form only and will be revised and updated prior to the commencement of any construction activities. Detailed Method Statements will be prepared in respect of each aspect of the proposed development.

2.0 Proposed Grid Connection Route

The proposed grid connection is approximately 9.9km in length and runs in a north westerly direction from ESB Clahane 110kV Substation to the proposed Ballynagare Wind Farm 38kV Substation. The UGC will exit the Clahane Substation Compound initially going east before then going north west all along an access track from the ESB substation until reaching the N69 Public National Road. It continues in the N69 where it will utilise Horizontal Directional Drilling (HDD) to cross beneath the first bridge of the cable route before leaving the N69.

Upon leaving the N69, the route then continues on local roads in a north westerly direction to reach the R557 Regional Road. Along this section of the route, it again utilises Horizontal Directional Drilling (HDD) to cross beneath the second bridge on the route.

On the R557 the cable route continues in a south westerly direction where it crosses two bridges utilising Horizontal Directional Drilling (HDD) to cross both structures. The route then leaves the R557 and continues north along a local road, before continuing north on a proposed access track within private land until entering the Ballynagare 38kV Wind Farm Substation.

The exact location of the UGC within the proposed cable route corridor will be determined following a further detailed assessment to be undertaken prior to construction and following consultation with Kerry County Council and all other relevant stakeholders, having regard for all environmental protection measures required.

Figure 1 outlines the proposed grid connection route.

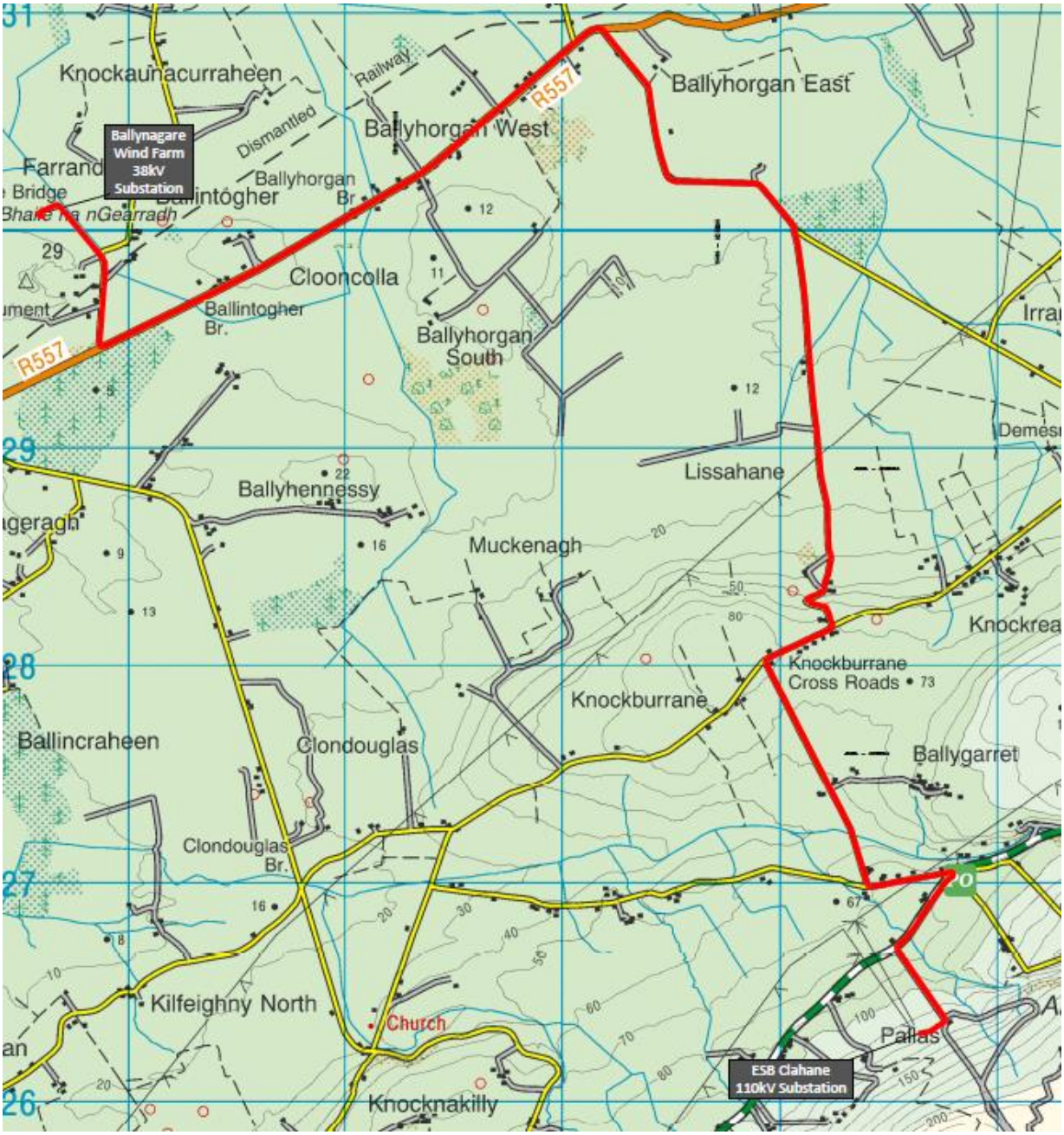

Figure 1 - Proposed Grid Connection Route

Table 1 of this report summaries the route location, features of the underground cable connection and proposed route.

Table 1 – UGC Route Location Summary			
Wind Farm Substation Access Track	**Private Access Track**	**Public Road**	**ESBN Clahane Site**
430m	520m	8935m	15m

Table 1: Clahane 110kV Substation to Ballynagare Wind Farm Substation – UGC Route Location Summary

3.0 Assessment of Proposed Route and Construction Requirements

The table below separates the grid connection route into a number of sections and describes the specific construction requirements of each individual section.

Table 2 - Summary of Preliminary Grid Connection Design Route	
Section	**Description**
Section 1 2863m	**UGC from Clahane Substation to Junction on Local Road at Lisahane Listowel** The proposed UGC will exit the Clahane Substation Compound to the east along a private access track and continue along this in a north westerly direction for approximately 500m until reaching the N69 National Public Road. The route then heads along the N69 for approx. 80m before encountering a bridge (Bridge 1) which will utilize HDD method to cross beneath it. After crossing Bridge 1 the route continues along the N69 for approx. 350m before leaving it at the junction at Banemore and heading along a Local road in a western direction for approx. 410m. The route then leaves this Local Road and goes north along another Local Road for approx. 255m before it reaches another bridge (Bridge 2) which will utilize HDD method to cross beneath it. After crossing Bridge 2 the route continues in a north westerly direction for approx. 900m along the same Local road until it reaches a junction. At this junction it heads in a westerly direction for approx. 350m before reaching another junction and the route leaves this local road at this point and heads north west along another Local road. <u>Features:</u> Section 1 contains 4 No. joint bays. Joint bays will be located below ground and finished/reinstated to the required roads specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 01 (JB-01) will be located approx. 500m north east of the Clahane Substation building. The joint bay will be installed in a private access track off the public road. • Joint Bay 02 (JB-02) will be located approx. 673m north east of JB-01. The joint bay will be installed in a local public road. • Joint Bay 03 (JB-03) will be located approx. 743m after JB-02. The joint bay will be installed in a local public road. • Joint Bay 04 (JB-04) will be located approx. 749m after JB-03. The joint bay will be installed in a local public road. Section 1 contains 2 No. HDD Crossings:

	• HDD Crossing 1 consists of the proposed route crossing over Bridge 1 on the N69. Insufficient clearance exists within the bridge structure and it is proposed to cross this bridge adopting the HDD method on the N69. All proposed HDD crossings may require a transition chamber to be installed at either side of the drill following the works. The location of these transition chambers will to be determined by the drilling Contractor following site investigation works to be completed as part of the detailed design. The final location of the HDD will need to be confirmed by the Drilling Contractor as part of the detailed design phase based on ground conditions and site investigations. The final HDD design will need to be agreed with TII and Kerry County Council. • HDD Crossing 2 consists of the proposed route crossing over Bridge 2 on a Local road. Insufficient clearance exists within the bridge structure, and it is proposed to cross this bridge adopting the HDD method on the Local Road.
Section 2 7037m	**Junction on Local Road at Lisahane Listowel to Ballynagare Wind farm 38kV Substation** The route continues north east on this local road for approx. 1,410m until it is required to cross a culvert. After passing this culvert the route continues along this local road for approx. 570m until it comes to another junction. At this junction it merges onto another Local Road and continues in a north westerly direction for approx. 1,460m before joining the R557. When it reaches the R557, the route continues south west for approx. 1,335m until it required to cross Bridge 3 which will utilize HDD method to cross beneath it. After crossing Bridge 3 the route continues in a south westerly direction for approx. 960m along the same Local Road until it reaches another bridge (Bridge 4) which will utilize HDD method to cross beneath it. The route continues along this road for approx. 480m until it leaves this road to head in a northerly direction along a local road. It continues on this road for approx. 440m. At this point it reaches the proposed access road for Ballynagare Wind Farm 38kV Substation which is within private land. <u>Features:</u> Section 2 contains 9 No. joint bays. Joint bays will be located below ground and finished/reinstated to the required roads specification. Joint bays will have associated communication chambers and link boxes which will have a surface access hatch which will match existing ground levels. • Joint Bay 05 (JB-05) will be located approx. 700m after JB-04. The joint bay will be installed in a local public road.

	• Joint Bay 06 (JB-06) will be located approx. 742m after JB-05. The joint bay will be installed in the public local road. • Joint Bay 07 (JB-07) will be located approx. 676m after JB-06. The joint bay will be installed in the public local road. • Joint Bay 08 (JB-08) will be located approx. 780m after JB-07. The joint bay will be installed in the public local road. • Joint Bay 09 (JB-09) will be located approx. 675m after JB-08. The joint bay will be installed in the regional road, the R557. • Joint Bay 10 (JB-10) will be located approx. 785m after JB-09. The joint bay will be installed in the regional road, the R557. • Joint Bay 11 (JB-11) will be located approx. 740m after JB-10. The joint bay will be installed in the regional road, the R557. • Joint Bay 12 (JB-12) will be located approx. 732m after JB-11. The joint bay will be installed in the regional road, the R557. • Joint Bay 13 (JB-13) will be located approx. 686m after JB-12. The joint bay will be installed in the public local road. Section 2 contains 2 No. HDD Crossings: • HDD Crossing 3 consists of the proposed route crossing over Bridge 3 on the R557. Insufficient clearance exists within the bridge structure, and it is proposed to cross this bridge adopting the HDD method on the R557. • HDD Crossing 4 consists of the proposed route crossing over Bridge 4 on the R557. Insufficient clearance exists within the bridge structure, and it is proposed to cross this bridge adopting the HDD method on the R557.
Refer to the drawings submitted for location details. Note: The precise location of the proposed route may be subject to change as result of ESB design review, existing services/utility locations, ground conditions and any environmental constraints.	

Table 2: Summary of Preliminary Grid Connection Design Route

4.0 Preliminary Site Investigations

It would be proposed to carry out Preliminary site investigations along the cable route prior to construction to confirm design assumptions.

The following items may be carried out:

4.1 UGC Route

Slit trenches at locations of major service crossings (Full road width).

5 No. trial holes along the route to ascertain ground conditions and thermal resistivity of the soil.

Traffic Management – Single lane closure with Stop/Go system in place and full road closures may be required on some narrow local roads.

Equipment:

- 4x4 vehicle
- Concrete vibrator
- Wheeled dumper
- Soil compactor
- 360° tracked excavator (only rubber tracked machines will be allowed on public roads)

5.0 UGC Construction Methodology

The proposed UGC trench will consist of 3 no. 110mm diameter HDPE power cable ducts and 1 no. 110mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,220mm deep, with variations on this design to adapt to service crossings and watercourse crossings. The power cable ducts will accommodate 3 no. power cables. The communications duct will accommodate a fibre cable to allow communications between the Ballynagare Wind Farm substation and the ESB Clahane Substation.

The ducts will be installed and the trench reinstated in accordance with the landowner's requirements where installed in private lands. The installation of the electrical cabling/fibre cable will be pulled through section by section. Construction methodologies to be implemented and materials to be used will ensure that the UGC is installed in accordance with the requirements of the private landowners.

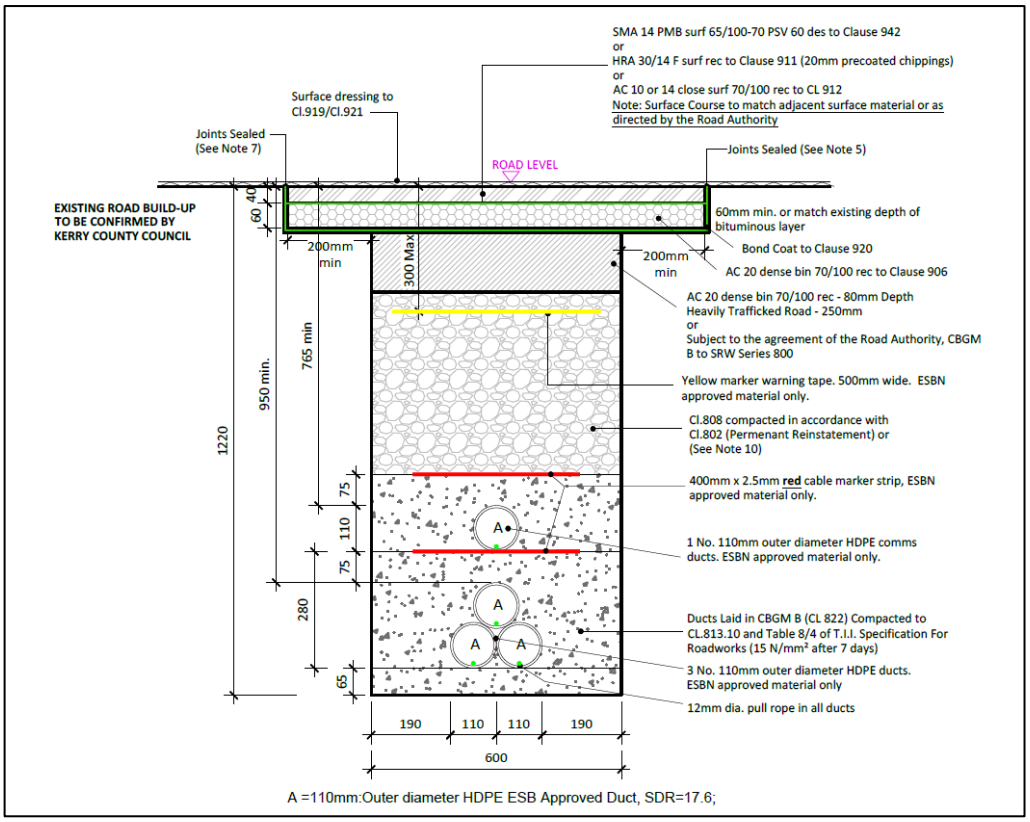

Figure 2 - Typical Trench in Roadway

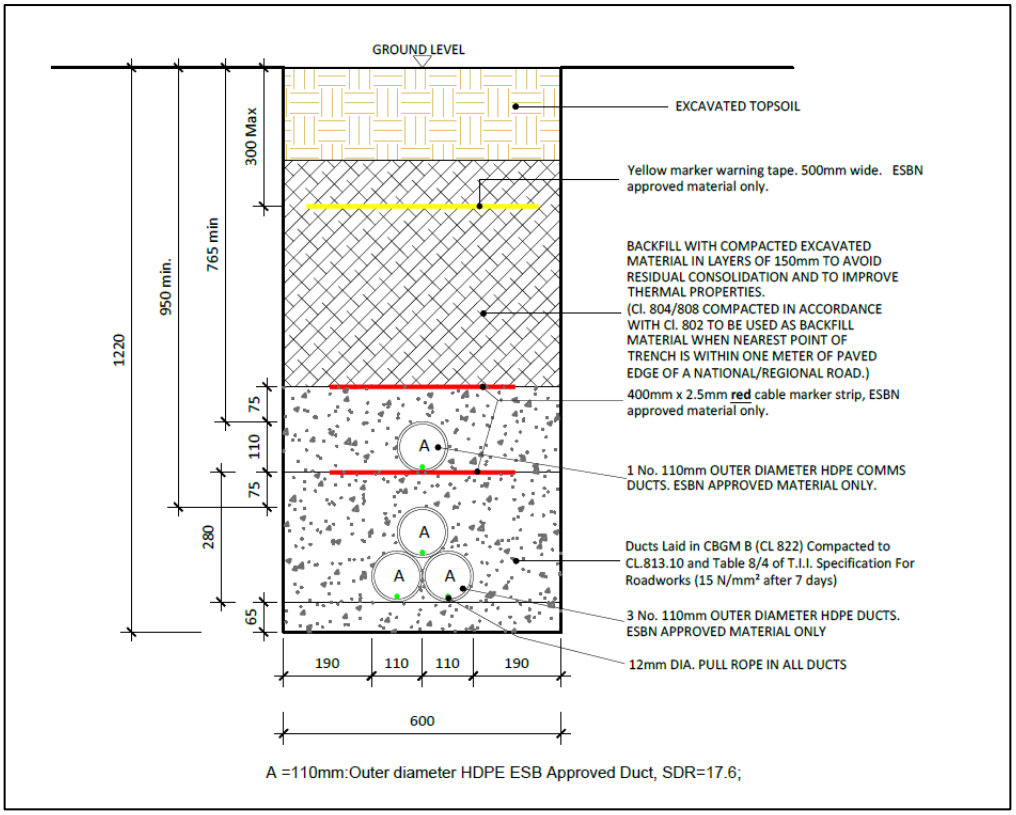

Figure 3 - Typical Trench in Off Road Section

5.1 Marker Posts

Surface cable markers will be placed along the route where cable depth is unavoidably shallow, due to constraints such as existing services, to indicate the precise location of the UGC. These markers will be metallic plates in accordance with ESB standards.

Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions. Corrosion proof aluminium triangular danger signs, with a 700mm base, and with centred lightning symbol, on fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker posts shall also be placed in the event that burial depth is not to standard. The precise siting of marker posts will be dictated by ESBN as part of the detailed design process.

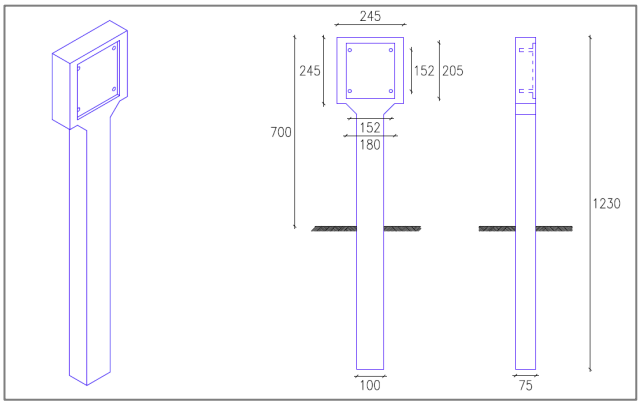

Figure 4 - ESB Marker Posts

5.2 Trenching Methodology

The following section outlines the methodology to be followed during trenching works:-

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures as required by conditions where relevant;
- All existing underground services shall be identified on site prior to the commencement of construction works;
- At watercourse crossings, the Contractor will be required to adhere to the control measures outlined within the planning application, the detailed Construction Environmental Management Plan (CEMP) to be prepared prior to the commencement of construction, and best practice construction methodologies;
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- In the event that culverts require removal for ducting installation, it is proposed that a suitable method of damming the water source and pumping the water around the work area would be set out in a method statement and agreed with the relevant stakeholders. Once the ducts are installed the culvert will be reinstated to match existing levels and dimensions. If works of this nature are required, the Contractor will liaise with Inland Fisheries Ireland in advance of works;
- Traffic management measures will be implemented in accordance with those included in the Traffic Management Report, and a detailed Traffic Management Plan will be prepared and agreed with Kerry County Council;
- The excavated trench will be approximately 600mm in width and approximately 1220mm deep both within the public road network and within private lands;
- The base of the excavated trench will be lined with sand bedding to be imported to site from a local licensed supplier. The 110mm diameter HDPE cable ducting will be placed into the prepared trench, inspected and backfilled as per Figures 2 & 3.
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported off site and disposed of at a fully authorised soil recovery site;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 100m section of trench will be opened at any one time. The second 100 metres will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;

- Works will only be conducted in normal working hours of Monday to Friday 08:00 to 20:00 and Saturday 08:00 to 18:00, with no works on Sundays or Bank Holidays except in exceptional circumstances or in the event of an emergency;
- Following the installation of ducting, pulling the cable will take approximately 1 no. days.

Equipment:

- 1 Excavator Operator;
- 2-3 General Operatives;
- 1 no. tracked excavator;
- 1 no. dumper or tractor and trailer.

Materials:

- Sand for pipe bedding;
- Ready-mix Concrete where necessary (delivered to site);
- Trench backfilling material (excavated material and aggregates) to relevant specifications;
- 110mm diameter HDPE ducting;
- Temporary Surface Reinstatement Materials.



Figure 5 - Typical 38kV Underground Duct Installation

5.3 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2m in height. Where excess material exists, it will be disposed of to a licensed facility.

5.4 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the works area or within the temporary construction compound to be located within the permitted Wind Farm sites. Oils and fuels will not be stored on site and will be stored in an appropriately bunded area within the temporary storage compound.

5.5 Joint Bays and Associated Chambers

Joints Bays are to be provided approximately every 700m - 750m along the UGC routes to facilitate the jointing of 14 no. lengths of UGC. 38kV Joint Bays are typically 1.6m x 4.5m x 1.275m pre-cast concrete structures installed below the finished ground level.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between Ballynagare Wind Farm and the existing 110kV substation at Clahane. Link Box Chambers are also required approximately every second joint bay along the cable route. Link Boxes are used for earthing and bonding cable sheaths of underground power cables. Link Box Chambers and Communication Chambers are located close to Joint Bays, these are pre-cast concrete structures with an access cover at the finished surface level.

The precise siting of all Joint Bays, Link Box Chambers, and Communication Chambers is subject to approval by ESBN. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions. The marker posts will consist of a corrosion-proof aluminium triangular danger sign, with a 750mm base, and with a centred lightning symbol, on engineering grade fluorescent yellow background. They will be installed inadequately sized concrete foundations and will also be placed where the cable has not been buried to the standard depth, due to existing road conditions. Drawings of the joint bays and communication chambers are included within this planning package

Equipment:

- 360° tracked excavator
- 1 no. tracked dumper or tractor and trailer

Materials:

- Sand for pipe bedding
- Ready-mix Concrete where necessary (delivered to site);
- Trench backfilling material (excavated material and aggregates) to relevant specifications;
- Precast Chamber Units / Construction materials for chambers
- Cable ducting

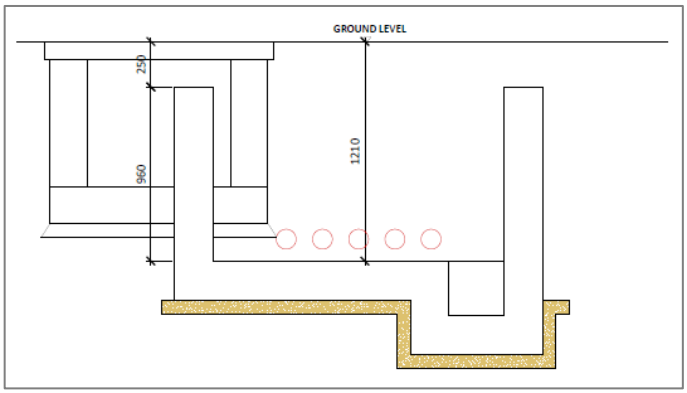

Figure 6 - Typical Section through Joint Bay and Link Box

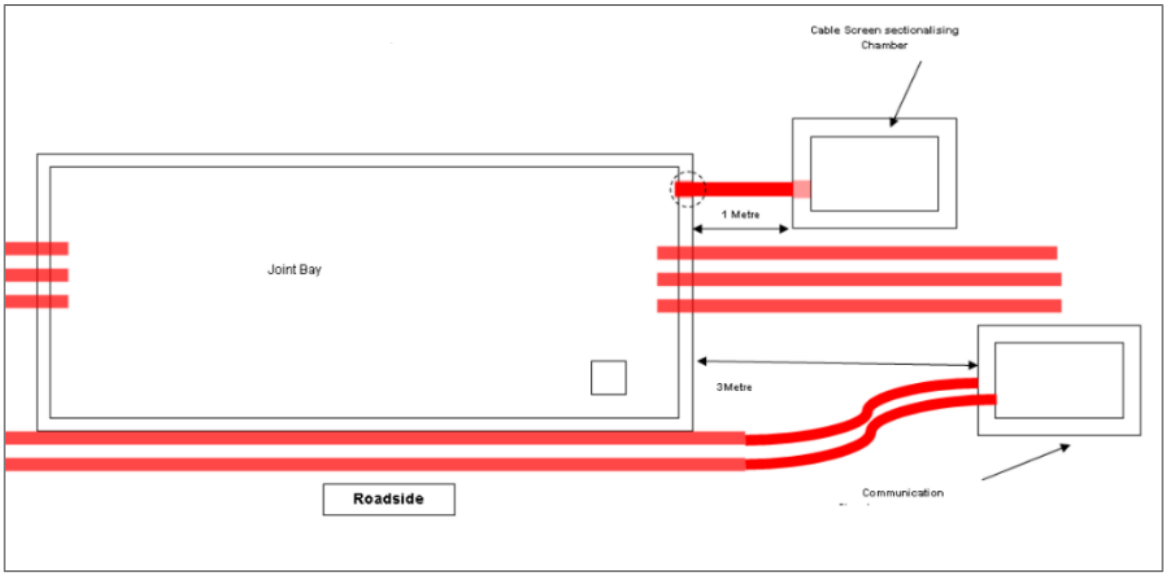

Figure 7 -Typical Joint Bay and Link Box Plan Details

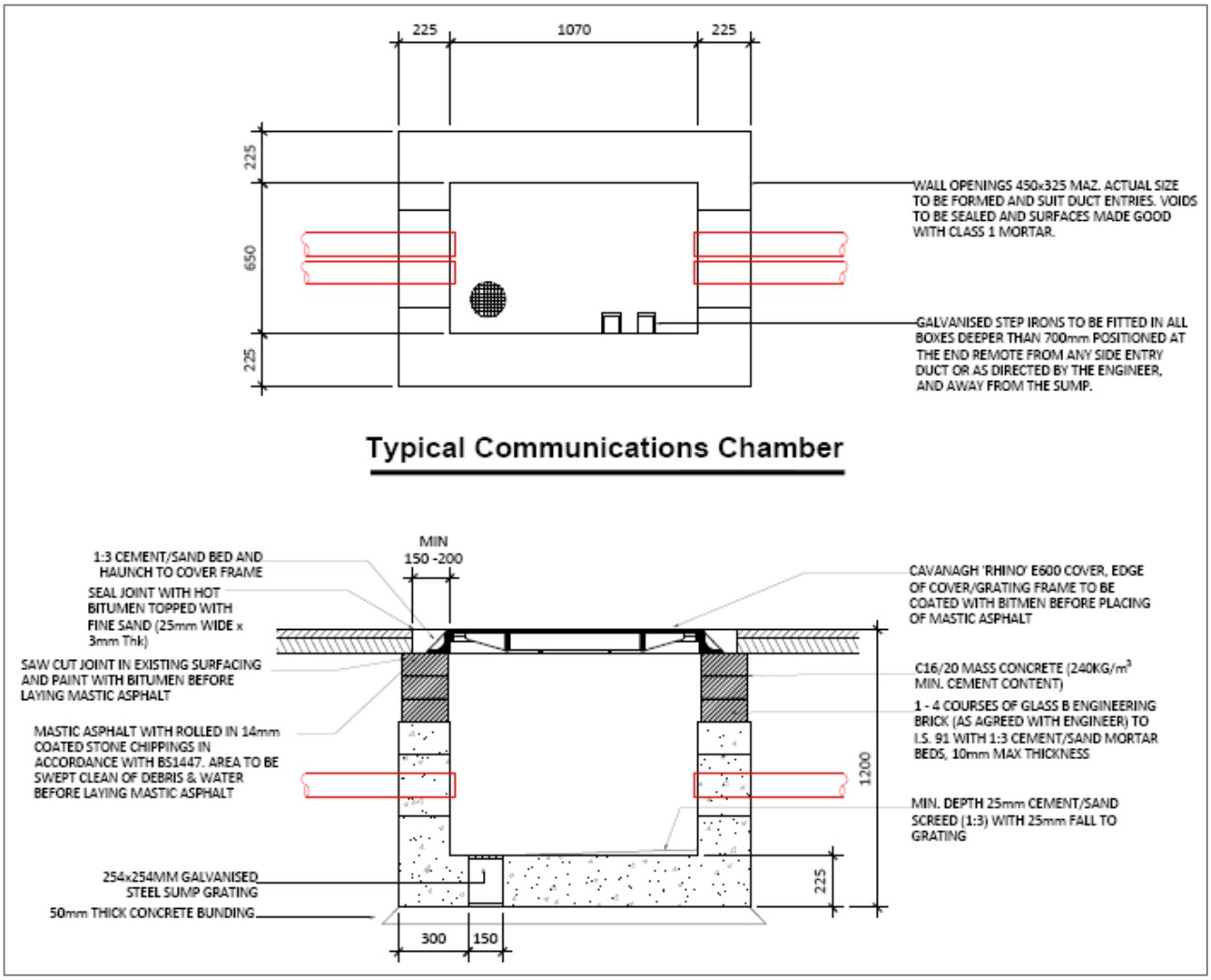

Figure 8 - Typical Communications Chamber



Figure 9 - Typical Link Box Chamber

6.0 Major Watercourse Crossings

The proposed cable route will have 4 No. bridge crossings of which all require HDD crossings as there is insufficient cover on the bridges. Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority. The cable would be located within the bridge deck where there is sufficient depth available in the bridge, where there is insufficient depth available horizontal directional drilling (HDD) will be employed as an alternative.

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled "Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites", these guidelines will be adhered to during the construction of the proposed development. Numerous other minor watercourses crossing locations have been noted along the proposed cable route i.e. culverts, pipe drains. These minor watercourses will be identified and surveyed as part of the detailed design process prior to construction.

6.1 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as roads, bridges, railways, watercourses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. There are bridge crossings on this UGC route which will require HDD.

The proposed drilling methodology is as follows:-

- A works area of circa 40m^2 for the HDD entry side, and circa 20m^2 on the HDD exit side will be required for the HDD equipment and vehicles. These areas will be fenced off during the HDD implementation.
- The drilling rig and fluid handling units will be located on the entry side of the local road and will be appropriately bunded using sand bags, which will contain any fluid spills and stormwater run-off.
- Entry and exit pits (approximately 2m (w) x 3m (L) x 1m deep) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.

- The HDD pilot bore will be undertaken using a wireline guidance system. Assembly will be set up by the drilling team and steering engineer.
- The pilot bore will be drilled to the pre-determined profile and alignment under the watercourse crossings.
- The steering engineer and drill team will monitor the drilling works to ensure that modelled stresses and pressures are not exceeded.
- The drilled cuttings will be flushed back by drilling fluid to the entry and exist pits and re-cycled for re-use.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit side which will then be pulled back to the entry side as part of the pre-reaming/hole opening process to enlarge the hole to the correct size.
- When the pre-reaming/hole opening/hole cleaning has been completed, a reamer of slightly smaller diameter than the final cut will be installed on the drill string to which the ducts will be attached for installation.
- The drilling fluid will be disposed of to a licensed facility.
- The ducts will be cleaned and proven and their installed location surveyed.
- The entry and exit pits will be reinstated to the specification of ESB Networks and any requirements of Kerry County Council.
- A transition chamber/transition coupler will be installed on either side of the HDD following the horizontal directional drilling as per ESB requirements.

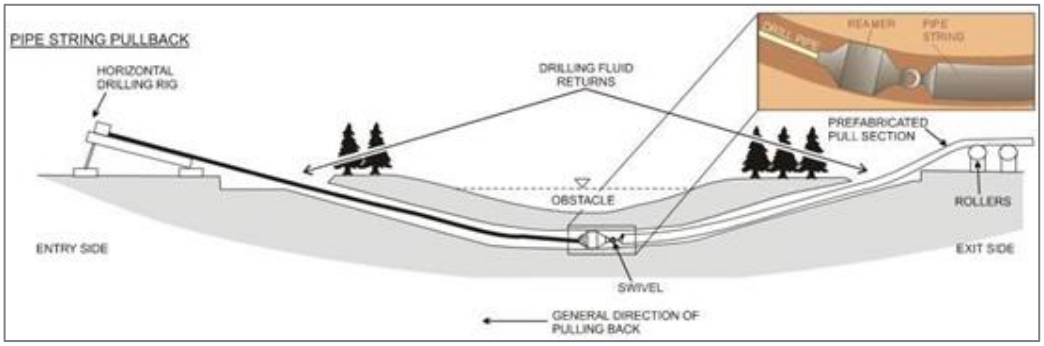

Figure 10 - Typical HDD Installation (not to scale)

7.0 Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the Contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, measures proposed within the CEMP, and the guidance documents and measures listed below. These method statements will be adhered to by the Contractors and will be overseen by the Project Manager, Environmental Manager and ECoW where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures proposed below:-

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

- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin;
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects.* Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and Contractors* (C532);
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines;*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocket book*. (C762) 4th edition. CIRIA;
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The proposed works will be carried out by employing accepted good work practices during construction, and environmental management measures such as those discussed below. Please note that the following measures will be supplemented by further specific environmental protection measures that will be included in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.

- All materials shall be stored at the temporary compound within the wind farm site and transported to the works zone immediately prior to construction;
- Where drains and watercourses are crossed with underground cables, the release of sediment will be prevented through the implementation of best practice construction methodologies.
- Weather conditions will be taken into account when planning construction activities to minimise risk of run off from site;
- Provision of 50m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;
- If dewatering is required as part of the proposed works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- The Contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The Contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, and the Contractor is required to prepare a contingency plan for before and after such events;
- The Contractor will carry out visual examinations of local watercourses from the proposed works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.

- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the solar park sites; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or waste water into watercourses;
- Cabins, containers, workshops, plant, materials storage and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

8.0 Access Routes to Work Area

The proposed grid route will consist entirely of UGC. Where the proposed underground cable will be installed predominantly within existing road networks, it will be accessed via the existing public road network. The Contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private tracks, where appropriate. Prior to the commencement of development, precise access arrangements will be agreed with the respective landowners.

A detailed Traffic Management Plan will be prepared, and agreed with Kerry County Council, prior to the commencement of construction.

Temporary access roads on private land (if required due to ground conditions and/or landowner requirements) will consist of timber or aluminium bog mats (Figure 11) to spread the weight of machinery over a greater area to prevent damage to the ground. If necessary, a low ground pressure excavator may also be utilised. This machine is designed to spread its weight across a wider area thereby reducing the pressure exerted on the ground. No invasive works will be undertaken when placing the matting. Upon completion of the works, all mats will be removed immediately. Access routes will be carefully selected to avoid any damage to land. Local consultation will be carried out with all relevant landowners to ensure that any potential disturbance will be minimised. Prior to the commencement of construction, the Contractor will assess all access routes and determine the requirement for bog mats. Any such requirements will be incorporated into the relevant method statement.



Figure 11 - Temporary Aluminium Panel Tracks

9.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with Kerry County Council. All work on public roads will be subject to the approval of a road opening license application. The Contractor will prepare detailed traffic management plans for inclusion as part of the road opening applications.

Where road widths allow, the UGC installation works will allow for one side of the road to be open to traffic at all times by means of a 'Stop/Go' type traffic management system, where a minimum 2.5m roadway will be maintained at all times. Temporary traffic signals will be implemented to allow road users safely pass through the works area by channelling them onto the open side of the road. Typically, the UGC will be installed in 100m sections, and no more than 100m will be excavated without the majority of the previous section being reinstated. Where the construction requires the crossing of a road, works on one carriageway will be completed before the second carriageway is opened, to maintain traffic flows.

All construction vehicles will be parked within the works area so as not to cause additional obstruction or inconvenience to road users or residents. The traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

In the event of emergency; steel plates, which will be available on site, can be put in place across the excavation to allow traffic to flow on both sides of the road.

All traffic management measures will comply with those outlined in the accompanying Traffic Management Report and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with Kerry County Council, prior to the commencement of development.

10.0 Road Opening Licence

The proposed UGC works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from Kerry County Council. A Traffic Management Plan (TMP) will be agreed

with Kerry County Council prior to the commencement of the development. This TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with Kerry County Council in advance of the preparation of the TMP.

11.0 Relocation of Existing Services

In order to facilitate the installation of the proposed UGC, it may be necessary to relocate existing underground services such as water mains, telecoms or existing cables. In advance of any construction activity, the Contractor will undertake additional surveys of the proposed route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

11.1 Underground Cables

If existing underground cables are found be present, a trench will be excavated, and new ducting and cabling will be installed along the new alignment and connected to the network on either end. The trench will be backfilled with suitable material to the required specification. Warning strip and marking tape will be laid at various depths over the cables as required. Marker posts and plates will be installed at surface level to identify the new alignment of the underground cable, with the underground cables will then be re-energised.

11.2 Water Mains

The water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the utility standards.

12.0 Cable Pulling

Once the ducting is installed the electrical cables (situated on a drum) are pulled through the ducting by a specialised mechanical winch. The winch will also monitor the tension on the cables being pulled so as not to damage the cables. A guide rope is installed with the ducting to assist in the cable pulling process. The guide rope also is used for proving the ducts by attaching a mandrel, a sponge or brush, for cleaning the duct installed. Cable lubricant is applied to the outside of the cables being pulled through the duct. The lubricant assists in the pulling process by removing friction between the cable and the rollers. This not only speeds up the process but also prevents snagging and therefore damage to the cable.

13.0 Reinstatement of Private Land

Once all construction works are complete, the work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in in consultation with the landowner and in line with any relevant measures outlined in the CEMP and associated conditions.

14.0 Emergency Response Plan

All site personnel will be inducted in the provisions of the Emergency Response Plan. The following outlines some of the information, on the types of emergency, which must be communicated to site staff (list not exhaustive);

- Release of hazardous substance - Fuel or oil spill
- Concrete spill or release of concrete
- Flood event – extreme rainfall event
- Environmental buffers and exclusion zones breach
- Housekeeping of materials and waste storage areas breach
- Stop Works order due to environmental issue or concern

The Emergency Response Plan must be completed by the appointed Contractor before the project begins.

15.0 Invasive Species Best Practice Measures

Invasive species can be introduced into a location by contaminated plant, machinery and equipment which were previously used in locations that contained invasive species. Good site organisation and hygiene management shall be maintained always on site, and best practice measures will be implemented, as follows:

- The Contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;
- Plant and machinery will be inspected upon arrival and departure from site and cleaned/washed as necessary to prevent the spread of invasive aquatic/ riparian species such as Japanese knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the Contractor to confirm the implementation of measures;
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

16.0 Waste Management

All waste products (general waste, plastic, timber, etc.) arising during the construction phase will be managed and disposed of in accordance with the provisions of the Waste Management Act 1996 and associated amendments and regulations, and a Waste Management Plan will be prepared by the Contractor prior to the commencement of construction. All waste material will be disposed of at a fully licensed facility.

14.0 Archaeology

The following are the mitigation measures which will be carried out during construction where required;

- If required a project archaeologist will be appointed to oversee the project.
- Demarcation of protective buffer zones around cultural heritage sites where there is a potential for disturbance during the construction phase and inclusion of the same in site induction.

APPENDIX 5.1

WIND FARMS & HEALTH LITERATURE REVIEW - CHAPMAN 2015

Summary of main conclusions reached in 25 reviews of the research literature on wind farms and health.

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1. Council of Canadian Academies (2015). Understanding the evidence. Wind Turbine Noise.
2. Schmidt JH, Klokker M (2014) Health effects related to wind turbine noise exposure: a systematic review. PLoS ONE 9(12): e114183. doi:10.1371/journal.pone.0114183
3. 2014: McCunney RJ, Mundt KA, Colby WD, Dobie R, Kaliski K, Blais M. Wind turbines and health: a critical review of the scientific literature. Journal of Occupational & Environmental Medicine 2014; 56(11):pe108-130.
4. 2014: Knopper LD, Olson CA, McCallum LC, Whitfield Aslund ML, Berger RG, Souweine K, McDaniel M. Wind turbines and human health. Frontiers in Public Health 2014; 19 June
5. 2014: Arra I, Lynn H, Barker K, Ogbuneke C, Regalado S. Systematic review 2013: association between wind turbines and human distress. Cureus 6(5): e183. doi:10.7759/cureus.183 [Note: this review is a very poor quality paper published in a non-indexed, pay-to-publish journal. A detailed critique of it can be found at the end of this file.]
6. 2014: National Health and Medical Research Council (Australia). University of Adelaide full report (296pp) and draft consultation report (26pp). Final Report (Feb 15 2015)
7. 2013: VTT Technical Research Centre of Finland. (in Finnish) – summary at end of document
8. 2013: Department of Health, Victoria (Australia) Wind farms, sound and health.
9. 2012: Massachusetts Department of Environmental Protection. Independent Expert Science Panel Releases Report on Potential Health Effects of Wind Turbines
10. 2012: Oregon Wind Energy Health Impact Assessment.
11. 2011: Fiumicelli D. Windfarm noise dose-response: a literature review. Acoustics Bulletin 2011; Nov/Dec:26-34 [copies available from simon.chapman@sydney.edu.au]
12. 2011: Bolin K et al. Infrasound and low frequency noise from wind turbines: exposure and health effects. Environmental Res Let 2011;
13. 2010: Knopper LD, Ollsen CA. Health effects and wind turbines: a review of the literature. Environmental Health 2010; 10:78
14. 2010: UK Health Protection Agency Report on the health effects of infrasound
15. 2010: NHMRC (Australia) Rapid Review of the evidence
16. 2010: Chief Medical Officer of Health in Ontario
17. 2010: UK Health Protection Agency. Environmental noise and health in the UK. A report by the Ad Hoc Expert Group on Noise and Health. (this report is about all environmental noise)

18. 2009: Minnesota Department of Health. Environmental Health Division. Public Health Impacts of Wind Turbines.
19. 2009: Colby et al. Wind Turbine Sound and Health Effects: An Expert Panel Review.
20. 2008: Chatham-Kent Public Health Unit.
21. 2007: National Research Council (USA): Impact of wind energy development on humans (Chapter 4: pp97-120) of: Environmental Impacts of Wind-Energy Projects.
22. 2006: Context and Opinion Related to the Health Effects of Noise Generated by Wind Turbines, Agence Française de Sécurité Sanitaire de l'Environnement et du Travail(Affset), 2006. (in French only)
23. 2005: Jakobsen J. Infrasound emission from wind turbines. *J Low Frequency Noise, Vibration and Active Control* 2005; 24(3):145-155
24. 2004: Leventhall G. Low frequency noise and annoyance. *Noise & Health 2004;*.6(23):59-72
25. 2003: Eja Pedersen's Review for the Swedish EPA

Reviews of the evidence - extracted highlights

Direct health effects from noise and WTS

- "There is no consistent evidence that noise from wind turbines—whether estimated in models or using distance as a proxy—is associated with self-reported human health effects. Isolated associations may be due to confounding, bias or chance." NHMRC (2014) full report

- "There are no direct pathological effects from wind farms and that any potential impact on humans can be minimised by following existing planning guidelines." *Source: NHMRC 2010*
http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects." *Source: Colby 2009 review*
http://199.88.77.35/EFiles/docs/CD/PlanCom/10_0426_IT_100416160206.pdf

- "... surveys of peer-reviewed scientific literature have consistently found no evidence linking wind turbines to human health concerns." *Source: CanWEA*
http://www.canwea.ca/pdf/CanWEA%20-%20Addressing%20concerns%20with%20wind%20turbines%20and%20human%20health.pdf

- "There is insufficient evidence that the noise from wind turbines is directly... causing health problems or disease." *Source: Massachusetts review*
http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf

- "There is no reason to believe, based on the levels and frequencies of the sounds and... sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences." *Source: Colby 2009 review* http://199.88.77.35/EFiles/docs/CD/PlanCom/10_0426_IT_100416160206.pdf

- "... while some people living near wind turbines report symptoms such as dizziness, headaches, and sleep disturbance, the scientific evidence available to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects. The sound level from wind turbines at common residential setbacks is not sufficient to cause hearing impairment or other direct health effects..." *Source: Ontario CMOH Report* http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf

- "... the audible noise created by a wind turbine, constructed at the approved setback distance does not pose a health impact concern."*Source: Chatham-Kent Public Health Unit* http://www.harvestingwindsupport.com/blog/wp-content/uploads/2011/03/Chatham-KentHealth-and-Wind-.pdf

- There is no evidence for a set of health effects, from exposure to wind turbines that could be characterized as a "Wind Turbine Syndrome." *Source: Massachusetts review* http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf

- "... there is not an association between noise from wind turbines and measures of psychological distress or mental health problems." *Source: Massachusetts review* http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf

- "Evidence that environmental noise damages mental health is… inconclusive." *Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

- "…no association was found between road traffic noise and overall psychological distress…"*Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

- "To date, no peer reviewed scientific journal articles demonstrate a causal link between people living in proximity to modern wind turbines, the noise (audible, low frequency noise, or infrasound) they emit and resulting physiological health effects." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf
  "... there is no scientific evidence that noise at levels created by wind turbines could cause health problems other than annoyance..." *Source: Eja Pedersen 2003 Review* http://www.naturvardsverket.se/Documents/publikationer/620-5308-6.pdf

  "None of the... evidence reviewed suggests an association between noise from wind turbines and pain and stiffness, diabetes, high blood pressure, tinnitus, hearing

impairment, cardiovascular disease, and headache/migraine." *Source: Massachusetts review* http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf

"...there are no evidences that noise from wind turbines could cause cardiovascular and psycho-physiological effects." *Source: Eja Pedersen 2003 Review* http://www.naturvardsverket.se/Documents/publikationer/620-5308-6.pdf

"…there was no evidence that environmental noise was related to raised blood pressure…"*Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

- "The health impact of the noise created by wind turbines has been studied and debated for decades with no definitive evidence supporting harm to the human ear." *Source: Chatham-Kent Public Health Unit* http://www.harvestingwindsupport.com/blog/wp-content/uploads/2011/03/Chatham-KentHealth-and-Wind-.pdf

- "The electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health..."*Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "... no consistent associations were found between wind turbine noise exposure and symptom reporting, e.g. chronic disease, headaches, tinnitus and undue tiredness." *Source: Bolin et al 2011 Review* http://iopscience.iop.org/1748-9326/6/3/035103/pdf/1748-9326_6_3_035103.pdf

- "... low level frequency noise or infrasound emitted by wind turbines is minimal and of no consequence... Further, numerous reports have concluded that there is no evidence of health effects arising from infrasound or low frequency noise generated by wind turbines." *Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "... renewable energy generation is associated with few adverse health effects compared with the well documented health burdens of polluting forms of electricity generation..." *Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "Although opposition to wind farms on aesthetic grounds is a legitimate point of view, opposition to wind farms on the basis of potential adverse health consequences is not justified by the evidence." *Source: Chatham-Kent Public Health Unit* http://www.harvestingwindsupport.com/blog/wp-content/uploads/2011/03/Chatham-KentHealth-and-Wind-.pdf

- "What is apparent is that numerous websites have been constructed by individuals or groups to support or oppose the development of wind turbine projects, or media sites

reporting on the debate. Often these websites state the perceived impacts on, or benefits to, human health to support the position of the individual or group hosting the website. The majority of information posted on these websites cannot be traced back to a scientific, peer-reviewed source and is typically anecdotal in nature. In some cases, the information contained on and propagated by internet websites and the media is not supported, or is even refuted, by scientific research. This serves to spread misconceptions about the potential impacts of wind energy on human health..." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf

- Afsset was mandated by the Ministries responsible for health and the environment to conduct a critical analysis of a report issued by the *Académie nationale de medicine* that advocated the use of a minimum 1,500 metre setback distance for 2.5 MW wind turbines or more. The Affset report concluded that "It appears that the noise emitted by wind turbines is not sufficient to result in direct health consequences as far as auditory effects are concerned. [...] A review of the data on noise measured in proximity to wind turbines, sound propagation simulations and field surveys demonstrates that a permanent definition of a minimum 1,500 m setback distance from homes, even when limited to windmills of more than 2.5 MW, does not reflect the reality of exposure to noise and does not seem relevant."

Annoyance

- "... wind turbine noise is comparatively lower than road traffic, trains, construction activities, and industrial noise."*Source: Chatham-Kent Public Health Unit* http://www.harvestingwindsupport.com/blog/wp-content/uploads/2011/03/Chatham-KentHealth-and-Wind-.pdf

- "There is consistent evidence that noise from wind turbines—whether estimated in models or using distance as a proxy—is associated with annoyance, and reasonable consistency that it is associated with sleep disturbance and poorer sleep quality and quality of life. However, it is unclear whether the observed associations are due to wind turbine noise or plausible confounders" NHMRC (2014) full report

- "The perception of noise depends in part on the individual - on a person's hearing acuity and upon his or her subjective tolerance for or dislike of a particular type of noise. For example, a persistent "whoosh" might be a soothing sound to some people even as it annoys others."*Source: NRC 2007* http://www.vawind.org/assets/nrc/nrc_wind_report_050307.pdf

- "... some people might find [wind turbine noise annoying. It has been suggested that annoyance may be a reaction to the characteristic "swishing" or fluctuating nature of wind turbine sound rather than to the intensity of sound." *Source: Ontario CMOH Report*

http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf

- "… being annoyed can lead to increasing feelings of powerlessness and frustration, which is widely believed to be at least potentially associated with adverse health effects over the longer term."*Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

- "Wind turbine annoyance has been statistically associated with wind turbine noise, but found to be more strongly related to visual impact, attitude to wind turbines and sensitivity to noise." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf

- "... self reported health effects like feeling tense, stressed, and irritable, were associated with noise annoyance and not to noise itself..." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf

- "... many of the self reported health effects are associated with numerous issues, many of which can be attributed to anxiety and annoyance." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf

- "To date, no peer reviewed articles demonstrate a direct causal link between people living in proximity to modern wind turbines, the noise they emit and resulting physiological health effects. If anything, reported health effects are likely attributed to a number of environmental stressors that result in an annoyed/stressed state in a segment of the population." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf

- "… some community studies are biased towards over-reporting of symptoms because of an explicit link between…noise and symptoms in the questions inviting people to remember and report more symptoms because of concern about noise." *Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

- "... it is probable that some persons will inevitably exhibit negative responses to turbine noise wherever and whenever it is audible, no matter what the noise level." *Source: Fiumicelli review abstract*

- "The major source of uncertainty in our assessment is related to the subjective nature of response to sound, and variability in how people perceive, respond to, and cope with sound." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "... sleep difficulties, as well as feelings of uneasiness, associated with noise annoyance could be an effect of the exposure to noise, although it could just as well be that

respondents with sleeping difficulties more easily appraised the noise as annoying." *Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "Even noise that falls within known safety limits is subjective to the recipient and will be received and subsequently perceived positively or negatively."*Source: Chatham-Kent Public Health Unit* http://www.harvestingwindsupport.com/blog/wp-content/uploads/2011/03/Chatham-KentHealth-and-Wind-.pdf

- "... annoyance was strongly correlated with a negative attitude toward the visual impact of wind turbines on the landscape..." *Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "Respondents tended to report more annoyance when they also noted a negative effect on landscape, and ability to see the turbines was strongly related to the probability of annoyance."*Source: Minnesota Health Dept 2009* http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf

- "[It is proposed that annoyance is not a direct health effect but an indication that a person's capacity to cope is under threat. The person has to resolve the threat or their coping capacity is undermined, leading to stress related health effects... Some people are very annoyed at quite low levels of noise, whilst other are not annoyed by high levels." *Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "Further, sounds, such as repetitive but low intensity noise, can evoke different responses from individuals… Some people can dismiss and ignore the signal, while for others, the signal will grow and become more apparent and unpleasant over time… These reactions may have little relationship to will or intent, and more to do with previous exposure history and personality." *Source: Minnesota Health Dept 2009* http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf

- "Stress and annoyance from noise often do not correlate with loudness. This may suggest [that other factors impact an individual's reaction to noise… individuals with an interest in a project and individuals who have some control over an environmental noise are less likely to find a noise annoying or stressful." *Source: Minnesota Health Dept 2009* http://www.health.state.mn.us/divs/eh/hazardous/topics/windturbines.pdf

- "There is a possibility of learned aversion to low frequency noise, leading to annoyance and stress..." *Source: Leventhall 2005 review* http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=59;epage=72;aulast=Leventhall

- "Noise produced by wind turbines generally is not a major concern for humans beyond a half mile or so because various measures to reduce noise have been implemented in the design of modern turbines."*Source: NRC 2007* http://www.vawind.org/assets/nrc/nrc_wind_report_050307.pdf

- "Noise… levels from an onshore wind project are typically in the 35-45 dB(A) range at a distance of about 300 meters... These are relatively low noise or sound-pressure levels compared with other common sources such as a busy office (~60 dB(A)), and with nighttime ambient noise levels in the countryside (~20-40 dB(A))." *Source: NRC 2007* http://www.vawind.org/assets/nrc/nrc_wind_report_050307.pdf

- "Complaints about low frequency noise come from a small number of people but the degree of distress can be quite high. There is no firm evidence that exposure to this type of sound causes damage to health, in the physical sense, but some people are certainly very sensitive to it." *Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

- "… there is the theoretical possibility that annoyance may lead to stress responses and then to illness. If there is no annoyance then there can be no mechanism for any increase in stress hormones by this pathway… if stress-related adverse health effects are mediated solely through annoyance then any mitigation plan which reduces annoyance would be equally effective in reducing any consequent adverse health effects. It would make no difference whether annoyance reduction was achieved through actual reductions in sound levels, or by changes in attitude brought about by some other means." *Source: Ad Hoc Expert Group on Noise and Health* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1279888026747

<u>Infrasound</u>

- "Infrasound is audible when the sound levels are high enough. The hearing threshold for infrasound is much higher than other frequencies. Infrasound from wind farms is at levels well below the hearing threshold and is therefore inaudible to neighbouring residents. There is no evidence that sound which is at inaudible levels can have a physiological effect on the human body . This is the case for sound at any frequency, including infrasound." http://docs.health.vic.gov.au/docs/doc/5593AE74A5B486F2CA257B5E0014E33C/$FILE/Wind%20farms,%20sound%20and%20%20health%20-%20Technical%20information%20WEB.pdf

- "Claims that infrasound from wind turbines directly impacts the vestibular system have not been demonstrated scientifically... evidence shows that the infrasound levels near wind turbines cannot impact the vestibular system." http://www.mass.gov/dep/public/press/0112wind.htm
- "There is no evidence that infrasound ... [from wind turbines ... contributes to perceived annoyance or other health effects." *Source: Bolin et al 2011 Review* http://iopscience.iop.org/1748-9326/6/3/035103/pdf/1748-9326_6_3_035103.pdf

- "There is no consistent evidence of any physiological or behavioural effect of acute exposure to infrasound in humans." *Source: UK HPA Report* http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1265028759369

- "... self reported health effects of people living near wind turbines are more likely attributed to physical manifestation from an annoyed state than from infrasound." *Source: Knopper&Ollson review* http://www.ehjournal.net/content/pdf/1476-069X-10-78.pdf

- "... infrasound from current generation upwind model turbines [is well below the pressure sound levels at which known health effects occur. Further, there is no scientific evidence to date that vibration from low frequency wind turbine noise causes adverse health effects." *Source: Ontario CMOH Report* http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf

- "It would appear... that infrasound alone is hardly responsible for the complaints... from people living up to two km from the large downwind turbines." *Source: Jakobsen 2005 review* http://multi-science.metapress.com/content/w6r4226247q6p416/

- "From a critical survey of all known published measurement results of infrasoundfrom wind turbines it is found that wind turbines of contemporary design with therotor placed upwind produce very low levels of infrasound. Even quite close to theseturbines the infrasound level is far below relevant assessment criteria, including thelimit of perception."*Source: Jakobsen 2005 review* http://multi-science.metapress.com/content/w6r4226247q6p416/

- "With older downwind turbines, some infrasound also is emitted each time a rotor blade interacts with the disturbed wind behind the tower, but it is believed that the energy at these low frequencies is insufficient to pose a health hazard." *Source: NRC 2007* http://www.vawind.org/assets/nrc/nrc_wind_report_050307.pdf

Shadow flicker

- "Scientific evidence suggests that shadow flicker [from the rotating blades of wind turbines does not pose a risk for eliciting seizures as a result of photic stimulation." *Source: Massachusetts review* http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf

- Shadow flicker from wind turbines… is unlikely to cause adverse health impacts in the general population. The low flicker rate from wind turbines is unlikely to trigger seizures in people with photosensitive epilepsy. Further, the available scientific evidence suggests that very few individuals will be annoyed by the low flicker frequencies expected from most modern wind turbines." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpa

ctAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "Flicker frequency due to a turbine is on the order of the rotor frequency (i.e., 0.6-1.0 Hz), which is harmless to humans. According to the Epilepsy Foundation, only frequencies above 10 Hz are likely to cause epileptic seizures." *Source: NRC 2007* http://www.vawind.org/assets/nrc/nrc_wind_report_050307.pdf

Community & social response to wind turbines

- The perception of sound as noise is a subjective response that is influenced by factors related to the sound, the person, and the social/environmental setting. These factors result in considerable variability in how people perceive and respond to sound... Factors that are consistently associated with negative community response are fear of a noise source... [and noise sensitivity..." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "Wind energy developments could indirectly result in positive health impacts... if they increase local employment, personal income, and community-wide income and revenue. However, these positive effects may be diminished if there are real or perceived increases in income inequality within a community." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "Effective public participation in and direct benefits from wind energy projects (such as receiving electricity from the neighboring wind turbines) have been shown to result in less annoyance in general and better public acceptance overall." *Source: Massachusetts review* http://www.mass.gov/dep/energy/wind/turbine_impact_study.pdf

- "... people who benefit economically from wind turbines [are less likely to report noise annoyance, despite exposure to similar sound levels as those people who [are not economically benefiting." *Source: NHMRC 2010* http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/new0048_evidence_review_wind_turbines_and_health.pdf

- "Landowners... may perceive and respond differently (potentially more favorably) to increased sound levels from a wind turbine facility, particularly if they benefit from the facility or have good relations with the developer..." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "The level of annoyance or disturbance experienced by those hearing wind turbine sound is influenced by individuals' perceptions of other aspects of wind energy facilities,

such as turbine visibility, visual impacts, trust, fairness and equity, and the level of community engagement during the planning process." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "Wind energy facilities... can indirectly result in positive health impacts by reducing emissions of [green house gases and harmful air pollutants, and... Communities near fossil-fuel based power plants that are displaced by wind energy could experience reduced risks for respiratory illness, cardiovascular diseases, cancer, and premature death." *Source: Oregon review* http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Oregon%20Wind%20Energy%20HIA%20Public%20comment.pdf

- "The environmental and human-health risk reduction benefits of wind-powered electricity generation accrue through its displacement of electricity generation using other energy sources (e.g., fossil fuels), thus displacing the adverse effects of those other generators." *Source: NRC 2007* http://www.vawind.org/assets/nrc/nrc_wind_report_050307.pdf

- "Community engagement at the outset of planning for wind turbines is important and may alleviate health concerns about wind farms. Concerns about fairness and equity may also influence attitudes towards wind farms and allegationsabout effects on health. These factors deserve greater attention in future developments." *Source: Ontario CMOH Report* http://www.health.gov.on.ca/en/public/publications/ministry_reports/wind_turbine/wind_turbine.pdf

Summary of 2013 VTA Finnish report

VTT Technical Research Centre of Finland has published a new study with a conclusion that wind turbines do not cause any adverse health effects. The study consisted of a review of nearly 50 scientific research articles conducted in Europe, USA, Australia and New Zealand over the past 10 years.

Due to the increased number of wind power projects in Finland, a growing concern has arisen among the public regarding the possible negative impacts wind energy production may have on human health. VTT Technical Research Centre of Finland conducted a comprehensive literature review covering nearly 50 scientific research articles. The review concluded that in the light of current scientific research, there is no evidence to show that the infrasound produced by modern wind turbines is anything but harmless.

The sound of a nearby wind farm is does not possess such qualities or volume that it would cause physical symptoms to humans. The study also concluded that the infra sounds below the auditory threshold does not constitute a health hazard. Additionally, most of the infra sound caused by a wind farm is mixed with other infra sound from the environment and

does therefore not cause any additional exposure. According to the research articles reviewed, the low frequency sound with potential hazardous health impacts would have to be of a higher volume than that caused by wind farms, in order to have an impact on our health. Also, concern that shadow flicker may cause epileptic seizures are overruled in the research material. Such seizures cannot be caused by the type of flicker the slow rotation speed of the wind turbine blades produce.

Commentary: Major problems with recent systematic review on wind farms and distress.

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At least 20 reviews of the evidence on whether wind turbines cause health problems including stress have been published since 2003 (1). Cureus recently published another (2) where the authors referenced none of these.

Highlights of the findings of these reviews may be found here (1). The most recent (2014) review by Australia's peak health and medical agency, The National Health and Medical Research Council (3) concluded:

"There is no consistent evidence that noise from wind turbines… is associated with self reported human health effects. Isolated associations may be due to confounding, bias or chance. There is consistent evidence that noise from wind turbines—whether estimated in models or using distance as a proxy—is associated with annoyance, and reasonable consistency that it is associated with sleep disturbance and poorer sleep quality and quality of life. However, it is unclear whether the observed associations are due to wind turbine noise or plausible confounders."

and

"The association between estimated noise level and annoyance was significantly affected by the visual attitude of the individual (i.e. whether they found wind farms beautiful, or ugly and unnatural) in the three studies that assessed this as a potential confounding factor. Residents in [one] study with a negative attitude to the visual impact of wind farms on the landscape had over 14 times the odds of being annoyed compared with those people without a negative visual attitude. …This means that factors other than the noise produced by wind turbines contribute to the annoyance experienced by survey respondents."

Against this background, I was curious to see what a new systematic review would conclude. According to the Cureus website, the new paper was peer reviewed. This is difficult to understand because of the sheer volume of major and minor problems it contains. Together, these make its contribution valueless to scholarly understanding of the

phenomenon of noise and health complaints about wind farms. The paper shows many signs of poor understanding of the subject matter of their review, of critical appraisal methods, of some basic conventions in systematic reviewing, of structuring in scientific writing, and much more besides.

The problems commence in the first line of the abstract where the confusing statement is made that "the proximity of wind turbines to residential areas has been associated with a higher level of complaints compared to the general population." I assume here that they are trying to say that those living near turbines have a higher prevalence of health complaints like sleep disturbance and general "human distress" than in the wider population. The prevalence of sleeping problems in general populations is as high as 33% (4) and reference material exists that quantifies the prevalence of many health problems in general populations (5, 6). Instead, the authors support their statement with a reference to a small qualitative study of 15 people both affected and unaffected by turbines (7). No conclusions about the prevalence of health problems in communities near turbines or in matched comparison populations can be drawn from that paper. I know of no published evidence that would allow such a statement to be made.

The authors state that their search strategy located 18 eligible papers but that these were based on six original studies. They explain that the 12 non-original "studies" (several of which were reviews or commentaries) were then excluded. Yet in their "key results" they proceed to describe the characteristics of all 18 papers and thus act as if these were not excluded ("All 18 peer-reviewed studies captured in our review found an association…").

The authors do not appear to understand what an "outcome" is. The abstract lists "outcome" variables that are not outcomes at all (such as study quality and journal name). These are independent variables, not dependent ones.

Their eligibility criteria for study selection are perplexing. What for example, is the difference between "peer-reviewed studies" and "studies published in peer-reviewed journals"? So too, is their noting that they searched the Cochrane Library for relevant studies. The Cochrane Library is a repository of reviews of evidence for health interventions, not for data on the prevalence of health complaints.

The authors seem not to understand the difference between studies and trials. For obvious reasons, there have been no trials conducted in this area.

Their main conclusions are that:

An association exists between wind turbines and distress in humans.

The existence of a dose-response relationship (between distance from wind turbines and distress) and the consistency of the association across studies .. argues for the credibility of this association.

The first conclusion is very imprecise and sweeping and ripe for being megaphoned by anti-wind farm interest groups as if it actually meant something. One of the six original studies reviewed (Salt & Hullar) (8) should have never been included in this review – see below. The Nissenbaum et a study (9) is listed as of moderate quality with a low risk of bias. Yet all three authors and two out of three reviewers of that paper are members of Society for Wind Vigilance, an anti-wind organization. Nissenbaum has been raising health concerns in study areas for several years, potentially biasing collected data. Neither of these problems is mentioned in this review. Two critiques of this study were published in Noise and Health pointing out the very poor quality of the results, analysis and the overstatements of conclusions (10, 11).

The Shepherd et al study (12) which the authors rate as of "high" quality, failed to make any mention that the small wind farm community involved had for years been subjected to a local wind farm opposition group fomenting anxiety about health issues (13). Indeed, with one exception (14), the five studies referenced were performed in areas where complaints of annoyance were being raised. But such farms are unlikely to be representative of all wind farms. As our work shows, over nearly 65% of wind farms in Australia have never received a single complaint (15), and 73% of complainants in Australia are concentrated around just 6/51 farms. The failure of the authors to note this fundamental problem of study sample selection bias is another major problem.

Among the five "original" studies they considered satisfied their selection criteria was a paper by Salt & Hullar (8). This paper is not in any way a "study" of "the association between wind turbines and human distress." It reports no original empirical data and is essentially a backgrounder on infrasound and the "possibility" that wind turbine might create auditory distress. It is unfathomable why this paper was included in the data set.

Table 2 purports to be a meaningful summary of the findings of these six studies on the association between turbine exposure and "distress". I would defy anyone to make any sense of the Table, particularly the column headed "does [sic] response".

By way of comparison to the lack of detail provided by the authors of this review, it is instructive to look at the results from the Dutch study which formed the basis of the

Pedersen 2009 paper(14) which were further analysed by Bakker et al (16) who noted that sleep disturbance was assessed by a question dealing with the frequency of sleep disturbance by environmental sound ("how often are you disturbed by sound?"). Two thirds of all respondents reported not being disturbed by any sound at all. Disturbance by traffic noise or other mechanical sound was reported by 15.2% of the respondents. Disturbance by the sound of people and of animals was reported by 13.4% of the respondents. Relevantly, disturbance by the sound of wind turbines was reported by only 4.7% of the respondents (6% in areas deemed to be quiet and 4% in areas deemed to be noisy). Bakker and colleagues (16) note that it was not clear from the study if there was a primary source causing sleep disturbance and how respondents attributed being awakened by different environmental sound sources. What was clear was that wind turbines were less frequently reported as a sleep disturbing sound source, than other environmental sounds irrespective of the area type (quiet versus noisy). Analysis showed that among respondents who could hear wind turbine sound, annoyance was the only factor that predicted sleep disturbance. The authors speculated that being annoyed might contribute to a person's sensitivity for any environmental sound, and the reaction might be caused by the combination of all sounds present. It might also be the case that people annoyed by wind turbine noise attribute their experience of sleep disturbance to wind turbine noise, even if that was not the source of their awakening.

Swathes of the paper are given over to descriptions of their efforts to rate the levels of evidence in the four reviewed studies. But they never ever describe their approach in any way that might permit replication of how they went about such rating. How was level of evidence actually determined? It should have been explicitly defined in the text. Their discussion of the risk of bias across studies is bizarre. "The quality of the study could be confounded by journal name and author". Surely the authors mean here that the evaluation of the quality of the study could be biased by this knowledge. The term "confounded" has another meaning.

Their "key results" consist of no more than five bullet points. These read like draft notes-to-self (eg: None of these studies captured in our review found any association (potential publication bias)".

The authors chose to use the term "distress" instead of "annoyance". The American Medical Dictionary defines distress as 1. Mental or physical suffering or anguish or 2. Severe strain resulting from exhaustion or trauma. Annoyance on the other hand is defined as 1. The act of annoying or the state of being annoyed or 2. A cause of irritation or vexation; a nuisance. (The American Heritage Dictionary of the English Language, Fourth Edition copyright 2000) and is generally identified as a highly subjective state in medical literature. It is clear that the authors chose a stronger term than was used by the majority of studies. Most literature refers to annoyance, while the referenced alternative of "Wind Turbine Syndrome" was coined in a vanity press published case study with extraordinary weaknesses of selection bias, methodology and analysis (17). Similarly, "extreme annoyance" is rarely used in the

literature. Annoyance is by far the most commonly used term in the material referenced, so it is unclear why “distress” was chosen.

The paper is riddled with imprecise, mangled and contradictory language. For example: key finding 1: “All 18 peer-reviewed studies captured in our review found an association…” and key finding 2: “None of these studies captured in our review found any association (potential publication bias)”; infelicitous prose: “these complaints are coined in research”; “There might be a theoretical incline to give studies in high impact journals higher quality…”; basic grammatical errors: “the study’s principle outcome”; “there was no missing data.” It is unconventionally structured with extremely scant results and methods sections providing no adequate explanations of how key decisions on quality or bias were made.

The publication of this very poor paper is regrettable.

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APPENDIX 5.2

EMF & YOU

Energy for generations

EMF & YOU

Information about Electric & Magnetic Fields and the electricity network in Ireland

April 2017

ABOUT ESB

ESB was established in 1927, as a corporate body in the Republic of Ireland under the Electricity (Supply) Act of 1927. Since then, ESB has been providing energy for those life moments, big and small, profound and everyday where electricity influences people's lives for the better. As a strong, diversified, vertically integrated utility, ESB operates right across the electricity market: from generation, through transmission and distribution to supply of customers.

ESB is fully committed to protecting the health and safety of employees, contractors, customers and the public. Safety is a core company value of ESB and this value guides the approach to safety across all business activities. Arising from concerns about possible adverse health effects resulting from exposure to electric and magnetic fields (EMF) from electrical equipment, such as power lines and appliances, ESB has set out its policy in relation to this topic in this booklet.



WELCOME

ESB understands that some people may have concerns about the potential side effects of frequent EMF exposure on health. Over the last 35 years, there has been considerable public debate surrounding EMF and this has generated many questions.

The main interest of people in this country has centred around the fields produced by ESB overhead power transmission lines, but questions have also been asked about the fields produced by other electrical sources such as household electrical appliances, distribution lines and substations. In accordance with our desire to deal in an open manner with this issue we are providing you with information on this subject, covering key questions such as:

- What are EMFs?
- What studies have been carried out so far?
- Are there risks to human health?
- What is the national and international guidance on EMF exposure?
- Do power lines affect animals?
- Should people take any special precautions against EMF?

The quality of your living and working environment, along with the welfare of livestock and farm crops is of the utmost importance to us at all times. All of ESB Networks plant and equipment complies with the European Recommendation (1999/519/EC) on the limitation of exposure of the general public to electromagnetic fields (0Hz to 300 GHz). Despite over 35 years of intensive research into power frequency EMFs, the international overriding scientific consensus is that EMFs, as generated from power lines, do not cause any adverse long term health effects.

We hope you find this booklet useful and informative and that it provides the answers to the questions currently being asked on this issue, which first became an area of Irish public concern in the 1980s. To explain any technical terms used in the following pages, a glossary has been included on page 32. Please contact ESB for more information or visit our website at www.esb.ie

Pat O'Doherty, Chief Executive



WHAT ARE ELECTROMAGNETIC FIELDS?

Electromagnetic Fields have been recognised since electricity was discovered and have been the subject of thousands of scientific studies across the globe.

Our knowledge and understanding of EMF has grown significantly in recent years.

Electric and Magnetic Fields occur both naturally and from man-made sources.

All electricity, both natural and man-made, produces two types of fields: electric fields and magnetic fields. EMF are produced by natural phenomena which have been a constant part of the environment throughout human evolution. For instance, the Earth has a natural electric field and a magnetic field.

The most common source of man-made EMF that we encounter is electricity.

The man-made sources include all electrical systems including house wiring, electrical appliances and overhead and underground power lines. In Ireland the voltage in homes is 230V. Electricity in Ireland is transmitted at voltages of up to 400,000V (400kV).

The Electric Field

The electric field depends on voltage. The higher the voltage, the stronger the electric field. You can imagine it as being like pressure in a water pipe. A 400kV power line produces a higher electric field than a 110kV power line. The magnitude of an electric field is expressed in volts or kilovolts (thousands of volts) per metre. This is written as V/m or kV/m.

Electric fields are strongest closest to a power line and their level reduces quickly with distance. Electric fields are blocked by buildings, trees etc.

Therefore, inside a typical house the dominant sources of electric fields are typical household appliances such as microwave ovens, hair-dryers and electric blankets.

There are no external electric fields associated with underground cables. This is because the electric field produced is contained within the cable.

The Magnetic Field

The magnetic field is produced by moving electric charges and so the strength of the magnetic field varies directly with the current flows in lines or cables. As a result, the magnetic field can vary at different times during the day. You can imagine this as being like the flow rate of water in a water pipe. Magnetic fields are measured in units of microtesla (μT). Unlike electric fields, magnetic fields are not blocked by buildings, trees etc. Like electric fields, magnetic fields are highest closest to an electricity line or cable and their level reduces quickly with distance from the line or cable.

Appliances that use a lot of power, such as electric heaters or cookers, generate higher levels of magnetic fields than lower powered appliances.

Q Why does a fluorescent light glow under a high voltage powe line?

There is a well-known phenomenon whereby a fluorescent light will glow dimly if placed below a high-voltage power line. This effect is caused by the electric field. The electric field causes a tiny current (measured in millionths of an ampere) to flow through the mercury vapour inside the tube which casts a weak glow. The moment you move the fluorescent light away from the line, the electric field weakens and the light goes out. This phenomenon has no impact on people or other organisms.



WHAT IS THE ELECTROMAGNETIC SPECTRUM?

Electromagnetic energy travels in waves. These waves span a broad range of frequencies from static frequency (fields that do not change direction with time) at one end of the spectrum, to very high frequency (fields that change billions of times per second) at the other end of the spectrum.

The electromagnetic spectrum shown in Figure A identifies the various types of electromagnetic energy based on their frequency. The earth's magnetic field is largely constant and therefore is described as a static field. Its frequency is very low or zero. The earth's static magnetic field (which acts like a giant bar magnet) causes a compass to align north-south.

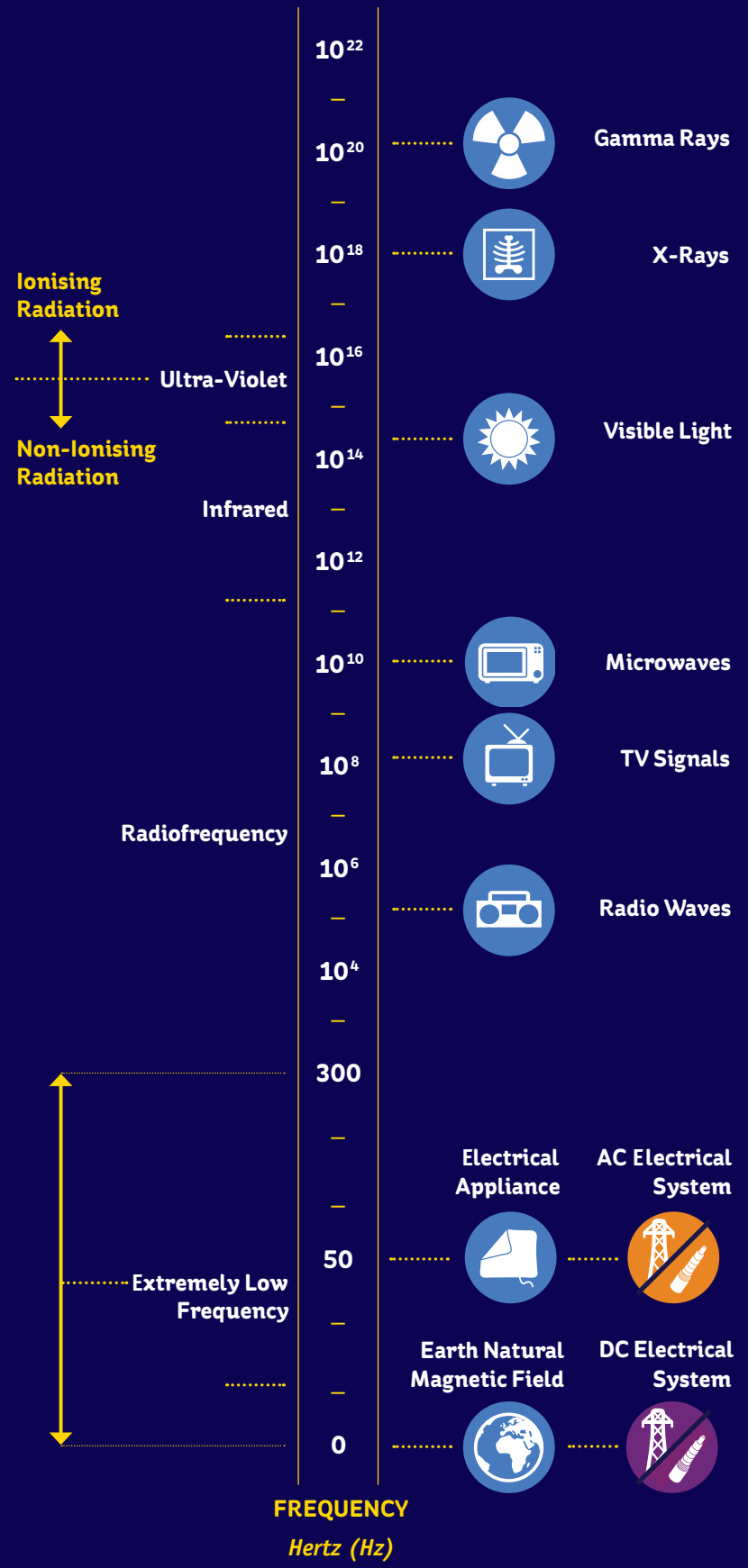
Most man-made sources of electric and magnetic fields fluctuate in direction and intensity. They are called time-varying or alternating current fields (AC). Time-varying or AC fields come from anything that runs on electricity, from electrical installations to household appliances.

Their frequency is expressed in Hertz (Hz). Hertz is the rate at which the field alternates back and forth per second. The electric power system operates at 50Hz in Ireland and Europe and 60Hz in some other places such as North America and thus is a source of EMF at these frequencies. Such frequencies are in the extremely low frequency (ELF) range, 0-300Hz. The ELF EMF from all electrical equipment are time-varying fields with a dominant frequency of 50Hz in Ireland/Europe.

The strength of the EMF or field depends on how close you are to the equipment. Hence the EMF a person can experience from a household appliance can be similar or higher than that from transmission lines because you can be much closer to the household appliance than an overhead transmission line, which is usually several metres or more away from you.

THE ELECTROMAGNETIC SPECTRUM

FIGURE A



ARE EMFs ASSOCIATED WITH ELECTRICITY THE SAME AS RADIATION?

No. The fields resulting from electricity are fundamentally different from x-ray and gamma ray radiation.

Whilst these are all forms of electromagnetic energy there are important fundamental differences.

The term radiation is usually used to refer to ionising energy. Ionising means that, if the radiation is sufficiently strong, it can break bonds in molecules and therefore damage biological molecules including the DNA of cells. Only the high-frequency portion of the electromagnetic spectrum is ionising. This includes, x-rays, gamma rays and ultraviolet light.

The energy in visible light, radio frequency and fields in the static and 50Hz ranges, including electricity, are all classified as non-ionising.

It is very important to realise that 50Hz fields, i.e. electricity, are non-ionising. They have insufficient energy to ionise molecules. Examples of non-ionising energy include EMF from the earth and electric power sources, radio waves and TV waves, microwaves, and most frequencies of visible light. *See figure A, page 9.*



WHAT SCIENTIFIC STUDIES ON THE HEALTH IMPACT OF EMF HAVE BEEN CARRIED OUT?

Since 1979 many scientific studies have been carried out on the possible effects of EMF on people.

To determine if something is harmful to health, scientists evaluate the results from three different types of studies.

1. Epidemiological Studies

Epidemiology is the study of patterns of disease in populations. It searches for statistical links or associations between exposures, such as EMF, and disease in human populations. Epidemiological studies are usually observational, meaning that researchers investigate, but do not try to change, what happens as people go about their daily lives. As a result, epidemiological studies are susceptible to certain kinds of errors that lead an exposure and a disease to be associated even when one does not cause the other. For example, the positive association between number of doctors per capita and mortality rates arises not because doctors increase mortality, but rather because of social and economic factors such as industrialisation and job opportunities. Likewise, just because persons with a certain health condition live near electric power sources does not mean that the fields from these power sources caused the condition. Other environmental and behavioural causes would have to be ruled out, as would the possibility that some people moved to the area after already developing the health condition.

2. Experimental Studies – People and Animals

These studies involve exposing people or animals to EMF in controlled laboratory conditions and looking for biological changes. For practical reasons, human experimental studies of EMF are usually short-term. Experimental studies generally study effects of short-term exposures.

3. Experimental Studies – Cells and Tissues

These studies involve exposing isolated tissues and cells to EMF in controlled laboratory conditions to investigate potential mechanisms of interaction.

TWO TYPES OF TECHNOLOGY

Transmission systems worldwide are typically constructed as overhead lines and in some cases underground cables are used.

Two types of technology can be used to transmit electricity. Both AC and DC power lines produce electric and magnetic fields. AC lines produce AC electric and magnetic fields and DC lines produce static electric and magnetic fields. ESB Networks transmission and distribution networks are AC systems.

When electricity transmission cables are placed underground, the metallic shielding of the cables block the electric field from the cables above the ground, but this shielding does not block the magnetic field from the cables.

ALTERNATING MAGNETIC FIELDS



STATIC MAGNETIC FIELDS

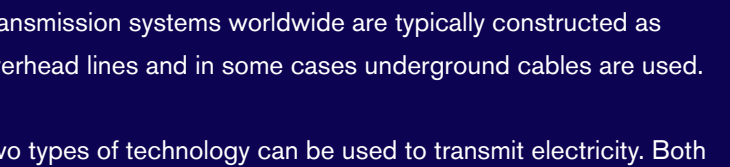


Figure B. Schematic comparison of AC and DC current flow and the resulting magnetic fields.

THE EFFECT OF DISTANCE ON MAGNETIC FIELDS

Both AC and DC technologies produce magnetic fields and both decrease with distance as you move away from the line or cable. See graph below:

AC LINES AND CABLES

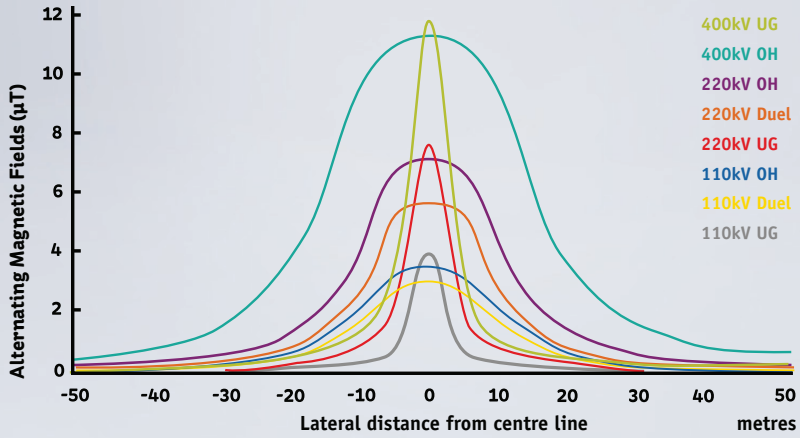


Figure C Illustrates the magnetic field from overhead AC lines operating in Ireland. The field strength decreases with distance. The fields from these AC lines are far below the 1998 ICNIRP Guidelines for exposure to AC magnetic fields (100µT). In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200µT reference level for exposure for the general public, but these have not yet been adopted by the European Union.





WHAT DO HEALTH AND SCIENTIFIC AGENCIES SAY ABOUT RESEARCH ON AC MAGNETIC FIELDS AND HEALTH?

National and international health and scientific agencies have reviewed more than 35 years of research including thousands of studies.

None of these agencies has concluded that exposure to ELF-EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health.
Agencies have recognised a statistical association between estimated higher long-term exposures to magnetic fields and childhood leukaemia in some epidemiological studies. However they have not been able to rule out the contribution of chance, selection bias and other factors to explain this association with reasonable confidence. Neither long-term studies of animals, nor studies of cellular mechanisms, have confirmed a biological basis for such an association. This explains why no health agency has concluded that there is a causal relationship between magnetic fields and health effects.

SCENIHR is the European Union's Scientific Committee on Emerging and Newly Identified Health Risks. The committee provides opinions on emerging or newly-identified health and environmental risks.

On 4 February 2014, SCENIHR published its "Preliminary opinion on Potential health effects of exposure to electromagnetic fields (EMF)". This is an update to its 2009 opinion.

The committee reported that new epidemiology studies do not shed light on a previously reported association with childhood leukaemia. Shortcomings in these studies, and a lack of experimental support from animal studies or cellular evidence prevent a causal interpretation of this statistical association.

Several recent epidemiology studies examined residential proximity to power lines and childhood leukaemia risk, but overall provided no new evidence for an association. In the largest study to date, Bunch et al. (2014) provided an extension and update to the 2005 study in the United Kingdom by Draper et al.

The authors extended the study period by 13 years (1962-2008), included lower voltage lines (132kV) in addition to 275/400kV lines, and included Scotland in addition to England and Wales in their analyses. Bunch et al. (2014) included over 53,000 childhood cancer cases and over 66,000 healthy control children and reported no overall association with residential proximity to 132kV, 275kV, and 400kV power lines for leukaemia or any other cancer among children.

The statistical association with distance that was reported in the earlier Draper et al. (2005) study was not apparent in this extended analysis.

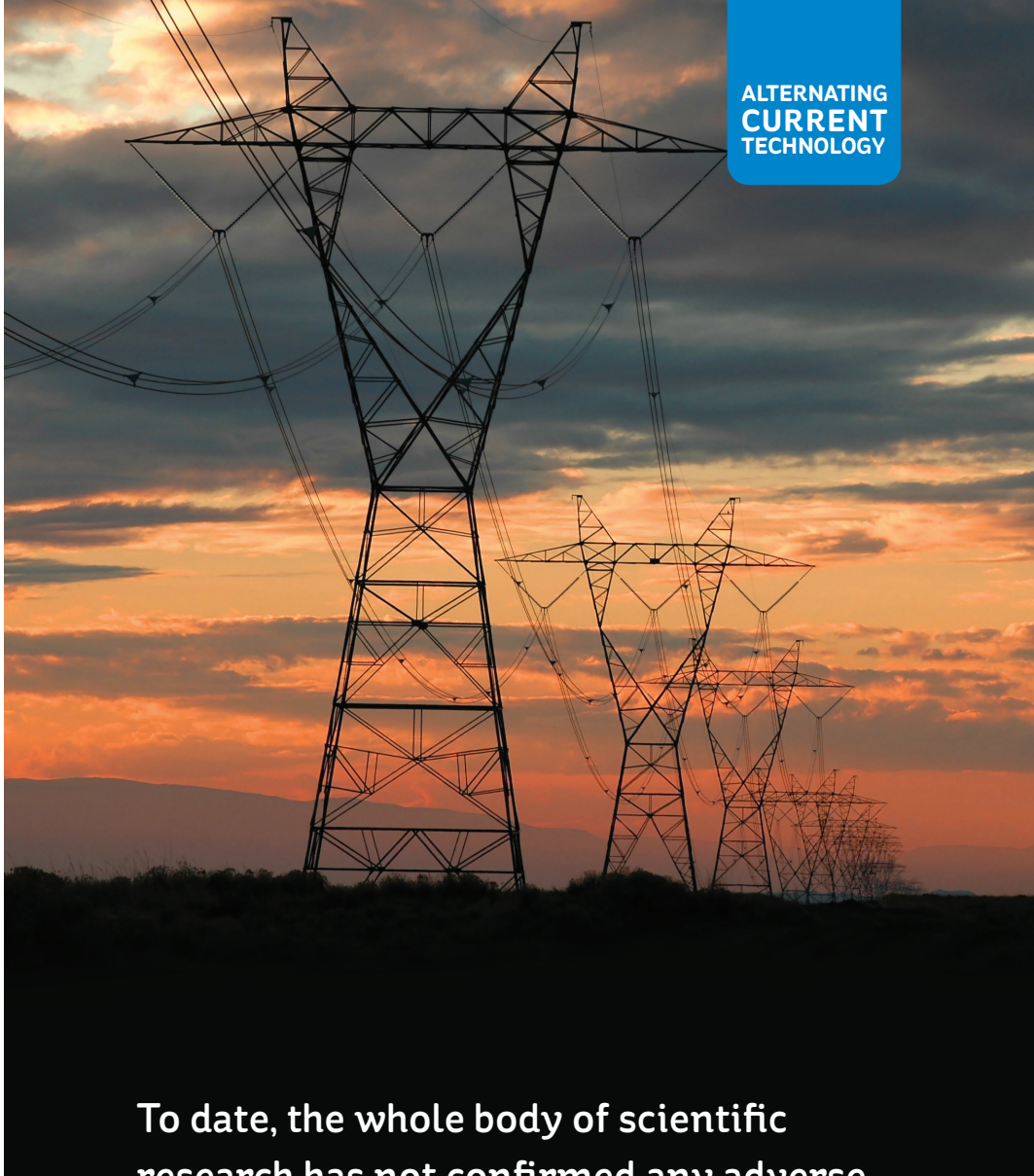
No health agency has concluded that exposure to EMF from power lines and other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health.

In 2007, the World Health Organisation updated the International Agency for Research on Cancer (IARC) report with the publication of its comprehensive review of ELF-EMF health research.[1]

The conclusions of the World Health Organisation report can be summarised as follows:

- The research does not establish that exposure to EMF of the nature associated with power lines causes or contributes to any disease or illness.
- There are no substantive health issues related to electric fields at levels generally encountered by members of the public.
- While epidemiology studies have reported a weak statistical association between childhood leukaemia and long-term exposures to magnetic fields greater than 0.3-0.4μT, this association is not supported by the laboratory studies and has not been considered a causal relationship.
- The animal studies as a whole do not show adverse effects, including cancer, among animals exposed to high levels of magnetic fields.
- The laboratory studies on cells and tissues have not confirmed any explanation as to how weak magnetic fields could cause disease.
- Because the epidemiology studies have limitations and the experimental studies provide little or no support for an association with cancer or mechanisms to cause cancer, the World Health Organisation did not conclude that magnetic fields cause childhood leukaemia. Thus, considering all of the research together, the reviewers for the World Health Organisation did not conclude that magnetic fields cause any long-term, adverse health effects.
- The view of the World Health Organisation on ELF-EMF and health issues provided on its website is "based on a recent in-depth review of scientific literature, [we conclude] that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields".[2]

[1] http://www.who.int/peh-emf/publications/elf_ehc/en/index.html
[2] http://www.who.int/peh-emf/about/whatisemf/en/index.html



To date, the whole body of scientific research has not confirmed any adverse effect to human health from EMF.

Independent international health and scientific agencies are continuing to review and monitor the possibility of health effects from exposure to EMF. They are doing this not because they have identified a problem but to ensure that even the smallest possibility of a health risk has not been overlooked, given that everyone in the developed world is exposed to EMF.

The findings of these agencies carry considerable weight, as they reflect the judgements of groups of multiple scientists rather than the views of individuals.

The World Health Organisation stated that the scope of any actions we may take to reduce EMF exposure, either personally or as a society, should be proportional to the strength of the science. The actions to reduce exposure should be very low in cost and should not compromise the health, social and economic benefits of electricity to our society.

WHAT IS THE VIEW OF THE IRISH GOVERNMENT?

In March 2007, Ireland's Department of Communications, Marine and Natural Resources (DCMNR) assembled a panel of independent scientists to review EMF and radio frequency research. The conclusions are summarised in the document entitled "Health Effects of Electromagnetic Fields". The conclusions of this report were consistent with those of The International Agency for Research on Cancer (IARC), the World Health Organisation and other national and international agencies. In relation to EMF, the report states:

'No adverse health effects have been established below the limits suggested by international guidelines.'

In 1988 and 1992, The Department of Energy (Dr T. McManus) published comprehensive assessments of scientific research on electromagnetic fields. In summary of the views of the national and international organisations who have produced reports and addressed the issue, Dr. McManus concludes 'Without exception these reports and the position taken by the organisations concerned do not see enough evidence to be able to indict electromagnetic fields as a hazard to health'.

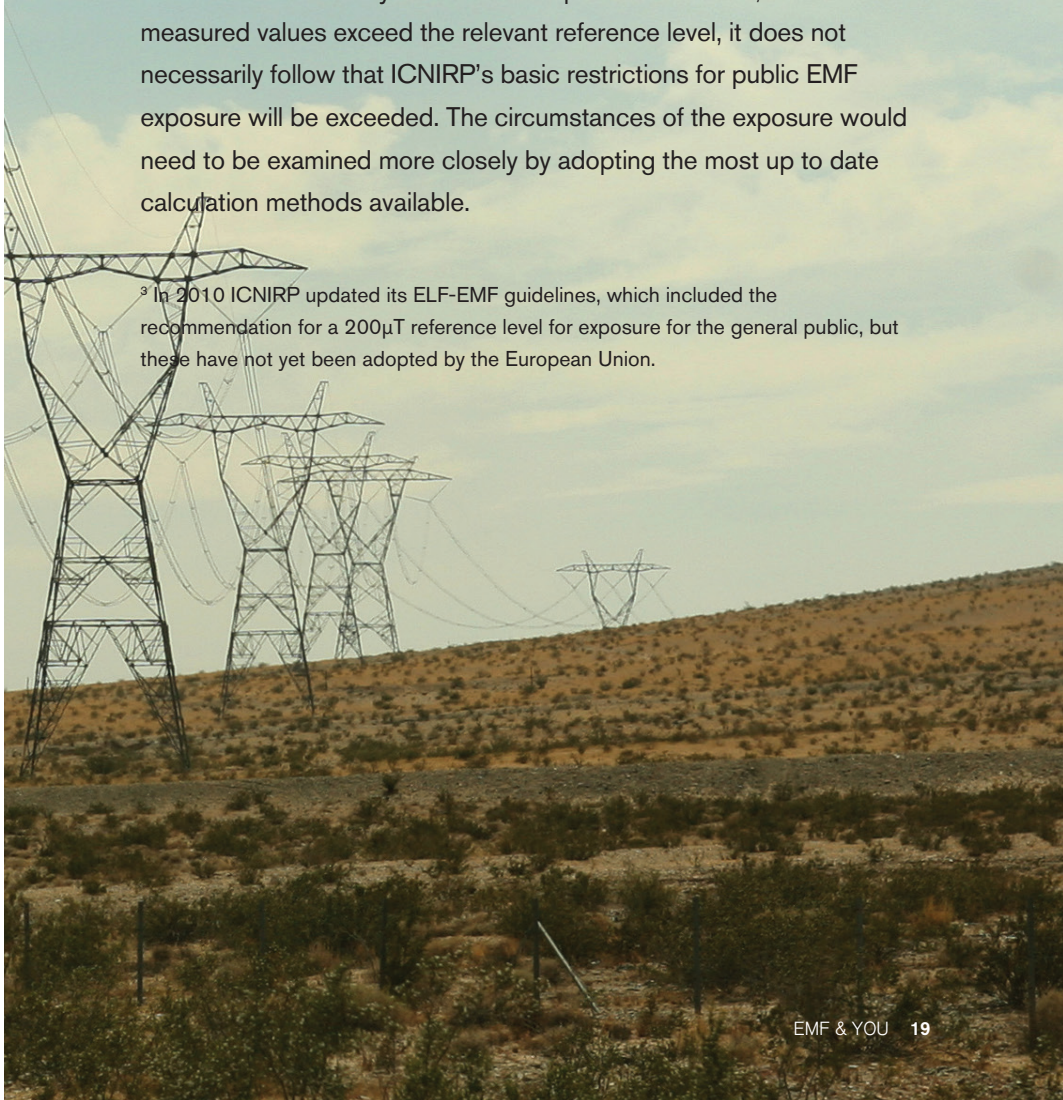
In 2011, Professor Denis O'Sullivan, Chief Scientific Advisor to the Irish Government published an updated review entitled 'A Review of Recent Investigations into the Possible Health Effects of Exposure to Electromagnetic Fields (EMF) from Power Lines'. In relation to possible long term health effects Professor O'Sullivan concludes that 'the lack of positive findings in controlled experiments or in studies on animals further weakens the belief that this association is in fact, a real one. Furthermore, there is no known biological explanation for the effect. It is simply not possible for the level of energies associated with power lines to cause cancer'.

WHAT IS THE VIEW OF THE EUROPEAN UNION?

In 1999, the Council of the European Union adopted a recommendation in relation to public and occupational exposure to EMF. This recommendation applies the exposure guidelines advocated in 1998 by the ICNIRP, to locations where people spend significant time.

The 1998 ICNIRP guidelines specify limits on exposure to EMF, which are called 'basic restrictions'. To make sure that these basic restriction limits are not exceeded, conservative measurable 'reference levels' for both electric and magnetic field exposure are provided. For the general public these reference levels at 50Hz are 5kV/M and 100μT.[3] If the EMF exposure level is less than the reference level, compliance with the basic restriction is assured. However, if exposure exceeds the reference level, the circumstances of the exposure need to be examined more closely to confirm compliance. However, even if the measured values exceed the relevant reference level, it does not necessarily follow that ICNIRP's basic restrictions for public EMF exposure will be exceeded. The circumstances of the exposure would need to be examined more closely by adopting the most up to date calculation methods available.

[3] In 2010 ICNIRP updated its ELF-EMF guidelines, which included the recommendation for a 200μT reference level for exposure for the general public, but these have not yet been adopted by the European Union.





ARE THERE ANY PRECAUTIONS THAT NEED TO BE TAKEN?

A 2007 Government report stated that, while there is limited scientific evidence of an association between ELF-EMF and childhood leukemia, considerable research carried out in laboratories does not support this possibility.

Nevertheless, the report recommended that the evidence should not be discounted and suggested no-cost, or lowcost, precautionary measures to lower people's exposure to ELF fields.

As a precautionary measure, it recommended that future power lines and power installations should be sited away from heavily populated areas. The report also noted that lowering international guideline limits as a precautionary measure is not recommended by the World Health Organisation.

These precautionary goals are achieved by routing transmission lines as far from existing residences as is reasonably possible, optimising the phasing of adjacent lines, and incorporating stakeholder input during the consultation process carried out in the development of new electricity infrastructure.

Source: Report from Expert Group on the Health Effects of Electromagnetic Fields for Department of Communications, Marine and Natural Resources, 2007.

DO POWER LINES AFFECT ANIMALS?

As with human health, some have expressed concern about the potential effects of EMF from high-voltage transmission lines on animal health, welfare, behaviour and productivity.
The potential effects from EMF on both economically important domesticated animal species and wildlife have been investigated since the 1970s. This has led to a good understanding of the potential means by which EMF could affect organisms in the vicinity of power lines.
Overall, the research does not show that EMF have adverse effects on the health, behaviour or productivity of animals, including livestock.

The substantial body of research on wild and domestic animals is informative for all large mammals and does not indicate any risk. Thus, there is no scientific basis in the research literature to conclude that the presence of a transmission line would create conditions that would impair the health of animals or would precipitate abnormal behaviour.
Studies on dairy cows, for example, failed to find any consistent variation in fertility, hormone levels, milk fat content or dry matter intake beyond what would be expected due to normal variation even when exposed to ELF-EMF far stronger than would occur from the Irish transmission system.
Other research on sheep has examined the effect of ELF-EMF on weight gain, wool production, behaviour, onset of puberty and immune function. None of the studies showed consistent or replicated evidence of adverse effects.

Crops, Plants and Trees

As scientific literature has accumulated, both from laboratory and field studies, on the potential effect of EMF from transmission lines on plants, including agricultural crops and trees, and forest and woodland vegetation, no adverse effects on plants have been reported from electric and magnetic field exposures at levels comparable to those near high-voltage transmission lines.



WHERE CAN I FIND MORE INFORMATION ON EMFS?

The following sources are recommended should you require more detailed information on EMFs.

- The World Health ORGANISATION – International EMF Project(2007)
  www.who.int/mediacentre/factsheets/fs322/en/index.html

- The European Health Risk Assessment Netw ork on Electromagnetic Fields Exposure (2010)
  http://efhran.polimi.it/docs/EFHRAN_D2_final.pdf

- Health Protection Agency
  www.hpa.org.uk/Topics/Radiation/UnderstandingRadiation/UnderstandingRadiationTopics/ElectromagneticFields/ElectricAndMagneticFields/HealthEffectsOfElectricAndMagneticFields/

- Department of Communications, Climate Action & Environment
  www.dccae.gov.ie

- European Commission
  http://ec.europa.eu/enterprise/sectors/electrical/documents/lvd/electromagnetic-fields/

- International Agency for Research on Cancer
  www.iarc.fr/en

- International Commission on Non-ionising Radiation Protection
  www.icnirp.de

- Scientific Committee of the European Commissions
  http://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenihr_consultation_19_en.htm

WHAT IS ESB'S POSITION AND COMMITMENT?

ESB's position on EMF and health is based on the authoritative conclusions and recommendations of established national and international health and scientific agencies which have reviewed the body of scientific research.

These agencies have consistently concluded that the research does not indicate that EMF cause any adverse health effects at the levels encountered in our everyday environment and that compliance with the existing ICNIRP standards provides sufficient public health protection.

ESB recognises that some individuals are concerned about issues regarding EMF and health. ESB is committed to addressing these concerns. By continuing to closely monitor engineering and scientific research in this area and provide information to the general public and to ESB staff on this issue.

ESB's policy in relation to this issue is as follows:

i. ESB shall apply all legal requirements relating to EMF in Ireland, Northern Ireland, UK and in other jurisdictions where local legislation does not set as high a standard.
ii. ESB shall design and operate generation, transmission and distribution networks and telecommunications infrastructure in compliance with legislation and with due regard to the latest recommendations and guidance of leading international experts and independent bodies on EMF.
iii. ESB shall closely monitor and support engineering / scientific research on EMF.
iv. ESB shall comply with the requirements of 1999/519/EC regarding the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz).
v. ESB shall provide information for the public on its website about the hazards and risks associated with EMF arising out of ESB equipment and/or premises.

AC ELECTRIC FIELDS

Graph 1. The graphic shows some examples of different sources of electric fields and how they compare to typical electric fields associated with overhead electricity lines that make up part of the electricity grid in Ireland.

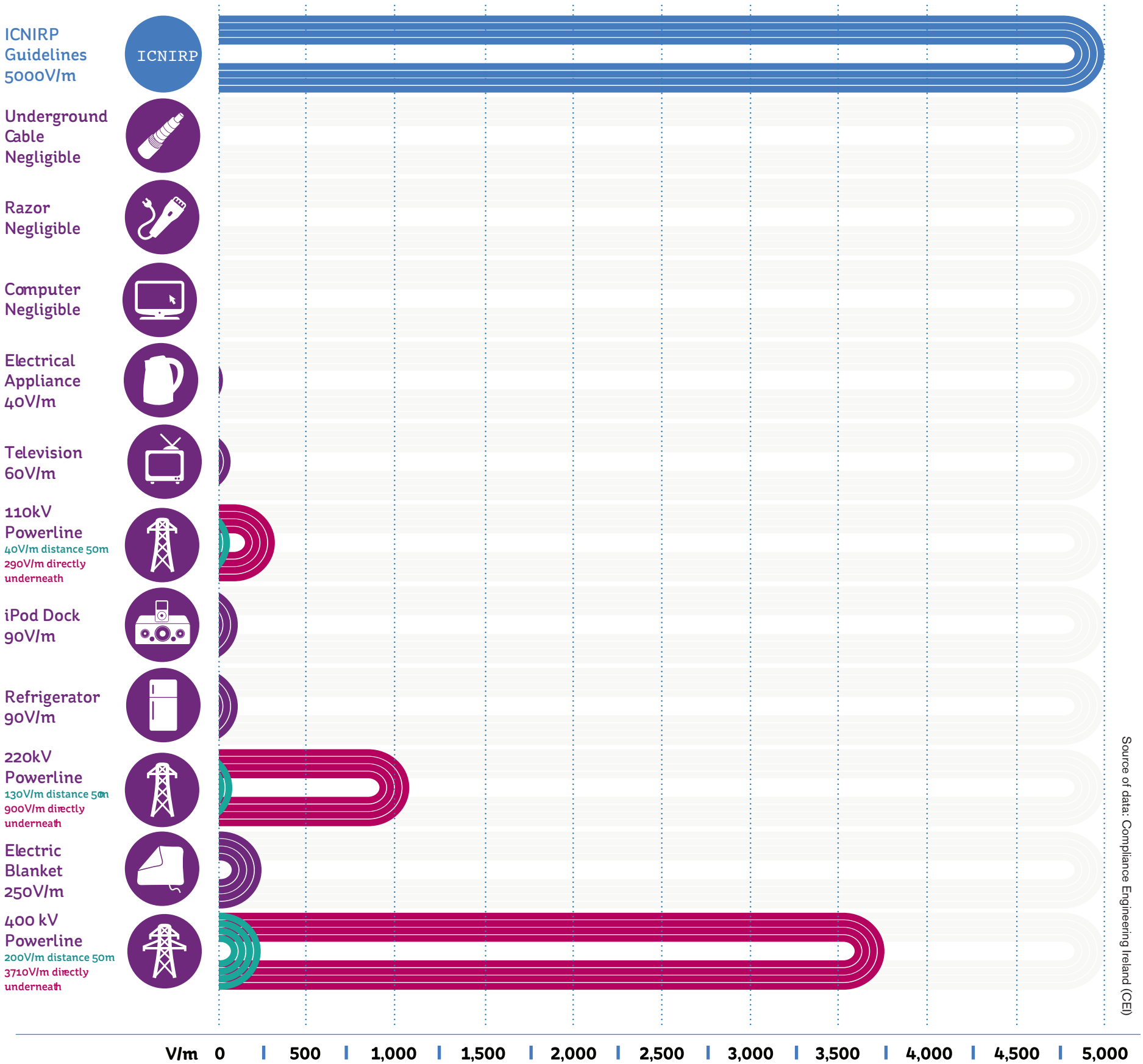
The graph also references the ICNIRP guidelines for exposure to electric fields set to ensure public health and safety.

The International Commission on Non-Ionising Radiation Protection (ICNIRP) was established in 1992.

This independent scientific commission was established to advance non-ionising radiation protection for the benefit of people and the environment. It provides science-based guidance and recommendations including independent international guidelines and recommended limits of exposure. ICNIRP is formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

This provides an indication of approximate fields from lines and appliances.

COMPARISON OF AC ELECTRIC FIELDS FROM COMMON SOURCES



5kV/m is a reference value, 9.2KV/m is maximum allowable electric field as per the ICNIRP recommendations (using the Dimbylow calculations).

AC MAGNETIC FIELDS

Graph 2. The graphic opposite shows some examples of different sources of magnetic fields and how magnetic field levels from these sources compare to typical magnetic field levels from electricity lines or cables that make up part of the electricity grid in Ireland.

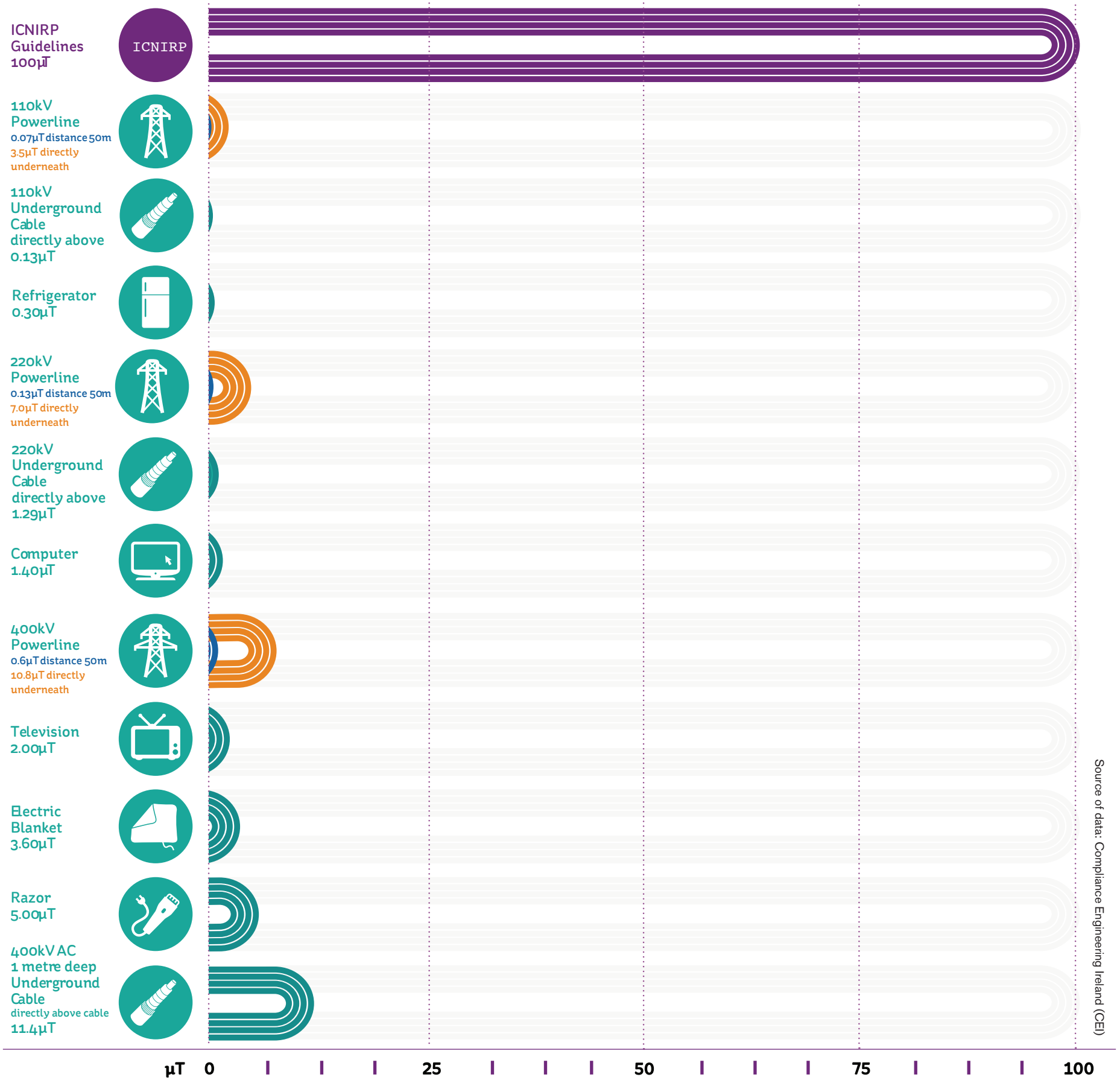
The graph also references the ICNIRP guidelines for exposure to magnetic fields set to ensure public health and safety.

The International Commission on Non-Ionising Radiation Protection (ICNIRP) was established in 1992.

This independent scientific commission was established to advance non-ionising radiation protection for the benefit of people and the environment. It provides science-based guidance and recommendations including independent international guidelines and recommended limits of exposure. ICNIRP is formally recognised by the World Health Organisation and the European Union as the non-governmental standard setting body for EMF.

This graphic provides an indication of approximate fields from lines and appliances.

COMPARISON OF DIFFERENT SOURCES OF AC MAGNETIC FIELDS (μT)



Source of data: Compliance Engineering Ireland (CEI)

GLOSSARY

AC (ALTERN ATING CURRENT)

Electricity that changes direction at regular intervals is described as AC electricity. AC is the form in which electricity is delivered to our homes and businesses. This is the type of electricity used mainly on the Irish transmission system and in every other system in the world.

CARCINOGENIC

Any substance or agent, including ionising radiation, that causes cancer.

CONDUCTOR

An object or material that can carry electricity, like the power cables used in an overhead line.

CURRENT

The movement of an electrical charge similar to the rate of fluid flow in a pipeline.

DC (DIRECT CURRENT)

Electricity that flows in one direction only, like the battery in your car.

ELECTRIC FIELD

An electric field is created by the difference in electric potential (voltage) between the conductors in power cables. The strength of an electric field is expressed in units of volts per meter (V/m). Higher voltage sources produce higher electric fields.

ELECTROMAGNETIC FIELD

The term electromagnetic field is frequently used to refer to electromagnetic energy across a wide frequency spectrum ranging from the earth's natural fields to cosmic radiation.
Sometimes it refers to frequencies above about 100 kHz where electric and magnetic fields are coupled and radiate away from sources.

ELF (EXTREMELY LOW FREQUENCY)

Frequencies found at the end of the electromagnetic spectrum that contain very little energy and cannot directly break molecules apart, ie., non-ionising. 50Hz electric power operates at ELF levels.

FREQUENCY

AC Electricity is transmitted in waves. The number of times the wave repeats itself in a second is the frequency and is measured in Hertz. On the Irish transmission system, AC electricity is transmitted at 50Hz.

INDUCED CURRENT

A flow of electric current in an object created by the proximity to an AC power source.

IONISING RADIATI ON

Radiation, such as X-rays, which has sufficient energy to break molecular chemical and electrical bonds.

MAGNETIC FIELD

Created by the movement of electric charges. Magnetic fields surround magnetic materials and electric currents. In magnetic materials and permanent magnets, the field is created by the coordinated spins of electrons and nuclei within iron atoms. The magnitude of the magnetic field is expressed as magnetic flux density, also referred to as magnetic field strength. Measured in Tesla (for large fields) or μT (for small fields).

MOLECULE

The smallest particle of a substance that retains the properties of that substance.

NON-IONISING RADIATION

Electromagnetic fields at frequencies that do not have enough energy to disrupt atoms or molecules.

RADIATION

Any of a variety of forms of energy propagated through space.

VOLTAGE

Voltage is the difference in electric potential between any two conductors of a circuit. It is the electric 'pressure' that exists between two points and is capable of producing the flow of current through an electrical conductor. Voltage in a power line is comparable to pressure on a pipeline.

APPENDIX 5.3

HOUSE PRICES STUDY – CXC SCOTLAND 2016

climate change

Scotland's centre of expertise connecting climate change research and policy

Impact of wind turbines on house prices in Scotland

Dr Stephan Heblich,[1] Dr Dan Olner,[2] Prof Gwilym Pryce[2] and Prof Chris Timmins[3]

With research assistance from Dr Ellie Bates[4] and Dr Tim Birabi[2]

October 2016

[1] *Department of Economics, University of Bristol, member of the ESRC AQMeN project.*

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[4] *School of Law, University of Edinburgh, member of the ESRC AQMeN project.*

ClimateXChange is Scotland's Centre of Expertise on Climate Change, supporting the Scottish Government's policy development on climate change mitigation, adaptation and the transition to a low carbon economy. The centre delivers objective, independent, integrated and authoritative evidence in response to clearly specified policy questions.

www.climatexchange.org.uk

Summary

This report presents the main findings of a research project estimating the impact on house prices from wind farm developments. It is based on analysis of over 500,000 property sales in Scotland between 1990 and 2014.

The methodology builds on research on the impact from wind farms on house prices in England (Gibbons 2014). This study improves the way the impact is estimated by looking at the impact of both single turbines and whole wind farms.

To control for the normal fluctuations in house prices we used a 'control group' that closely resembles the characteristics of the dwellings in the study but without being exposed to a wind farm. This provides prices that can be used to interpret a wind farm's impact on the price of dwellings nearby. As such a result showing no effect means that the house price of the property with a wind farm close by has increased or decreased at the same rate as the properties in the control group.

The study looked at both natural landscape and built environment in relation to how exposed a dwelling is to the visual impact of the wind farm.

Key findings

1. **No evidence of a consistent negative effect on house prices:** Across a very wide range of analyses, including results that replicate and improve on the approach used by Gibbons (2014), we do not find a consistent negative effect of wind turbines or wind farms when averaging across the entire sample of Scottish wind turbines and their surrounding houses. Most results either show no significant effect on the change in price of properties within 2km or 3km, or find the effect to be positive.

2. **Results vary across areas:** The results vary across different regions of Scotland. Our data do not provide sufficient information to enable us to rigorously measure and test the underlying causes of these differences, which may be interconnected and complex.

Our results persist under a variety of assumptions:

- whether or not we account for the visibility of turbines;
- whether we base the analysis on individual turbines or entire wind farms;
- whether we account for building heights or use only the natural terrain when estimating turbine visibility; and
- whether we follow individual dwellings over time or use postcode averages.

The complexity of the findings may be due to:

- attitudes towards wind farms and their benefits potentially varying across regions and different social and economic groups;
- Scotland having a higher proportion of its turbines located in remote areas; and
- the fact that some wind farms provide economic or leisure benefits (e.g. community funds or increasing access to rural landscapes through providing tracks for cycling, walking or horse riding).

Additionally these factors are not mutually exclusive. It is likely that they affect house prices simultaneously, and to varying degrees in different locations.

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Introduction and background

The Scottish Government has committed to a target for renewables to generate the equivalent of 100% of Scotland's electricity demand by 2020[5]. Onshore wind power is playing a central part in decarbonising Scotland's energy supply.

The rapid growth in onshore wind (both in Scotland and globally) has been accompanied by an interest in understanding the impacts of onshore wind development, both positive and negative. The overall economic benefits of investment and spending are relatively straightforward to measure[6]; impacts on communities less so. Survey-based approaches consistently show a majority in favour of renewable power generation in principle but paint a more mixed picture for those directly affected by nearby wind farm development[7].

There is now a substantial body of research on the local impacts of wind farms. Some of this research has looked at measurable effects on house price in order to understand the objective effects on communities, beyond stated views. Have properties near to, or in sight of, new wind farm developments seen price changes that differ from other houses? Until recently, all extant studies had consistently found no robust evidence of any such price impact. One of the most recent studies, by RenewableUK and the Centre for Economics and Business Research, used seven wind farm case studies across England and Wales, and came to the same conclusion: either no impact or even a slight positive one[8].

Very shortly after that study, however, Steve Gibbons looked again at English and Welsh wind farms using a larger data-set and property prices between 2000 and 2012, and found evidence for negative price impacts[9]. In Gibbons' analysis of previous house price studies[10], the key problem he identifies is sample size: while some studies contain many properties, the number of observations actually used to estimate the price impact tends to be too low to be statistically reliable. Many also do not compare price changes across time. Gibbons' research design allows for comparison of much larger groups of property prices before and after wind farms became operational, allowing for more robust results.

The present study bases its price impact analysis on Gibbons' approach, including his use of a landscape analysis to determine whether properties can likely see a turbine[11], or whether line of sight is blocked. Line of sight analysis allows us to test whether visibility of turbines affects house prices differently to proximity alone, by separating visible and non-visible turbines into two groups. We have also explored ways of improving on Gibbons' approach, greatly increasing the resolution and precision of the data. These improvements are listed below:

1. Whilst we replicate Gibbons' approach using average house price per postcode and postcode-centre for housing location, we also repeat the analysis using individual property prices based on full address locations.
2. We use a dataset of wind turbines that includes their exact location and tip height, rather than the centre-point of wind farms. Relying on the centre-point of wind farms might be particularly problematic in a Scottish context where some wind farms are very spread out. When turbines are dispersed in this way, it is possible for a house to be a very long way from the centre of the wind farm, but very close to a peripheral turbine.
3. Our landscape analysis uses 5 metre grid squares (versus 200 metre in Gibbons). Combined with the exact property locations and turbine locations, this gives much more accurate lines of sight.

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[5] 2020 Routemap For Renewable Energy In Scotland – Update, 2015, http://www.gov.scot/Resource/0048/00485407.pdf

[6] RenewableUK, 'Onshore Wind: Direct and Wider Economic Benefits', 2015, http://www.renewableuk.com/en/publications/index.cfm/BiGGAR.

[7] See e.g. Christopher R. Jones and J. Richard Eiser, 'Understanding "Local" Opposition to Wind Development in the UK: How Big Is a Backyard?', *Energy Policy* 38, no. 6 (2010): 3106–17.

[8] RenewableUK, 'The Effect of Wind Farms on House Prices', 2014, http://ruk.pixl8-hosting.co.uk/en/publications/index.cfm/RenewableUK-Cebr-Study-The-effect-of-wind-farms-on-house-prices.

[9] Stephen Gibbons, 'Gone with the Wind: Valuing the Visual Impacts of Wind Turbines through House Prices', *Journal of Environmental Economics and Management* 72 (July 2015): 177–96, doi:10.1016/j.jeem.2015.04.006.

[10] Ibid. p.179

[11] Why 'likely'? - The real landscape may differ in ways the model has not captured - for example, vegetation may be blocking a view.

4. Taking advantage of this higher resolution, we have also added building height data (where available) to test whether buildings may block a property's view.

The following section describes the data used in more detail, and then explains the two key steps in producing the analysis: the line of sight analysis and the econometric house price analysis. The full results are then presented, before concluding with some possible explanations for the findings.

Details of the house price impact analysis

Overview of the data and method

In this section, we outline the data sources for the project and explain how they were used to produce the house price impact analysis. The following four sub-sections describe the **four sources of data** used:

1. House price data for Scotland from January 1990 to March 2014.
2. Wind turbines that became operational between November 1995 and December 2014.
3. Digital Elevation Model (DEM) data for the Scottish landscape, giving height above sea-level for 5-metre grid squares covering the whole of Scotland.
4. Building height data, added to the DEM data.

We shall then detail the two steps of data preparation and analysis. The first step was to carry out a line of sight analysis identifying which houses could most likely see at least one turbine. This provided full details for each house of the number of visible turbines and their distance. The second step was to use this information, along with property price change over time (and a number of other control variables; see below), to produce the final house price impact analysis.

House price data

Data for property prices in Scotland comes from two previously unlinked versions of price data from Registers of Scotland (RoS). By linking these, the house price record covers just over 23 years (1990 to March 2014). While RoS record every Scottish sale, the analysis here drops any sales that, for a number of reasons, were not suitable. For example, not all properties could be exactly geocoded because the RoS record contained insufficient address information to obtain a location match and had to be excluded.

Only repeat sales (properties that sold more than once within the time period of the data) were used in the house price analysis. Following properties over time in this way helps us to compare like with like when estimating the house price impact of turbines being constructed. One limitation of this repeat sales approach is that we do not know whether there have been major changes to the dwelling over time. However, provided changes to dwellings are fairly randomly distributed across all dwellings in the data, this should not have a big effect on the results. In total, the RoS data provided 637,000 repeat-sale properties, accounting for just over 1.7 million sales.

Following Gibbons, we restricted the properties used in the analysis to those within 15km of at least one turbine (i.e. within the green circles in Figure 2). This is done, as Gibbons says, because "as the distance to the wind farm increases, the number of other potential coincident and confounding factors increases, making any attempt to identify wind farm impacts less credible"[12]. This reduces the total number of properties in the analysis to 509,275.

Wind turbines

Three sources have been combined to produce the wind turbine dataset:

1. Precise wind turbine locations were acquired from Ordnance Survey's "Points of interest" (POI) data, freely available through an academic license[13]. Its latest incarnation (as of late 2015) is much more comprehensive than previous versions. This data is collated for Ordnance Survey by PointX (www.pointx.co.uk). The POI turbine data itself is mainly supplied to Ordnance Survey by RenewableUK.
2. Dates that wind farms became operational were 'scraped' from RenewableUK's website (www.renewableuk.com) and then matched to turbines.

[12] Gibbons, 'Gone with the Wind'. p.180

[13] Code and guidance for extracting specific types of POI data are accessible at the Sheffield Methods Institute github page: github.com/SheffieldMethodsInstitute/windfarmsHousePrices

3. Turbine tip height information was collated through direct research of planning applications and other publicly available sources[14].

Figure 1 shows the cumulative rise in the number of turbines becoming operational in Scotland from 1995 onwards; the total reaches just over 2,500 turbines by the end of 2014.

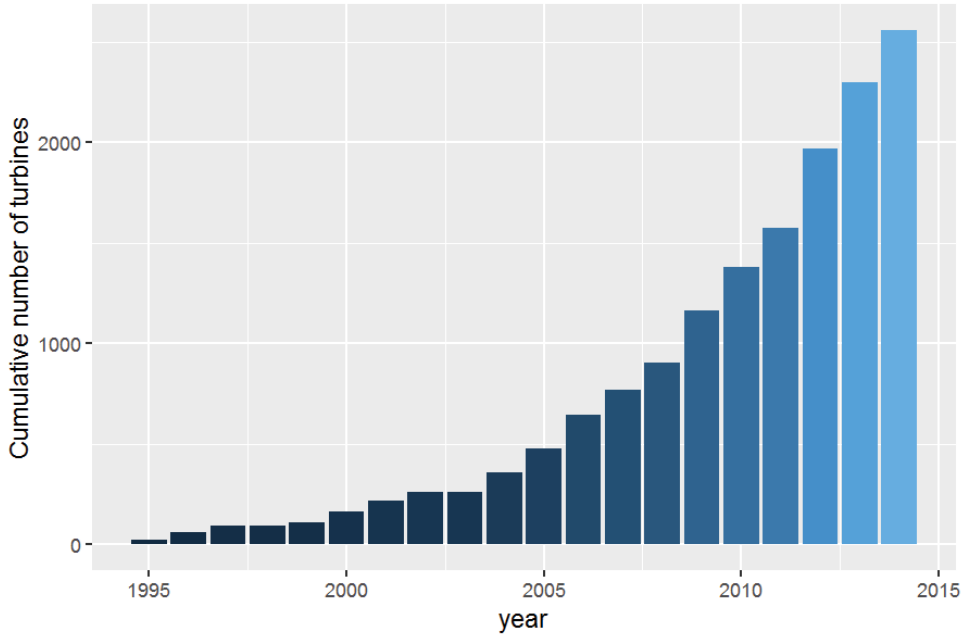

Figure 1: Number of operational wind turbines in Scotland, cumulative from 1995 to 2014

Landscape and building height data

To determine whether a turbine is likely to be viewable from a particular property, we need to know if any landscape features intervene to block the view. This requires using a 3D 'Digital Elevation Model' (DEM) of the Scottish terrain, onto which houses and turbines can be added. We use Ordnance Survey's "OS Terrain 5" DEM, which provides height above sea level for every 5-by-5 metre grid point.

The OS Terrain 5 data can be used to identify which houses have their lines of sight blocked by the physical landscape, but this does not account for the effect of other buildings. To correct for this, we also use building height data for the majority of properties in Scotland, combining Ordnance Survey's Mastermap with LIDAR data from the Centre for Environmental Data Analysis (CEDA). The OS Terrain 5 DEM data's 5 metre resolution is fine enough to allow addition of building footprints and heights derived from the Mastermap and CEDA data.

On the map of Scotland in Figure 2, areas for which we used building data are shown with the yellow (Mastermap) and red (CEDA) grid areas. Where both sources covered the same area, we used the slightly better quality Mastermap data. These two sources do not cover all buildings in Scotland, but because data exists for all the larger conurbations, 84% percent of properties have a line of sight that crosses building height data and so could potentially have that view blocked. Calculations are run both with and without building heights for comparison, with the latter using the 84% subset of houses that may have had a line of sight blocked by a building.

[14] The majority of the work tracking down tip heights was done by Dr Ellie Bates, University of Edinburgh.

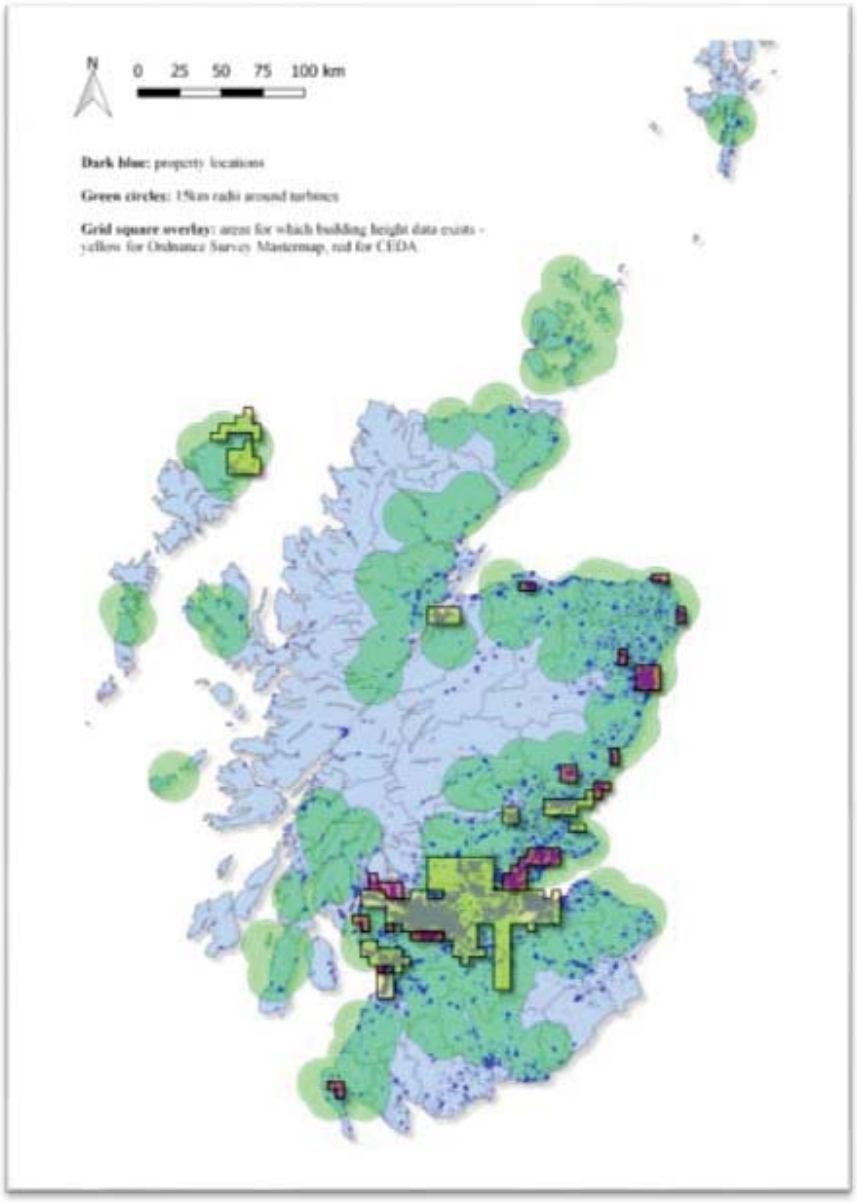

Figure 2: Scotland - housing data location (dark blue), turbine 15km radii and building height data location

Analysis step 1: Which houses can likely see turbines? 'Line of sight' analysis

The econometric analysis requires the following information for each repeat-sale property:

- Which turbines, if any, are within 15km?
- How close is each of them to the property?
- Of those turbines within this 15km range, which are visible to this property and which likely cannot be seen?

We used Pythagoras' Theorem to compute distances between each dwelling and turbine. To estimate turbine visibility, we used 'line of sight' analysis (also known as "intervisibility" analysis)[15]. Figure 3 and Figure 4 illustrate how this process is carried out using the example of a particular property in Glasgow that has its line of sight blocked by another building. 136 batches of housing, turbine and landscape data are processed - these figures use a batch covering the Cathkin Braes wind turbine, installed in 2013[16]. (Other batches process larger groups of turbines together, e.g. the Whitelee wind farm to south of Glasgow in Figure 3 is processed in one batch.)

The dotted line on the map of Glasgow in Figure 3 marks an 8.7km line of sight between this example property and the Cathkin Braes turbine. Figure 4 gives the landscape cross-section for this same line (with horizontal distance at 1/8th scale, relative to height), showing how the DEM landscape data - both with and without building heights - is used. The line starts two metres above ground level on the site of the house[17] and 'looks' towards the turbine blade tip height. If the highest point of the tip is visible above landscape and buildings, the line of sight is clear. In this example, for landscape alone, the house (left-hand side of graph) has a clear line of sight. If building heights are used, however (green in Figure 4), line of sight is blocked.

This process was repeated for all properties. The addition of building height data blocked a great many more from view of a turbine. Without building heights, 80% of properties within 15km of a turbine are identified as having a line of sight to at least one. This drops to 32% when building heights are used - an unsurprising result given how many properties are located in conurbations. Note that this binary visibility result says nothing about a turbine's actual visual impact which will depend on proximity. For example, a visible turbine will presumably have a much bigger visual impact when viewed from nearby properties compared with the view from houses 15km away. As Gibbons says:

> "Existing literature based on fieldwork suggests that large turbines are potentially perceptible up to 20km or more in good visibility conditions, but 10 to 15km is more typical for a casual observer and details of individual turbines are lost by 8km."[18]

[15] Code and guidance for this is available at the Sheffield Methods Insitute github page: github.com/SheffieldMethodsInstitute/windfarmsHousePrices

[16] See e.g. "£5m city turbine will be visible around world (From Evening Times)." 2013. www.eveningtimes.co.uk/news/13256714.__5m_city_turbine_will_be_visible_around_world

[17] The building data for the house is discounted: for the building height check, line of sight is only checked once the line has got past the building's edge.

[18] Gibbons p.180

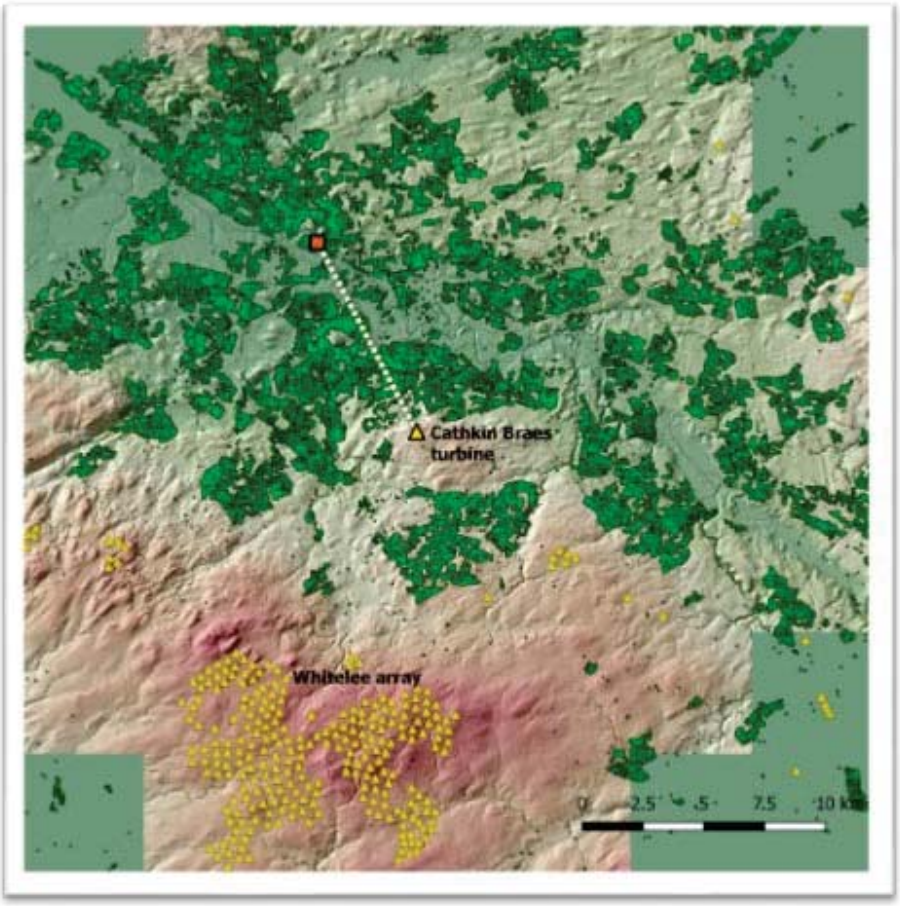

Figure 3: Digital Elevation Model for Glasgow area. Repeat-sales properties in green. Wind turbines are yellow triangles. Dotted line is an example line of sight (matches figure below) for a sample Glasgow property to Cathkin Braes turbine tip.

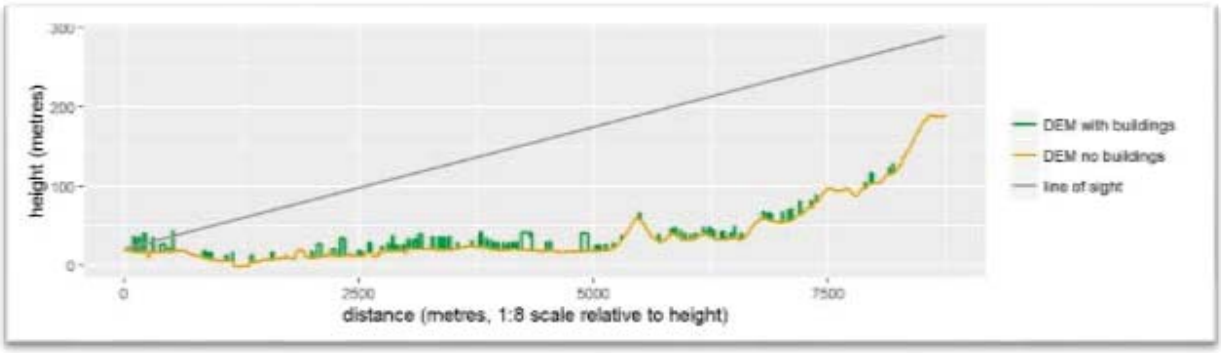

Figure 4: example line of sight blocked by buildings that would not be blocked by landscape alone. Matches dotted line in above figure. Property on left, Cathkin Braes turbine tip on right. Note horizontal distance is 1/8 of actual scale, relative to height.

Analysis step 2: house price impact using 'difference in differences'

The aim of the econometric analysis described in this section is to assess the house price impact as distance increases, both for visible and non-visible turbines and wind farms.

We use a "difference in differences" approach to identify the causal effect of wind turbine proximity and visibility. This approach seeks to estimate how rates of change in house prices differ between properties "exposed" to wind turbines (through proximity and/or visibility) compared with those that are not exposed. We use only `repeat sale' properties, as described above. We label properties exposed to wind turbines - those we want to identify any price impact for - as the "treatment group".

To measure the causal effect of wind turbine exposure, we would ideally like to know how the same dwelling's change in price over time is affected by the presence or absence of a wind farm. Clearly, observing both states at the same time is not possible. Instead, we construct a "control group" that closely resembles the characteristics of the treatment group but has not been exposed to a wind farm. The control group thus provides us with a counterfactual dwelling price, which we interpret as what the price would have been if the treatment group had not been in proximity to, or in sight of, wind turbines. This setup allows us to compare the average change in 'exposed' dwellings' house price to the average change in 'unexposed' dwellings' house price before and after turbines become operational - a so called *difference-in-differences* framework.

The first difference is how much the treatment and control groups change price between the chosen time periods. The second difference is how these two changes compare. This second difference is labelled the "treatment effect", i.e. the causal impact of wind farm developments on house price growth. If we were to produce the same findings as Gibbons, with the treatment group's price increasing **less** than the control group, then the impact of wind turbines on house price growth would be negative. For example, if we find a house price impact of -10%, this means that prices in the treatment group went up by 10% less than they did in the control group. On the other hand, if we find a positive effect, say 10%, this means that prices in the treatment group went up by 10% more than in the control group.

Note that a key assumption in the difference-in-differences framework is that the treatment and control groups show the same trends in house price growth in the pre-treatment period (the 'common trends assumption'), which means that they are subject to the same influences on price before the turbine is installed.

For all results, we repeated our difference-in-differences analysis using a large variety of additional controls that control for possible unobserved factors. This is the same as the "fixed effects" approach used by Gibbons (2014). The essential principle of a fixed effects approach is to allow fixed (i.e. constant over time) differences in subsets of the data to be accounted for. Including fixed effects allows the analysis to control for factors that we cannot easily measure (such as cultural differences or unknown economic, political or physical factors) but are likely to be fairly constant over time and may cause different price trends. The most intuitive fixed effects are regional. For example, there might be different house price trends across NUTS2 regions because of differences in the fixed characteristics across regions, such as their physical geography. These differences can be controlled for using fixed effects even if we do not have detailed data on the different underlying characteristics. This may be important if wind farms are sited taking these features into account.

All of the results presented in this report include basic fixed effects that control for variations in overall house price trends and differences in property characteristics. We use annual and quarterly fixed-effect controls to flexibly account for house price trends. Since we are looking at repeat sales, our estimations further include a set of house fixed effects - allowing each property its own trend line - that absorb any time-invariant house characteristics such as its footprint size or number of bedrooms. These are the "basic" controls used in all the results reported here.

We then add a number of additional controls to the models in order to test sensitivity. First, a number of geographic controls are added, allowing different house price effects over time by including fixed effects for slope (for each individual property), elevation (height above sea level for each property) and aspect (which compass direction the property's slope is facing, indicating which direction their predominant view is likely to be). Second, we add controls for different price effects across distance rings. These controls are in line with the ones used by Gibbons (2014). In addition, we allow house prices to differ between Scotland's four NUTS2 regions and include a set of region-by-year interactions. These additional fixed effects results are provided in the appendices.

Results

We present three sets of results. We start with the Gibbons (2014) approach, which is based on postcode averages for house prices and computes proximity and visibility using the centre point of entire wind farms (rather than individual turbines). We then compare these baseline results with outputs based on more fine-grained analysis that follows individual dwellings over time and calculates turbine proximity and visibility based on individual wind turbines. This is done both for visibility based just on terrain, and also visibility that also accounts for any buildings that may block the view.

Result #1: Analysis based on Postcode Averages & Wind Farm Centre Points ('centroids') (Gibbons)

Figure 5 shows the percentage impact on house price growth of a dwelling close to a wind farm being able to see the wind farm (blue line) compared with not being able to see the wind farm (red line). The approach used to derive this first set of results is similar to Gibbons (2014). They are based on:

- the change in average house prices in a given postcode before and after a wind farm became operational (rather than individual dwellings); and
- the effect of entire wind farms (rather than individual turbines).

Compared to the individual-property-level repeat sales analysis, one may think of this as a repeat sales estimation at the postcode level. However, instead of looking at the same house selling multiple times, we now look at multiple transactions in the same postcode. The implicit assumption is that houses within the same postcode unit are very similar and could be used interchangeably.

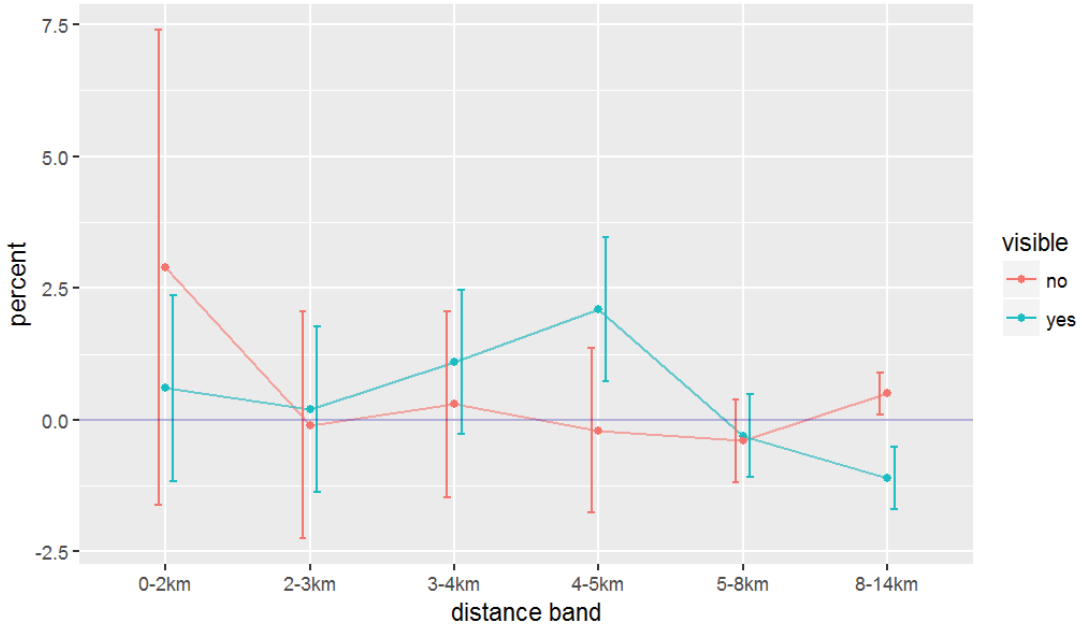

Figure 5: Result #1: Percent difference in the change of house price

(Postcode/wind farm centroids[19], **whole wind farm** visible/not visible.)

The horizontal axis shows the distance between the postcode of dwellings and the centre of the wind farm. These distances are grouped into 6 bands: (i) 0-2km, (ii) 2-3km, (iii) 3-4km, (iv) 4-5km, (v) 5-8km, and (vi) 8-14km. The vertical bars show the confidence intervals for each estimate. If the confidence interval is narrow, depicted by a short vertical bar, it means the estimate is precise. The longer the bar, the wider the confidence interval,[20] and the less precise the estimate is. If this vertical bar is entirely above zero, it means the result suggests a significant[21] positive effect on house price change caused by the construction of the wind farm. If the vertical bar lies entirely below zero, it means that the effect is significantly negative. If the vertical bar extends above and below zero, as is the case for most of the estimates in Figure 5, it means that there is no significant effect, either positive or negative. In other words, we cannot rule out a zero effect at the 95% confidence level.

A zero effect does not mean that house price growth has flat-lined. Rather it means that the treatment group (those properties that are in close proximity to a wind turbine) have a similar house price growth trajectory as the control group (those properties that are not in close proximity to a wind turbine).

The results in Figure 5 suggest that visible turbines have a positive effect on house prices (the blue line is above zero for the first four distance bands). However, the majority of confidence intervals extend above and below zero. This suggests that there is no significant house price effect in the first three distance bands, but a possible slight positive effect for visible turbines in the 4-5km band, dropping to a negative effect in the 8-14km band.

As discussed above, we repeated our analysis using a large variety of different specifications that control for a variety of possible unobserved factors using the same "fixed effects" approach used by Gibbons (2014). The results of the key variations from this exercise are presented in Figure A1 in the appendix, where Figure 5 is replicated in Figure A1(A) for comparison. We can see that the results are broadly consistent with Figure 5 in that none of the graphs show significant negative impacts of wind turbines on house price growth in the first three distance bands. Some graphs do, however, suggest a significant **positive** impact on house price growth, particularly in the second distance band (2-3 km), and particularly for visible turbines (see graphs (B), (C), (D), (F), and (H) of Figure A1). A more detailed description of the results in Figure A1 is presented in the Appendix.

Result #2: Analysis based on Repeat Sales & Individual Turbines

Figure 6 shows results based on the repeat sales of individual properties and the impact on house price growth after individual turbines become operational[22]. Here we see a significant positive impact on house price growth in the first distance band (1-2km) for properties that cannot see any turbines, but this effect is much smaller and statistically insignificant for properties in the same distance band that can see turbines. Note that the positive effect on properties, for which turbines are visible, becomes statistically significant in the second, third and fourth distance bands. The two furthest distance bands, however, do indicate negative price impacts. Though these results are mixed, as confidence intervals for visible/not visible turbines cross or touch the zero line.

Results of the sensitivity analysis—comparison with a variety of different fixed effects—are presented in Figure A2 in the appendix. Again, these different versions of the results tell a similar story with the positive impact on house price growth

[19] Centroid means centre point of an aerial unit (e.g. postcode) or multiple points.
[20] Based on the 95% level of confidence, which is the standard threshold used in statistical studies.
[21] Statistical "significance", in this context, means that there is less than a 5% chance that an estimated negative or positive house price impact is purely due to random variation in the data.
[22] Again, this is replicated in the appendix, figure A2(A).

tending to diminish with distance for properties that cannot see turbines, but rising then falling with distance for properties that can see turbines.

Crucially, there are no consistent signs of negative impacts on house price growth in the first three distance bands. In these results, the negative signal in the furthest two bands is again mixed, with no completely consistent pattern either side of zero.

Note that at shorter distances, confidence intervals tend to be larger. This is unsurprising, as sample sizes at shorter distances are smaller (there are not many houses very close to turbines) and so there will necessarily be more uncertainty in our estimates at close distances.

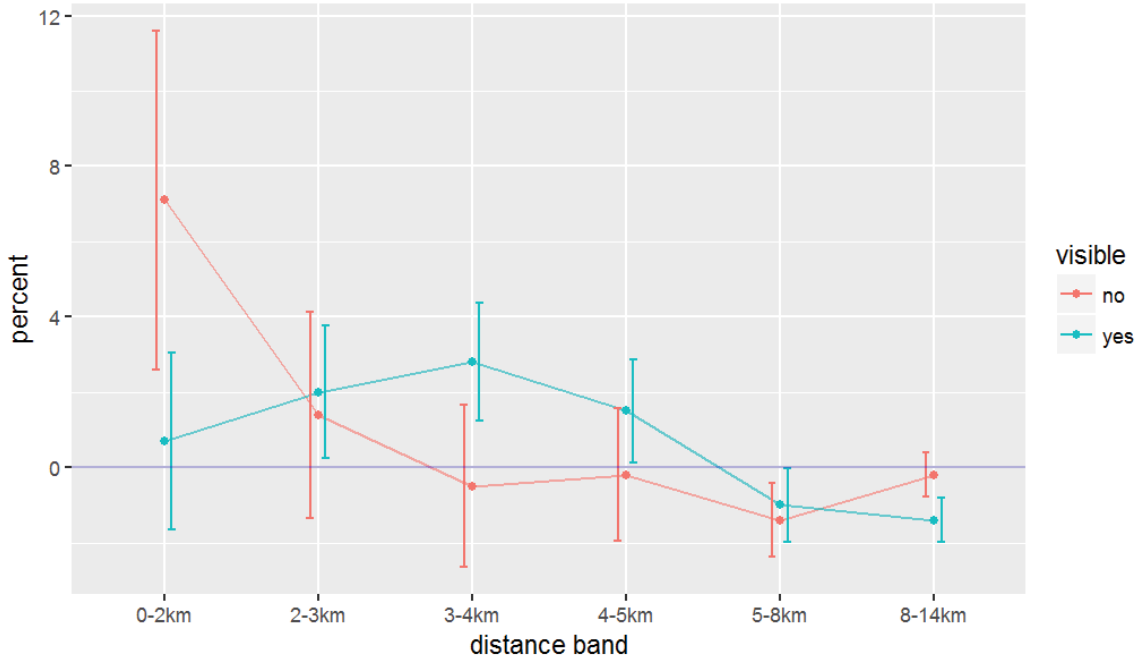

Figure 6: Result #2: Percent difference in the change of house price

(All repeat sales, turbine visible / not visible)

Results for individual repeat sales properties (Figure A2, appendix) show much the same pattern, but with larger percentage effects. The larger non-visible turbine effects at very close distance do, again, have large confidence intervals - but these do not cross the zero line. For both the centroid and repeat-sales results, any impact on house price growth tends to drop off as distances increase, though there is a great deal of variability in this response.

Repeat-sales results take advantage of having individual turbine data to distinguish between responses to turbines over and under 100 metres to tip height (appendix, figures A2(E) and A2(F); A3(E) and A3(F)). Sub-100 metre turbines are associated with consistent negative house price impacts, if they can be seen - but, again, confidence intervals cross the zero line. This is not the case for those out of sight, however.

Turbines over 100 metres in height are very similar to the main results - with perhaps a more clear decay of positive effect over distance for non-visible turbines. It is worth noting that: (a) Aberdeenshire has a large proportion of the sub-100 metre turbines and (b) most of the above 100 metre turbines were built after 2006, so this difference in response could be rooted in these different times and places.

Result #3: Analysis based on Repeat Sales & Individual Turbines, Taking into Account Building Heights

One disadvantage with both Result #1 (the Gibbons approach) and Result #2 (the individual houses/turbines approach) is that the visibility estimates do not take into account the possibility of buildings (as opposed to natural features) blocking the line of sight to turbines and wind farms.

Figure 7 shows the results of an analysis based on the repeat sales of individual properties and the impact on house price change after individual turbines become operational taking into account the height of buildings that might block the view of turbines. (Again, the appendix shows the results of the sensitivity analysis for these results in Figure A3). While the main findings remain similar to Results #1 and #2 in that there are no consistent signs of negative house price effects in the first three distance bands, it is clear that the estimates of impacts of visible and non-visible turbines on house price changes appear to be much closer in Result #3. Looking across all the results in Appendix figure A3, for both visible and non-visible turbines, the impact on house price growth seems to be more positive in the second distance band (2-3km) than in the closest distance band (0-2km), but then declines in distance bands three and four. As with the previous result, there appear to be negative price impacts in the last two distance bands, particularly for visible turbines, but these results are less consistent in the sensitivity analysis.

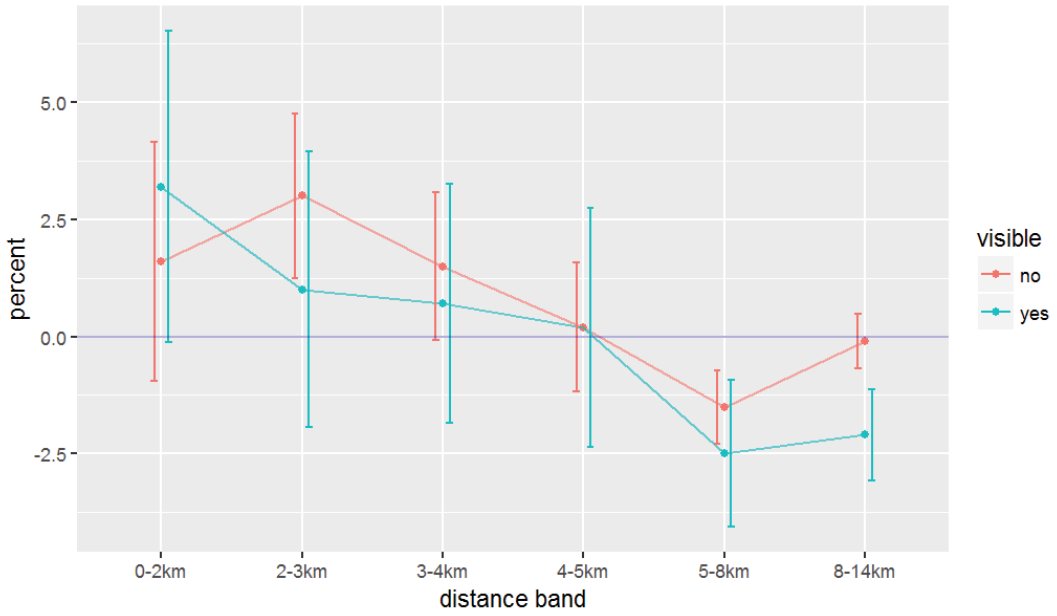

Figure 7: Result #3 Percent difference in the change of house price

(All repeat sales, turbine visible / not visible, using building height data for line-of-sight)

While results using building height data in Figure 7 are broadly similar to those relying on terrain-based line of sight, for some of these regressions there are quite different results even for properties that cannot "see" a turbine. This is because it uses a different sample of houses - only those that have lines of sight that cross areas that have available building height data. If this is not done, it is impossible to know whether a property has a clear line of sight due to no

buildings blocking it, or just that no building height data was available. As mentioned above, this still accounts for 84% of properties - but these are all in the larger conurbations. The properties that "can see" and "cannot see" are, of course, also different. The building height results, then, say more about the impact of wind turbines in urban areas than the non-building height sample.

The main difference in the building height result is in the nearest distance band where the effects on house price growth for properties whose line of sight is blocked by a building are noticeably smaller in comparison to those with line of sight blocked by terrain. With terrain only, visible and non-visible appeared to show a quite different response (Figure 6), but when the building height data are included (Figure 7), the impact of visible and non-visible turbines both have the same direction of change as distance is increased (though again, the wide confidence intervals mean there is considerable uncertainty surrounding the estimates).

The pattern of difference between sub-100-metre turbines (Figure A3(E)) and those over (Figure A3(F)) is similar to the terrain-based results once the uncertainty surrounding estimates is taken into account. For turbines less than 100 metres that can be seen despite building height, there appear to be large impacts on the price growth of properties in close proximity, and these impacts diminish at further distances, but the confidence intervals are so wide, we cannot be sure that the effects are different to zero for any of the distance bands, visible or non-visible. Much more precise results are available for turbines over 100m with statistically significant positive effects for the second distance band (2-3km) in Figure A3(F).

Summary and possible explanations for the results

In summary, we have not found any consistent evidence of a negative impact of wind turbines on house price growth. Generally speaking the effect is either positive at particular distance bands (2-3km) or not distinguishable from zero.

Note again that a zero effect does not mean that house price growth has flat-lined. Rather, it means that there is no significant difference between the house price growth of the treatment group (properties close to turbines) and that of the control group (properties far away from turbines).

A positive effect means that the treatment group has a higher rate of house price growth than the control group. The repeat sales analysis, for example, finds a positive effect of 2% for houses in the 2-3km distance band that can see a turbine (Figure 6). This means that the value of those houses went up by 2% more than the increase in value of dwellings in the control group.

We also find some evidence that that the impact of wind turbines on house price growth appears to vary across different regions of Scotland. This finding has not, as far as we are aware, been systematically tested in previous UK studies using the rigorous methods applied here.

There is some evidence from the results that property prices respond differently to wind turbines in different parts of Scotland. It must be emphasised, this finding is somewhat tentative. Using the current method, sample sizes are too small to be fully reliable. However, it does suggest that while some areas see the positive impacts described above, others may see negative impacts.

Results for Angus/Dundee and Clackmannanshire/Fife regions, all clustered north of the Firth of Forth, appear to see some negative impacts for visible turbines, though most of these have confidence intervals crossing or just touching zero. In contrast, North and South Lanarkshire show the most positive price impacts at close distances. Other regions either produce no geographical results due to data limitations, or are very mixed.

Our data do not provide sufficient information to enable us to rigorously measure and test the underlying causes of these differences which may be interconnected and complex. Differential impacts may arise, for example, from interactions between variations in physical terrain, urban social structures, local approaches to turbine development policy and community engagement.

We now conclude the report by offering a number of possible explanations for our findings.

Heterogeneous and changing preferences

The reason our results are consistently different to those reported by Gibbons (2014) might be because attitudes towards wind farms may be different in Scotland than in other parts of the UK, and may also vary significantly within Scotland, and between individuals. Attitudes may also have varied over time – e.g. in response to public debates about energy futures or rural economic development. So our complex findings may reflect genuine complexity and fluidity in the preferences and attitudes of homeowners across Scotland over the time period considered.

Location of turbines

In Scotland, a much higher proportion of turbines are likely to be located on moors and mountains, and in much more remote areas than in England and Wales. These differences in terrain might be another important reason for the discrepancies between our results and those of Gibbons (2014), as might the potential alternative uses of the land on which turbines are constructed. For example, in remote mountain locations, there may be fewer alternative commercially viable uses for the land and so the opportunity cost in terms of foregone alternative revenue streams from the land may be smaller. In contrast, high quality farmland locations in England and Wales may well have more valuable

alternative uses that have to be foregone, both now and in the future, if turbines are constructed. This may itself affect the attitudes of, and financial impact on, local residents and businesses.

Amenity and economic benefits

The positive house price impacts presented above may also reflect the fact that some wind farms provide economic and leisure benefits to the surrounding areas.

- E.g.1: The Whitelee wind farm had 25,000 visitors in the first two years of opening[23] and provides 130kms of tracks for walkers, cyclists, horse riders and dog walkers. These benefits may be substantial and may offset any negative aesthetic or noise effects. The positive effect of such amenities might be particularly strong if the previous land use was essentially barren and of little aesthetic merit. The effects, positive and negative, are likely to vary geographically but not necessarily in the same way.
- E.g.2: Some renewable energy companies provide community and development funds to fund a range of projects that benefit the locality and potentially generate employment. The SSE Clyde wind farm fund[24], for example, is expected to provide a total of £17.5 million for local projects that boost local investment and employment, offer training, prevent poverty, or benefit the local or social environment in some way. Such initiatives may improve the quality of life of local residents and increase house prices accordingly.

Patterns of social stratification

Attitudes towards wind turbines and the economic benefits may vary across different social and economic groups. If the location of these groups relative to the location of wind farms varies (e.g. because affluent households are more concentrated in the outskirts in some cities than in others) then the house price responses might vary depending on location.

For example, Kavanagh, Lee and Pryce (2016)[25] find that poverty is much more concentrated in the inner city in Dundee than it is in Edinburgh. The maps in Figure 11 below make the same point using the Scottish Index of Multiple Deprivation. Note also that Kavanagh, Lee and Pryce (2016) identify significant change in the geographic patterns of poverty between 2001 and 2010. Since wind turbines tend to be located in rural areas, households living near the edge of the city are most likely to be affected, either positively or negatively, and variations in the pattern of wealth over time and between cities might affect the pattern of house price impact.

[23] http://www.pfr.co.uk/cloich/15/Wind-Power/23/Tourism/

[24] See for example http://www.southlanarkshire.gov.uk/info/200168/getting_involved_in_your_community/571/sse_clyde_wind_farm_fund

25 Kavanagh, L., Lee, D. and Pryce, G. (forthcoming) Is Poverty Decentralising? Quantifying Uncertainty in the Decentralisation of Urban Poverty. Annals of the American Association of Geographers, freely available here: http://bit.ly/2dAihAX

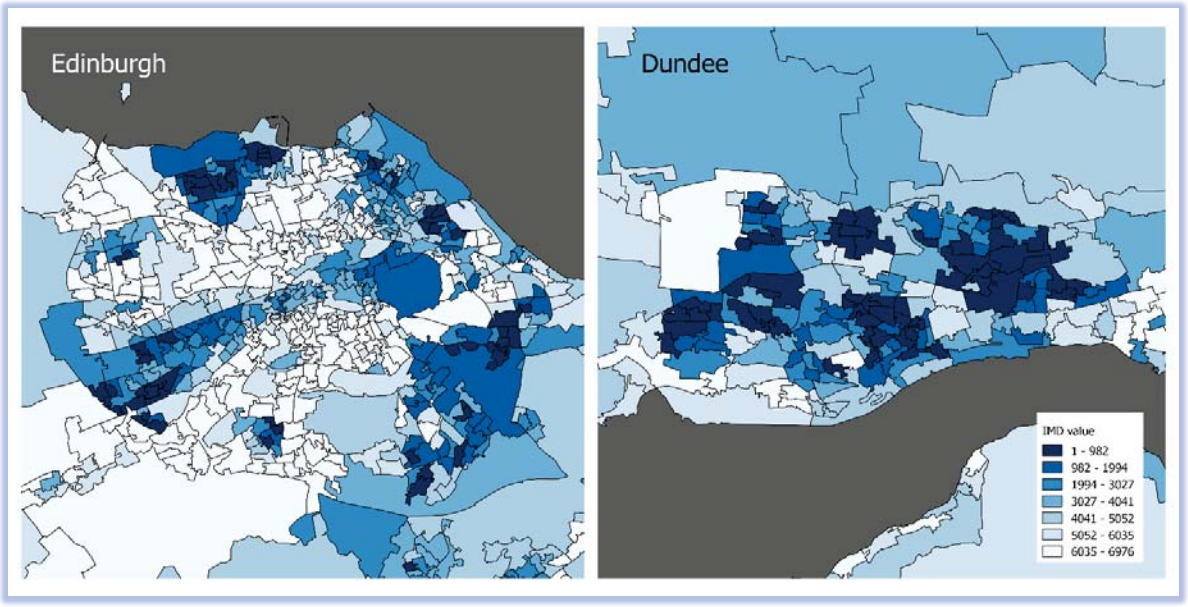

Figure 11: 2011 Scottish Index of Multiple Deprivation in Edinburgh and Dundee. Lower values (darker blue) are more deprived areas, higher values are less deprived.

Overall, those who are likely to be able to see a wind turbine typically live in lower value houses (and presumably have lower incomes) than those who cannot (Figure 12). It may be that those on lower incomes are less averse to wind turbines, perhaps because the marginal benefit of any community fund or other positive spillover from wind farm projects is larger relative to their disposable income.

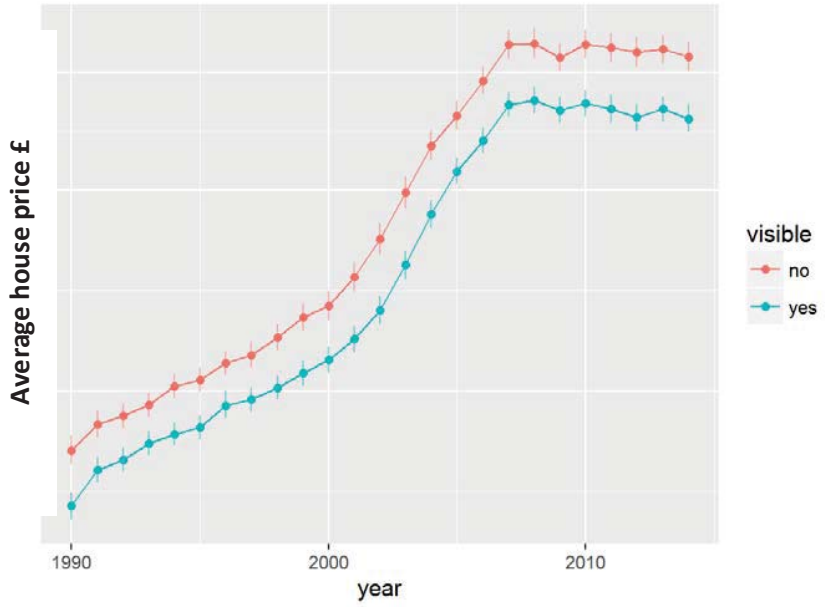

Figure 12: Average annual house prices (plotted on log scale) for houses that will have a turbine in sight at some point within the timeframe of the study vs. those that do not

Interactions between multiple causes

These explanations are not mutually exclusive. It is likely that they affect house prices simultaneously, and to varying degrees in different locations.

These forces may also reinforce or negate each other. They may each wax and wane over time and have different effects at different spatial scales leading to a complex and fluid set of potential outcomes at each point in time.

Further research would be needed to identify which of these effects is most prevalent and persistent. However, it should be noted that the data we collated for this project are unlikely to be sufficient to disentangle these effects in a robust way.

Appendix: Sensitivity analysis

Introduction

We noted above that we use a "fixed effect" methodology to control for a wide range of factors that we cannot observe or measure directly. Provided these factors remain fairly constant over time, we can control for their impact on price trends by introducing additional categorical variables into the analysis. All of the results presented in this report include basic fixed effects that control for differences in dwelling attributes, such as number of bedrooms, which we assume remain constant over time.

We also experimented with a wide number of additional controls. This allows us to test whether our results are robust to changes in how the analysis is set up. For example, we included fixed effects that allow different house price effects to occur over time for: the land gradient (for each individual property); elevation (height above sea level for each property); and aspect (which compass direction the property's slope is facing, indicating which direction their predominant view is likely to be). We also included controls for different price effects across distance rings and we allowed house prices to differ between Scotland's four NUTS2 regions and include a set of region-by-year interactions.

The impacts of these different specifications are presented in the graphs below for each of main categories of results presented under the labels A1, A2, and A3 which relate to the headings used in the main body of the report:

- Figure A1 reports sensitivity analysis for Result #1: Analysis based on Postcode Averages & Wind Farm Centre-Points ('centroids') (Gibbons),
- Figure A2 reports sensitivity analysis for Result #2: Analysis based on Repeat Sales & Individual Turbines
- Figure A3 reports sensitivity analysis for Result #3: Analysis based on Repeat Sales & Individual Turbines, Taking into Account Building Heights

You will see that each of the three figures contains eight sub-graphs, labelled (A) to (H) which give results for each type of fixed effects analysis. The labels for each are explained below:

The first sub-figure, labelled (A), is the "basic" fixed effects used in all analyses:

- **(A) "properties"**: includes fixed effects for time and properties. Note that these results are the same as the results used in the main sections above: they include the same time fixed effects and the property-level fixed effects as those used in Figures 5, 6 and 7 and follow the method described in the "Analysis Step 2" section above. We reproduce them below for ease of comparison with the additional results.

Sub-figures (B) to (D) in Figures A1, A2 and A3 below each add an extra fixed effect on top of the last. In order, these are:

- **(B) "geography":** fixed effects for slope, elevation and aspect;
- **(C) "rings"**: fixed effects for properties in each distance ring from turbines (or wind farms for figure A1);
- **(D) "NUTS2"**: fixed effects for Scotland's four NUTS2 regions.

Each sensitivity analysis includes a further four sub-figures. These run separate analyses on a particular subset of the data, with each of them using the full set of fixed effects. All three break down properties by their distance from the Scottish coast:

- **(G) "Coast < 2km"**: contains only coastal properties – i.e. those within 2km of the coast;
- **(H) "Coast > 2km"**: contains only inland properties – i.e. those located 2km or more beyond any coastal point.

Sub-figures (E) and (F) vary depending on whether the analysis is based on postcodes/wind farm centre-points or individual dwellings/turbines:

In **Figure A1** the analysis is based on postcode and wind farm centre-points and the results are broken down by wind farm size:

- **A1(E) "Single turbines"**: looks just at single turbine sites;
- **A1(F) "More than one turbine"**: looks at sites with more than one turbine.

In **Figures A2 and A3**, the analysis is based on individual turbines (rather than entire wind farms), and so we can estimate the impact of turbine height:

- **A2(E) and A3(E) "Turbines < 100m"**: plots the impact of turbines that are less than 100m tall;
- **A2(F) and A3(F) "Turbines < 100m"**: plots the impact of turbines over 100m tall.

Note that all graphs in the appendix have the same scale for the vertical axis, which is limited to the plus/minus 15% price change interval. This was done to make each sub-figure directly comparable. Any confidence intervals (i.e. the vertical bars plotted for each estimate) beyond this range are cut off at the 15% limit.

Sensitivity analysis for result #1: based on Postcode Averages & Wind Farm Centre-Points ('centroids') (Gibbons)

The results in the graphs (E) and (F) of Figure A1 allow us to compare the effects of "wind farms" consisting of single turbines (graph A1(E)) and those with two turbines or more (graph A1(F)). Single-turbine effects have wider confidence intervals making the estimates less precise and not statistically different from zero. The estimates are also noticeably less precise for coastal locations (A1(G)) than for inland properties (A1(H)). Controlling for "geography" using fixed effects for slope, elevation and aspect (A1(B)), distance rings (A1(C)) and NUTS2 region (A1(D)) yields relatively precise positive house price effects particularly for the 2-3km distance band.

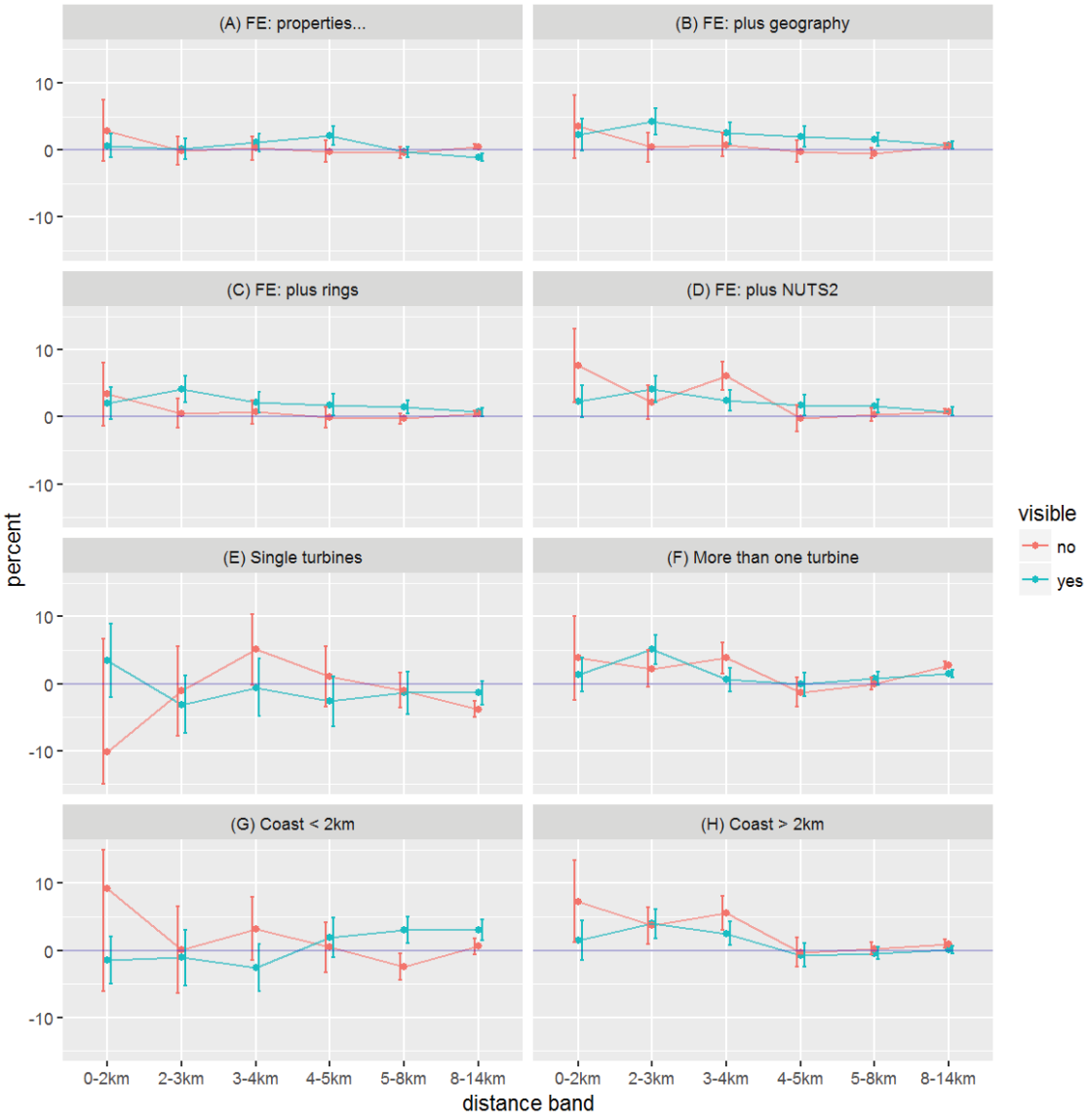

Figure A1: Percent difference in the change of house price

(Postcode/wind farm centroids, whole wind farm visible / not visible)

Sensitivity analysis for result #2: based on Repeat Sales & Individual Turbines

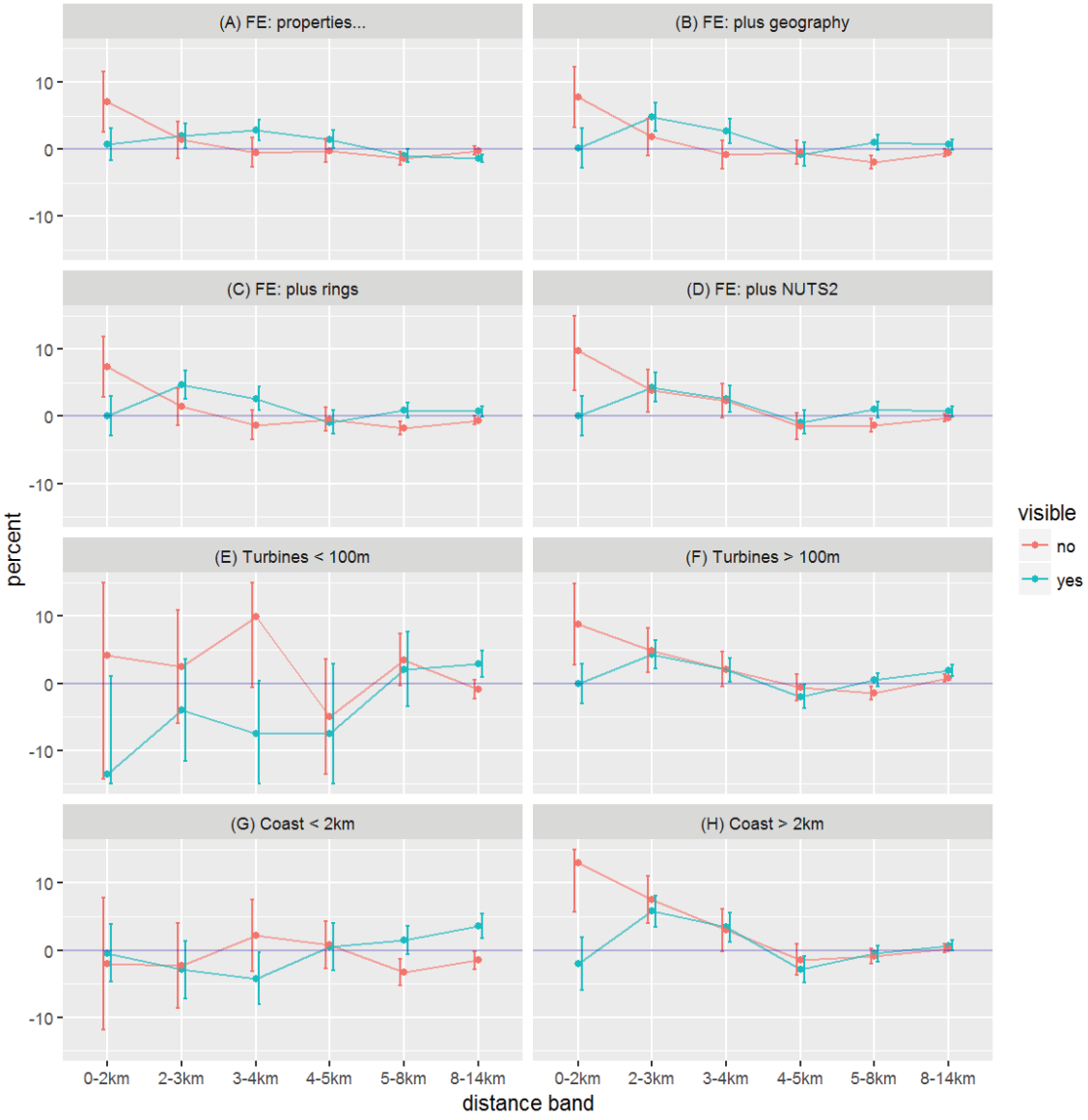

Figure A2: Percent difference in the change of house price

(All repeat sales, turbine visible / not visible)

Sensitivity analysis for result #3: based on Repeat Sales & Individual Turbines and Taking into Account Building Heights

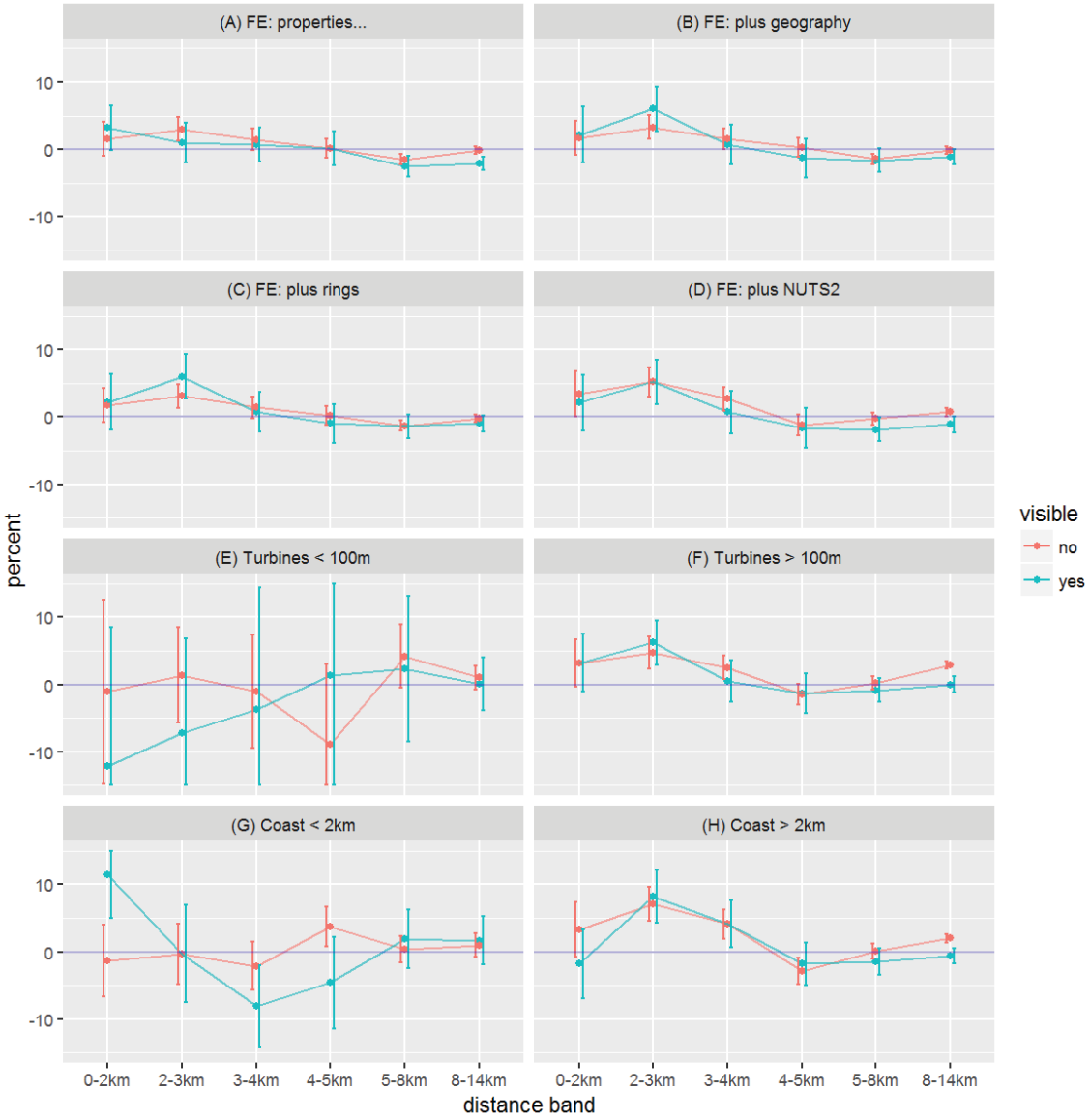

Figure A3: Percent difference in the change of house price

(All repeat sales, turbine visible / not visible accounting for building heights)

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APPENDIX 6.1

TURBINE BASE BOTANICAL STUDIES

Planning and Environmental Consultants

Appendix 6-1

Botanical Survey
Ballynagare Wind Farm

DOCUMENT DETAILS

Client:	**Enerco**
Project Title:	**Botanical Survey Ballynagare Wind Farm**
Project Number:	**200512**
Document Title:	**Ballynagare Windfarm**
Document File Name:	**BS – F – 2021.10.26 – 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	D1	20.10.2021	OOG	PR
01	F	26.10.2021	OOG	PR

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1. INTRODUCTION

1.1 Introduction

MKO were commissioned to undertake detailed botanical surveys to provide an evaluation and assessments of the habitats occurring on site at Ballynagare Wind Farm, Co. Kerry. The detailed assessments focussed on the habitats occurring immediately adjacent to the constructed development footprint including the turbine bases new access roads and associated infrastructure. The detailed botanical surveys were undertaken on the 09th September 2020 and 20th June 2021.

1.2 Survey Methods

A total of 13 relevés were undertaken adjacent to the construction footprint.

Relevés that were undertaken in peatland habitats followed guidelines set out in the following document:

- *Perrin, P.M, Martin, J.R., Barron, J.R., Roche & O' Hanrahan, B. (2014) Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79. National Parks and Wildlife Service.*

All species were readily identifiable during the survey. Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

1.3 Statement of Authority

Field surveys were undertaken by John Hynes (B.Sc., M.Sc., MCIEEM) and Olivia O 'Gorman (B.Sc., M.Sc.,), of MKO on 09th September 2020 and 20th June 2021.

This report has been reviewed by Pat Roberts (B.Sc., M.Sc., MCIEEM). Pat is a highly experienced ecologist has over 14 years' professional experience in environmental management and ecological assessment.

2. RESULTS

Turbine 1

Turbine number 1 will be located within an area of previously cut-over bog (PB4) which now supports reed and large sedge swamp (FS1) habitat.

Table 2- 1 Botanical Survey Result

Quadrat 1	Grid reference: 489107, 633303	Date 09/09/2020
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	100
Phragmites australis	Common Reed	7
Juncus inflexus	Hard Rush	+
Angelica sylvestris	Wild Angelica	+
Stachys palustris	Marsh woundwort	+
Succisa pratensis	Devils bit scabious	+
% Bare ground		0
% Hummocks		0
Habitat Classification		Cut-over bog (PB4) supporting reed and large sedge swamp (FS1).

Table 2- 2 Botanical Survey Result

Quadrat 1	Grid reference: 489090, 633309	Date 20/06/2021
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	7
Phragmites australis	Common Reed	20
Osmunda regalis	Royal Fern	40
Juncus effusus	Soft rush	5
Myrica Gale	Bog myrtle	2
Succisa pratensis	Devils bit scabious	3

Potamogeton spp.	Pondweed spp.	+
Comarum palustre	Marsh Cinquefoil	+
Carex echinata	Star sedge	+
% Bare ground		0
% Hummocks		0
Habitat Classification		Cut-over bog (PB4) supporting reed and large sedge swamp (FS1).



Plate 2- 1 Turbine 1 will be located within Reed and Large Sedge Swamp

Turbine 2

Turbine number 2 is located cut-over bog (PB4) This section of peatland is dominated by purple moor grass *(Molinia caerulea)*.

Table 2- 3 Botanical Survey Results

Quadrat 1	Grid reference: 511849, 680428	Date 09/09/2020
Species	**Common Name**	**% Cover**

Molinia caerulea	Purple moor grass	30
Rhynchospora alba	White Beak-sedge	15
Carex panicea	Carnation sedge	7
Erica tetralix	Cross leaved heath	5
Calluna vulgaris	Heather	3
Vaccinium myrtillus	Bilberry	3
Eriophorum angustifolium	Common cottongrass	3
Narthecium ossifragum	Bog Asphodel	+
Sphagnum palustre	Blunt-leaved Bog-moss	+
Sphagnum tenellum	Soft Bog-moss	+
Hypnum jutlandicum	Heath Plait-moss	+
% Bare ground		35
% Hummocks		0
Habitat Classification		Cutover bog (PB4)

Table 2- 4 Botanical Survey Results

Quadrat 1	Grid reference: 511849, 680428	Date 20/06/2021
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	2
Narthecium ossifragum	Bog Asphodel	2
Eriophorum angustifolium	Common cottongrass	10
Drosera rotundifolia	Round-leave sundew	5
Myrica Gale	Bog Myrtle	2
Rhynchospora alba	Lousewort	+
Erica tetralix	Cross leaved heath	+

% Bare ground	55
% Hummocks	0
Habitat Classification	Cutover bog (PB4)



Plate 2- 2 Turbine 2 will be located within revegetated cut-over bog (PB4)

Turbine 3

Turbine number 3 will be located within Remnant Raised Bog (PB1).

Table 2- 5 Botanical Survey Results

Quadrat 1	Grid reference: 488970, 632546	Date 09/09/2021
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	70
Erica tetralix	Cross leaved heath	15
Calluna vulgaris	Heather	25
Carex panicea	Carnation Sedge	15
Myrica gale	Bog Myrtle	1
Rhynchospora alba	White beak sedge	1
Spahgnum inundatum	Lessser cow horn bog moss	5
Narthecium ossifragum	Bog Asphodel	+
Potentilla erecta	Tormentil	+
% Bare ground (exposed peat)		10
% Hummocks		0
Habitat Classification		Remnant Raised Bog (PB1)

Table 2- 6 Botanical Survey Results

Quadrat 1	Grid reference: 488974, 632546	Date 20/06/2021
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	5
Narthecium ossifragum	Bog Asphodel	5
Carex panicea	Carnation Sedge	15
Myrica gale	Bog Myrtle	2
Schoenus nigricans	Black bog rush	1

Erica tetralix	Cross leaved heath	+
Erica cinerea	Bell Heather	+
Drosera rotundifolia	Round leaved sundew	+
% Bare ground (exposed peat)		20
% Hummocks		0
Habitat Classification		Remnant Raised Bog (PB1)



Plate 2- 3 Turbine 3 will be located within Remnant Raised Bog (PB1

Turbine 4

Turbine number 3 will be located within cut-over bog (PB4). This habitat is dominated by purple moor grass *(Molinia caerulea)* and Heather *(Calluna vulgaris).*

Table 2- 7 Botanical Survey Results

Quadrat 1	Grid reference: 489605, 632144	Date 09/09/2020
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	10

Carex panicea	Carnation Sedge	10
Erica tetralix	Cross leaved heath	+
% Bare ground (exposed peat)		70
% Hummocks		0
Habitat Classification		Cut-over bog (PB4)

Table 2- 8 Botanical Survey Results

Quadrat 1	Grid reference: 489605, 632144	Date 20/06/2021
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	2
Carex panicea	Carnation Sedge	25
Myrica Gale	Bog Myrtle	1
Trichophorum germanicum	Deer grass	+
% Bare ground (exposed peat)		80
% Hummocks		0
Habitat Classification		Cut-over bog (PB4)



Plate 2- 4 Turbine 4 will be located within revegetated cut-over bog (PB4)

Turbine 5

Turbine number 5 will be located within improved agricultural grassland (GA1) which is under agricultural management and subject to grazing by cattle. This habitat is dominated by perennial rye-grass *(Lolium perenne).*

Table 2- 9 Botanical Survey Results

Quadrat 1	Grid reference: 488706, 631747	Date 09/09/2020
Species	**Common Name**	**% Cover**
Lolium perenne	Perennial rye-grass	90
Rumex obtusifolius	Broadleaf dock	10
Ranunculus repens	Creeping buttercup	1
Urtica dioica	Nettle	1
Poa pratensis sens lat.	Smooth meadow grass	+
Rumex crispus spp.	Curled dock	+

% Bare ground (exposed peat)	0
% Hummocks	0
Habitat Classification	Improved Agricultural Grassland (GA1)



Plate 2- 5 Turbine 5 will be located within Improved Agricultural Grassland (GA1)

Turbine 6

Turbine number 6 will be located within revegetated cut-over bog (PB4). This habitat wet underfoot in places however, it is used for turbary activities and heavily drained.

Table 2- 10 Botanical Survey Results

Quadrat 1	Grid reference: 489103,631745	Date 09/09/2020
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	80
Ulex europaeus	Gorse	10
Myrica gale	Bog myrtle	7
Calluna vulgaris	Heather	40

Erica tetralix	Crossed leaved heath	5
Osmunda regalis	Royal fern	2
Sphagnum spp.	*Sphagnum spp.*	1
Succisa pratensis	Devil's bit scabious	+
Potentilla erecta	Tormentil	+
% Bare ground (exposed peat)		0
% Hummocks		0
Habitat Classification		Revegetated cut-over bog (PB4)

Table 2- 11 Botanical Survey Results

Quadrat 1	Grid reference: 489103,631745	Date 20/06/2021
Species	**Common Name**	**% Cover**
Molinia caerulea	Purple moor grass	20
Ulex europaeus	Gorse	2
Myrica gale	Bog myrtle	20
Calluna vulgaris	Heather	30
Erica tetralix	Crossed leaved heath	5
Osmunda regalis	Royal fern	2
Sphagnum spp.	*Sphagnum spp.*	20
Eriophorum angustifolium	Common Cottongrass	+
Narthecium ossifragum	Bog Asphodel	+
% Bare ground (exposed peat)		0
% Hummocks		0
Habitat Classification		Revegetated cut-over bog (PB4)



Plate 2- 6 Turbine 6 will be located within Revegetated cut-over bog (PB4)

Turbine 7

Turbine number 7 will be located within improved agricultural grassland (GA1) which is under agricultural management and subject to grazing by cattle. This habitat is dominated by perennial rye-grass *(Lolium perenne).*

Table 2- 12 Botanical Survey Results

Quadrat 1	Grid reference: 488815, 631261	Date 09/09/2020
Species	**Common Name**	**% Cover**
Lolium perenne	Perennial rye-grass	100
Rumex obtusifolius	Broadleaf dock	15
Poa pratensis sens lat.	Smooth meadow grass	5
% Bare ground (exposed peat)		0
% Hummocks		0
Habitat Classification		Improved Agricultural Grassland (GA1)

Table 2- 13 Botanical Survey Results

Quadrat 1	Grid reference: 489103,631745	Date 20/06/2021
Species	**Common Name**	**% Cover**
Lolium perenne	Perennial rye-grass	100
Ranunculus repens	Creeping buttercup	5
Taraxacum officinale agg	Dandelion	+
Trifolium spp.	Clover spp	+
% Bare ground (exposed peat)		0
% Hummocks		0
Habitat Classification		Mowed Improved Agricultural Grassland (GA1)



Plate 2- 7 Turbine 5 will be located within Improved Agricultural Grassland (GA1)

Compound

The compound is located within Improved Agricultural Grassland (GA1) comprised of perennial ryegrass and broadleaf dock with areas of bareground.



Plate 2- 8 Compound will be located within improved agricultural grassland (GA1)

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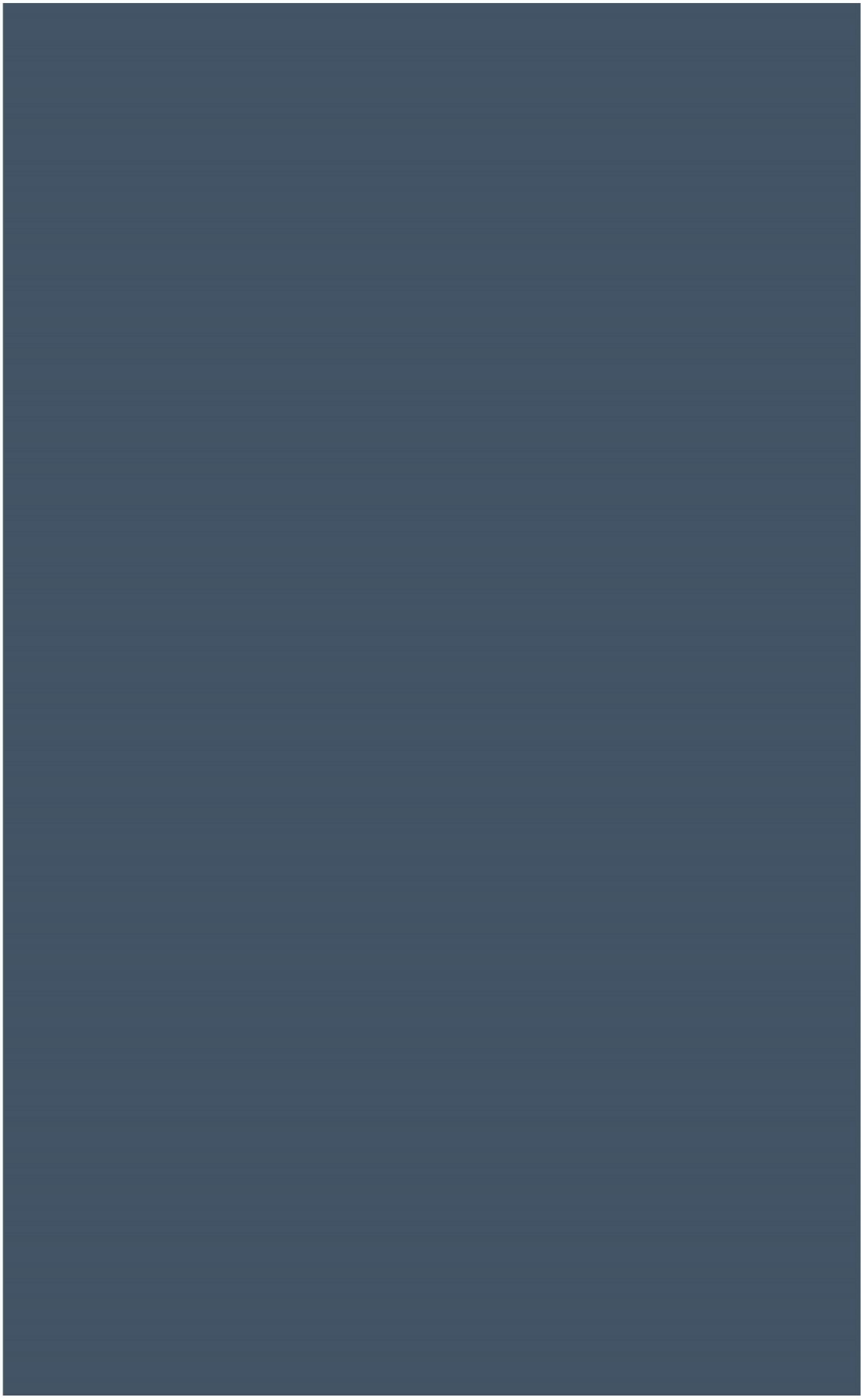

APPENDIX 6.2

BAT SURVEY REPORT

Appendix 6-2 – Bat Survey Report

Ballynagare Wind Farm, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd.**
Project Title:	**Ballynagare Wind Farm, Co. Kerry**
Project Number:	**200512**
Document Title:	**Bat Survey Report**
Document File Name:	**200512 – BR F – 2021.11.17**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	17/11/2020	AJ	JH

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APPENDICES

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Appendix 2 – Site Risk Assessment

Appendix 3 – 2019 Ecobat Per Detector Results

Appendix 4 – Overall Risk Assessment

1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats, as part of an application for planning permission of a proposed wind farm at Ballynagare, County Kerry. This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the proposed development on bats. Where necessary, mitigation is prescribed to minimise the potential for likely significant effects.

Bat surveys undertaken in 2020 are consistent with the methodologies described in NatureScot 2021[1] and were used to inform on the assessment of effects on bats. Bat surveys employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level.

The mitigation outlined in this report has been designed in accordance with the Northern Ireland Environment Agency (NIEA) Natural Environment Division (NED) Guidance [2], which was produced in August 2021, following the completion of the bat surveys at the Proposed Development site.

For the purposes of this EIAR, where the 'Proposed Development' is referred to, this relates to the development for which permission is sought. Where the 'the site' is referred to, this relates to the primary EIAR Study Area for the development, as delineated by the EIAR Study Area in green as shown on Figure 2-1. The actual development boundary, for the purposes of the planning permission application, occupies a smaller area within the primary EIAR Study Area.

The EIAR Study Area, 'the site', encompasses an area of approximately 611 hectares. The permanent footprint of the proposed development measures approximately 9.67 hectares, which represents approximately 1.6% of the primary EIAR Study Area. Further details on project description and components are outlined in Chapter 4 of this EIAR.

1.1 Background

Wind energy provides a clean, sustainable alternative to fossil fuels in generating electricity. However, wind energy development can impact wildlife, directly through mortality and indirectly through disturbance and habitat loss. Bat fatalities have been reported at wind energy facilities around the world, raising concern about the cumulative impacts of such developments on bat populations (Arnett *et al.* 2016). No large-scale studies have been undertaken in Ireland to date. However, a study from the UK estimated bat fatalities at 0 – 5.25 bats per turbine per month (Mathews *et al.* 2016). While these results are not directly applicable to Ireland due to differences in bat species and behaviour, Ireland shares more similarities with bat assemblages of Great Britain, when compared to those of mainland Europe.

Investigative research in North America and mainland Europe have revealed the mechanisms for bat mortality at wind turbines. Fatalities arise from direct collision with moving turbine blades (Horn *et al.* 2008, Cryand *et al.* 2014) and barotrauma (Baer Wald *et al.* 2008), i.e. internal injuries caused by air pressure changes. The reason why bats fly in the vicinity of wind turbines has been attributed to several different behavioural and environmental factors, e.g. habitat associations, weather conditions and, species ecology.

Pre-construction bat surveys are undertaken to gain an insight into bat activity in the absence of turbines and to predict and mitigate against any future risks identified. Survey design and analyses of results at

[1] *NatureScot published Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Version: August 2021 (NatureScot, 2021).*
[2] *Northern Ireland Environment Agency Natural Environment Division (NED) published Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland (NIEA, 2021).*

the proposed development site were undertaken with reference to the latest policy and legislation, scientific literature and industry guidelines. Any spatial, temporal or behavioural factors that may put bats at risk were fully considered.

1.2 Bat Survey and Assessment Guidance

Several guidelines for surveying bats at wind energy developments have been produced in Europe, the UK and Ireland.

At a European level, the Advisory Committee to the EUROBATS Agreement, to which Ireland is a signatory, have produced Guidelines for Consideration of Bats in Wind Farm Projects which outlines an approach for assessing the potential impacts of wind turbines on bats during planning, construction and operation phases (Rodrigues, 2015). However, these guidelines are based on continental scenarios and include more diverse species and behaviours than those typical of Ireland. As such, EUROBATS guidance may recommend a level of survey that may prove inappropriate in Irish scenarios. Nevertheless, the guidance is evidence-based and provides a useful European context, within which Member States are encouraged to produce specific national guidance, focusing on local circumstances.

Bat Conservation Ireland produced Wind Turbine/Wind Farm Development Bat Survey Guidelines (BCI, 2012a). This document provides advice to practitioners and decision makers in Ireland on necessary qualifications for surveyors, health and safety considerations, pre-construction and post-construction survey methodologies and information to be included in a report. In the absence of comprehensive Irish research, these guidelines provide generalised methodology rather than detailed technical advice.

The second edition of the UK Bat Conservation Trust Bat Survey Good Practice Guidelines (Hundt, 2012) includes a chapter (Chapter 10) on survey methodologies for assessing the potential impacts of wind turbines on bats. The document provides technical guidance for consultants carrying out impact assessments. However, the recommendations are not based on any research findings specific to the UK. A third edition to the guidelines, published in early 2016, removed the chapter on surveying wind turbine developments. Prior to the publication of the BCT guidelines, Natural England's *Bat and Onshore Wind Turbines: Interim Guidance* provided a pragmatic interpretation of the EUROBATS recommendations, as applied to onshore wind energy facilities in the UK (Natural England, 2014). In addition, the Chartered Institute of Ecology and Environmental Management (CIEEM) publishes advice on best practice as well as updates on the current state of knowledge in *the Technical Guidance Series* and in the quarterly publication *In Practice*.

In August 2021, NatureScot (formerly Scottish Natural Heritage), published *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (NatureScot, 2021). The 2021 version supersedes the 2019 version of the guidance. The purpose of the guidance is to help planners, developers and ecological consultants to consider the potential effects of onshore wind energy developments on bats. The emphasis is on direct impacts such as collision mortality, but there is reference throughout to the need for a full impact assessment requiring wider consideration of other (indirect) effects. The Guidance replaces previous guidance on the subject; notably that published by Natural England and Chapter 10 of the Bat Conservation Trust publication, *Bat Surveys: Good Practice Guidelines (2nd edition),* (Hundt, 2012) and tailors the generic EUROBATS guidance on assessing the impact of wind turbines on European bats (Rodrigues *et al.* (2014)). The document guides the user through the key elements of survey, impact assessment and mitigation.

The NIEA (NED) recently published *Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland*. This new guidance follows and builds upon the recently updated NatureScot 2021 guidance. The latter guidance has set the industry standard since its publication in 2019. The NED guidance does not aim to replace the NatureScot guidance, but it does provide additional clarifications and recommendations regarding survey requirements and impact assessment in an Irish context.

The survey scope and assessment provided in this report are in accordance with NatureScot 2021 Guidance. The mitigation outlined in this report is in accordance with NIEA, 2021.

1.3 Statement of Authority

Scope development and project management was overseen by Aoife Joyce (BSc., MSc.) and John Hynes (BSc., MSc., MCIEEM). Aoife has over two years' experience in ecological assessments and has completed CIEEM and BCI courses in Bat Impacts and Mitigation, Bat Tree Roost Identification and Endoscope training and Kaleidoscope Pro Analysis. John is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and has over 9 years' professional ecological consultancy experience. He is also a former member of the Bat Conservation Ireland management council.

Bat surveys were conducted by MKO ecologists Aoife Joyce, Luke Dodebier (BSc.), Rachel Walsh (BSc.) and Neil Campbell (BSc.). They were assisted by Cathal Bergin. Cathal was a student ecologist, carrying out placement with MKO. All staff have relevant academic qualifications to complete the surveys and assessments that they were required to do.

Data analysis was undertaken, and results were compiled by Aoife Joyce and Luke Dodebier. Impact assessment, the design of mitigation and final reporting was completed by Aoife Joyce under the supervision of John Hynes (BSc., MSc.) and Pat Roberts (BSc., MCIEEM), who both reviewed and approved the final document. Pat has over 10 years' experience in management and ecological assessment.

1.4 Irish Bats: Legislation, Policy and Status

Ireland has nine resident bat species, comprising more than half of Ireland's native terrestrial mammals (Montgomery *et al.,* 2014).

All Irish bats are protected under European legislation, namely the Habitats Directive (92/43/EEC). All Irish species are listed under Annex IV of the Directive, requiring strict protection for individuals, their breeding sites and resting places. The lesser horseshoe bat (*Rhinolophus hipposideros*) is further listed under Annex II of the Directive, requiring the designation of conservation areas for the species. Under this Directive, Ireland is obliged to maintain the favourable conservation status of Annex-listed species. This Directive has been transposed into Irish law through the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477/2011).

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2019). Under this legislation, it is an offence to intentionally disturb, injure or kill a bat, or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

The NPWS monitors the conservation status of European protected habitats and species and reports their findings to the European Commission every 6 years in the form of an Article 17 Report. The most recent report for the Republic of Ireland was submitted in 2019. Table 1-1 summarises the current conservation status of Irish bat species and identified threats to Irish bat populations.

Table 1-1 Irish Bat Species Conservation Status and Threats (NPWS, 2019)

Bat Species	Conservation Status	Principal Threats
Common pipistrelle *Pipistrellus pipistrellus*	Favourable	**A05** Removal of small landscape features for agricultural land parcel consolidation (M) **A14** Livestock farming (without grazing) [impact of anti-helminthic dosing on dung fauna] (M) **B09** Clear--cutting, removal of all trees (M) **F01** Conversion from other land uses to housing, settlement or recreational areas (M) **F02** Construction or modification (e.g. of housing and settlements) in existing urban or recreational areas (M) **F24** Residential or recreational activities and structures generating noise, light, heat or other forms of pollution (M) **H08** Other human intrusions and disturbance not mentioned above (Dumping, accidental and deliberate disturbance of bat roosts (e.g. caving) (M) **L06** Interspecific relations (competition, predation, parasitism, pathogens) (M) **M08** Flooding (natural processes) **D01** Wind, wave and tidal power, including infrastructure (M)
Soprano pipistrelle *Pipistrellus pygmaeus*	Favourable	
Nathusius' pipistrelle *Pipistrellus nathusii*	Unknown	
Leisler's bat *Nyctalus leisleri*	Favourable	
Daubenton's bat *Myotis daubentoni*	Favourable	
Natterer's bat *Myotis nattereri*	Favourable	
Whiskered bat *Myotis mystacinus*	Favourable	
Brown long-eared bat *Plecotus auritus*	Favourable	
Lesser horseshoe bat *Rhinolophus hipposideros*	Inadequate	

2. PROJECT DESCRIPTION

The proposed development is located approximately 9km west of Listowel and approximately 2km north of Lixnaw, County Kerry. The proposed development is located within the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

The site is accessed via a number of local roads and bog tracks. From the south the site is accessed via local roads adjoining the R557 regional road, located to the south of the site, which in turn adjoins the N69 National Secondary Road, south of Listowel. The south of the site can also be accessed from the west via a bridge over the Brick River.

The land-use/activities within the proposed site consists predominantly of turbary and agriculture. Land-use in the surrounding landscape comprises a mix of agricultural land, forestry, cutaway and lowland peatlands.

The proposed development comprises:

i. *Construction of 7 no. wind turbines with the following maximum and minimum parameters:*
   - *Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum*
   - *Hub height of 95m*
   - *Rotor diameter in the range of 150m maximum to 149m minimum*

ii. *Turbine hardstand areas;*

iii. *Provision of 1 no. permanent meteorological mast with a height in the range of 110 metres maximum to 100 metres minimum.*

iv. *Upgrade of existing roads and access junctions.*

v. *Provision of new site entrances, roads and hardstand areas.*

vi. *2 no. peat storage areas.*

vii. *2 no. construction compounds.*

viii. *1no. borrow pit.*

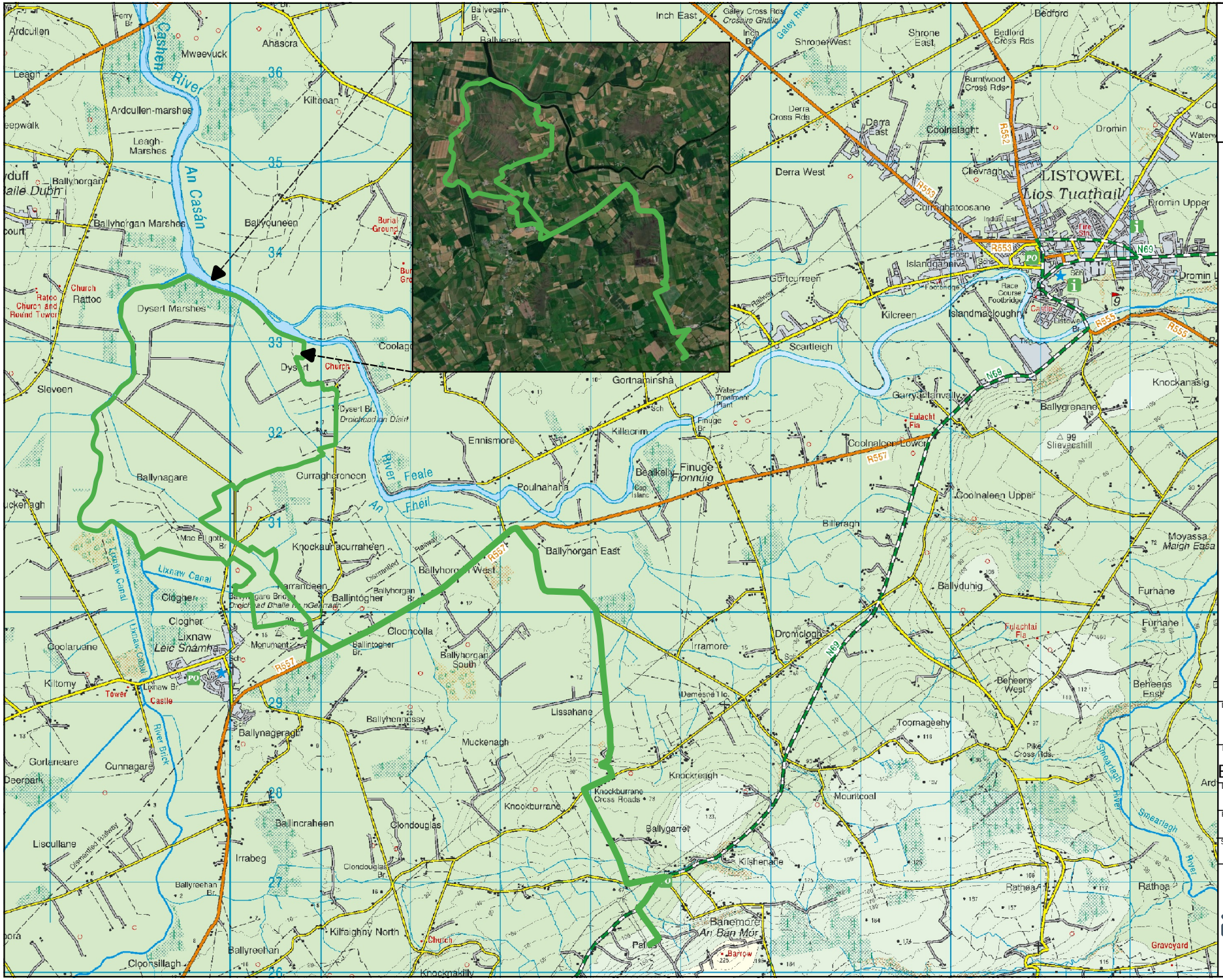
ix. *All site drainage works.*

x. *1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank.*

xi. *All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation.*

xii. *Connection of the proposed 38kV on-site substation via underground cable in the public road network to the entrance of the existing Clahane 110kV substation at the junction with the N69 public road, in the townland of Pallas.*

xiii. *All ancillary site and ground works, apparatus and signage.*



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3. METHODS

3.1 Consultation

A scoping exercise was undertaken as part of the EIAR for the proposed development. A Scoping Document, providing details of the application site and the proposed development, was prepared by MKO and circulated to consultees in December 2020. As part of this exercise, prominent Irish conservation groups were contacted, and Bat Conservation Ireland (BCI) and National Parks and Wildlife Service (NPWS) were specifically invited to comment on the potential of the proposed development to affect bats.

Details of consultation responses specifically related to bats are provided in Section 4.1 below.

3.2 Desk Study

A desk study of published material was undertaken prior to conducting field surveys. The aim was to provide context to the site in order to assist bat survey planning and assessment. This included the identification of designated sites, species of interest or any other potential risk factors within the site and the surrounding region. The results of the desk study including sources of information utilised are provided below.

3.2.1 Bat Records

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. The most recent search examined bat presence and roost records within a 10 km radius of a central point within the Proposed Development (Grid Ref: E089463 N132116) (BCI 2012, Hundt 2012, NatureScot 2021). Available bat records were provided by Bat Conservation Ireland on 04/10/2021. Results from the National Biodiversity Data Centre were also reviewed for bat species present within the relevant 10km grid squares of the Proposed Development.

The NPWS maintains all lesser horseshoe bat roost monitoring datasets and roost locations. As the proposed development is within the known distribution range of lesser horseshoe bat, the NPWS were consulted to provide any records of lesser horseshoe roosts within 10km of the Proposed Development. An information request was sent to the NPWS scientific data unit requesting records from the Rare and Protected Species Database on the 19th June 2021. A response was received on the 28th June 2021.

In addition, information on species' range and distribution, available in the 2019 Article 17 Reports (NPWS, 2019), was reviewed in relation to the location of the proposed development. The aim was to identify any high-risk species at the edge of their range.

3.2.2 Bat Species' Range

EU member states are obliged to monitor the conservation status of natural habitats and species listed in the Annexes of the Habitats Directive. Under Article 17, they are required to report to the European Commission every six years. In April 2019, Ireland submitted the third assessment of conservation status for Annex-listed habitats and species, including all species of bats (NPWS, 2019).

The 2019 Article 17 Reports were reviewed for information on bat species' range and distribution in relation to the location of the proposed development. The aim was to identify any high-risk species at the edge of their range (NatureScot, 2021).

3.2.3 Designated Sites

The National Parks and Wildlife Service (NPWS) map viewer and website provides information on rare and protected species, sites designated for nature conservation and their conservation objectives. A search was undertaken of sites designated for the conservation of bats within a 10 km radius of the site (BCI 2012, Hundt, 2012, NatureScot 2021). This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

3.2.4 Landscape Features

3.2.4.1 Ordnance Survey Mapping

Ordnance survey maps (OSI 1:5,000 and 1:50,000) and aerial photographs were reviewed to identify any habitats and features likely to be used by bats. Maps and images of the site and general landscape were examined for suitable foraging or commuting habitats including woodlands and forestry, hedgerows, treelines and watercourses. In addition, any potential roost sites, such as buildings and bridges, were noted for further investigation.

3.2.4.2 Geological Survey Ireland

The Geological Survey Ireland (GSI) online mapping tool and University of Bristol Spelaeological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the proposed site (BCI, 2012) (last searched on the 11th October 2021). Furthermore, the archaeological database of national monuments was reviewed for any evidence of manmade underground structures, e.g. souterrains, that may be used by bats (last searched on the 11th October 2021).

3.2.4.3 National Biodiversity Data Centre Bat Landscape Mapping

The National Biodiversity Data Centre (NBDC) map viewer presents “Bat Landscape” maps for individual species and for all species combined. Lundy et al. (2011) used Maximum Entropy Models to examine the relative importance of bat landscape and habitat associations in Ireland. The resulting map provides a 5-point scale, ranging from highest habitat suitability index (presented in red) to lowest suitability index (presented in green). However, squares highlighted as less favourable may still have local areas of abundance.

The location of the proposed development was reviewed in relation to bat habitat suitability indices. The aim of this was to assess habitat suitability for all bat species within the site. It is worth noting that these results are based on a modelling exercise and not confirmed bat species records. Regardless, they may provide a useful indication of potential favourable bat associations within the proposed site.

3.2.4.4 Additional Wind Energy Projects in the Wider Landscape

A search for existing and permitted wind energy developments within 10km of the proposed site was undertaken (NatureScot, 2021). The IWEA interactive wind map (iwea.com) was reviewed in conjunction with wind farm planning applications from Kerry County Council. Other infrastructure developments and proposals (e.g. roads) were also noted. Information on the location and scale of these developments was gathered to inform cumulative effects. More details on other infrastructure developments can be found in Chapter 2 of the main EIAR.

3.2.5 Multidisciplinary Surveys

Multidisciplinary walkover surveys were undertaken 11th May, 26th May, 2nd July, 16th July, 9th September, 11th September and 24th September 2020 and on 1st April, 18th June, 21st June and 8th October 2021. The site was systematically and thoroughly walked in a ground-truthing exercise with the habitats on the proposed site assessed and classified. The grid connection route was surveyed on the 18th and 21st of June, 1st September and 8th October 2021 and is further outlined in Chapter 6 of the EIAR.

3.3 Field Surveys

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2020. During these surveys, habitats within the site were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High, Moderate, Low* and *Negligible*, and are described fully in **Appendix 1**.

3.3.2 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 75m) of the boundary of the Proposed Development footprint (NatureScot, 2021). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in May, July and September 2020. A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats).

Any potential roost sites were subject to a roost assessment. This comprised a detailed inspection of the exterior and interior (if accessible) to look for evidence of bat use, including live and dead specimens, droppings, feeding remains, urine splashes, fur oil staining and noises.

Any potential tree roosts were examined for the presence of rot holes, hazard beams, cracks and splits, partially detached bark, knot holes, gaps between overlapping branches and any other potential roost features (i.e. PRFs) identified by Andrews (2018).

No structures or trees with PRFs were identified within 275m of the Proposed Development footprint.

One structure was identified within the wider site (Grid Ref: Q 90463 32419) and was subject to a roost assessment on 11th May and 2nd July 2020. A dusk emergence survey was carried out on the night of the 11th May 2020. Two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). Conditions were suitable for bat surveys; dry, warm (13˚C), calm (Beaufort Force 1). The emergence survey commenced half an hour before sunset and lasted for 1.5 hours. The purpose was to identify any bat species, numbers, access points and roosting locations within the structure.

3.3.3 Manual Transects

Manual activity surveys comprised walked transects at dusk. A series of representative transect routes were selected throughout the proposed wind farm site. The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey

results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect routes are presented in Figures 3-1- 3-3.

Transects were walked by two surveyors, recording bats in real time. Dusk surveys commenced 30 minutes before sunset and were completed for 3 hours after sunset. Surveyors were equipped with active full spectrum bat detectors, the Batlogger M bat detector (Elekon AG, Lucerne, Switzerland), and all bat activity was recorded for subsequent analysis to confirm species identifications. Transects surveys were undertaken in Spring, Summer and Autumn 2020. Table 3-1 summarises survey effort in relation to walked transects.

Table 3-1 Survey Effort - Manual Transects

Date	Surveyors	Sunrise/ Sunset	Type	Weather	Walked (km)
11th May 2020	Aoife Joyce and Luke Dodebier	21:22	Dusk	13°C, dry, calm/light air	3.25
16th July 2020	Rachel Walsh and Cathal Bergin	21:50	Dusk	19°C, dry with drizzle, calm/moderate breeze	6.75
9th September 2020	Luke Dodebier and Neil Campbell	20:07	Dusk	14°C, dry with drizzle, calm/light air	5.47
Total Survey Effort					**15.47km**



Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Spring Transect Route

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N

Drawing Title

Spring Transect Route

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	3-1
Scale	Date
1:17057	12/11/21

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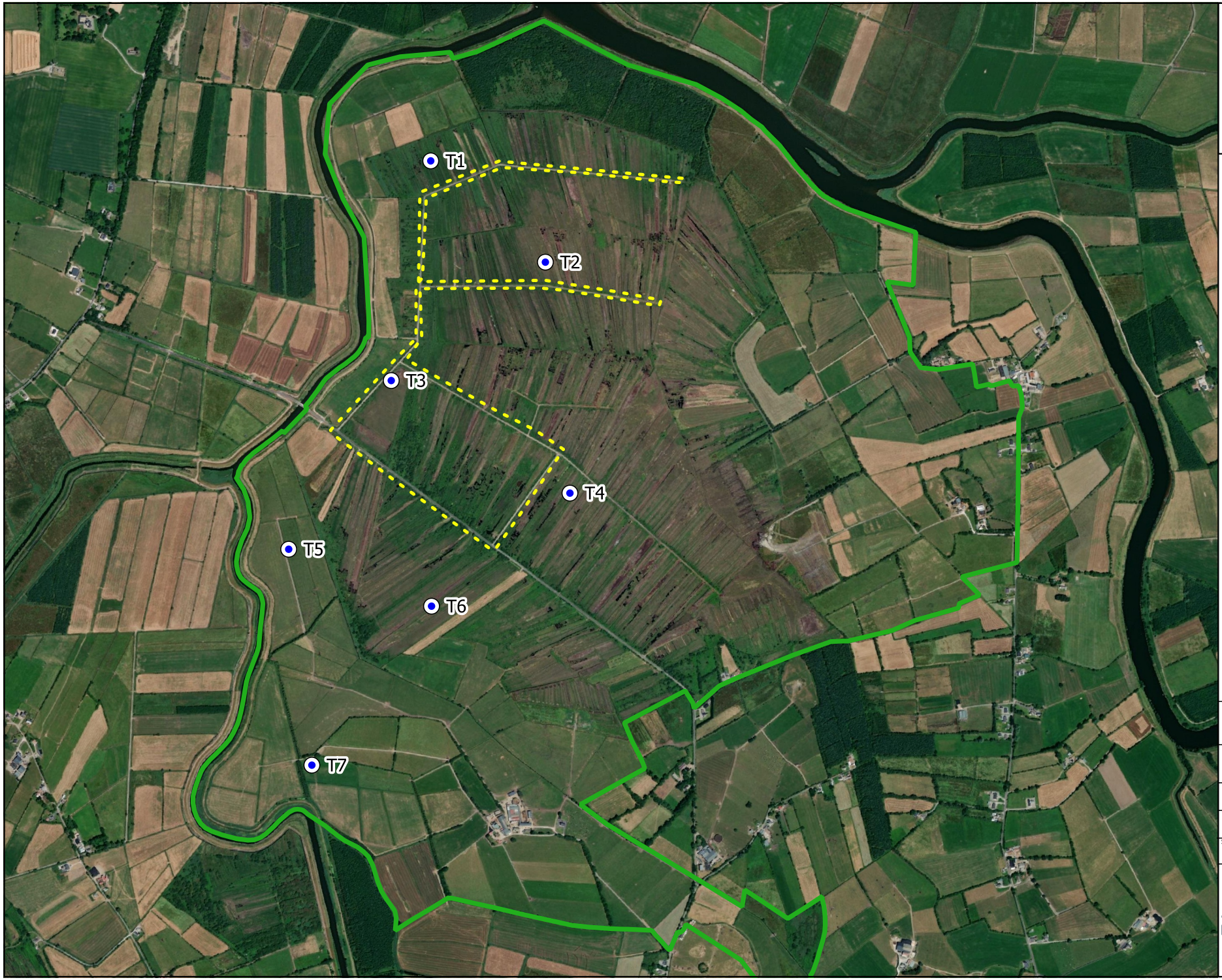

Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Summer Transect Route

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Drawing Title

Summer Transect Route

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	3-2
Scale	Date
1:17057	12/11/21

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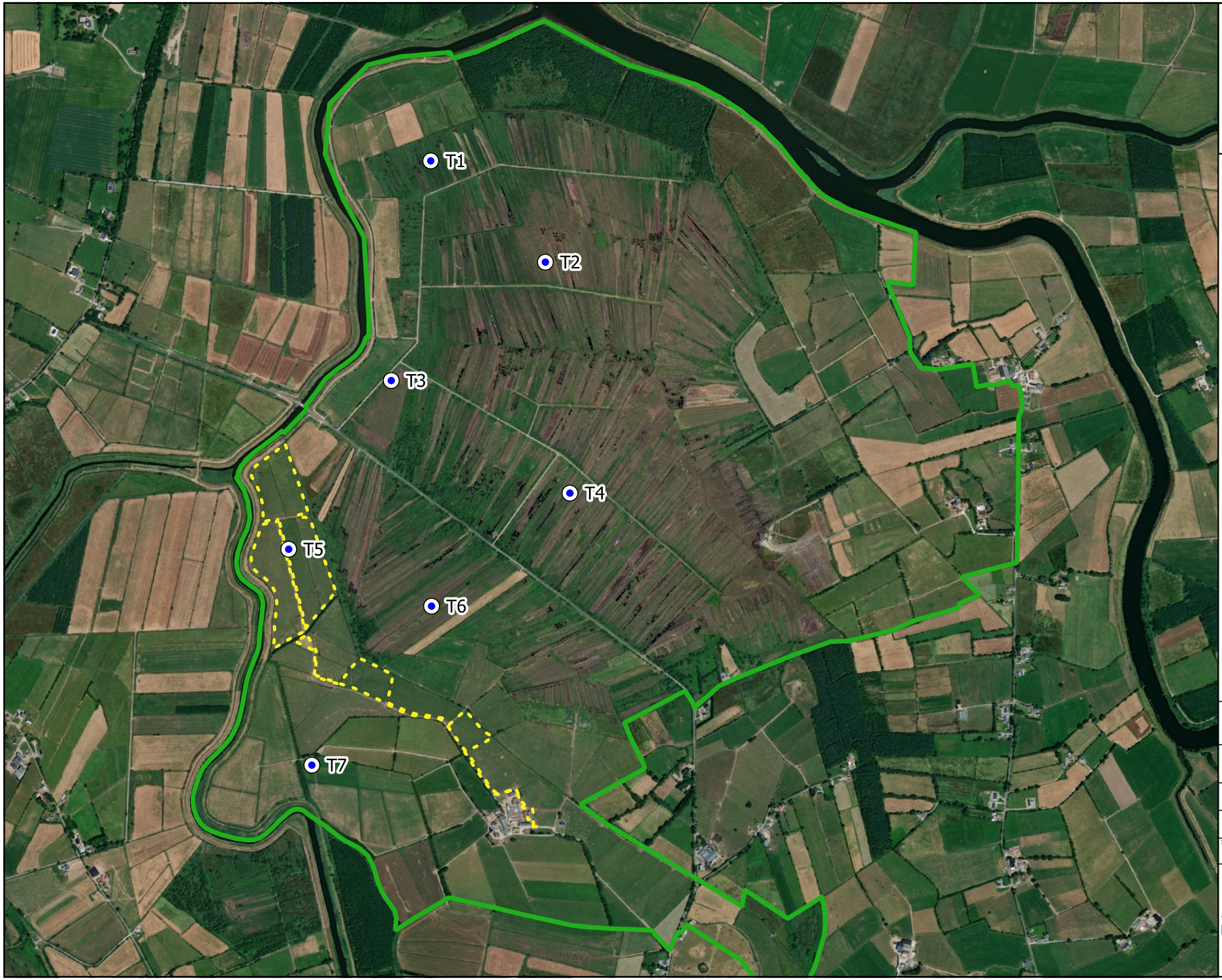

Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Autumn Transect Route

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Drawing Title

Autumn Transect Route

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	3-3
Scale	Date
1:17057	12/11/21

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3.3.4 Ground-level Static Surveys

Where developments have more than 10 turbines, NatureScot requires 1 detector per turbine up to 10 plus a third of additional turbines. Given that 7 turbines were proposed 7 detectors were deployed to ensure compliance with NatureScot guidance. Detectors were numbered utilising an initial indicative layout that included 9 turbines. The extent of the Proposed Development changed through the design process, and the number of turbines reduced by 2. The final layout includes 7 turbines. The detector locations achieved a good spatial spread in relation to the proposed turbines and sampled the range of available habitats.

Automated bat detectors were deployed at 7 no. locations for at least 10 nights in 2020 in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) (NatureScot, 2021). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout. Detector locations achieved a representative spatial spread in relation to proposed turbines and sampled the range of available habitats. Figure 3-4 presents static detector locations in relation to the final proposed layout. Static detector locations are described in Table 3-2.

Table 3-2 Ground-level Static Detector Locations

ID	Location (ITM)	Habitat	Linear Feature within 50m	Corresponding Turbine No.
2020				
D01	E089127 N133256	Cutover bog	Drainage ditch & scrub	T1
D02	E089631 N132516	Cutover bog	Drainage ditch	T2
D04	E089059 N132435	Cutover bog, beside ditch	Drainage ditch, scrub & track	T3
D06	E088709 N131892	Improved agricultural grassland	Drainage ditch	T5
D07	E089092 N131682	Cutover bog, beside drain	Drainage ditch	T6
D08	E088888 N131151	Improved agricultural grassland	Hedgerow/treeline & drainage ditch	T7
D09	E089613 N132065	Cutover bog	Drainage ditch	T4

Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed using settings recommended for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset until 30 minutes after sunrise. The Song Meter automatically adjusts sunset and sunrise times using the Solar Calculation Method when provided with GPS coordinates.

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e. minimum 10 no.) with appropriate weather conditions were captured (i.e. dusk temperatures above 8˚, wind speeds less than 5m/s and no or only very light rainfall). Table 3-3 summarises survey effort achieved in 2020 for each of the 7 no. detector locations.

Table 3-3 Survey Effort - Ground-level Static Surveys 2020

Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	11th May – 26th May 2020	15	11
Summer	2nd July – 16th July 2020	14	14
Autumn	9th September – 24th September 2020	15	13
Total Survey Effort		**44**	**38**



Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Static Detector Location

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Drawing Title

Static Detector Locations

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	3-4
Scale	Date
1:17057	12/11/21

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Website: ww.mkoireland.ie

3.4 Bat Call Analysis

All recordings from 2020 were later analysed using bat call analysis software Kaleidoscope Pro v.5.1.9 (Wildlife Acoustics, MA, USA). The aim of this was to identify, to a species or genus level, what bats were present at the proposed development site. Bat species were identified using established call parameters, to create site-specific custom classifiers and were manually verified.

Echolocation signal characteristics (including signal shape, peak frequency of maximum energy, signal slope, pulse duration, start frequency, end frequency, pulse bandwidth, inter-pulse interval and power spectra) were compared to published signal characteristics for local bat species (Russ, 1999). Myotis species (potentially Daubenton's bat (*M. daubentonii*), Whiskered bat (*M. mystacinus*), Natterer's bat (*M. nattereri*) were considered as a single group, due to the difficulty in distinguishing them based on echolocation parameters alone (Russ, 1999). The echolocation of soprano pipistrelle (*P. pygmaeus*) and common pipistrelle (*P. pipistrellus*) are distinguished by having distinct (peak frequency of maximum energy in search flight) of ~55 kHz and ~46 kHz respectively (Jones & van Parijs, 1993).

Plate 3-1 below shows a typical sonogram of echolocation pulses for common pipistrelle recorded with a SM4BAT bioacoustic static bat recording device. The recorded file is illustrated using Wildlife Acoustics Kaleidoscope software.

Individual bats of the same species cannot be distinguished by their echolocation alone. Thus, 'bat passes' was used as a measure of activity (Collins, 2016). A bat pass was defined as a recording of an individual species/species group's echolocation containing at least two echolocation pulses and of maximum 15s duration. All bat passes recorded in the course of this study follow these criteria, allowing comparison.

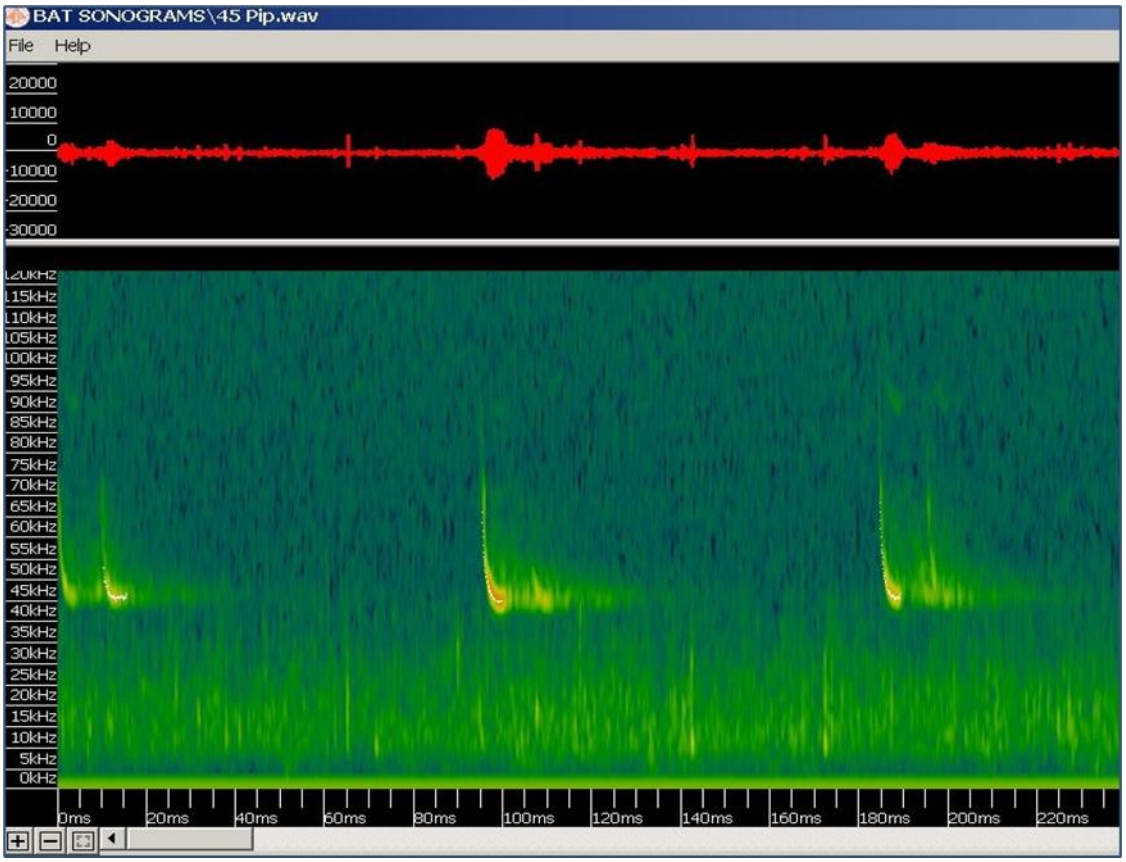

Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

Static detector monitoring results were uploaded to the online database tool Eco bat (ecobat.org.uk). This web-based interface, launched in August 2016, allows users to upload activity data and to contrast results with a comparable reference range, allowing objective interpretation. Uploaded data then contributes to the overall dataset to provide increasingly robust outputs. Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting levels of bat activity in order to provide objective and consistent assessments. Table 3-4 defines bat activity levels as they relate to Ecobat percentile values (NatureScot, 2021).

Static detector at ground level results for the Proposed Development were uploaded on the 31st May 2021. Database records used in analyses were limited to those within a similar time of year (within 30 days) and a within a similar geographic region (within 200 km).

Guidelines in the use of Ecobat recommend a Reference Range of 2000+ to be confident in the relative activity level. The reference range is the stratified dataset of bat results recorded in the same region, at the same time of year, by which percentile outputs can be generated. This comprises all records of nightly bat activity across Ireland.

Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 2000. As Ecobat continues to be utilised in Ireland the accuracy of data outputs and results will improve over time. Results of Ecobat analysis for the proposed development site can be found in Table 4-4 in the results section below.

Table 3-4 Ecobat Percentile Score and Categorised Level of Activity (NatureScot, 2021)

Ecobat Percentile	Bat Activity Level
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

3.6 Assessment of Collision Risk

3.6.1 Population Risk

NatureScot (2021) provides a generic assessment of bat collision risk for UK species, based on species behaviour and flight characteristics. In the guidelines, this measure of collision risk is used, in combination with relative abundance, to indicate the potential vulnerability of British bat populations. No such assessment is provided for Irish bat populations.

In Plate 3-2, an adapted assessment of vulnerability for Irish bat populations is provided. This adaptation of the NatureScot Guidance Table 2 was based on collision risk and species abundance of Irish bat populations. Species' collision risk follows those described in NatureScot (2021). Relative abundance for Irish species was determined in accordance with Wray *et al.* (2010) using population data available in the 2019 Article 17 reports (NPWS, 2019). Feeding and commuting behaviours, and habitat preferences for bat species in Ireland were also considered.

Relative Abundance	Low Collision Risk	Medium Collision Risk	High Collision Risk
Common species			Common pipistrelle Soprano pipistrelle
Rarer species	Daubenton's bat Brown long-eared bat Lesser horseshoe bat		Leisler's bat
Rarest species	Natterer's bat Whiskered bat		Nathusius' pipistrelle

Low Population Vulnerability	Medium Population Vulnerability	High Population Vulnerability

Plate 3-2 Population Vulnerability of Irish Bat Species (Adapted from NatureScot, 2021)

3.6.2 Site Risk

The likely impact of a proposed development on bats is related to site-based risk factors, including habitat and development features. The cross-tablature result of habitat risk and project size determines the site risk (i.e. Low, Medium or High) (Plate 3-3) i.e. Table 3a (NatureScot, 2021). Table 5-1 in the results section describes the criteria and site-specific characteristics used to determine an indicative risk level for the proposed site. All site assessment levels, as per NatureScot (2021) are presented in **Appendix 2**.

		Project Size		
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Low/Lowest Site Risk (1-2)	Medium Site Risk (3)	High/Highest Site Risk (4-5)

Plate 3-3 Site-risk Level Assessment Matrix (Table 3a, NatureScot, 2021)

3.6.3 Overall Risk Assessment

An overall assessment of risk was made by combining the site risk level (i.e. Medium) and the population risk (i.e. Ecobat bat activity outputs), as shown in the overall risk assessment matrix table (Plate 3-4) i.e. Table 3b (NatureScot, 2021). The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values).

	Ecobat Activity Category					
Site Risk Level	Nil (0)	Low (1)	Low-Moderate (2)	Moderate (3)	Moderate-High (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (15-25)

Plate 3-4 Overall Risk Assessment Matrix (Table 3b, NatureScot, 2021)

This exercise was carried out for each high collision risk species. Overall risk assessments were also considered in the context of any potential impacts at the population level, particularly for species identified as having high population vulnerability (Plate 3-2).

3.7 Limitations

A comprehensive suite of bat surveys have been undertaken at the Proposed Development site in 2020. The surveys undertaken in 2020, in accordance with NatureScot Guidance, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Development on bats receptors.

The information provided in this report accurately and comprehensively describes the baseline environment; provides an accurate prediction of the likely effects of the Proposed Development; prescribes mitigation as necessary; and describes the predicted residual impacts. The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines.

No significant limitations in the scope, scale or context of the assessment have been identified. Overall, a comprehensive assessment has been achieved.

4. SURVEY RESULTS

4.1 Consultation

4.1.1 Bat Conservation Ireland

Bat Conservation Ireland were invited to comment on the potential of the Proposed Development to affect bats. The following response was received on 15/12/2020. *"Unfortunately as we are a very small organisation with limited resources, we do not have the capacity to comment on planning issues."*

Recommendations made by the Bat Conservation Ireland were fully considered in the design of bat surveys and the preparation of this report.

4.1.2 Development Applications Unit - NPWS

A detailed scoping exercise was undertaken for the Proposed Development. This is described fully in Chapter 2 of the EIAR. A response from the Department of Culture, Heritage and the Gaeltacht on 26th January 2021 provided no specific recommendations were made in relation to bats.

4.2 Desk Study

4.2.1 Bat Records

Bat Conservation Ireland

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of the Proposed Development site (IG Ref: E089463 N132116). Available bat records were provided by Bat Conservation Ireland on 04/10/2021. A number of observations have been recorded within 10km; two roosts, five transects and ten ad-hoc observations. At least five of Ireland's nine resident bat species were recorded within 10 km of the proposed development including common and soprano pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat. The results of the database search are provided in Table 4-1.

Table 4-1 National Bat Database of Ireland Records within 10km

Record	Species	Grid Reference	Date	Location/Name
Roost	*Plecotus auritus*	Q9329	*Unknown*	Kiltomy, Co. Kerry
	Plecotus auritus	Q9923	*Unknown*	Lyracrumpane, Co. Kerry
Transect	*Unknown*	Q8898328977	*Unknown*	Cunnigar Townland Transect
	Myotis daubentonii, Unidentified bat	Q9511132113	*Unknown*	Finuge Bridge Transect
	Myotis daubentonii, Unidentified bat	Q9808433646	*Unknown*	Flesk
	Plecotus auritus, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	Q9810334140	*Unknown*	McCarthy Keville O'Sullivan
	Unidentified bat, Myotis daubentonii	Q9808433646	*Unknown*	Racecourse Footbridge Transect
Ad-Hoc	*Unknown*	Q8102732190	14/09/2017	BATLAS 2020
	Myotis daubentonii	Q8867432437	14/09/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz)	Q8097934227	14/09/2017	BATLAS 2020
	Unidentified bat	Q8693734611	14/09/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	Q8293235816	14/09/2017	BATLAS 2020
	Unknown	Q8903036562	14/09/2017	BATLAS 2020
	Pipistrellus pygmaeus	Q8468537781	14/09/2017	BATLAS 2020
	Nyctalus leisleri	Q8959838312	14/09/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii, Plecotus auritus	Q9890433627	09/06/2019	BATLAS 2020
	Pipistrellus pygmaeus	Q9274031448	28/08/2019	BATLAS 2020

National Parks and Wildlife Service – Lesser horseshoe Roost Records

An information request was sent to the NPWS scientific data unit requesting records from the Rare and Protected Species Database on the 16th June 2021. A response was received on the 28th June 2021. The search yielded no lesser horseshoe bat roosts within 10km of the site.

Any SAC that has lesser horseshoe bat as a qualifying interest will also have a "Conservation Objective". This aims to manage and protect the qualifying interest. Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (European Commission, 2013) (NPWS, 2018). It is defined in positive terms such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Research has shown that lesser horseshoe bats normally forage in woodlands/scrub within 2.5km of their roosts (Bontadina *et al.,* 2002); therefore, a 2.5km zone is considered an appropriate distance to foraging areas (NPWS, 2018). Habitat areas within 2.5km of known roosts are important for supporting bat populations.

The Proposed Development site is not located within 2.5km of any lesser horseshoe designated SAC. Additionally, no suitable roosting habitat for this species was recorded on the site of Proposed Development.

National Biodiversity Data Centre

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of the Proposed Development was made on the 29th of April 2021. The search yielded records for six bat species within 10km. Table 4-5 lists the bat species recorded within the hectads which pertain to the site (Q83 and Q93).

Table 4-2 NBDC Bat Records within 10km of Proposed Development

Grid Square	Species	Database	Designation
Q93	Brown long-eared bat *Plecotus auratus*	National Bat Database of Ireland	HD Annex IV, WA
Q83 & Q93	Daubenton's bat *Myotis daubentonii*	National Bat Database of Ireland	HD Annex IV, WA
Q93	Natterer's bat *Myotis nattereri*	National Bat Database of Ireland	HD Annex IV, WA
Q83 & Q93	Leisler's bat *Nyctalus leisleri*	National Bat Database of Ireland	HD Annex IV, WA
Q83 & Q93	Common pipistrelle *Pipistrellus pipistrellus*	National Bat Database of Ireland	HD Annex IV, WA
Q83 & Q93	Soprano pipistrelle *Pipistrellus pygmaeus*	National Bat Database of Ireland	HD Annex IV, WA

4.2.2 Bat Species Range

The potential for negative impacts is likely to increase where there are high risk species at the edge of their range (NatureScot, 2021). Therefore, range maps presented in the 2019 Article 17 Reports (NWPS, 2019) were reviewed in relation to the location of the proposed development.

The Proposed Development site is located outside the current range for lesser horseshoe bat, nathusius' pipistrelle, Whiskered bat. The proposed development site is partially outside or at the edge of the range for brown long-eared bat and within range for all other species.

4.2.3 Designated Sites

Within Ireland, the lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the proposed site is situated outside the known range of this species. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs and pNHAs within a 10 km radius of the site found no sites designated for the conservation of bats.

4.2.4 Landscape Features and Habitat Suitability

A review of mapping and photographs provided insight into the habitats and landscape features present at the Proposed Development site. In summary, the primary land use within the proposed site is turbary while the remainder of the site supports marginal farmland and peatland habitats.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the site. However, an underground limestone cave was identified approximately 1.5km outside the proposed site (Table 4-3). This location has been fully avoided by the Proposed Development. A search of the National Monuments Database did not reveal the presence of any manmade subterranean areas within the site.

A search of the UBSS Cave Database for the Republic of Ireland found no caves within the proposed site or within 10km of the site boundary.

Table 4-3 Subterranean Sites

Class	Location (ITM)	Description	Distance from site
Limestone Cave 0811NWK001	Townland: Lixnaw Grid Ref (ITM): E489244 N629090	Cave	Approximately 1.5km

A review of the NBDC bat landscape map provided a habitat suitability index of 23.56 (yellow). This indicates that the proposed development area has moderate habitat suitability for bat species.

4.2.5 Other Wind Energy Developments

Table 4-4 provides an overview of wind farms in the vicinity of the Proposed Development.

Table 4-4 Wind Farm Developments within 10km of the Proposed Development

Wind Farm Name and Location	No. Turbines	Status
Within 10km of Proposed Development		
Pallas/Clahane	20	Existing
Pallas/Clahane Extension	6	Existing
Ballincollig Hill	2	Existing
Beale Hill Wind Farm	4	Existing
Ballyhorgan	10	Proposed
Cloghaneleskirt	5	Existing
Knocknagoum/Maghanknockane	15	Existing
Tullahennel Wind Farm (made up of Tullahennel South, Tullahennel North and Larha wind farm)	13	Existing

4.3 Overview of the site and Bat Habitat Appraisal

The site is dominated by Cut-over bog (PB4) and Improved Agricultural Grassland (GA1). The improved agricultural grassland habitat surrounds the cut-over bog habitats with some of the agricultural areas having been reclaimed from peatland. The majority of the grassland within the site is under active agricultural management comprising of grazing or mowing practices including the grassland habitats associated with components of development footprint. The cut-over bog (PB4) habitat remains in use for turbary activities. Some areas of the habitat remain relatively bare, with little vegetation, however other areas have regenerated with Large reed and sedge swamp (FS1) vegetation. There is a relatively small area of intact raised bog habitat of approximately 2.9 ha, located to the west of the cut-over habitats and adjacent to the local access roadway.

Additional habitats within the site include Raised bog (PB1), Conifer plantation (WD4), Hedgerows (WL1), Treeline (WL2), Scrub (WS1), Spoil and bare ground (ED2), Dry meadows and grassy verges (GS2), Drainage ditches (FW4), Depositing/lowland rivers (FW2) and Buildings and artificial surfaces (BL3). Further details on habitats present within site can be found in Chapter 6 of the EIAR.

There are two large blocks and one small block of coniferous forestry plantation within the site. The plantation forestry is dominated by Sitka Spruce (*Picea sitchensis*). The forestry blocks were semi-mature plantation and was boarded by willow species in places.

Hedgerows were recorded along the field margins within the site many of which occur within agricultural grassland habitats. The species which occurred included Hawthorn *(Crataegus monogyna),* Rowan *(Sorbus aucuparia),* Dog Rose *(Rosa canina),* Bramble *(Rubus fruticosus agg.)* with occasional trees including Ash *(Fraxinus excelsior)* and Sycamore *(Acer pseudoplatanus).* Treelines within the study area were comprised of Ash and conifer species.

Results from the desktop review and walkover surveys were used to assess habitats for their suitability to support foraging and commuting bats, and roosting bats, according to Collins (2016). Suitability categories, divided into *High, Moderate, Low* and *Negligible,* are described fully in **Appendix 1**.

With regard to foraging and commuting bats, areas of closed canopy forestry as well as exposed areas of grassland and peatland habitats were considered *Negligible-Low* suitability, i.e. Suitable but isolated habitat that could be used by small numbers of foraging bats such as a lone tree or patch of scrub (Collins, 2016). Forestry edge habitats created by commercial forestry and roadways show potential for foraging and commuting bats. However, these habitats are surrounded by wide expanses of agricultural grassland and peatland habitats and thus, are not very well connected to the surrounding landscape. As such, these habitats were classified as *Low* suitability.

An assessment of the various woodland and forestry habitats was undertaken. Trees present on site comprise a mixture of mature and immature commercial coniferous species with Negligible – Low roosting potential. One structure was identified within the wider site area and was subjected to a roost assessment, described in the following Section 4.4.

All other habitats present were assigned a *Negligible* value.

4.3.1 Grid Connection Route

A 38kV connection between the Proposed Development site and the national electricity grid will be necessary to export electricity from the Proposed Development. Further details on the grid connection route are described in in Chapter 4 of this EIAR.

It is intended to connect to the National Grid via an underground cable connection running from the proposed onsite substation to the existing Clahane Substation, located approximately 7 kilometres to the southeast, in the townland of Pallas, (the "Grid Connection Route"). The underground cabling will

follow the route of existing public roadways. The Grid Connection Route will measure approximately 13.8km in length for connection to the Clahane substation.

The existing road corridor associated with the Grid Connection Route is bordered by grass verges classified as *Dry meadows and grassy verges (GS2).* Adjacent to the road corridor, several habitat types occur including *Hedgerows (WL1), Treelines (WL2), Earth banks (BL2), Improved agricultural grassland (GA1), Scrub (WS1), Stone walls (BL1), Drainage ditches (FW4)* and dwellings houses and agricultural buildings (BL3). The Treeline and hedgerows are predominantly composed of Ash *(Fraxinus excelsior)* and Sycamore *(Acer pseudoplatanus),* with Rowan *(Sorbus aucuparia),* Hazel *(Corylus avellana),* Hawthorn *(Crataegus monogyna)* and Willow *(Salix spp). Scrub (WS1)* habitat was comprised of bramble and willow spp.

With regard to commuting and foraging bats, features along the underground cable route were assessed as having *Moderate* suitability i.e. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water (Collins, 2016).

With regard to roosting bats, habitat features such as mature trees were assessed as having *Low-Moderate* suitability. All other habitats along the underground cable route were assessed as having *Negligible* suitability i.e. Negligible habitat features likely to be used by roosting bats/trees of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential (Collins, 2016).

The underground cable route will be confined to existing site and public roads. Other than the features presented in Table 4-5 below, no potential roost features were identified along the underground cable route. There are a total of 5 watercourse and culvert crossings along the grid connection route. Further details of all water crossing are provided in Chapter 4 of this EIAR.

Table 4-5 Proposed Grid Connection Water Crossings

Watercourse Crossing Ref No.	Location (Irish Grid Ref)	Watercourse Bridge Type	Extent of Works	Bat Habitat Suitability
gWC1	E091322 N129687	1500mm high stone arch bridge.	Horizontal Directional Drilling. No disturbance to either the bridges or streams.	***Negligible*** *– no suitable gaps/crevices identified. No evidence of bat use identified.*
gWC2	E092150 N130148	1500mm high stone arch bridge.	Horizontal Directional Drilling. No disturbance to either the bridges or streams.	***Negligible*** *– no suitable gaps/crevices identified. No evidence of bat use identified.*
gWC3	E094143 N129461	500mm internal Ø concrete pipe	Horizontal Directional Drilling. No disturbance to either the bridges or streams.	***Low*** *– No evidence of bat use identified. No suitable gaps/crevices identified; however, there is some ivy cover which may provide suitable roosting habitat.*
gWC4	E094344 N127235	1500mm high stone arch bridge	Horizontal Directional Drilling. No disturbance to either the bridges or streams.	***Low*** *– No evidence of bat use identified. No suitable gaps/crevices identified; however, there is some ivy cover which may provide suitable roosting habitat.*
gWC5	E127235 N126776	2000mm high stone arch bridge	Horizontal Directional Drilling. No disturbance to either the bridges or streams.	***Negligible*** *– no suitable gaps/crevices identified. No evidence of bat use identified. Some ivy cover.*



Water Crossing No.1 Watercourse channel with concrete abutment



Water Crossing No.1



Water Crossing No.2 Watercourse channel with concrete abutment



Water Crossing No.2



Water Crossing No.3 – Culvert with overgrown channel



Water Crossing No.3 – Culvert with overgrown channel



Water Crossing No.4 – Stone wall with ivy cover



Water Crossing No.4 – ivy covered stone wall


Water Crossing No.5 – Concrete and stone bridge structure


Water Crossing No.5 – Overgrown water channel

4.3.2 Turbine Delivery Route

The proposed turbine delivery route has been the subject of a route assessment to determine if any road widening works are required along its length. Full details of the assessment are included as part of the traffic impact assessment set out in Chapter 14, Section 14.1 of this EIAR. Prior to the construction of the proposed development, a detailed traffic management plan will be prepared by the haulage company and submitted to Kerry County Council for approval.

The proposed transport route for the large wind turbine plant will be via the entry point at the port of Foynes, east to Limerick on the N69, south to Abbeyfeale and Castleisland via the M20 and N21, to Tralee on the N21 and finally, north on the N69 towards the site where it exits the N69 at Mountcoal. The transport route leaves the national road network on the N69 to join the L6055, before heading northwest for approximately 4km to the priority junction with the R557. The route then heads southwest for 2.5km before turning right into an unnamed local road towards the site at Ballynagare. The route from the N69 is discussed in detail in Chapter 14.

The route assessment considered comprises of;

- Location 1 - the N69 / L6055 junction at Mountcoal,
- Location 2 - the left-hand bend on the L6055 at Mountcoal,
- Location 3 - the crossroads on the L6055 with the L1027,
- Locations 4, 5 and 6 – bends on the L6055,
- Location 7 - the R557 / L6055 junction,
- Location 8 – R557 Local road junction,
- Locations 9 to 12 – Access junctions A to D providing access to the site.

Overall, the proposed route will aim to retain areas of linear treelines and hedgerow habitats. However, the turbine delivery route will likely require cutting back/trimming of treeline and hedgerow habitat to accommodate oversail, as well as temporary junction accommodation works, as indicated in the preliminary traffic assessment detailed in Chapter 14. Where there is the possibility that the delivery vehicle will track outside of the existing road corridor, there will likely be a temporary loss of improved agricultural grassland (GA1), earth bank (BL2) treeline (WL2) and hedgerow (WL1) habitat.

Hedgerows and treelines within the study area are assigned **Local Importance (higher value)** as they provide supporting semi-natural habitat with have high biodiversity and degrees of naturalness in a local context. Where potential tree/hedgerow removal is required to facilitate the turbine delivery, these areas will be reinstated after the construction phase. In addition, upon completion of the turbine delivery phase, any temporary junction accommodation works will revert back to its existing condition prior to the commencement of the works.

4.4 Roost Surveys

Following the search for roosts in 2020, no structures containing potential suitable bat roost features were identified within 200m plus the rotor radius (75m) of the Proposed Development footprint. One derelict structure (Grid Ref: E090465 N132422) was identified within the wider site area and was subjected to a roost assessment in May and July 2020 (Plates 4-1 and 4-2).

The structure had multiple bat access points in gaps in the windows, under soffits and roof tiles. Connectivity to the area is provided by hedgerows and treelines. Evidence of small amounts of bat droppings were identified within the building during the roost assessments. However, no other evidence was recorded. Overall, the structure was assessed as *Low* suitability due to the state of disrepair and considerable influx of light into the structure.

The structure is located outside the Proposed Development footprint. Consequently, there is no potential for significant effect with regard to the loss or disturbance of this roosting habitat.



Plate 4-1 Derelict Structure - Southern Elevation



Plate 4-2 Derelict Structure - Northern Elevation

The Proposed Development site was checked for potential tree roosts but no trees with significant roosting features were identified within the site. Trees may have increased or decreased probability of hosting roosting bats in certain circumstances i.e. Having large broadleaf trees with cavities or other damage such as rot or loose bark increased probability whereas, conifer plantations and young trees with little – no damage have a decreased probability of hosting bats (Kelleher and Marnell, 2006). The surrounding habitats were assessed as largely unsuitable for roosting bats.

4.5 Manual Transects

Manual transects were undertaken in Spring, Summer and Autumn 2020. Bat activity was recorded on all surveys. In general, soprano pipistrelle (n=220) was recorded most frequently, followed by common pipistrelle (n=131). Instances of Leisler's bat (n=10) and brown long-eared bat (n=1) were less frequent. However, species composition and activity levels varied significantly between surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 4-3 presents results for individual species per survey period. Figures 4-1 – 4-3 present the spatial distribution of bat activity across surveys. Bat activity was concentrated along hedgerows, scrub, walls and linear (road/track) habitats.

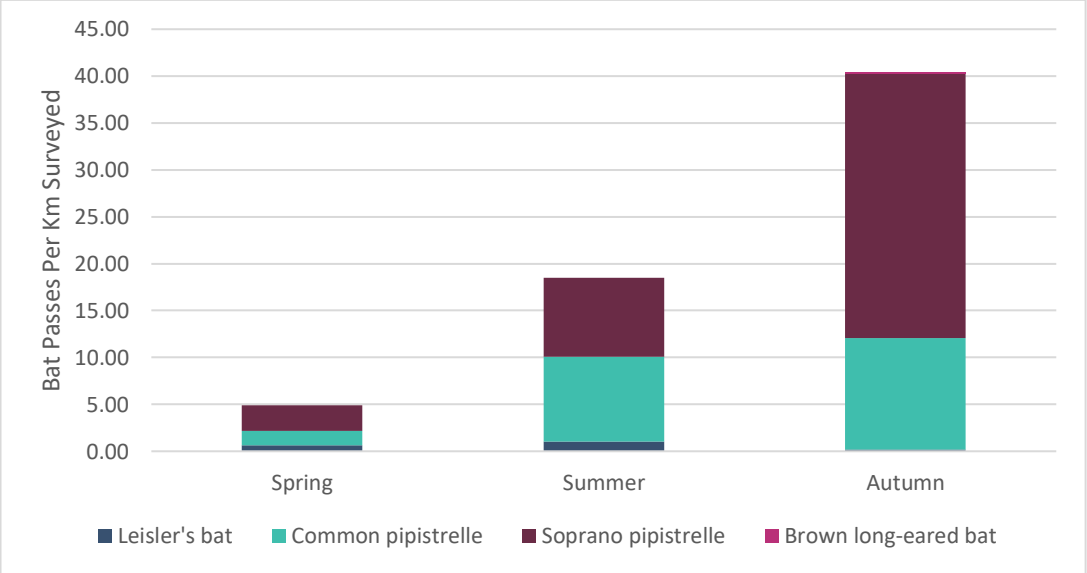

Plate 4-3 2020 Transect Results - Species Composition Per Survey Period

Surveyors were positioned at a derelict structure for 1.5hours during the spring dusk survey to look for bats exiting/re-entering the building. No bats were observed emerging however bats were recorded commuting beside the building and adjacent treelines to surrounding areas.



Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Spring Transect Route

Spring Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

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Drawing Title

Spring Transect Results

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	4-1
Scale	Date
1:17057	12/11/21

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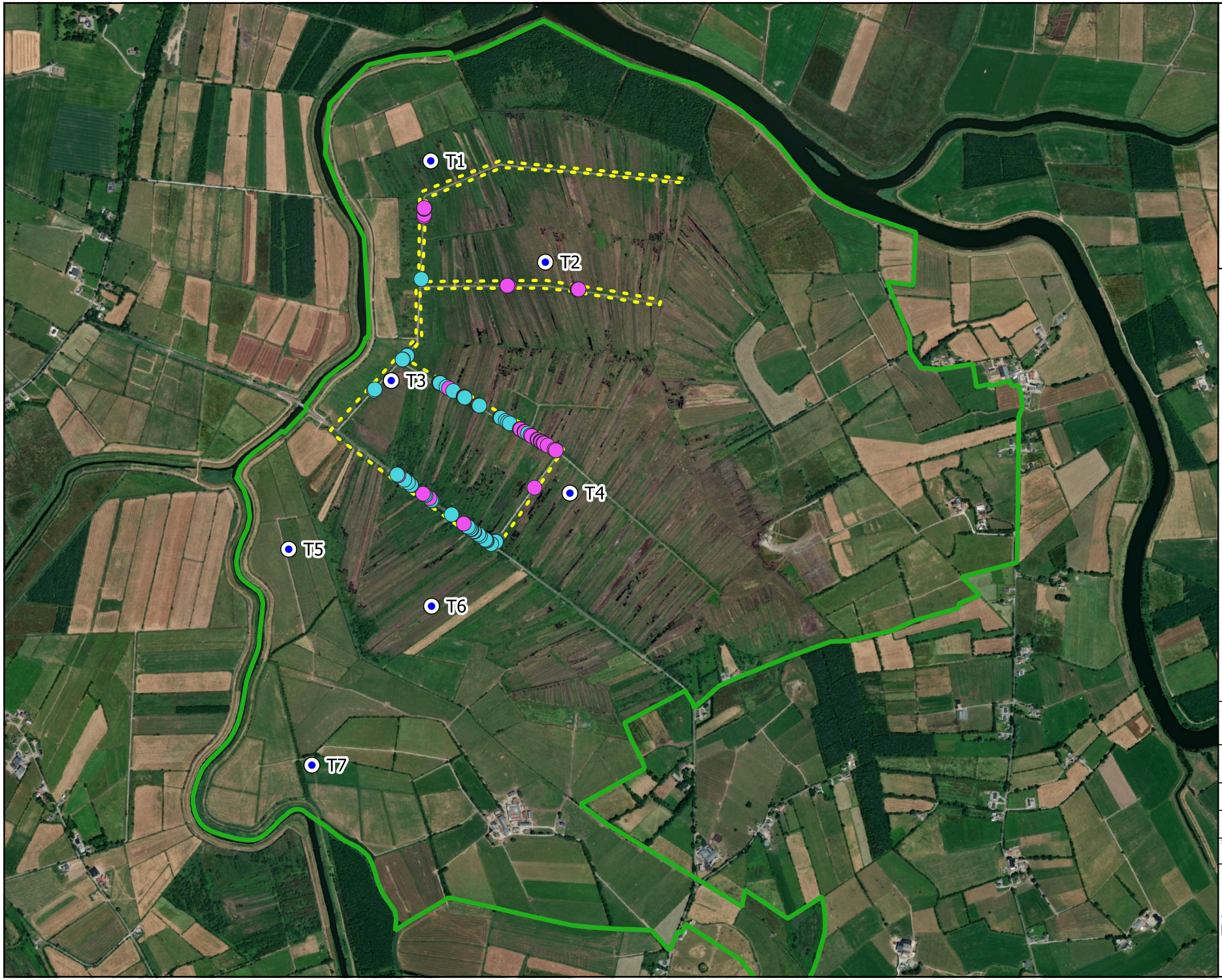

Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Summer Transect Route

Summer Transect Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

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Drawing Title

Summer Transect Results

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	4-2
Scale	Date
1:17057	12/11/21

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Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Autumn Transect Route

Autumn Transect Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Brown long-eared bat

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Drawing Title

Autumn Transect Results

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	4-3
Scale	Date
1:17057	12/11/21

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4.6 Ground-level Static Surveys

In total, 16,755 bat passes were recorded across all deployments. In general, soprano pipistrelle (n=9,548), occurred most frequently, followed by common pipistrelle (n=4,131) and Leisler's bat (n=2,615). Instances of *Myotis sp.* (n=353), brown long-eared bat (n=88) were significantly less. nathusius' pipistrelle (n=20) was rare. Plate 4-4 presents relative species composition across all ground-level static detector surveys.

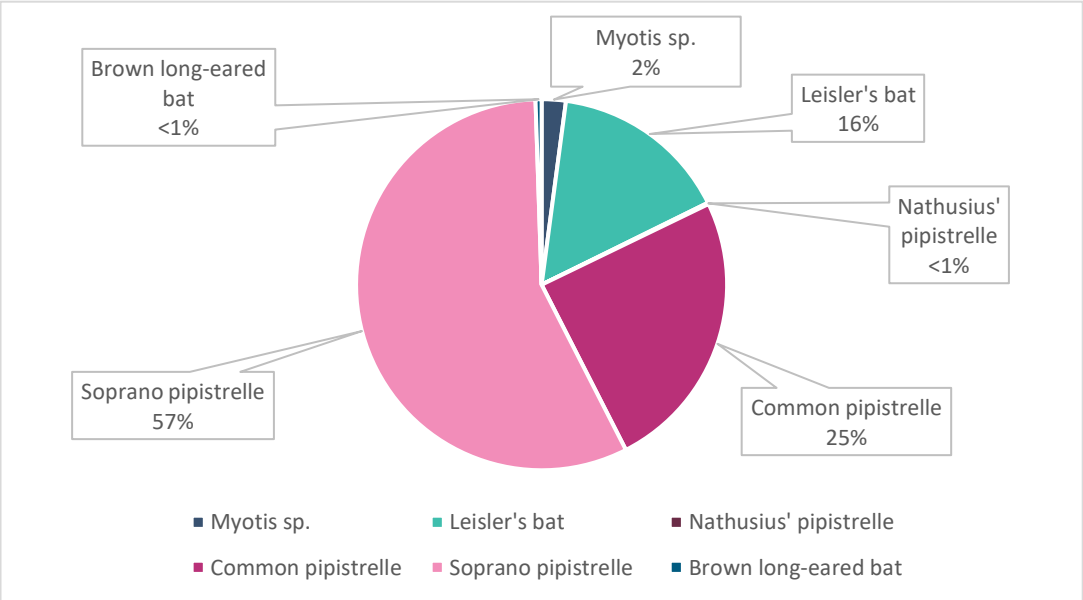

Plate 4-4 2020 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

Bat activity was calculated as total bat passes per hour (bpph) per season to account for any bias in survey effort, resulting from varying night lengths between seasons. Plate 4-5 and Table 4-6 presents these results for each species. Bat activity was dominated by common pipistrelle in Spring, Leisler's bat in Summer and soprano pipistrelle in Autumn. In addition, soprano pipistrelle occurred frequently in Summer. Instances of *Myotis sp.* were less frequent. Brown long-eared bat and nathusius' pipistrelle were relatively rare.

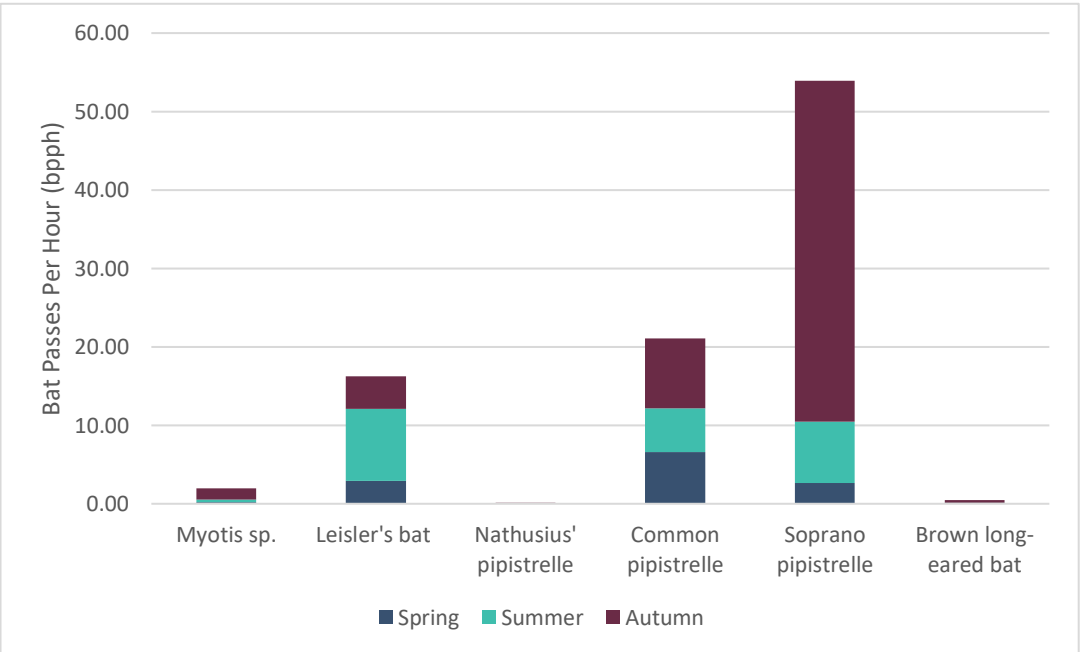

Plate 4-5 2020 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

Table 4-6 2020 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

	Spring	Summer	Autumn
Total Survey Hours	**287.6**	**112.2**	**182**
Myotis sp.	0.18	0.37	1.43
Leisler's bat	2.89	9.22	4.12
Nathusius' pipistrelle	0.02	0.02	0.06
Common pipistrelle	6.56	5.62	8.86
Soprano pipistrelle	2.64	7.84	43.46
Brown long-eared bat	0.04	0.08	0.37

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the proposed site. Activity is often variable between survey nights. Therefore, the Median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). Plate 4-6 illustrates the Median Nightly Pass Rate per species per deployment. Zero data, when a species was not detected on a night, was also included.

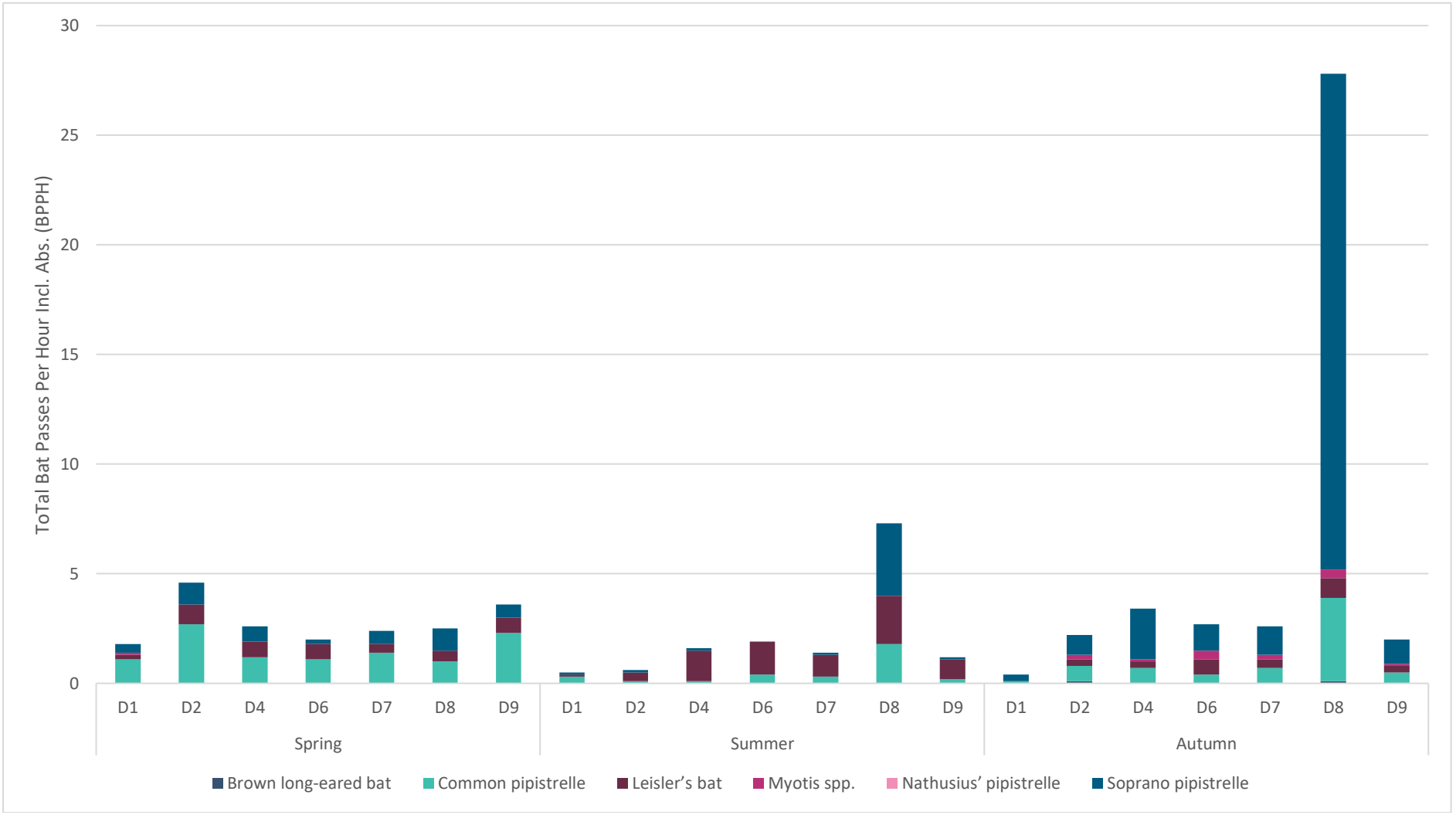

Plate 4-6 2020 Static Detector Surveys: Median Nightly Pass Rate (bpph) Including Absences, Per Location Per Survey Period

Common pipistrelle activity was predominant at all detector locations in Spring. Summer bat activity was dominated by Leisler's bat at D02, D04, D06, D07 and D09. Soprano pipistrelle was predominant at D08 in summer and was higher than all other detectors. Autumn activity was dominated by soprano pipistrelle across all detectors. In addition, activity at D08 in Autumn was significantly higher than all other detectors during the same period.

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 4-7 presents the results of Ecobat analysis for each species per season on a site-level. **Appendix 3** provides these results per detector. Median activity levels for Leisler's bat, soprano pipistrelle and common pipistrelle peaked at ***Moderate to High*** for at least one season. Median activity levels for *Myotis sp.* and brown long-eared bat peaked at ***Low to Moderate*** for at least one season. Median activity levels for nathusius' pipistrelle peaked with ***Low*** activity across all seasons. Maximum activity levels peaked with ***High*** activity for Leisler's bat, soprano pipistrelle and common pipistrelle across all seasons. Maximum activity levels for *Myotis sp.* and brown long-eared bat peaked at ***Moderate to High***, while nathusius' pipistrelle peaked with maximum activity levels of ***Moderate***.

Table 4-7 Static Detector Surveys: Site-level Ecobat Analysis

Survey Period	Median Percentile	Median Bat Activity	Max Percentile	Max Bat Activity	Nights Recorded	Ref Range
2020						
Common pipistrelle						
Spring	69	Moderate - High	98	High	123	4423
Summer	43	Moderate	95	High	78	5060
Autumn	71	Moderate - High	94	High	127	3935
Soprano pipistrelle						
Spring	56	Moderate	90	High	122	4124
Summer	46	Moderate	96	High	84	4910
Autumn	78	Moderate - High	100	High	100	4001
Nathusius' pipistrelle						
Spring	12	Low	55	Moderate	8	946
Summer	14	Low	14	Low	2	1201
Autumn	18	Low	38	Low - Moderate	10	927
Leisler's bat						
Spring	55	Moderate	87	High	129	3867
Summer	57	Moderate	89	High	107	4259
Autumn	61	Moderate - High	92	High	112	2998
***Myotis* sp.**						
Spring	12	Low	46	Moderate	49	2997
Summer	31	Low - Moderate	73	Moderate - High	43	3375
Autumn	38	Low - Moderate	78	Moderate - High	89	3182
Brown long-eared bat						
Spring	21	Low - Moderate	46	Moderate	6	1660
Summer	14	Low	46	Moderate	12	2312
Autumn	18	Low	63	Moderate - High	56	2405

4.7 Importance of Bat Population Recorded at the Site

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

All bat species in Ireland are protected under the Bonn Convention (1992), Bern Convention (1982) and the EU Habitats Directive (92/43/EEC). Additionally, in Ireland bat species are afforded further protection under the Birds and Natural Habitats Regulations (2011) and the Wildlife Acts 1976-2019. No bat roosts were identified within the footprint of the Proposed Development. Bats as an Ecological Receptor have been assigned ***Local Importance (Higher value)*** on the basis that the habitats within the site are utilized by a regularly occurring bat population of Local Importance.

A suspected bat roost of Local Importance was identified within the wider site area. No bats were observed emerging from the structure during any site visits. However, small amounts of old bat droppings were identified within the structure. No roosting site of National Importance (i.e. site greater than 100 individuals) was recorded within the site. The suspected roost has been avoided by the Proposed Development.

5. RISK AND IMPACT ASSESSMENT

This risk and impact assessment has been undertaken in accordance with NIEA and NatureScot Guidance. As per the NatureScot Guidance, wind farms present four potential risks to bats:

- Collision mortality, barotrauma and other injuries
- Loss or damage to commuting and foraging habitat
- Loss of, or damage to, roosts
- Displacement of individuals or populations

For each of these four risks, the detailed knowledge of bat distribution and activity within the site has been utilized to predict the potential effects of the wind farm on bats.

5.1 Collision Mortality

5.1.1 Assessment of Site-Risk

The likely impact of a proposed development on bats is related to site-based risk factors, including habitat and development features. The site risk assessment, as per Table 3a of the NatureScot guidance, is provided in Table 5-1 below.

Table 5-1 Site-risk Level Determination for the Proposed Development Site (Adapted from NatureScot 2021)

Criteria	Site-specific Evaluation	Site Assessment
Habitat Risk	One potential low value roost identified within the wider site, outside the Proposed Development footprint. A small number of PRFs of low quality were identified within the site with no roosts identified during the surveys undertaken. The habitats within the site provide potential suitable foraging habitat for bats and is connected to the wider landscape by linear features such as scrub, treelines and rivers/streams. However, it does not provide an extensive and diverse habitat mosaic of high quality for foraging bats or meet any of the criteria of a high-risk site as set out in Table 3a of NatureScot, 2021.	Low
Project Size	Following the criteria set out in NatureScot, 2021 the project is of Small scale as it consists of 7 no. turbines. Whilst those turbines are over 100m in height, it is not a strategic infrastructural development and is well below the number of turbines that would constitute a Large development (NatureScot, 2021). Proposed other wind energy developments within 5km. Comprising turbines >100 m in height	Medium
Site Risk Assessment (from criteria in Plate 3-3)		**Low Site Risk (2)**

The site of the Proposed Development is located in an area of predominantly cutover bog and agricultural grassland. As per table 3a of the NatureScot Guidance (2021), it has a *Low* habitat risk score. As per Table 3a, the Proposed Development is a *Medium* project size (7 turbines). The cross tabulation of a Medium project on a Low risk site results in an overall risk score of **Low** (NatureScot Table 3a).

5.1.2 Assessment of Collision Risk

The following high-risk species were recorded during the dedicated surveys:

- Leisler's bat,
- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle

The Overall Risk Assessment for high collision risk species is provided in the sections below. Overall Risk was determined, in accordance with Table 3b of NatureScot guidance (**Appendix 4**), by a cross-tablature of the site risk level (i.e. Low) and Ecobat bat activity outputs for each species. The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values). NatureScot recommends that that most appropriate activity level (i.e. median or maximum) be utilised to determine the overall risk assessment for a species.

As per NatureScot guidance there is no requirement to complete an Overall Risk Assessment for low-risk species. During the extensive suite of surveys undertaken that following low risk species were recorded:

During the extensive suite of surveys undertaken that following low risk species were recorded:

- *Myotis sp.*
- Brown long-eared bat

Overall activity levels were low for the above species therefore no significant collision related effects are anticipated.

5.1.2.1 Leisler's bat

This site is within the current range of the Leisler's bat (NPWS, 2019). Leisler's bats are classed as a rarer species of a high population risk which have a high collision risk (Plate 3-2). Leisler's bats were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Leisler's bat was found to be *Medium* at typical activity levels and peak activity levels (See Table 5-2 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog and improved agricultural grassland with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is *Medium* collision risk level assigned to the local population of Leisler's Bat.

Table 5-2 Leisler's bat - Overall Risk Assessment 2020

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Low (2)	Moderate (3)	Typical Risk is Medium (6)	High (5)	Peak Risk is Medium (10)
Summer		Moderate (3)	Typical Risk is Medium (6)	High (5)	Peak Risk is Medium (10)
Autumn		Moderate to High (4)	Typical Risk is Medium (8)	High (5)	Peak Risk is Medium (10)

Detector locations with High median Leisler's bat activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for Leisler's bat recorded, per detector, per survey period. No detectors registered nights with High median levels of Leisler's bat activity across any season in 2020.

5.1.2.2 Soprano pipistrelle

This site is within the current range of the soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelle are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-2). Soprano pipistrelle were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for soprano pipistrelle was found to be *Medium* at typical activity levels and *Medium* at peak activity levels across all three seasons (See Table 5-3 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog and improved agricultural grassland with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is *Medium* collision risk level assigned to the local population of soprano pipistrelle.

Table 5-3 Soprano pipistrelle - Overall Risk Assessment 2020

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Low (2)	Moderate (3)	Typical Risk is Medium (6)	High (5)	Peak Risk is Medium (10)
Summer		Moderate (3)	Typical Risk is Medium (6)	High (5)	Peak Risk is Medium (10)
Autumn		Moderate to High (4)	Typical Risk is Medium (8)	High (5)	Peak Risk is Medium (10)

Detector locations with High median soprano pipistrelle activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for soprano pipistrelle recorded, per detector, per survey period. Detector D04 and D08 registered nights with High median levels of Soprano pipistrelle activity in Autumn 2020. These detectors correspond to Turbines T3 and T7 respectively (Figure 3-4). Given that high median activity levels were recorded near Turbines 3 and 7 in autumn, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in Section 6.2 below.

No other detectors recorded High median levels of soprano pipistrelle activity across any other season in 2020.

5.1.2.3 Common pipistrelle

This site is within the current range of the common pipistrelle bat (NPWS, 2019). Common pipistrelle are classed as a common species of a medium population risk which have a high collision risk (Plate 3-2). Common pipistrelle were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot 2021); overall activity risk

for common pipistrelle at typical activity levels was found to be Medium at typical activity levels and *Medium* at peak activity levels across all seasons (See Table 5-4 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog and improved agricultural grassland with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is *Medium* collision risk level assigned to the local population of common pipistrelle.

Table 5-4 Common pipistrelle - Overall Risk Assessment 2020

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Low (2)	Moderate to High (4)	Typical Risk is Medium (8)	High (5)	Peak Risk is Medium (10)
Summer		Moderate (3)	Typical Risk is Medium (6)	High (5)	Peak Risk is Medium (10)
Autumn		Moderate to High (4)	Typical Risk is Medium (8)	High (5)	Peak Risk is Medium (10)

Detector locations with High median common pipistrelle activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for common pipistrelle recorded, per detector, per survey period. Detectors D02 registered nights with High median levels of soprano pipistrelle activity in Spring 2020. Detectors D08 registered nights with High median levels of common pipistrelle activity in Autumn 2020. These detectors correspond to Turbines T2 and T7 respectively (Figure 3-4). Given that high median activity levels were recorded near these turbines, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development in line with the case study example provided in Appendix 5 of the NatureScot Guidance. Further details on proposed curtailment can be found in Section 6.2 below.

No other detectors recorded High median levels of common pipistrelle activity across any other season in 2020.

5.1.2.4 Nathusius' pipistrelle

This Proposed Development site is outside the current known range of the nathusius' pipistrelle bat (NPWS, 2019). Nathusius' pipistrelle are classed as a rarest species of a high population risk which have a high collision risk (Plate 3-2). Low numbers of nathusius' pipistrelle (n=32) were recorded during static activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021); overall activity risk for nathusius' pipistrelle at typical activity levels was found to be *Low*. Peak risk levels for nathusius' pipistrelle were found to be Medium in Spring and *Low* in Summer and Autumn. (See Table 5-5 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is predominantly cutover bog and improved agricultural grassland with low levels of bat activity recorded during the walked transects undertaken. Thus, there is **Low** collision risk level assigned to the local population of nathusius' pipistrelle.

Table 5-5 Common Pipistrelle - Overall Risk Assessment 2020

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot, 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot, 2021)
Spring	Low (2)	Low (1)	Typical Risk is Low (2)	Moderate (3)	Typical Risk is Medium (6)
Summer		Low (1)	Typical Risk is Low (2)	Low (1)	Typical Risk is Low (2)
Autumn		Low (1)	Typical Risk is Low (2)	Low to Moderate (2)	Typical Risk is Low (4)

Detector locations with High median nathusius' pipistrelle activity levels

A summary of Ecobat bat activity results, as shown in **Appendix 3**, provides key metrics for nathusius' pipistrelle recorded, per detector, per survey period. No detectors registered nights with High median levels of nathusius' pipistrelle activity across any season in 2020.

5.1.3 Collision Risk Summary

Site-level collision risk for high collision risk bat species was typically *Medium,* except for nathusius' pipistrelle which was considered *Low*. Overall bat activity levels were typical of the nature of the site, which is predominantly cutover bog and agricultural grasslands with low levels of bat activity recorded during the static detector surveys as well as the walked transects undertaken.

However, following per detector Ecobat analysis, detectors D02, D04, and D08 showed high median activity levels across at least one season (Table 5-6). Taking a precautionary approach and given the potential for high collision risk was recorded at median activity levels at these detectors, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development, in line with the case study example provided in Appendix 5 of the NatureScot (2021) Guidance and based on the site-specific data. This would involve curtailment during periods with high median bat activity (i.e. Spring at T2, and Autumn at T3 and T7), with simultaneous activity monitoring taking place. Turbines would be curtailed during the weather conditions most suitable for bat activity at the site, see Section 6.2.2.2 "Determining curtailment" below. Proposed curtailment and monitoring is outlined in section 6.2 below.

Table 5-6 Ecobat Results High Median Bat Activity Per Detector 2020

Survey Period	Nights Recorded	Detector ID	Corresponding Turbine	Median Bat Activity	Median Bat Activity Level	Max Bat Activity	Max Bat Activity Level
SOPRANO PIPISTRELLE							
Autumn	16	D04	T3	83	High	92	High
Autumn	16	D08	T7	97	High	100	High
COMMON PIPISTRELLE							
Spring	12	D02	T2	81	High	94	High
Autumn	16	D08	T7	88	High	93	High

5.2 Loss or Damage to Commuting and Foraging Habitat

In absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Development is predominantly located within cutover bog and open agricultural grassland habitats and there will be no net loss of bat foraging/commuting habitat associated with the Proposed Development.

There are no large areas of forestry within the Proposed Development site. Approximately 236m of hedgerow and 122m of treeline will be permanently removed within the bat buffer at T7. The removal of trees is provided to achieve the required buffer distance for the protection of bats, from the turbines to the canopy of the nearest habitat feature, as recommended by the Natural England (2014) and NatureScot (2021). Further details on buffer calculations can be found in section 6.1.3 of this report. Section 6.1.4 provides further details on proposed replanting.

Proposed replanting will ensure there will be no significant effect in relation to habitat fragmentation or loss of foraging habitat for bats in the area. Overall, the proposed replanting will ensure there is no net loss in the linear landscape features within the site. Planting will be of species indigenous to the local area. This will have a positive impact on bats as it will provide additional commuting and foraging opportunities.

There may be some requirement for road widening and junction accommodation works along the turbine delivery route. The proposed transport route has been subject to a preliminary route assessment to determine if any widening or junction works are required along its length. Some areas of oversail are required which may involve tree/hedgerow trimming. In addition, there may be a requirement for the temporary removal of some areas of hedgerow/treeline for the proposed delivery route. Upon completion of the turbine delivery phase of the Proposed Development, any linear habitat features removed will be reinstated. Full details of the assessment are included as part of the traffic impact assessment set out in Chapter 14 of this EIAR. No permanent loss of, or damage to, commuting or foraging habitats is anticipated as a result of the turbine delivery.

The underground cable route will be confined to existing site and public roads. There will be no requirement to remove trees/hedgerows etc. as part of the underground cable route and no loss or damage to commuting or foraging habitats is anticipated.

Given the extensive area of habitat that will remain undisturbed throughout the site and the avoidance of the most significant areas of faunal habitat (i.e. natural hedgerows and scrub), no significant effects with regard to loss of commuting and foraging habitat are anticipated.

5.3 Loss of, or Damage to, Roosts

The Proposed Development is predominantly located within cutover bog and improved agricultural grassland. The trees within the site are comprised predominantly of hawthorn, rowan and conifer species and do not provide potential roosting habitat of significance for bats.

One derelict structure was identified within the wider site and was subjected to dusk emergence surveys. Small amounts of old bat droppings were identified within the structure, and while a small number of bats were observed flying in the vicinity of the building during the roost surveys, none were observed emerging or re-entering. This structure and the surrounding linear habitat features will be avoided and retained as part of the Proposed Development; thus, no loss of roosting habitat is anticipated.

The underground cabling will connect from the Proposed Development site to the existing Clahane electricity substation located approximately 5.5km southeast in the townland of Pallas, predominately

following proposed and existing roads. There will be no requirement to remove trees/forestry as part of the underground cable route. Therefore, there will be no loss of tree roosting habitat associated with these works.

All bridges along the cable route were assessed as having *Negligible* or *Low* value for roosting bats. The cable will either be installed via horizontal directional drilling. The bridges along the route will not be altered, in any regard, by the proposed works as the options for crossing bridges do not require any works to be carried out on the bridge structure.

No potential for significant effect with regard to the loss of, or damage to, roosting habitat as a result of the Proposed Development or underground cable route, is anticipated.

5.4 Displacement of Individuals or Populations

The Proposed Development is predominantly located within cutover bog and improved agricultural grassland. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no significant displacement of individuals or populations is anticipated.

6. BEST PRACTICE AND MITIGATION MEASURES

This section describes the best practice and site-specific mitigation measures that are in place to avoid and reduce the potential for significant effects on local bat populations.

6.1 Standard Best Practice Measures

6.1.1 Noise Restrictions

During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (S.I. No. 632 of 2001).

6.1.2 Lighting Restrictions

Whilst there is a requirement for aviation lighting on the turbines, lighting in general throughout the development has been minimised and the applicant commits to not using LED lighting.

Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. Exterior lighting, during construction and post construction, shall be designed to minimize light spillage, thus reducing the effect on areas outside the Proposed Development, and consequently on bats i.e. Lighting will be directed away from mature trees/treelines around the periphery of the site boundary to minimize disturbance to bats. Directional accessories can be used to direct light away from these features, e.g. through the use of light shields (Stone, 2013). The luminaries will be of the type that prevent upward spillage of light and minimize horizontal spillage away from the intended lands.

The proposed lighting around the site shall be designed in accordance with the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK.

In addition, the applicant commits to the use of lights during construction, operation and decommissioning (such that they are necessary) in line with the following guidance that is provided in the Dark Sky Ireland Lighting Recommendations:

- Every light needs to be justifiable,
- Limit the use of light to when it is needed,
- Direct the light to where it is needed,
- Reduce the light intensity to the minimum needed,
- Use light spectra adapted to the environment,
- When using white light, use sources with a “warm” colour temperature (less than 3000K).

With regard to the potential for lighting to increase collision risk, it is noted that there will be some illumination of the turbines in the form of aviation lighting, and whilst this lighting is unlikely to result in any significant increase in collision risk, a comprehensive and site-specific mitigation and monitoring programme for a period of at least 3 years post construction. If in the course of this monitoring, any potential for significant effects on bats is identified, specific measures including curtailment, will be implemented to avoid any such impacts.

6.1.3 Buffering

In accordance with NIEA Guidance, a minimum 50m buffer to all habitat features used by bats (e.g. hedgerows, tree lines etc.) should be applied to the siting of all wind turbines (See example provided below). This buffer is measured between the blade tip of the turbine and the nearest point of the habitat feature. For wind farms proposed to be key-holed into commercial forestry plantation, NIEA Guidance recommends a minimum buffer of 100m between the turbines and the edge of the forestry. No turbines are located within or at the edge of forestry habitats.

The Proposed Development is predominantly located within cutover bog and improved agricultural grasslands and linear landscape features such as hedgerows and trees have been largely retained or avoided. All turbines, except for T7, are located in open peatland/grassland habitats and do not require a buffer. There is a requirement for the removal of a short section of hedgerow/treeline associated with the Turbine 7 buffer.

The turbine model to be installed on the site will have an overall ground-to-blade tip height in the range of 170m maximum to 169.5m minimum; rotor diameter in the range of 150m maximum to 149m minimum and hub height of 95m. The buffer calculation is based on the lowest potential swept area of the turbine blades, and therefore the largest area of required forestry felling. Should a turbine with a higher blade swept area be built, the area of temporary felling required will be lower.

Figure 6-1 below shows the extent of the area to be removed as part of the T7 bat buffer. This vegetation-free area will be maintained during the operational life of the Proposed Development.

It is necessary to calculate the distance between the edge of the habitat feature and the centre of the tower (b). Using the formula:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

Where, **bl** =Blade length, **hh** = hub height, **fh** = feature height all in metres.

E.g. (below) **b** = 69.3m (Plate 6-1)

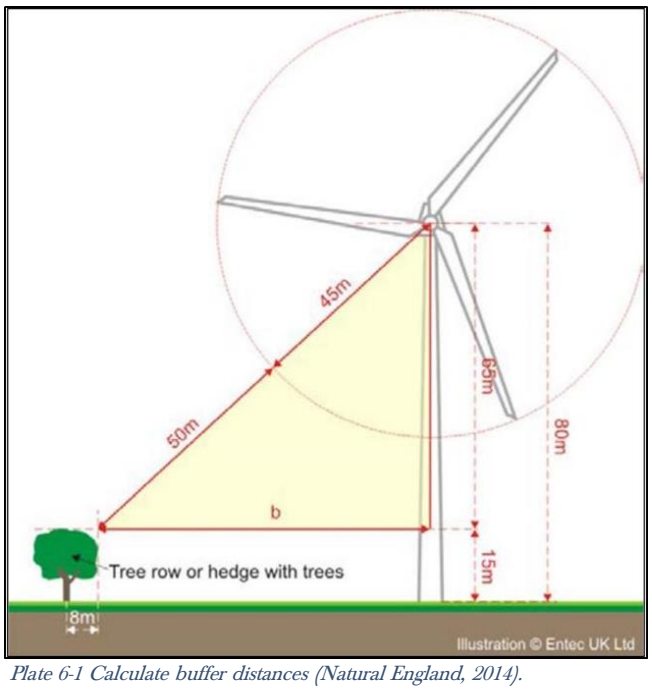

Plate 6-1 Calculate buffer distances (Natural England, 2014).

6.1.4 Turbine Specific Replanting

In the absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. However, the Proposed Development is predominantly located within cutover bog and improved agricultural grasslands and linear landscape features such as hedgerows and trees have been largely retained or avoided.

The loss of a short section of hedgerow/treeline associated with the Turbine 7 buffer will not result in any significant effect in relation to habitat fragmentation or loss of foraging habitat for bats in the area.

To comply with NIEA and NatureScot recommendations in relation to habitat buffering to avoid bat fatalities, approximately 358m of hedgerow/tree habitat will be lost as a result of the recommended buffers applied for bats.

There is a network of linear landscape features in the wider area that will be fully retained, and the loss of hedgerow/trees is not anticipated to have a significant effect on local bat populations. However, it is proposed to plant a new area of treeline/hedgerow in the vicinity of T7 to offset any potential loss in linear habitat features and to provide additional new opportunities for commuting and foraging bats. The location in which the proposed planting will take place will be subject to final landowner agreement. Planting will be of species indigenous to the local area.

Overall, there will be no net loss of linear habitat features as a result of the bat buffers.



Map Legend

- EIAR Study Area
- Proposed Turbine Locations
- Turbine 7 Bat Buffer
- Proposed T7 Tree Removal

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Drawing Title

Proposed T7 Tree Removal

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AJ	PR
Project No.	Drawing No.
200441	6-1
Scale	Date
1:3029	12/11/21

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6.1.5 Blade Feathering

NIEA Guidelines also recommend that, in addition to buffers applied to habitat features, all wind turbines are subject to 'feathering' of turbine blades when wind speeds are below the cut-in speed of the proposed turbine. This means that the turbine blades are pitched at 90 degrees or parallel to the wind to reduce their rotation speed to below two revolutions per minute while idling. This measure has been shown to significantly reduce bat fatalities (by up to 50%) in some studies (NIEA, 2021).

In accordance with NIEA Guidelines, blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine.

6.2 Bat Mitigation and Monitoring Plan

Overall risk levels for high collision risk bat species was typically ***Medium,*** except for nathusius' pipistrelle which was *Low*. This risk level is reflective of the nature of the site, which is predominantly cutover bog and open agricultural grassland habitats with low levels of bat activity recorded during the static detector surveys as well as walked and driven transects undertaken. However, taking a precautionary approach and given the potential for high collision risk, at three turbine locations, was recorded at median activity levels, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development, in line with the case study example provided in Appendix 5 of the NatureScot (2021) Guidance and based on the site-specific data.

6.2.1 Curtailment

Curtailment involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation (blade feathering) below the cut-in speed.

Site-level collision risk for high collision risk bat species was typically *Medium,* except for nathusius' pipistrelle which was considered *Low*. Overall bat activity levels were typical of the nature of the site, which is predominantly cutover bog and agricultural grasslands with low levels of bat activity recorded during the static detector surveys as well as the walked transects undertaken.

However, following per detector Ecobat analysis, detectors D02 (i.e. Turbine 2), D04 (i.e. Turbine 3), and D08 (i.e. Turbine 7) showed high median activity levels across at least one season (Table 5-6). Taking a precautionary approach and given the potential for high collision risk was recorded at median activity levels at these detectors, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development. The strategy is in line with the case study example provided in Appendix 5 of the NatureScot Guidance and has been informed by the extensive suite of site-specific survey data. Curtailment will be implemented during periods with high median bat activity (i.e. Spring at T2, and Autumn at T3 and T7), with simultaneous activity monitoring taking place. Turbines will be curtailed during the weather conditions most suitable for bat activity at the site.

Recent research used to inform NatureScot guidance has found that 90% of all bat activity can occur on sites when temperature exceeded 11.5°C and windspeed was below 5m/s. In addition, the bat activity is generally recorded 30 minutes after sunset and 40 minutes prior to sunrise. These conditions are largely consistent with the high seasonal activity peaks recorded at the proposed development site. Therefore, a software module will be programmed into the SCADA system controlling the turbines to curtail turbines when all these criteria are met. Curtailment is achieved by opening the blade pitch into the fully-feathered position, which reduces blade rotation speed to <1rpm.

The effectiveness of curtailment will be monitored in order to determine (a) whether it is working effectively (i.e. whether bat mortality is detected, thereby confirming its effectiveness), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties.

A summary of the proposed seasonal curtailment at Turbines 2, 3 and 7 is provided in Table 6-2 below.

Table 6-1 Turbine Specific Curtailment Strategy for High-risk Species

Turbine No.	Proposed Curtailment Period		
	Spring (April to May)	Summer (June to mid-August)	Autumn (mid-August to October)
Turbine 2	Yes	No	No
Turbine 3	No	No	Yes
Turbine 7	No	No	Yes

6.2.2 Operational Monitoring

As per NIEA and NatureScot Guidance, at least 3 years of post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity i.e. the 50 metre separation between the proposed turbine blade tips and the nearest landscape feature. For example, it may be that the construction of wind turbines reduces bat activity patterns at the site relative to that recorded pre-construction, due to the implementation of the 50-metre buffer described above, and to a level at which there is no longer potential for significant effects on bats (NatureScot, 2021).

Post construction monitoring will include static detector surveys, walked survey transects and corpse searching to record any bat fatalities resulting from collision. At a minimum monitoring will be conducted for 3 years post construction.

The results of post construction monitoring shall be utilised to assess changes in bat activity patterns post construction and to monitor the implementation of the mitigation strategy. The performance of the curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed would be analysed to confirm the efficacy of the curtailment during different periods of bat activity. At the end of each year, the efficacy of the curtailment programme will be reviewed, and any identified efficiencies incorporated into the curtailment programme. This approach allows for an evidence-based review of the potential or bat fatalities at the site, post construction, to ensure that the necessary measures, based on a new baseline post-construction, are implemented for the protection of bat species locally.

The below subsections provide additional detail on the proposed survey effort, timing, and mitigation.

6.2.2.1 Monitoring Year 1

6.2.2.1.1 *Bat activity surveys*

Static monitoring at turbine bases and nacelle shall take place at each turbine during the bat activity season (between April and October) (NIEA, 2021). Full spectrum recording detectors shall be utilised for the same duration as during pre-application surveys and at the same density (NatureScot, 2021). As described in Section 3.5 above, the assessment of bat activity levels will include the use of 'Ecobat', a web-based interface, allowing uploaded activity data to be contrasted with a comparable reference range, allowing objective and robust interpretation. Walked survey transects will also be conducted.

Key weather parameters and other factors that are known to influence collision risk will be monitored and shall include:

- Windspeed in m/s (measured at nacelle height)
- Temperature (ºC)
- Precipitation (mm/hr)

6.2.2.1.2 *Carcass searches*

Carcass searches, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with NIEA Guidance (See section 6.2.2.3 below). This shall include searcher efficiency trials and an assessment of scavenger removal rates to determine the appropriate correction factor to be applied in relation to determining an accurate estimate of collision mortality. Casualty searches shall use a method with high observer efficiency (>50% as per NatureScot). NED guidance acknowledges that trained dog search teams are "*significantly more efficient and faster at finding carcasses than human surveyors"* and NatureScot guidance states that conservation dogs "*should preferably be used to achieve more robust results*". Therefore, the use of conservation dogs will be necessary where observed human searcher efficiency is less than 50%.

Calculating casualty rates across the site shall be done in accordance with the methods and formulas provided in Appendix 4 of the NatureScot Guidance. Surveys should cover all activity seasons and should be undertaken by trained surveyors.

Should no bat fatalities be recorded in Year 1, curtailment in Year 2 could be reduced/re-evaluated or removed with monitoring continuing to inform this strategy.

The curtailment programme for Year 2 will then be devised/altered as necessary around key activity periods and weather parameters recorded in Year 1.

6.2.2.2 Monitoring Years 2 & 3

Monitoring surveys shall continue in Year 2 and 3, and the success of the curtailment strategy shall be assessed in line with the baseline data collected in the subsequent year(s).

The performance of the curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed shall be analysed to confirm it is neither significantly over- nor under- curtailing during different periods of bat activity.

At the end of each year, the efficacy of the curtailment programme shall be reviewed, and any identified efficiencies incorporated into the curtailment programme.

6.2.2.3 Carcass Search Survey Methodology

As per NatureScot (2021), it is recommended that systematic searches should be conducted within a 100m x 100m grid centred on the turbine, although the exact protocol for carcass searches will vary given the precise objectives of the surveys (i.e. survey may be targeted at particular times of year or locations). It is recommended that at least two search periods (Summer and Autumn) are used. Spring should also be included if there is particular reason to do so, for example if there are multiple casualties during other survey periods. For a given amount of resource available for carcass searches, there is a trade-off between search frequency and the time period that can be monitored. The longer the inter-search interval, the greater the likelihood of the bat being predated before it is found.

Daily searches are recommended in order to refine mitigation. At other sites, searches at 2-4 day intervals are acceptable, based on the predation rates observed at most locations in the National Bats and Wind Turbines study (NatureScot, 2021). Data will be obtained from the turbine operators on whether or not the target turbine was operational on the night preceding the search, with the surveying protocol being adjusted as necessary if the turbines were either non-operational or were not rotating

because of a lack of wind. To maximise the duration of monitoring during each season, whilst maintaining low carcass removal rates, surveying can be split into blocks as illustrated in Table 6-2.

Table 6-2 Proposed survey effort approach to maximise the duration of monitoring during each season (Source: NatureScot, 2021)

Days 1-10	Days 11-20	Days 21-30	Days 31-40	Days 41-50	Days 51-60
Initial 'sweep' then survey alternate days (d2, d4, d6, d8, d10)	No Survey	Initial 'sweep' then survey alternate days	No Survey	Initial 'sweep' then survey alternate days	No Survey

Searcher efficiency trials

Searcher efficiency trials will be conducted at the site to provide appropriate correction factors. The trials should ideally use dead bats, however if unavailable, similar coloured mammals of equivalent size can be used. The exact methods used will be documented and it is proposed that at least 10 carcasses are used, as otherwise the correction of casualty rates becomes very coarse (missing just 1 bat out of 5 would substantially influence the correction factor) (NatureScot, 2021). The best detailed search efficiency trial methodology has been published by NatureScot (2021) and will form the basis for this project.

Scavenger removal rates

Estimates of carcass removal rates will be undertaken as part of the post-construction monitoring and will inform the results of mortality monitoring. The standard best practice for this is fully described in the NatureScot (2021) guidance document and will be followed during the implementation of this proposed post-construction monitoring protocol.

The results of the scavenger removal rates and corpse searching will be used to obtain an 'estimate of total carcasses per site per month', see NatureScot (2021) Appendix 4 for calculations.

6.3 Residual Impacts

Not Significant Effect

Taking into consideration the sensitive design of the project, the proposed best practice and adaptive mitigation measures; significant residual effects on bats with regard to 1) Collision mortality, barotrauma and other injuries, 2) Loss or damage to commuting and foraging habitat, 3) Loss of, or damage to, roosts and 4) Displacement of individuals or populations are not anticipated.

7. CONCLUSION

This report provides a full and comprehensive assessment of the potential for impact on bat populations at the Proposed Development Site. The surveys and assessment provided in this report are in accordance with NatureScot guidance. Following consideration of the residual effects (post mitigation) it is noted that the Proposed Development will not result in any significant effects on bats.

Provided that the proposed wind farm development is constructed and operated in accordance with the design, best practice and mitigation that is described within this report, significant effects on bats are not anticipated at any geographic scale.

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APPENDIX 1

BAT HABITAT SUITABILITY APPRAISAL

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Bat Survey Report

Appendix 1 – Habitat Suitability Assessment



HABITAT SUITABILITY ASSESSMENT

Guidelines for assessing the potential suitability of a site for bats, based on the presence of habitat features (taken from Collins, 2016)

Suitability	Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions1 and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats, i.e. unlikely to be suitable for maternity or hibernation2. A tree of sufficient size and age to contain potential roost features but with none seen from the ground or features seen with only very limited roosting potential3.	Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitats. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High-quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

[1] For example, in terms of temperature, humidity, height above ground, light levels or levels of disturbance.
[2] Larger numbers of Common pipistrelle may be present during autumn and winter in large buildings in highly urbanised areas, based on evidence from the Netherlands (Korsten *et al.* 2015).
[3] Categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

APPENDIX 2

SITE RISK ASSESSMENT

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Appendix 2 – Site Risk Assessment (Table 3a, NatureScot, 2021)

SITE RISK ASSESSMENT

Table 3a: *Stage 1 - Initial site risk assessment*

Site Risk Level (1-5)*		**Project Size**		
		Small	**Medium**	**Large**
Habitat Risk	**Low**	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	**Description**
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	**Description**
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

APPENDIX 3

ECOBAT - PER DETECTOR RESULTS

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Appendix 3 – 2020 Ecobat Per Detector Results



Summary tables are provided in the main bat report for each species recorded showing key metrics per detector per survey period.

LEISLER'S BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	13	3867	D01	46	Moderate	62	Moderate - High
Spring	15	3867	D02	57	Moderate	83	High
Spring	15	3867	D04	55	Moderate	82	High
Spring	12	3867	D06	55	Moderate	71	Moderate - High
Spring	15	3867	D07	40	Low - Moderate	76	Moderate - High
Spring	14	3867	D08	46	Moderate	75	Moderate - High
Spring	15	3867	D09	55	Moderate	85	High
Summer	5	4259	D01	40	Low - Moderate	60	Moderate
Summer	12	4259	D02	48	Moderate	62	Moderate - High
Summer	14	4259	D04	65	Moderate - High	87	High
Summer	15	4259	D06	66	Moderate - High	89	High
Summer	11	4259	D07	57	Moderate	77	Moderate - High
Summer	14	4259	D08	73	Moderate - High	82	High
Summer	14	4259	D09	57	Moderate	80	Moderate - High
Autumn	2	2998	D01	28	Low - Moderate	38	Low - Moderate
Autumn	12	2998	D02	48	Moderate	78	Moderate - High
Autumn	16	2998	D04	52	Moderate	79	Moderate - High
Autumn	16	2998	D06	67	Moderate - High	86	High
Autumn	14	2998	D07	59	Moderate	77	Moderate - High
Autumn	15	2998	D08	73	Moderate - High	89	High
Autumn	14	2998	D09	52	Moderate	86	High

MYOTIS SP.

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	9	2997	D01	12	Low	46	Moderate
Spring	6	2997	D02	12	Low	30	Low - Moderate
Spring	6	2997	D04	12	Low	40	Low - Moderate
Spring	6	2997	D06	12	Low	46	Moderate
Spring	3	2997	D07	12	Low	12	Low
Spring	3	2997	D08	12	Low	12	Low
Spring	3	2997	D09	12	Low	12	Low
Summer	4	3375	D01	23	Low - Moderate	31	Low - Moderate

Summer	2	3375	D02	27	Low - Moderate	40	Low - Moderate
Summer	2	3375	D04	31	Low - Moderate	31	Low - Moderate
Summer	5	3375	D06	31	Low - Moderate	46	Moderate
Summer	2	3375	D07	14	Low	14	Low
Summer	6	3375	D08	23	Low - Moderate	31	Low - Moderate
Summer	5	3375	D09	14	Low	31	Low - Moderate
Autumn	3	3182	D01	18	Low	18	Low
Autumn	9	3182	D02	38	Low - Moderate	55	Moderate
Autumn	10	3182	D04	38	Moderate	63	Moderate - High
Autumn	12	3182	D06	59	Moderate	71	Moderate - High
Autumn	11	3182	D07	48	Moderate	59	Moderate
Autumn	15	3182	D08	59	Moderate	78	Moderate - High
Autumn	9	3182	D09	38	Low - Moderate	48	Moderate

SOPRANO PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	13	4124	D01	46	Moderate	73	Moderate - High
Spring	14	4124	D02	66	Moderate - High	83	High
Spring	14	4124	D04	56	Moderate	68	Moderate - High
Spring	11	4124	D06	30	Low - Moderate	62	Moderate - High
Spring	14	4124	D07	53	Moderate	77	Moderate - High
Spring	14	4124	D08	60	Moderate	80	Moderate - High
Spring	12	4124	D09	57	Moderate	75	Moderate - High
Summer	8	4910	D01	23	Low - Moderate	57	Moderate
Summer	9	4910	D02	14	Low	57	Moderate
Summer	7	4910	D04	57	Moderate	64	Moderate - High
Summer	6	4910	D06	31	Low - Moderate	40	Low - Moderate
Summer	8	4910	D07	30	Low - Moderate	74	Moderate - High
Summer	14	4910	D08	78	Moderate - High	96	High
Summer	9	4910	D09	40	Low - Moderate	72	Moderate - High
Autumn	11	4001	D01	55	Moderate	79	Moderate - High
Autumn	15	4001	D02	71	Moderate - High	90	High
Autumn	16	4001	D04	83	High	92	High
Autumn	16	4001	D06	76	Moderate - High	88	High
Autumn	16	4001	D07	77	Moderate - High	89	High
Autumn	16	4001	D08	97	High	100	High
Autumn	14	4001	D09	75	Moderate - High	87	High

COMMON PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	14	4423	D01	66	Moderate - High	78	Moderate - High
Spring	12	4423	D02	81	High	94	High
Spring	14	4423	D04	66	Moderate - High	85	High
Spring	10	4423	D06	63	Moderate - High	74	Moderate - High
Spring	13	4423	D07	67	Moderate - High	90	High
Spring	15	4423	D08	60	Moderate	94	High
Spring	15	4423	D09	73	Moderate - High	91	High
Summer	7	5060	D01	40	Low - Moderate	51	Moderate
Summer	7	5060	D02	31	Low - Moderate	60	Moderate
Summer	7	5060	D04	31	Low - Moderate	51	Moderate
Summer	9	5060	D06	40	Low - Moderate	55	Moderate
Summer	7	5060	D07	46	Moderate	62	Moderate - High
Summer	14	5060	D08	69	Moderate - High	95	High
Summer	9	5060	D09	31	Low - Moderate	71	Moderate - High
Autumn	9	3935	D01	38	Low - Moderate	70	Moderate - High
Autumn	14	3935	D02	71	Moderate - High	89	High
Autumn	13	3935	D04	68	Moderate - High	84	High
Autumn	16	3935	D06	54	Moderate	87	High
Autumn	15	3935	D07	70	Moderate - High	89	High
Autumn	16	3935	D08	88	High	93	High
Autumn	15	3935	D09	63	Moderate - High	83	High

NATHUSIUS' PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	-	946	D01	-	Nil	-	Nil
Spring	1	946	D02	51	Moderate	51	Moderate
Spring	-	946	D04	-	Nil	-	Nil
Spring	-	946	D06	-	Nil	-	Nil
Spring	-	946	D07	-	Nil	-	Nil
Spring	-	946	D08	-	Nil	-	Nil
Spring	2	946	D09	12	Low	12	Low
Summer	-	1201	D01	-	Nil	-	Nil
Summer	-	1201	D02	-	Nil	-	Nil
Summer	-	1201	D04	-	Nil	-	Nil
Summer	2	1201	D06	14	Low	14	Low

Summer	-	1201	D07	-	Nil	-	Nil
Summer	-	1201	D08	-	Nil	-	Nil
Summer	-	1201	D09	-	Nil	-	Nil
Autumn	-	927	D01	-	Nil	-	Nil
Autumn	2	927	D02	18	Low	18	Low
Autumn	1	927	D04	38	Low - Moderate	38	Low - Moderate
Autumn	2	927	D06	28	Low - Moderate	38	Low - Moderate
Autumn	1	927	D07	18	Low	18	Low
Autumn	1	927	D08	18	Low	18	Low
Autumn	2	927	D09	18	Low	18	Low

BROWN LONG-EARED BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	-	1660	D01	-	Nil	-	Nil
Spring	1	1660	D02	12	Low	12	Low
Spring	-	1660	D04	-	Nil	-	Nil
Spring	-	1660	D06	-	Nil	-	Nil
Spring	-	1660	D07	-	Nil	-	Nil
Spring	5	1660	D08	30	Low - Moderate	46	Moderate
Spring	-	1660	D09	-	Nil	-	Nil
Summer	-	2312	D01	-	Nil	-	Nil
Summer	2	2312	D02	14	Low	14	Low
Summer	1	2312	D04	14	Low	14	Low
Summer	-	2312	D06	-	Nil	-	Nil
Summer	-	2312	D07	-	Nil	-	Nil
Summer	2	2312	D08	14	Low	14	Low
Summer	4	2312	D09	14	Low	14	Low
Autumn	-	2405	D01	-	Nil	-	Nil
Autumn	8	2405	D02	18	Low	18	Low
Autumn	5	2405	D04	18	Low	38	Low - Moderate
Autumn	8	2405	D06	18	Low	38	Low - Moderate
Autumn	5	2405	D07	38	Low - Moderate	38	Low - Moderate
Autumn	12	2405	D08	43	Moderate	63	Moderate - High
Autumn	5	2405	D09	18	Low	38	Low - Moderate

APPENDIX 4

OVERALL SITE RISK ASSESSMENT

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Bat Survey Report

Appendix 4 – Overall Risk Assessment (Table 3b, NatureScot, 2021)

Table 3b: *Stage 2 - Overall risk assessment*

Site risk level (from Table 3a)	Ecobat activity category (or equivalent justified categorisation)					
	Nil (0)	Low (1)	Low-moderate (2)	Moderate (3)	Moderate-high (4)	High (5)
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Med (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

The scores in the table are a product of multiplying site risk level and the Ecobat activity category (or equivalent). The activity categories equate to those given in Table 1 for high collision risk species. Nil (0) means no bat activity was recorded across the whole site, but caution is needed here, because although the values given in this column are "0", at sites where pre-construction surveys found no bat activity, there remains the possibility that new turbines could attract some bat species, thereby altering the level of risk that applies in reality.

Overall assessment:

Low (green)	0-4
Medium (amber)	5-12
High (red)	15-25

It is important to have an understanding of both "typical" and unusually high levels of bat activity at a site so that potentially important peaks in activity are not overlooked. It is therefore recommended that both the highest Ecobat activity category and the most frequent activity category (i.e. the median) are assessed separately in Table 3b and presented in the overall risk assessment. A judgement can then be made on which is the most relevant. It should be noted that presenting mean activity levels can be highly misleading where the data are highly skewed, as is frequently the case with bat activity at wind turbines (Lintott & Mathews, 2018).

APPENDIX 6.3

CONFIDENTIAL APPENDIX – BADGER ACTIVITY MAP



Map Legend

- EIAR Study Area

Badger Evidence

- Badger Sett
- Snuffle holes
- Trails leading to the river

N

CONFIDENTIAL APPENDIX

Microsoft product screen shots reprinted with permission from Microsoft Corporation

Drawing Title: Badger Activity Map

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
TB	PR
Project No.	Drawing No.
200512	Figure 6.6
Scale	Date
1:18000	23.11.2021

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APPENDIX 6.4

BIODIVERSITY MANAGEMENT AND ENHANCEMENT PLAN

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Biodiversity Management and Enhancement Plan

Proposed Ballynagare Wind Farm, Co. Kerry



DOCUMENT DETAILS

Client:	**EM Power**
Project Title:	**Proposed Ballynagare Wind Farm, Co. Kerry**
Project Number:	**200512**
Document Title:	**Biodiversity Management and Enhancement Plan**
Document File Name:	**BMEP – D – 2021.11.19– 200512**

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Rev	Status	Date	Author(s)	Approved By
01	Draft	19.11.2021	OOG	PR

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1. INTRODUCTION

1.1 Background

This Biodiversity Management and Enhancement Plan (BMEP) has been prepared in support of the Environmental Impact Assessment Report (EIAR) produced for the proposed Ballynagare Wind Farm, Co. Kerry.

A Biodiversity Management and Enhancement Plan has been prepared as part of the Proposed Development to enhance the biodiversity value of lands within the control of the proposed development in accordance with the NBDC guidelines on pollinator friendly management of Wind Farms[1]. Primarily this plan focuses on the ecological enhancement of habitat for Marsh Fritillary and general pollinators. The measures described in this management plan aim to enhance the biodiversity potential of the available lands within or adjacent to the development footprint.

1.1.1 Statement of Authority

This report has been prepared by Olivia O'Gorman (B.Sc., M.Sc). Olivia has over four years of professional experience in environmental management and ecological assessment. This report has been reviewed by Pat Roberts (B.Sc., M.Sc., MCIEEM). Pat is a highly experienced ecologists with over 14 years' professional experience in environmental management and ecological assessment and is a full member of the Institute of Ecology and Environmental Management (CIEEM).

[1] *National Biodiversity Data Centre (2021) Pollinator-friendly management of Wind Farms. Guidelines. No 12. National Biodiversity Data Series No. 25*

2. BIODIVERSITY MEASURES

2.1 Habitat Enhancement

2.1.1 Management of Habitat adjacent to Proposed Development Infrastructure

Included in the enhancement measures of the plan, are measures that will reinstate the embankments (cut and fill areas) alongside the newly constructed infrastructure i.e., site access roads and turbine hardstands.

As fully described in the Peat & Spoil Management Plan '*Peat and spoil shall be side-cast along founded roads only where it can be placed in a stable formation i.e. where the topography and ground conditions allow.* and '*Peat and spoil shall only be cast to safe heights and slope angles, considering the topography and the ground conditions. This height shall generally be up to 1m, and the slopes shall be not greater than 1 (v): 2 or 3 (h) unless a site-specific assessment during detailed design indicates a greater height and angle is safe.'*

In regards the update of existing access roads, excavations of new access tracks in peat and where new access roads will ne created, *'side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes will be required where areas of weaker peat are encountered'.* Where new access roads will be created within the proposed development site *', side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes may be required if localised areas of weaker peat are encountered. Drainage shall be installed to divert surface and groundwater from the construction areas.'*

In order to facilitate the re-establishment of vegetation within these areas, the following measures are proposed throughout the wind farm site:

- The implementation of this plan will be overseen by a suitably qualified ecologist prior to commencement and throughout the construction period.
- Areas of high pollinator value i.e., vegetated with both grassy and flowering plants, which are outside of the development footprint but within the proposed development boundary will be identified by the supervising ecologist at the outset and avoided during works.
- No application of chemical and organic fertilisers or herbicides and pesticides will be undertaken within the development footprint.
- No additional drainage to be installed in proximity to enhanced habitat areas during the lifetime of the development.
- The use of off-road vehicles on the site will be restricted to the proposed new site access tracks.
- The planting of forestry will not be permitted.
- Seedlings of coniferous or other trees or any invasive plants will be removed from this area on an annual basis during the lifetime of the Proposed Development.
- Peat extraction within enhanced habitats will not be permitted.
- Burning and dumping will not be permitted.
- Where revegetation has not established or ground conditions do not allow for easy recolonisation, reseeding will be restricted to species occurring in the immediate surroundings and which are of benefit to pollinators as laid out in the NBDC guidelines[2].

[2] *National Biodiversity Data Centre (2021) Pollinator-friendly management of Wind Farms. Guidelines. No 12. National Biodiversity Data Series No. 25*

- Where required, any reseeding of grasses will use fescue spp., including Sheep's fescue (*Festuca ovina*) or red fescue (*Festuca rubra*). Such grasses will help to stabilise the reinstated peat, while not outcompeting any natural revegetation from local seed dispersal.
- Additional grasses species to be considered include yorkshire-fog, cocksfoot *(Dactylis glomerata),* false brome *(Brachypodium sylvaticum*), downy oat grass *(Helictotrichon pubescens),* bent grass species *(Agrostis spp.)* and meadow grasses (*Poa spp.*)
- Known larval food plants for a wide variety of insect species will be planted. These may include bird's-foot-trefoil, cuckoo flower, holly, ivy, nettle, marsh thistle, devil's-bit scabious, wood sorrel, sheep's sorrel, hare's-tail cottongrass and cabbage family plants, where appropriate to the existing habitat type and conditions.
- Where hedgerow or treeline will be removed as a result of the proposed development footprint new hedgerows or treeline will be planted and will comprise of native species (See section 2.2).
- Native species including willow spp., whitethorn, wild rose, blackthorn (flowers in spring) bramble, (flowers in summer), ivy (flowers in autumn), will be planted and these will provide food for pollinator throughout the year. Holly, rowan, crab apple and spindle are also native species that may be included.
- Works would also be preceded by a toolbox talk to the construction team by the project ecologist to ensure measures are implemented.
- The areas that surround the wind farm infrastructure that are the subject of this plan will be monitored on an ongoing basis to measure their success.

2.2 Hedgerow Replanting

There will be a loss of approximately 358m of hedgerow and treeline within the area surrounding Turbine 7 as a result of bat mitigation measures. This loss will be mitigated by replanting 441 metres of hedgerow which will be composed of native species which are indigenous to the local area and in line with the National Pollinator Plan as described above.

Replanting of this hedgerow will ensure there is no net loss of this habitat while also maintaining connectivity between the existing hedgerow habitats. The location of the new section of hedgerow is presented in Figure 2.1.

2.3 Management and Enhancement of Habitats for Marsh Fritillary

Dedicated surveys were undertaken within the study area to identify areas of suitable marsh fritillary habitat. Marsh fritillary was not recorded within the Proposed Development study area however, suitable habitat for the species exists in fragmented areas within the site (see Figure 2.2.). An area of suitable habitat for the species was identified within the proposed development boundary adjacent to the trackway in the vicinity of T4. This plan sets out measures that will manage and enhance the habitats available within the site for Marsh Fritillary. During the construction phase the construction corridor will be kept to a minimum to avoid direct habitat loss for Marsh Fritillary while new habitat will be created in a designed enhancement area within the proposed development boundary. The following habitat enhancement measures will be implemented:

- Areas of suitable marsh fritillary habitat will be fenced off or clearly marked prior to the commencement of any site works under the guidance and supervision of a suitably qualified Ecological Clerk of Works (ECoW).
- Pre-commencement surveys will be undertaken for marsh fritillary within the vicinity of T4 as this area supports the most suitable areas of habitats for the species.
- Vegetation structure and suitability will be monitored following the NBDC survey methodology (NBDC, 2020).

- Habitat condition monitoring will be undertaken during construction and in year 1 post construction to ensure that there are no negative effects on marsh fritillary habitat.
- No works will be undertaken within the marsh fritillary habitat during either construction or operation of the wind farm.
- Peat or spoil material excavated from areas containing devil's bit scabious (the food plant of marsh fritillary larvae) will be saved and laid in areas where the infrastructure is adjacent to existing Marsh fritillary habitat within the EIAR development boundary to the enhance existing areas of Marsh Fritillary habitat. The enhancement of such vegetation will provide a large food source for adult and larval stage marsh fritillary.

2.4 Whooper Swan Enhancement Plan

A Whooper swan Enhancement plan details best practice and management measures which will be implemented as part of the Proposed Development. The mitigation measures outlined in the Whooper swan Enhancement plan include the provision of an area of 12ha of land north of the wind farm study area, adjacent to Ballyouneen, for enhancement as foraging habitat for whooper swan. A series of management prescriptions to maintain high quality and attractive foraging habitat for whooper swan are proposed. These include maintaining a suitable grazing sward through grazing/cutting/topping and maintaining a high-quality green sward through fertilising. Furthermore, potential disturbance such as livestock, will be avoided when the whooper swan are wintering in Ireland (October to March). In addition to the 12ha proposed for enhancement, a further 14ha of adjacent improved grassland will be included in the management plan to ensure it is available to whooper swan throughout the winter season for the lifetime of the wind farm. These measures are fully described in the Ornithology Appendix of 7-7 of Chapter 7.

2.5 Timing of Works

Vegetation replacement works will be conducted in line with the provisions of the Wildlife Acts 1979-2012 as amended.

2.6 Monitoring

2.6.1 Vegetation Monitoring

To confirm that habitat enhancement has been successful, all areas of enhanced vegetation will be monitored post-enhancement. Monitoring results will be reported within an Annual Environmental Report with any criteria failures identified and corrective actions implemented as part of the Ballynagare Construction Environmental Management Plan (CEMP).

Prior to the commencement of habitat enhancement measures, permanent vegetation monitoring plots will be established within the enhancement areas. The monitoring plot locations will be selected using stratified random sampling. This will allow the monitoring plots to be representative of microtopography and vegetation cover, sampling areas from the wettest, intermediate and driest parts of the management areas. Monitoring plots will be surveyed with plot sizes being 2m x 2m. Biotic and abiotic parameters that form baseline indicators of ecological and where appropriate, hydrological condition of the habitats will be recorded. Monitoring plots will be marked out and their location recorded using GIS. The number of monitoring plots will be determined by the level of habitat homogeneity recorded while also ensuring that enhanced areas are adequately surveyed and monitored. Visual inspections of enhanced areas within the application site will be carried out biannually during the first two years after enhancement to check for potential soil erosion or movement and degradation of replaced turves. Vegetation monitoring will be carried out in years 1, 3, 5 and 10 after restoration. Results will be analysed and a report of the findings will be produced. The enhancement plan will be regularly updated and amended where necessary to improve the efficacy of

the enhancement work. The number of monitoring plots will be determined and stated during the initial survey, although this may change depending on the results of the initial surveys. Monitoring will involve the following:

Vegetation monitoring

- A number of fixed relevé sites (i.e., permanent quadrats) will be set up in areas where active management is proposed within the designed enhancement area. Baseline data will be recorded prior to the commencement of habitat management activities set out in this outline plan. The character of each relevé will be recorded (e.g., species proportions present, vegetation structure and height) and photographs will be taken of each relevé from a fixed point.
- The relevés will then be re-examined during years 1, 3, 5 and 10 following restoration in order to establish the extent of habitat improvement resulting from management practices.

The efficacy of the habitat enhancement measures employed will be reviewed in years 1, 3, 5 and 10 following commencement of the plan on the basis of the results of vegetation sampling and water level readings from the managed areas. Analysis of the data collected will be the basis for a review of the measures and techniques employed.

2.7 Reporting

Reports detailing the monitoring works carried out, the results obtained and a review of their success, along with any suggestions for amendments to the plan will be prepared in years 1, 3, 5 and 10 following commencement of the plan's implementation.

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APPENDIX 7.1

SPECIES LIST

Planning and Environmental Consultants

Appendix 7-1 Species List

Ballynagare Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Appendix 7-1 Species List**
Document File Name:	**Appendix 7-1 F 2021/08/10 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
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Table 7 - 1 - 1 Target species recorded during surveys

Species	Scientific Name	Rationale
Barn Owl	*Tyto alba*	Red List & Schedule 4
Bar-tailed Godwit	*Limosa lapponica*	Annex I & Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Black-headed Gull	*Chroicocephalus ridibundus*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Brent Goose	*Branta bernicla*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Buzzard	*Buteo buteo*	Schedule 4
Common Gull	*Larus canus*	SCI of Tralee Bay Complex SPA
Cormorant	*Phalacrocorax carbo*	SCI of River Shannon and River Fergus Estuaries SPA
Curlew	*Numenius arquata*	Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Dunlin	*Calidris alpina*	Annex I & Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Golden Plover	*Pluvialis apricaria*	Annex I & Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Grey Plover	*Pluvialis squatarola*	Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Grey Wagtail	*Motacilla cinerea*	Red List
Hen Harrier	*Circus cyaneus*	Annex I & Schedule 4 & SCI of Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA
Kestrel	*Falco tinnunculus*	Red List & Schedule 4
Kingfisher	*Alcedo atthis*	Annex I
Lapwing	*Vanellus vanellus*	Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Little Egret	*Egretta garzetta*	Annex I
Mallard	*Anas platyrhynchos*	SCI of Tralee Bay Complex SPA
Meadow Pipit	*Anthus pratensis*	Red List
Oystercatcher	*Haematopus ostralegus*	Red List & SCI of Tralee Bay Complex SPA

Species	Scientific Name	Rationale
Peregrine Falcon	*Falco peregrinus*	Annex I & Schedule 4
Redshank	*Tringa totanus*	Red List & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Short-eared Owl	*Asio flammeus*	Annex I & Schedule 4
Shoveler	*Spatula clypeata*	Red List & SCI of River Shannon and River Fergus Estuaries SPA
Snipe	*Gallinago gallinago*	Red List
Sparrowhawk	*Accipiter nisus*	Schedule 4
Teal	*Anas crecca*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Whooper Swan	*Cygnus cygnus*	Annex I & SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Wigeon	*Mareca penelope*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA

Table 7 - 1 - 2 Species recorded on the wind farm site to a 500m radius

Species	Scientific Name	Target Species
Barn Owl	*Tyto alba*	Yes
Barn Swallow	*Hirundo rustica*	No
Bar-tailed Godwit	*Limosa lapponica*	Yes
Blackbird	*Turdus merula*	No
Black-headed Gull	*Chroicocephalus ridibundus*	Yes
Blue Tit	*Cyanistes caeruleus*	No
Brent Goose	*Branta bernicla*	Yes
Buzzard	*Buteo buteo*	Yes
Chaffinch	*Fringilla coelebs*	No
Coal Tit	*Periparus ater*	No
Common Gull	*Larus canus*	Yes
Cormorant	*Phalacrocorax carbo*	Yes

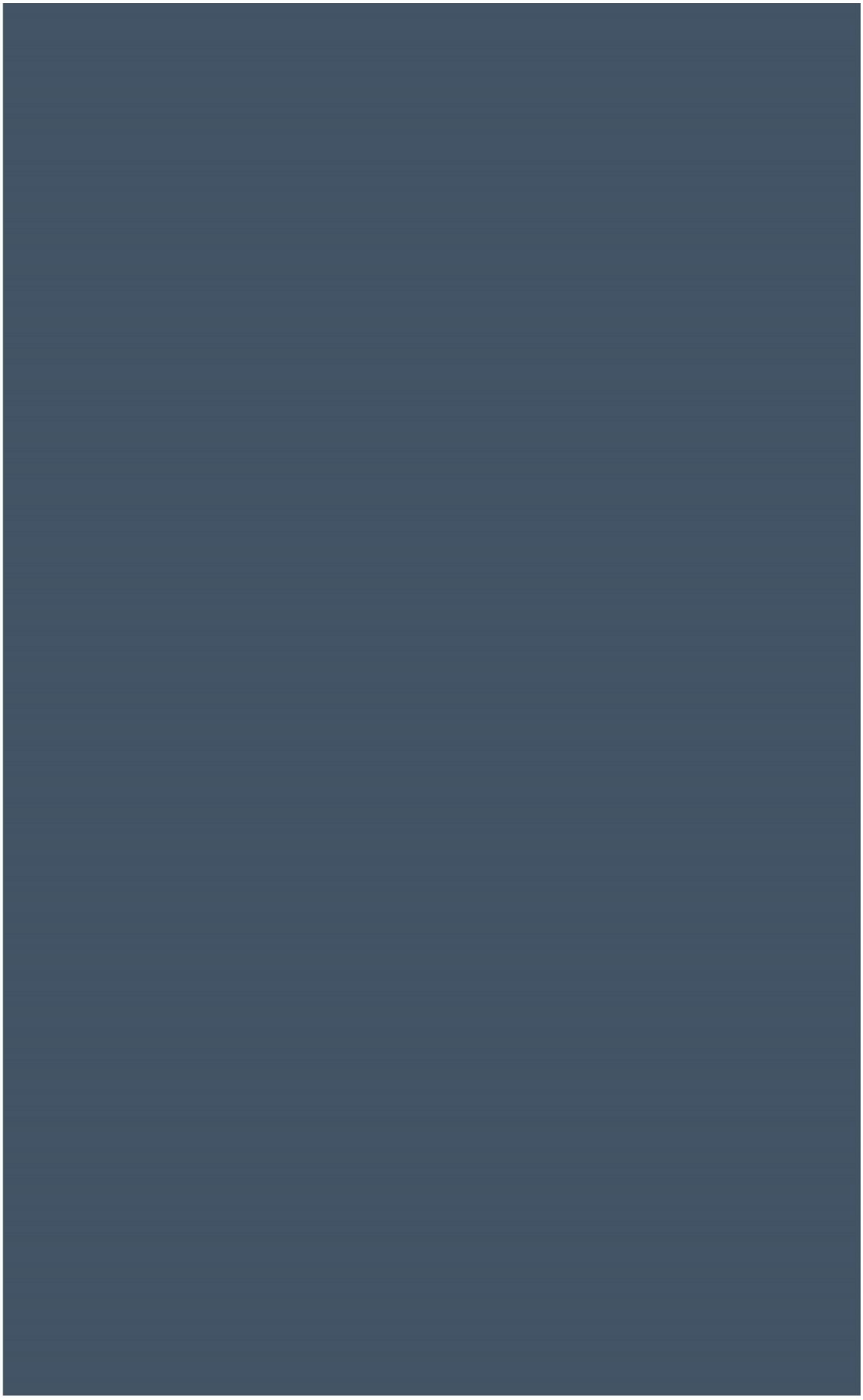
Species	Scientific Name	Target Species
Cuckoo	*Cuculus canorus*	No
Curlew	*Numenius arquata*	Yes
Dunnock	*Prunella modularis*	No
Fieldfare	*Turdus pilaris*	No
Golden Plover	*Pluvialis apricaria*	Yes
Goldfinch	*Carduelis carduelis*	No
Great Black-backed Gull	*Larus marinus*	No
Great Tit	*Parus major*	No
Grey Heron	*Ardea cinerea*	No
Hen Harrier	*Circus cyaneus*	Yes
Herring Gull	*Larus argentatus*	No
Hooded Crow	*Corvus cornix*	No
Jackdaw	*Coloeus monedula*	No
Kestrel	*Falco tinnunculus*	Yes
Lapwing	*Vanellus vanellus*	Yes
Lesser Black-backed Gull	*Larus fuscus*	No
Little Egret	*Egretta garzetta*	Yes
Magpie	*Pica pica*	No
Mallard	*Anas platyrhynchos*	Yes
Meadow Pipit	*Anthus pratensis*	Yes
Mistle Thrush	*Turdus viscivorus*	No
Moorhen	*Gallinula chloropus*	No
Mute Swan	*Cygnus olor*	No
Oystercatcher	*Haematopus ostralegus*	Yes
Peregrine Falcon	*Falco peregrinus*	Yes
Pheasant	*Phasianus colchicus*	No
Pied Wagtail	*Motacilla alba*	No

Species	Scientific Name	Target Species
Raven	*Corvus corax*	No
Redshank	*Tringa totanus*	Yes
Reed Bunting	*Emberiza schoeniclus*	No
Reed Warbler	*Acrocephalus scirpaceus*	No
Robin	*Erithacus rubecula*	No
Rook	*Corvus frugilegus*	No
Sedge Warbler	*Acrocephalus schoenobaenus*	No
Short-eared Owl	*Asio flammeus*	Yes
Shoveler	*Spatula clypeata*	Yes
Skylark	*Alauda arvensis*	No
Snipe	*Gallinago gallinago*	Yes
Sparrowhawk	*Accipiter nisus*	Yes
Starling	*Sturnus vulgaris*	No
Stonechat	*Saxicola rubicola*	No
Teal	*Anas crecca*	Yes
Whooper Swan	*Cygnus cygnus*	Yes
Willow Warbler	*Phylloscopus trochilus*	No
Woodpigeon	*Columba palumbus*	No
Wren	*Troglodytes troglodytes*	No

Table 7 - 1 - 3 Species recorded further than 500m from the wind farm site

Species	Scientific Name	Target Species
House Martin	*Delichon urbicum*	No
Linnet	*Linaria cannabina*	No
House Sparrow	*Passer domesticus*	No
Kingfisher	*Alcedo atthis*	Yes
Grey Wagtail	*Motacilla cinerea*	Yes

Species	Scientific Name	Target Species
Grey Plover	*Pluvialis squatarola*	Yes
Wigeon	*Mareca penelope*	Yes
Dunlin	*Calidris alpina*	Yes



APPENDIX 7.2

SURVEY EFFORT

Appendix 7-2 Survey Effort

Ballynagare Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Appendix 7-2 Survey Effort**
Document File Name:	**Appendix 7-2 F 2021/08/10 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	10/08/2021	SD	PC

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Table 7 - 2 - 1 Vantage point survey effort

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
08/04/2019	Vantage Point Survey	VP2	3:00 starting at 14:55	Visibility: good; Wind speed and direction: gentle breeze ESE; Cloud cover and height: 60% >500m; Rain: none; Frost: none; Snow: none		CMc
08/04/2019	Vantage Point Survey	VP2	3:00 starting at 18:25	Visibility: good; Wind speed and direction: light breeze ESE; Cloud cover and height: 50% >500m; Rain: none; Frost: none; Snow: none		CMc
17/04/2019	Vantage Point Survey	VP3	3:00 starting at 15:10	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none		CMc
17/04/2019	Vantage Point Survey	VP3	3:00 starting at 18:40	Visibility: good; Wind speed and direction: light breeze ESE; Cloud cover and height: 80% >500m; Rain: none; Frost: none; Snow: none		CMc
29/04/2019	Vantage Point Survey	VP1	3:00 starting at 15:30	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 80% >500m; Rain: none; Frost: none; Snow: none		CMc
29/04/2019	Vantage Point Survey	VP1	3:00 starting at 17:00	Visibility: good; Wind speed and direction: light air SSE; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none		CMc
09/05/2019	Vantage Point Survey	VP2	3:00 starting at 04:55	Visibility: good; Wind speed and direction: light breeze NNW; Cloud cover and height: 20-50% >500m; Rain: none; Frost: none; Snow: none		CMc
09/05/2019	Vantage Point Survey	VP2	3:00 starting at 08:25	Visibility: good; Wind speed and direction: light breeze NNW; Cloud cover and height: 25-80% >500m; Rain: light showers; Frost: none; Snow: none		CMc
14/05/2019	Vantage Point Survey	VP1	3:00 starting at 04:45	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 90% >500m; Rain: none; Frost: none; Snow: none	Mute swan sitting on a nest by the VP with 5 or 6 chicks	CMc
14/05/2019	Vantage Point Survey	VP1	3:00 starting at 09:45	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 80-90% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
16/05/2019	Vantage Point Survey	VP3	3:00 starting at 04:40	Visibility: moderate; Wind speed and direction: light air E; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
16/05/2019	Vantage Point Survey	VP3	3:00 starting at 12:15	Visibility: moderate; Wind speed and direction: light breeze ESE; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
05/06/2019	Vantage Point Survey	VP1	3:00 starting at 09:30	Visibility: good; Wind speed and direction: light breeze NNW; Cloud cover and height: 60-75% 150-500m; Rain: none; Frost: none; Snow: none		CMc
05/06/2019	Vantage Point Survey	VP1	3:00 starting at 13:00	Visibility: good; Wind speed and direction: light breeze NNW; Cloud cover and height: 50% 150-500m; Rain: none; Frost: none; Snow: none		CMc
10/06/2019	Vantage Point Survey	VP2	3:00 starting at 12:00	Visibility: good; Wind speed and direction: light breeze NNW; Cloud cover and height: 50-75% 150-500m; Rain: none; Frost: none; Snow: none		CMc
10/06/2019	Vantage Point Survey	VP2	3:00 starting at 16:30	Visibility: good; Wind speed and direction: light breeze NNW; Cloud cover and height: 75-90% 150-500m; Rain: none; Frost: none; Snow: none	One heavy shower in the last hour	CMc
19/06/2019	Vantage Point Survey	VP3	3:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 80-90% 150-500m; Rain: none; Frost: none; Snow: none		CMc
19/06/2019	Vantage Point Survey	VP3	3:00 starting at 13:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 90% 150-500m; Rain: none; Frost: none; Snow: none		CMc
03/07/2019	Vantage Point Survey	VP1	3:00 starting at 06:30	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 99% >500m; Rain: none; Frost: none; Snow: none		CMc
03/07/2019	Vantage Point Survey	VP1	3:00 starting at 10:00	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 66-75% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
05/07/2019	Vantage Point Survey	VP3	3:00 starting at 06:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 15-70% >500m; Rain: none; Frost: none; Snow: none		CMc
05/07/2019	Vantage Point Survey	VP3	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 95-100% >500m; Rain: none; Frost: none; Snow: none	Disturbance in the afternoon; agricultural activities, slurry spreading, sileage cutting	CMc
12/07/2019	Vantage Point Survey	VP2	3:00 starting at 10:00	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 90-100% 150-500m; Rain: drizzle; Frost: none; Snow: none	Drizzle in the first hour, dry otherwise	CMc
12/07/2019	Vantage Point Survey	VP2	3:00 starting at 13:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 75% 150-500m; Rain: none; Frost: none; Snow: none		CMc
02/08/2019	Vantage Point Survey	VP1	3:00 starting at 10:00	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 50-60% >500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swans with 6 juveniles by the VP for both watches	CMc
02/08/2019	Vantage Point Survey	VP1	3:00 starting at 19:30	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 50-75% >500m; Rain: none; Frost: none; Snow: none	One snipe heard calling after dark	CMc
09/08/2019	Vantage Point Survey	VP2	3:00 starting at 15:45	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 90-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none		CMc
09/08/2019	Vantage Point Survey	VP2	3:00 starting at 19:15	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
12/08/2019	Vantage Point Survey	VP3	3:00 starting at 16:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 50-80% 150-500m; Rain: none; Frost: none; Snow: none		CMc
12/08/2019	Vantage Point Survey	VP3	3:00 starting at 19:10	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 80-100% 150-500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
02/09/2019	Vantage Point Survey	VP1	3:00 starting at 05:50	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 90-100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
02/09/2019	Vantage Point Survey	VP1	3:00 starting at 09:20	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
04/09/2019	Vantage Point Survey	VP2	3:00 starting at 05:50	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 75-80% 150-500m; Rain: light showers; Frost: none; Snow: none	#VALUE!	CMc
04/09/2019	Vantage Point Survey	VP2	3:00 starting at 09:20	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 60-90% 150-500m; Rain: none; Frost: none; Snow: none	High tide, much less activity than the first watch	CMc
27/09/2019	Vantage Point Survey	VP3	3:00 starting at 06:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 90-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none		CMc
27/09/2019	Vantage Point Survey	VP3	3:00 starting at 09:30	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 80-90% 150-500m; Rain: none; Frost: none; Snow: none	Flock of gulls flew through in the dark at 07:05, not bright enough to confirm identification. 120+ birds, looked to be a mix of mostly common and lesser black-backed with a few greater black-backed gulls	CMc
04/10/2019	Vantage Point Survey	VP1	3:00 starting at 13:40	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 50-75% >500m; Rain: none; Frost: none; Snow: none	Mallard, curlew and oystercatcher could be heard calling throughout	CMc
04/10/2019	Vantage Point Survey	VP1	3:00 starting at 17:10	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 60-80% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
18/10/2019	Vantage Point Survey	VP2	3:00 starting at 13:10	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 80-90% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
18/10/2019	Vantage Point Survey	VP2	3:00 starting at 16:40	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 60-70% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
22/10/2019	Vantage Point Survey	VP3	3:00 starting at 13:00	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 95-100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
22/10/2019	Vantage Point Survey	VP3	3:00 starting at 16:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 95-100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
08/11/2019	Vantage Point Survey	VP1	3:00 starting at 06:50	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 5-100% >500m; Rain: none; Frost: light; Snow: none	Low ground fog during the first hour. Disturbance; frequent loud bangs thoughout watch (shotgun/crow banger)	CMc
08/11/2019	Vantage Point Survey	VP1	3:00 starting at 10:20	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 5-15% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
20/11/2019	Vantage Point Survey	VP3	3:09 starting at 07:01	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 50-80% 150-500m; Rain: none; Frost: none; Snow: none	Heavy rain on arrival, cleared quickly. Whooper swan and snipe could be heard calling in the dark. As light came in whooper swan could be seen roosting from the VP. At 08:40 359 whooper swan were visible from the VP.	CMc
20/11/2019	Vantage Point Survey	VP3	3:00 starting at 12:10	Visibility: good; Wind speed and direction: light breeze SE; Cloud cover and height: 90% 150-500m; Rain: none; Frost: none; Snow: none	At 12:10 whooper swan were in four distinct groups; centre (32); south (19); east (123); and west (39)	CMc
26/11/2019	Vantage Point Survey	VP2	3:00 starting at 12:30	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
29/11/2019	Vantage Point Survey	VP2	3:00 starting at 07:20	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 60-90% >500m; Rain: none; Frost: none; Snow: none	At 07:35 whooper swan could be heard in their roosts. Shortly after wingbeats were heard with no visuals - possibly flying low over the embankment or behind the embankment. At 08:11 21 whooper swan were counted in a flock to the south of the VP.	CMc
09/12/2019	Vantage Point Survey	VP2	3:00 starting at 11:20	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 25-80% >500m; Rain: none; Frost: none; Snow: none		CMc
09/12/2019	Vantage Point Survey	VP2	3:00 starting at 14:20	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 15-60% >500m; Rain: none; Frost: none; Snow: none		CMc
11/12/2019	Vantage Point Survey	VP1	3:00 starting at 10:55	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 80% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
11/12/2019	Vantage Point Survey	VP1	3:00 starting at 14:25	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 80-90% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
12/12/2019	Vantage Point Survey	VP3	3:00 starting at 10:50	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 75-100% 150-500m; Rain: light showers; Frost: none; Snow: none	2 whooper swan in front of VP on arrival, 109 whooper swan in neighbouring field	CMc
12/12/2019	Vantage Point Survey	VP3	3:00 starting at 14:20	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 90-100% 150-500m; Rain: light showers; Frost: none; Snow: none	12 whooper swan in front of VP on arrival and 271 whooper swan in neighbouring field	CMc
28/01/2020	Vantage Point Survey	VP1	3:00 starting at 07:30	Visibility: moderate; Wind speed and direction: moderate breeze W; Cloud cover and height: 80-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none		CMc
28/01/2020	Vantage Point Survey	VP1	3:00 starting at 13:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 70-80% 150-500m; Rain: light showers; Frost: none; Snow: none	2 mute swan foraging in field beside VP throughout watch	CMc
13/02/2020	Vantage Point Survey	VP1	3:00 starting at 09:10	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 50-80% >500m; Rain: none; Frost: none; Snow: none	VP flooded, had to move back slightly. 3 curlew, 3 whooper swan, 5 teal and 27 black-headed gull in flooded field by VP on arrival	CMc
13/02/2020	Vantage Point Survey	VP1	3:00 starting at 15:50	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 60-80% >500m; Rain: none; Frost: none; Snow: none	3 mute swan, 27 black-headed gull and great black-backed gull in flooded field by VP on arrival. Snipe and mallard heard calling in the dark, no visuals.	CMc
17/03/2020	Vantage Point Survey	VP1	3:00 starting at 13:00	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none	2 mute swan foraging in fields beside the VP on arrival	CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
24/03/2020	Vantage Point Survey	VP1	3:00 starting at 05:30	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 80-90% 150-500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swan nest building beside VP - same place as last breeding season. 5 mute swans were roosting by the VP. A breeding pair on one side of the road and three on the other side.	CMc
15/04/2020	Vantage Point Survey	VP1	3:00 starting at 18:40	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 5% >500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swan beside VP throughout. Nest building/foraging	CMc
16/04/2020	Vantage Point Survey	VP1	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light air NE; Cloud cover and height: 33-40% >500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swans beside VP throughout. Nest building/foraging	CMc
01/05/2020	Vantage Point Survey	VP1	3:00 starting at 05:05	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 40-60% >500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swan foraging by VP throughout. Mallard calling in the dark just N of VP	CMc
01/05/2020	Vantage Point Survey	VP1	3:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 50-60% >500m; Rain: none; Frost: none; Snow: none	Male mute swan foraging by VP throughout	CMc
12/06/2020	Vantage Point Survey	VP1	3:00 starting at 12:00	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none		CMc
18/06/2020	Vantage Point Survey	VP1	3:00 starting at 09:00	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
09/07/2020	Vantage Point Survey	VP1	3:00 starting at 14:50	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 30-50% >500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swan with 2 juveniles in fields/water throughout watch	CMc
28/07/2020	Vantage Point Survey	VP1	3:00 starting at 09:15	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 66-80% >500m; Rain: none; Frost: none; Snow: none	Breeding pair of mute swan with 2 juveniles in fields/water throughout watch	CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
31/08/2020	Vantage Point Survey	VP1	3:00 starting at 14:55	Visibility: moderate; Wind speed and direction: light breeze S; Cloud cover and height: 90-100% >500m; Rain: persistent; Frost: none; Snow: none		CMc
31/08/2020	Vantage Point Survey	VP1	3:00 starting at 18:25	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none	Curlew heard calling from the river at 16:19. Curlew heard calling from the south from 20:00-20:30	CMc
16/09/2020	Vantage Point Survey	VP1	3:00 starting at 06:15	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 80-90% >500m; Rain: none; Frost: none; Snow: none		CMc
16/09/2020	Vantage Point Survey	VP1	3:00 starting at 10:50	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 60-90% >500m; Rain: drizzle; Frost: light; Snow: on ground		CMc
06/10/2020	Vantage Point Survey	VP1	3:00 starting at 13:30	Visibility: good; Wind speed and direction: moderate breeze NW; Cloud cover and height: 50-75% >500m; Rain: heavy showers; Frost: none; Snow: none		CMc
23/10/2020	Vantage Point Survey	VP1	3:00 starting at 16:20	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 50-90% >500m; Rain: none; Frost: none; Snow: none	Curlew and snipe calling after dark	CMc
23/11/2020	Vantage Point Survey	VP1	3:00 starting at 12:15	Visibility: good; Wind speed and direction: moderate breeze SW; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none	unusually quiet, but very windy	CMc
26/11/2020	Vantage Point Survey	VP1	3:00 starting at 07:20	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 75% >500m; Rain: light showers; Frost: none; Snow: none	whooper swan heard calling from roost to the north upon artival. Whooper swan heard calling from the SE at 07:46	CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
17/12/2020	Vantage Point Survey	VP1	3:00 starting at 09:40	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 75-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none	Incidental: local stopped to show surveyor video of a flock of whooper foraging behind trees on Joe Keanes land, only one or two birds could be seen through the trees, but could be heard calling.	CMc
17/12/2020	Vantage Point Survey	VP1	3:00 starting at 14:25	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 75-100% 150-500m; Rain: light showers; Frost: none; Snow: none	Between VP watches, went onsite, met farm worker who said a dead swan had been found a day previous, was not found today while surveyor was having a look around. 3 possible roosts. Curlew heard calling in the dark from behind VP	CMc
27/01/2021	Vantage Point Survey	VP1	3:00 starting at 07:30	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none	in the dark, curlew were heard calling from the N, mallard from the E and snipe wereheard flying around the VP	CMc
27/01/2021	Vantage Point Survey	VP1	3:00 starting at 11:40	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none		CMc
15/02/2021	Vantage Point Survey	VP1	3:00 starting at 12:20	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none		CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
15/02/2021	Vantage Point Survey	VP1	2:00 starting at 16:50	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none	mute swan were still on site after dark	CMc
22/03/2021	Vantage Point Survey	VP1	3:00 starting at 05:40	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Snipe heard drumming in the bog in the dark.	CMc
22/03/2021	Vantage Point Survey	VP1	3:00 starting at 10:30	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CMc

Table 7 - 2 - 2 Winter walkover survey

Date	Survey	Area	Duration (h)	Weather Conditions	Comments	Surveyor
24/10/2019	Winter Walkover Survey	North	3:00 starting at 12:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 50-66% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
25/10/2019	Winter Walkover Survey	South	2:45 starting at 13:00	Visibility: moderate; Wind speed and direction: light air S; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none		CMc
13/12/2019	Winter Walkover Survey	North and South	5:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 80-100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
21/01/2020	Winter Walkover Survey	North and South	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 80-95% >500m; Rain: none; Frost: none; Snow: none		CMc
17/03/2020	Winter Walkover Survey	North and South	5:00 starting at 07:30	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none	Hedges and reeds cut along T7, very little bird activity as a result. Mist in the last two hours	CMc
05/10/2020	Winter Walkover Survey	North and South	5:15 starting at 09:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 95-100% >500m; Rain: none; Frost: none; Snow: none	Curlew feathers found along T1	CMc
06/01/2021	Winter Walkover Survey	North and South	6:00 starting at 09:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 50% >500m; Rain: none; Frost: heavy; Snow: none	minus 4°C at start of survey. Local told surveyor about heron roost in Dysert, surveyor could not locate it	CMc
12/02/2021	Winter Walkover Survey	North and South	6:00 starting at 10:00	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	very quite. Very little passerine activity	CMc
04/03/2021	Winter Walkover Survey	North and South	5:30 starting at 09:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 66-100% 150-500m; Rain: none; Frost: none; Snow: none	T5 and the end of T4 were flooded	CMc

Table 7 - 2 - 3 Breeding walkover survey effort

Date	Survey	Area	Duration (h)	Weather Conditions	Comments	Surveyor
26/04/2019	Breeding Walkover Survey	North and South	3:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 80% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
26/04/2019	Breeding Walkover Survey	North and South	3:00 starting at 12:00	Visibility: good; Wind speed and direction: gentle breeze S; Cloud cover and height: 90% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
27/05/2019	Breeding Walkover Survey	North and South	3:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 80-100% 150-500m; Rain: heavy showers; Frost: none; Snow: none	CBS adapted survey	CMc
27/05/2019	Breeding Walkover Survey	North and South	3:00 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze WNW; Cloud cover and height: 90-100% 150-500m; Rain: none; Frost: none; Snow: none	CBS adapted survey	CMc
27/06/2019	Breeding Walkover Survey	North and South	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 50-100% >500m; Rain: none; Frost: none; Snow: none		CMc
27/06/2019	Breeding Walkover Survey	North and South	3:00 starting at 11:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 30-50% >500m; Rain: none; Frost: none; Snow: none		CMc
26/07/2019	Breeding Walkover Survey	South	3:00 starting at 14:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 50% 150-500m; Rain: none; Frost: none; Snow: none		CMc
27/07/2019	Breeding Walkover Survey	North	3:00 starting at 09:00	Visibility: good; Wind speed and direction: light air NW; Cloud cover and height: 60-95% 150-500m; Rain: none; Frost: none; Snow: none	Light drizzle for the first 20 mins	CMc
24/05/2020	Breeding Walkover Survey	North and South	5:00 starting at 08:30	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 25-50% >500m; Rain: none; Frost: none; Snow: none		CMc
19/06/2020	Breeding Walkover Survey	North and South	5:00 starting at 09:00	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 75-100% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Area	Duration (h)	Weather Conditions	Comments	Surveyor
16/07/2020	Breeding Walkover Survey	North and South	5:00 starting at 12:30	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 30-50% >500m; Rain: none; Frost: none; Snow: none		CMc

Table 7 - 2 - 4 Waterbird distribution survey effort

Date	Survey	Radius	Duration (h)	Weather Conditions	Comments	Surveyor
26/08/2019	Wildfowl Distribution Survey	5km	3:30 starting at 10:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 80-100% 150-500m; Rain: none; Frost: none; Snow: none	Curlew feathers found frequently along river bank	CMc
26/08/2019	Wildfowl Distribution Survey	5km	2:30 starting at 14:30	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
12/09/2019	Wildfowl Distribution Survey	5km	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none	Some light mist in the first hour	CMc
12/09/2019	Wildfowl Distribution Survey	5km	3:00 starting at 14:00	Visibility: good; Wind speed and direction: light breeze NW; Cloud cover and height: 80-100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
30/09/2019	Wildfowl Distribution Survey	5km	3:00 starting at 10:00	Visibility: poor; Wind speed and direction: light breeze E; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none		CMc
30/09/2019	Wildfowl Distribution Survey	5km	3:00 starting at 13:00	Visibility: poor; Wind speed and direction: light breeze E; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none		CMc
11/10/2019	Wildfowl Distribution Survey	5km	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 75-100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
29/10/2019	Wildfowl Distribution Survey	5km	5:20 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze E; Cloud cover and height: 42278% >500m; Rain: none; Frost: none; Snow: none		CMc
07/11/2019	Wildfowl Distribution Survey	5km	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 50-60% 150-500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Radius	Duration (h)	Weather Conditions	Comments	Surveyor
21/11/2019	Wildfowl Distribution Survey	5km	5:30 starting at 09:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none	Showers only in the final hour	CMc
03/12/2019	Wildfowl Distribution Survey	5km	6:00 starting at 09:30	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 10-20% >500m; Rain: none; Frost: light; Snow: none		CMc
17/12/2019	Wildfowl Distribution Survey	5km	5:30 starting at 10:00	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 10-30% >500m; Rain: none; Frost: none; Snow: none		CMc
03/01/2020	Wildfowl Distribution Survey	5km	5:30 starting at 09:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 33% >500m; Rain: none; Frost: none; Snow: none		CMc
27/01/2020	Wildfowl Distribution Survey	5km	5:00 starting at 09:30	Visibility: moderate; Wind speed and direction: light air S; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none		CMc
07/02/2020	Wildfowl Distribution Survey	5km	5:55 starting at 10:35	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 90-100% >500m; Rain: light showers; Frost: none; Snow: none		CMc
18/02/2020	Wildfowl Distribution Survey	5km	5:15 starting at 11:00	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 50-90% >500m; Rain: light showers; Frost: none; Snow: none		CMc
02/03/2020	Wildfowl Distribution Survey	5km	5:00 starting at 08:00	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 75-95% >500m; Rain: none; Frost: none; Snow: none		CMc
23/03/2020	Wildfowl Distribution Survey	5km	6:00 starting at 09:00	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 90-95% >500m; Rain: none; Frost: none; Snow: none		CMc
02/05/2020	Wildfowl Distribution Survey	5km	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 40-60% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Radius	Duration (h)	Weather Conditions	Comments	Surveyor
28/05/2020	Wildfowl Distribution Survey	5km	5:00 starting at 14:00	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 40-50% >500m; Rain: none; Frost: none; Snow: none		CMc
07/08/2020	Wildfowl Distribution Survey	5km	5:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 50-80% >500m; Rain: none; Frost: none; Snow: none		CMc
19/08/2020	Wildfowl Distribution Survey	5km	6:00 starting at 09:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
03/09/2020	Wildfowl Distribution Survey	5km	5:00 starting at 09:30	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 80-90% >500m; Rain: none; Frost: none; Snow: none	No whooper swan found	CMc
22/09/2020	Wildfowl Distribution Survey	5km	5:00 starting at 10:00	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 90-100% >500m; Rain: none; Frost: none; Snow: none	No whooper swan found	CMc
02/10/2020	Wildfowl Distribution Survey	5km	5:30 starting at 09:30	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 50-75% >500m; Rain: none; Frost: none; Snow: none	No whooper swan observed	CMc
23/10/2020	Wildfowl Distribution Survey	5km	6:00 starting at 09:00	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 40-80% >500m; Rain: none; Frost: none; Snow: none		CMc
04/11/2020	Wildfowl Distribution Survey	5km	3:00 starting at 09:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 20-50% >500m; Rain: none; Frost: none; Snow: none		CMc
04/11/2020	Wildfowl Distribution Survey	5km	3:00 starting at 12:00	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 50-100% >500m; Rain: none; Frost: none; Snow: none		CMc
17/11/2020	Wildfowl Distribution Survey	5km	6:00 starting at 09:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 90-100% >500m; Rain: light showers; Frost: none; Snow: none		CMc

Date	Survey	Radius	Duration (h)	Weather Conditions	Comments	Surveyor
04/12/2020	Wildfowl Distribution Survey	5km	3:00 starting at 09:30	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 50-100% >500m; Rain: none; Frost: none; Snow: none		CMc
04/12/2020	Wildfowl Distribution Survey	5km	2:30 starting at 12:30	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 50-101% >500m; Rain: none; Frost: none; Snow: none		CMc
18/12/2020	Wildfowl Distribution Survey	5km	6:00 starting at 09:40	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 90% >500m; Rain: none; Frost: none; Snow: none	Deceased whooper swan found onsite, was not present previous day, very fresh, being scavanged by hooded crow	CMc
08/01/2021	Wildfowl Distribution Survey	5km	6:00 starting at 10:00	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 75% >500m; Rain: none; Frost: heavy; Snow: none		CMc
26/01/2021	Wildfowl Distribution Survey	5km	6:15 starting at 09:45	Visibility: good; Wind speed and direction: gentle breeze W; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
04/02/2021	Wildfowl Distribution Survey	5km	6:00 starting at 09:30	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 33-66% >500m; Rain: light showers; Frost: none; Snow: none		CMc
19/02/2021	Wildfowl Distribution Survey	5km	6:00 starting at 10:00	Visibility: good; Wind speed and direction: light breeze S; Cloud cover and height: 66-100% >500m; Rain: light showers; Frost: none; Snow: none	there were more swans in ballyouneen that could not be counted due to access issues/visibilty from the public roads	CMc
02/03/2021	Wildfowl Distribution Survey	5km	5:30 starting at 09:30	Visibility: good; Wind speed and direction: light breeze E; Cloud cover and height: 0-33% >500m; Rain: none; Frost: none; Snow: none		CMc

Date	Survey	Radius	Duration (h)	Weather Conditions	Comments	Surveyor
26/03/2021	Wildfowl Distribution Survey	5km	6:00 starting at 09:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-100% >500m; Rain: heavy showers; Frost: none; Snow: none	heavy hail/sleet showers	CMc

Table 7 - 2 - 5 Hen harrier roost survey effort

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
30/10/2019	Hen Harrier Roost Survey	HHVP1	2:30 starting at 15:10	Visibility: moderate; Wind speed and direction: gentle breeze E; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
31/10/2019	Hen Harrier Roost Survey	HHVP2	2:30 starting at 15:10	Visibility: moderate; Wind speed and direction: light air SE; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none	No hen harrier observations	CMc
15/11/2019	Hen Harrier Roost Survey	HHVP2	2:40 starting at 14:50	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 25-50% >500m; Rain: none; Frost: none; Snow: none	No hen harrier observations	CMc
18/11/2019	Hen Harrier Roost Survey	HHVP1	2:10 starting at 15:15	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 95-100% >500m; Rain: none; Frost: none; Snow: none		CMc
20/12/2019	Hen Harrier Roost Survey	HHVP1	2:56 starting at 14:25	Visibility: good; Wind speed and direction: light air SE; Cloud cover and height: 1% >500m; Rain: none; Frost: none; Snow: none	Juvenile hen harrier observed on two occasions	GM
22/12/2019	Hen Harrier Roost Survey	HHVP2	2:58 starting at 14:04	Visibility: good; Wind speed and direction: fresh breeze SW; Cloud cover and height: 3% 150-500m; Rain: light showers; Frost: none; Snow: none	Male kestrel observed	GM
22/01/2020	Hen Harrier Roost Survey	HHVP2	2:40 starting at 15:00	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
29/01/2020	Hen Harrier Roost Survey	HHVP1	2:30 starting at 15:30	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none	No hen harrier observations.	CMc

Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
04/02/2020	Hen Harrier Roost Survey	HHVP2	2:40 starting at 15:50	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 60-90% >500m; Rain: light showers; Frost: none; Snow: none	No hen harrier observations.	CMc
20/02/2020	Hen Harrier Roost Survey	HHVP1	2:40 starting at 16:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 50-70% 150-500m; Rain: none; Frost: none; Snow: none		CMc
17/03/2020	Hen Harrier Roost Survey	HHVP2	2:40 starting at 16:40	Visibility: moderate; Wind speed and direction: light breeze N; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none	No hen harrier observations	CMc
18/03/2020	Hen Harrier Roost Survey	HHVP1	2:30 starting at 16:50	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 95-100% 150-500m; Rain: none; Frost: none; Snow: none	No hen harrier observations	CMc
01/10/2020	Hen Harrier Roost Survey	HHVP2	2:30 starting at 17:15	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 90-100% >500m; Rain: light showers; Frost: none; Snow: none		CMc
06/10/2020	Hen Harrier Roost Survey	HHVP1	2:10 starting at 17:20	Visibility: good; Wind speed and direction: gentle breeze NW; Cloud cover and height: 60% >500m; Rain: none; Frost: none; Snow: none		CMc
11/11/2020	Hen Harrier Roost Survey	HHVP2	2:30 starting at 15:00	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 100% 150-500m; Rain: drizzle; Frost: none; Snow: none		CMc
26/11/2020	Hen Harrier Roost Survey	HHVP1	2:40 starting at 14:30	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 66% >500m; Rain: none; Frost: none; Snow: none		CMc
08/12/2020	Hen Harrier Roost Survey	HHVP2	2:30 starting at 14:30	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 25-100% >500m; Rain: none; Frost: none; Snow: none	Incidental hen harrier male	CMc

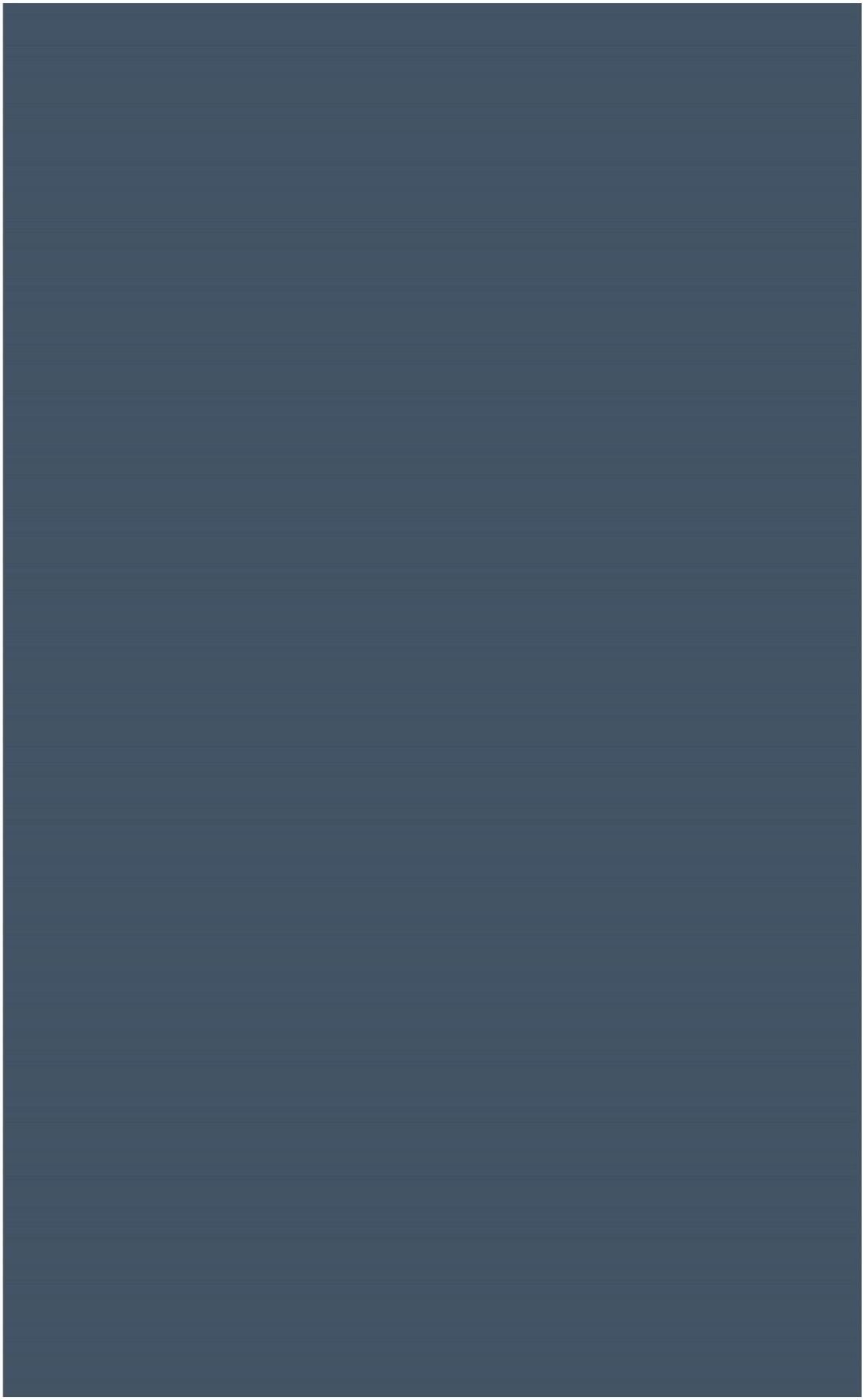
Date	Survey	Vantage Point	Duration (h)	Weather Conditions	Comments	Surveyor
23/12/2020	Hen Harrier Roost Survey	HHVP1	2:20 starting at 14:40	Visibility: good; Wind speed and direction: gentle breeze N; Cloud cover and height: 75-95% >500m; Rain: none; Frost: none; Snow: none	86 whooper swan in Ballyouneen	CMc
07/01/2021	Hen Harrier Roost Survey	HHVP2	2:40 starting at 14:30	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 10% >500m; Rain: none; Frost: light; Snow: none		CMc
28/01/2021	Hen Harrier Roost Survey	HHVP1	2:40 starting at 15:20	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 95% >500m; Rain: light showers; Frost: none; Snow: none	129 whooper swan in ballyouneen	CMc
11/02/2021	Hen Harrier Roost Survey	HHVP2	2:30 starting at 15:45	Visibility: good; Wind speed and direction: gentle breeze SE; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CMc
22/02/2021	Hen Harrier Roost Survey	HHVP1	2:30 starting at 16:00	Visibility: good; Wind speed and direction: moderate breeze S; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CMc
15/03/2021	Hen Harrier Roost Survey	HHVP2	2:30 starting at 16:45	Visibility: good; Wind speed and direction: light air W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none		CMc
30/03/2021	Hen Harrier Roost Survey	HHVP1	2:30 starting at 18:10	Visibility: moderate; Wind speed and direction: light breeze W; Cloud cover and height: 66-100% >500m; Rain: none; Frost: none; Snow: none	Fog rolled in after first hour, roost was still visible	CMc

Table 7 - 2 - 6 Breeding raptor survey effort

Date	Survey	Raptor Survey	Duration (h)	Weather Conditions	Comments	Surveyor
16/04/2019	Breeding Raptor Survey	BRVP1	3:00 starting at 13:30	Visibility: good; Wind speed and direction: light air S; Cloud cover and height: 50% >500m; Rain: none; Frost: none; Snow: none	Disturbance; turf cutting	CMc
23/04/2019	Breeding Raptor Survey	BRVP2	3:00 starting at 11:20	Visibility: good; Wind speed and direction: light breeze ESE; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none		CMc
23/04/2019	Breeding Raptor Survey	BRVP3	3:00 starting at 14:50	Visibility: good; Wind speed and direction: gentle breeze SSE; Cloud cover and height: 60% >500m; Rain: none; Frost: none; Snow: none		CMc
30/04/2019	Breeding Raptor Survey	BRVP4	3:00 starting at 15:00	Visibility: good; Wind speed and direction: light breeze W; Cloud cover and height: 50% >500m; Rain: none; Frost: none; Snow: none		CMc
10/05/2019	Breeding Raptor Survey	BRVP2	3:00 starting at 10:00	Visibility: good; Wind speed and direction: light air SW; Cloud cover and height: 50-80% >500m; Rain: none; Frost: none; Snow: none		CMc
13/05/2019	Breeding Raptor Survey	BRVP1	3:00 starting at 09:00	Visibility: good; Wind speed and direction: light breeze SSE; Cloud cover and height: 0-5% >500m; Rain: none; Frost: none; Snow: none		CMc
15/05/2019	Breeding Raptor Survey	BRVP4	3:00 starting at 12:00	Visibility: good; Wind speed and direction: light air SSE; Cloud cover and height: 80% >500m; Rain: none; Frost: none; Snow: none		CMc
20/05/2019	Breeding Raptor Survey	BRVP3	3:00 starting at 14:00	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 50-80% >500m; Rain: none; Frost: none; Snow: none		CMc
04/06/2019	Breeding Raptor Survey	BRVP2	3:00 starting at 08:20	Visibility: moderate; Wind speed and direction: light air NE; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none	Persistant rain throughout but not obscuring visibility	CMc
04/06/2019	Breeding Raptor Survey	BRVP1	3:00 starting at 11:30	Visibility: moderate; Wind speed and direction: light breeze N; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none	Light persistant rain at the start, cleared to showers, dry in the final hour	CMc

Date	Survey	Raptor Survey	Duration (h)	Weather Conditions	Comments	Surveyor
12/06/2019	Breeding Raptor Survey	BRVP3	3:00 starting at 08:30	Visibility: good; Wind speed and direction: light breeze NNE; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
17/06/2019	Breeding Raptor Survey	BRVP4	3:00 starting at 13:30	Visibility: good; Wind speed and direction: light air WSW; Cloud cover and height: 60% 150-500m; Rain: none; Frost: none; Snow: none		CMc
02/07/2019	Breeding Raptor Survey	BRVP1	3:00 starting at 10:15	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none	People drawing turf for first hour	CMc
02/07/2019	Breeding Raptor Survey	BRVP2	3:00 starting at 07:00	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none		CMc
10/07/2019	Breeding Raptor Survey	BRVP3	3:00 starting at 09:40	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 100% 150-500m; Rain: persistent; Frost: none; Snow: none	Heavy rain in the final hour, otherwise dry for the watch	CMc
17/07/2019	Breeding Raptor Survey	BRVP4	3:00 starting at 13:50	Visibility: moderate; Wind speed and direction: gentle breeze SW; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none		CMc
03/05/2020	Breeding Raptor Survey	BRVP1	3:00 starting at 13:30	Visibility: good; Wind speed and direction: light air E; Cloud cover and height: 90-95% >500m; Rain: none; Frost: none; Snow: none	No raptor observations	CMc
13/05/2020	Breeding Raptor Survey	BRVP2	3:00 starting at 16:00	Visibility: good; Wind speed and direction: gentle breeze NE; Cloud cover and height: 50% >500m; Rain: none; Frost: none; Snow: none	No raptor observations	CMc
23/05/2020	Breeding Raptor Survey	BRVP3	3:00 starting at 07:00	Visibility: good; Wind speed and direction: moderate breeze W; Cloud cover and height: 66-90% 150-500m; Rain: light showers; Frost: none; Snow: none	No raptor observations	CMc
24/05/2020	Breeding Raptor Survey	BRVP4	3:00 starting at 14:00	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 50% >500m; Rain: none; Frost: none; Snow: none	No raptor observations	CMc

Date	Survey	Raptor Survey	Duration (h)	Weather Conditions	Comments	Surveyor
09/06/2020	Breeding Raptor Survey	BRVP1	3:00 starting at 16:40	Visibility: good; Wind speed and direction: light breeze SW; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none	No raptor observations	CMc
10/06/2020	Breeding Raptor Survey	BRVP2	3:00 starting at 10:40	Visibility: good; Wind speed and direction: light air N; Cloud cover and height: 100% 150-500m; Rain: drizzle; Frost: none; Snow: none	No raptor observations	CMc
10/06/2020	Breeding Raptor Survey	BRVP3	3:00 starting at 14:25	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 80-100% 150-500m; Rain: drizzle; Frost: none; Snow: none		CMc
12/06/2020	Breeding Raptor Survey	BRVP4	3:00 starting at 16:00	Visibility: good; Wind speed and direction: light breeze NE; Cloud cover and height: 100% >500m; Rain: none; Frost: none; Snow: none	No raptor observations	CMc
07/07/2020	Breeding Raptor Survey	BRVP1	3:00 starting at 08:00	Visibility: good; Wind speed and direction: gentle breeze SW; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none	Heavy rain in the last hour	CMc
08/07/2020	Breeding Raptor Survey	BRVP2	3:00 starting at 13:00	Visibility: moderate; Wind speed and direction: light breeze E; Cloud cover and height: 100% 150-500m; Rain: light showers; Frost: none; Snow: none	Heavy rain in hour 2	CMc
09/07/2020	Breeding Raptor Survey	BRVP3	3:00 starting at 11:00	Visibility: good; Wind speed and direction: light breeze N; Cloud cover and height: 50-80% >500m; Rain: none; Frost: none; Snow: none		CMc
16/07/2020	Breeding Raptor Survey	BRVP4	3:00 starting at 09:00	Visibility: moderate; Wind speed and direction: light breeze W; Cloud cover and height: 100% 150-500m; Rain: none; Frost: none; Snow: none	Fog at start, burnt off within the first hour	CMc



APPENDIX 7.3

SUMMARY TABLES

Planning and Environmental Consultants

Appendix 7-3 Summary Tables

Ballynagare Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Appendix 7-3 Summary Tables**
Document File Name:	**Appendix 7-3 F 2021/07/29 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	29/07/2021	SD	PC

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Table 7 - 3 - 1 Non-target species observed during Vantage Point and Walkover Surveys

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Barn Swallow	2019				✓	✓	✓	✓	✓	✓			
	2020					✓	✓	✓	✓				
	2021												
Blackbird	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	2021	✓	✓	✓									
Blue Tit	2019				✓								
	2020			✓									
	2021												
Chaffinch	2019				✓	✓	✓						
	2020	✓		✓		✓	✓	✓					
	2021		✓	✓									
Coal Tit	2019												
	2020					✓							
	2021												
Cuckoo	2019				✓	✓	✓						
	2020					✓	✓						
	2021												
Dunnock	2019					✓							
	2020												
	2021	✓											
Fieldfare	2019												✓
	2020	✓											
	2021												
Goldfinch	2019					✓	✓	✓	✓		✓	✓	

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2020			✓		✓	✓	✓		✓	✓		
	2021												
Great Tit	2019												
	2020												
	2021			✓									
Hooded Crow	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2021	✓	✓	✓									
House Martin	2019				✓		✓						
	2020												
	2021												
House Sparrow	2019							✓					
	2020												
	2021												
Jackdaw	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020	✓	✓	✓	✓		✓	✓			✓	✓	
	2021	✓	✓										
Linnet	2019				✓								
	2020												
	2021												
Magpie	2019				✓	✓	✓	✓		✓	✓	✓	✓
	2020			✓			✓		✓		✓		
	2021	✓		✓									
Mistle Thrush	2019				✓								
	2020											✓	✓
	2021	✓											

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pheasant	2019					✓	✓	✓			✓	✓	
	2020			✓	✓	✓	✓			✓			
	2021			✓									
Pied Wagtail	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
	2021	✓	✓	✓									
Raven	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020	✓		✓		✓	✓	✓		✓		✓	✓
	2021	✓	✓	✓									
Reed Bunting	2019				✓	✓	✓	✓			✓		
	2020	✓					✓	✓			✓		
	2021			✓									
Reed Warbler	2019												
	2020						✓						
	2021		✓										
Robin	2019				✓	✓					✓	✓	
	2020	✓				✓	✓			✓	✓		
	2021	✓	✓	✓									
Rook	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2021	✓	✓	✓									
Sedge Warbler	2019					✓	✓	✓	✓	✓			
	2020					✓	✓						
	2021												
Skylark	2019				✓	✓	✓						
	2020						✓						

Species	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	2021												
Starling	2019				✓	✓	✓	✓	✓	✓	✓	✓	✓
	2020		✓				✓						✓
	2021												
Stonechat	2019				✓	✓	✓	✓		✓	✓	✓	✓
	2020	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
	2021		✓	✓									
Willow Warbler	2019												
	2020						✓						
	2021												
Woodpigeon	2019				✓	✓	✓	✓	✓	✓			✓
	2020	✓				✓	✓	✓				✓	✓
	2021												
Wren	2019				✓	✓	✓	✓	✓	✓	✓	✓	
	2020	✓		✓		✓	✓	✓		✓	✓	✓	
	2021	✓	✓	✓									

Table 7 - 3 - 2 Distribution of activity for target species recorded during Vantage Point Surveys. Bird seconds at Potential Collision Height (PCH) represents all flights of all birds which occurred between 10-200m, as a worst case scenario for swept height of the turbine blades.

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Bar-tailed Godwit	2019	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2020	number of observations									1	1			**2**

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Black-headed Gull	2019	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2020	number of observations		1									3	1	**5**
		duration of flights (seconds)											72	10	**82**
		bird seconds at PCH											1620	2400	**4020**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Buzzard	2019	number of observations						1			1				**2**
		duration of flights (seconds)						180			60				**240**
		bird seconds at PCH						360			60				**420**
	2020	number of observations									1				**1**
		duration of flights (seconds)									240				**240**
		bird seconds at PCH									80				**80**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Common Gull	2019	number of observations										1			**1**
		duration of flights (seconds)										20			**20**
		bird seconds at PCH										260			**260**

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	2020	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Cormorant	2019	number of observations					1								**1**
		duration of flights (seconds)					30								**30**
		bird seconds at PCH					30								**30**
	2020	number of observations	2	1	1		1		1		1		2		**9**
		duration of flights (seconds)	30	7	23		42		10		12		27		**151**
		bird seconds at PCH	25	0	23		42		10		10		22		**132**
	2021	number of observations		2	3										**5**
		duration of flights (seconds)		32	60										**92**
		bird seconds at PCH		35	60										**95**
Curlew	2019	number of observations							3	3	6	1		1	**14**
		duration of flights (seconds)							24	33	32	10		7	**106**
		bird seconds at PCH							34	40	40	0		147	**261**
	2020	number of observations		1	1		1	1	7	5	7	7	2	1	**33**
		duration of flights (seconds)		0	40		3	25	79	93	194	133	15	20	**602**
		bird seconds at PCH		0	40		0	225	1034	426	497	213	5	595	**3035**
	2021	number of observations	4	1	2										**7**
		duration of flights (seconds)	92	0	14										**106**
		bird seconds at PCH	330	0	0										**330**
Hen Harrier	2019	number of observations													**0**
		duration of flights (seconds)													**0**

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		bird seconds at PCH													**0**
	2020	number of observations				2									**2**
		duration of flights (seconds)				140									**140**
		bird seconds at PCH				30									**30**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Kestrel	2019	number of observations					1			2					**3**
		duration of flights (seconds)					60			25					**85**
		bird seconds at PCH					60			25					**85**
	2020	number of observations		2						3		5	1		**11**
		duration of flights (seconds)		12						43		157	35		**247**
		bird seconds at PCH		12						41		143	35		**231**
	2021	number of observations		2	1										**3**
		duration of flights (seconds)		35	240										**275**
		bird seconds at PCH		35	240										**275**
Lapwing	2019	number of observations									1				**1**
		duration of flights (seconds)									67				**67**
		bird seconds at PCH									3510				**3510**
	2020	number of observations								1		1	1	3	**6**
		duration of flights (seconds)								10		50	25	33	**118**
		bird seconds at PCH								190		400	500	5650	**6740**
	2021	number of observations		2											**2**
		duration of flights (seconds)		20											**20**
		bird seconds at PCH		900											**900**
Little Egret	2019	number of observations					2	1			1	1		1	**6**

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		duration of flights (seconds)					120	10			40	12		3	**185**
		bird seconds at PCH					120	10			240	12		0	**382**
	2020	number of observations	1		2			3	1	1	2	1	5	1	**17**
		duration of flights (seconds)	44		16			19	23	12	23	12	72	7	**228**
		bird seconds at PCH	79		34			14	23	0	6	4	28	0	**188**
	2021	number of observations	1	2	2										**5**
		duration of flights (seconds)	7	30	55										**92**
		bird seconds at PCH	0	30	60										**90**
Mallard	2019	number of observations					1				4				**5**
		duration of flights (seconds)					60				82				**142**
		bird seconds at PCH					200				610				**810**
	2020	number of observations	1		3	1	1				1		2		**9**
		duration of flights (seconds)	1		25	44	15				8		80		**173**
		bird seconds at PCH	0		100	252	15				8		1470		**1845**
	2021	number of observations		1	3										**4**
		duration of flights (seconds)		12	45										**57**
		bird seconds at PCH		30	200										**230**
Redshank	2019	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2020	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2021	number of observations			1										**1**
		duration of flights (seconds)			2										**2**
		bird seconds at PCH			0										**0**

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Snipe	2019	number of observations								1		2			**3**
		duration of flights (seconds)								0		13			**13**
		bird seconds at PCH								0		47			**47**
	2020	number of observations										1			**1**
		duration of flights (seconds)										25			**25**
		bird seconds at PCH										45			**45**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Sparrowhawk	2019	number of observations						1							**1**
		duration of flights (seconds)						198							**198**
		bird seconds at PCH						193							**193**
	2020	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
Teal	2019	number of observations													**0**
		duration of flights (seconds)													**0**
		bird seconds at PCH													**0**
	2020	number of observations		1											**1**
		duration of flights (seconds)		0											**0**
		bird seconds at PCH		0											**0**
	2021	number of observations													**0**
		duration of flights (seconds)													**0**

Species	Year	Observations and Flights	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
		bird seconds at PCH													**0**
Whooper Swan	2019	number of observations									1		3	8	**12**
		duration of flights (seconds)									30		138	165	**333**
		bird seconds at PCH									30		1422	375	**1827**
	2020	number of observations	5	2								4	3	21	**35**
		duration of flights (seconds)	98	32								229	143	427	**929**
		bird seconds at PCH	308	68								1420	209	1416	**3421**
	2021	number of observations	3												**3**
		duration of flights (seconds)	45												**45**
		bird seconds at PCH	75												**75**

Table 7 - 3 - 3 Target species observed during breeding walkover surveys. Shaded cells represent months in which no walkover surveys were undertaken

.Species	Year	Abundance	Apr	May	Jun	Jul	Aug	Sep	Total
Cormorant	2019	number of observations							**0**
		number of individuals							**0**
	2020	number of observations		1					**1**
		number of individuals		1					**1**
Curlew	2019	number of observations			1	2			**3**
		number of individuals			2	17			**19**
	2020	number of observations							**0**
		number of individuals							**0**
Great Black-backed Gull	2019	number of observations				1			**1**
		number of individuals				1			**1**
	2020	number of observations							**0**
		number of individuals							**0**

Grey Heron	2019	number of observations	1	1					**2**
		number of individuals	1	1					**2**
	2020	number of observations		1					**1**
		number of individuals		1					**1**
Herring Gull	2019	number of observations				1			**1**
		number of individuals				1			**1**
	2020	number of observations							**0**
		number of individuals							**0**
Kestrel	2019	number of observations	1						**1**
		number of individuals	1						**1**
	2020	number of observations			1				**1**
		number of individuals			1				**1**
Lesser Black-backed Gull	2019	number of observations			2	1			**3**
		number of individuals			3	1			**4**
	2020	number of observations							**0**
		number of individuals							**0**
Little Egret	2019	number of observations	2	1		1			**4**
		number of individuals	2	1		1			**4**
	2020	number of observations			1				**1**
		number of individuals			1				**1**
Mallard	2019	number of observations			1				**1**
		number of individuals			1				**1**
	2020	number of observations							**0**
		number of individuals							**0**
Meadow Pipit	2019	number of observations	5	6	4	7			**22**
		number of individuals	11	6	4	8			**29**
	2020	number of observations							**0**
		number of individuals							**0**

Mute Swan	2019	number of observations							0
		number of individuals							0
	2020	number of observations							0
		number of individuals							0
Snipe	2019	number of observations							0
		number of individuals							0
	2020	number of observations							0
		number of individuals							0
Sparrowhawk	2019	number of observations							0
		number of individuals							0
	2020	number of observations							0
		number of individuals							0

Table 7 - 3 - 4 Target species observed during winter walkover surveys. Shaded cells represent months in which no walkover surveys were undertaken.

Species	Year	Abundance	Oct	Nov	Dec	Jan	Feb	Mar	Total
Common Gull	2019	number of observations	1						1
		number of individuals	6						6
	2020	number of observations							0
		number of individuals							0
	2021	number of observations							0
		number of individuals							0
Cormorant	2019	number of observations							0
		number of individuals							0
	2020	number of observations							0
		number of individuals							0
	2021	number of observations				1			1
		number of individuals				1			1

Species	Year	Abundance	Oct	Nov	Dec	Jan	Feb	Mar	Total
Curlew	2019	number of observations	2						**2**
		number of individuals	17						**17**
	2020	number of observations				1			**1**
		number of individuals				79			**79**
	2021	number of observations				2	2	2	**6**
		number of individuals				27	2	25	**54**
Great Black-backed Gull	2019	number of observations	1						**1**
		number of individuals	2						**2**
	2020	number of observations							**0**
		number of individuals							**0**
	2021	number of observations							**0**
		number of individuals							**0**
Grey Heron	2019	number of observations	1						**1**
		number of individuals	2						**2**
	2020	number of observations	1			1		1	**3**
		number of individuals	1			1		1	**3**
	2021	number of observations					1		**1**
		number of individuals					2		**2**
Hen Harrier	2019	number of observations	1						**1**
		number of individuals	1						**1**
	2020	number of observations							**0**
		number of individuals							**0**
	2021	number of observations							**0**
		number of individuals							**0**
Kestrel	2019	number of observations			1				**1**
		number of individuals			1				**1**

Species	Year	Abundance	Oct	Nov	Dec	Jan	Feb	Mar	Total
	2020	number of observations							0
		number of individuals							0
	2021	number of observations				1			1
		number of individuals				1			1
Lapwing	2019	number of observations	1						1
		number of individuals	110						110
	2020	number of observations				1			1
		number of individuals				9			9
	2021	number of observations							0
		number of individuals							0
Lesser Black-backed Gull	2019	number of observations	1						1
		number of individuals	27						27
	2020	number of observations							0
		number of individuals							0
	2021	number of observations							0
		number of individuals							0
Little Egret	2019	number of observations	2						2
		number of individuals	2						2
	2020	number of observations				1		1	2
		number of individuals				1		1	2
	2021	number of observations						2	2
		number of individuals						2	2
Mallard	2019	number of observations	2						2
		number of individuals	6						6
	2020	number of observations	4					1	5
		number of individuals	19					2	21

Species	Year	Abundance	Oct	Nov	Dec	Jan	Feb	Mar	Total
	2021	number of observations				2		3	**5**
		number of individuals				40		5	**45**
Meadow Pipit	2019	number of observations							**0**
		number of individuals							**0**
	2020	number of observations							**0**
		number of individuals							**0**
	2021	number of observations						5	**5**
		number of individuals						6	**6**
Moorhen	2019	number of observations							**0**
		number of individuals							**0**
	2020	number of observations							**0**
		number of individuals							**0**
	2021	number of observations						1	**1**
		number of individuals						1	**1**
Mute Swan	2019	number of observations	3		2				**5**
		number of individuals	34		17				**51**
	2020	number of observations				1		1	**2**
		number of individuals				1		7	**8**
	2021	number of observations				1	3	3	**7**
		number of individuals				7	17	13	**37**
Redshank	2019	number of observations							**0**
		number of individuals							**0**
	2020	number of observations				1			**1**
		number of individuals				5			**5**
	2021	number of observations							**0**
		number of individuals							**0**

Species	Year	Abundance	Oct	Nov	Dec	Jan	Feb	Mar	Total
Snipe	2019	number of observations							**0**
		number of individuals							**0**
	2020	number of observations	1			1			**2**
		number of individuals	2			1			**3**
	2021	number of observations							**0**
		number of individuals							**0**
Whooper Swan	2019	number of observations	5		2				**7**
		number of individuals	157		44				**201**
	2020	number of observations							**0**
		number of individuals							**0**
	2021	number of observations				3	3	1	**7**
		number of individuals				34	73	37	**144**

Table 7 - 3 - 5 Target species observed during waterbird distribution surveys.

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
Bar-tailed Godwit	2019	number of observations						2	1				**3**
		number of individuals						2	3				**5**
	2020	number of observations		1									**1**
		number of individuals		70									**70**
	2021	number of observations		1									**1**
		number of individuals		12									**12**
Black-headed Gull	2019	number of observations										1	**1**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
		number of individuals										15	**15**
	2020	number of observations		2							5	3	**10**
		number of individuals		128							372	117	**617**
	2021	number of observations	2										**2**
		number of individuals	297										**297**
Brent Goose	2019	number of observations								1	1	1	**3**
		number of individuals								5	5	5	**15**
	2020	number of observations	1		1		1						**3**
		number of individuals	5		2		2						**9**
	2021	number of observations	1	1	1								**3**
		number of individuals	5	5	5								**15**
Common Gull	2019	number of observations						1	4	1		1	**7**
		number of individuals						3	8	86		2	**99**
	2020	number of observations											**0**
		number of individuals											**0**
	2021	number of observations	1										**1**
		number of individuals	50										**50**
Cormorant	2019	number of observations				3			3	2			**8**
		number of individuals				9			5	4			**18**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
	2020	number of observations											**0**
		number of individuals											**0**
	2021	number of observations											**0**
		number of individuals											**0**
Curlew	2019	number of observations						18	10	4	1	4	**37**
		number of individuals						120	31	89	32	443	**715**
	2020	number of observations	1					3	1	2	7	3	**17**
		number of individuals	28					31	4	50	674	124	**911**
	2021	number of observations	1	3	2								**6**
		number of individuals	6	559	9								**574**
Dunlin	2019	number of observations										1	**1**
		number of individuals										59	**59**
	2020	number of observations											**0**
		number of individuals											**0**
	2021	number of observations											**0**
		number of individuals											**0**
Golden Plover	2019	number of observations										3	**3**
		number of individuals										680	**680**
	2020	number of observations									1		**1**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
		number of individuals									400		**400**
	2021	number of observations											**0**
		number of individuals											**0**
Great Black-backed Gull	2019	number of observations						2	3	1		1	**7**
		number of individuals						5	275	3		5	**288**
	2020	number of observations								1			**1**
		number of individuals								2			**2**
	2021	number of observations											**0**
		number of individuals											**0**
Grey Heron	2019	number of observations						3	1	1			**5**
		number of individuals						3	1	1			**5**
	2020	number of observations					1	2			1	1	**5**
		number of individuals					1	2			1	1	**5**
	2021	number of observations		1	1								**2**
		number of individuals		1	1								**2**
Grey Plover	2019	number of observations								1		1	**2**
		number of individuals								656		141	**797**
	2020	number of observations											**0**
		number of individuals											**0**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
	2021	number of observations											**0**
		number of individuals											**0**
Herring Gull	2019	number of observations							1	1			**2**
		number of individuals							1	3			**4**
	2020	number of observations								1			**1**
		number of individuals								2			**2**
	2021	number of observations											**0**
		number of individuals											**0**
Kingfisher	2019	number of observations						1					**1**
		number of individuals						1					**1**
	2020	number of observations											**0**
		number of individuals											**0**
	2021	number of observations											**0**
		number of individuals											**0**
Lapwing	2019	number of observations							1	3	2	5	**11**
		number of individuals							9	210	75	353	**647**
	2020	number of observations	1	2							3	3	**9**
		number of individuals	8	424							308	481	**1221**
	2021	number of observations		1									**1**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
		number of individuals		37									**37**
Lesser Black-backed Gull	2019	number of observations						1	4	1			**6**
		number of individuals						6	517	27			**550**
	2020	number of observations					1			2			**3**
		number of individuals					1			16			**17**
	2021	number of observations											**0**
		number of individuals											**0**
Little Egret	2019	number of observations						5	4	3	1	2	**15**
		number of individuals						7	14	4	1	2	**28**
	2020	number of observations	1	1	1			1	1	1	2		**8**
		number of individuals	1	1	1			1	1	6	2		**13**
	2021	number of observations		3									**3**
		number of individuals		3									**3**
Mallard	2019	number of observations						2	3	2	2	1	**10**
		number of individuals						5	6	8	14	4	**37**
	2020	number of observations	1	1	1			1		1	3	1	**9**
		number of individuals	8	1	2			34		4	60	31	**140**
	2021	number of observations		5	1								**6**
		number of individuals		100	3								**103**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
Moorhen	2019	number of observations						1					**1**
		number of individuals						1					**1**
	2020	number of observations						1					**1**
		number of individuals						1					**1**
	2021	number of observations											**0**
		number of individuals											**0**
Mute Swan	2019	number of observations						1		1	2	2	**6**
		number of individuals						7		5	90	49	**151**
	2020	number of observations	3	6	8		2	1		5	14	7	**46**
		number of individuals	58	57	30		4	4		31	46	68	**298**
	2021	number of observations	1	10	9								**20**
		number of individuals	42	62	58								**162**
Oystercatcher	2019	number of observations						4	5	2			**11**
		number of individuals						16	14	4			**34**
	2020	number of observations									1		**1**
		number of individuals									5		**5**
	2021	number of observations											**0**
		number of individuals											**0**
Redshank	2019	number of observations						3		2		1	**6**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
		number of individuals						34		16		6	**56**
	2020	number of observations											**0**
		number of individuals											**0**
	2021	number of observations											**0**
		number of individuals											**0**
Shoveler	2019	number of observations											**0**
		number of individuals											**0**
	2020	number of observations			1								**1**
		number of individuals			1								**1**
	2021	number of observations											**0**
		number of individuals											**0**
Snipe	2019	number of observations							2			1	**3**
		number of individuals							3			2	**5**
	2020	number of observations									1	1	**2**
		number of individuals									6	1	**7**
	2021	number of observations	1										**1**
		number of individuals	6										**6**
Teal	2019	number of observations									1		**1**
		number of individuals									2		**2**

Species	Year	Abundance	Jan	Feb	Mar	Apr	May	Aug	Sep	Oct	Nov	Dec	Total
	2020	number of observations			1								**1**
		number of individuals			3								**3**
	2021	number of observations											**0**
		number of individuals											**0**
Whooper Swan	2019	number of observations								7	19	21	**47**
		number of individuals								465	843	997	**2305**
	2020	number of observations	15	17	11		1			6	27	29	**106**
		number of individuals	639	661	551		3			167	583	703	**3307**
	2021	number of observations	17	20	9								**46**
		number of individuals	987	591	496								**2074**
Wigeon	2019	number of observations									1	1	**2**
		number of individuals									200	269	**469**
	2020	number of observations											**0**
		number of individuals											**0**
	2021	number of observations											**0**
		number of individuals											**0**

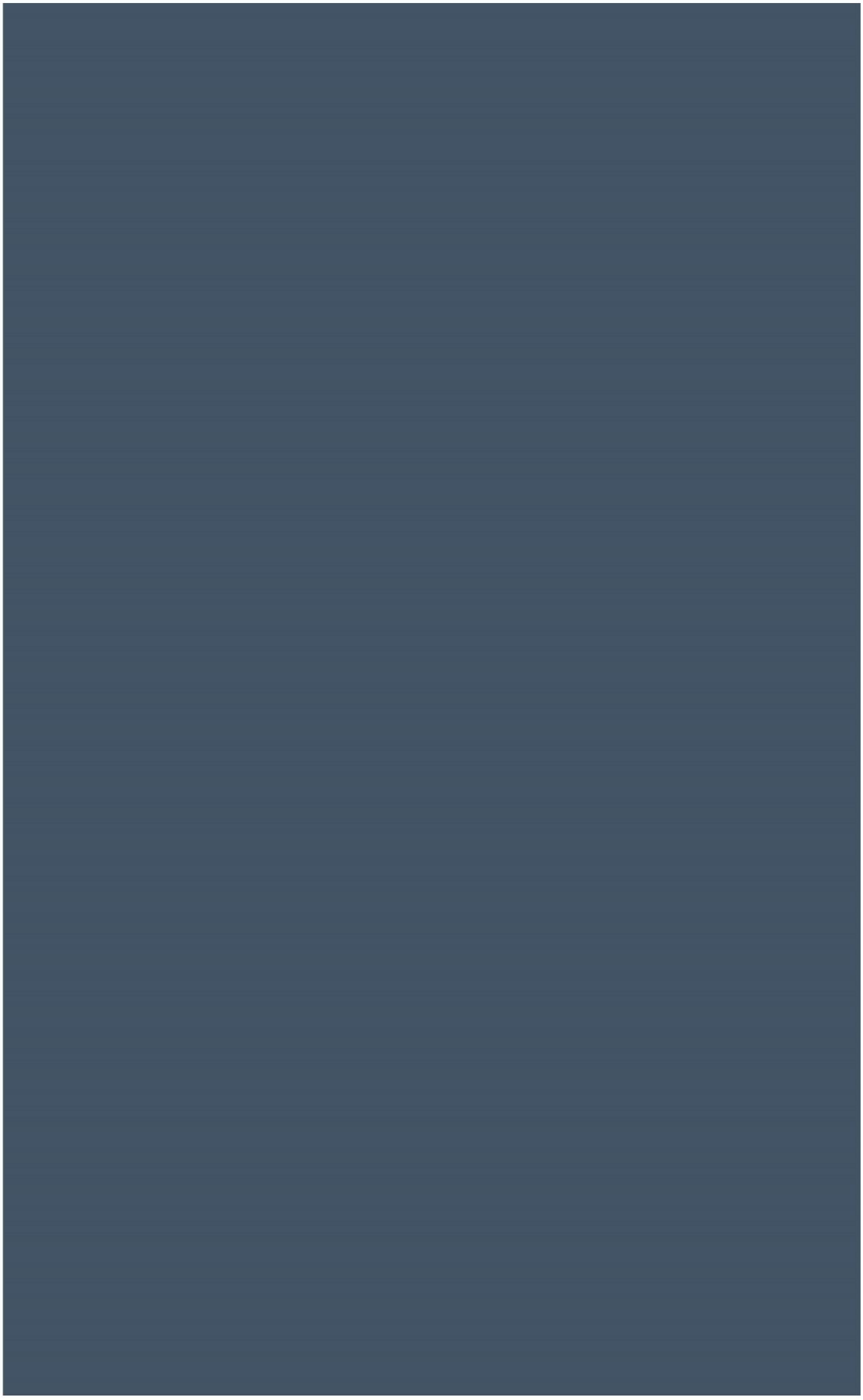
Table 7 - 3 - 6 Monthly abundance of raptors during Breeding Raptor Surveys

Species	Year	Abundance	Apr	May	Jun	Jul	Total

Kestrel	2019	number of observations		2	4		**6**
		number of individuals		3	4		**7**
	2020	number of observations			1	2	**3**
		number of individuals			1	2	**3**
Sparrowhawk	2019	number of observations	1				**1**
		number of individuals	1				**1**
	2020	number of observations					**0**
		number of individuals					**0**

Table 7 - 3 - 7 Monthly abundance of hen harrier during Hen Harrier Roost Surveys

Species	Year	Abundance	Oct	Nov	Dec	Jan	Feb	Mar	Total
Hen Harrier	2019	number of observations	2	2	2				**6**
		number of individuals	2	3	2				**7**
	2020	number of observations	3	2	4	3	1		**13**
		number of individuals	3	4	4	4	1		**16**
	2021	number of observations				5	6		**11**
		number of individuals				5	8		**13**



APPENDIX 7.4

SURVEY DATA

Appendix 7-4 – Survey Data

Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd**
Project Title:	**Wind Farm Development, Co. Kerry**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	05/07/2021	SD	PC

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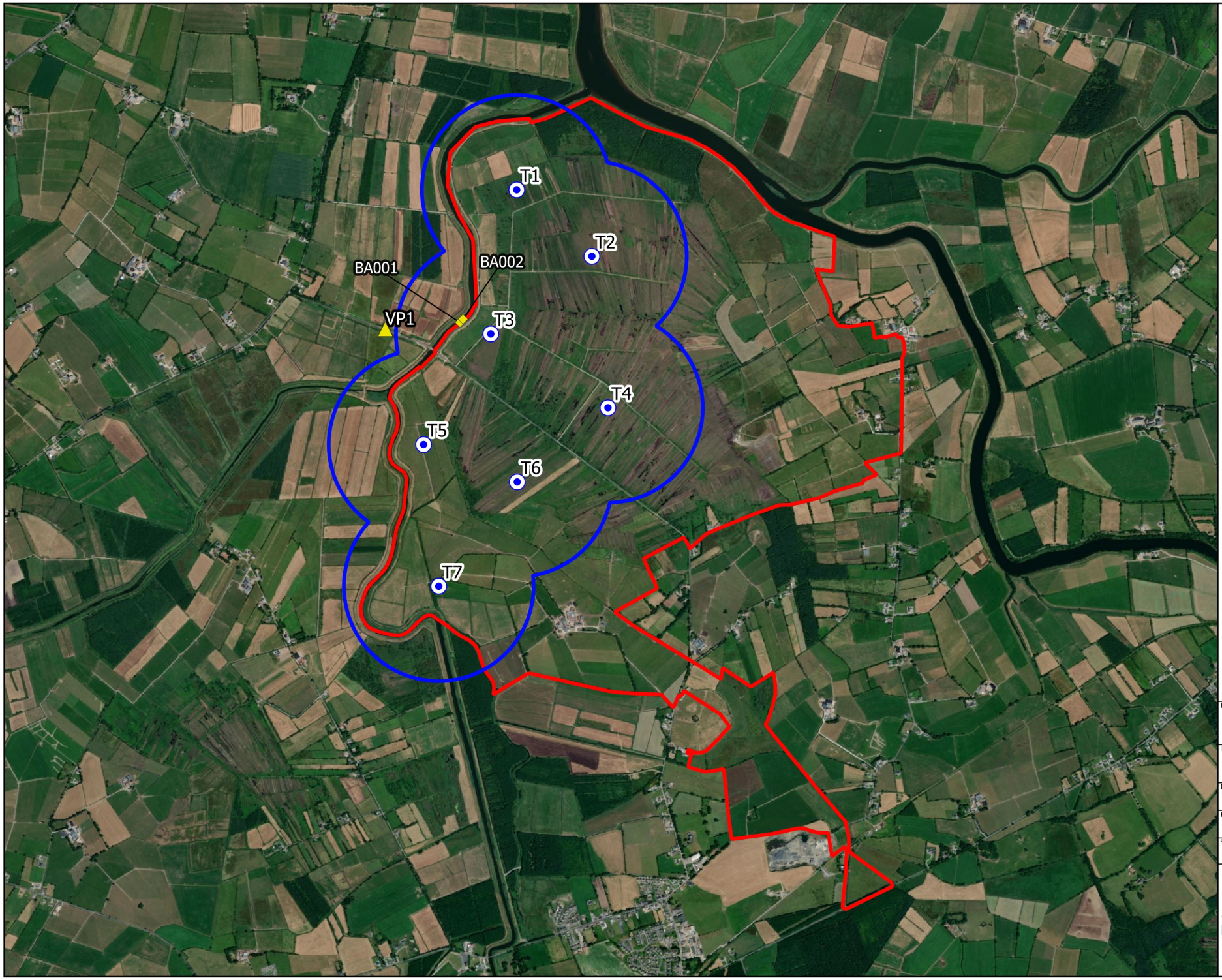
1.1 Bar-tailed Godwit

Table 7 - 4 - 1 Bar-tailed Godwit Vantage Point Survey

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
BA001	VP1	16/09/2020	11:20	Bar-tailed Godwit	1	watercourses; foraging at waters edge, observed landing on sediment and foraging	CMc
BA002	VP1	23/10/2020	16:34	Bar-tailed Godwit	2	watercourses and improved agricultural grassland; standing at rivers edge	CMc

Table 7 - 4 - 2 Bar-tailed Godwit Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BA001	River Cashen	26/08/2019	not given	Bar-tailed Godwit	1	estuaries; flying along waterway <20m and calling	CMc
BA002	River Cashen	26/08/2019	not given	Bar-tailed Godwit	1	estuaries; flying along waterway <20m and calling	CMc
BA003	Ardcullen Marshes	12/09/2019	not given	Bar-tailed Godwit	3	watercourses; flying along waterway <10m	CMc
BA004	Ballyhorgan Marshes	18/02/2020	not given	Bar-tailed Godwit	70	improved agricultural grassland;	CMc
BA005	Ballyouneen	04/02/2021	11:25	Bar-tailed Godwit	12	improved agricultural grassland; foraging, field was very flooded	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Bar-tailed Godwit Observations

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Drawing Title: Bar-tailed Godwit Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-1
Scale	Date
1:26000	05.07.21

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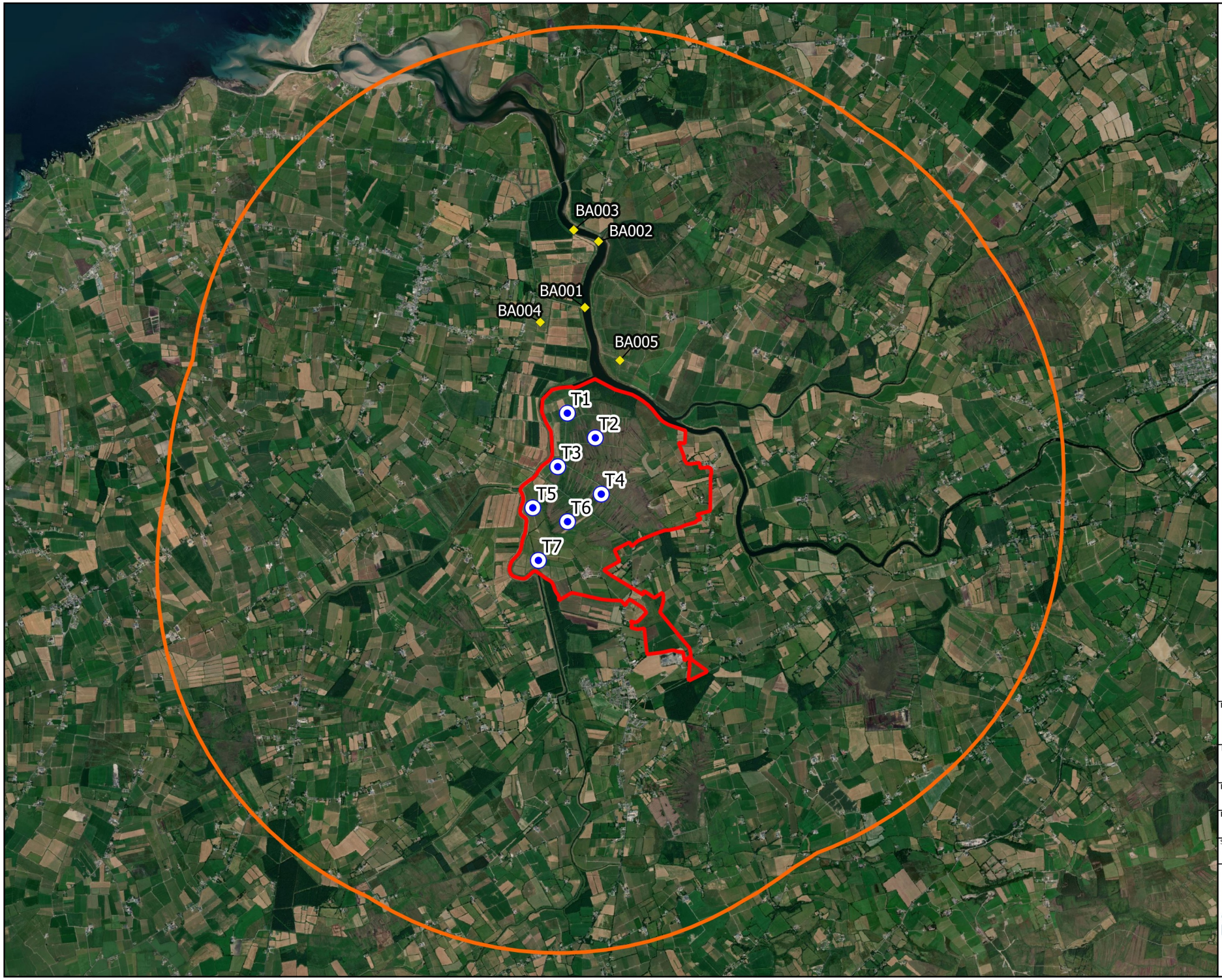

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Bar-tailed Godwit Observation

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Drawing Title
Bar-tailed Godwit Waterbird Distribution Survey

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-2
Scale	Date
1:70000	05.07.21

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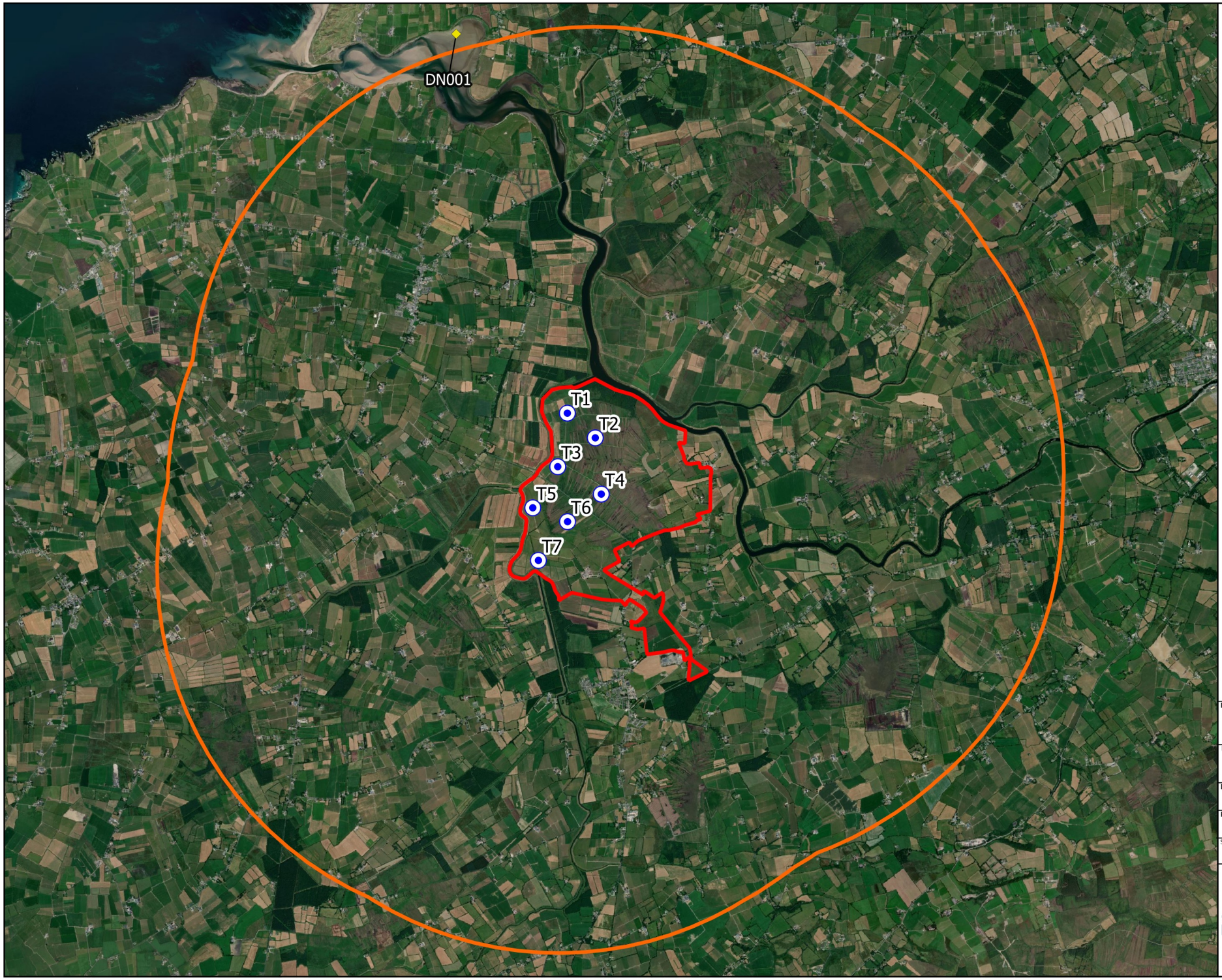
1.2 Dunlin

Table 7 - 4 - 3 Dunlin Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
DN001	Mouth of the Cashen River	17/12/2019	not given	Dunlin	59	sea inlets and bays; present	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Dunlin Observations

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Drawing Title

Dunlin
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-3
Scale	Date
1:70000	05.07.21

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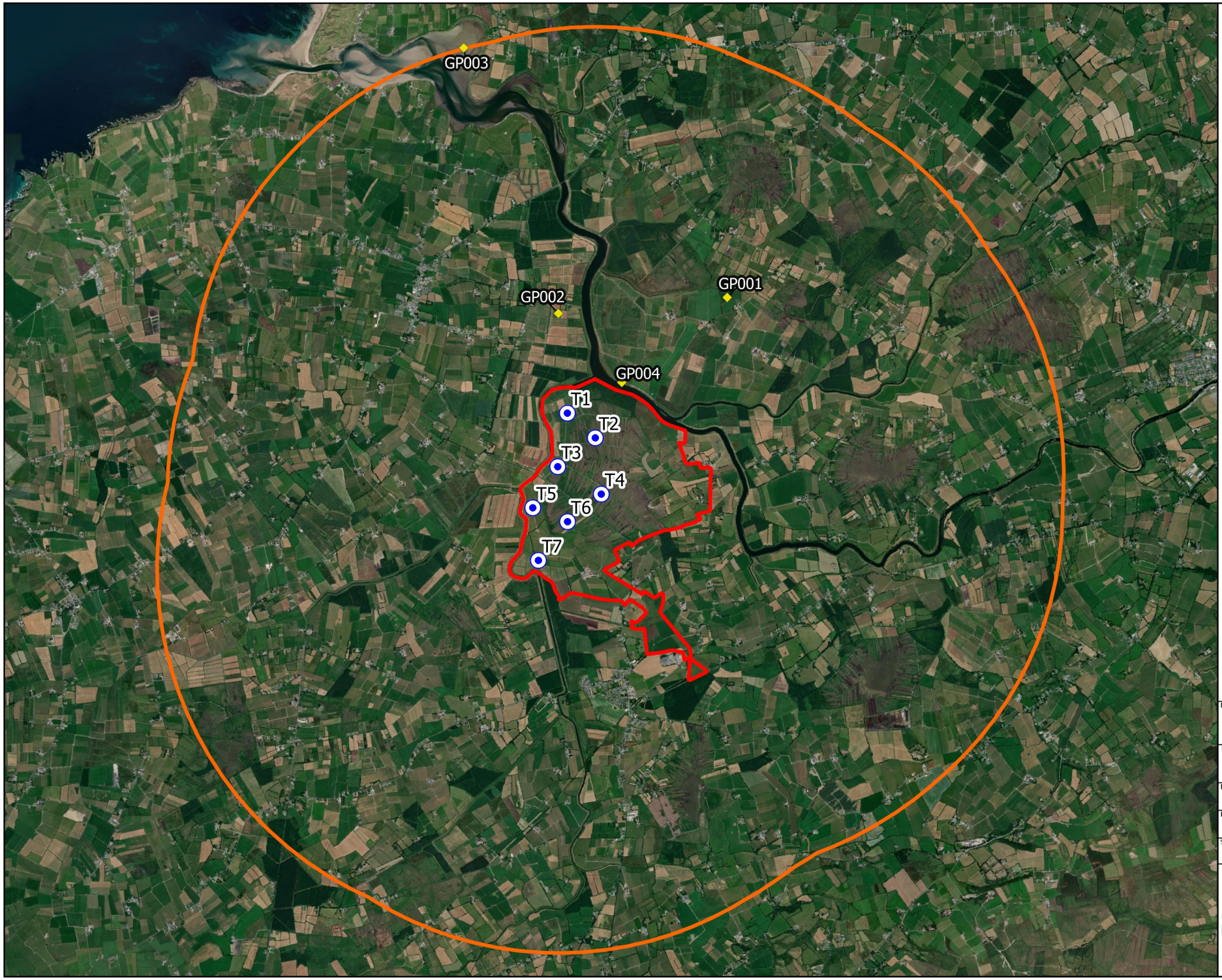
1.3 Golden Plover

Table 7 - 4 - 4 Golden Plover Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GP001	Ballyouneen	03/12/2019	not given	Golden Plover	50	improved agricultural grassland; present	CMc
GP002	Ballyhorgan Marshes	17/12/2019	not given	Golden Plover	30	improved agricultural grassland; present	CMc
GP003	Mouth of the Cashen River	17/12/2019	not given	Golden Plover	600	sea inlets and bays; present	CMc
GP004	Ballyouneen	17/11/2020	11:14	Golden Plover	400	improved agricultural grassland; roosting, flock was in a tightly packed group, count was an estimate, posdibly up to 500 birds there	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Golden Plover Observations

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Drawing Title

Golden Plover
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-4
Scale	Date
1:70000	05.07.21

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1.4 Hen Harrier

Table 7 - 4 - 5 Hen Harrier Vantage Point Survey

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
HH001	VP1	16/09/2020	08:20	Hen Harrier	1	70	50	20	0	0	watercourses and improved agricultural grassland; hunting	CMc
HH002	VP1	16/09/2020	11:25	Hen Harrier	1	70	60	10	0	0	watercourses and improved agricultural grassland; hunting and mobbed, flew over the river disturbing some curlew, hunted over field before being mobbed by small passerines and flew away	CMc

Table 7 - 4 - 6 Hen Harrier Winter Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
HH001	24/10/2019	not given	Hen Harrier	1	improved agricultural grassland; adult female mobbed by 3 rooks (wintering)	CMc

Table 7 - 4 - 7 Incidental Hen Harrier Records

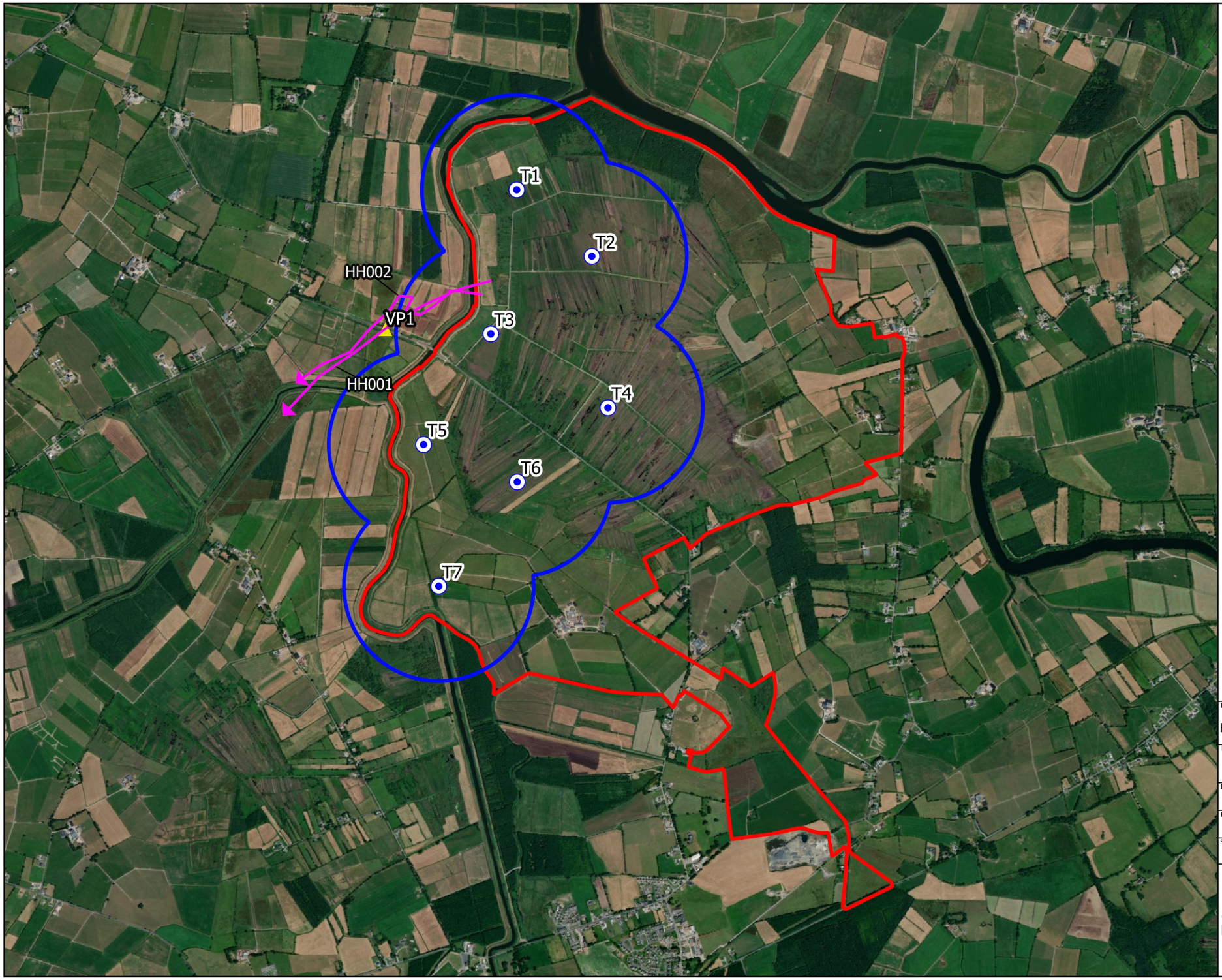
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
HH001	Wildfowl Distribution Survey, ferry bridge	28/05/2020	not given	Hen Harrier	1	conifer plantation; male bird flying over confier plantation	CMC
HH002	Wildfowl Distribution Survey, ballynagare	17/11/2020	not given	Hen Harrier	1	improved agricultural grassland; adult female	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
HH003	Hen Harrier Roost Survey, en route to hhvp2	08/12/2020	14:32	Hen Harrier	1	cutover bog and buildings and artificial surfaces; adult male flew across the road as surveyor drove to the hhvp, incidental sighting on the way to the hhvp	CMc
HH004	Wildfowl Distribution Survey, ballyouneen	04/02/2021	11:57	Hen Harrier	1	improved agricultural grassland and watercourses; flying female, in view briefly	CMc

Table 7 - 4 - 8 Supplementary Hen Harrier Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
HH001	VP2	09/08/2019	16:54	Hen Harrier	1	120	120	0	0	0	grassland and marsh; hunting. flew back and forth over field. looked to be repeatedly diving at something out of view. lost out of site behind an embankment , female	CMc
HH002	VP2	09/08/2019	20:07	Hen Harrier	1	5	5	0	0	0	grassland and marsh; briefly came into view from behind embankment	CMc
HH003	VP3	12/08/2019	16:30	Hen Harrier	1	40	0	20	20	0	conifer plantation; flying through the site, female	CMc
HH004	VP3	22/10/2019	17:15	Hen Harrier	1	95	90	5	0	0	grassland and marsh; hunting, adult female	CMc
HH005	VP3	22/10/2019	18:40	Hen Harrier	1	40	35	5	0	0	grassland and marsh; flying through, adult female	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
HH006	VP3	20/11/2019	09:09	Hen Harrier	1	67	67	0	0	0	improved agricultural grassland; hunting, female	CMc
HH007	VP3	20/11/2019	13:37	Hen Harrier	1	12	7	2	3	0	improved agricultural grassland; hunting, male	CMc
HH008	VP3	12/12/2019	12:24	Hen Harrier	1	12	12	0	0	0	improved agricultural grassland; flying, adult female	CMc
HH009	VP3	12/12/2019	12:38	Hen Harrier	1	44	8	32	4	0	improved agricultural grassland; hunting, adult male	CMc
HH010	VP3	12/12/2019	12:39	Hen Harrier	1	3	3	0	0	0	improved agricultural grassland; spotted briefly while observing a male, adult female	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Hen Harrier Flights at PCH

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Drawing Title

Hen Harrier Vantage Point Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-5
Scale	Date
1:26000	05.07.21

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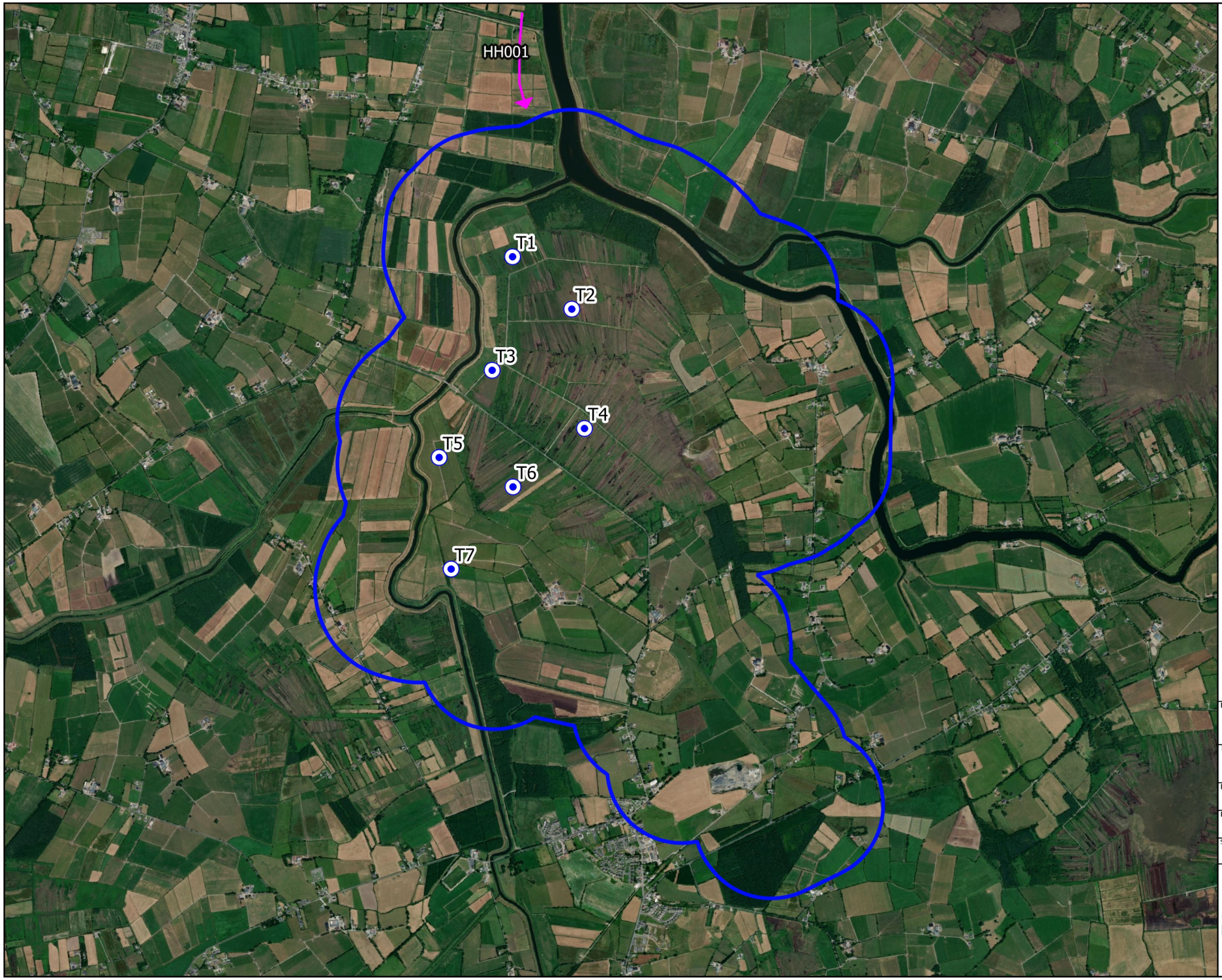

Map Legend

- 500m Survey Radius
- Turbine Location
- Hen Harrier Observations (winter season)

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Drawing Title: Hen Harrier Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-6
Scale	Date
1:33000	05.07.21

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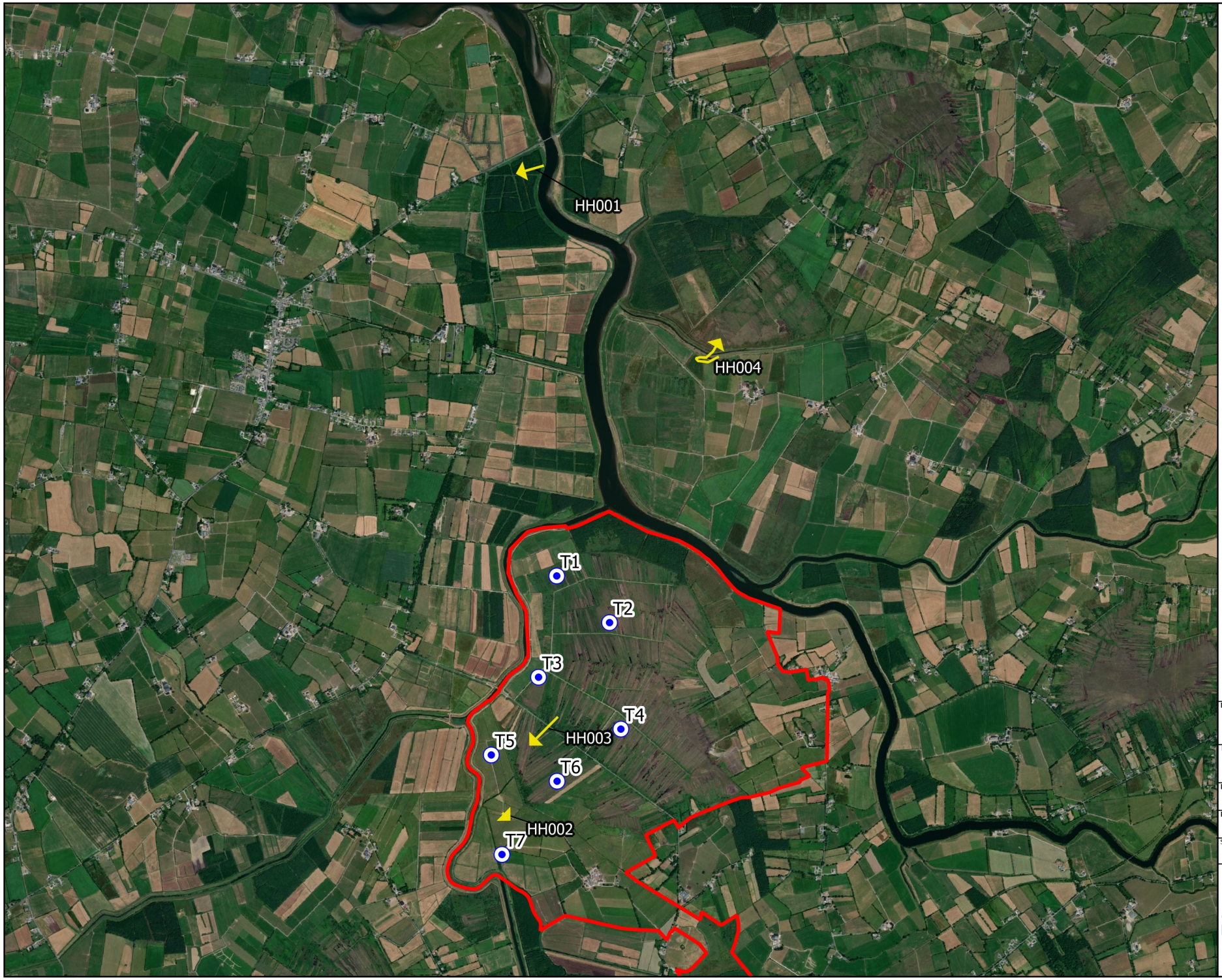

Map Legend

- Wind Farm Site
- Turbine Location
- Hen Harrier Observations

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Drawing Title: Hen Harrier Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-7
Scale	Date
1:37000	05.07.21

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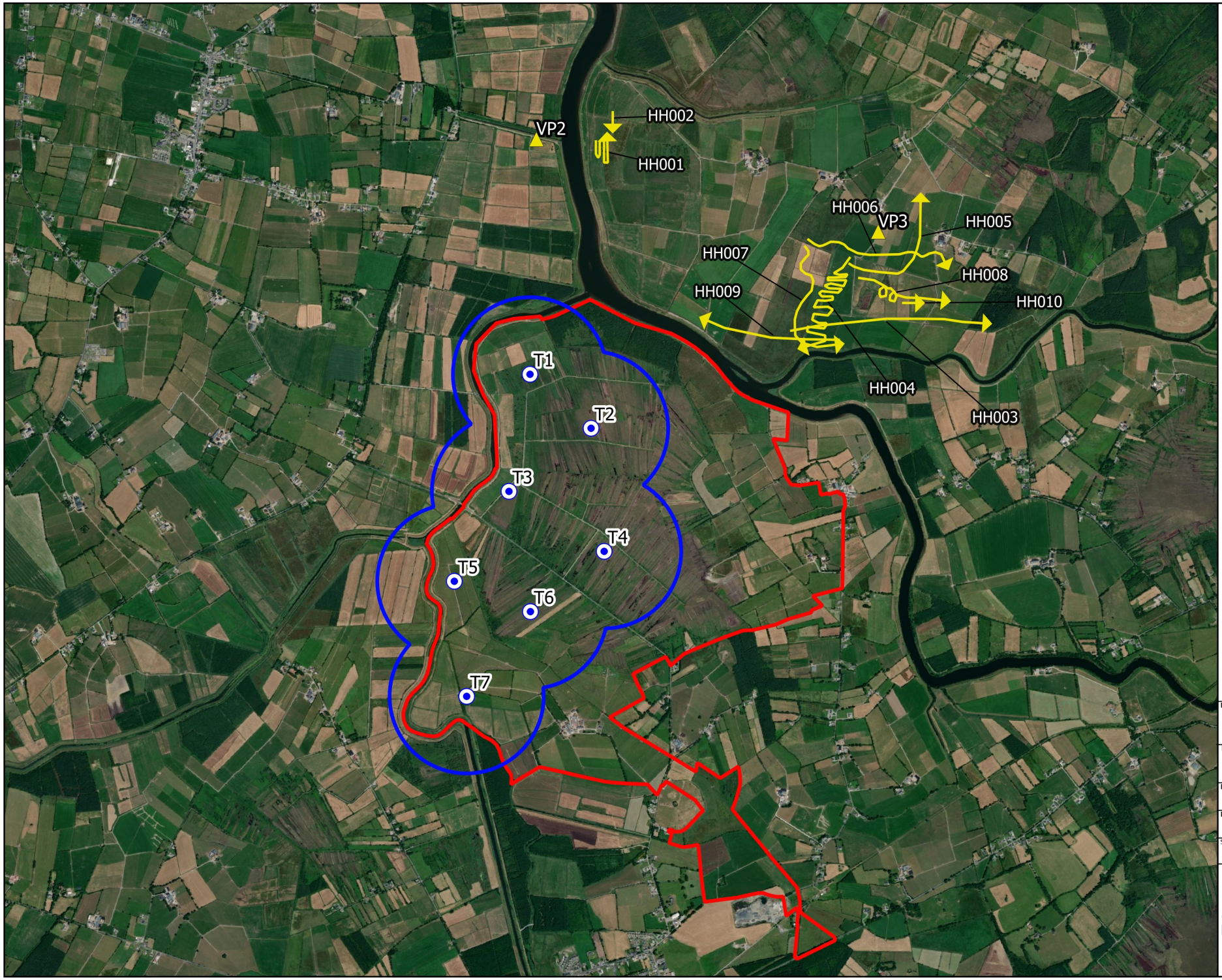

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Hen Harrier Observations

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Drawing Title: Hen Harrier Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-8
Scale	Date
1:32000	05.07.21

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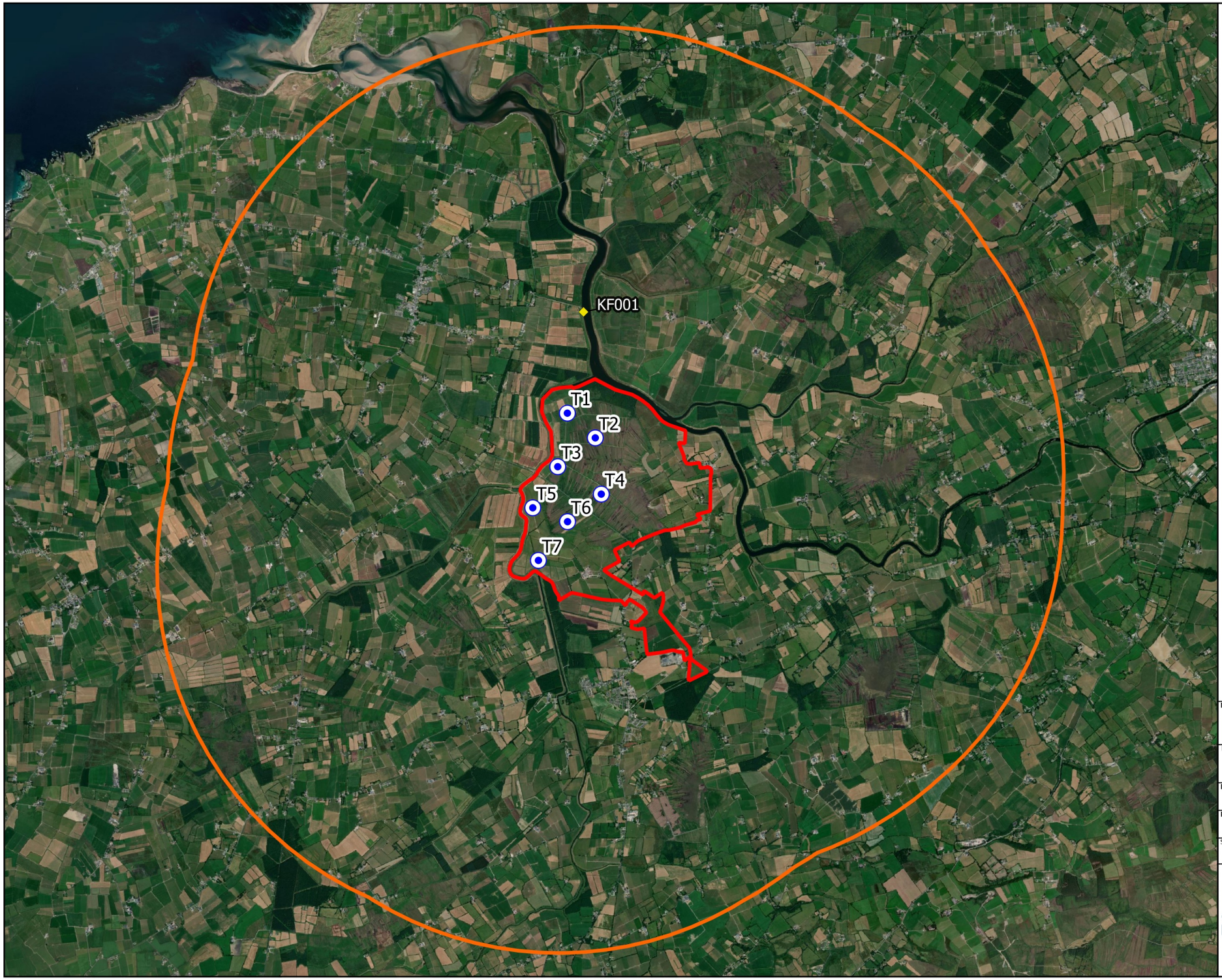
1.5 Kingfisher

Table 7 - 4 - 9 Kingfisher Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	River Cashen	26/08/2019	not given	Kingfisher	1	estuaries; flying along the waterway <5m	CMc

Table 7 - 4 - 10 Supplementary Kingfisher Data

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
KF001	VP2	08/04/2019	not given	Kingfisher	1	watercourses; present	CMc
KF002	VP2	09/08/2019	not given	Kingfisher	3	watercourses; present	CMc
KF003	VP2	04/09/2019	not given	Kingfisher	1	watercourses; present	CMc
KF004	VP2	18/10/2019	not given	Kingfisher	1	watercourses; present	CMc
KF005	VP2	26/11/2019	not given	Kingfisher	1	watercourses; present	CMc
KF006	VP2	09/12/2019	not given	Kingfisher	1	watercourses; present	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Kingfisher Observations

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Drawing Title

Kingfisher
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-9
Scale	Date
1:70000	05.07.21

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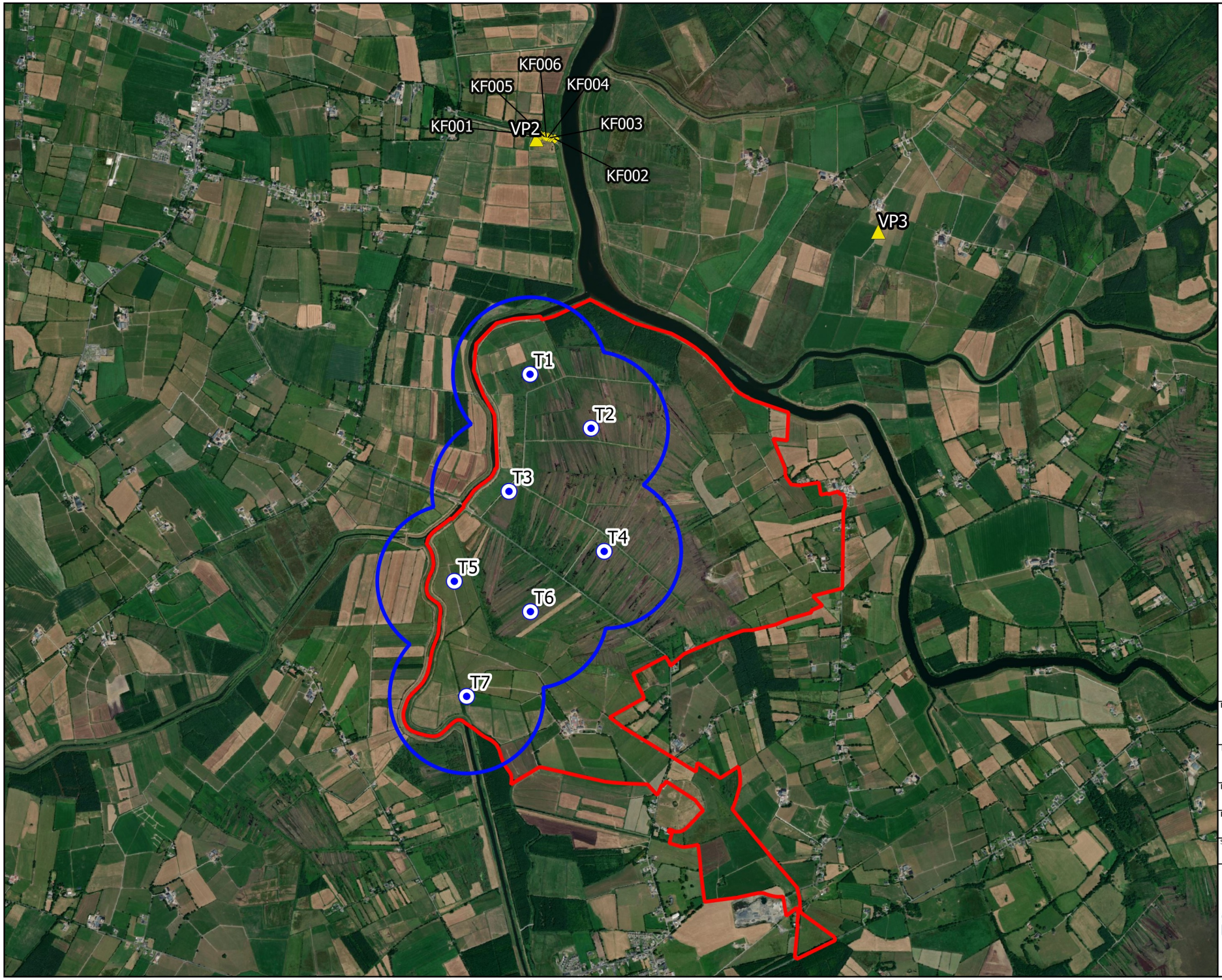

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Kingfisher Observations

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Drawing Title: Kingfisher Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-10
Scale	Date
1:32000	05.07.21

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1.6 Little Egret

Table 7 - 4 - 11 Little Egret Vantage Point Survey (lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
ET001	VP1	14/05/2019	10:06	Little Egret	1	40	0	40	0	0	estuaries; flying through site, lost to sight behind embankment	CMc
ET002	VP1	14/05/2019	11:13	Little Egret	1	80	0	70	10	0	grassland and marsh; flying through site	CMc
ET003	VP1	05/06/2019	15:56	Little Egret	1	10	0	10	0	0	watercourses; moving position along the river	CMc
ET004	VP1	02/09/2019	07:08	Little Egret	6	40	0	40	0	0	cutover bog; flying through	CMc
ET005	VP1	04/10/2019	17:38	Little Egret	1	12	0	12	0	0	grassland and marsh; flying	CMc
ET006	VP1	11/12/2019	16:16	Little Egret	1	3	3	0	0	0	improved agricultural grassland; flying	CMc

Table 7 - 4 - 12 Little Egret Vantage Point Survey (upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
ET007	VP1	28/01/2020	09:56	Little Egret	2	35	0	0	35	0	watercourses; flying though	CMc
ET008	VP1	28/01/2020	16:00	Little Egret	1	9	0	2	7	0	improved agricultural grassland and watercourses; flew past vp and dropped behind the embankment	CMc
ET009	VP1	17/03/2020	15:00	Little Egret	3	6	0	6	0	0	grassland and marsh; flying	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
ET010	VP1	24/03/2020	07:02	Little Egret	2	10	2	5	3	0	improved agricultural grassland; flying and landed	CMc
ET011	VP1	12/06/2020	12:24	Little Egret	1	6	0	0	6	0	grassland and marsh; flying along watercourse	CMc
ET012	VP1	12/06/2020	13:52	Little Egret	1	8	0	0	8	0	improved agricultural grassland; flying through	CMc
ET013	VP1	18/06/2020	10:02	Little Egret	1	5	5	0	0	0	grassland and marsh; flying	CMc
ET014	VP1	09/07/2020	16:15	Little Egret	1	23	0	0	23	0	improved agricultural grassland and watercourses; flying through	CMc
ET015	VP1	31/08/2020	19:53	Little Egret	3	12	12	0	0	0	watercourses; flying, flying in a group with cu and h	CMc
ET016	VP1	16/09/2020	07:46	Little Egret	1	15	15	0	0	0	watercourses; flying	CMc
ET017	VP1	16/09/2020	08:40	Little Egret	1	8	2	6	0	0	watercourses and improved agricultural grassland; flying and landed	CMc
ET018	VP1	06/10/2020	14:56	Little Egret	1	12	9	4	0	0	watercourses; flying	CMc
ET019	VP1	23/11/2020	13:21	Little Egret	1	25	7	2	16	0	cutover bog, improved agricultural grassland and watercourses;	CMc
ET020	VP1	23/11/2020	13:29	Little Egret	1	5	5	0	0	0	watercourses;	CMc
ET021	VP1	23/11/2020	13:34	Little Egret	1	25	20	5	0	0	cutover bog;	CMc
ET022	VP1	26/11/2020	07:59	Little Egret	1	10	10	0	0	0	watercourses and improved agricultural grassland;	CMc
ET023	VP1	26/11/2020	09:44	Little Egret	1	7	2	5	0	0	improved agricultural grassland;	CMc
ET024	VP1	17/12/2020	15:45	Little Egret	1	7	7	0	0	0	improved agricultural grassland; flying and landed	CMc
ET025	VP1	27/01/2021	13:54	Little Egret	1	7	7	0	0	0	improved agricultural grassland and watercourses; flying and landed	CMc
ET026	VP1	15/02/2021	14:06	Little Egret	1	15	15	0	0	0	cutover bog; flying and landed	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
ET027	VP1	15/02/2021	17:57	Little Egret	2	15	0	10	5	0	improved agricultural grassland and watercourses; flying	CMc
ET028	VP1	22/03/2021	07:18	Little Egret	2	25	5	20	0	0	watercourses and improved agricultural grassland; flying, one landed in field behind embankment	CMc
ET029	VP1	22/03/2021	13:07	Little Egret	1	30	10	15	5	0	improved agricultural grassland and watercourses; flying	CMc

Table 7 - 4 - 13 Little Egret Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
ET001	26/04/2019	11:50	Little Egret	1	depositing/lowland rivers; flying at 20m, adult (suitable nesting habitat; possible breeder)	CMc
ET002	26/04/2019	12:45	Little Egret	1	improved agricultural grassland; flying at 15m, adult (flyover; non-breeding)	CMc
ET003	27/05/2019	10:15	Little Egret	1	watercourses; flying along watercourse, adult (suitable nesting habitat; possible breeder)	CMc
ET004	26/07/2019	not given	Little Egret	1	improved agricultural grassland and cutover bog; present (flyover; non-breeding)	CMc
ET005	24/10/2019	not given	Little Egret	1	watercourses; in a drainage stream (wintering)	CMc
ET006	25/10/2019	not given	Little Egret	1	watercourses; feeding on river bank (wintering)	CMc
ET007	21/01/2020	13:03	Little Egret	1	watercourses; flying at 0-15m (wintering)	CMc
ET008	17/03/2020	not given	Little Egret	1	improved agricultural grassland; flying over drain (wintering)	CMc
ET009	19/06/2020	not given	Little Egret	1	watercourses; standing on riverbank (suitable nesting habitat; possible breeder)	CMc
ET010	04/03/2021	09:53	Little Egret	1	improved agricultural grassland; flying (wintering)	CMc
ET011	04/03/2021	11:30	Little Egret	1	cutover bog; flushed (wintering)	CMc

Table 7 - 4 - 14 Little Egret Waterbird Distribution Survey

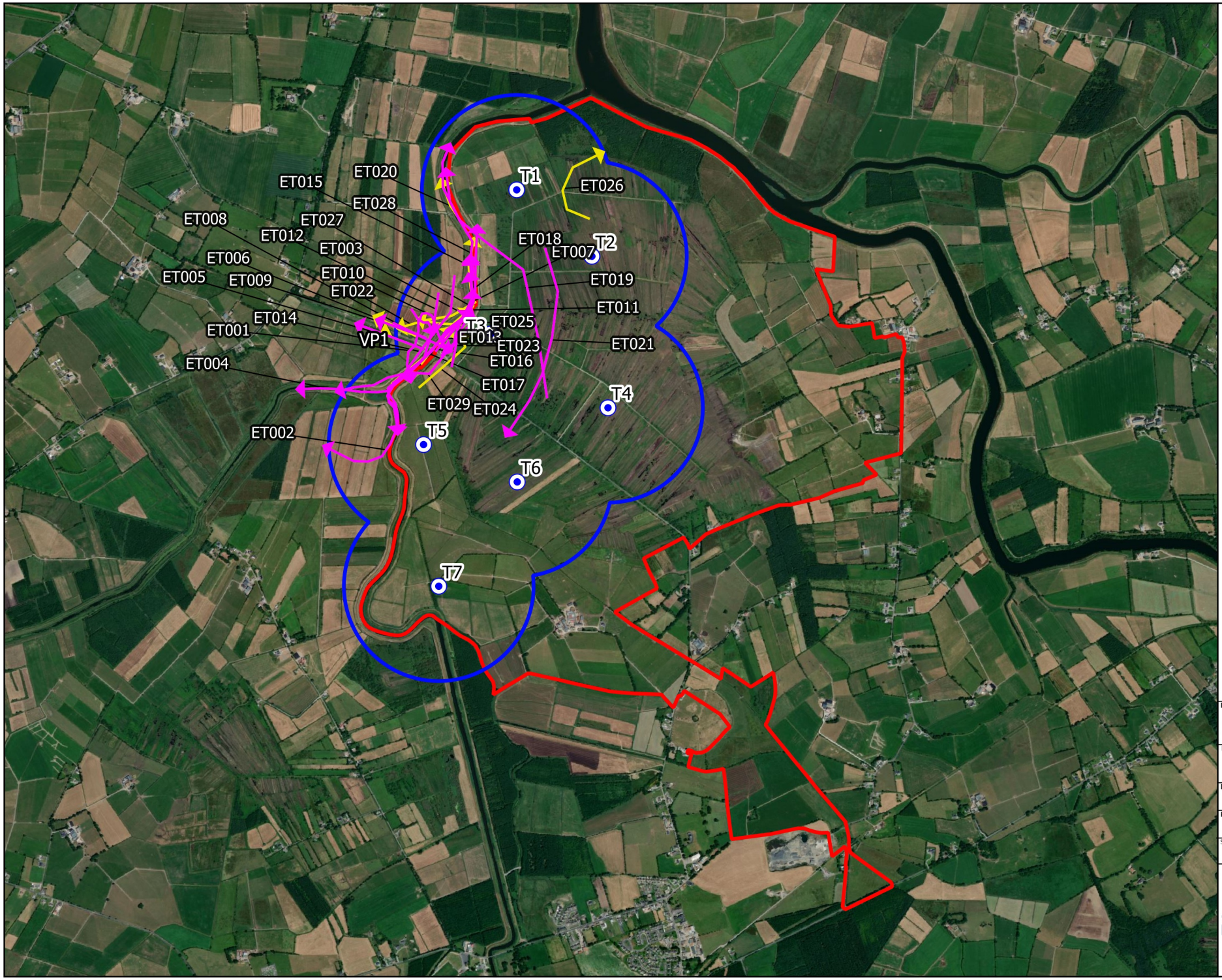
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
ET001	River Cashen	26/08/2019	not given	Little Egret	1	estuaries; standing on sediment in estuary	CMc
ET002	River Cashen	26/08/2019	not given	Little Egret	1	estuaries; flying along waterway <20m	CMc
ET003	River Cashen	26/08/2019	not given	Little Egret	1	estuaries; feeding in a tributary	CMc
ET004	River Cashen	26/08/2019	not given	Little Egret	3	estuaries; feeding in estuary	CMc
ET005	River Cashen	26/08/2019	not given	Little Egret	1	watercourses; feeding in the watercourse	CMc
ET006	Ballyouneen	12/09/2019	not given	Little Egret	1	watercourses; flying along watercourse 10-20m	CMc
ET007	Ardcullen Marshes	12/09/2019	not given	Little Egret	6	watercourses; flushed by surveyor	CMc
ET008	Ferry Bridge	30/09/2019	not given	Little Egret	1	watercourses; flying over water at 15m	CMc
ET009	Ballyouneen	30/09/2019	not given	Little Egret	6	improved agricultural grassland; feeding in flooded field	CMc
ET010	The Cashen	11/10/2019	not given	Little Egret	2	muddy sand shores; feeding at low tide	CMc
ET011	Ballynagare Bridge	11/10/2019	not given	Little Egret	1	watercourses; feeding in a small stream/drainage ditch	CMc
ET012	The Cashen	29/10/2019	not given	Little Egret	1	muddy sand shores; present	CMc
ET013	The Cashen	07/11/2019	not given	Little Egret	1	muddy sand shores; present	CMc
ET014	Ballyouneen	03/12/2019	not given	Little Egret	1	improved agricultural grassland; present	CMc
ET015	Mouth of the Cashen River	17/12/2019	not given	Little Egret	1	sea inlets and bays; present	CMc
ET016	Farrandeen	27/01/2020	not given	Little Egret	1	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
ET017	Killarida	18/02/2020	not given	Little Egret	1	improved agricultural grassland; present	CMc
ET018	Ballynagare Bridge	23/03/2020	not given	Little Egret	1	improved agricultural grassland; foraging in agricultural grassland	CMc
ET019	Ferry Bridge	19/08/2020	13:45	Little Egret	1	watercourses; standing at rivers edge	CMc
ET020	Farrandeen	03/09/2020	14:42	Little Egret	1	improved agricultural grassland; standing in an agricultural field	CMc
ET021	Ballyouneen	23/10/2020	11:35	Little Egret	6	improved agricultural grassland; foraging	CMc
ET022	Ballynagare Bridge	17/11/2020	10:14	Little Egret	1	improved agricultural grassland; foraging	CMc
ET023	Killarida	17/11/2020	12:34	Little Egret	1	watercourses; flushed	CMc
ET024	Ballynagare	04/02/2021	13:34	Little Egret	1	improved agricultural grassland; foraging	CMc
ET025	Ballynagare	04/02/2021	14:10	Little Egret	1	improved agricultural grassland; foraging	CMc
ET026	Ballynagare	04/02/2021	14:11	Little Egret	1	improved agricultural grassland; flushed	CMc

Table 7 - 4 - 15 Supplementary Little Egret Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
ET001	VP2	08/04/2019	18:35	Little Egret	1	5	0	5	0	0	estuaries; flying along estuary, adult	CMc
ET002	VP2	10/06/2019	13:56	Little Egret	1	5	0	2	3	0	watercourses; moving position along the river	CMc
ET003	VP2	09/08/2019	18:15	Little Egret	1	10	2	8	0	0	improved agricultural grassland; took off from canal and flew away	CMc
ET004	VP2	09/08/2019	19:55	Little Egret	1	2	2	0	0	0	freshwater; briefly seen flying along waterway	CMc
ET005	VP2	04/09/2019	05:55	Little Egret	1	5	5	0	0	0	buildings and artificial surfaces; flying along farm road	CMc
ET006	VP2	04/09/2019	07:24	Little Egret	4	15	0	10	5	0	watercourses; flying along watercourse	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
ET007	VP2	04/09/2019	08:27	Little Egret	1	10	0	10	0	0	watercourses; flying through	CMc
ET008	VP2	04/09/2019	09:40	Little Egret	1	5	0	5	0	0	watercourses; flying	CMc
ET009	VP2	04/09/2019	10:00	Little Egret	1	5	0	5	0	0	watercourses; flying	CMc
ET010	VP2	04/09/2019	10:50	Little Egret	1	3	3	0	0	0	watercourses; flying	CMc
ET011	VP2	18/10/2019	16:40	Little Egret	1	3	3	0	0	0	watercourses; flushed from canal	CMc
ET012	VP2	18/10/2019	17:33	Little Egret	1	11	7	4	0	0	watercourses; flying along watercourse	CMc
ET013	VP2	26/11/2019	14:50	Little Egret	2	12	0	0	12	0	improved agricultural grassland; flying	CMc
ET014	VP2	29/11/2019	08:10	Little Egret	1	5	5	0	0	0	grassland and marsh; flying	CMc
ET015	VP2	29/11/2019	08:10	Little Egret	1	2	0	2	0	0	improved agricultural grassland; landed in mud at the end of the road	CMc
ET016	VP2	09/12/2019	14:16	Little Egret	2	5	0	5	0	0	watercourses; flying	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Little Egret Flights
- Little Egret Flights at PCH

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Drawing Title: Little Egret Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-11
Scale	Date
1:26000	05.07.21

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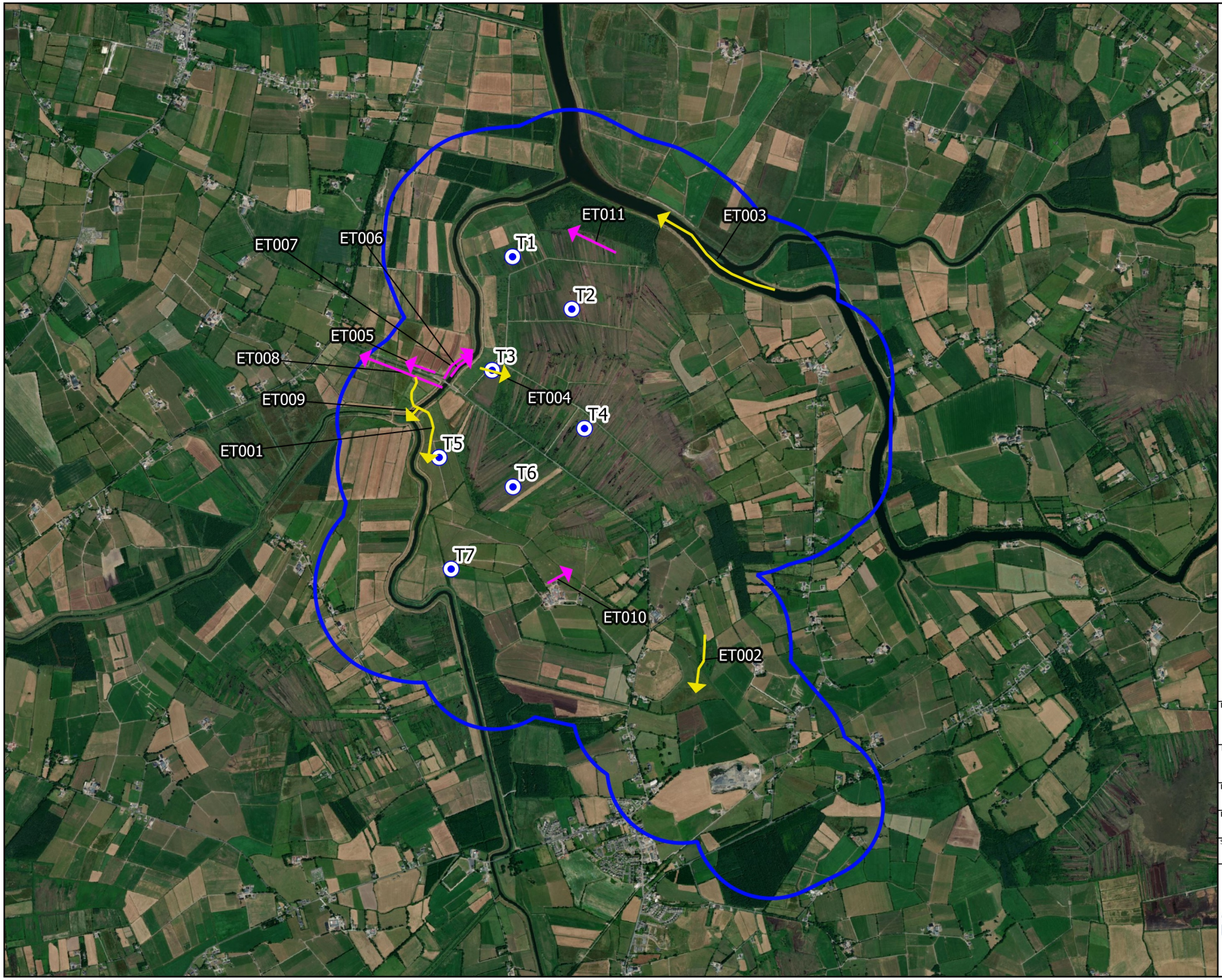

Map Legend

- 500m Survey Radius
- Turbine Location
- Little Egret Observations (breeding season)
- Little Egret Observations (winter season)

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Drawing Title: Little Egret Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-12
Scale	Date
1:33000	05.07.21

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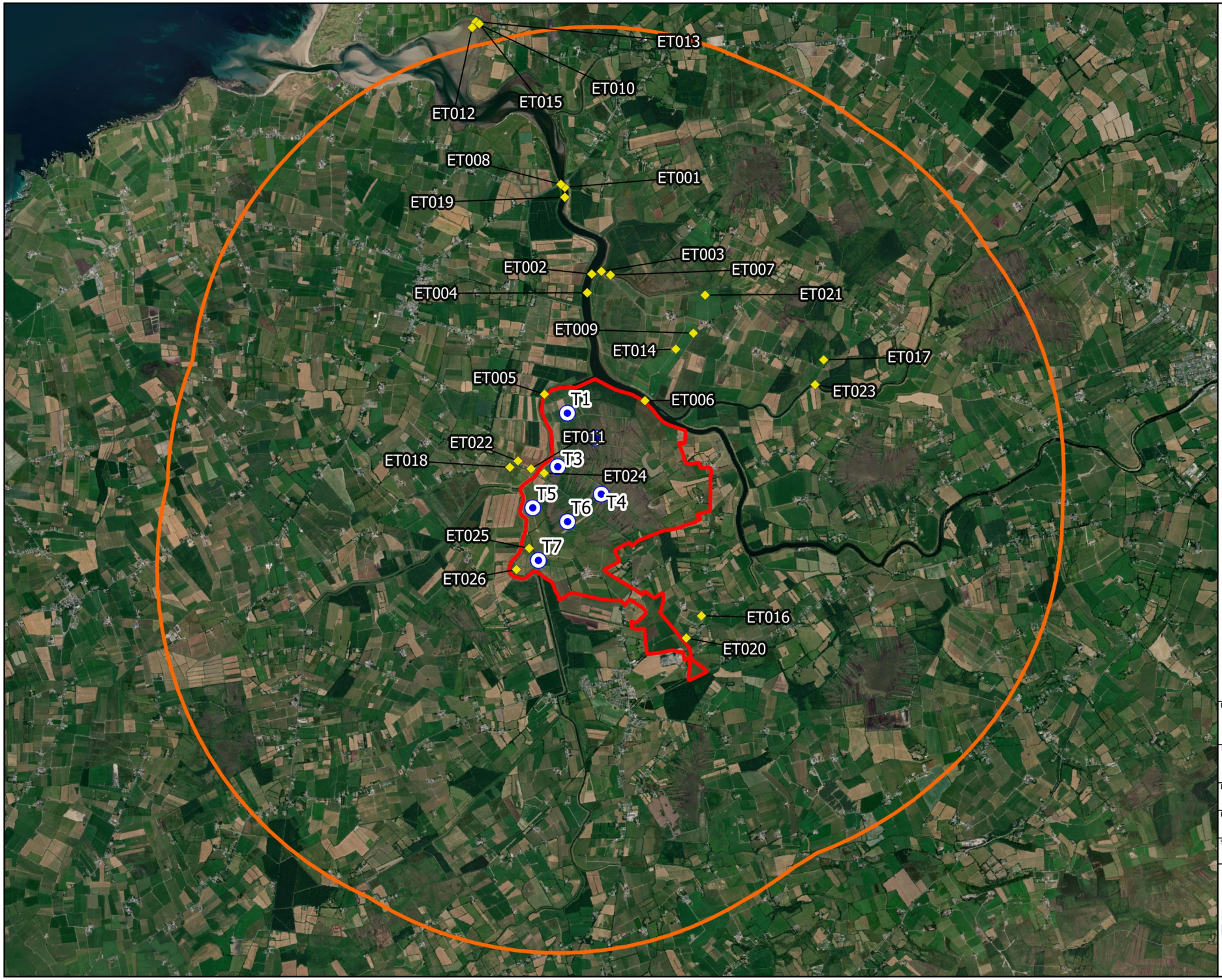

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Little Egret Observations

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Drawing Title

Little Egret
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-13
Scale	Date
1:70000	05.07.21

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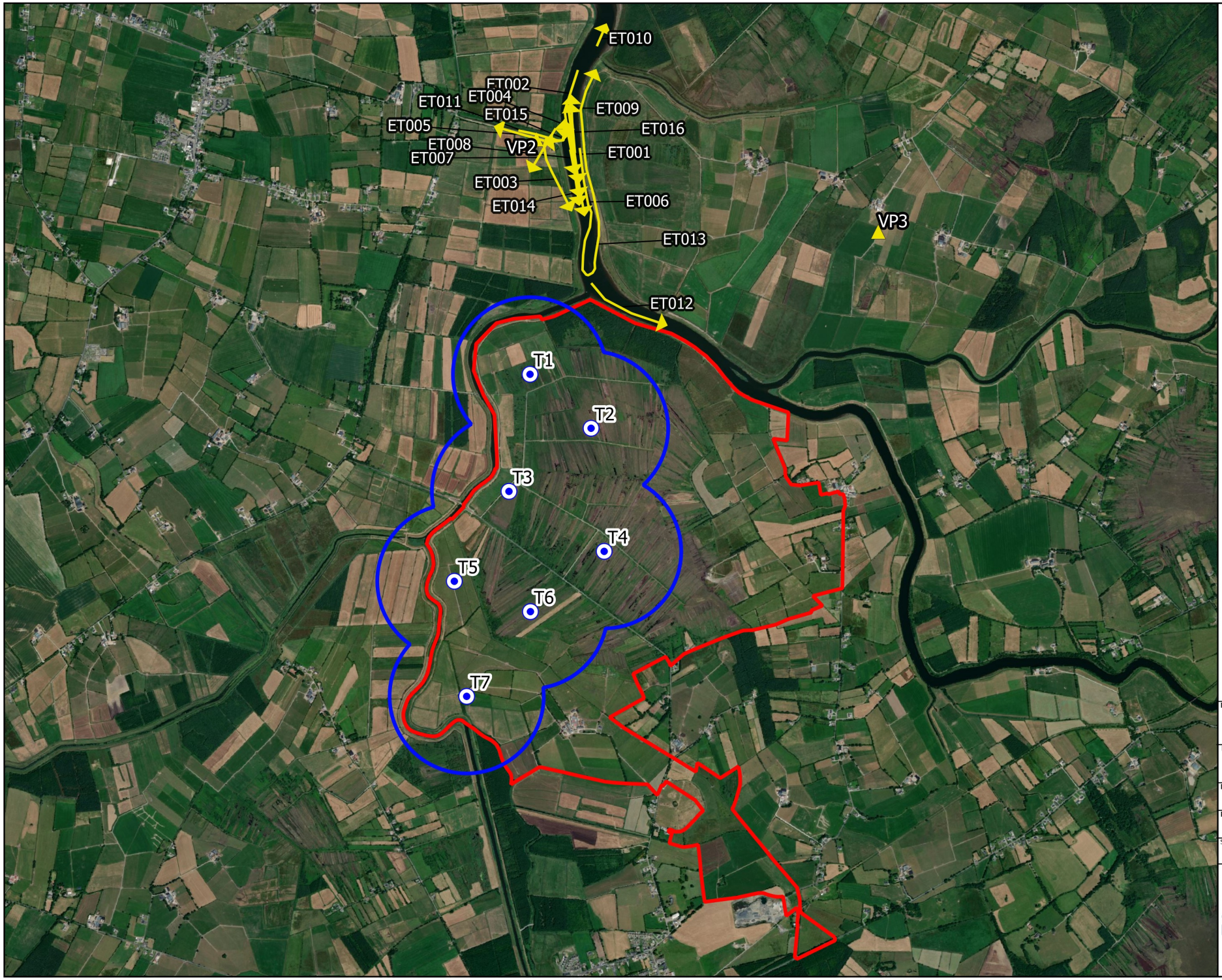

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Little Egret Observations

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Drawing Title: Little Egret Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-14
Scale	Date
1:32000	05.07.21

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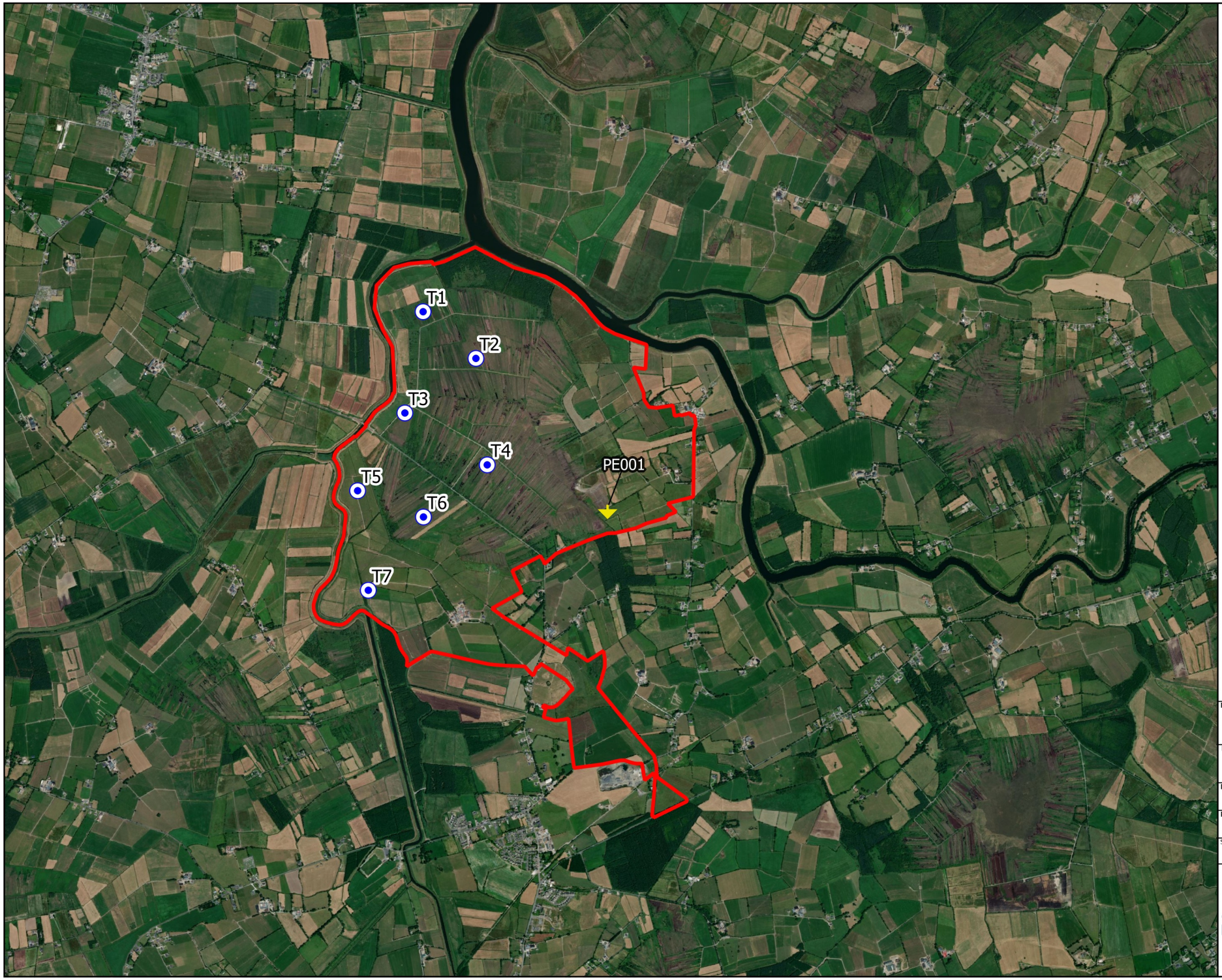
1.7 Peregrine Falcon

Table 7 - 4 - 16 Incidental Peregrine Falcon Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
PE001	Hen Harrier Roost Survey, hhvp2	01/10/2020	18:25	Peregrine Falcon	1	cutover bog; perched on fencepost throughout watch	CMc

Table 7 - 4 - 17 Supplementary Peregrine Falcon Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
PE001	VP3	22/10/2019	17:18	Peregrine Falcon	1	6	6	0	0	0	grassland and marsh; landed on a fence post and was chased away by hooded crow, adult female	CMc



Map Legend

- Wind Farm Site
- Turbine Location
- Peregrine Falcon Observations

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Drawing Title	Peregrine Falcon Incidental Records
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-15
Scale: 1:37000	Date: 05.07.21

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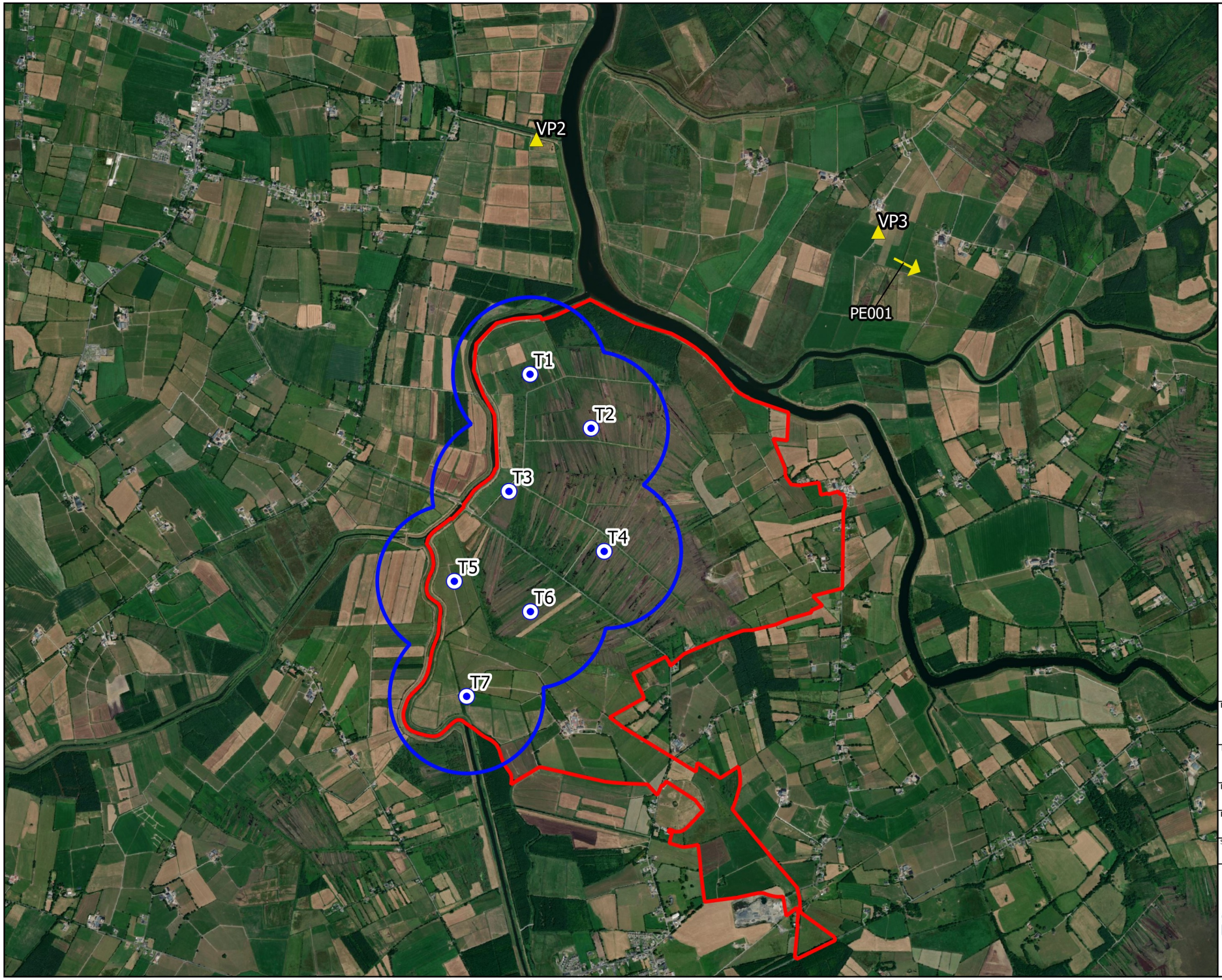

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Peregrine Falcon Observations

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Drawing Title
Peregrine Falcon Supplementary Data

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-16
Scale	Date
1:32000	05.07.21

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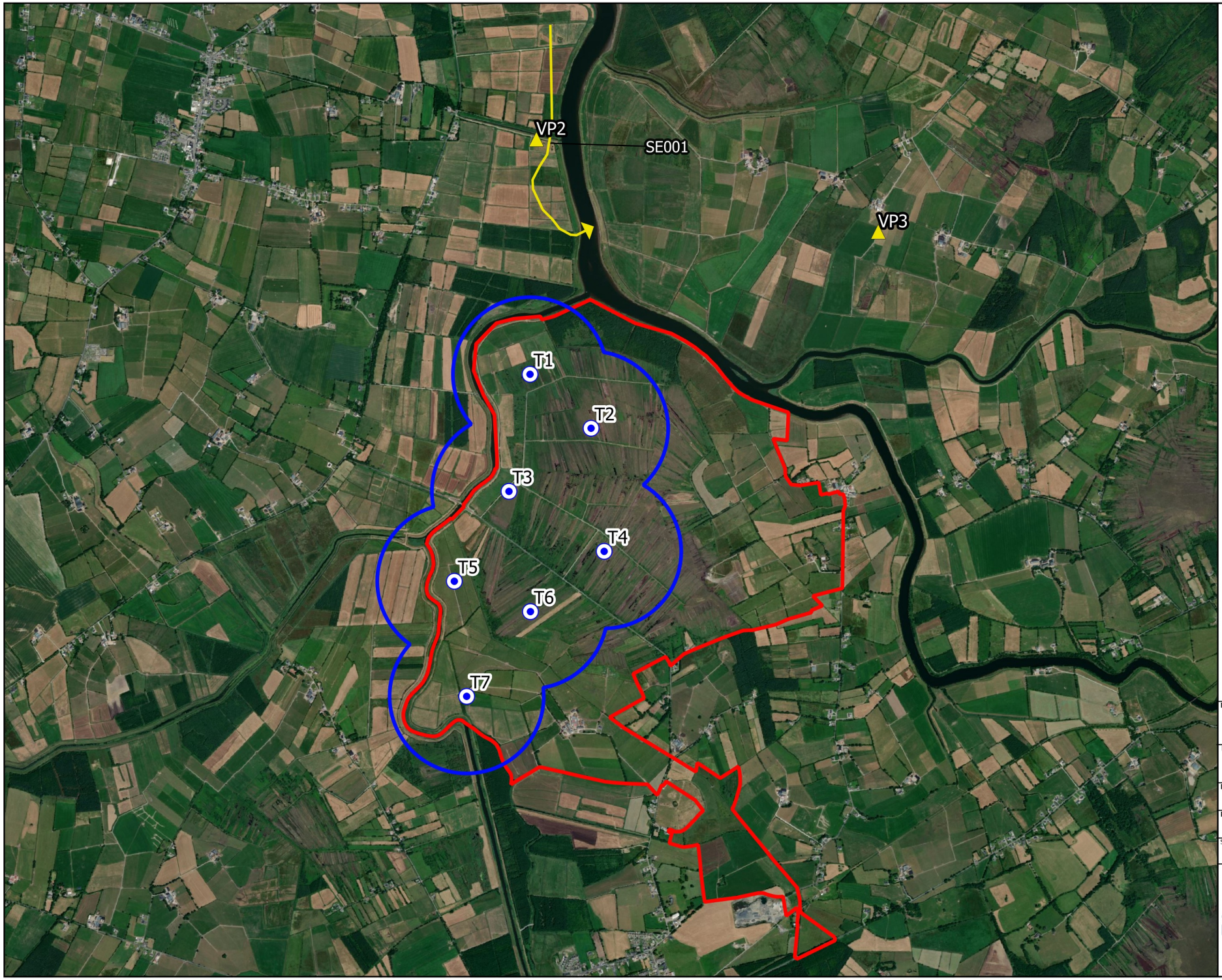
1.8 Short-eared Owl

Table 7 - 4 - 18 Supplementary Short-eared Owl Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
SE001	VP2	08/04/2019	19:56	Short-eared Owl	1	90	60	30	0	0	estuaries; flying through site, landed briefly on fence post, took off again, lost to sight behind embankment	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Short-eared Owl Observations

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Drawing Title: Short-eared Owl Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-17
Scale	Date
1:32000	05.07.21

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1.9 Whooper Swan

Table 7 - 4 - 19 Whooper Swan Vantage Point Survey (lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS001	VP1	02/09/2019	10:25	Whooper Swan	1	30	0	0	30	0	watercourses; flying through	CMc
WS002	VP1	08/11/2019	07:19	Whooper Swan	2	5	2	3	0	0	grassland and marsh; flying	CMc
WS003	VP1	08/11/2019	08:25	Whooper Swan	2	87	0	9	78	0	watercourses; flying	CMc
WS004	VP1	08/11/2019	11:59	Whooper Swan	27	46	0	40	6	0	watercourses; flying in a group, some of the group climbed above 25m	CMc
WS005	VP1	11/12/2019	11:11	Whooper Swan	1	59	2	12	45	0	improved agricultural grassland and watercourses; flying	CMc
WS006	VP1	11/12/2019	11:23	Whooper Swan	6	11	5	6	0	0	improved agricultural grassland and watercourses; flying and landed	CMc
WS007	VP1	11/12/2019	11:31	Whooper Swan	2	13	1	5	7	0	improved agricultural grassland; left field beside vp and flew away	CMc
WS008	VP1	11/12/2019	11:35	Whooper Swan	3	20	4	16	0	0	improved agricultural grassland and watercourses; left field beside vp and flew away	CMc
WS009	VP1	11/12/2019	11:57	Whooper Swan	2	19	0	12	7	0	improved agricultural grassland and watercourses; flying along watercourse	CMc
WS010	VP1	11/12/2019	12:38	Whooper Swan	2	3	3	0	0	0	improved agricultural grassland; landed in field by vp	CMc
WS011	VP1	11/12/2019	15:14	Whooper Swan	2	17	0	0	17	0	improved agricultural grassland and watercourses; flying	CMc
WS012	VP1	11/12/2019	16:16	Whooper Swan	6	23	0	23	0	0	improved agricultural grassland; flying	CMc

Table 7 - 4 - 20 Whooper Swan Vantage Point Survey (upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS013	VP1	28/01/2020	08:10	Whooper Swan	2	3	3	0	0	0	improved agricultural grassland; observed landing in agricultural field	CMc
WS014	VP1	28/01/2020	08:20	Whooper Swan	6	19	2	5	12	0	improved agricultural grassland and watercourses; flew across the river, circled over the agricultural field, flew back across the river and dropped behind the embankment	CMc
WS015	VP1	28/01/2020	08:25	Whooper Swan	5	13	2	5	6	0	improved agricultural grassland and watercourses; flew across the river, circled over the agricultural field, flew back across the river and dropped behind the embankment	CMc
WS016	VP1	28/01/2020	09:11	Whooper Swan	3	28	1	3	24	0	improved agricultural grassland and watercourses; took off from angricultural field and flew towards ballyouneen	CMc
WS017	VP1	28/01/2020	15:31	Whooper Swan	2	35	0	3	32	0	watercourses; flew over vp, then along river towards ballyouneen	CMc
WS018	VP1	13/02/2020	16:53	Whooper Swan	4	32	15	5	12	0	improved agricultural grassland; flew over vp, and landed in flooded field	CMc
WS019	VP1	23/10/2020	16:30	Whooper Swan	4	45	0	0	45	0	improved agricultural grassland and conifer plantation; flying and calling	CMc
WS020	VP1	23/10/2020	18:29	Whooper Swan	5	72	0	0	72	0	improved agricultural grassland and cutover bog; flying	CMc
WS021	VP1	23/10/2020	18:30	Whooper Swan	5	80	0	0	80	0	improved agricultural grassland; flying, appeared to land, lost to sight behind forestry	CMc
WS022	VP1	23/10/2020	18:53	Whooper Swan	15	32	0	0	32	0	improved agricultural grassland; flying, flying, calling, appeard to land	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS023	VP1	26/11/2020	08:12	Whooper Swan	2	15	3	10	2	0	improved agricultural grassland;	CMc
WS024	VP1	26/11/2020	08:26	Whooper Swan	1	65	0	0	65	0	cutover bog, improved agricultural grassland and watercourses;	CMc
WS025	VP1	26/11/2020	09:35	Whooper Swan	2	63	3	3	57	0	improved agricultural grassland and watercourses;	CMc
WS026	VP1	17/12/2020	10:35	Whooper Swan	5	15	10	5	0	0	improved agricultural grassland; flying	CMc
WS027	VP1	17/12/2020	11:10	Whooper Swan	9	30	0	25	5	0	improved agricultural grassland and watercourses; flying	CMc
WS028	VP1	17/12/2020	11:27	Whooper Swan	2	35	0	0	35	0	improved agricultural grassland; flying	CMc
WS029	VP1	17/12/2020	11:51	Whooper Swan	5	40	10	30	0	0	improved agricultural grassland and cutover bog; flying	CMc
WS030	VP1	17/12/2020	14:56	Whooper Swan	2	3	3	0	0	0	improved agricultural grassland; landed and began to forage, spotted just as the landed, joining the other swans	CMc
WS031	VP1	17/12/2020	15:06	Whooper Swan	1	45	5	40	0	0	improved agricultural grassland; flying and landed, joined foraging flock	CMc
WS032	VP1	17/12/2020	15:11	Whooper Swan	3	5	5	0	0	0	improved agricultural grassland; flying and landed, only in view above embankment briefly	CMc
WS033	VP1	17/12/2020	15:12	Whooper Swan	1	50	3	42	5	0	improved agricultural grassland; flying	CMc
WS034	VP1	17/12/2020	15:21	Whooper Swan	6	45	5	20	20	0	improved agricultural grassland and watercourses; flying, dropped behind embankment	CMc
WS035	VP1	17/12/2020	15:44	Whooper Swan	3	55	0	20	35	0	improved agricultural grassland and watercourses; flying	CMc
WS036	VP1	17/12/2020	16:16	Whooper Swan	5	15	0	10	5	0	improved agricultural grassland; flying, lost to sight behind trees	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
WS037	VP1	17/12/2020	16:40	Whooper Swan	7	9	7	2	0	0	improved agricultural grassland; flying and landed, joined other whooper swan as light was fading	CMc
WS038	VP1	17/12/2020	16:52	Whooper Swan	6	12	5	7	0	0	improved agricultural grassland and watercourses; flying and landed	CMc
WS039	VP1	17/12/2020	16:58	Whooper Swan	6	45	5	30	10	0	improved agricultural grassland and watercourses; flying and landed	CMc
WS040	VP1	17/12/2020	17:00	Whooper Swan	2	7	5	2	0	0	improved agricultural grassland; landing, just caught coming in to land	CMc
WS041	VP1	17/12/2020	17:01	Whooper Swan	5	7	5	2	0	0	improved agricultural grassland and watercourses; flying and landed	CMc
WS042	VP1	17/12/2020	17:06	Whooper Swan	6	9	5	4	0	0	improved agricultural grassland; flying and landed	CMc
WS043	VP1	27/01/2021	09:23	Whooper Swan	3	25	10	15	0	0	cutover bog and improved agricultural grassland; flying and landed	CMc
WS044	VP1	27/01/2021	10:07	Whooper Swan	3	20	10	10	0	0	improved agricultural grassland; flying, lost to sight behind tree line	CMc
WS045	VP1	15/02/2021	18:37	Whooper Swan	25	10	10	0	0	0	improved agricultural grassland and watercourses; flying to roost, looked like the birds flew into the river/riverside of the embankment to roost	CMc

Table 7 - 4 - 21 Whooper Swan Vantage Point Survey (non-flight)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
WS046	VP1	13/02/2020	09:10	Whooper Swan	3	improved agricultural grassland; foraging on agricultural grassland upon arrival at the vp	CMc
WS047	VP1	17/12/2020	09:43	Whooper Swan	7	improved agricultural grassland; foraging, observed on the way to the vp	CMc

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
WS048	VP1	17/12/2020	09:44	Whooper Swan	5	improved agricultural grassland; foraging, observed on the way to the vp	CMc
WS049	VP1	17/12/2020	10:01	Whooper Swan	8	improved agricultural grassland; foraging, 5 flew away during 1st watch had returned by 2nd watch	CMc
WS050	VP1	17/12/2020	15:14	Whooper Swan	2	improved agricultural grassland; foraging, in view between a line of trees	CMc
WS051	VP1	27/01/2021	08:13	Whooper Swan	55	improved agricultural grassland; foraging, more birds could be heard further south but could not be seen through trees/fog. likely birds were roosting here	CMc
WS052	VP1	15/02/2021	12:46	Whooper Swan	57	improved agricultural grassland; foraging, mixed flock with mute swans	CMc

Table 7 - 4 - 22 Whooper Swan Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WS001	24/10/2019	not given	Whooper Swan	5	improved agricultural grassland; feeding adults, mixed flock of mute and whooper swans (wintering)	CMc
WS002	24/10/2019	not given	Whooper Swan	7	improved agricultural grassland; feeding (wintering)	CMc
WS003	24/10/2019	not given	Whooper Swan	119	improved agricultural grassland; feeding (wintering)	CMc
WS004	24/10/2019	not given	Whooper Swan	21	improved agricultural grassland; feeding (wintering)	CMc
WS005	25/10/2019	not given	Whooper Swan	5	improved agricultural grassland; feeding (wintering)	CMc
WS006	13/12/2019	not given	Whooper Swan	38	improved agricultural grassland; foraging on agricultural grassland (wintering)	CMc
WS007	13/12/2019	not given	Whooper Swan	6	improved agricultural grassland; foraging on agricultural grassland (wintering)	CMc
WS008	06/01/2021	12:14	Whooper Swan	18	improved agricultural grassland; foraging (wintering)	CMc
WS009	06/01/2021	12:30	Whooper Swan	15	improved agricultural grassland; foraging (wintering)	CMc
WS010	06/01/2021	12:38	Whooper Swan	1	improved agricultural grassland; foraging, single juvenile (wintering)	CMc
WS011	12/02/2021	11:37	Whooper Swan	3	improved agricultural grassland; foraging (wintering)	CMc
WS012	12/02/2021	11:47	Whooper Swan	42	improved agricultural grassland; foraging, spread out in the field (wintering)	CMc

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
WS013	12/02/2021	13:14	Whooper Swan	28	improved agricultural grassland; foraging and flushed, flew away as surveyor approached to get a clear view to count (wintering)	CMc
WS014	04/03/2021	09:44	Whooper Swan	37	improved agricultural grassland; foraging, non-flight (wintering)	CMc

Table 7 - 4 - 23 Incidental Whooper Swan Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS001	Hen Harrier Roost Survey, hhvp1 ballyouneen	29/01/2020	not given	Whooper Swan	74	improved agricultural grassland; foraging in agricultural grassland, visible from the hhvp	CMc
WS002	Hen Harrier Roost Survey, hhvp2 ballynagare	11/11/2020	not given	Whooper Swan	7	improved agricultural grassland; foraging , observed while on the way to hhvp2	CMc
WS003	Wildfowl Distribution Survey, ballynagare	17/11/2020	not given	Whooper Swan	11	improved agricultural grassland; flew off site and around the bog slowly turning north	CMc
WS004	Vantage Point Survey, ballynagare	17/12/2020	not given	Whooper Swan	50-60	improved agricultural grassland; local showed me a video of birds foraging, a few could be seen from the vp	CMc
WS005	Vantage Point Survey, lixnaw canal	17/12/2020	not given	Whooper Swan	1+	improved agricultural grassland; foraging, observed between vp watches	CMc
WS006	Vantage Point Survey, ballynagare	17/12/2020	not given	Whooper Swan	2	improved agricultural grassland; flushed , observed between vp watches	CMc
WS007	Vantage Point Survey, ballynagare	17/12/2020	not given	Whooper Swan	4	improved agricultural grassland; foraging, observed between vp watches	CMc
WS008	Hen Harrier Roost Survey, ballynagare	11/02/2021	16:01	Whooper Swan	16	improved agricultural grassland; foraging observed on the way to hhvp2	CMc
WS009	Hen Harrier Roost Survey, ballynagare	11/02/2021	16:02	Whooper Swan	6	improved agricultural grassland; foraging (possibly mute), possibly more present, only seen from the main road and through the trees	CMc

Table 7 - 4 - 24 Supplementary Whooper Swan Data (flights)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS001	VP2	08/04/2019	17:28	Whooper Swan	2	3	2	1	0	0	improved agricultural grassland; alighted from agricultural field, lost to sight behind trees	CMc
WS002	VP2	08/04/2019	19:15	Whooper Swan	1	70	20	50	0	0	estuaries; flying through site, landed in the estuary, lost to sight behind embankment, adult	CMc
WS003	VP2	08/04/2019	19:33	Whooper Swan	9	20	10	10	0	0	estuaries; heard calling for approximately 5 minutes, then flew up from behind embnkment, flew over field then lost to sight behind embankment again, adults	CMc
WS004	VP3	17/04/2019	15:31	Whooper Swan	3	5	5	0	0	0	grassland and marsh; flying low, lost to sight behind trees, looked to be coming in to land	CMc
WS005	VP2	04/09/2019	06:30	Whooper Swan	2	3	3	0	0	0	watercourses; flying along waterway/field	CMc
WS006	VP2	04/09/2019	07:21	Whooper Swan	2	15	15	0	0	0	watercourses; flying along watercourse	CMc
WS007	VP2	18/10/2019	18:20	Whooper Swan	3	18	8	10	0	0	watercourses and conifer plantation; flying	CMc
WS008	VP3	22/10/2019	13:42	Whooper Swan	15	7	7	0	0	0	improved agricultural grassland; disturbed by cattle, moved position	CMc
WS009	VP3	22/10/2019	15:01	Whooper Swan	5	83	65	18	0	0	grassland and marsh; took flight from field, flew around site and landed back with the rest of the flock	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS010	VP3	22/10/2019	15:02	Whooper Swan	5	54	3	45	6	0	grassland and marsh; as previous, except 3 birds separated and flew away	CMc
WS011	VP3	22/10/2019	16:49	Whooper Swan	2	22	0	15	7	0	grassland and marsh; left main flock and flew away	CMc
WS012	VP3	22/10/2019	18:05	Whooper Swan	4	18	6	12	0	0	grassland and marsh; left main flock and flew away	CMc
WS013	VP3	22/10/2019	19:00	Whooper Swan	20	18	3	0	0	0	watercourses; left flock, dropped behind embankment	CMc
WS014	VP3	22/10/2019	19:08	Whooper Swan	20	27	17	0	0	0	grassland and marsh; left field, lost to sight in the dim light	CMc
WS015	VP3	20/11/2019	07:45	Whooper Swan	2	7	5	2	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS016	VP3	20/11/2019	07:46	Whooper Swan	5	4	3	1	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS017	VP3	20/11/2019	07:48	Whooper Swan	3	4	3	1	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS018	VP3	20/11/2019	07:48	Whooper Swan	6	9	3	6	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS019	VP3	20/11/2019	07:49	Whooper Swan	2	3	3	0	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS020	VP3	20/11/2019	07:50	Whooper Swan	3	3	3	0	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS021	VP3	20/11/2019	07:51	Whooper Swan	4	7	5	2	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS022	VP3	20/11/2019	07:52	Whooper Swan	4	12	7	5	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS023	VP3	20/11/2019	08:04	Whooper Swan	2	3	3	0	0	0	improved agricultural grassland; leaving roost to go to foraging grounds	CMc
WS024	VP3	20/11/2019	08:04	Whooper Swan	9	11	4	4	3	0	improved agricultural grassland; moving between flocks	CMc
WS025	VP3	20/11/2019	08:12	Whooper Swan	6	7	3	4	0	0	improved agricultural grassland; moving between flocks	CMc
WS026	VP3	20/11/2019	08:16	Whooper Swan	2	9	5	4	0	0	improved agricultural grassland; moving between flocks	CMc
WS027	VP3	20/11/2019	08:21	Whooper Swan	3	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS028	VP3	20/11/2019	08:33	Whooper Swan	5	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS029	VP3	20/11/2019	08:36	Whooper Swan	4	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS030	VP3	20/11/2019	08:40	Whooper Swan	2	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS031	VP3	20/11/2019	08:46	Whooper Swan	7	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS032	VP3	20/11/2019	08:49	Whooper Swan	2	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS033	VP3	20/11/2019	09:23	Whooper Swan	3	7	7	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS034	VP3	20/11/2019	09:24	Whooper Swan	2	4	4	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS035	VP3	20/11/2019	09:25	Whooper Swan	5	12	12	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS036	VP3	20/11/2019	09:34	Whooper Swan	3	8	6	2	0	0	improved agricultural grassland; moving between flocks	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS037	VP3	20/11/2019	09:35	Whooper Swan	4	7	7	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS038	VP3	20/11/2019	09:36	Whooper Swan	2	8	8	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS039	VP3	20/11/2019	09:36	Whooper Swan	1	8	8	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS040	VP3	20/11/2019	09:39	Whooper Swan	2	5	3	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS041	VP3	20/11/2019	09:41	Whooper Swan	7	10	8	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS042	VP3	20/11/2019	09:41	Whooper Swan	2	10	8	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS043	VP3	20/11/2019	09:47	Whooper Swan	2	6	5	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS044	VP3	20/11/2019	09:48	Whooper Swan	1	10	8	2	0	0	improved agricultural grassland; moving between flocks	CMc
WS045	VP3	20/11/2019	09:50	Whooper Swan	1	4	4	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS046	VP3	20/11/2019	09:53	Whooper Swan	3	6	6	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS047	VP3	20/11/2019	09:55	Whooper Swan	2	6	6	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS048	VP3	20/11/2019	09:56	Whooper Swan	3	6	5	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS049	VP3	20/11/2019	09:59	Whooper Swan	2	6	5	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS050	VP3	20/11/2019	10:02	Whooper Swan	1	4	4	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS051	VP3	20/11/2019	10:02	Whooper Swan	1	5	4	1	0	0	improved agricultural grassland; moving between flocks	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS052	VP3	20/11/2019	10:03	Whooper Swan	2	5	4	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS053	VP3	20/11/2019	10:07	Whooper Swan	2	4	4	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS054	VP3	20/11/2019	10:10	Whooper Swan	8	5	5	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS055	VP3	20/11/2019	13:59	Whooper Swan	3	6	5	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS056	VP3	20/11/2019	14:00	Whooper Swan	1	11	8	3	0	0	improved agricultural grassland; moving between flocks	CMc
WS057	VP3	20/11/2019	14:19	Whooper Swan	1	4	4	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS058	VP3	20/11/2019	14:22	Whooper Swan	2	4	4	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS059	VP3	20/11/2019	14:36	Whooper Swan	2	7	6	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS060	VP3	20/11/2019	14:37	Whooper Swan	2	5	5	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS061	VP3	20/11/2019	14:54	Whooper Swan	38	5	5	0	0	0	improved agricultural grassland; moving between flocks	CMc
WS062	VP3	20/11/2019	14:58	Whooper Swan	6	4	3	1	0	0	improved agricultural grassland; moving between flocks	CMc
WS063	VP2	26/11/2019	13:01	Whooper Swan	4	23	0	0	23	0	improved agricultural grassland; flying	CMc
WS064	VP2	26/11/2019	14:51	Whooper Swan	1	3	3	0	0	0	freshwater; on water	CMc
WS065	VP2	29/11/2019	07:52	Whooper Swan	2	7	5	2	0	0	improved agricultural grassland; left roost to join swans south of vp	CMc
WS066	VP2	29/11/2019	07:55	Whooper Swan	1	5	5	0	0	0	watercourses; flying along watercourse	CMc

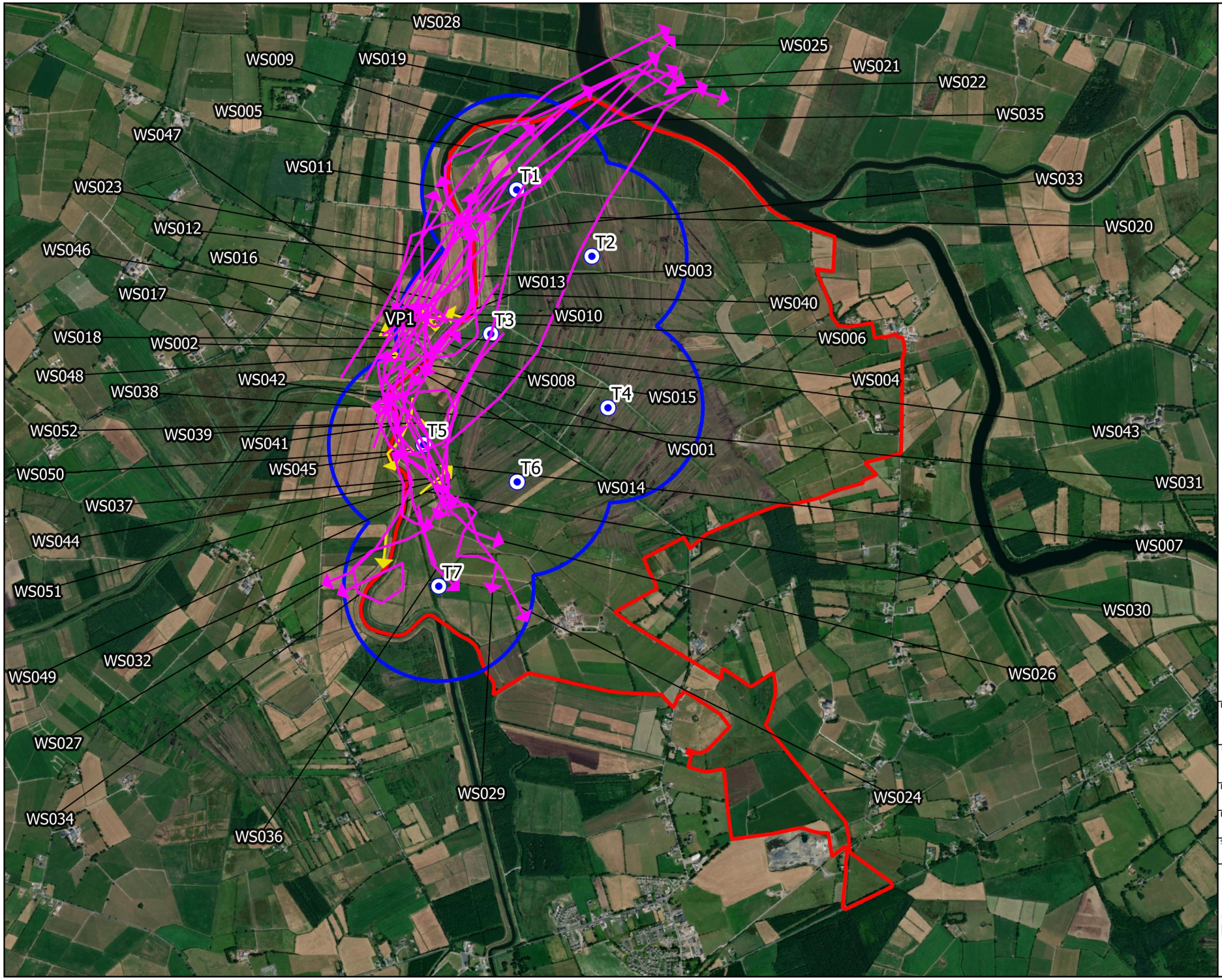
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS067	VP2	29/11/2019	07:55	Whooper Swan	16	8	3	5	0	0	improved agricultural grassland; left roost to go to foraging ground	CMc
WS068	VP2	29/11/2019	08:00	Whooper Swan	9	17	15	2	0	0	improved agricultural grassland; left roost to go to foraging ground	CMc
WS069	VP2	29/11/2019	08:00	Whooper Swan	16	17	15	2	0	0	improved agricultural grassland; left roost to go to foraging ground	CMc
WS070	VP2	29/11/2019	08:02	Whooper Swan	6	25	20	5	0	0	improved agricultural grassland; left roost to go to foraging ground	CMc
WS071	VP2	29/11/2019	08:03	Whooper Swan	12	18	16	2	0	0	improved agricultural grassland; left roost to go to foraging ground	CMc
WS072	VP2	29/11/2019	08:03	Whooper Swan	2	27	20	7	0	0	improved agricultural grassland; left roost to go to foraging ground	CMc
WS073	VP2	09/12/2019	12:41	Whooper Swan	5	7	7	0	0	0	grassland and marsh; flying and landed	CMc
WS074	VP2	09/12/2019	12:53	Whooper Swan	2	3	3	0	0	0	grassland and marsh; flying	CMc
WS075	VP2	09/12/2019	15:10	Whooper Swan	7	5	0	5	0	0	improved agricultural grassland; flying	CMc
WS076	VP3	12/12/2019	11:30	Whooper Swan	2	12	0	0	0	0	improved agricultural grassland; flying and landed	CMc
WS077	VP3	12/12/2019	11:31	Whooper Swan	4	8	0	0	0	0	improved agricultural grassland; moving position in the field	CMc
WS078	VP3	12/12/2019	11:32	Whooper Swan	3	2	0	0	0	0	improved agricultural grassland; landed in field	CMc
WS079	VP3	12/12/2019	11:38	Whooper Swan	7	34	0	0	0	0	improved agricultural grassland and watercourses; flying and landed	CMc
WS080	VP3	12/12/2019	11:56	Whooper Swan	1	5	5	0	0	0	improved agricultural grassland; landed	CMc
WS081	VP3	12/12/2019	12:06	Whooper Swan	2	5	2	3	0	0	improved agricultural grassland; flying and landed	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
WS082	VP3	12/12/2019	12:08	Whooper Swan	1	3	0	3	0	0	improved agricultural grassland; flying and landed	CMc
WS083	VP3	12/12/2019	12:09	Whooper Swan	2	4	4	0	0	0	improved agricultural grassland; flying and landed	CMc
WS084	VP3	12/12/2019	12:15	Whooper Swan	24	12	12	0	0	0	improved agricultural grassland; flying and landed	CMc
WS085	VP3	12/12/2019	12:15	Whooper Swan	6	12	1	11	0	0	improved agricultural grassland; flying and landed	CMc
WS086	VP3	12/12/2019	12:36	Whooper Swan	6	6	6	0	0	0	improved agricultural grassland; flying	CMc
WS087	VP3	12/12/2019	13:07	Whooper Swan	6	15	11	4	0	0	improved agricultural grassland; flying and landed	CMc
WS088	VP3	12/12/2019	13:18	Whooper Swan	2	3	3	0	0	0	improved agricultural grassland; landed	CMc
WS089	VP3	12/12/2019	13:49	Whooper Swan	6	10	8	2	0	0	improved agricultural grassland; flying and landed	CMc
WS090	VP3	12/12/2019	16:47	Whooper Swan	2	26	23	3	0	0	improved agricultural grassland; flying and landed	CMc
WS091	VP3	12/12/2019	16:53	Whooper Swan	5	26	23	3	0	0	improved agricultural grassland; flying and landed	CMc

Table 7 - 4 - 25 Supplementary Whooper Swan Data (non-flights)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
WS092	VP2	08/04/2019	not given	Whooper Swan	16	improved agricultural grassland and estuaries; 2 flocks across river 16 and 8 possibly more	CMc
WS093	VP2	08/04/2019	not given	Whooper Swan	8	improved agricultural grassland and estuaries; 2 flocks across river 16 and 8 possibly more	CMc
WS094	VP2	18/10/2019	not given	Whooper Swan	33	improved agricultural grassland; observed in fields throughout watch. possibly more present, line of sight slightly obscured from vp	CMc

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
WS095	VP2	09/12/2019	not given	Whooper Swan	41	improved agricultural grassland; foraging in field across the river vp throughout watch	CMc
WS096	VP2	09/12/2019	not given	Whooper Swan	14	improved agricultural grassland; foraging in field across the river vp throughout watch	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Whooper Swan Flights
- Whooper Swan Flights at PCH

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Drawing Title	Whooper Swan Vantage Point Survey
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-18
Scale: 1:26000	Date: 05.07.21

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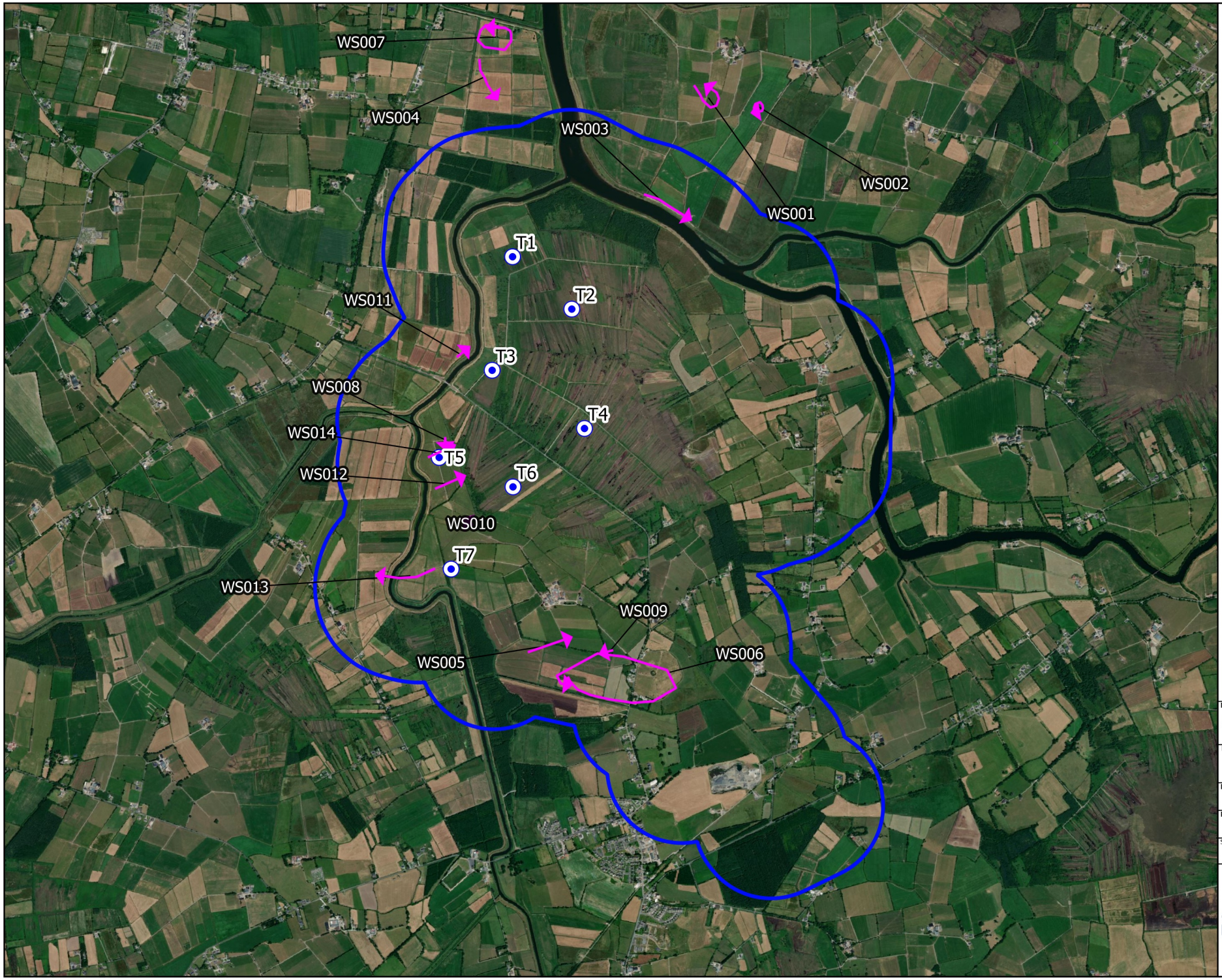

Map Legend

- 500m Survey Radius
- Turbine Location
- Whooper Swan Observations (winter season)

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Drawing Title: Whooper Swan Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-19
Scale	Date
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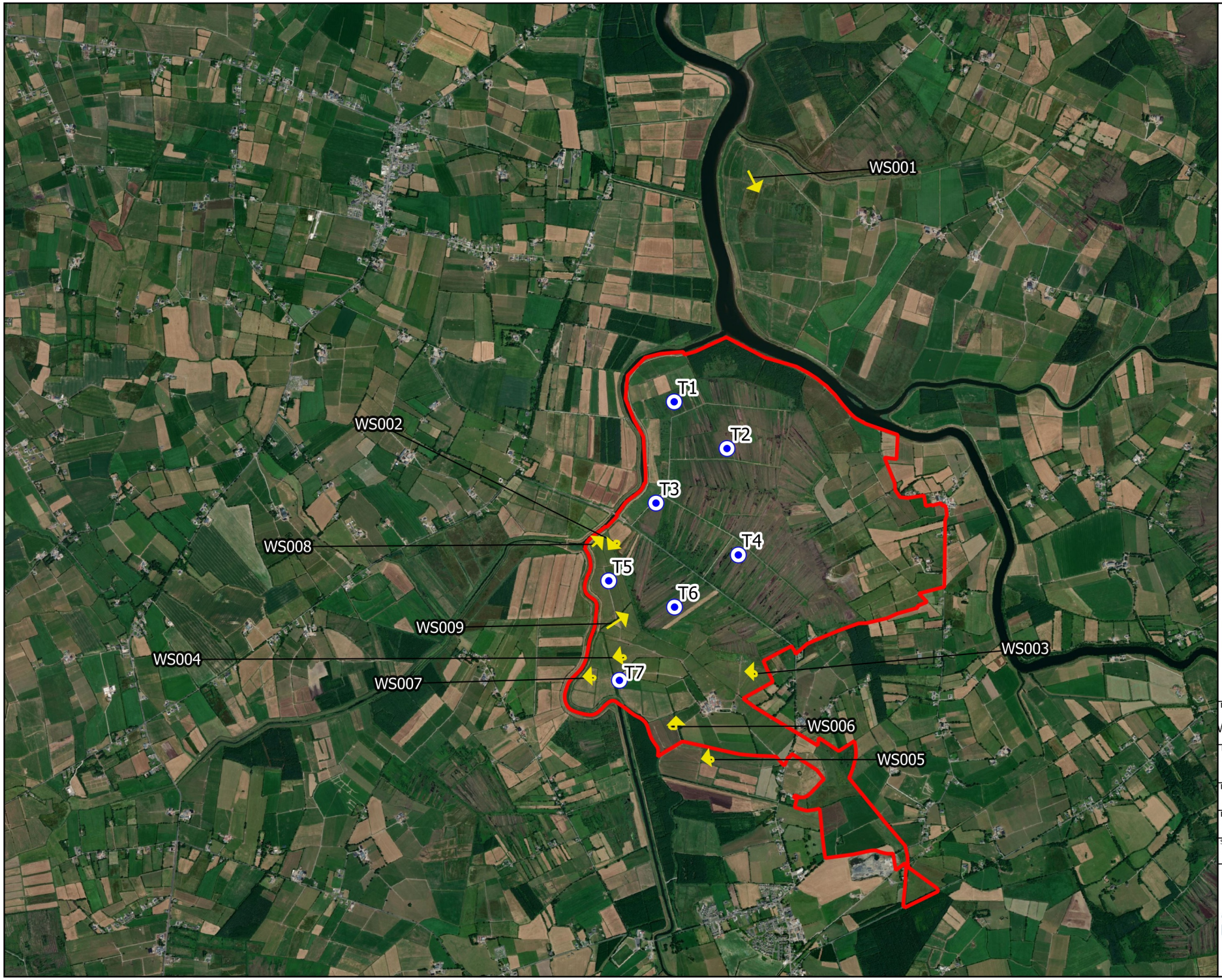

Map Legend

- Wind Farm Site
- Turbine Location
- Whooper Swan Observations

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Drawing Title: Whooper Swan Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-20
Scale	Date
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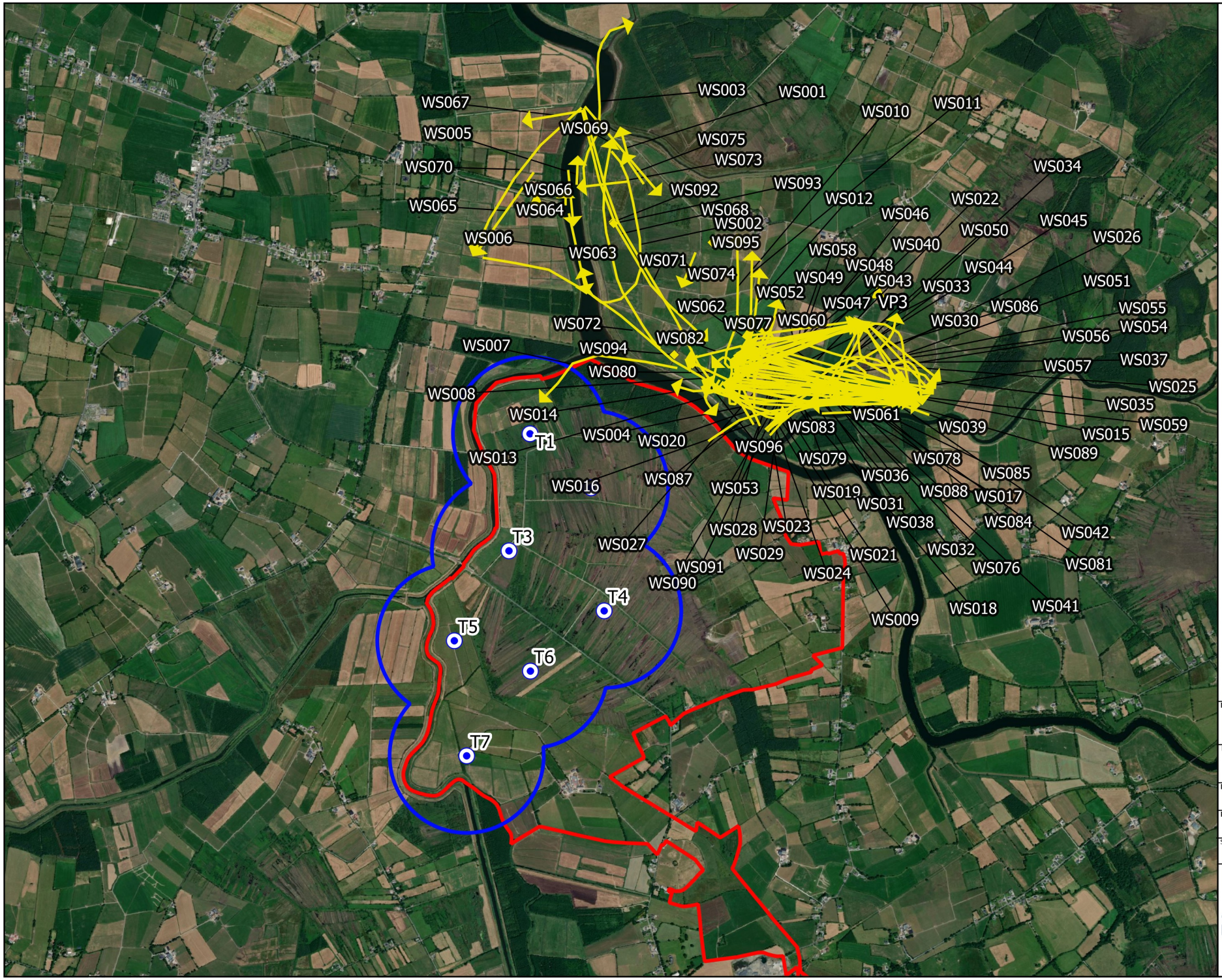
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WS001
WS010
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WS005
WS069
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WS073
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WS066
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WS068
WS046
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WS042
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WS029
WS021
WS032
WS091
WS076
WS081
WS090
WS024
T4
T5
WS009
WS018
WS041
T6
T7
Map Legend
Wind Farm Site
500m Radius of Turbines
Turbine Location
Supplementary Vantage Point
Whooper Swan Observations (flights)
Whooper Swan Observations (non-flights)
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Drawing Title
Whooper Swan Supplementary Data
Project Title
Ballynagare Wind Farm
Drawn By
S Doyle
Checked By
P Cregg
Project No.
200512
Drawing No.
Fig 7-4-21
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1.10 Black-headed Gull

Table 7 - 4 - 26 Black-headed Gull Vantage Point Survey (flights)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BH001	VP1	23/11/2020	12:51	Black-headed Gull	1	15	0	15	0	0	watercourses and improved agricultural grassland;	CMc
BH002	VP1	23/11/2020	14:25	Black-headed Gull	35	42	0	12	30	0	improved agricultural grassland and watercourses;	CMc
BH003	VP1	23/11/2020	14:45	Black-headed Gull	9	15	0	0	15	0	cutover bog, improved agricultural grassland and conifer plantation;	CMc
BH004	VP1	17/12/2020	16:31	Black-headed Gull	300	10	2	5	3	0	improved agricultural grassland; flying, this flight behaviour was repeated throughout watch	CMc

Table 7 - 4 - 27 Black-headed Gull Vantage Point Survey (non-flights)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
BH005	VP1	13/02/2020	15:50	Black-headed Gull	27	improved agricultural grassland; foraging on agricultural grassland upon arrival at the vp	CMc

Table 7 - 4 - 28 Black-headed Gull Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH001	Ballyhorgan Marshes	17/12/2019	not given	Black-headed Gull	15	improved agricultural grassland;	CMc
BH002	Ballynagare Bridge	18/02/2020	not given	Black-headed Gull	56	improved agricultural grassland;	CMc

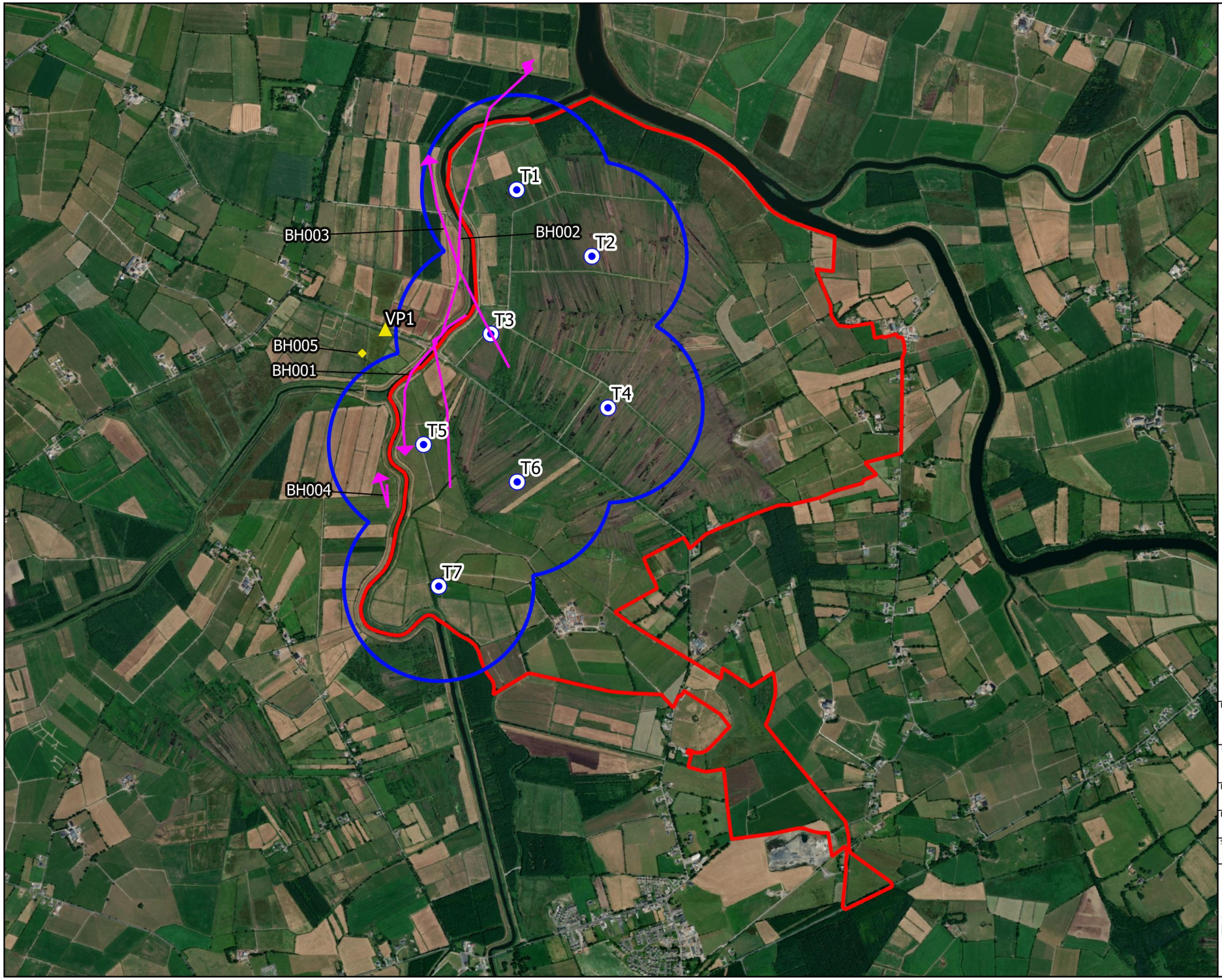
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH003	Ballyhorgan Marshes	18/02/2020	not given	Black-headed Gull	72	improved agricultural grassland;	CMc
BH004	Lixnaw Canal	04/11/2020	10:36	Black-headed Gull	150	improved agricultural grassland; foraging, flooded fields	CMc
BH005	Ballynagare	04/11/2020	10:41	Black-headed Gull	20	improved agricultural grassland; foraging, flooded fields	CMc
BH006	Ballynagare	17/11/2020	09:54	Black-headed Gull	52	improved agricultural grassland; foraging, flooded field	CMc
BH007	Ballyhorgan marshes	17/11/2020	10:27	Black-headed Gull	80	improved agricultural grassland; flying/foraging, approximate count, birds constantly flying around liw to the gound	CMc
BH008	Ballynagare	17/11/2020	14:03	Black-headed Gull	70	improved agricultural grassland; foraging	CMc
BH009	Ballynagare	18/12/2020	11:35	Black-headed Gull	30	improved agricultural grassland;	CMc
BH010	Ballynagare	18/12/2020	12:22	Black-headed Gull	32	improved agricultural grassland;	CMc
BH011	Ballyhorgan marshes	18/12/2020	12:46	Black-headed Gull	55	improved agricultural grassland;	CMc
BH012	Ballynagare	08/01/2021	15:53	Black-headed Gull	47	improved agricultural grassland;	CMc
BH013	Killarida	26/01/2021	11:05	Black-headed Gull	250	improved agricultural grassland;	CMc

Table 7 - 4 - 29 Incidental Black-headed Gull Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BH001	Vantage Point Survey, ballynagare	17/12/2020	not given	Black-Headed Gull	~300	improved agricultural grassland; pm of cu conservation was bird watching and reported these birds to the surveyor. were seen intermittently rising and dropping back down but were too far away to get accurate counts.	CMc

Table 7 - 4 - 30 Supplementary Black-headed Gull Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
BH001	VP2	09/08/2019	16:59	Black-headed Gull	1	10	0	0	10	0	improved agricultural grassland; flying through the site	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Black-headed Gull Flights at PCH
- Black-headed Gull non-flights

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Drawing Title: Black-headed Gull Vantage Point Survey

Project Title: Ballynagare Wind Farm

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Project No.	Drawing No.
200512	Fig 7-4-22
Scale	Date
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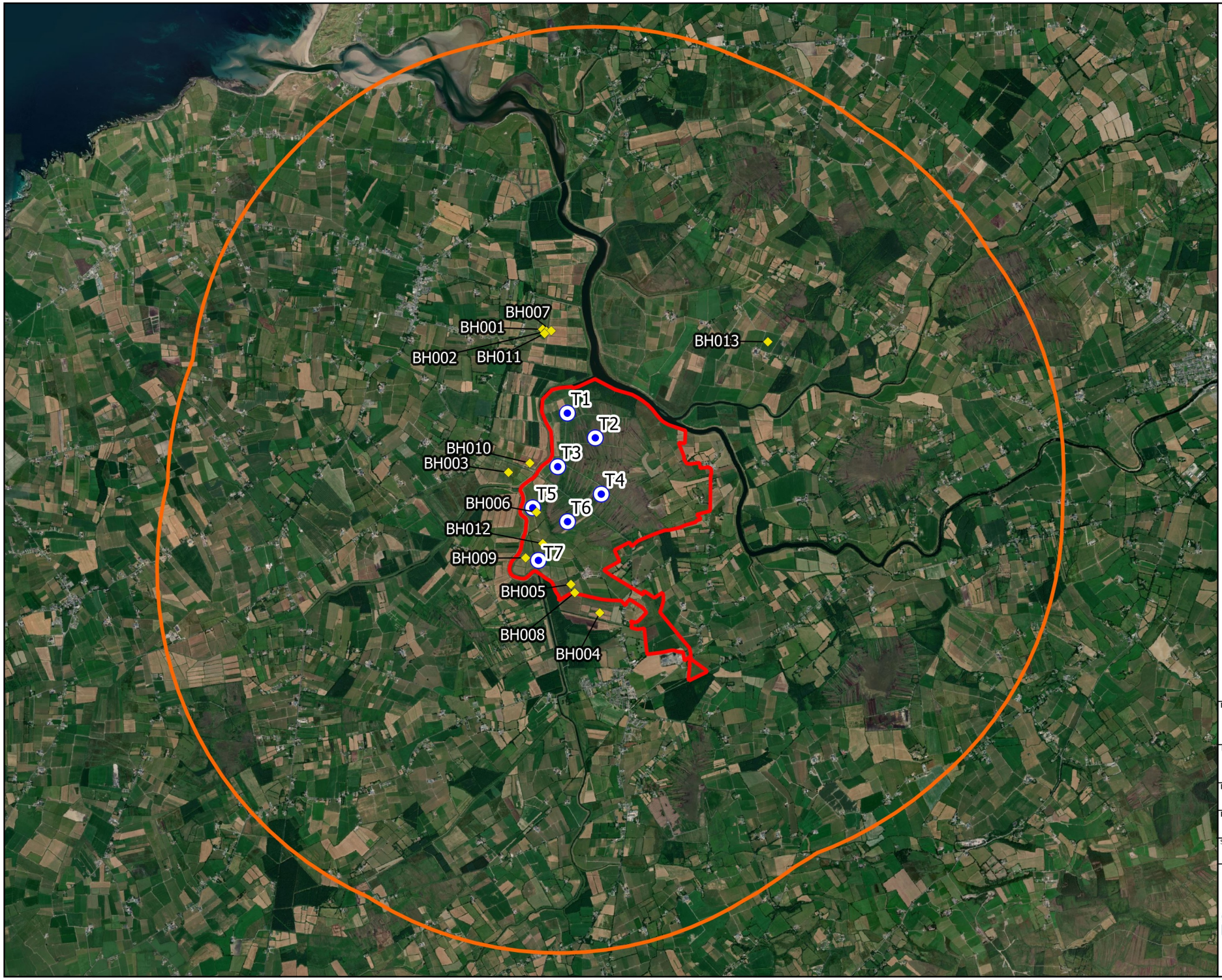

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Black-headed Gull Observations

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Drawing Title: Black-headed Gull Waterbird Distribution Survey

Project Title: Ballynagare Wind Farm

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Project No.	Drawing No.
200512	Fig 7-4-23
Scale	Date
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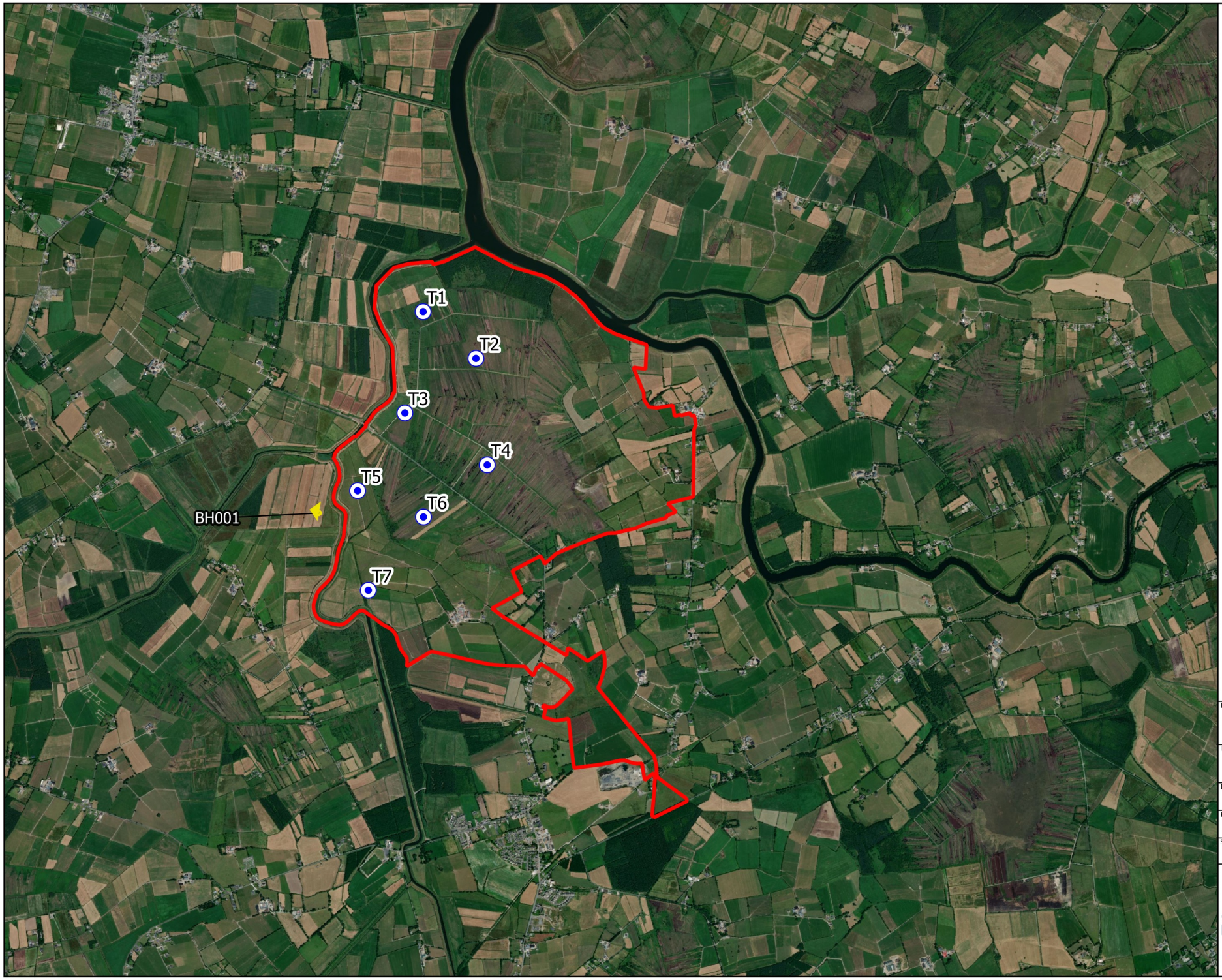

Map Legend

- Wind Farm Site
- Turbine Location
- Black-headed Gull Observations

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Drawing Title	Black-headed Gull Incidental Records
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-24
Scale: 1:37000	Date: 05.07.21

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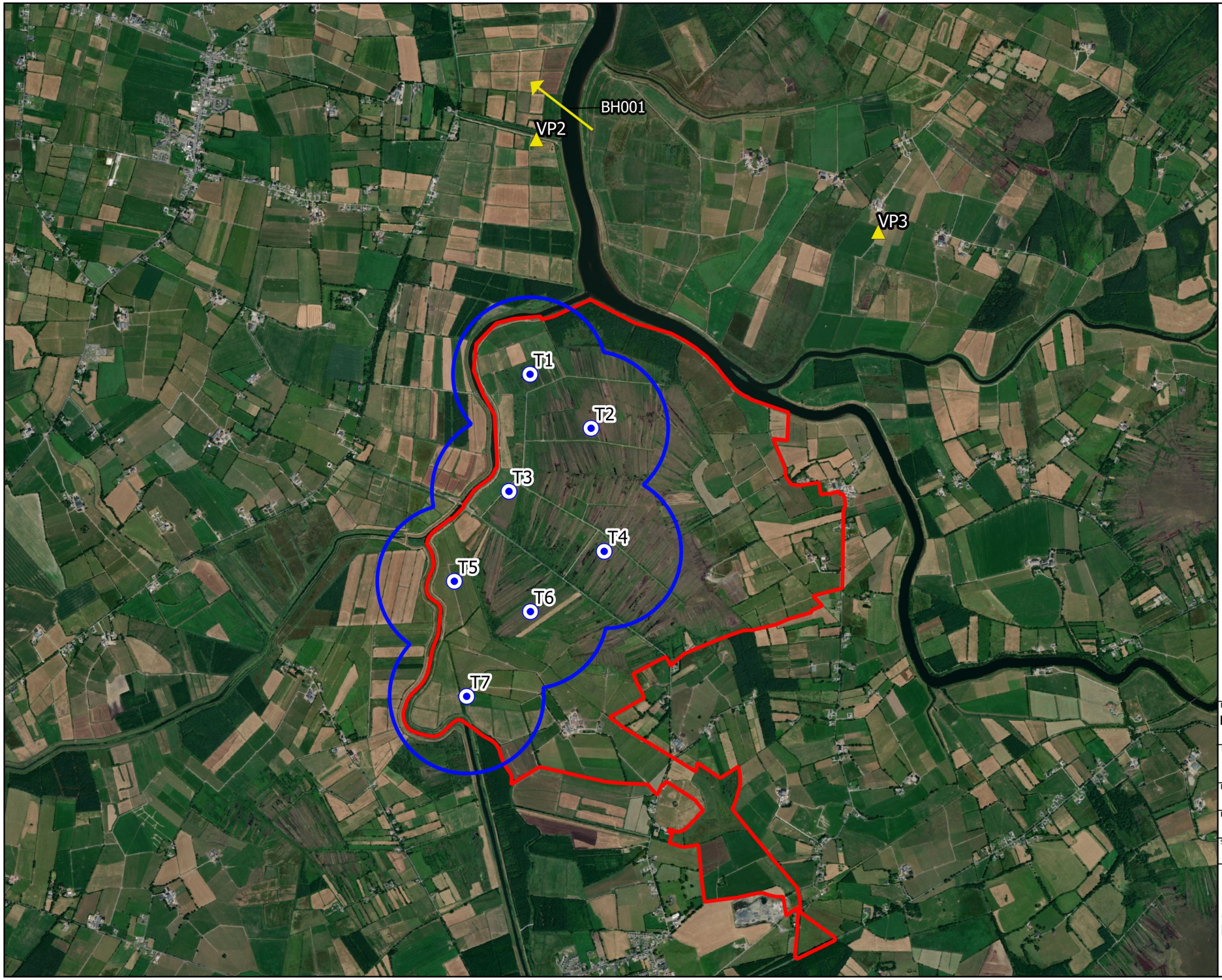

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Black-headed Gull Observations

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Drawing Title
Black-headed Gull Supplementary Data

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-25
Scale	Date
1:32000	05.07.21

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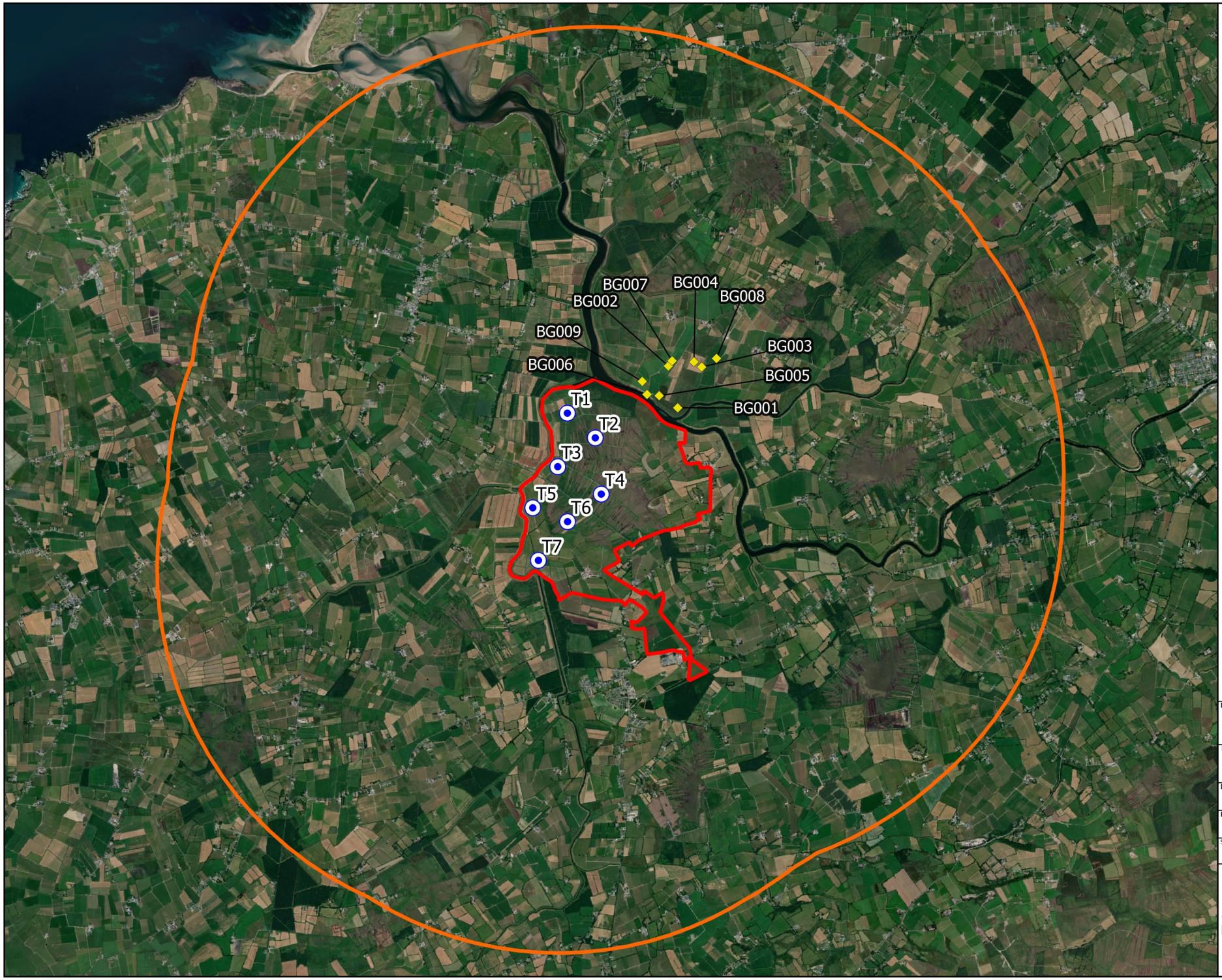
1.11 Brent Goose

Table 7 - 4 - 31 Brent Goose Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BG001	Ballyouneen	29/10/2019	not given	Brent Goose	5	improved agricultural grassland; present	CMc
BG002	Ballyouneen	21/11/2019	not given	Brent Goose	5	improved agricultural grassland; present	CMc
BG003	Ballyouneen	03/12/2019	not given	Brent Goose	5	improved agricultural grassland; present	CMc
BG004	Ballyouneen	03/01/2020	not given	Brent Goose	5	improved agricultural grassland; present	CMc
BG005	Ballyouneen	23/03/2020	not given	Brent Goose	2	improved agricultural grassland; foraging in agricultural grassland	CMc
BG006	Ballyouneen	02/05/2020	not given	Brent Goose	2	improved agricultural grassland; present	CMc
BG007	Ballyouneen	26/01/2021	11:20	Brent Goose	5	improved agricultural grassland; present	CMc
BG008	Ballyouneen	04/02/2021	12:13	Brent Goose	5	improved agricultural grassland; foraging	CMc
BG009	Ballyouneen	26/03/2021	11:14	Brent Goose	5	improved agricultural grassland; foraging	CMc

Table 7 - 4 - 32 Supplementary Brent Goose Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
BH001	VP3	20/11/2019	15:01	Brent Goose	5	15	1	2	12	0	improved agricultural grassland; flying and landed, joined flock of whooper swan	CMc
BH002	VP3	12/12/2019	11:26	Brent Goose	5	852	2	10	840	0	improved agricultural grassland; flying and landed	CMc
BH003	VP3	12/12/2019	12:15	Brent Goose	7	12	1	11	0	0	improved agricultural grassland; flying and landed	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Brent Goose Observations

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Drawing Title

Brent Goose
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-26
Scale	Date
1:70000	05.07.21

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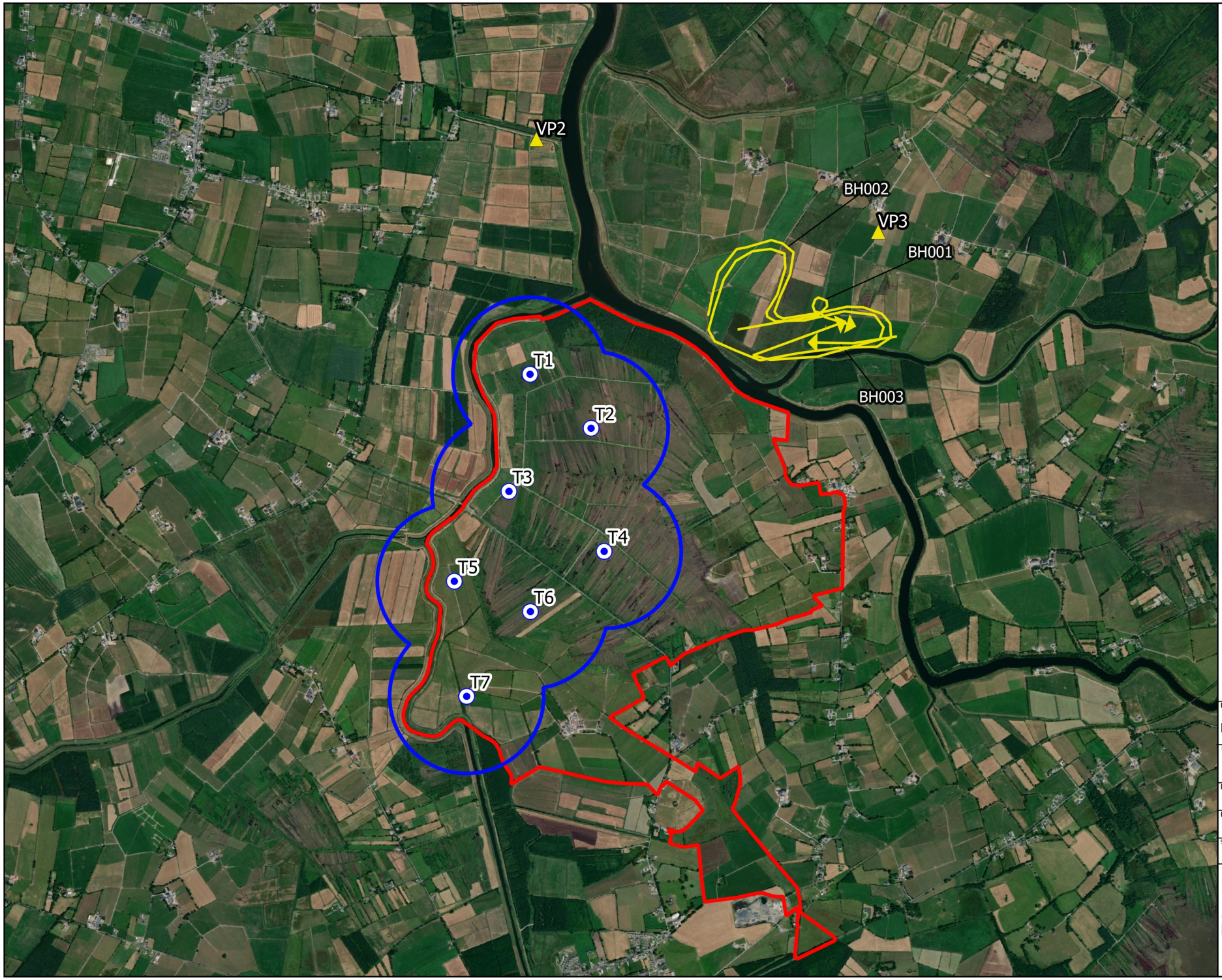

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Brent Goose Observations

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Drawing Title: Brent Goose Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-27
Scale	Date
1:32000	05.07.21

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1.12 Common Gull

Table 7 - 4 - 33 Common Gull Vantage Point Survey

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CM001	VP1	04/10/2019	18:59	Common Gull	13	20	0	0	20	0	watercourses and conifer plantation; flying	CMc

Table 7 - 4 - 34 Common Gull Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
CM001	24/10/2019	not given	Common Gull	6	improved agricultural grassland; feeding, mixed flock of great black-backed, lesser black-backed and common gulls (wintering)	CMc

Table 7 - 4 - 35 Common Gull Waterbird Distribution Survey

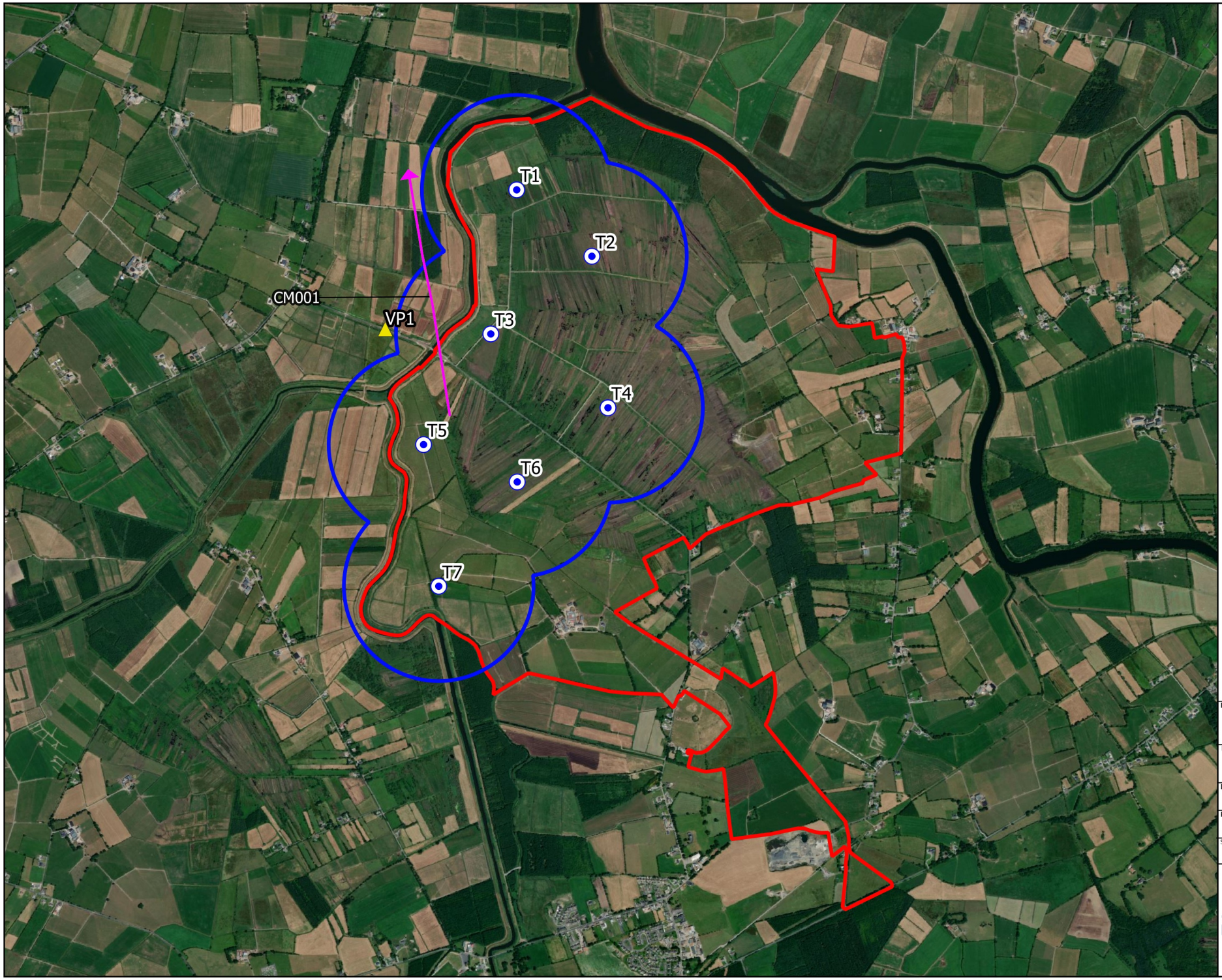
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CM001	River Cashen	26/08/2019	not given	Common Gull	3	estuaries; standing on sediment in estuary	CMc
CM002	Ballyouneen	12/09/2019	not given	Common Gull	1	watercourses; flying along watercourse 20-30m	CMc
CM003	Ballyouneen	12/09/2019	not given	Common Gull	1	watercourses; on an island of sediment in the middle of the waterway	CMc
CM004	Ardcullen Marshes	12/09/2019	not given	Common Gull	1	watercourses; roosting at rivers edge	CMc
CM005	Ballyouneen	30/09/2019	not given	Common Gull	5	improved agricultural grassland; flying over field at 30-40m	CMc
CM006	The Cashen	11/10/2019	not given	Common Gull	86	muddy sand shores; roosting on the sand	CMc
CM007	Ballyhorgan Marshes	17/12/2019	not given	Common Gull	2	improved agricultural grassland; present	CMc
CM008	Killarida	26/01/2021	11:06	Common Gull	50	improved agricultural grassland; present	CMc

Table 7 - 4 - 36 Incidental Common Gull Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CM001	Vantage Point Survey, vp3	27/04/2019	not given	Common Gull	<120	improved agricultural grassland; flock of gulls flew through in the dark at 07:05, not bright enough to confirm i.d.	CMc
CM002	Vantage Point Survey, vp2	04/09/2019	not given	Common Gull	<200	improved agricultural grassland; during the first hour, over 200 gulls flew through in the dark. could not i.d. them accurately in low light conditions, in pch, flying along waterway.	CMc

Table 7 - 4 - 37 Supplementary Common Gull Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CM001	VP2	08/04/2019	19:22	Common Gull	105	120	0	0	120	0	estuaries; large flock of gulls flying through the site	CMc
CM002	VP2	09/08/2019	17:25	Common Gull	4	20	0	0	20	0	improved agricultural grassland; flying through the site	CMc
CM003	VP2	09/08/2019	19:51	Common Gull	230	40	0	0	40	0	estuaries and conifer plantation; flying through the site in a long drawn out group	CMc
CM004	VP2	09/08/2019	20:09	Common Gull	35	30	0	0	30	0	estuaries and conifer plantation; flying through the site	CMc
CM005	VP2	09/08/2019	20:27	Common Gull	50	20	0	0	20	0	conifer plantation; mixed flock of birds, moving around too much to get an accurate count, likely count <50	CMc
CM006	VP3	12/08/2019	20:44	Common Gull	11	25	0	0	25	0	grassland and marsh; flying through the site	CMc
CM007	VP3	12/08/2019	20:59	Common Gull	18	25	0	0	25	0	grassland and marsh; flying through the site	CMc
CM008	VP2	04/09/2019	10:55	Common Gull	1	15	0	5	10	0	watercourses; flying	CMc
CM009	VP2	18/10/2019	16:54	Common Gull	20	157	120	37	0	0	watercourses; flying along watercourse	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Common Gull Flights at PCH

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Drawing Title	Common Gull Vantage Point Survey
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-28
Scale: 1:26000	Date: 05.07.21

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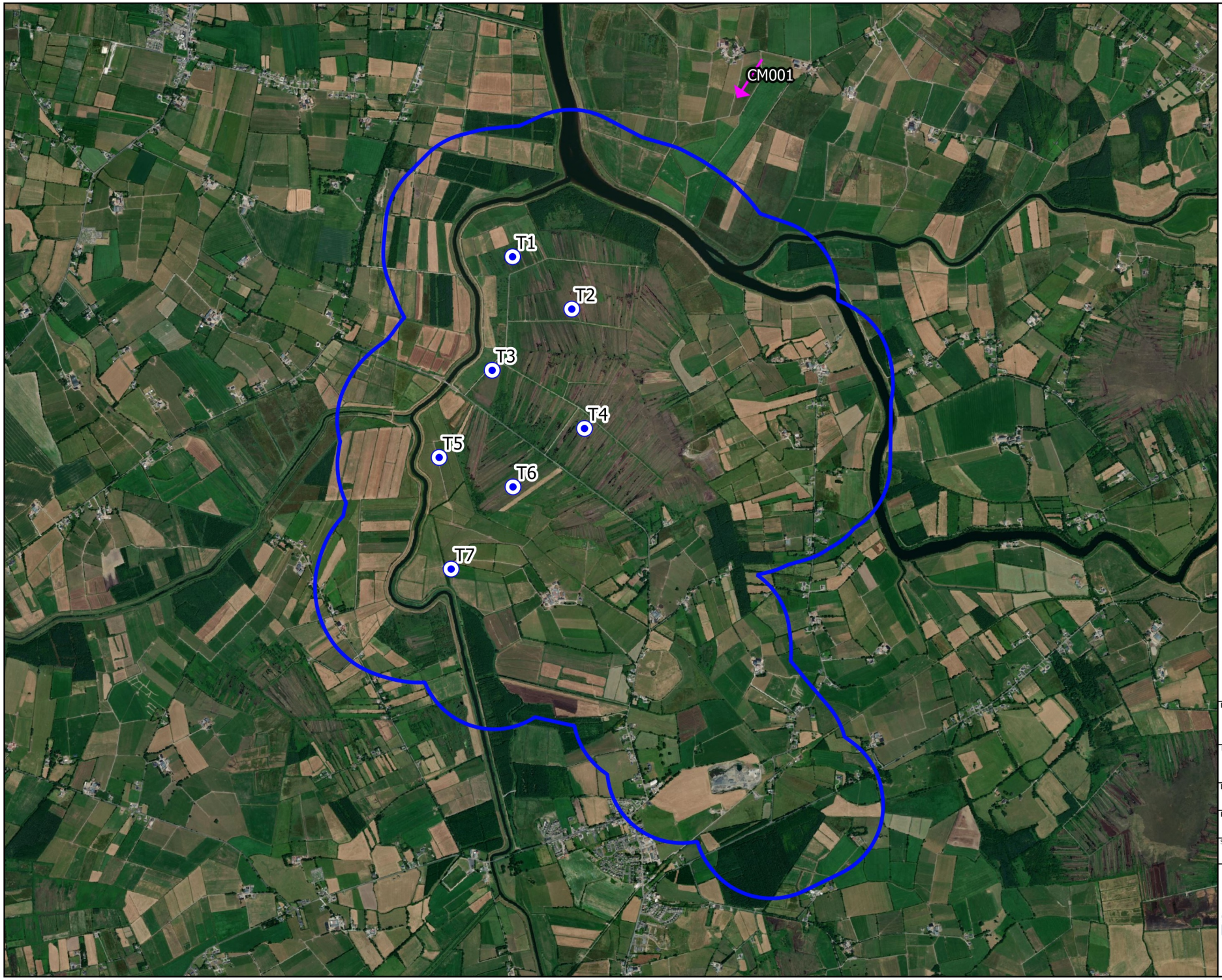

Map Legend

- 500m Survey Radius
- Turbine Location
- Common Gull Observations (winter season)

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Drawing Title: Common Gull Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-29
Scale	Date
1:33000	05.07.21

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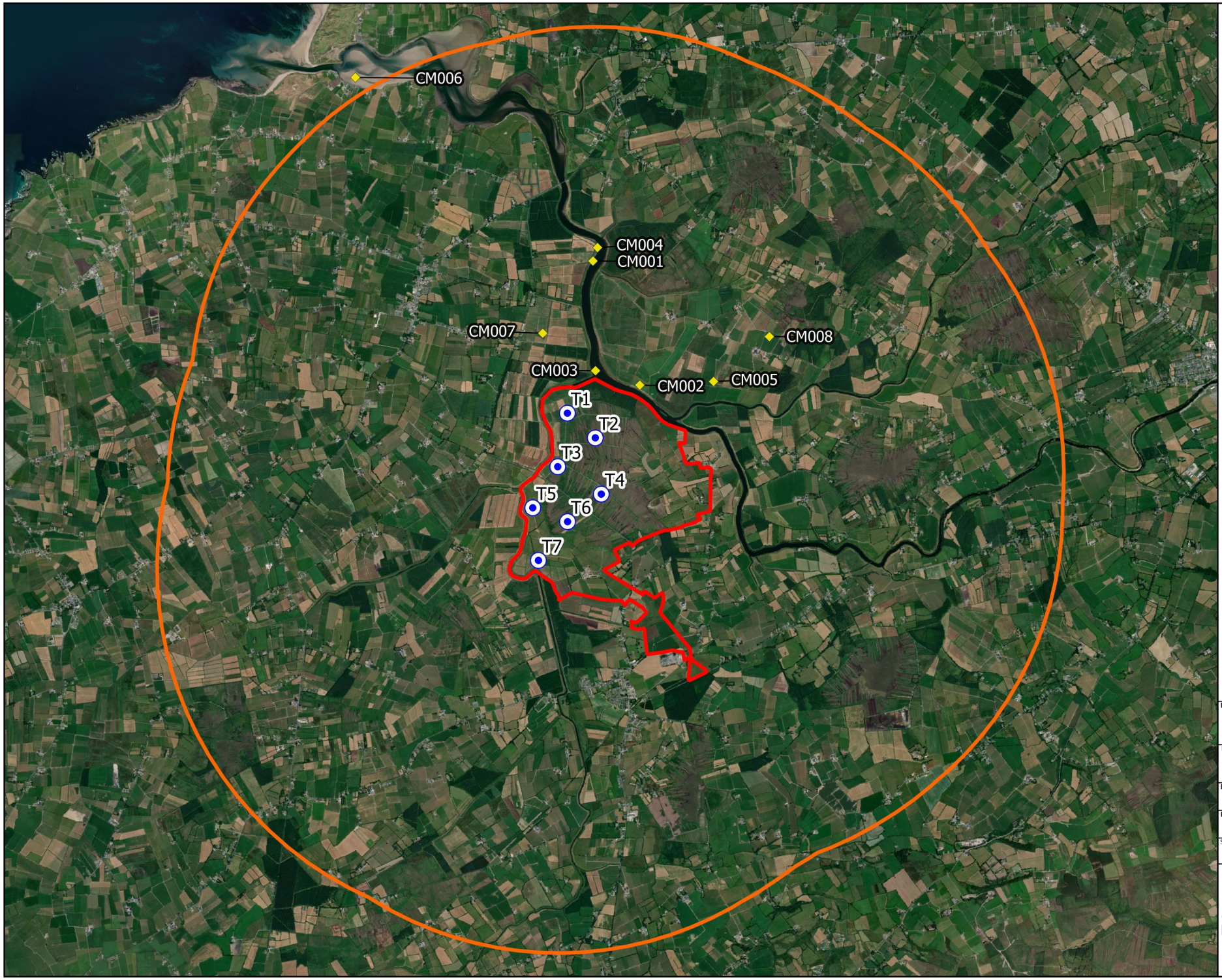

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Common Gull Observations

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Drawing Title

Common Gull
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-30
Scale	Date
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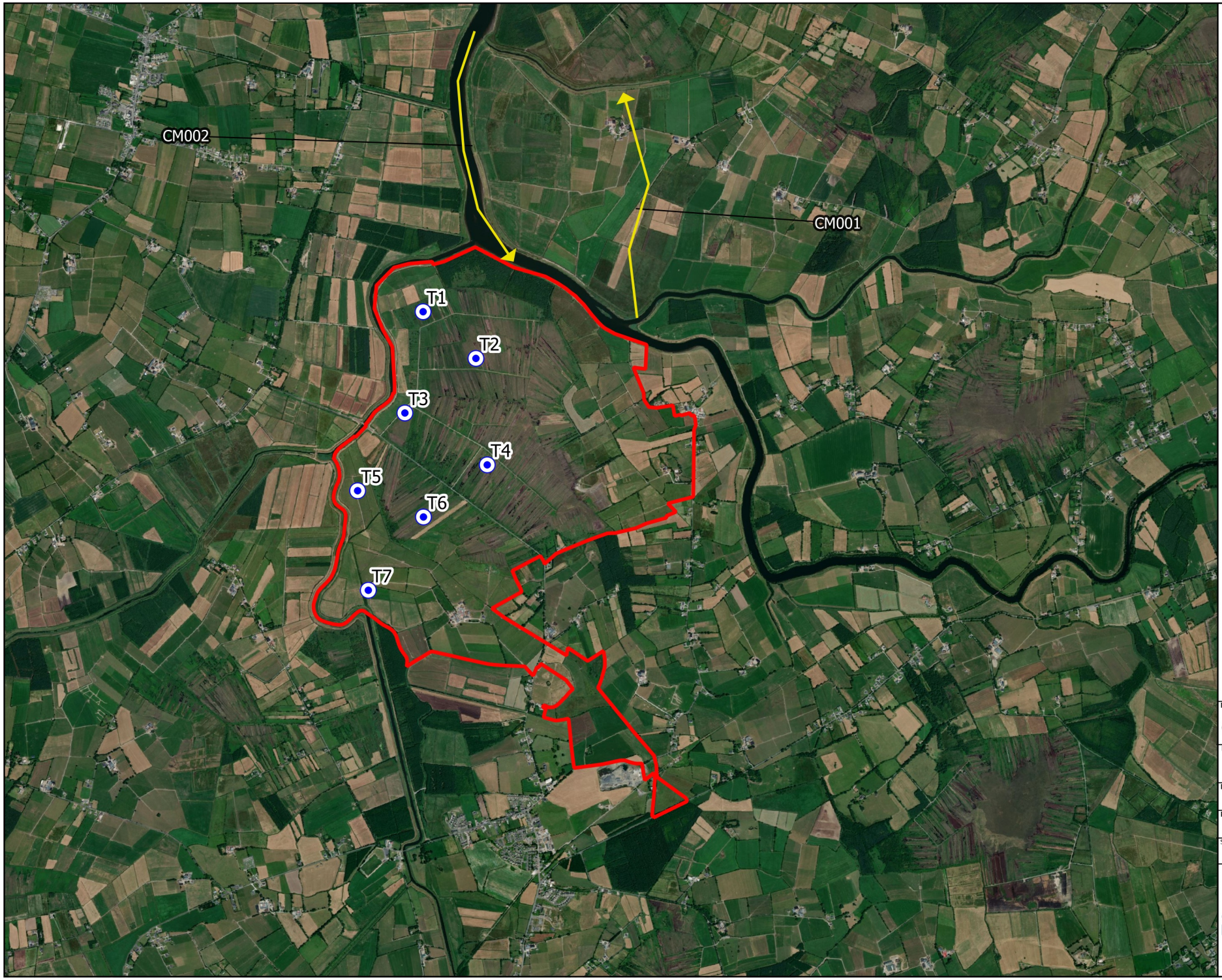

Map Legend

- Wind Farm Site
- Turbine Location
- Common Gull Observations

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Drawing Title: Common Gull Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-31
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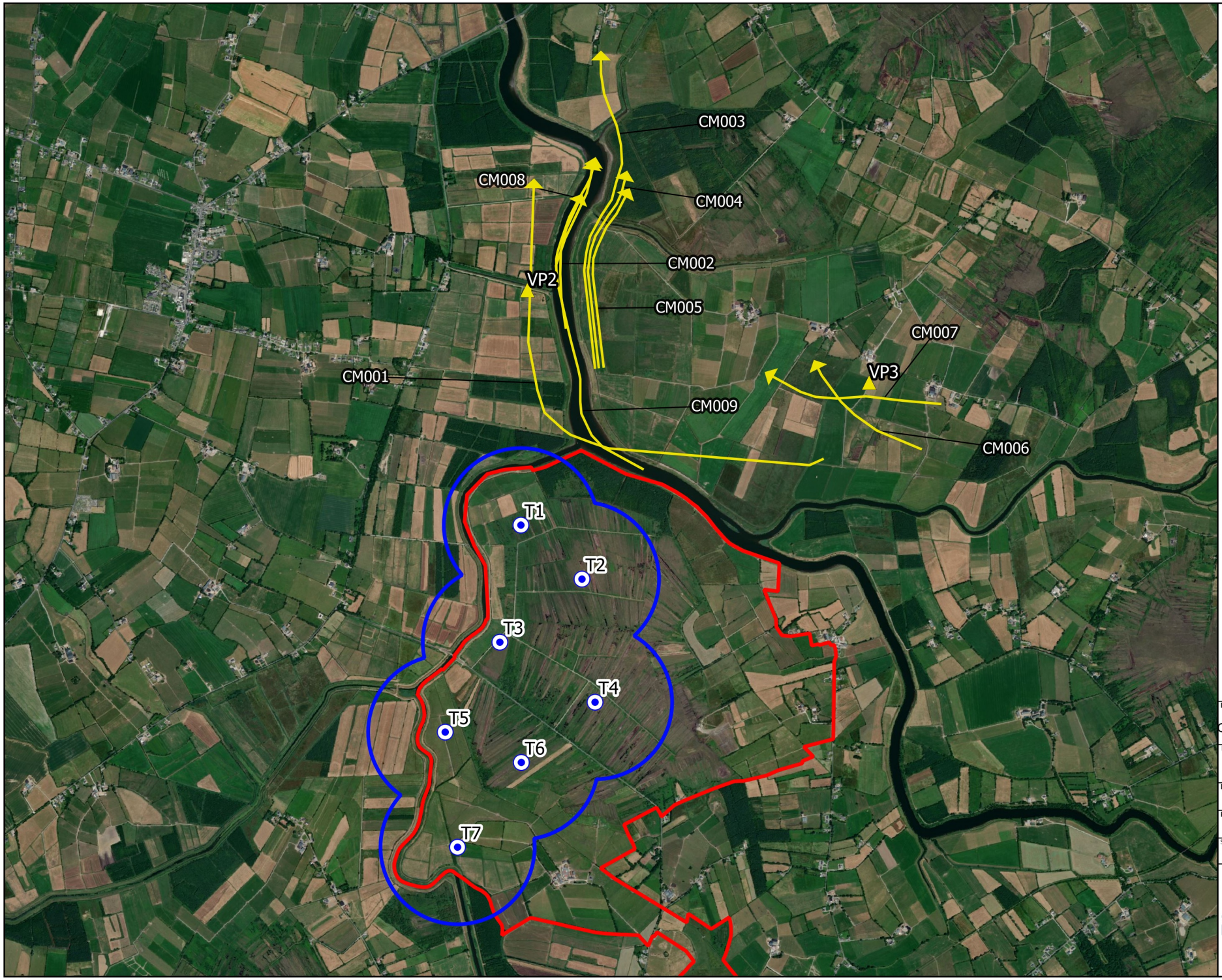

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Common Gull Observations

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Drawing Title: Common Gull Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
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Scale	Date
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1.13 Cormorant

Table 7 - 4 - 38 Cormorant Vantage Point Survey (flights; lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CA001	VP1	14/05/2019	10:17	Cormorant	1	30	0	20	10	0	estuaries; flying through site, lost to sight behind embankment	CMc

Table 7 - 4 - 39 Cormorant Vantage Point Survey (flights; upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CA002	VP1	28/01/2020	13:30	Cormorant	1	8	5	3	0	0	watercourses; flying though	CMc
CA003	VP1	28/01/2020	15:59	Cormorant	1	22	0	0	22	0	watercourses; flying though	CMc
CA004	VP1	13/02/2020	09:58	Cormorant	1	7	7	0	0	0	improved agricultural grassland; flew away out of flooded drain	CMc
CA005	VP1	24/03/2020	06:25	Cormorant	1	23	0	23	0	0	grassland and marsh; flying	CMc
CA006	VP1	01/05/2020	06:35	Cormorant	1	42	0	0	42	0	watercourses; flying along watercourse	CMc
CA007	VP1	09/07/2020	15:27	Cormorant	1	10	0	0	10	0	improved agricultural grassland; flying through	CMc
CA008	VP1	16/09/2020	12:00	Cormorant	1	12	5	10	0	0	watercourses; flying	CMc
CA009	VP1	23/11/2020	12:47	Cormorant	1	27	5	2	20	0	watercourses and improved agricultural grassland;	CMc
CA010	VP1	15/02/2021	14:17	Cormorant	1	7	2	5	0	0	watercourses; flying and landed	CMc
CA011	VP1	15/02/2021	15:03	Cormorant	1	25	5	20	0	0	watercourses; flying and landed in river	CMc
CA012	VP1	22/03/2021	07:26	Cormorant	1	20	0	0	20	0	watercourses and improved agricultural grassland; flying	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CA013	VP1	22/03/2021	07:42	Cormorant	1	25	0	25	0	0	watercourses and improved agricultural grassland; flying	CMc
CA014	VP1	22/03/2021	11:24	Cormorant	1	15	0	10	5	0	watercourses, cutover bog and conifer plantation; flying	CMc

Table 7 - 4 - 40 Cormorant Vantage Point Survey (non-flight)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
CA015	VP1	23/11/2020	12:42	Cormorant	1	watercourses; feeding	CMc

Table 7 - 4 - 41 Cormorant Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
CA001	24/05/2020	not given	Cormorant	1	improved agricultural grassland; flying through, 25-200m, 5 secs (flyover; non-breeding)	CMc
CA002	06/01/2021	11:33	Cormorant	1	watercourses; flying (wintering)	CMc

Table 7 - 4 - 42 Cormorant Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA001	River Cashen	26/08/2019	not given	Cormorant	7	estuaries; standing on a raised area in the estuary, with a mixed flock of 60+ gulls (lesser black-back and common gull adults and juveniles, too densly packed and moving too much to accurately count)	CMc
CA002	River Cashen	26/08/2019	not given	Cormorant	1	watercourses; flying along the watercourse	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA003	River Cashen	26/08/2019	not given	Cormorant	1	improved agricultural grassland and watercourses; flying along the watercourse and over field	CMc
CA004	Ballyouneen	12/09/2019	not given	Cormorant	1	watercourses; flying along watercourse at 15m	CMc
CA005	Ballyouneen	12/09/2019	not given	Cormorant	2	watercourses; on an island of sediment in the middle of the waterway	CMc
CA006	Ardcullen Marshes	12/09/2019	not given	Cormorant	2	watercourses; drying wings	CMc
CA007	The Cashen	11/10/2019	not given	Cormorant	2	muddy sand shores; feeding on the water	CMc
CA008	Ballyouneen	11/10/2019	not given	Cormorant	2	muddy sand shores; drying their wings at rivers edge	CMc

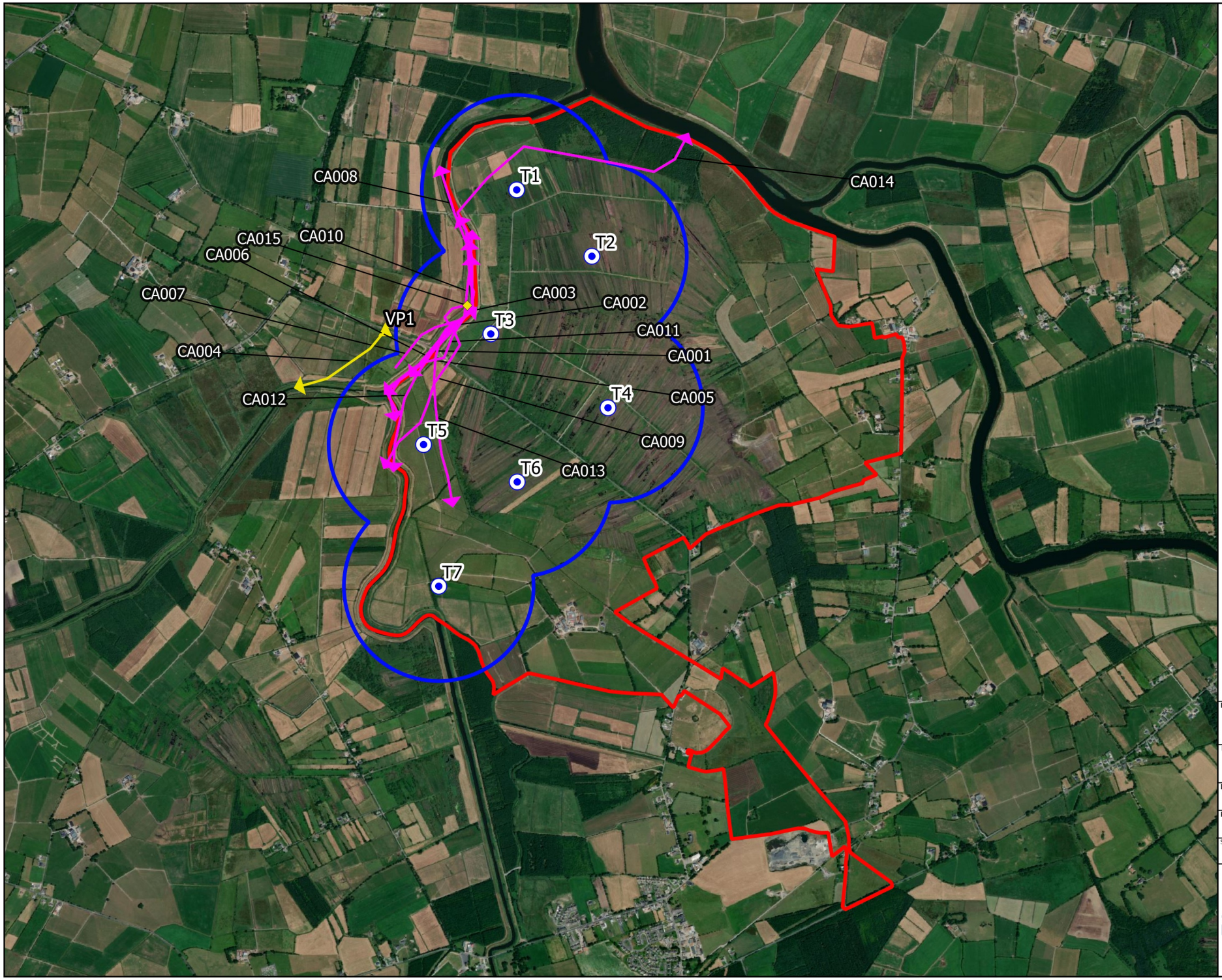
Table 7 - 4 - 43 Incidental Cormorant Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CA001	Hen Harrier Roost Survey, hhvp1 kilteean	20/12/2019	not given	Cormorant	1	improved agricultural grassland; observed	GM
CA002	Hen Harrier Roost Survey, hhvp1	20/02/2020	not given	Cormorant	1	improved agricultural grassland; flying through at 25-200m	CMc

Table 7 - 4 - 44 Supplementary Cormorant Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CA001	VP2	08/04/2019	18:40	Cormorant	1	5	0	5	0	0	estuaries; flying along estuary, adult	CMc
CA002	VP2	08/04/2019	19:25	Cormorant	1	10	0	10	0	0	grassland and marsh; flying through site	CMc
CA003	VP2	09/05/2019	10:30	Cormorant	1	2	2	0	0	0	freshwater; on the water feeding	CMc
CA004	VP2	12/07/2019	16:05	Cormorant	1	5	0	5	0	0	estuaries; flying through site	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CA005	VP2	09/08/2019	17:56	Cormorant	1	25	25	0	0	0	canals; landed in the canal, began fishing and then went out into the estuary out of sight	CMc
CA006	VP2	04/09/2019	08:35	Cormorant	1	10	0	10	0	0	watercourses; flying through	CMc
CA007	VP2	04/09/2019	10:47	Cormorant	1	10	0	0	10	0	watercourses; flying	CMc
CA008	VP2	04/09/2019	11:40	Cormorant	1	10	0	0	10	0	watercourses; flying	CMc
CA009	VP3	27/09/2019	07:30	Cormorant	1	25	0	25	0	0	grassland and marsh; flying through	CMc
CA010	VP3	27/09/2019	08:04	Cormorant	1	15	0	15	0	0	grassland and marsh; flying through	CMc
CA011	VP2	18/10/2019	18:03	Cormorant	2	4	2	2	0	0	watercourses; flying along watercourse	CMc
CA012	VP2	26/11/2019	15:01	Cormorant	1	10	0	10	0	0	grassland and marsh; flying	CMc
CA013	VP2	09/12/2019	12:15	Cormorant	1	18	0	0	18	0	watercourses; flying	CMc
CA014	VP2	09/12/2019	12:29	Cormorant	1	9	2	7	0	0	watercourses; flying	CMc
CA015	VP2	09/12/2019	14:15	Cormorant	1	7	0	0	7	0	watercourses; flying	CMc
CA016	VP2	09/12/2019	14:17	Cormorant	1	3	0	3	0	0	watercourses; flying	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Cormorant Flights at PCH
- Cormorant Flights

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Drawing Title: Comorant Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-33
Scale	Date
1:26000	05.07.21

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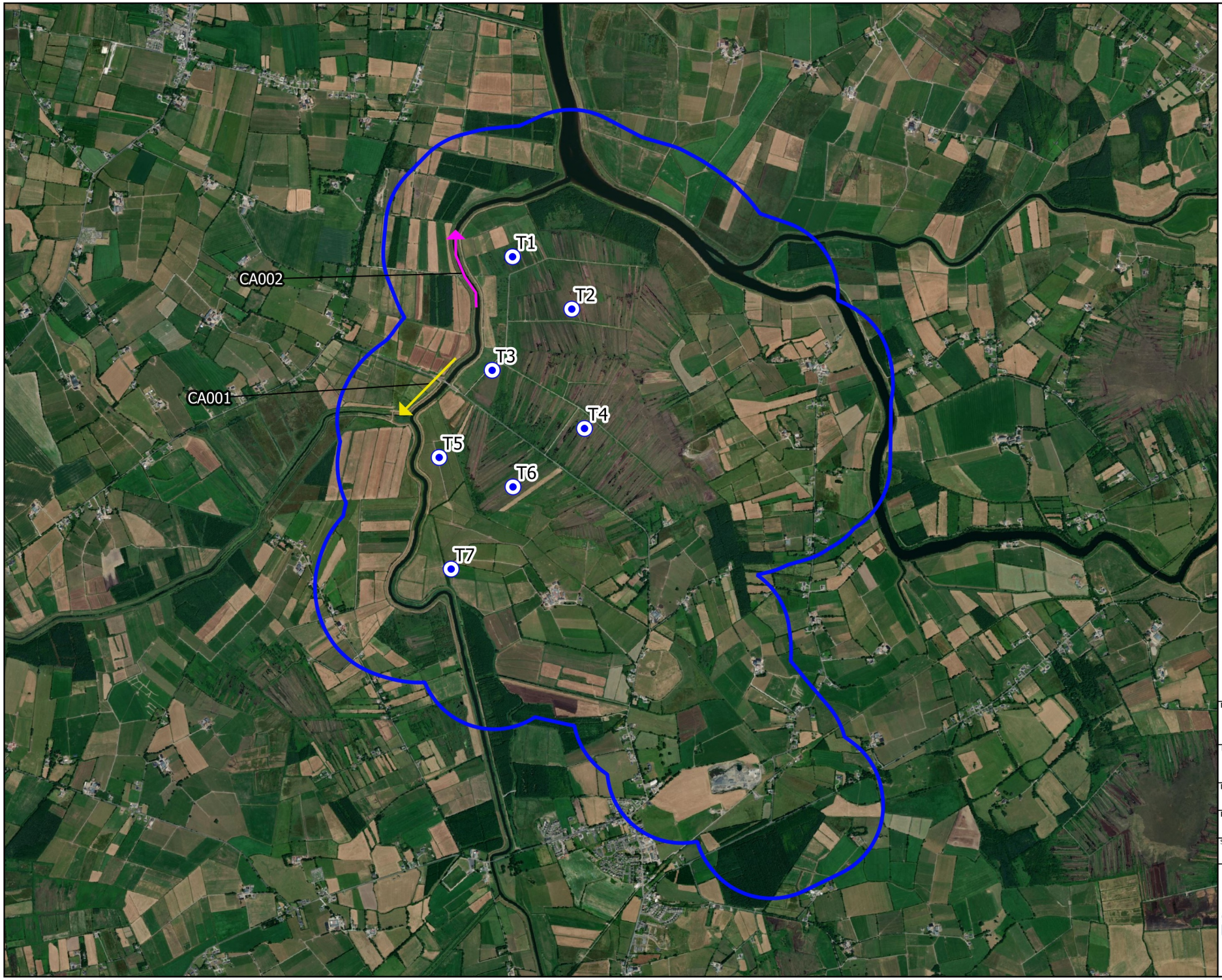

Map Legend

- 500m Survey Radius
- Turbine Location
- Cormorant Observation (breeding season)
- Cormorant Observation (winter season)

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Drawing Title: Cormorant Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-34
Scale	Date
1:33000	05.07.21

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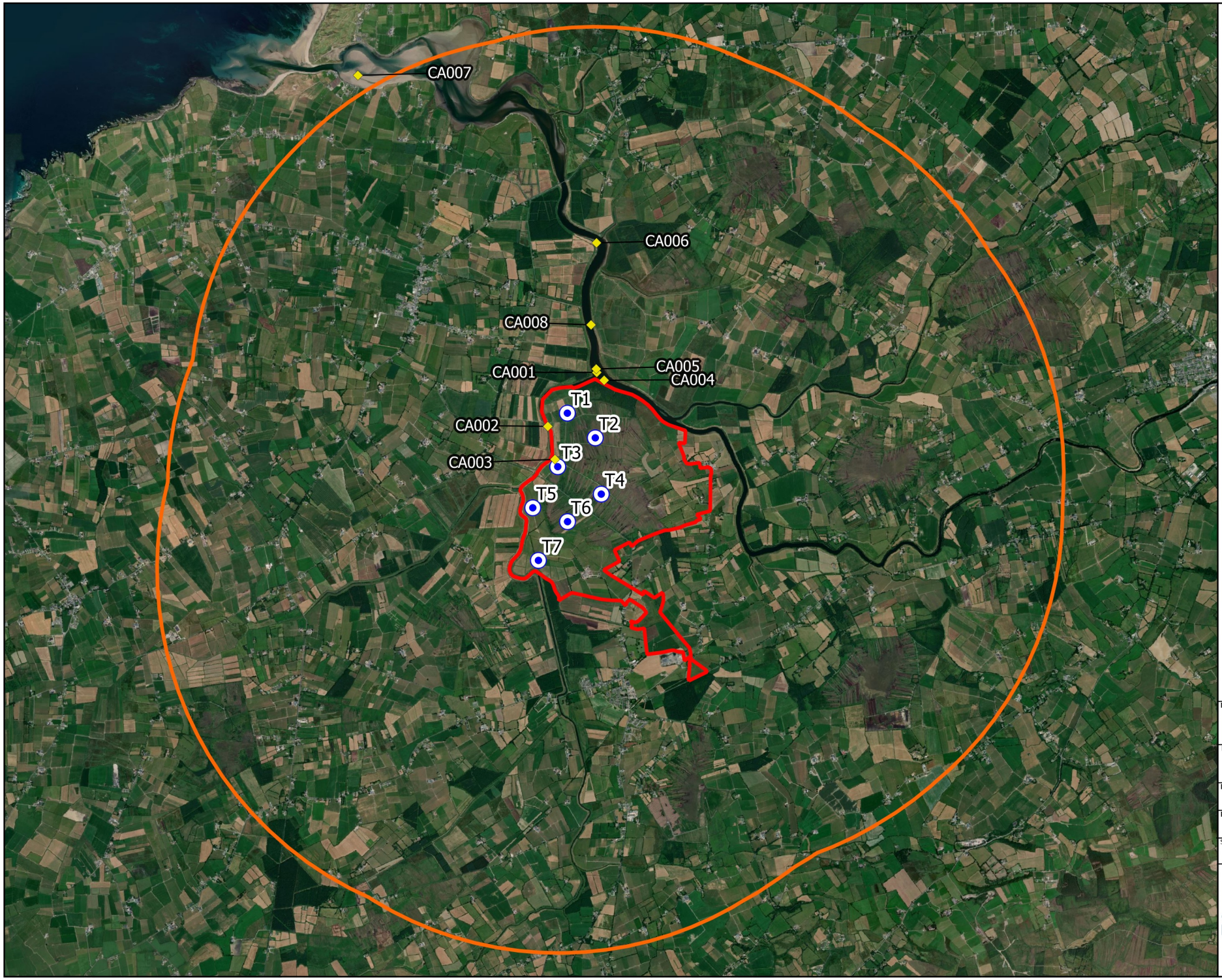

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Cormorant Observation

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N

Drawing Title

Cormorant
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-35
Scale	Date
1:70000	05.07.21

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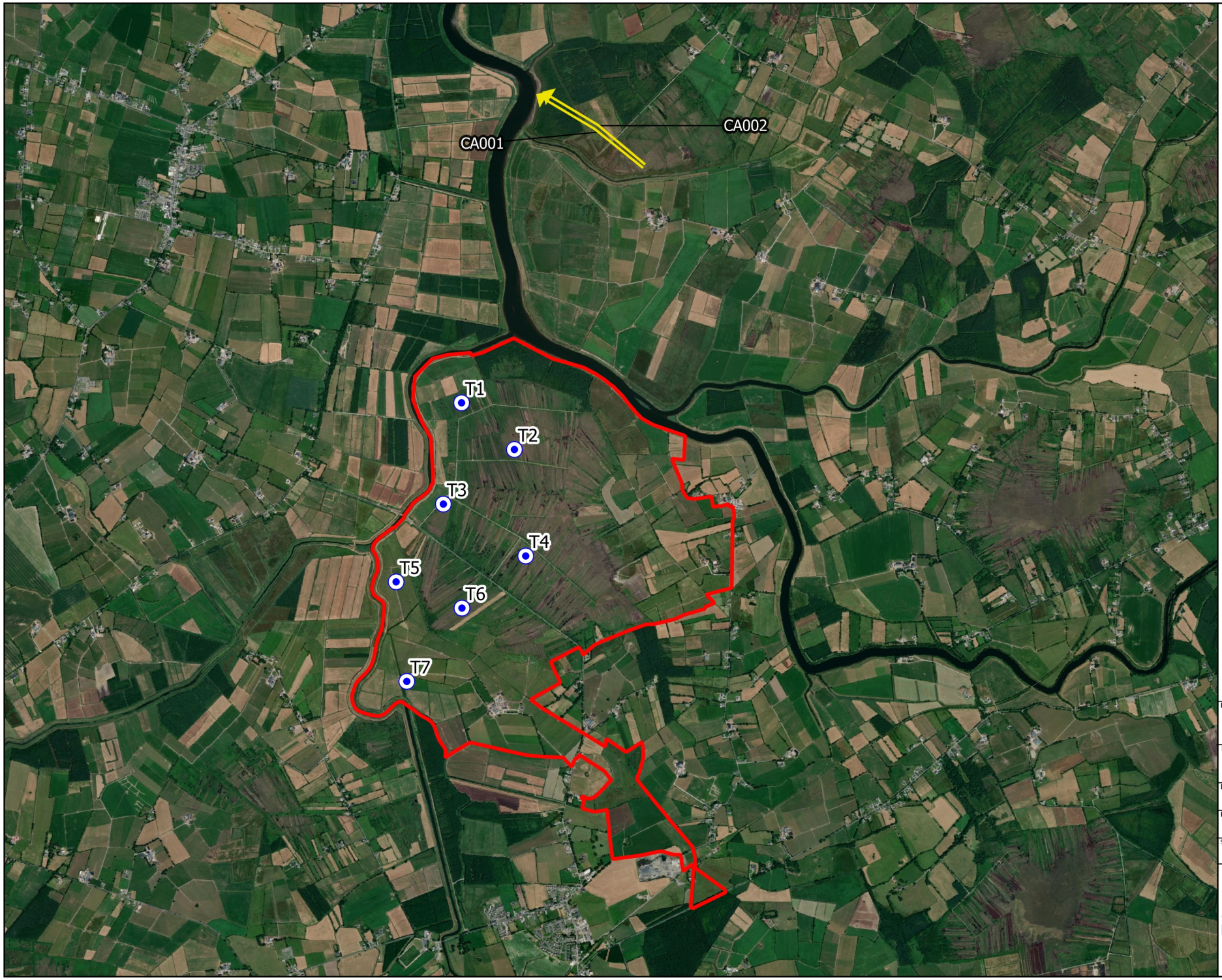

Map Legend

- Wind Farm Site
- Turbine Location
- Cormorant Observations

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Drawing Title: Cormorant Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-36
Scale	Date
1:37000	05.07.21

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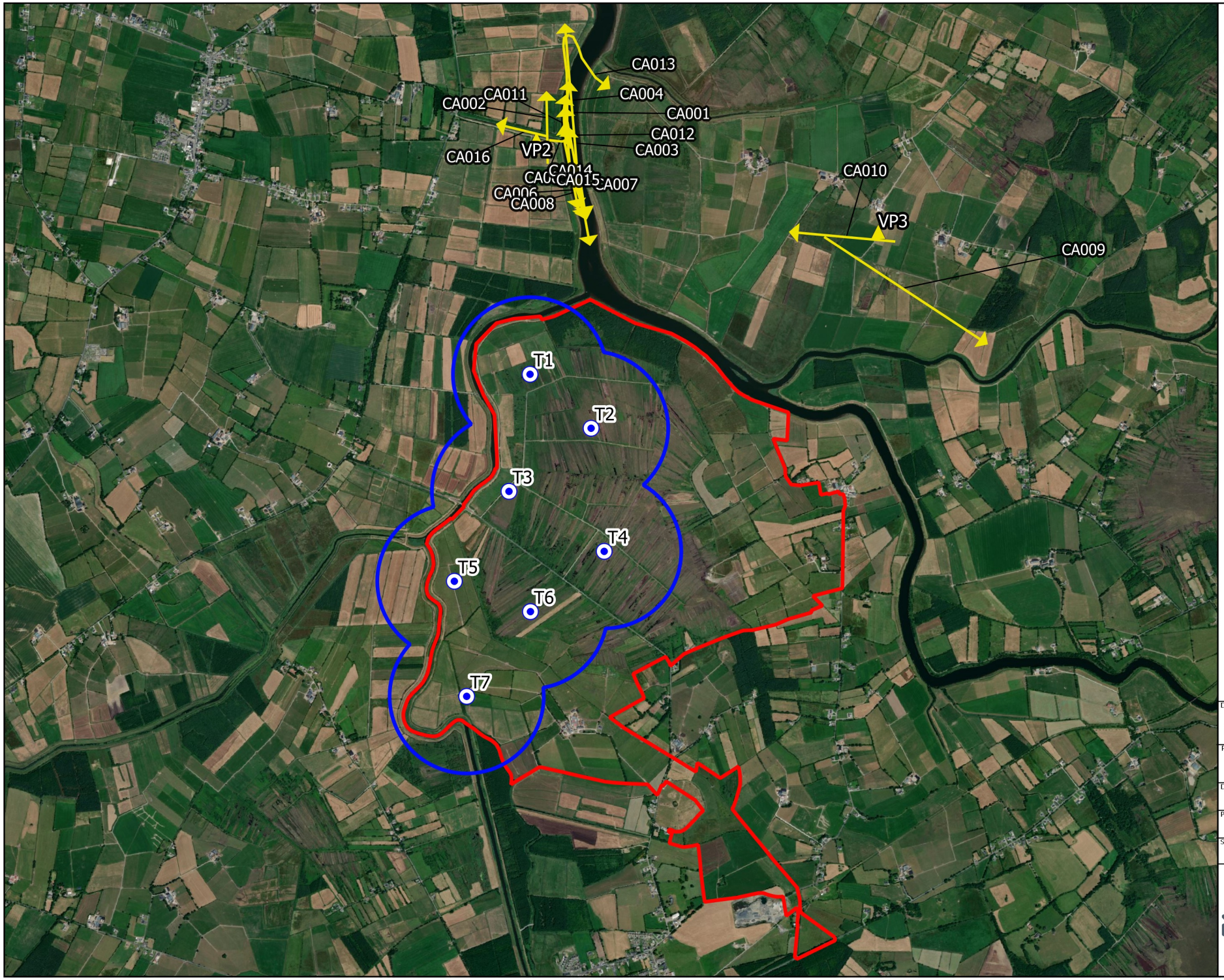

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Cormorant Observations

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Drawing Title: Supplementary Cormorant Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-37
Scale	Date
1:32000	05.07.21

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1.14 Curlew

Table 7 - 4 - 45 Curlew Vantage Point Survey (flights; lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CU001	VP1	03/07/2019	07:03	Curlew	1	7	0	0	7	0	grassland and marsh; flying through site	CMc
CU002	VP1	03/07/2019	07:07	Curlew	1	7	0	0	7	0	grassland and marsh; flying through site	CMc
CU003	VP1	03/07/2019	07:24	Curlew	2	10	0	10	0	0	grassland and marsh; flying through site	CMc
CU004	VP1	02/08/2019	12:28	Curlew	1	3	3	0	0	0	grassland and marsh; came up over the embankment briefly	CMc
CU005	VP1	02/08/2019	12:43	Curlew	2	10	0	10	0	0	grassland and marsh; flying through the site	CMc
CU006	VP1	02/08/2019	20:30	Curlew	1	20	0	20	0	0	improved agricultural grassland; flying along waterway and calling	CMc
CU007	VP1	02/09/2019	08:42	Curlew	1	5	0	5	0	0	watercourses; flying through	CMc
CU008	VP1	02/09/2019	08:42	Curlew	2	5	0	5	0	0	watercourses; flying through	CMc
CU009	VP1	02/09/2019	08:42	Curlew	1	5	0	5	0	0	watercourses; flying through	CMc
CU010	VP1	02/09/2019	08:42	Curlew	2	5	0	5	0	0	watercourses; flying through	CMc
CU011	VP1	02/09/2019	11:41	Curlew	1	12	2	10	0	0	grassland and marsh; flying, landed on the embankment	CMc
CU012	VP1	04/10/2019	13:58	Curlew	2	10	10	0	0	0	grassland and marsh; feeding in a field	CMc
CU013	VP1	11/12/2019	16:25	Curlew	21	7	0	7	0	0	watercourses; flying	CMc

Table 7 - 4 - 46 Curlew Vantage Point Survey (flights; upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU014	VP1	24/03/2020	06:39	Curlew	1	40	0	0	40	0	grassland and marsh; flying	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU015	VP1	01/05/2020	06:39	Curlew	6	3	3	0	0	0	grassland and marsh; briefly came above embankment into view	CMc
CU016	VP1	18/06/2020	09:55	Curlew	9	25	0	10	15	0	improved agricultural grassland and conifer plantation; flying and calling	CMc
CU017	VP1	09/07/2020	16:25	Curlew	30	12	2	7	3	0	improved agricultural grassland and watercourses; heard calling, then came into view over embankment, flew over field and landed	CMc
CU018	VP1	09/07/2020	17:05	Curlew	1	25	0	2	23	0	improved agricultural grassland; flying around site	CMc
CU019	VP1	09/07/2020	17:05	Curlew	23	3	3	0	0	0	improved agricultural grassland; moved position	CMc
CU020	VP1	09/07/2020	17:15	Curlew	30	8	5	3	0	0	improved agricultural grassland and watercourses; flew over the watercourse	CMc
CU021	VP1	28/07/2020	10:35	Curlew	13	7	4	3	0	0	improved agricultural grassland and watercourses; flushed by a tractor	CMc
CU022	VP1	28/07/2020	10:46	Curlew	47	12	2	7	3	0	improved agricultural grassland and watercourses; came up over embankment into view then flew along watercourse	CMc
CU023	VP1	28/07/2020	10:51	Curlew	11	12	2	7	3	0	improved agricultural grassland and watercourses; came up over embankment into view then flew along watercourse	CMc
CU024	VP1	31/08/2020	17:40	Curlew	1	5	2	3	0	0	improved agricultural grassland; flying and landed	CMc
CU025	VP1	31/08/2020	17:48	Curlew	10	27	0	27	0	0	watercourses; flying, flying along watercourse in a long drawn out group	CMc
CU026	VP1	31/08/2020	19:26	Curlew	1	23	0	0	23	0	improved agricultural grassland and conifer plantation; flying and calling	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU027	VP1	31/08/2020	19:41	Curlew	5	26	0	0	26	0	improved agricultural grassland and conifer plantation; flying and calling	CMc
CU028	VP1	31/08/2020	19:53	Curlew	37	12	12	0	0	0	watercourses; flying, flying in a group with et and h	CMc
CU029	VP1	16/09/2020	12:15	Curlew	1	50	2	5	43	0	watercourses, improved agricultural grassland and cutover bog; flying	CMc
CU030	VP1	16/09/2020	12:15	Curlew	1	50	2	5	43	0	watercourses, improved agricultural grassland and cutover bog; flying	CMc
CU031	VP1	16/09/2020	08:00	Curlew	8	45	0	12	32	0	improved agricultural grassland and watercourses; flying and calling	CMc
CU032	VP1	16/09/2020	11:05	Curlew	1	25	0	15	10	0	improved agricultural grassland; flying and calling	CMc
CU033	VP1	16/09/2020	07:40	Curlew	1	11	0	5	6	0	watercourses; flying and calling	CMc
CU034	VP1	16/09/2020	07:50	Curlew	1	13	0	10	3	0	watercourses; flying	CMc
CU035	VP1	06/10/2020	14:23	Curlew	1	23	10	13	0	0	watercourses; flying and calling	CMc
CU036	VP1	06/10/2020	14:34	Curlew	2	45	0	30	15	0	watercourses; flying and calling	CMc
CU037	VP1	23/10/2020	16:39	Curlew	1	3	3	0	0	0	watercourses; flying and calling, just in view above embankment briefly	CMc
CU038	VP1	23/10/2020	17:05	Curlew	1	12	5	7	0	0	improved agricultural grassland; flying and calling, landed	CMc
CU039	VP1	23/10/2020	17:40	Curlew	18	25	20	5	0	0	watercourses and improved agricultural grassland; flying and landed	CMc
CU040	VP1	23/10/2020	18:01	Curlew	1	25	12	13	0	0	watercourses; flying	CMc
CU041	VP1	26/11/2020	08:29	Curlew	1	15	10	5	0	0	watercourses;	CMc
CU042	VP1	17/12/2020	10:44	Curlew	35	20	3	2	15	0	improved agricultural grassland and watercourses; flying	CMc
CU043	VP1	27/01/2021	07:56	Curlew	1	7	7	0	0	0	watercourses; flying	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
CU044	VP1	27/01/2021	13:04	Curlew	3	30	0	5	25	0	watercourses and improved agricultural grassland; flying and landed	CMc
CU045	VP1	27/01/2021	13:52	Curlew	3	25	5	20	0	0	watercourses and improved agricultural grassland; flying and landed	CMc
CU046	VP1	27/01/2021	13:53	Curlew	6	30	0	10	20	0	improved agricultural grassland; flying	CMc
CU047	VP1	22/03/2021	06:32	Curlew	1	7	7	0	0	0	watercourses; flying and calling	CMc
CU048	VP1	22/03/2021	07:35	Curlew	1	7	7	0	0	0	watercourses; flying	CMc

Table 7 - 4 - 47 Curlew Vantage Point Survey (non-flights)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
CU049	VP1	02/09/2019	07:14	Curlew	1	improved agricultural grassland; calling after dark	CMc
CU050	VP1	13/02/2020	09:10	Curlew	3	improved agricultural grassland; foraging on agricultural grassland upon arrival at the vp	CMc
CU051	VP1	16/09/2020	07:50	Curlew	5	improved agricultural grassland; roosting, roosting on the embankment	CMc
CU052	VP1	23/10/2020	18:04	Curlew	35	improved agricultural grassland; roosting	CMc
CU053	VP1	26/11/2020	08:33	Curlew	8	improved agricultural grassland; foraging	CMc
CU054	VP1	15/02/2021	13:42	Curlew	6	improved agricultural grassland; foraging	CMc

Table 7 - 4 - 48 Curlew Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
CU001	27/06/2019	09:17	Curlew	2	improved agricultural grassland; landed in fields and began grazing (summering; non-breeding)	CMc

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
CU002	26/07/2019	16:17	Curlew	16	improved agricultural grassland and cutover bog; flying through site at 25m (summering; non-breeding)	CMc
CU003	21/01/2020	10:05	Curlew	6	watercourses; flying at 15-25m (wintering)	CMc
CU004	21/01/2020	10:20	Curlew	13	watercourses; roosting at waters edge (wintering)	CMc
CU005	21/01/2020	10:21	Curlew	60	improved agricultural grassland; flushed by surveyor (wintering)	CMc
CU006	16/07/2020	16:30	Curlew	1	cutover bog; calling and flying over the bog (summering; non-breeding)	CMc
CU007	05/10/2020	11:06	Curlew	15	improved agricultural grassland; foraging (wintering)	CMc
CU008	05/10/2020	14:15	Curlew	2	watercourses; flushed (wintering)	CMc
CU009	06/01/2021	12:21	Curlew	2	watercourses and improved agricultural grassland; flushed, flew away (wintering)	CMc
CU010	06/01/2021	14:35	Curlew	25	improved agricultural grassland; flushed (wintering)	CMc
CU011	12/02/2021	12:12	Curlew	1	improved agricultural grassland and watercourses; flying and calling (wintering)	CMc
CU012	12/02/2021	12:13	Curlew	1	improved agricultural grassland, watercourses and cutover bog; flying and calling (wintering)	CMc
CU013	04/03/2021	12:58	Curlew	6	improved agricultural grassland; flushed, flushed while driving between transects (wintering)	CMc
CU014	04/03/2021	13:20	Curlew	19	improved agricultural grassland and watercourses; roosting, flushed, roosting at start of flight line, disturbed by surveyor, rested again at far side of river in reeds (wintering)	CMc

Table 7 - 4 - 49 Curlew Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU001	River Cashen	26/08/2019	not given	Curlew	1	estuaries; flying along waterway <20m	CMc
CU002	River Cashen	26/08/2019	not given	Curlew	10	estuaries; disturbed by surveyor and flew away	CMc
CU003	River Cashen	26/08/2019	not given	Curlew	1	improved agricultural grassland; flying along embankment <20m	CMc
CU004	River Cashen	26/08/2019	not given	Curlew	17	estuaries; feeding in estuary	CMc
CU005	River Cashen	26/08/2019	not given	Curlew	2	estuaries; flying along waterway <20m	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU006	River Cashen	26/08/2019	not given	Curlew	1	estuaries; flushed from canal by surveyor	CMc
CU007	River Cashen	26/08/2019	not given	Curlew	2	estuaries; flying along the waterway <15m	CMc
CU008	River Cashen	26/08/2019	not given	Curlew	1	estuaries; feeding in estuary	CMc
CU009	River Cashen	26/08/2019	not given	Curlew	1	improved agricultural grassland; flying along embankment <10m and then landed	CMc
CU010	River Cashen	26/08/2019	not given	Curlew	3	estuaries and improved agricultural grassland; flew along the waterway and then landed in an agricultural field	CMc
CU011	River Cashen	26/08/2019	not given	Curlew	2	improved agricultural grassland and conifer plantation; flying along a tributary	CMc
CU012	River Cashen	26/08/2019	not given	Curlew	1	estuaries; flying along waterway	CMc
CU013	River Cashen	26/08/2019	not given	Curlew	1	watercourses; flying along waterway	CMc
CU014	River Cashen	26/08/2019	not given	Curlew	2	watercourses; flying along the watercourse	CMc
CU015	River Cashen	26/08/2019	not given	Curlew	6	improved agricultural grassland and watercourses; flying along the watercourse and over field	CMc
CU016	River Cashen	26/08/2019	not given	Curlew	3	improved agricultural grassland and watercourses; flying along the watercourse and over field	CMc
CU017	River Cashen	26/08/2019	not given	Curlew	2	watercourses and improved agricultural grassland; flying and landed in a field	CMc
CU018	River Cashen	26/08/2019	not given	Curlew	64	watercourses and improved agricultural grassland; flying and landed in a field	CMc
CU019	Ballyouneen	12/09/2019	not given	Curlew	1	watercourses; flying along watercourse <10m	CMc
CU020	Ballyouneen	12/09/2019	not given	Curlew	1	watercourses; flying along watercourse 20-30m	CMc
CU021	Ballyouneen	12/09/2019	not given	Curlew	2	watercourses; feeding at rivers edge at low tide	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU022	Ardcullen Marshes	12/09/2019	not given	Curlew	2	watercourses; flying along waterway 10-15m	CMc
CU023	Ardcullen Marshes	12/09/2019	not given	Curlew	3	improved agricultural grassland; feeding in field, flushed by surveyor	CMc
CU024	Ardcullen Marshes	12/09/2019	not given	Curlew	6	watercourses; flying along water at <10m	CMc
CU025	Ardcullen Marshes	12/09/2019	not given	Curlew	13	watercourses; feeding at rivers edge at low tide	CMc
CU026	Rahoonagh	30/09/2019	not given	Curlew	1	sea inlets and bays; flying along coast <10m	CMc
CU027	Sleveen	30/09/2019	not given	Curlew	1	improved agricultural grassland; flying over field at 20m	CMc
CU028	Sleveen	30/09/2019	not given	Curlew	1	improved agricultural grassland; flying over flooded field at <10m	CMc
CU029	The Cashen	11/10/2019	not given	Curlew	37	muddy sand shores; feeding at low tide	CMc
CU030	The Cashen	11/10/2019	not given	Curlew	4	muddy sand shores; feeding at low tide	CMc
CU031	Ballyouneen	11/10/2019	not given	Curlew	45	muddy sand shores; roosting on the sand, and rivers edge	CMc
CU032	The Cashen	29/10/2019	not given	Curlew	3	muddy sand shores;	CMc
CU033	The Cashen	07/11/2019	not given	Curlew	32	sea inlets and bays;	CMc
CU034	Ballyhorgan Marshes	17/12/2019	not given	Curlew	12	improved agricultural grassland;	CMc
CU035	Mouth of the Cashen River	17/12/2019	not given	Curlew	3	sea inlets and bays;	CMc
CU036	Mouth of the Cashen River	17/12/2019	not given	Curlew	78	sea inlets and bays;	CMc
CU037	Ballyouneen	17/12/2019	not given	Curlew	350	improved agricultural grassland;	CMc
CU038	Dysert	27/01/2020	not given	Curlew	28	improved agricultural grassland;	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU039	Derryco	07/08/2020	13:58	Curlew	1	watercourses; calling, curlew heard calling from the direction of the estuary, unkown number of birds, no visuals	CMc
CU040	Ballynagare	19/08/2020	13:44	Curlew	12	improved agricultural grassland; foraging	CMc
CU041	Ballyouneen	19/08/2020	13:46	Curlew	18	watercourses and improved agricultural grassland; flying, flying upstream dropped behind embankment into fields	CMc
CU042	Ballyouneen	22/09/2020	10:48	Curlew	4	watercourses and improved agricultural grassland; flying and calling, came into view above embankment briefly	CMc
CU043	Dysert	23/10/2020	10:13	Curlew	32	improved agricultural grassland; flying and landing, moving slowly west along the embankment in short bursts	CMc
CU044	Ballyouneen	23/10/2020	11:39	Curlew	18	improved agricultural grassland; roosting, on the embankment	CMc
CU045	Lixnaw Canal	04/11/2020	10:34	Curlew	6	improved agricultural grassland; foraging	CMc
CU046	Ballynagare	04/11/2020	10:40	Curlew	2	improved agricultural grassland; foraging, flooded fields	CMc
CU047	Ballyouneen	04/11/2020	13:01	Curlew	96	improved agricultural grassland; foraging, with whooper swan	CMc
CU048	Ballyouneen	04/11/2020	13:04	Curlew	231	improved agricultural grassland; roosting, with lapwing	CMc
CU049	Ballyhorgan marshes	17/11/2020	10:22	Curlew	27	improved agricultural grassland; foraging	CMc
CU050	Ballyouneen	17/11/2020	11:20	Curlew	300	improved agricultural grassland; foraging/flushed, birds were disturbed by surveyor driving through	CMc
CU051	Ballynagare	17/11/2020	14:03	Curlew	12	improved agricultural grassland; foraging	CMc
CU052	Ballynagare	18/12/2020	11:18	Curlew	45	improved agricultural grassland;	CMc
CU053	Ballynagare	18/12/2020	12:23	Curlew	1	improved agricultural grassland;	CMc
CU054	Ballyhorgan Marshes	18/12/2020	12:41	Curlew	78	improved agricultural grassland;	CMc
CU055	Ballynagare	26/01/2021	13:28	Curlew	6	improved agricultural grassland;	CMc
CU056	Ballyouneen	04/02/2021	11:24	Curlew	550	improved agricultural grassland; foraging/roosting, field was very flooded. 500-600 birds, some roosting, some foraging	CMc
CU057	Ballynagare	04/02/2021	14:11	Curlew	8	improved agricultural grassland; flushed	CMc
CU058	Ballynagare	19/02/2021	12:01	Curlew	1	improved agricultural grassland; flushed	CMc
CU059	Ballynagare	02/03/2021	10:28	Curlew	3	improved agricultural grassland; flushed	CMc
CU060	Ballynagare	26/03/2021	09:41	Curlew	6	improved agricultural grassland; flushed	CMc

Table 7 - 4 - 50 Incidental Curlew Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
CU001	Vantage Point Survey, fields behind vp1	03/07/2019	not given	Curlew	85	improved agricultural grassland; during the break between watches, counted feeding in the agricultural fields behind the vp	CMc
CU002	Vantage Point Survey, fields behind vp1	03/07/2019	not given	Curlew	16	improved agricultural grassland; feeding in agricultural grassland behind vp (100-200m away) on arrival	CMc
CU003	Wildfowl Distribution Survey, enbankment	26/08/2019	not given	Curlew	1	watercourses; feathers found along embankment frequently	CMc
CU004	Vantage Point Survey, vp2	04/09/2019	not given	Curlew	30+	watercourses; sitting on embankment at break	CMc
CU005	Hen Harrier Roost Survey, ballynagare bridge	01/10/2020	19:18	Curlew	1	watercourses; heard calling	CMc
CU006	Hen Harrier Roost Survey, ballynagare bridge	07/01/2021	not given	Curlew	6	improved agricultural grassland; flying over the road as surveyor drove to hhvp2	CMc

Table 7 - 4 - 51 Supplementary Curlew Data (flights)

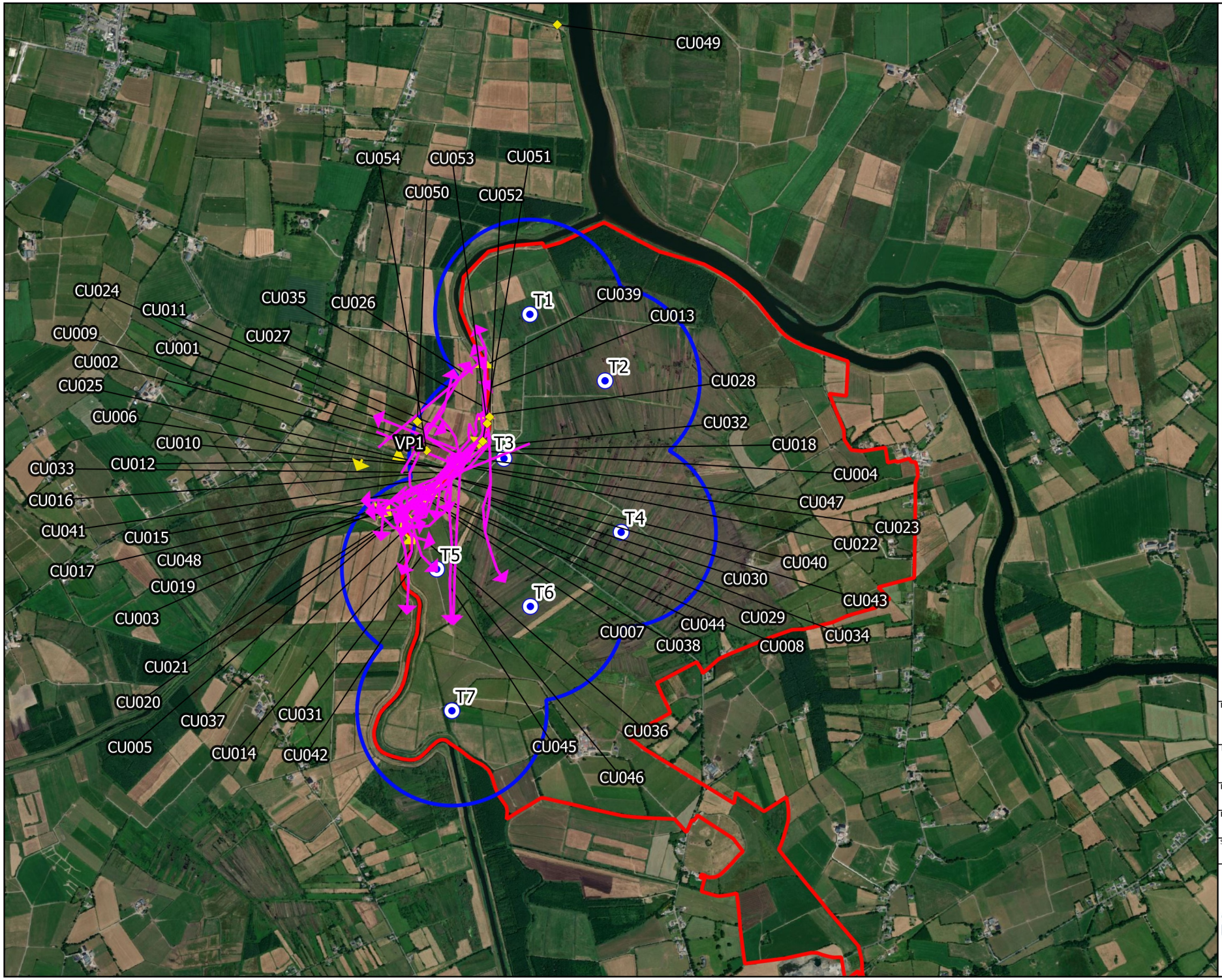
Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CU001	VP2	12/07/2019	11:05	Curlew	1	7	0	0	7	0	estuaries; flying through site	CMc
CU002	VP2	09/08/2019	20:03	Curlew	1	5	0	5	0	0	grassland and marsh; flying through the site	CMc
CU003	VP2	09/08/2019	20:10	Curlew	1	5	3	2	0	0	improved agricultural grassland; came out of canal and went into the estuary	CMc
CU004	VP2	09/08/2019	20:37	Curlew	5	10	0	0	10	0	improved agricultural grassland; flying through the site	CMc
CU005	VP2	09/08/2019	20:53	Curlew	2	3	3	0	0	0	improved agricultural grassland; flew out of the canal and into field behind embankment	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CU006	VP2	04/09/2019	07:00	Curlew	2	120	120	0	0	0	watercourses; feeding in the canal at low tide	CMc
CU007	VP2	04/09/2019	07:07	Curlew	2	3	3	0	0	0	watercourses; birds that were feeding flew away out of sight behind trees	CMc
CU008	VP2	04/09/2019	07:10	Curlew	4	6	0	6	0	0	watercourses; flew from waterway to field	CMc
CU009	VP2	04/09/2019	07:25	Curlew	1	8	3	5	0	0	watercourses; flew from field to watercourse	CMc
CU010	VP2	04/09/2019	07:45	Curlew	6	5	5	0	0	0	watercourses; flying along embankment	CMc
CU011	VP2	04/09/2019	07:47	Curlew	19	5	2	3	0	0	grassland and marsh; took to the air and landed again in the same field	CMc
CU012	VP2	18/10/2019	16:42	Curlew	35	7	5	2	0	0	watercourses; flushed from field by farmer	CMc
CU013	VP2	18/10/2019	16:45	Curlew	70	12	6	6	0	0	grassland and marsh; too flight from field, circled and landed again	CMc
CU014	VP2	18/10/2019	17:40	Curlew	175	7	4	3	0	0	watercourses; flying quickly along watercourse, landed in field with other curlew, approx. 150-200	CMc
CU015	VP2	26/11/2019	12:47	Curlew	12	12	9	3	0	0	improved agricultural grassland; flying	CMc
CU016	VP2	26/11/2019	13:06	Curlew	12	12	9	3	0	0	improved agricultural grassland; flying	CMc
CU017	VP2	26/11/2019	13:20	Curlew	10	10	0	0	17	0	improved agricultural grassland; flying	CMc
CU018	VP2	26/11/2019	14:33	Curlew	8	8	0	8	0	0	grassland and marsh; flying	CMc
CU019	VP2	26/11/2019	14:44	Curlew	16	8	0	8	0	0	improved agricultural grassland; flying and landed	CMc
CU020	VP2	26/11/2019	14:59	Curlew	17	8	1	1	6	0	improved agricultural grassland; flying and landed	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
CU021	VP2	29/11/2019	08:27	Curlew	6	2	2	0	0	0	grassland and marsh; flew up over the top of the embankment briefly	CMc
CU022	VP2	29/11/2019	08:34	Curlew	8	12	0	0	12	0	improved agricultural grassland; flying	CMc
CU023	VP2	29/11/2019	08:35	Curlew	1	12	0	0	12	0	improved agricultural grassland; flying	CMc
CU024	VP2	29/11/2019	08:53	Curlew	2	12	0	0	12	0	improved agricultural grassland; flying	CMc
CU025	VP2	29/11/2019	08:56	Curlew	2	12	0	0	12	0	improved agricultural grassland; flying	CMc
CU026	VP2	29/11/2019	09:04	Curlew	1	5	0	0	5	0	grassland and marsh; flying	CMc
CU027	VP2	09/12/2019	12:10	Curlew	28	11	0	3	8	0	watercourses; flying	CMc
CU028	VP2	09/12/2019	12:25	Curlew	2	5	0	0	5	0	watercourses; flying	CMc
CU029	VP2	09/12/2019	12:26	Curlew	18	8	8	0	0	0	watercourses; flying	CMc
CU030	VP2	09/12/2019	14:30	Curlew	14	10	0	0	10	0	watercourses; flying	CMc
CU031	VP2	09/12/2019	14:52	Curlew	12	2	2	0	0	0	watercourses; flying	CMc
CU032	VP2	09/12/2019	15:32	Curlew	8	12	0	0	12	0	improved agricultural grassland and watercourses; flying	CMc

Table 7 - 4 - 52 Supplementary Curlew Data (non-flights)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
CU033	VP2	09/05/2019	not given	Curlew	1	estuaries; feeding in tidal tributary of the estury at low tide	CMc
CU034	VP3	27/09/2019	not given	Curlew	1	improved agricultural grassland; calling in the dark	CMc
CU035	VP2	18/10/2019	not given	Curlew	61	improved agricultural grassland; observed in fields across the river, possibly roosting. hard to tell from the distance.	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Curlew Flights at PCH
- Curlew Flights
- Curlew Non-flights

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Drawing Title: Curlew Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-38
Scale	Date
1:26000	05.07.21

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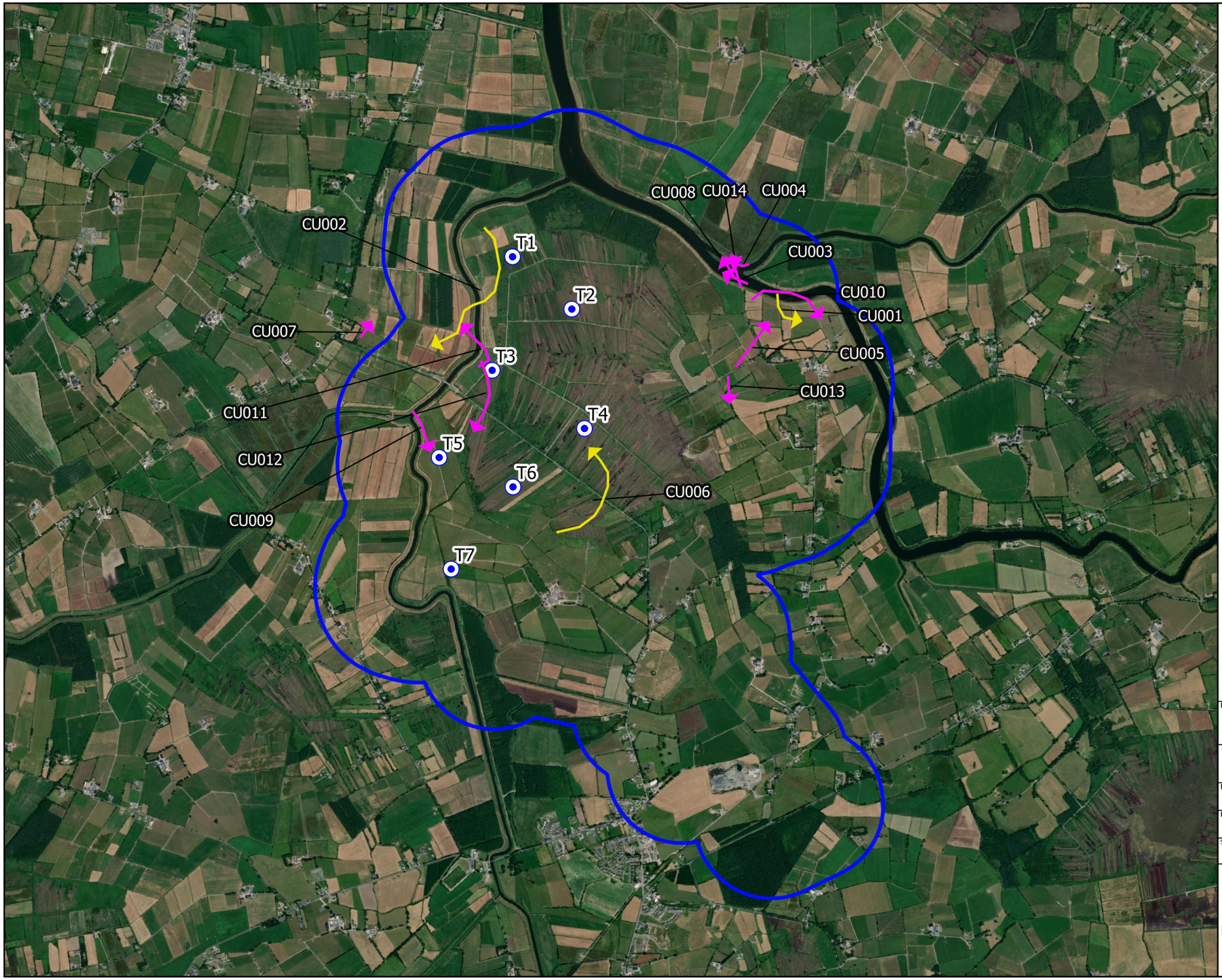

Map Legend

- 500m Survey Radius
- Turbine Location
- Curlew Observation (breeding season)
- Curlew Observation (winter season)

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Drawing Title: Curlew Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-39
Scale	Date
1:33000	05.07.21

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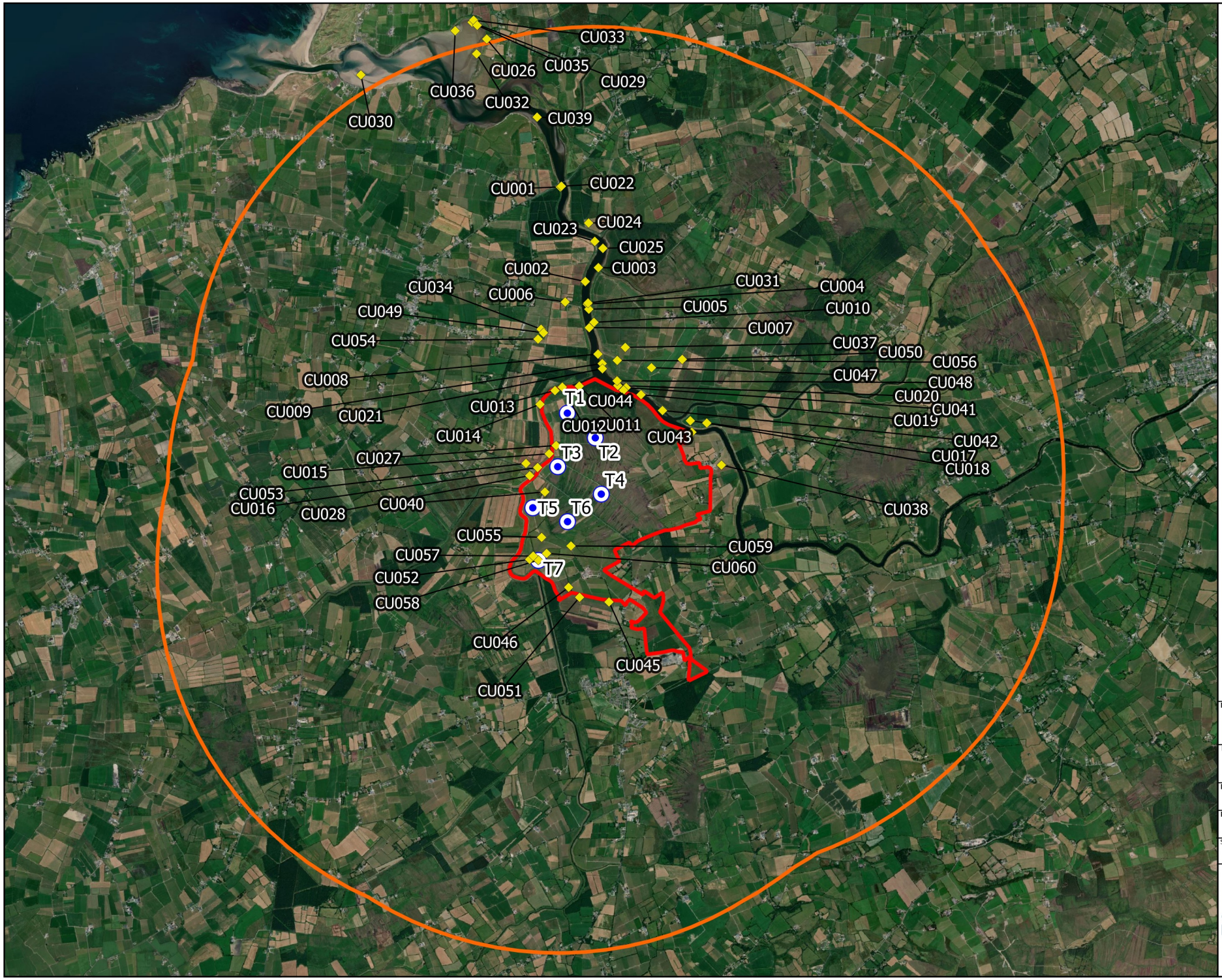

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Curlew Observation

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Drawing Title

Curlew
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

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S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-40
Scale	Date
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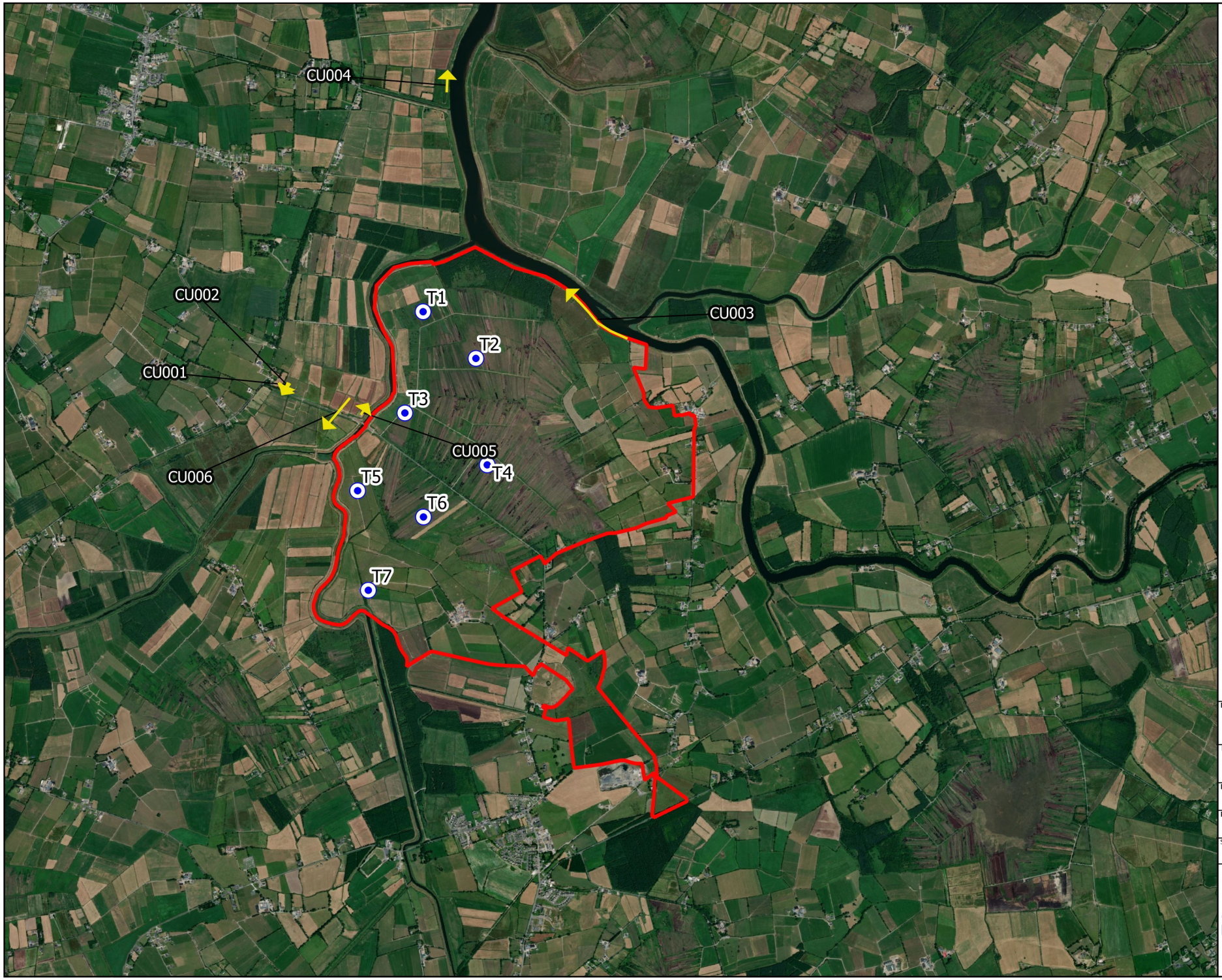

Map Legend

- Wind Farm Site
- Turbine Location
- Curlew Observations

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Drawing Title: Curlew Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-41
Scale	Date
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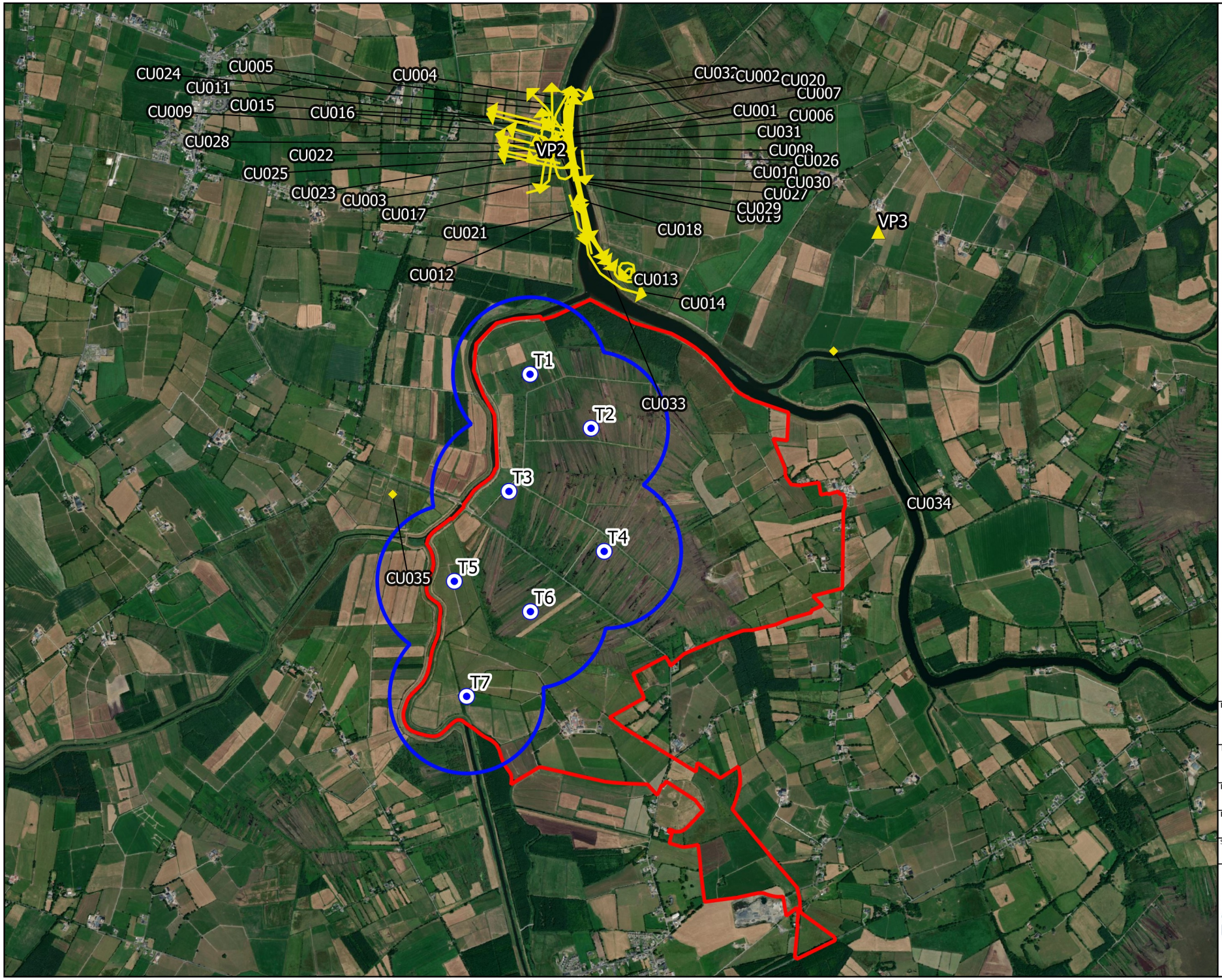

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Curlew Flight Observations
- Curlew Non-flight Observations

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Drawing Title: Supplementary Curlew Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-42
Scale	Date
1:32000	05.07.21

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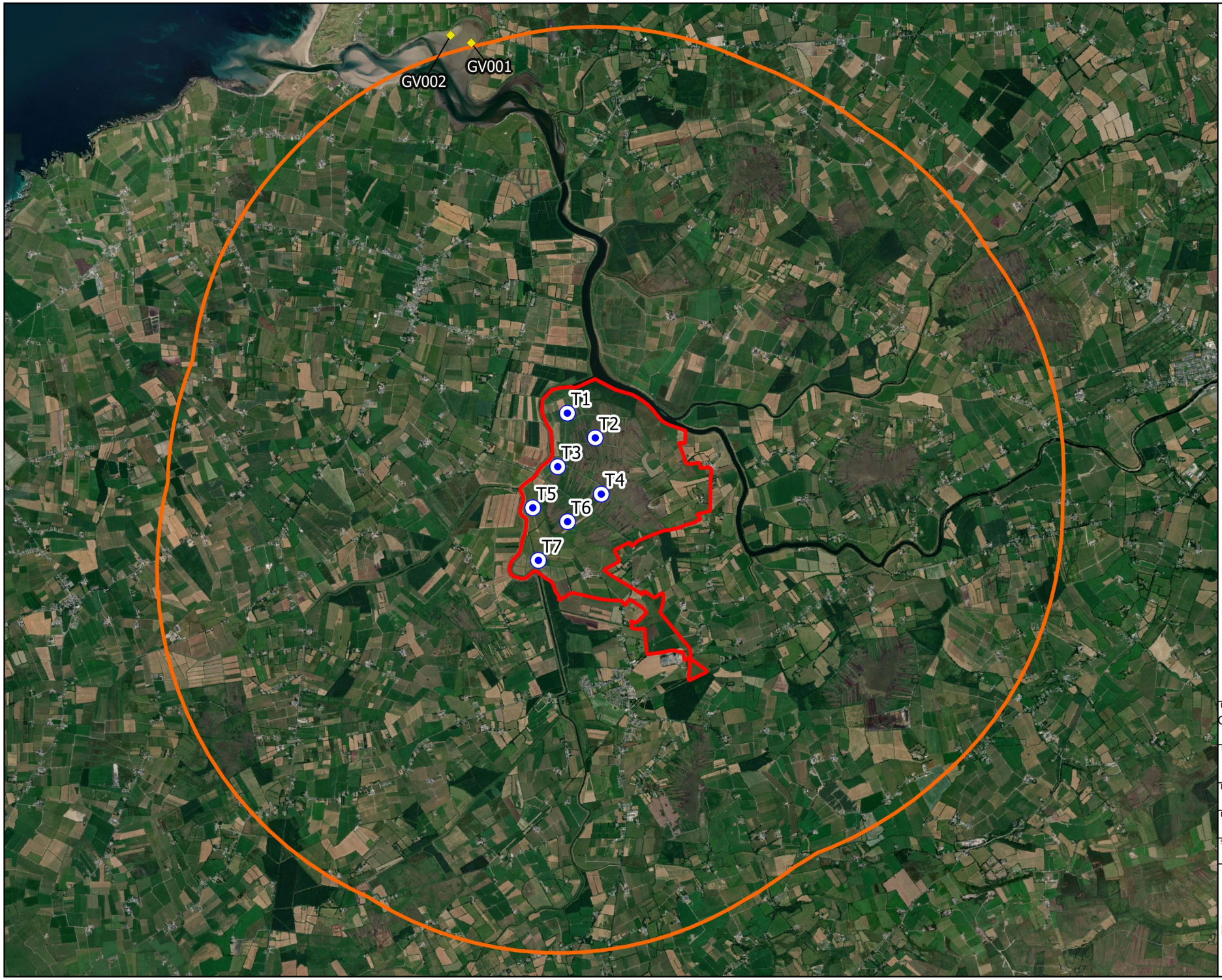
1.15 Grey Plover

Table 7 - 4 - 53 Grey Plover Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
GV001	The Cashen	29/10/2019	not given	Grey Plover	656	muddy sand shores; roosting	CMc
GV002	Mouth of the Cashen River	17/12/2019	not given	Grey Plover	141	sea inlets and bays; roosting on the sand at low tide	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Grey Plover Observation

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Drawing Title
Grey Plover Waterbird Distribution Survey

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-43
Scale	Date
1:70000	05.07.21

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1.16 Lapwing

Table 7 - 4 - 54 Lapwing Vantage Point Survey (flights; lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
L001	VP1	02/09/2019	11:30	Lapwing	54	67	2	5	60	0	watercourses and conifer plantation; flying through, landed in a field	CMc

Table 7 - 4 - 55 Lapwing Vantage Point Survey (flights; upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
L002	VP1	31/08/2020	19:54	Lapwing	38	10	5	5	0	0	watercourses and improved agricultural grassland; flying, came into view above embankment, not sure if the birds were in the waterway or in the field behind the waterway	CMc
L003	VP1	06/10/2020	15:27	Lapwing	8	50	0	35	15	0	improved agricultural grassland and watercourses; flying	CMc
L004	VP1	26/11/2020	08:44	Lapwing	20	25	0	0	25	0	improved agricultural grassland, cutover bog and watercourses;	CMc
L005	VP1	17/12/2020	15:02	Lapwing	150	26	5	10	11	0	improved agricultural grassland; moved position	CMc
L006	VP1	17/12/2020	16:29	Lapwing	500	7	2	3	2	0	improved agricultural grassland; flying, this flight behaviour was repeated throughout watch	CMc
L007	VP1	15/02/2021	13:22	Lapwing	60	20	5	10	5	0	improved agricultural grassland; circling	CMc

Table 7 - 4 - 56 Lapwing Vantage Point Survey (non-flight)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
L008	VP1	17/12/2020	09:44	Lapwing	68	improved agricultural grassland; roosting, observed on the way to the vp	CMc

Table 7 - 4 - 57 Lapwing Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
L001	25/10/2019	not given	Lapwing	110	improved agricultural grassland; took to the sky briefly, reaching pch and landed again (wintering)	CMc
L002	21/01/2020	10:21	Lapwing	9	improved agricultural grassland; flushed by surveyor (wintering)	CMc

Table 7 - 4 - 58 Lapwing Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L001	Ballyouneen	12/09/2019	not given	Lapwing	9	watercourses and improved agricultural grassland; flying over fields 20-40m, then flew away along the waterway <10m	CMc
L002	The Cashen	11/10/2019	not given	Lapwing	171	muddy sand shores; roosting on the sand	CMc
L003	Dysert	11/10/2019	not given	Lapwing	26	improved agricultural grassland; feeding in field	CMc
L004	Ballyouneen	29/10/2019	not given	Lapwing	13	improved agricultural grassland; feeding	CMc
L005	The Cashen	07/11/2019	not given	Lapwing	20	sea inlets and bays; roosting at shoreline	CMc
L006	The Cashen	21/11/2019	not given	Lapwing	55	sea inlets and bays; roosting at shoreline	CMc
L007	Ballyouneen	03/12/2019	not given	Lapwing	139	improved agricultural grassland; foraging on agricultural grassland	CMc
L008	Ballyhorgan Marshes	17/12/2019	not given	Lapwing	115	improved agricultural grassland; foraging on agricultural grassland	CMc

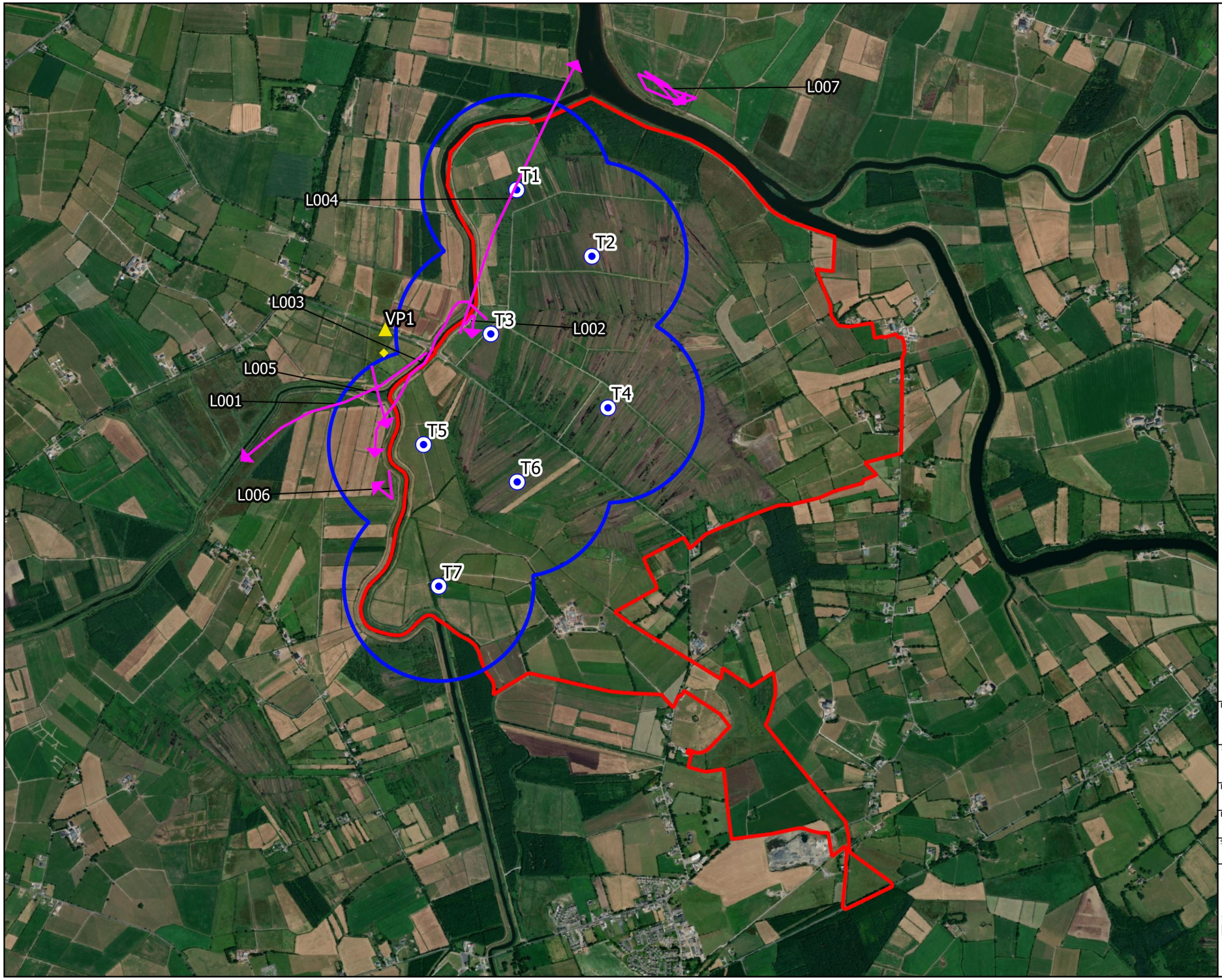
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L009	Mouth of the Cashen River	17/12/2019	not given	Lapwing	49	sea inlets and bays; roosting on the sand at low tide	CMc
L010	Mouth of the Cashen River	17/12/2019	not given	Lapwing	38	sea inlets and bays; roosting on the sand at low tide	CMc
L011	Ballyouneen	17/12/2019	not given	Lapwing	12	improved agricultural grassland; foraging on agricultural grassland	CMc
L012	Ferry Bridge	03/01/2020	not given	Lapwing	8	improved agricultural grassland; flying at 25-200m	CMc
L013	Ballynagare Bridge	18/02/2020	not given	Lapwing	235	improved agricultural grassland; roosting in flooded agricultural field	CMc
L014	Ballyhorgan Marshes	18/02/2020	not given	Lapwing	189	improved agricultural grassland; foraging on agricultural grassland	CMc
L015	Ballyouneen	04/11/2020	13:05	Lapwing	62	improved agricultural grassland; foraging, with curlew, hard to get a full count, this number is the miniumum present	CMc
L016	Ballyhorgan marshes	17/11/2020	10:25	Lapwing	187	improved agricultural grassland; roosting	CMc
L017	Ballyouneen	17/11/2020	11:14	Lapwing	59	improved agricultural grassland; foraging	CMc
L018	Ballynagare	18/12/2020	11:23	Lapwing	43	improved agricultural grassland; roosting	CMc
L019	Ballynagare	18/12/2020	11:42	Lapwing	38	improved agricultural grassland; circling at 40m	CMc
L020	Ballyhorgan Marshes	18/12/2020	12:43	Lapwing	400	improved agricultural grassland; roosting, rough count, birds were distant and tightly grouped	CMc
L021	Ballyouneen	04/02/2021	11:27	Lapwing	37	improved agricultural grassland; foraging/roosting, field was very flooded.	CMc

Table 7 - 4 - 59 Incidental Lapwing Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
L001	Vantage Point Survey, ballynagare	17/12/2020	not given	Lapwing	500	improved agricultural grassland; pm of cu conservation was bird watching and reported these birds to the surveyor. were seen intermittently rising and dropping back down but were too far away to get accurate counts.	CMc

Table 7 - 4 - 60 Supplementary Lapwing Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
L001	VP2	26/11/2019	13:19	Lapwing	46	22	0	0	22	0	improved agricultural grassland; flying	CMc
L002	VP2	26/11/2019	13:35	Lapwing	11	20	0	0	20	0	improved agricultural grassland; flying	CMc
L003	VP2	29/11/2019	08:04	Lapwing	30	15	0	0	15	0	improved agricultural grassland; flying	CMc
L004	VP2	29/11/2019	08:22	Lapwing	21	15	0	0	15	0	improved agricultural grassland; flying	CMc
L005	VP2	29/11/2019	09:02	Lapwing	46	18	0	0	18	0	improved agricultural grassland; flying	CMc
L006	VP2	29/11/2019	09:08	Lapwing	46	5	0	0	5	0	improved agricultural grassland; flying	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Lapwing Flights
- Lapwing Non-flights

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Drawing Title

Lapwing Vantage Point Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-44
Scale	Date
1:26000	05.07.21

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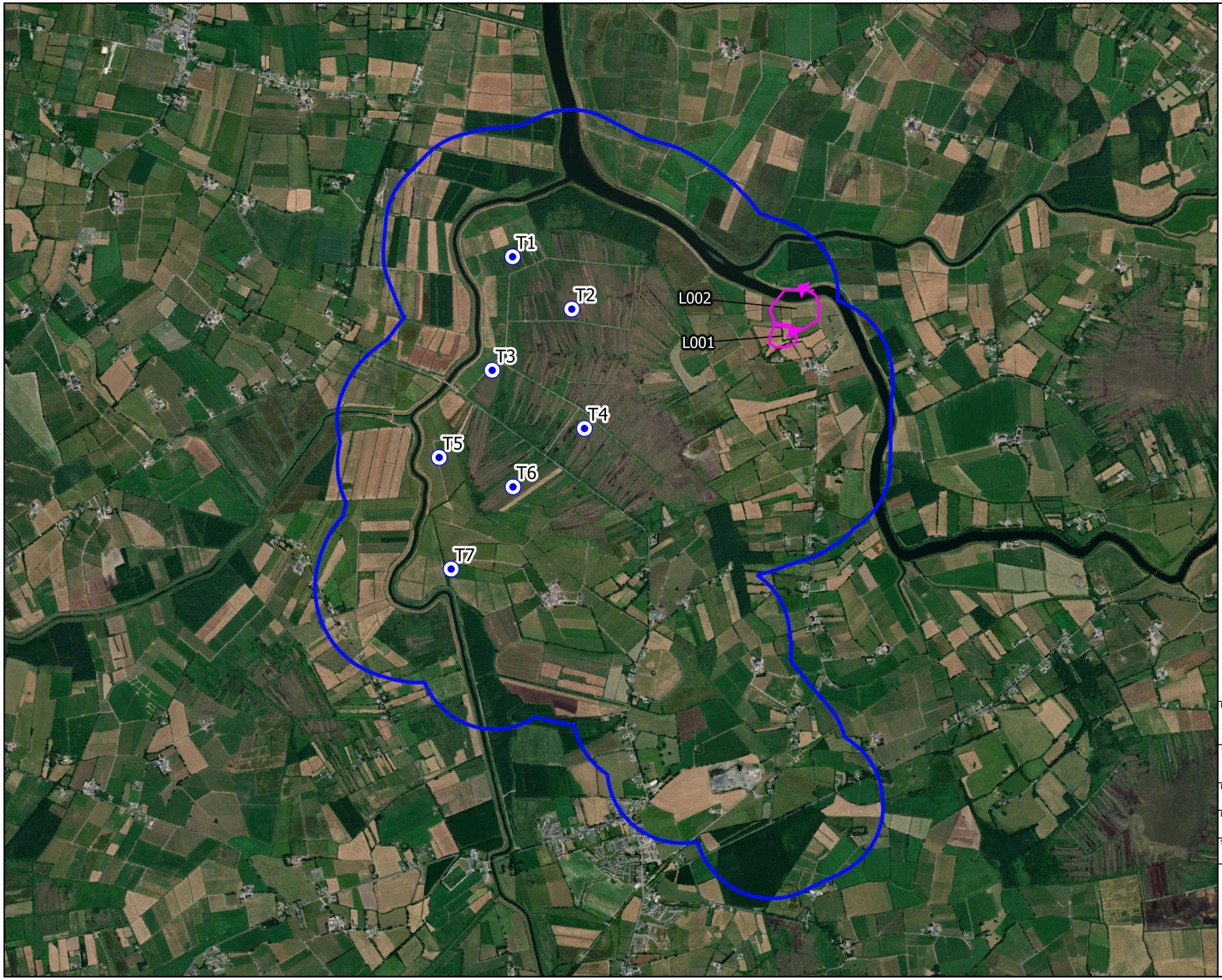

Map Legend

- 500m Survey Radius
- Turbine Location
- Lapwing Observation (winter season)

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Drawing Title: Lapwing Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-45
Scale	Date
1:33000	05.07.21

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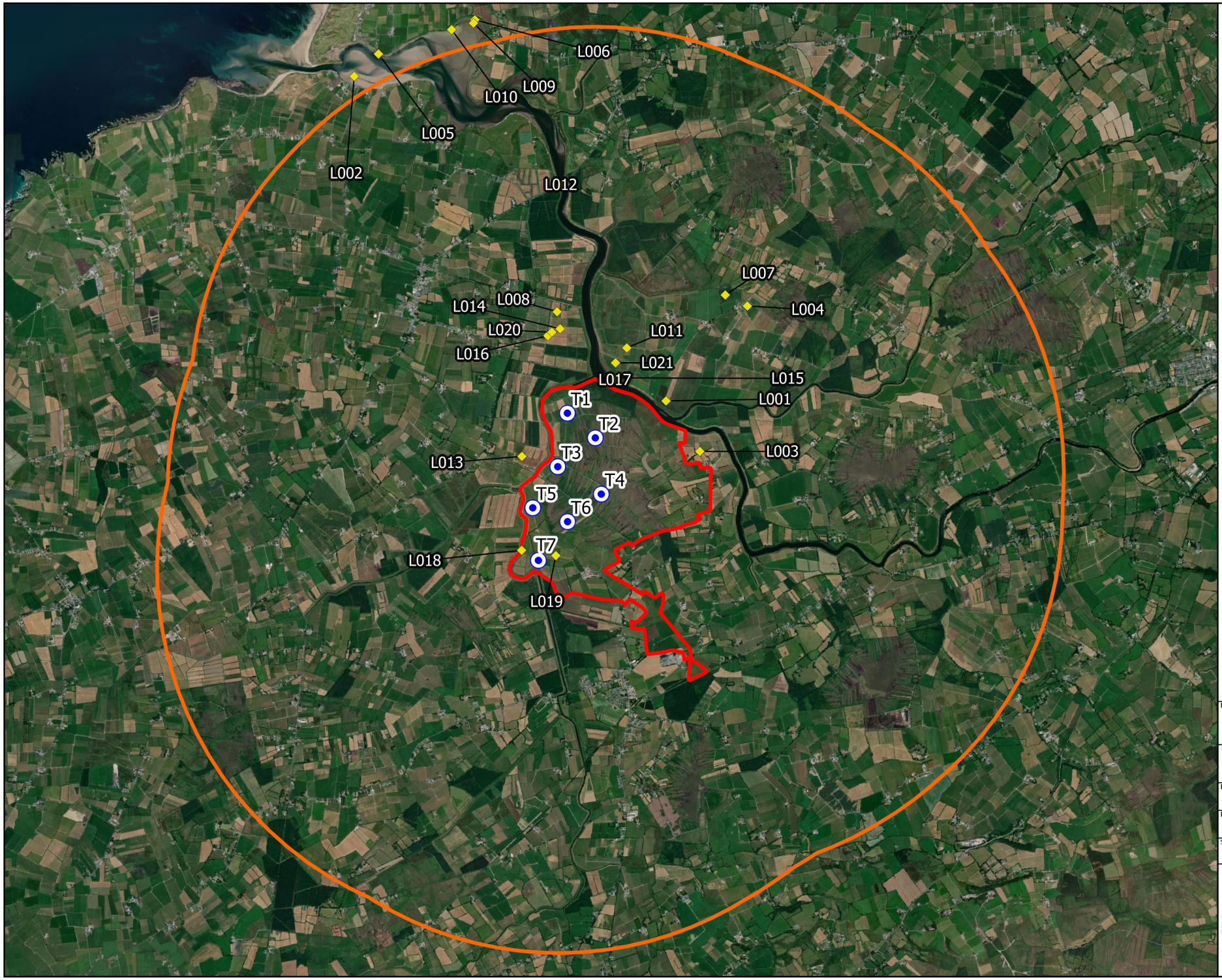

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Lapwing Observations

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Drawing Title

Lapwing
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-46
Scale	Date
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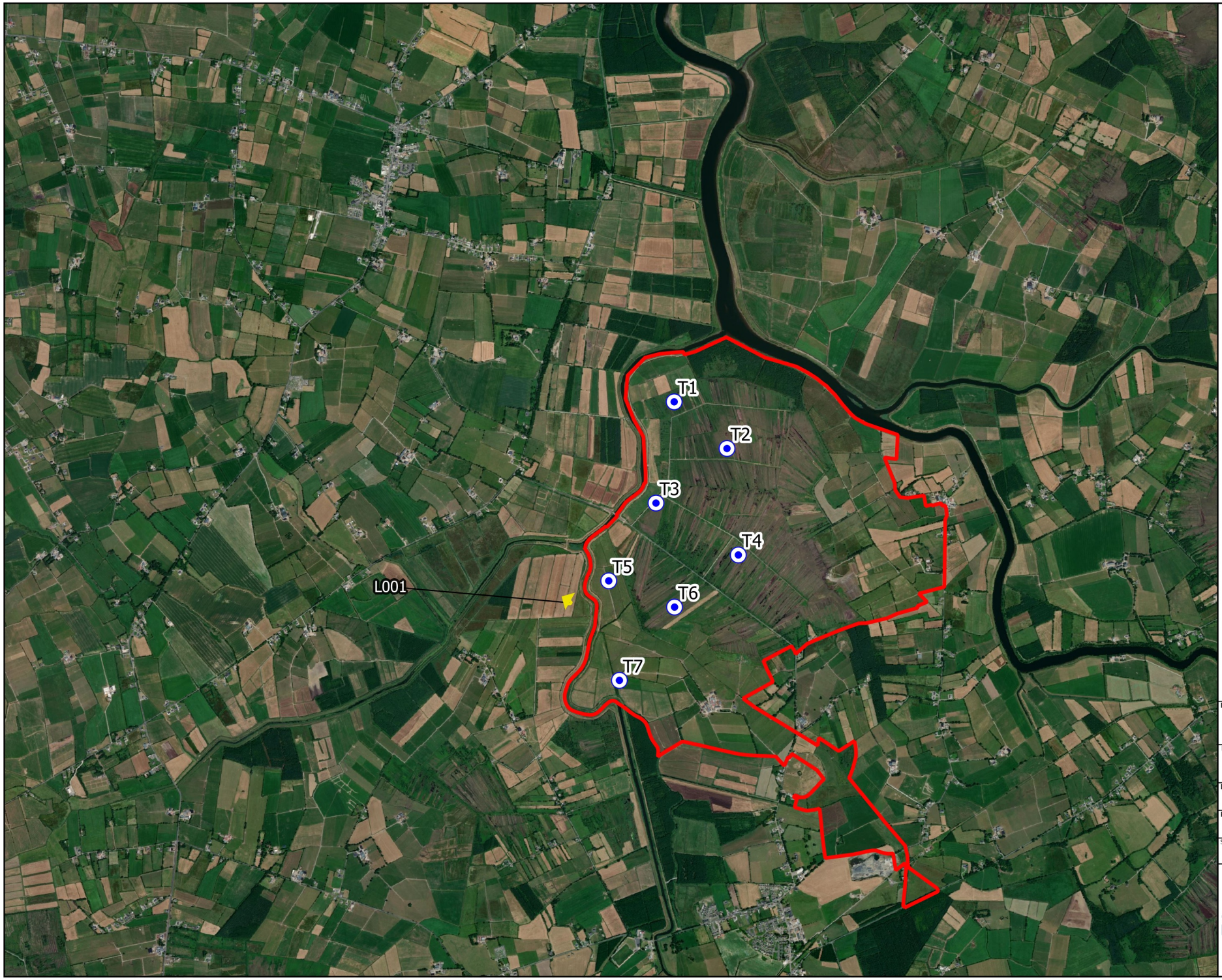

Map Legend

- Wind Farm Site
- Turbine Location
- Lapwing Observations

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Drawing Title: Lapwing Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-47
Scale	Date
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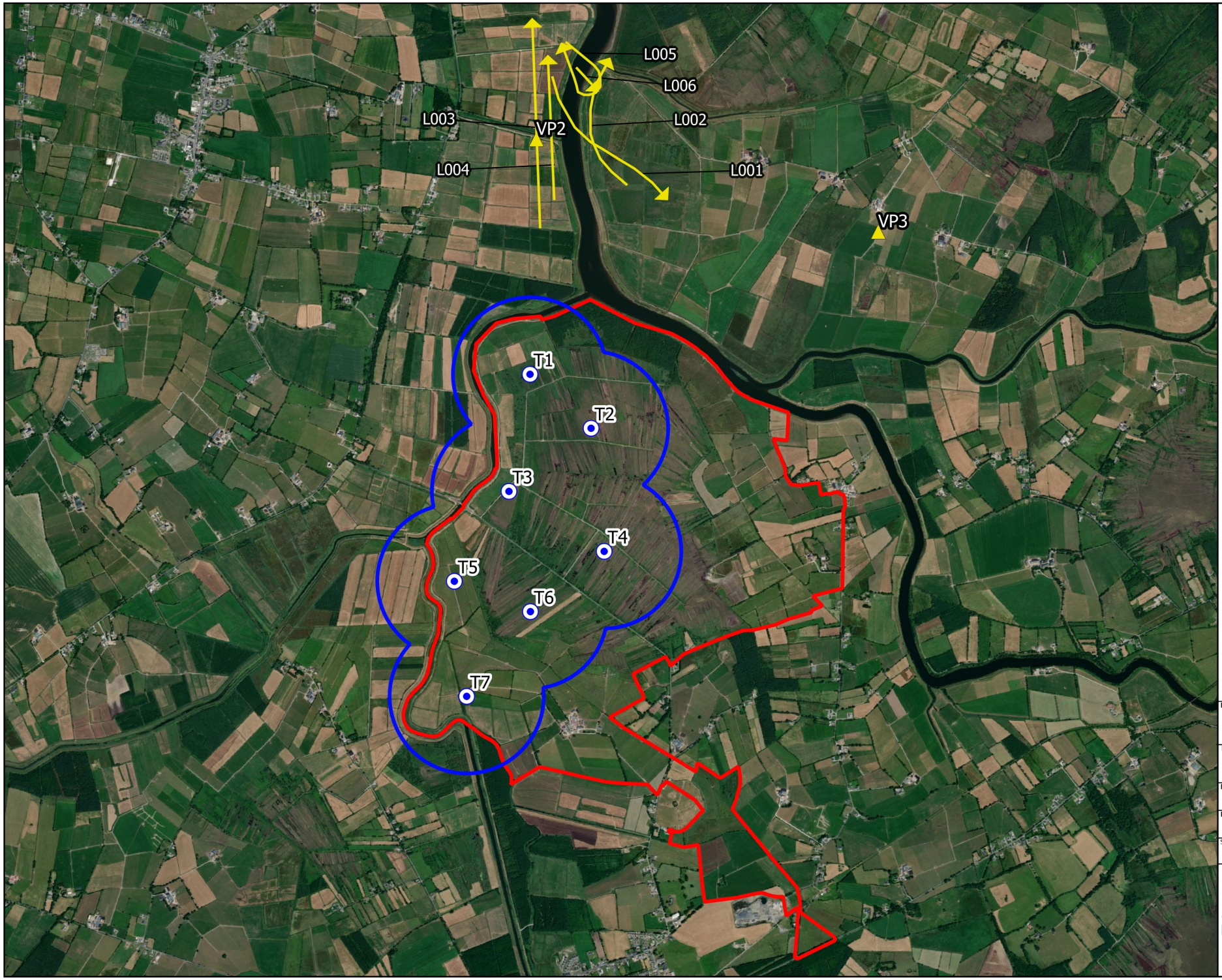

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Lapwing Observations

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Drawing Title: Supplementary Lapwing Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-48
Scale	Date
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1.17 Mallard

Table 7 - 4 - 61 Mallard Vantage Point Survey (lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
MA001	VP1	14/05/2019	05:47	Mallard	5	60	20	40	0	0	grassland and marsh; flying through the site the males appeared to be fighting and following the female	CMc
MA002	VP1	02/09/2019	06:33	Mallard	4	40	0	40	0	0	grassland and marsh; flying through, 4 female	CMc
MA003	VP1	02/09/2019	06:40	Mallard	1	5	5	0	0	0	grassland and marsh; flying through, female	CMc
MA004	VP1	02/09/2019	06:55	Mallard	3	7	7	0	0	0	grassland and marsh; flying through, 3 females	CMc
MA005	VP1	02/09/2019	07:40	Mallard	15	30	0	0	30	0	watercourses; flying through	CMc

Table 7 - 4 - 62 Mallard Vantage Point Survey (upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
MA006	VP1	28/01/2020	08:34	Mallard	2	1	1	0	0	0	improved agricultural grassland; observed landing in flooded agricultural field	CMc
MA007	VP1	24/03/2020	06:54	Mallard	4	25	0	0	25	0	grassland and marsh; flying, 4 males	CMc
MA008	VP1	15/04/2020	19:35	Mallard	6	44	2	10	32	0	watercourses and cutover bog; flying	CMc
MA009	VP1	18/06/2020	11:03	Mallard	1	15	0	0	15	0	improved agricultural grassland; flying	CMc
MA010	VP1	16/09/2020	08:10	Mallard	2	8	4	4	0	0	watercourses and improved agricultural grassland; flying and landed	CMc
MA011	VP1	23/11/2020	11:53	Mallard	24	65	5	10	50	0	cutover bog;	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
MA012	VP1	26/11/2020	08:39	Mallard	2	15	0	0	15	0	cutover bog;	CMc
MA013	VP1	15/02/2021	14:24	Mallard	3	12	2	8	2	0	improved agricultural grassland and cutover bog; flying and landed	CMc
MA014	VP1	22/03/2021	05:59	Mallard	1	5	0	0	5	0	watercourses; flying and calling	CMc
MA015	VP1	22/03/2021	06:33	Mallard	3	15	0	0	15	0	watercourses and improved agricultural grassland; flying, females	CMc
MA016	VP1	22/03/2021	08:02	Mallard	6	25	0	0	25	0	improved agricultural grassland and watercourses; flying	CMc

Table 7 - 4 - 63 Mallard Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
MA001	27/06/2019	10:32	Mallard	1	cutover bog; flying through site, adult female (flyover; non-breeding)	CMc
MA002	24/10/2019	not given	Mallard	2	improved agricultural grassland; flying through in pch (wintering)	CMc
MA003	24/10/2019	not given	Mallard	4	watercourses; flushed by surveyor (wintering)	CMc
MA004	17/03/2020	not given	Mallard	2	cutover bog; adult flying over the bog 15-25m (wintering)	CMc
MA005	05/10/2020	14:14	Mallard	2	watercourses; flushed (wintering)	CMc
MA006	05/10/2020	14:10	Mallard	2	watercourses; flushed (wintering)	CMc
MA007	05/10/2020	14:15	Mallard	9	watercourses; flushed (wintering)	CMc
MA008	05/10/2020	14:17	Mallard	6	watercourses; flushed (wintering)	CMc
MA09	06/01/2021	12:22	Mallard	2	watercourses; flushed, flew away (wintering)	CMc
MA010	06/01/2021	14:35	Mallard	38	watercourses; flushed (wintering)	CMc
MA011	04/03/2021	10:12	Mallard	2	cutover bog; flying, calling (wintering)	CMc

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
MA012	04/03/2021	11:31	Mallard	1	cutover bog; flying (wintering)	CMc
MA013	04/03/2021	13:21	Mallard	2	watercourses; foraging (wintering)	CMc

Table 7 - 4 - 64 Mallard Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA001	River Cashen	26/08/2019	not given	Mallard	4	watercourses, improved agricultural grassland and conifer plantation; took off from reeds, flew around and landed again	CMc
MA002	River Cashen	26/08/2019	not given	Mallard	1	watercourses, improved agricultural grassland and conifer plantation; took off from reeds, flew around and landed again	CMc
MA003	Ballyouneen	12/09/2019	not given	Mallard	2	watercourses and improved agricultural grassland; flying along watercourse10-20m	CMc
MA004	Ardcullen Marshes	12/09/2019	not given	Mallard	1	watercourses and improved agricultural grassland; flying at 20m	CMc
MA005	Killarida	30/09/2019	not given	Mallard	3	improved agricultural grassland; flushed from a flooded field by surveyor	CMc
MA006	Killarida	11/10/2019	not given	Mallard	6	watercourses; flushed by surveyor	CMc
MA007	Ballyouneen	29/10/2019	not given	Mallard	2	improved agricultural grassland;	CMc
MA008	Killacrim	21/11/2019	not given	Mallard	10	depositing/lowland rivers;	CMc
MA009	Dysert	21/11/2019	not given	Mallard	4	improved agricultural grassland;	CMc
MA010	Finuge Bridge	03/12/2019	not given	Mallard	4	watercourses;	CMc
MA011	Killarida	03/01/2020	not given	Mallard	8	watercourses;	CMc
MA012	Finuge Bridge	07/02/2020	not given	Mallard	1	watercourses;	CMc

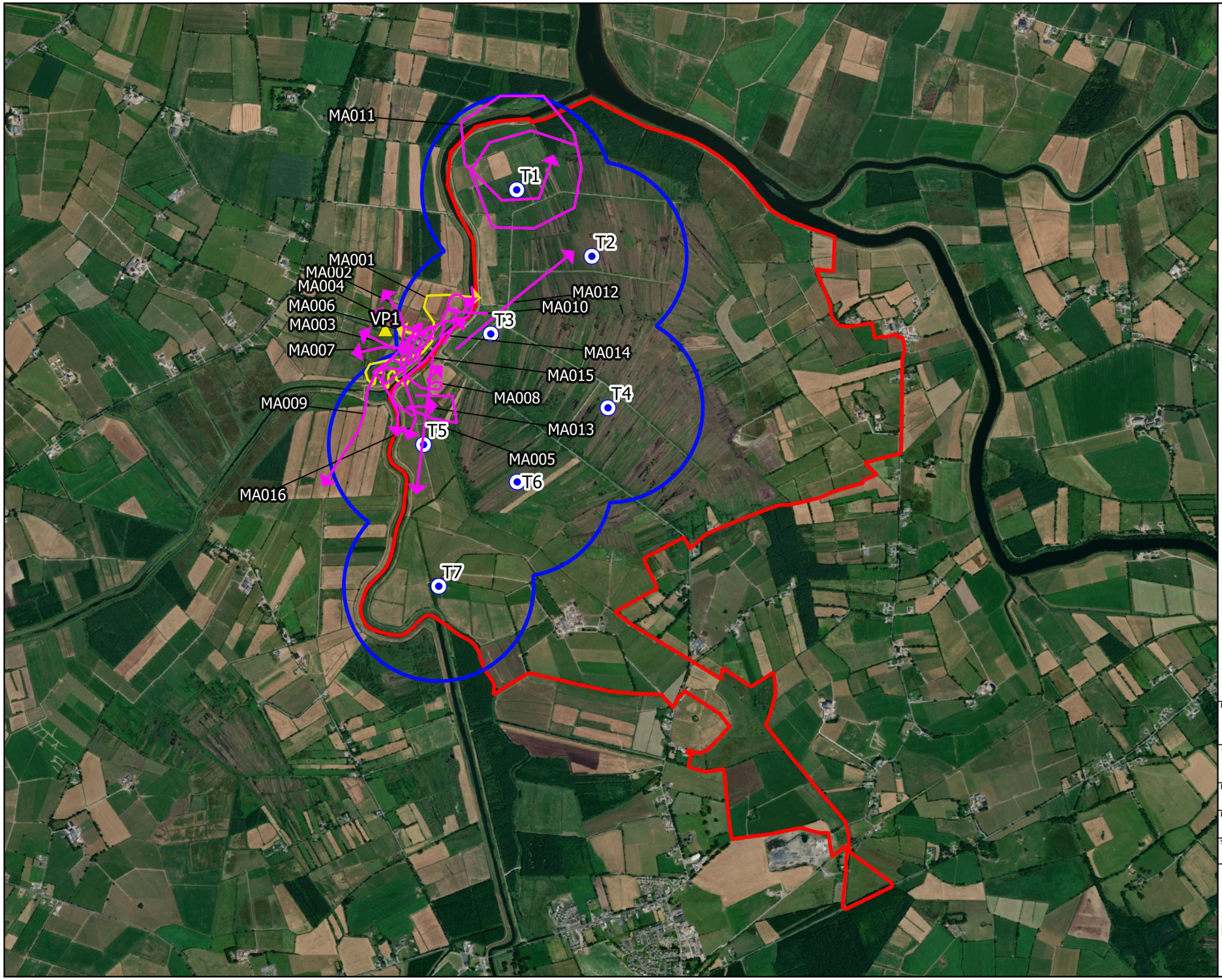
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA013	Lixnaw Canal	02/03/2020	not given	Mallard	2	improved agricultural grassland; foraging in agricultural grassland	CMc
MA014	Lixnaw Canal	19/08/2020	13:41	Mallard	34	improved agricultural grassland; foraging in flooded fields	CMc
MA015	Dysert	23/10/2020	10:17	Mallard	4	watercourses; flying, females	CMc
MA016	Lixnaw Canal	04/11/2020	10:34	Mallard	3	improved agricultural grassland; foraging, flooded fields	CMc
MA017	Ballynagare	04/11/2020	10:40	Mallard	55	improved agricultural grassland and watercourses; flushed	CMc
MA018	Ballynagare	04/11/2020	10:41	Mallard	2	improved agricultural grassland; foraging, flooded fields	CMc
MA019	Lixnaw Canal	18/12/2020	10:35	Mallard	31	improved agricultural grassland; foraging in flood	CMc
MA020	Ballyouneen	04/02/2021	11:23	Mallard	44	improved agricultural grassland; foraging, field was very flooded	CMc
MA021	Ballyouneen	04/02/2021	11:37	Mallard	18	improved agricultural grassland; foraging, in a very flooded part of the field	CMc
MA022	Ballynagare	04/02/2021	14:11	Mallard	12	improved agricultural grassland; flushed	CMc
MA023	Lixnaw Canal	04/02/2021	14:25	Mallard	18	improved agricultural grassland; foraging	CMc
MA024	Ballynagare	19/02/2021	11:59	Mallard	8	improved agricultural grassland; flushed	CMc
MA025	Ballynagare	02/03/2021	10:23	Mallard	3	improved agricultural grassland; flushed	CMc

Table 7 - 4 - 65 Incidental Mallard Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
MA001	Breeding Raptor Survey, brvp2	23/04/2019	not given	Mallard	2	bogs; spotted briefly at 5m for 2 seconds just moving position	CMc
MA002	Breeding Raptor Survey, brvp4	30/04/2019	not given	Mallard	2	bogs; breeding pair flying over bog at 15-20m	CMc
MA003	Breeding Raptor Survey, brvp1 (ballyhorgan)	07/07/2020	not given	Mallard	1	bogs; female flying through over the bog at 20m for 7 secs. not mapped.	CMc

Table 7 - 4 - 66 Supplementary Mallard Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
MA001	VP2	08/04/2019	16:19	Mallard	1	5	5	0	0	0	improved agricultural grassland; flew in low over agricultural field, landed in drainage ditch, adult female	CMc
MA002	VP2	08/04/2019	17:40	Mallard	1	10	0	0	10	0	improved agricultural grassland; flying through site, adult male	CMc
MA003	VP2	09/05/2019	06:09	Mallard	1	20	5	15	0	0	grassland and marsh; flying through site, female	CMc
MA004	VP3	16/05/2019	06:17	Mallard	5	120	10	90	20	0	grassland and marsh; flying around the site, the males appeared to be following the female. they were lost to sight behind the embankment, 4 male, 1 female	CMc
MA005	VP2	10/06/2019	17:59	Mallard	1	13	0	3	10	0	estuaries; flew into the river, adult female	CMc
MA006	VP2	09/08/2019	18:11	Mallard	3	20	0	0	20	0	improved agricultural grassland; flying through the site, 3 females	CMc
MA007	VP2	04/09/2019	07:52	Mallard	3	5	0	5	0	0	grassland and marsh; flying through over a field	CMc
MA008	VP3	22/10/2019	13:51	Mallard	4	16	2	2	12	0	watercourses; flew into site and landed	CMc
MA009	VP2	26/11/2019	13:45	Mallard	6	16	0	0	16	0	grassland and marsh; flying	CMc
MA010	VP2	26/11/2019	13:59	Mallard	10	17	0	12	5	0	improved agricultural grassland; flying	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Mallard Flights
- Mallard Flights at PCH

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Drawing Title	Mallard Vantage Point Survey
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-49
Scale: 1:26000	Date: 05.07.21

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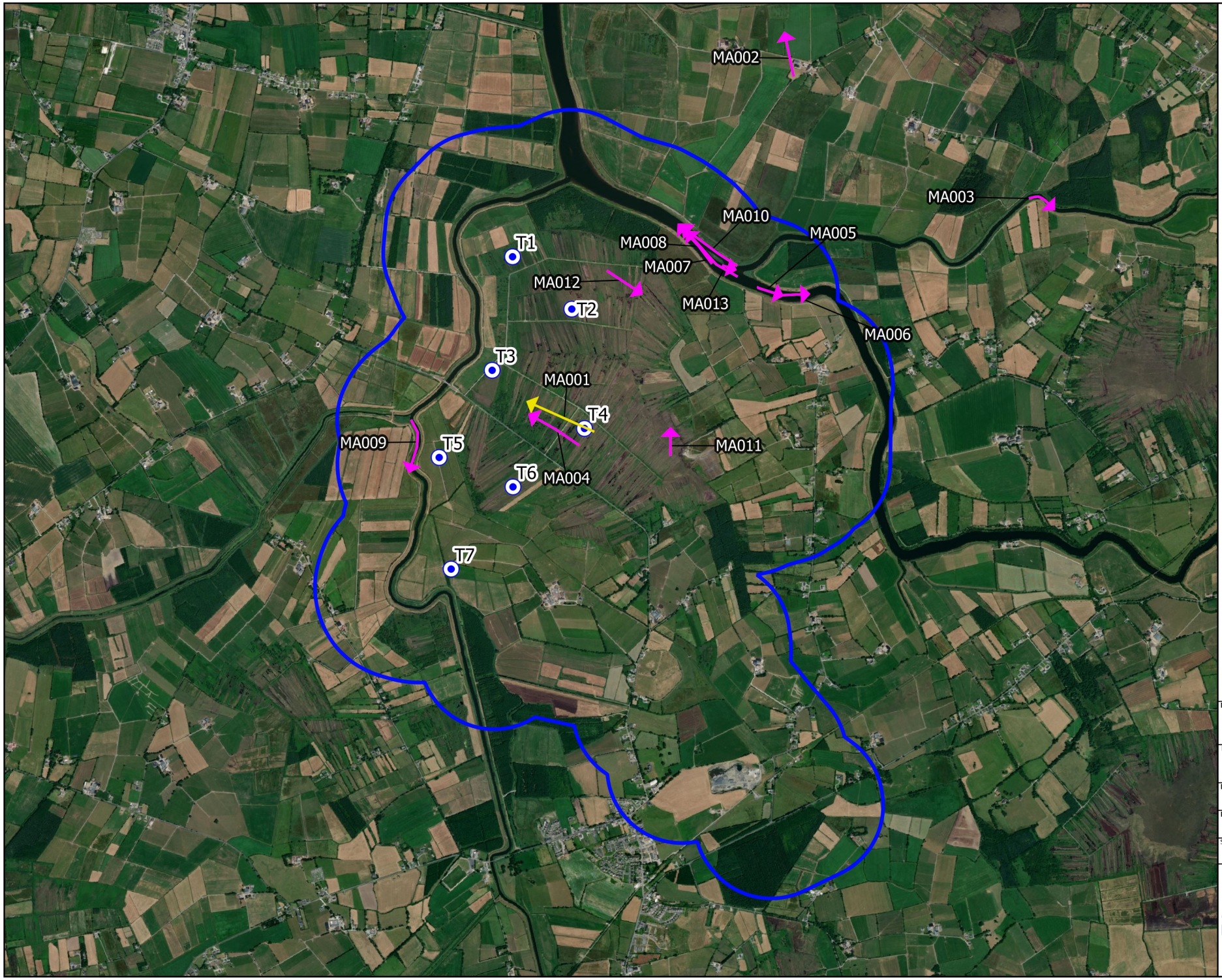

Map Legend

- 500m Survey Radius
- Turbine Location
- Mallard Observation (breeding season)
- Mallard Observation (winter season)

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Drawing Title: Mallard Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-50
Scale	Date
1:33000	05.07.21

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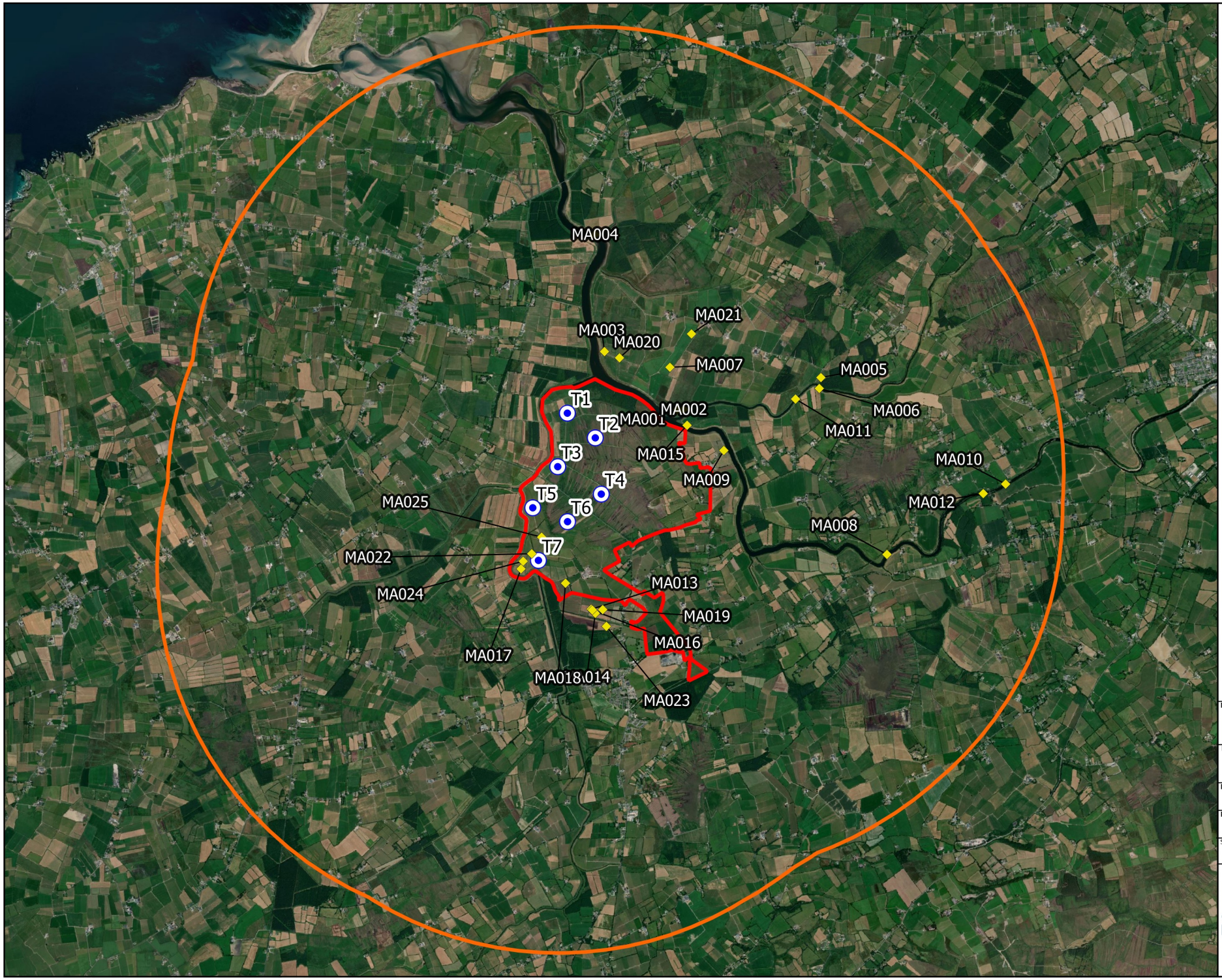

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Mallard Observation

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Drawing Title

Mallard
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-51
Scale	Date
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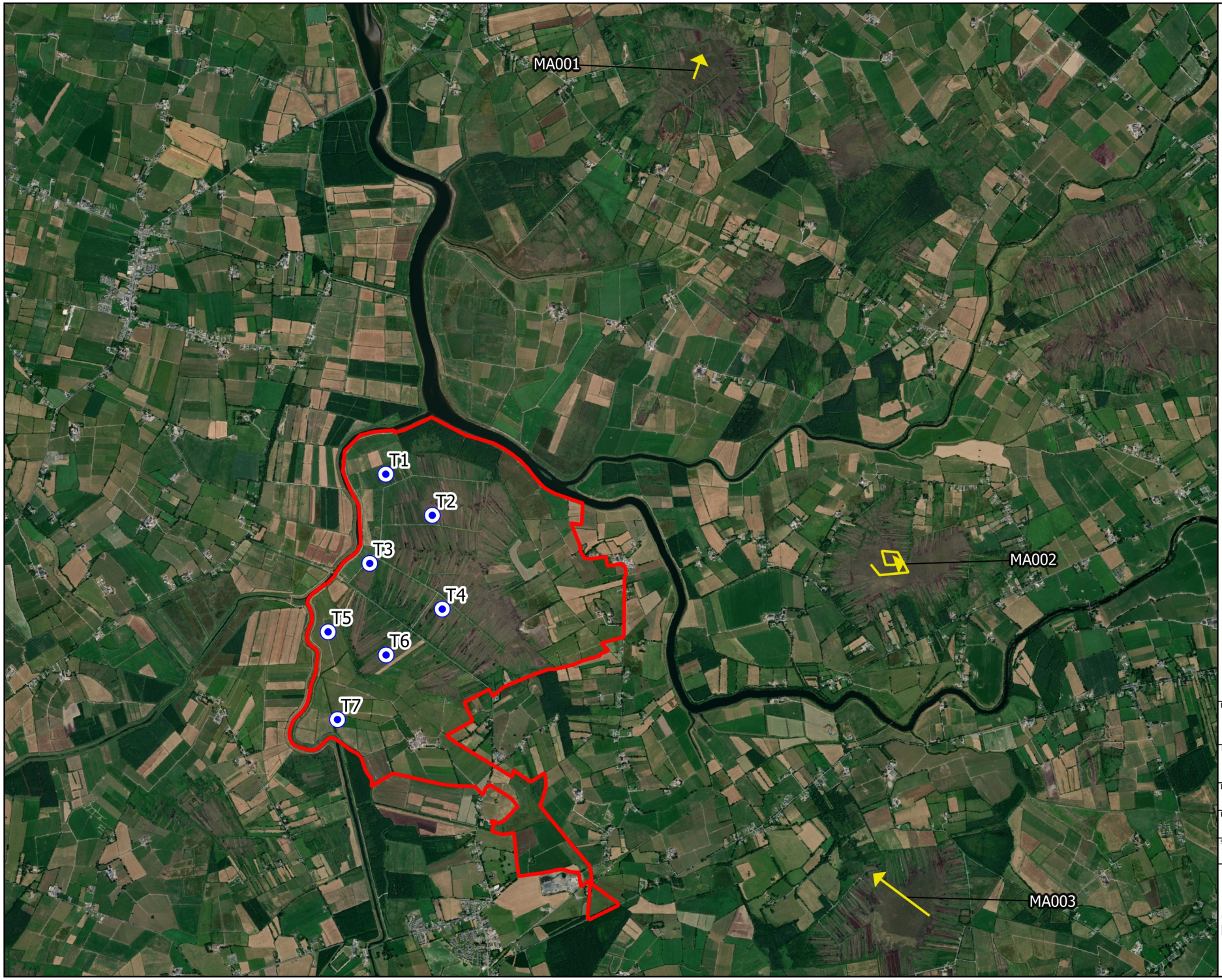

Map Legend

- Wind Farm Site
- Turbine Location
- Mallard Observations

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Drawing Title	Mallard Incidental Records
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-52
Scale: 1:42000	Date: 05.07.21

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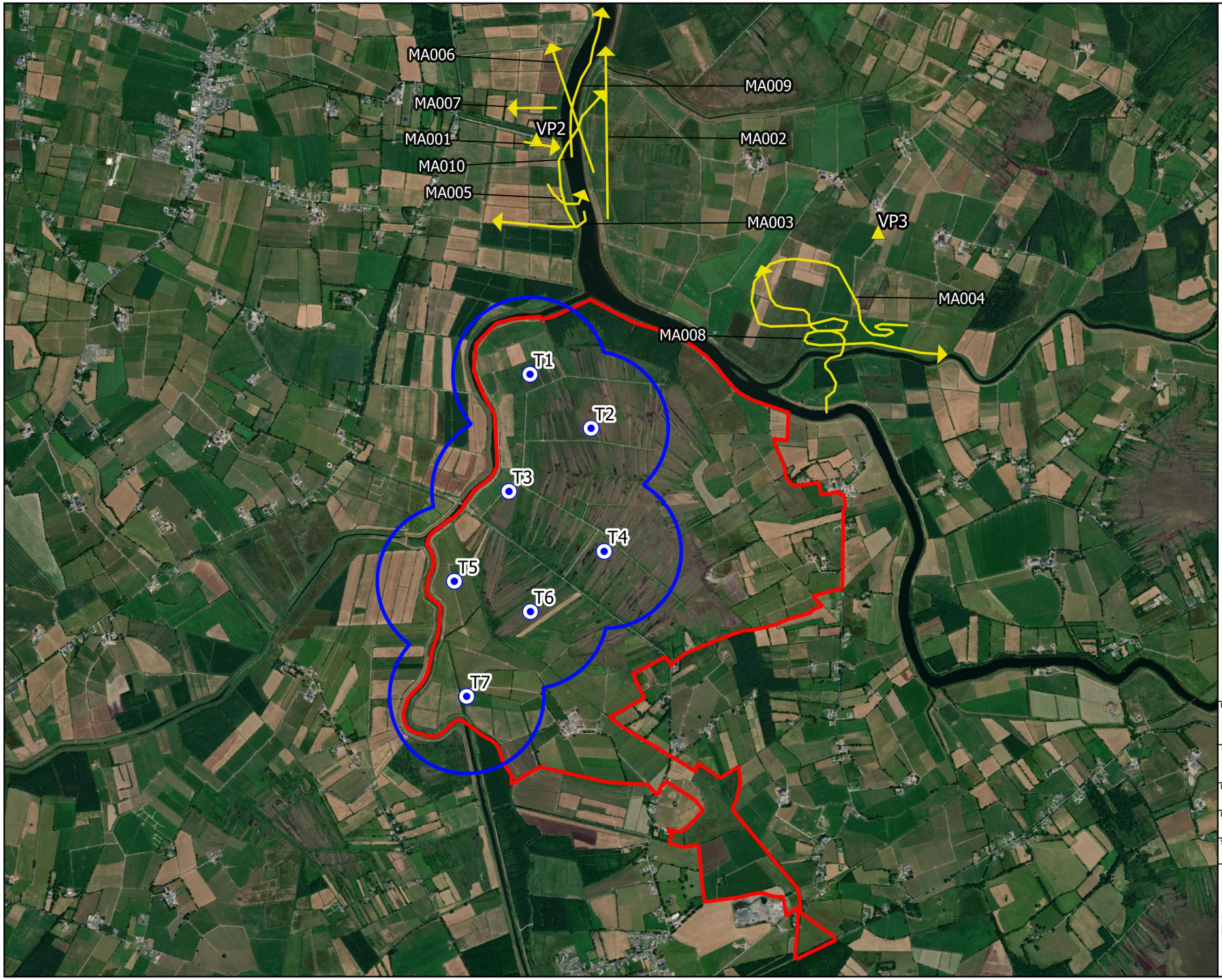

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Mallard Observations

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Drawing Title: Mallard Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-4-53
Scale	Date
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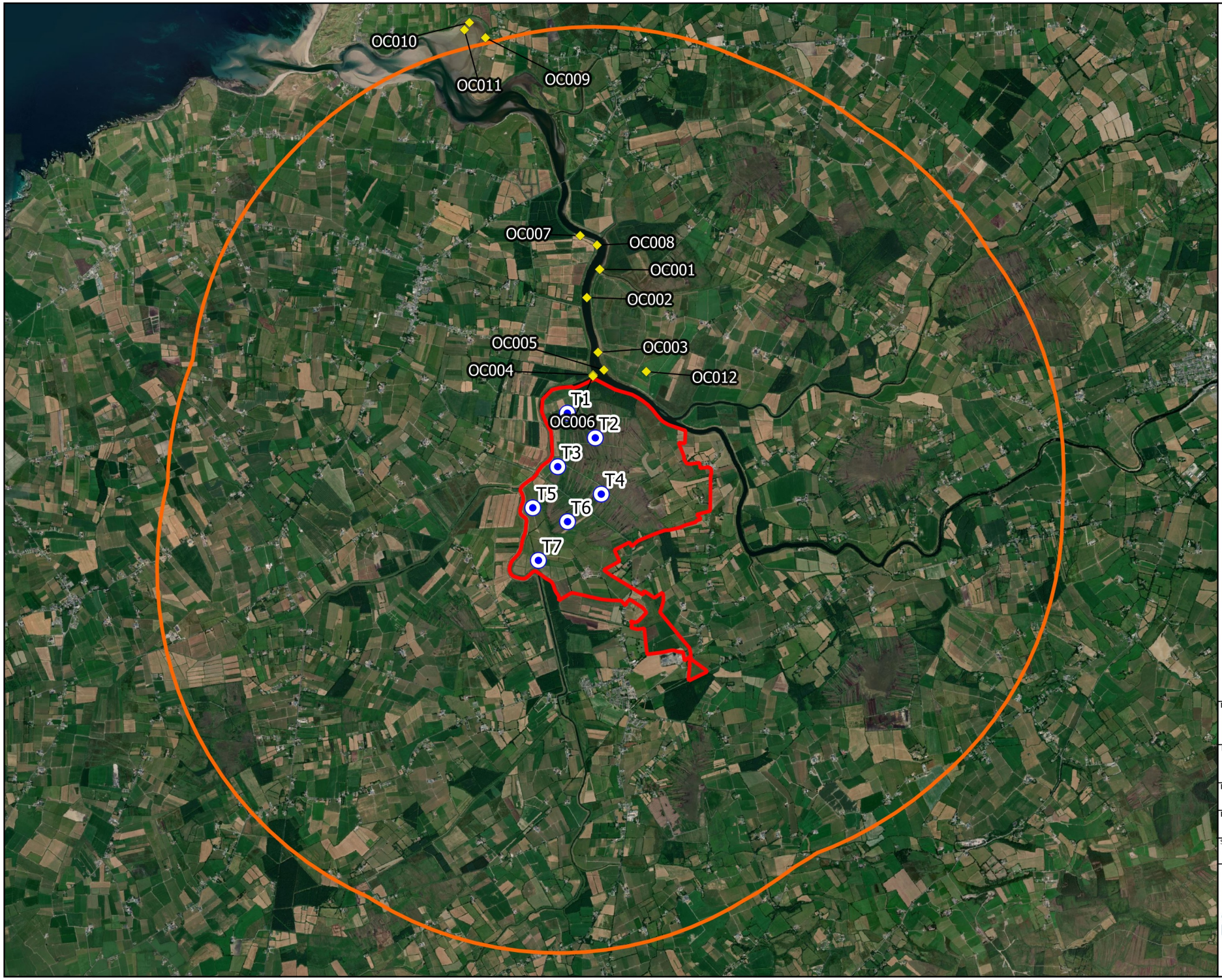
1.18 Oystercatcher

Table 7 - 4 - 67 Oystercatcher Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
OC001	River Cashen	26/08/2019	not given	Oystercatcher	1	estuaries; feeding in a tributary	CMc
OC002	River Cashen	26/08/2019	not given	Oystercatcher	10	estuaries; feeding in estuary	CMc
OC003	River Cashen	26/08/2019	not given	Oystercatcher	2	estuaries; feeding in estuary	CMc
OC004	River Cashen	26/08/2019	not given	Oystercatcher	3	estuaries; feeding in estuary	CMc
OC005	Ballyouneen	12/09/2019	not given	Oystercatcher	2	watercourses; feeding at rivers edge at low tide	CMc
OC006	Ballyouneen	12/09/2019	not given	Oystercatcher	2	watercourses; feeding at rivers edge at low tide	CMc
OC007	Ardcullen Marshes	12/09/2019	not given	Oystercatcher	7	watercourses; at waters edge	CMc
OC008	Ardcullen Marshes	12/09/2019	not given	Oystercatcher	2	watercourses; feeding at rivers edge at low tide	CMc
OC009	Rahoonagh	30/09/2019	not given	Oystercatcher	1	sea inlets and bays; flying along coast <10m	CMc
OC010	The Cashen	11/10/2019	not given	Oystercatcher	2	muddy sand shores; feeding at low tide	CMc
OC011	The Cashen	29/10/2019	not given	Oystercatcher	2	muddy sand shores;	CMc
OC012	Ballyouneen	04/11/2020	13:07	Oystercatcher	5	improved agricultural grassland; foraging	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Oystercatcher Observation

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Drawing Title

Oystercatcher
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

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200512	Fig 7-4-54
Scale	Date
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1.19 Redshank

Table 7 - 4 - 68 Redshank Vantage Point Survey

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
RK001	VP1	22/03/2021	07:27	Redshank	1	2	2	0	0	0	watercourses; flying, landed, foraging, low tide, foraging on intertidal mud at waters edge	CMc

Table 7 - 4 - 69 Redshank Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
RK001	21/01/2020	10:21	Redshank	5	watercourses; flushed by surveyor (wintering)	CMc

Table 7 - 4 - 70 Redshank Waterbird Distribution Survey

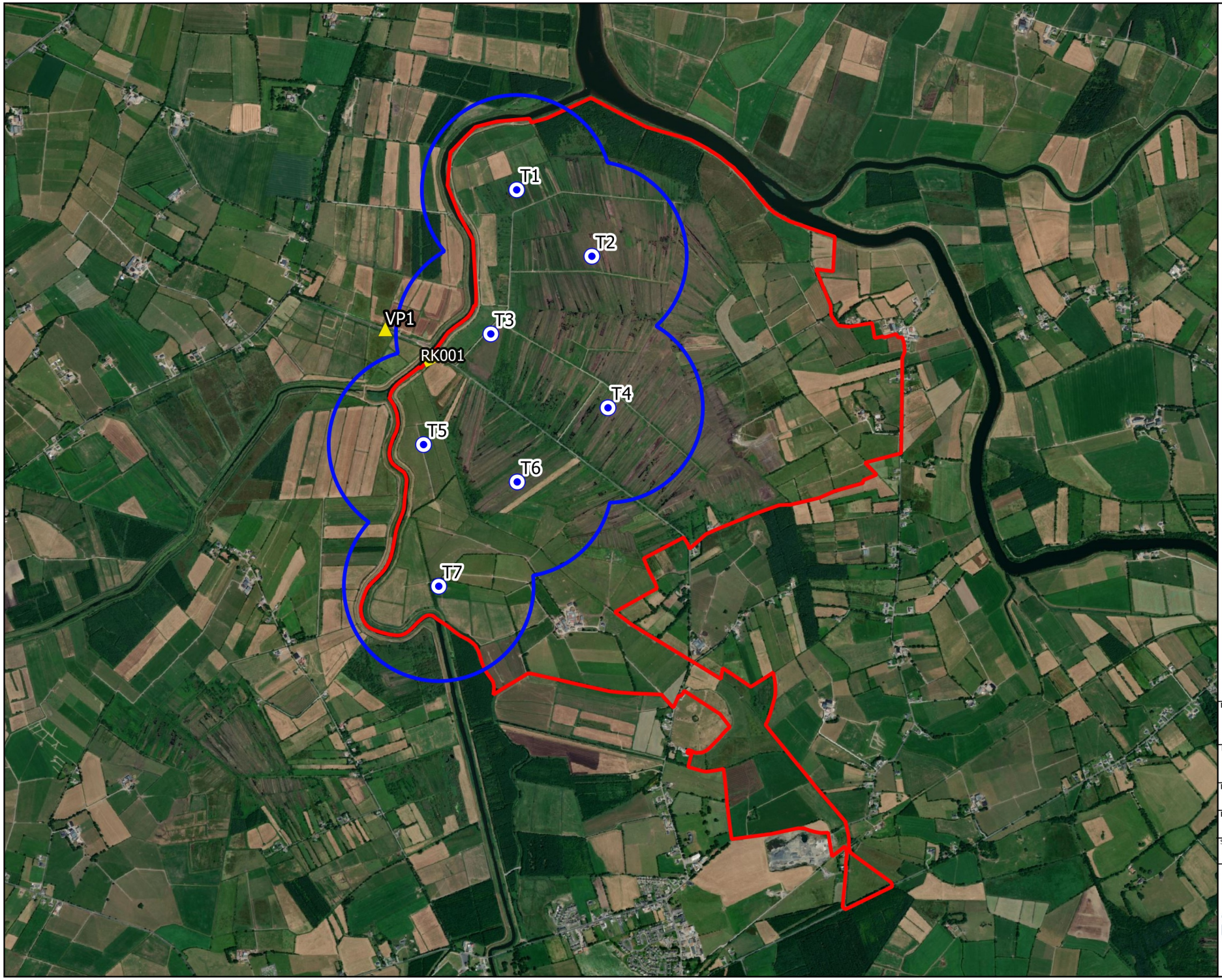
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
RK001	River Cashen	26/08/2019	not given	Redshank	3	estuaries; feeding in estuary	CMc
RK002	River Cashen	26/08/2019	not given	Redshank	29	estuaries; roosting on the bank of a tributary, flushed by surveyor	CMc
RK003	River Cashen	26/08/2019	not given	Redshank	2	watercourses; flushed by surveyor, possibly roosting	CMc
RK004	The Cashen	11/10/2019	not given	Redshank	4	muddy sand shores; feeding at low tide	CMc
RK005	The Cashen	29/10/2019	not given	Redshank	12	muddy sand shores;	CMc
RK006	Mouth of the Cashen River	17/12/2019	not given	Redshank	6	sea inlets and bays;	CMc

Table 7 - 4 - 71 Supplementary Redshank Data (flights)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
RK001	VP2	08/04/2019	16:44	Redshank	1	15	0	15	0	0	improved agricultural grassland and estuaries; flying along stream, then away over agriculutral grassland, lost to sight behind embankment	CMc
RK002	VP2	09/08/2019	17:42	Redshank	2	5	2	3	0	0	improved agricultural grassland; two birds flew along the canal, went up over the embankment and behind trees out of sight	CMc
RK003	VP2	04/09/2019	05:50	Redshank	12	5	5	0	0	0	watercourses; flushed by survyor as they got to vp	CMc
RK004	VP2	18/10/2019	16:56	Redshank	1	8	5	3	0	0	watercourses; flying along canal	CMc
RK005	VP2	26/11/2019	12:30	Redshank	4	3	3	0	0	0	improved agricultural grassland; flushed upon arrival to vp	CMc
RK006	VP2	09/12/2019	11:20	Redshank	2	3	3	0	0	0	watercourses; flushed by surveyor upon arrival	CMc
RK007	VP2	09/12/2019	12:14	Redshank	37	5	5	0	0	0	watercourses; flying	CMc
RK008	VP2	09/12/2019	12:59	Redshank	1	6	6	0	0	0	watercourses; flying	CMc
RK009	VP2	09/12/2019	13:16	Redshank	2	6	6	0	0	0	watercourses; flying	CMc

Table 7 - 4 - 72 Supplementary Redshank Data (non-flights)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
RK002	VP2	04/09/2019	not given	Redshank	1	improved agricultural grassland; calling frequently	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Redshank Flights

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Drawing Title: Redshank Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-55
Scale	Date
1:26000	05.07.21

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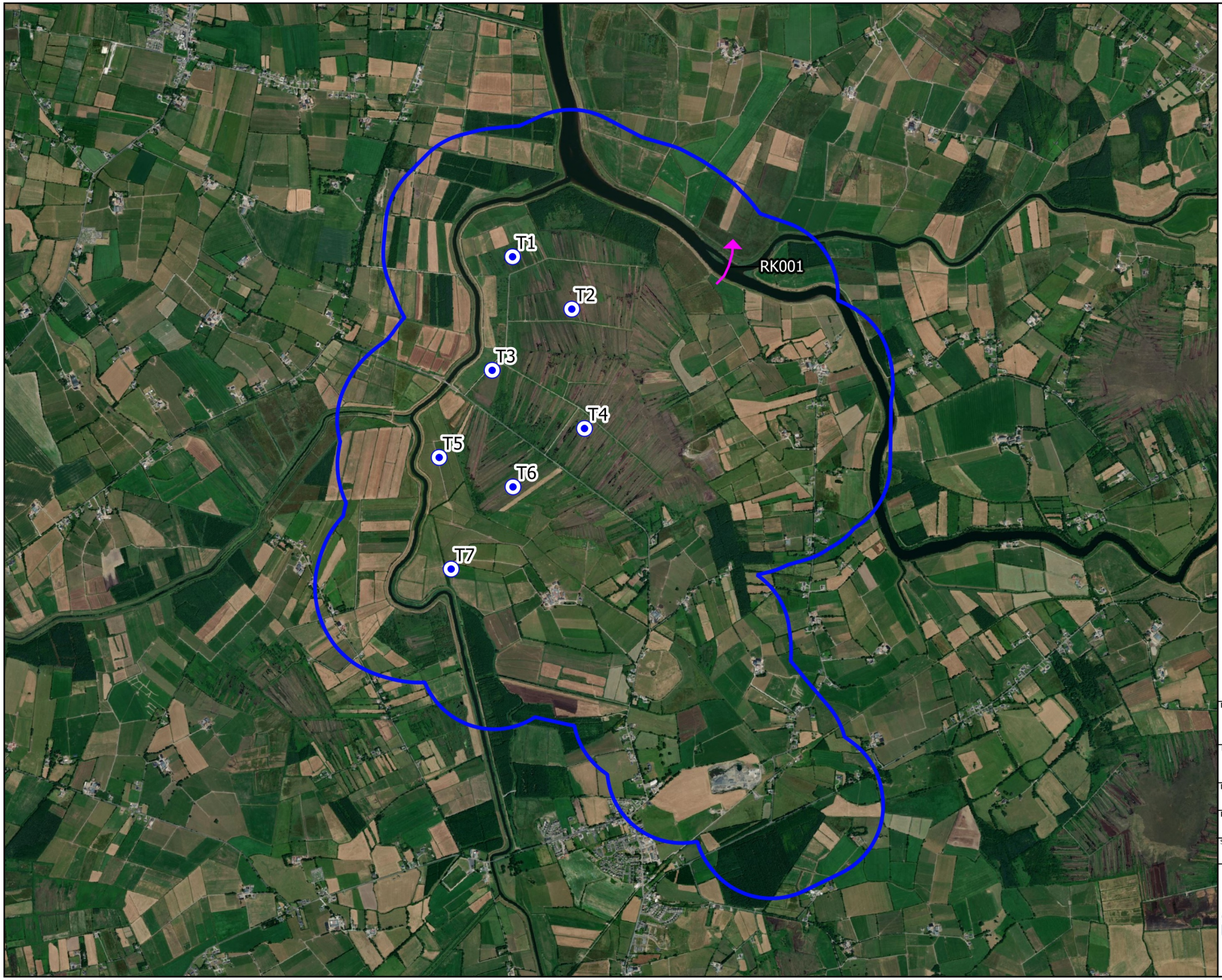

Map Legend

- 500m Survey Radius
- Turbine Location
- Redshank Observations

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Drawing Title: Redshank Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-56
Scale	Date
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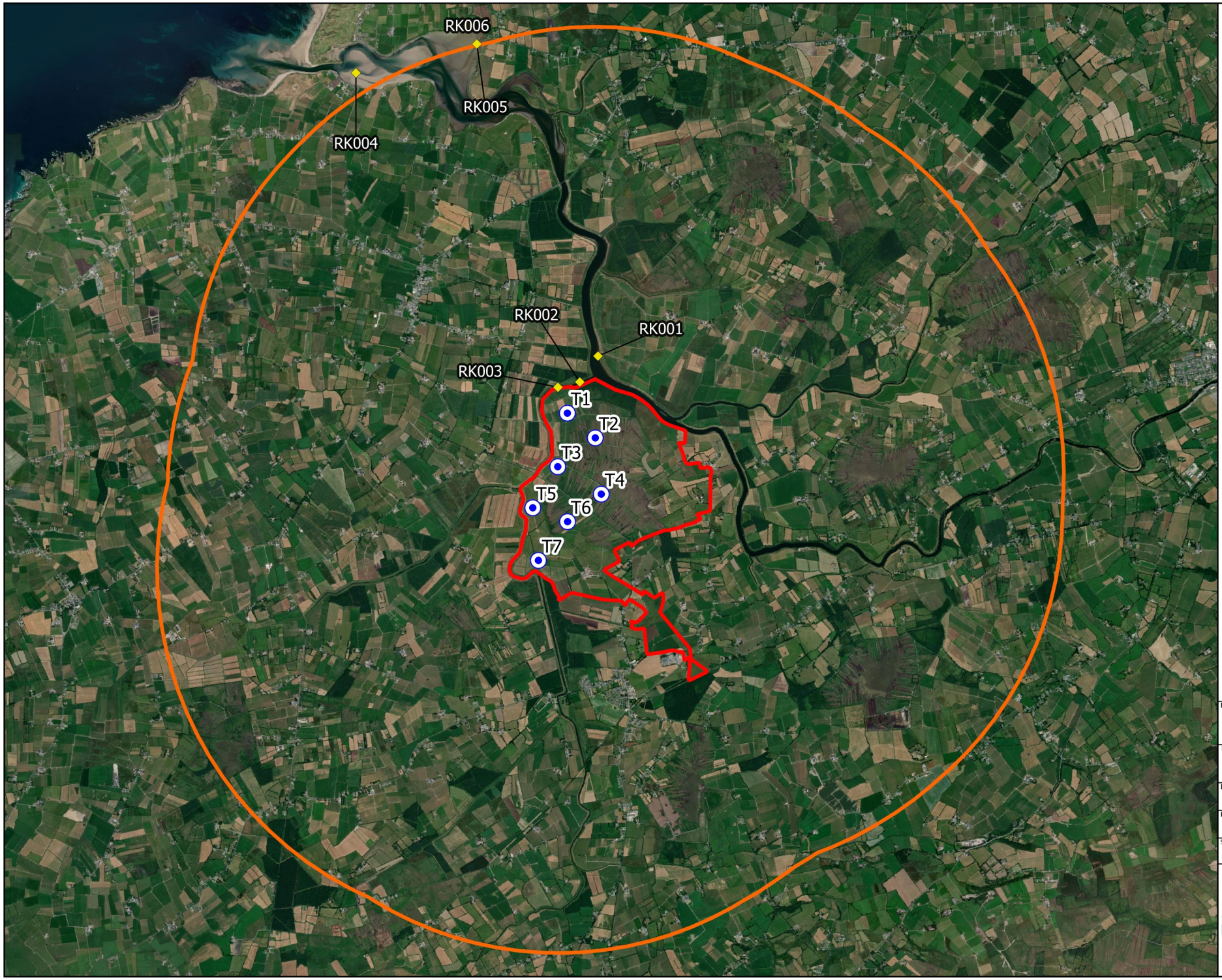

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Redshank Observations

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Drawing Title

Redshank
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-57
Scale	Date
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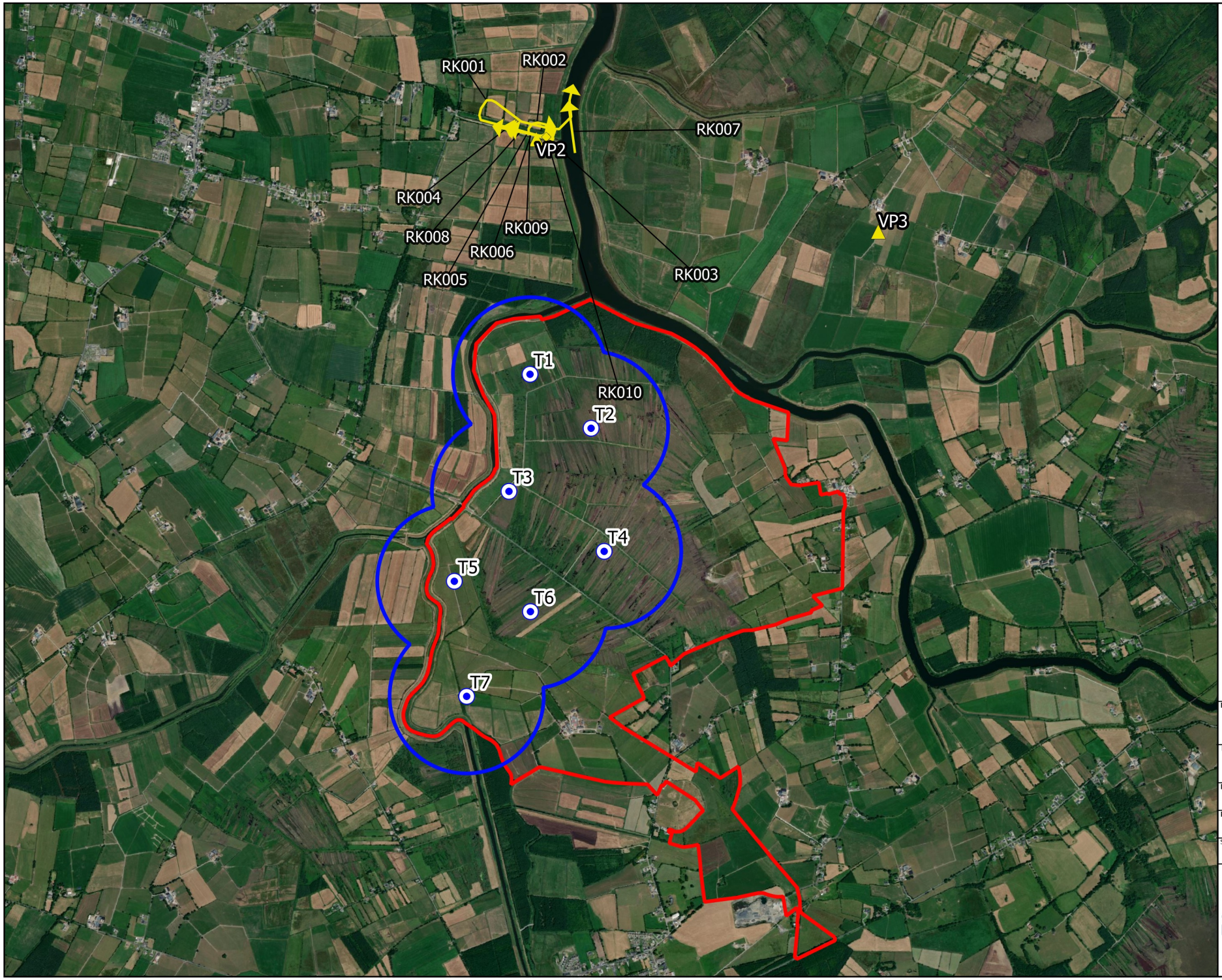

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Redshank Observations (flights)
- Redshank Observations (non-flights)

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Drawing Title: Redshank Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-58
Scale	Date
1:32000	05.07.21

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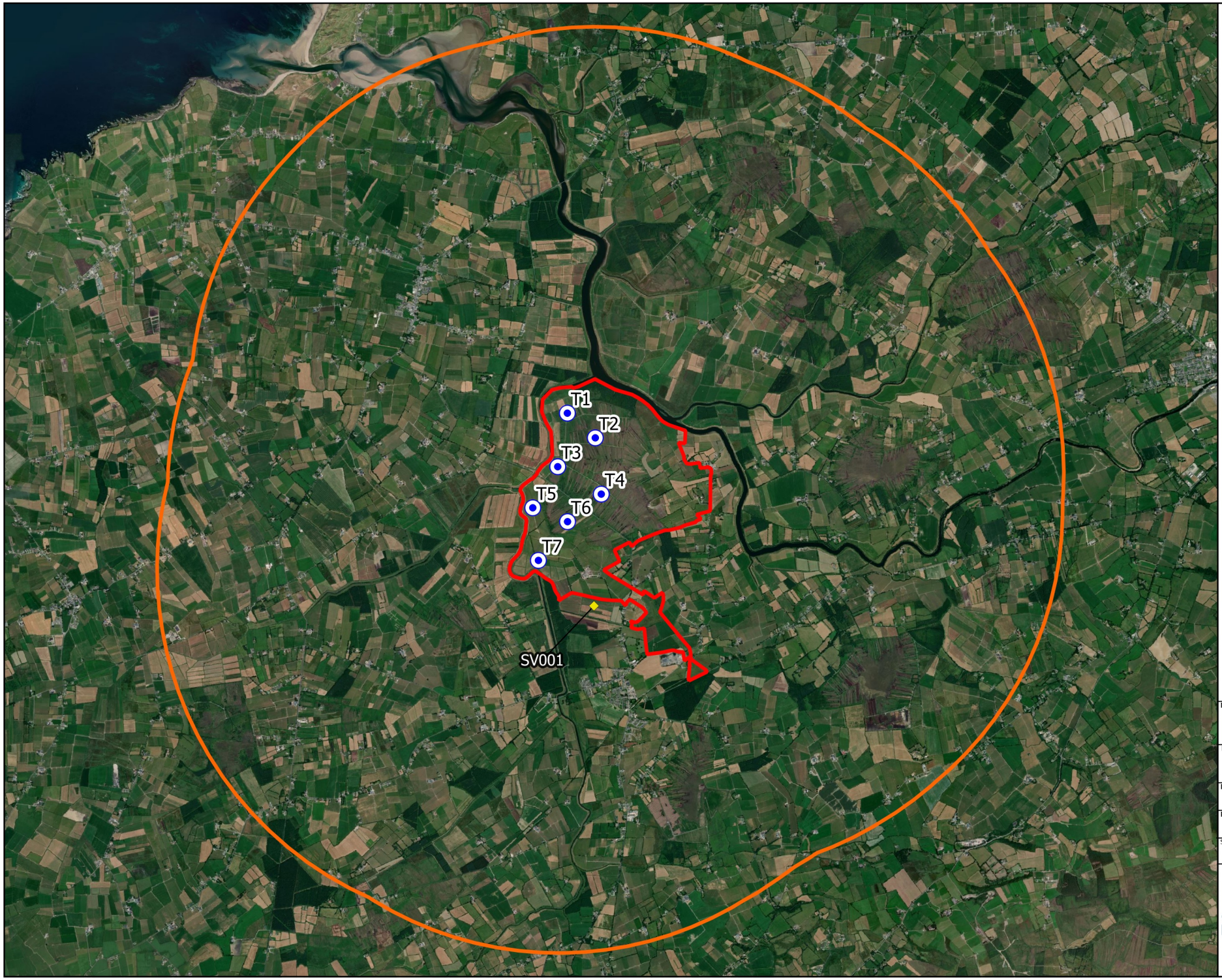
1.20 Shoveler

Table 7 - 4 - 73 Shoveler Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SV001	Lixnaw Canal	02/03/2020	not given	Shoveler	1	improved agricultural grassland; foraging in agricultural grassland	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Shoveler Observations

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Drawing Title

Shoveler
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-59
Scale	Date
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1.21 Teal

Table 7 - 4 - 74 Teal Vantage Point Survey

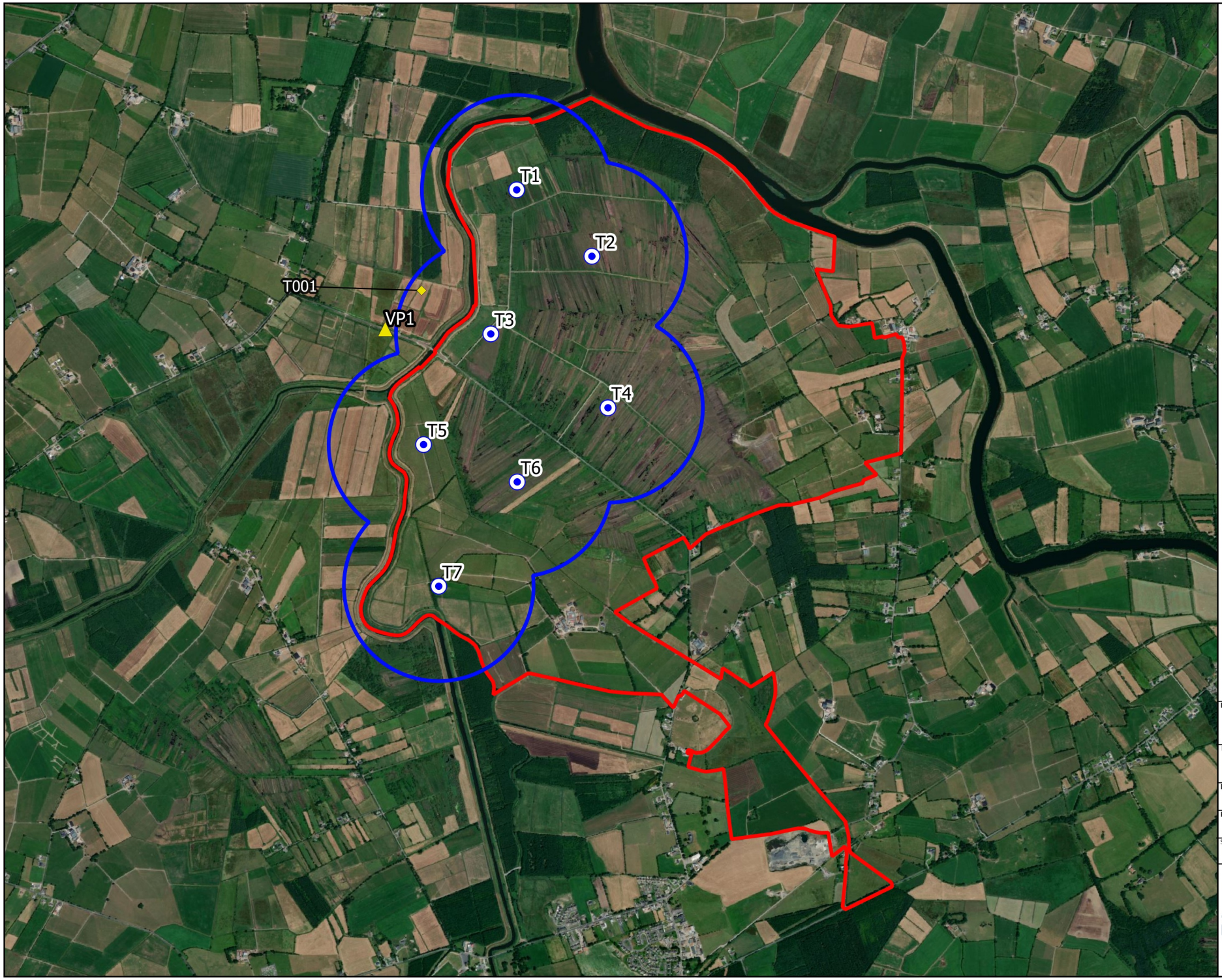
Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	VP1	13/02/2020	09:10	Teal	5	improved agricultural grassland; foraging on agricultural grassland upon arrival at the vp, same ploygon on map	CMc

Table 7 - 4 - 75 Teal Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	Killacrim	21/11/2019	not given	Teal	2	depositing/lowland rivers;	CMc
T002	Lixnaw Canal	02/03/2020	not given	Teal	3	improved agricultural grassland; foraging in agricultural grassland	CMc

Table 7 - 4 - 76 Incidental Teal Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
T001	Vantage Point Survey, ballynagare	17/12/2020	not given	Teal	300	improved agricultural grassland; pm of cu conservation was bird watching and reported these birds to the surveyor. the teal were not seen by the surveyor	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Teal Observation (non-flight)

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Drawing Title: Teal Vantage Point Survey

Project Title: Ballynagare Wind Farm

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S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-60
Scale	Date
1:26000	05.07.21

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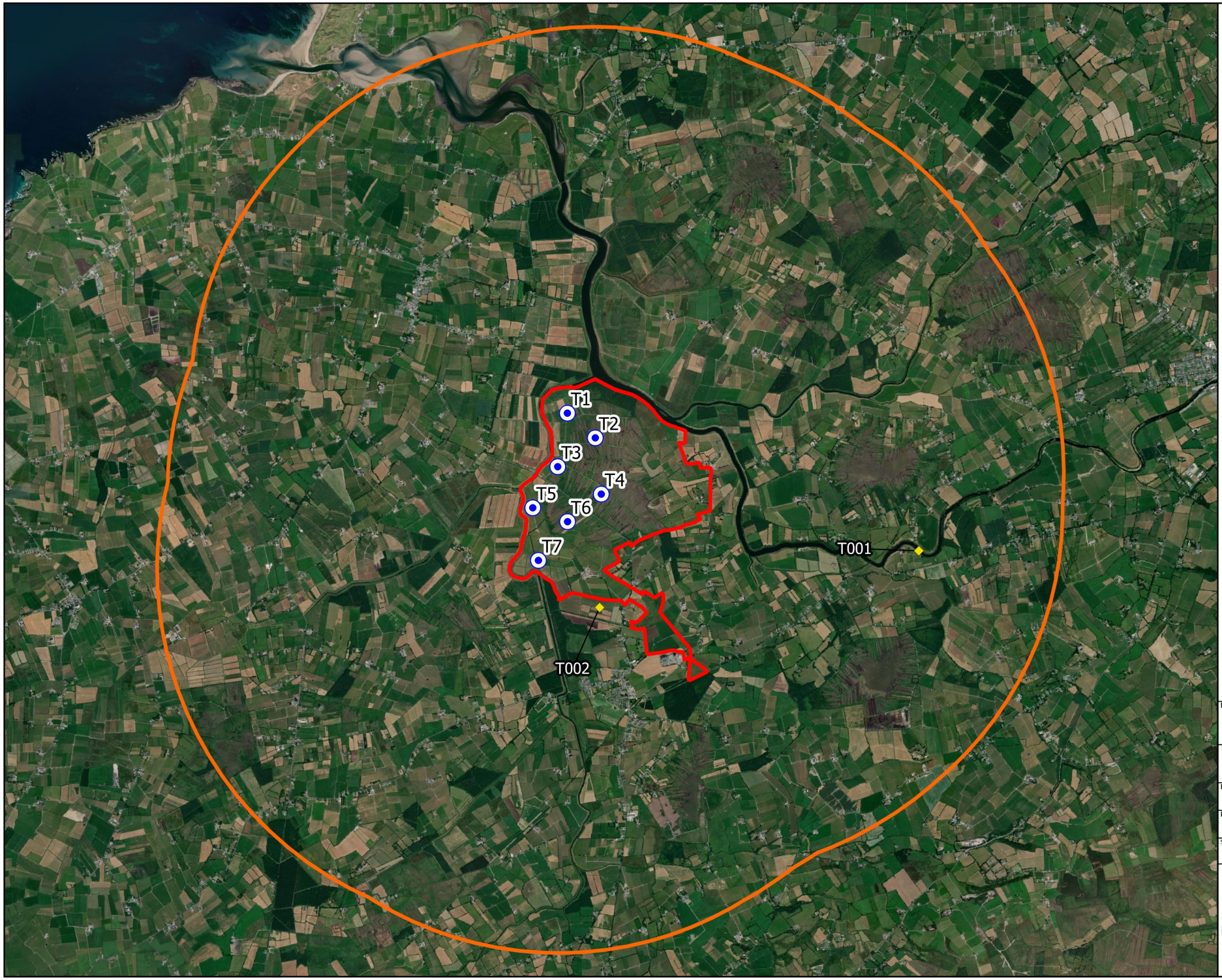

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Teal Observations

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Drawing Title

Teal
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

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Project No.	Drawing No.
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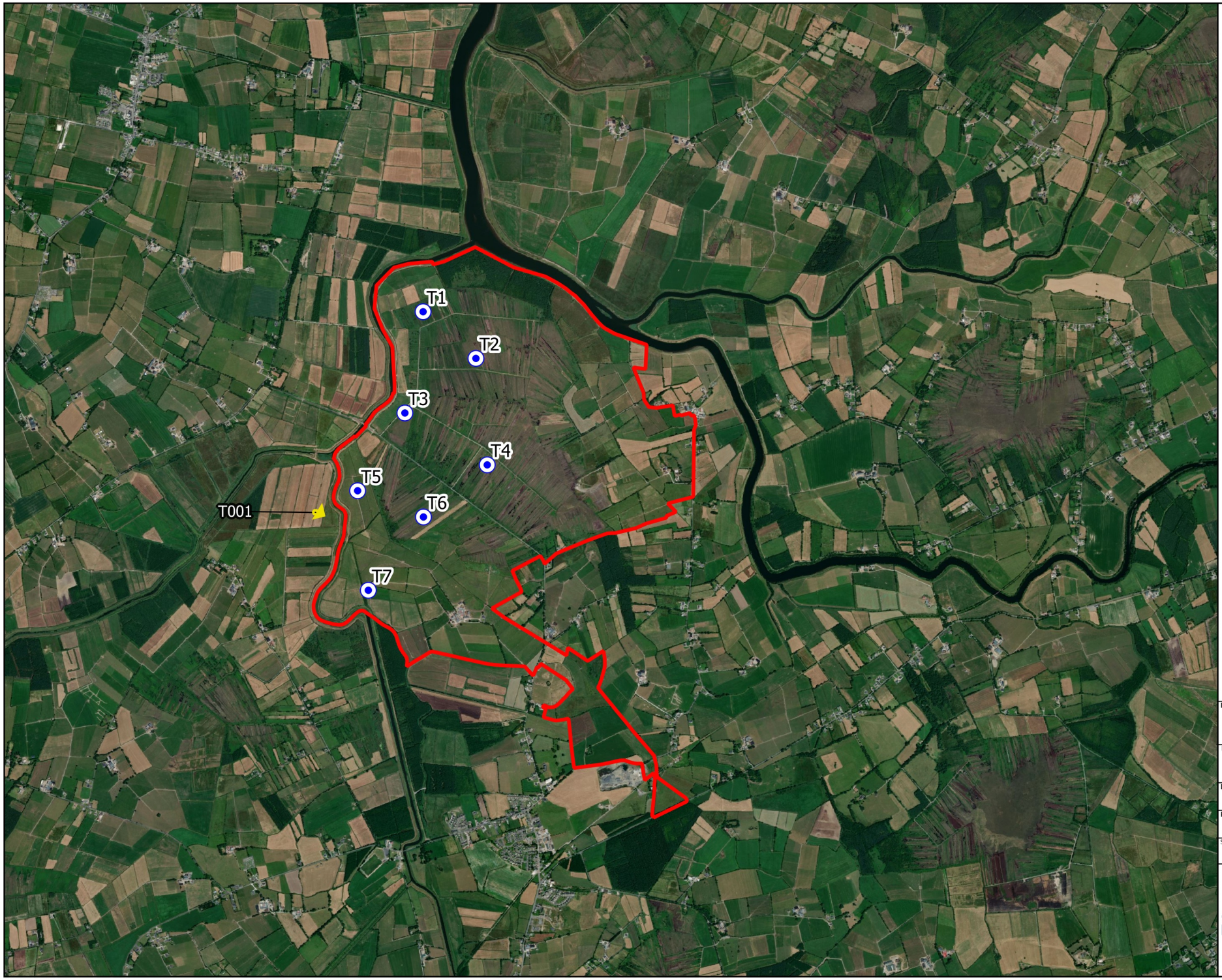

Map Legend

- Wind Farm Site
- Turbine Location
- Teal Observations

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Drawing Title: Teal Incidental Records

Project Title: Ballynagare Wind Farm

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Scale	Date
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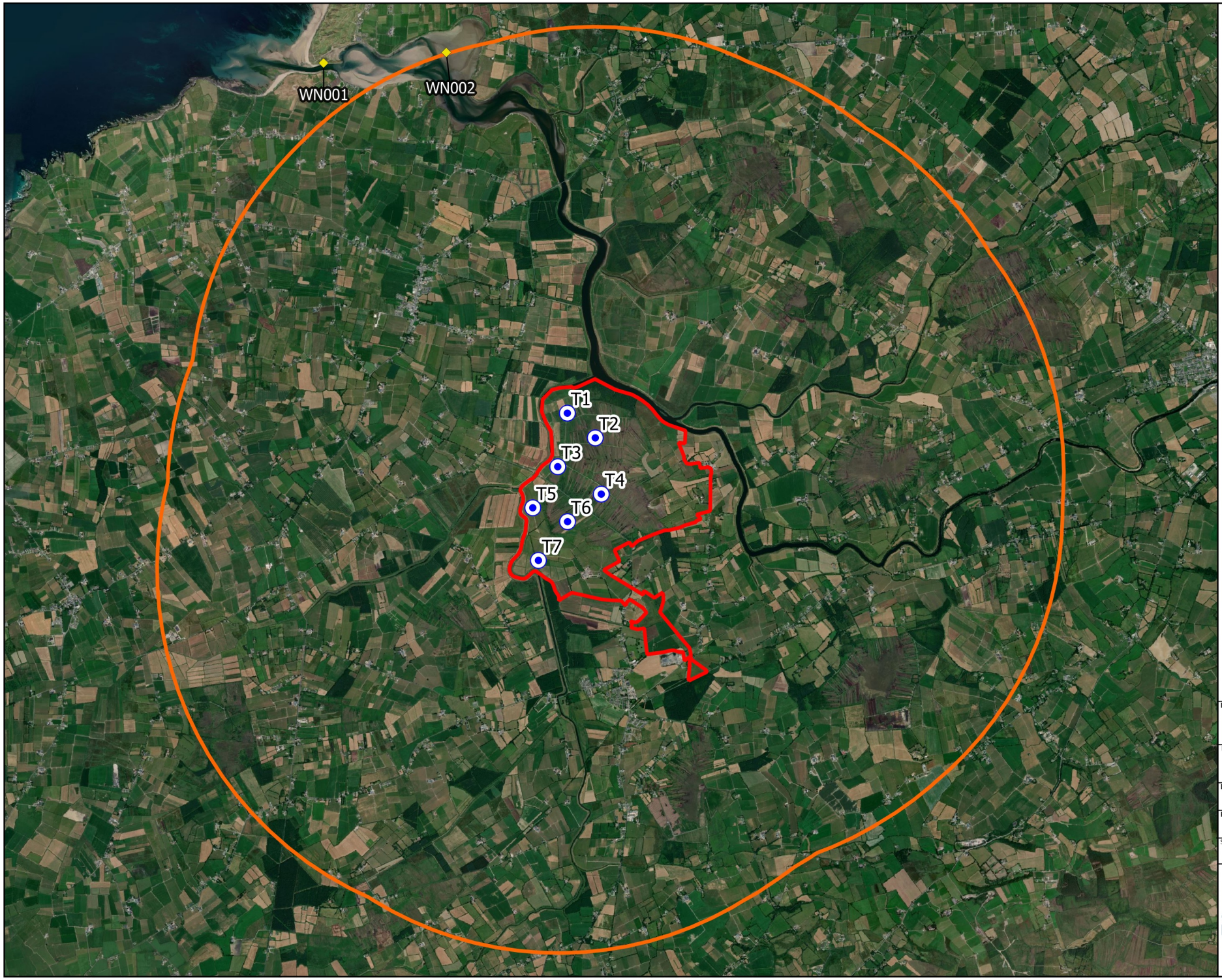
1.22 Wigeon

Table 7 - 4 - 77 Wigeon Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WN001	The Cashen	07/11/2019	not given	Wigeon	200	sea inlets and bays; on water, frequently disturbed by people collecting seaweed, at least 200	CMc
WN002	Mouth of the Cashen River	17/12/2019	not given	Wigeon	269	sea inlets and bays; on water, foraging	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Wigeon Observations

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Drawing Title

Wigeon
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

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Project No.	Drawing No.
200512	Fig 7-4-63
Scale	Date
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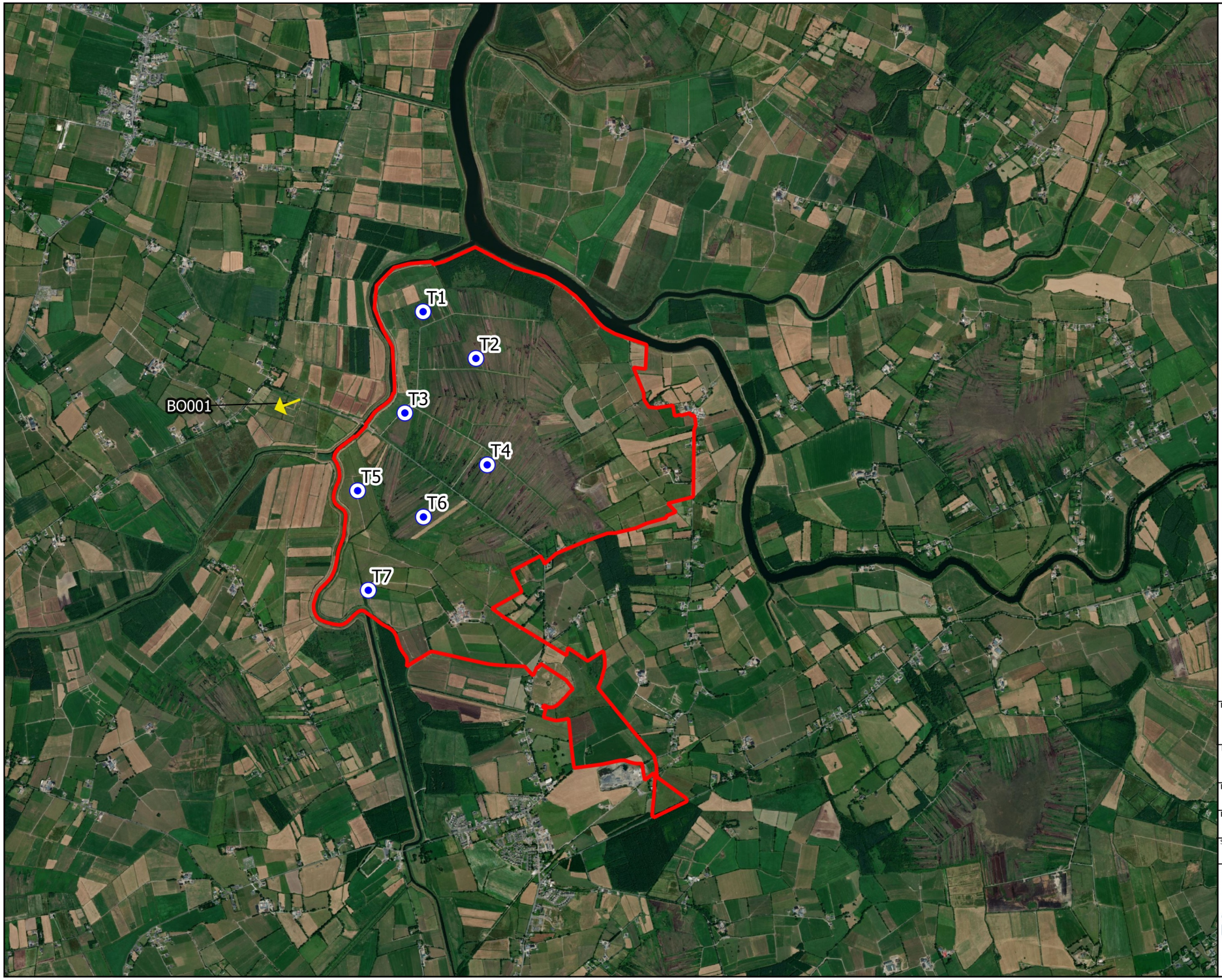
1.23 Barn Owl

Table 7 - 4 - 78 Incidental Barn Owl Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BO001	Vantage Point Survey, vp1	13/02/2020	not given	Barn Owl	1	improved agricultural grassland; as surveyor was turning the car to leave, owl landed on a fence post behind the vp for approximately 20 seconds before flying away (0-15m) into the darkness	CMc



Map Legend

- Wind Farm Site
- Turbine Location
- Barn Owl Observations

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Drawing Title	Barn Owl Incidental Records
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-64
Scale: 1:37000	Date: 05.07.21

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1.24 Kestrel

Table 7 - 4 - 79 Kestrel Vantage Point Survey (lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
K001	VP1	14/05/2019	10:40	Kestrel	1	60	0	50	10	0	grassland and marsh; hunting and hovering	CMc
K002	VP1	02/08/2019	11:03	Kestrel	1	10	0	0	10	0	grassland and marsh; hunting	CMc
K003	VP1	02/08/2019	12:05	Kestrel	1	15	0	0	15	0	grassland and marsh; hunting	CMc

Table 7 - 4 - 80 Kestrel Vantage Point Survey (upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K004	VP1	13/02/2020	10:12	Kestrel	1	12	0	12	0	0	conifer plantation; mobbed by 3 hooded crows	CMc
K005	VP1	31/08/2020	17:06	Kestrel	1	25	0	25	0	0	cutover bog; hunting	CMc
K006	VP1	31/08/2020	18:48	Kestrel	1	3	2	1	0	0	improved agricultural grassland and watercourses; perched and flying, perched on an esb pole then flew across river, dropped behind embankment out of sight	CMc
K007	VP1	31/08/2020	20:10	Kestrel	1	15	0	0	15	0	improved agricultural grassland; hunting	CMc
K008	VP1	06/10/2020	15:24	Kestrel	1	40	10	25	5	0	improved agricultural grassland and watercourses; hunting/mobbed, adult male	CMc
K009	VP1	06/10/2020	15:47	Kestrel	1	50	0	0	50	0	cutover bog; hunting	CMc
K010	VP1	06/10/2020	15:48	Kestrel	1	30	2	18	10	0	cutover bog; hunting, adult male, dropped into scrub	CMc
K011	VP1	06/10/2020	15:53	Kestrel	1	25	0	25	0	0	improved agricultural grassland and conifer plantation; hunting and landed, landed in forestry	CMc

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
K012	VP1	06/10/2020	16:08	Kestrel	1	12	2	2	8	0	improved agricultural grassland; hunting	CMc
K013	VP1	23/11/2020	12:37	Kestrel	1	35	0	20	15	0	improved agricultural grassland and watercourses;	CMc
K014	VP1	15/02/2021	13:41	Kestrel	1	25	0	0	25	0	improved agricultural grassland; flying	CMc
K015	VP1	15/02/2021	14:03	Kestrel	1	10	0	0	10	0	cutover bog; hunting	CMc
K016	VP1	22/03/2021	07:05	Kestrel	1	240	0	0	240	0	improved agricultural grassland and cutover bog; hunting	CMc

Table 7 - 4 - 81 Kestrel Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	26/04/2019	11:54	Kestrel	1	improved agricultural grassland; adult hunting, the ground under was not visible through the embankment. the habitat may not have been ga1 (flyover; non-breeding)	CMc
K002	13/12/2019	not given	Kestrel	1	improved agricultural grassland and watercourses; flying through at 15-25m height band (wintering)	CMc
K003	19/06/2020	not given	Kestrel	1	cutover bog; hovering, dropped into scrub, was then flushed by surveyor and continued hunting, adult female (suitable nesting habitat; possible breeder)	CMc
K004	06/01/2021	not given	Kestrel	1	improved agricultural grassland; flying low over the field (wintering)	CMc

Table 7 - 4 - 82 Kestrel Breeding Raptor Survey

Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K001	BRVP2	10/05/2019	12:13	Kestrel	1	cutover bog, hunting over the bog, mostly <25m high. moving slowly, hovering for short periods, then flew quickly away	suitable nesting habitat; possible breeder	CMc

Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
K002	BRVP2	10/05/2019	12:15	Kestrel	2	cutover bog, the first kestrel joined a second that was being mobbed by 2 hooded crows. the first bird was lost to sight at this stage. the second got away from the 2 hooded crows and flew away low and slowly, lost to sight behind scrub	pair; probable breeding	CMc
K003	BRVP1	04/06/2019	12:41	Kestrel	1	cutover bog, flying through the bog	suitable nesting habitat; possible breeder	CMc
K004	BRVP1	04/06/2019	13:31	Kestrel	1	cutover bog, flying through the bog	suitable nesting habitat; possible breeder	CMc
K005	BRVP3	12/06/2019	10:41	Kestrel	1	cutover bog, hunting, mostly in pch	suitable nesting habitat; possible breeder	CMc
K006	BRVP3	12/06/2019	11:07	Kestrel	1	cutover bog and conifer plantation, hunting, mostly in pch	suitable nesting habitat; possible breeder	CMc
K007	BRVP3	10/06/2020	15:52	Kestrel	1	cutover bog, hunting and dropped out of sight, adult male	suitable nesting habitat; possible breeder	CMc
K008	BRVP2	08/07/2020	14:12	Kestrel	1	cutover bog, flying at 30m, in view for 5 seconds, lost to sight behind trees	suitable nesting habitat; possible breeder	CMc
K009	BRVP3	09/07/2020	12:30	Kestrel	1	cutover bog, hunting at 25m over the bog, adult female	suitable nesting habitat; possible breeder	CMc

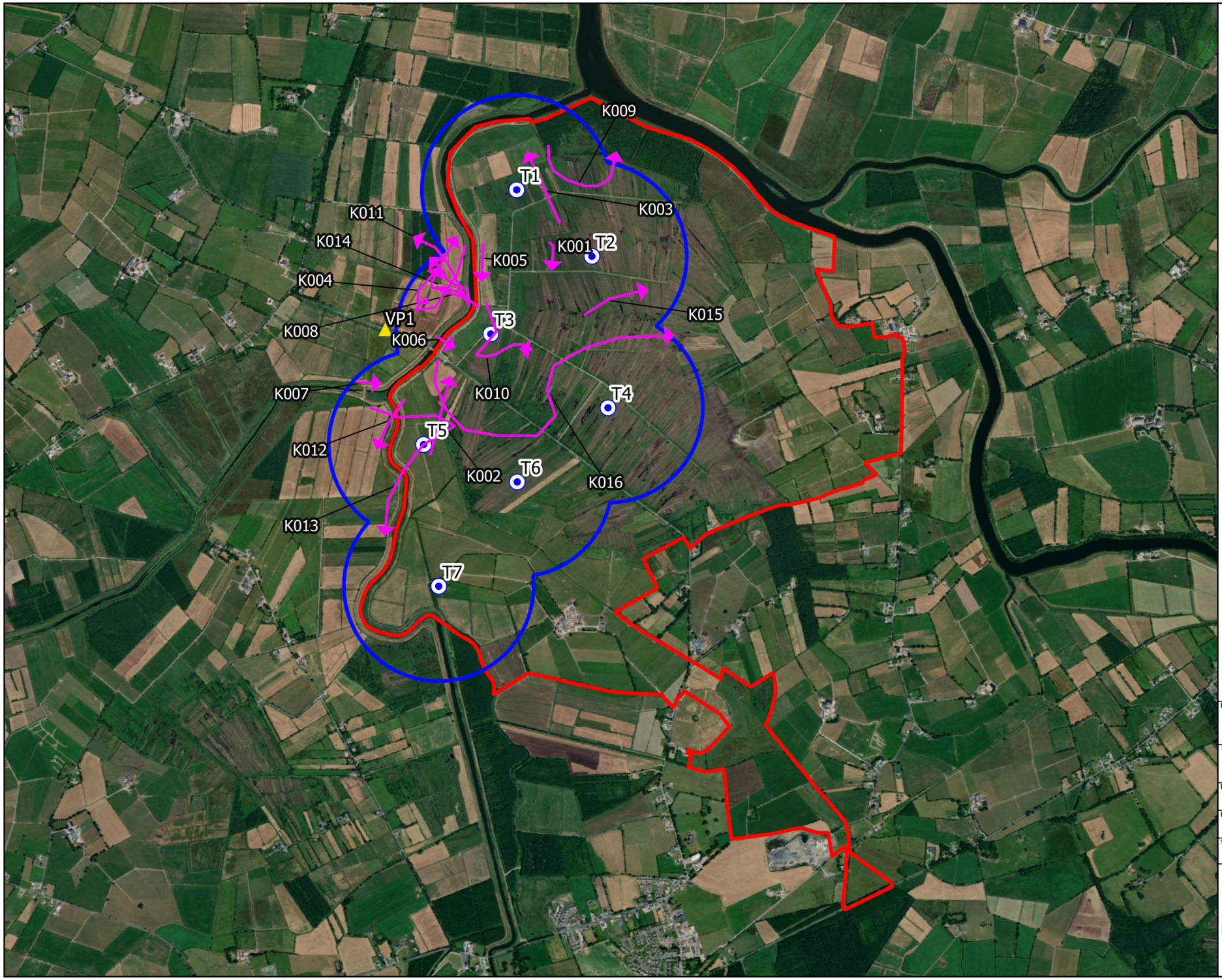
Table 7 - 4 - 83 Incidental Kestrel Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
K001	Breeding Raptor Survey, brvp2	04/06/2019	not given	Kestrel	1	improved agricultural grassland; flushed from a fence post as observer approached the brvp	CMc
K002	Wildfowl Distribution Survey, ferry bridge	26/08/2019	not given	Kestrel	1	improved agricultural grassland; being mobbed by 2 rooks	CMc
K003	Hen Harrier Roost Survey, hhvp2	22/12/2019	15:29	Kestrel	1	cutover bog and lowland blanket bog; male in very direct fast flight into scrub woodland	GM
K004	Winter Walkover Survey, between t7 and t3	17/03/2020	not given	Kestrel	1	bogs; observed flying over the bog <5m, while observer moved between transects	CMc
K005	Waterfowl Distribution Survey, ballyouneen	19/08/2020	not given	Kestrel	1	spoil and bare ground, improved agricultural grassland and watercourses; juvenile perched on fence post,	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
						flushed to spoil heap, stayed perched there until surveyor left	
K006	Wildfowl Distribution Survey, ballynagare	02/10/2020	not given	Kestrel	1	improved agricultural grassland; flying low over agricultural grassland	CMc
K007	Wildfowl Distribution Survey, ballynagare	07/01/2021	not given	Kestrel	1	cutover bog; female, perched on a fence post for 2 mins, flew away north	CMc

Table 7 - 4 - 84 Supplementary Kestrel Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
K001	VP3	19/06/2019	10:53	Kestrel	1	20	0	20	0	0	grassland and marsh; flying, started hovering and was mobbed by swallow	CMc
K002	VP3	05/07/2019	16:22	Kestrel	1	5	0	5	0	0	grassland and marsh; flying through site	CMc
K003	VP3	12/08/2019	18:01	Kestrel	1	30	0	30	0	0	grassland and marsh; hunting	CMc
K004	VP2	04/09/2019	09:20	Kestrel	1	5	2	3	0	0	grassland and marsh; hunting briefly, mobbed by rook	CMc
K005	VP2	04/09/2019	11:17	Kestrel	1	7	0	7	0	0	canals; flew across canal, lost to sight behind willow	CMc
K006	VP3	20/11/2019	13:41	Kestrel	1	10	0	10	0	0	improved agricultural grassland; hunting	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Kestrel Flights at PCH

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Drawing Title: Kestrel Vantage Point Survey

Project Title: Ballynagare Wind Farm

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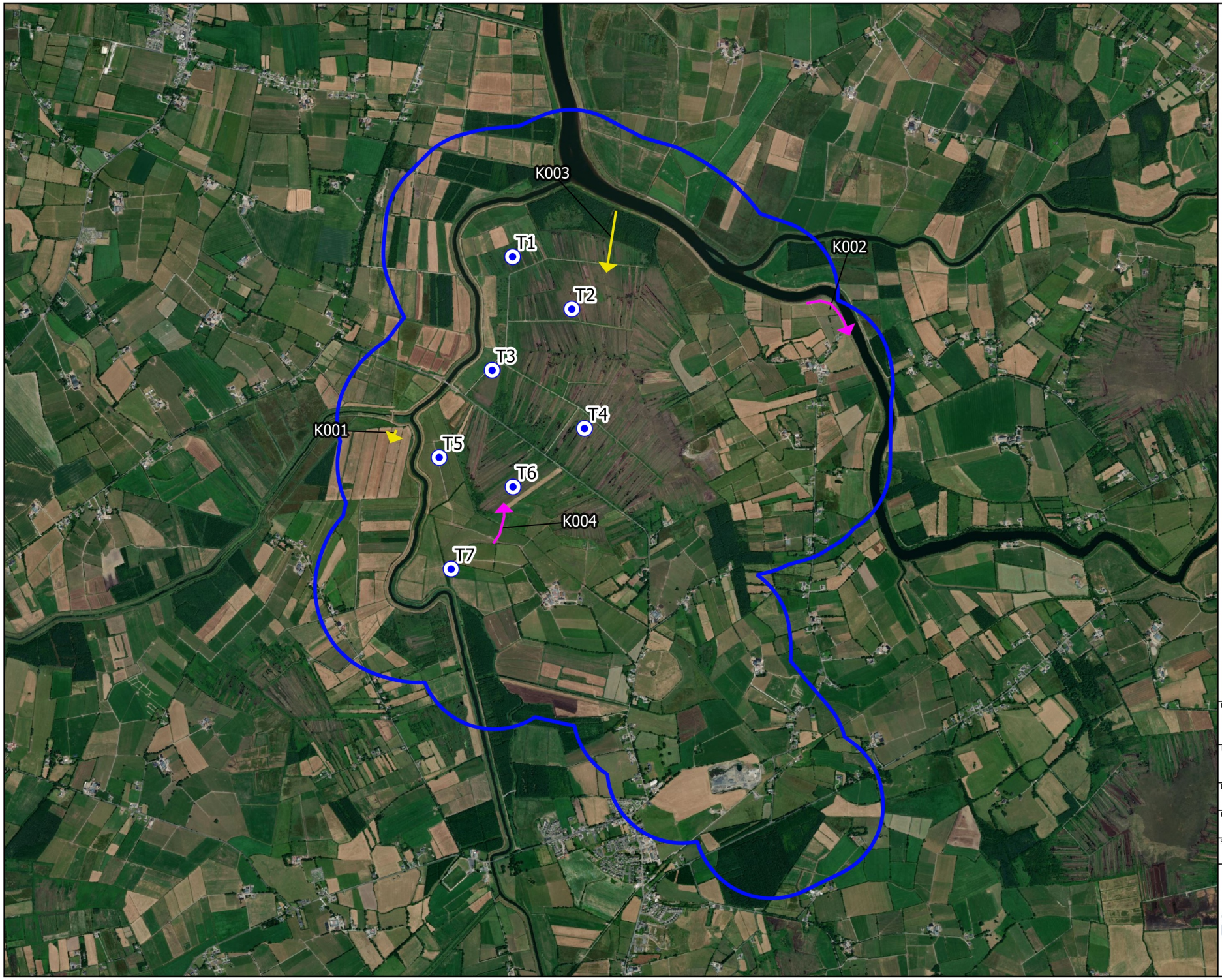

Map Legend

- 500m Survey Radius
- Turbine Location
- Kestrel Observation (breeding season)
- Kestrel Observation (winter season)

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Drawing Title: Kestrel Walkover Survey

Project Title: Ballynagare Wind Farm

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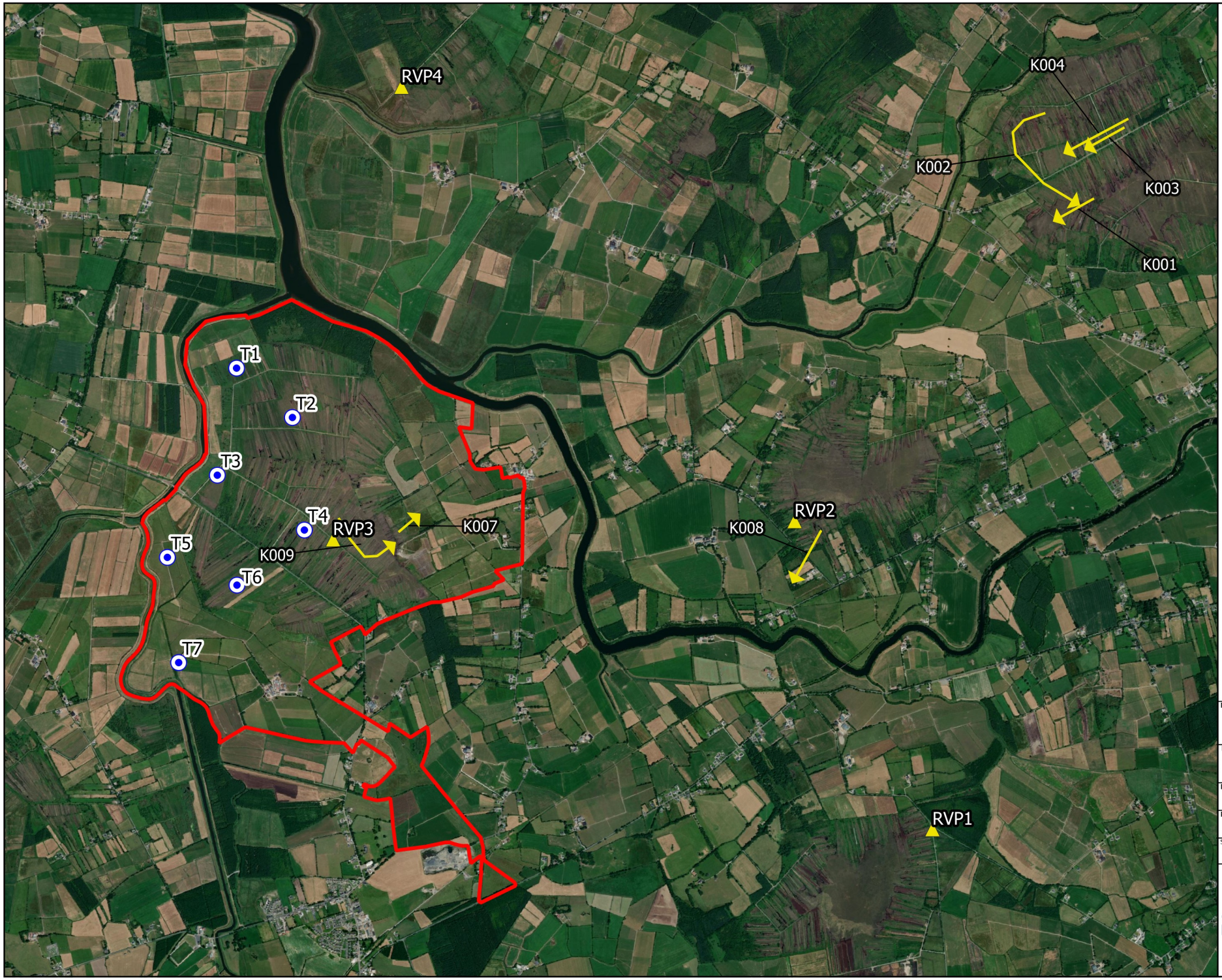

Map Legend

- Wind Farm Site
- Turbine Location
- Breeding Raptor Vantage Point
- Kestrel Observations

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Drawing Title: Kestrel Breeding Raptor Survey

Project Title: Ballynagare Wind Farm

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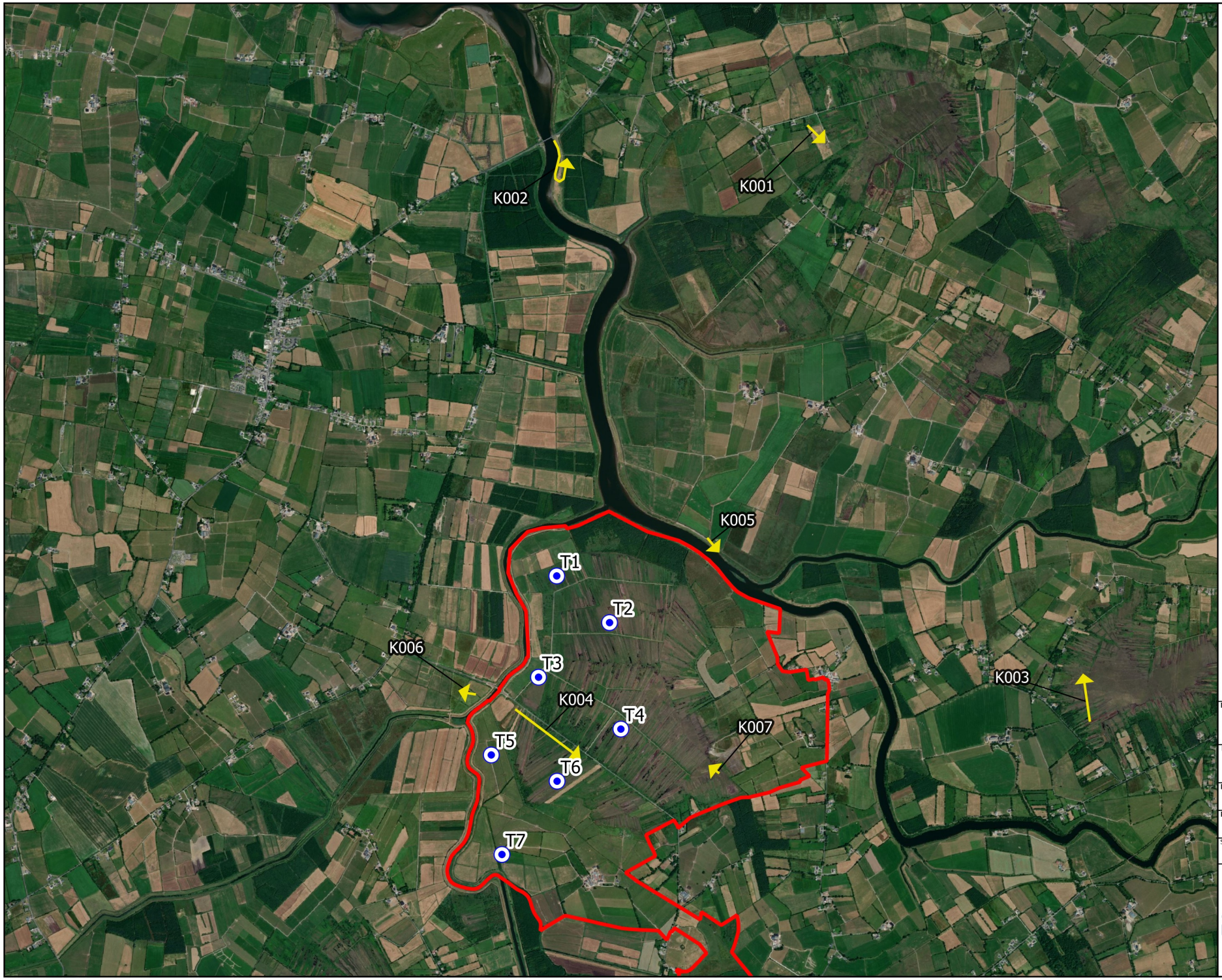

Map Legend

- Wind Farm Site
- Turbine Location
- Kestrel Observation

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Drawing Title: Kestrel Incidental Records

Project Title: Ballynagare Wind Farm

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S Doyle	P Cregg
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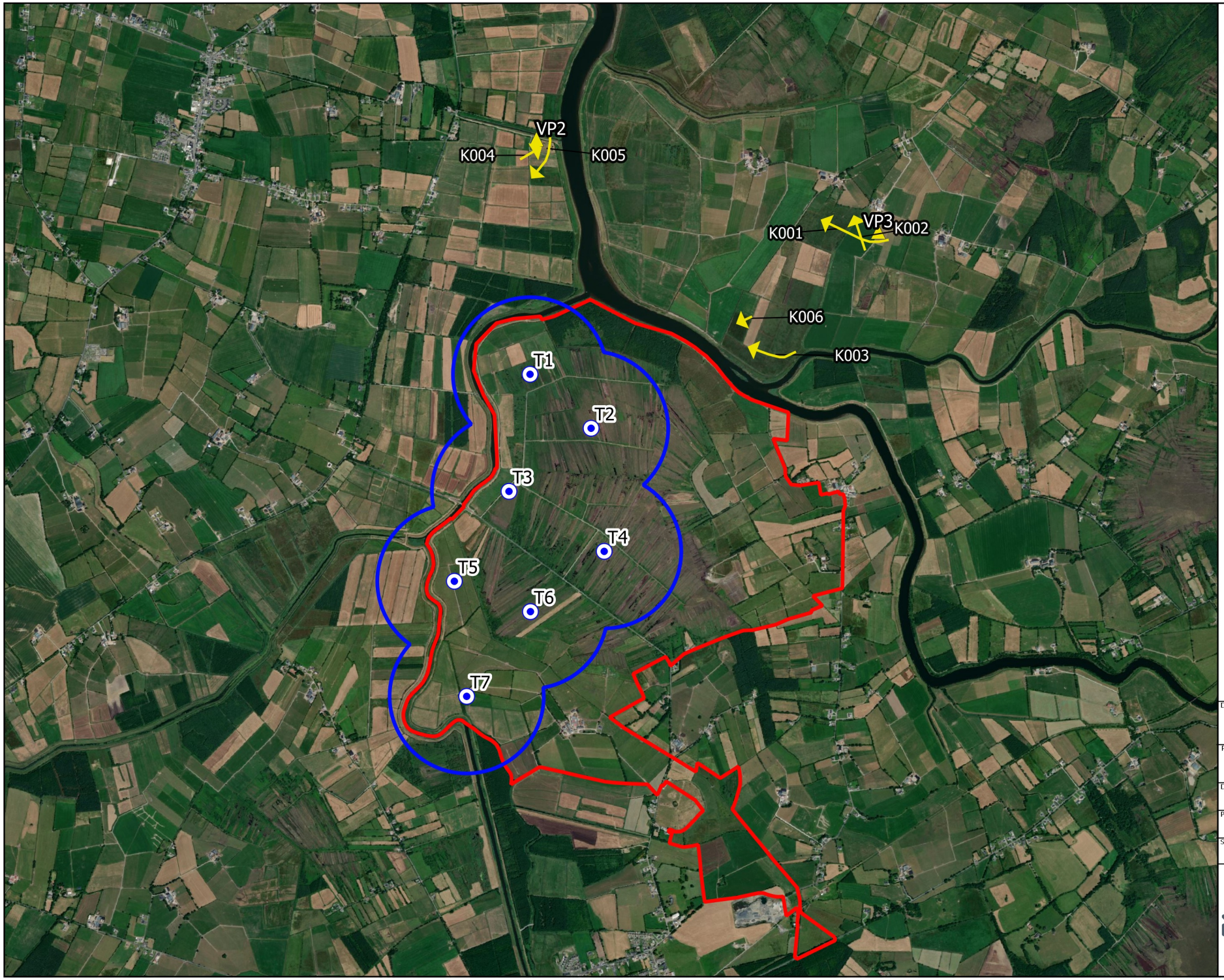

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Kestrel Observations

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Drawing Title: Kestrel Supplementary Data

Project Title: Ballynagare Wind Farm

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1.25 Snipe

Table 7 - 4 - 85 Snipe Vantage Point Survey (flights; lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
SN001	VP1	04/10/2019	17:48	Snipe	6	7	0	0	7	0	grassland and marsh; flying	CMc
SN002	VP1	04/10/2019	17:55	Snipe	1	6	1	5	0	0	grassland and marsh; flying	CMc

Table 7 - 4 - 86 Snipe Vantage Point Survey (flights; upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
SN003	VP1	06/10/2020	15:34	Snipe	3	25	0	10	5	0	improved agricultural grassland and watercourses; flying	CMc

Table 7 - 4 - 87 Snipe Vantage Point Survey (non-flights)

Map Ref.	VP	Date	Time	Species	Number	Habitat and activity	Surveyor
SN004	VP1	02/08/2019	not given	Snipe	1	improved agricultural grassland; calling after dark	CMc

Table 7 - 4 - 88 Snipe Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	21/01/2020	12:27	Snipe	1	cutover bog; flushed by surveyor (wintering)	CMc
SN002	19/06/2020	not given	Snipe	2	cutover bog; drumming, adults (courtship and display; probable breeding)	CMc
SN003	19/06/2020	not given	Snipe	1	cutover bog; drumming, adult (courtship and display; probable breeding)	CMc
SN004	05/10/2020	14:17	Snipe	2	watercourses and improved agricultural grassland; flushed (wintering)	CMc

Table 7 - 4 - 89 Snipe Waterbird Distribution Survey

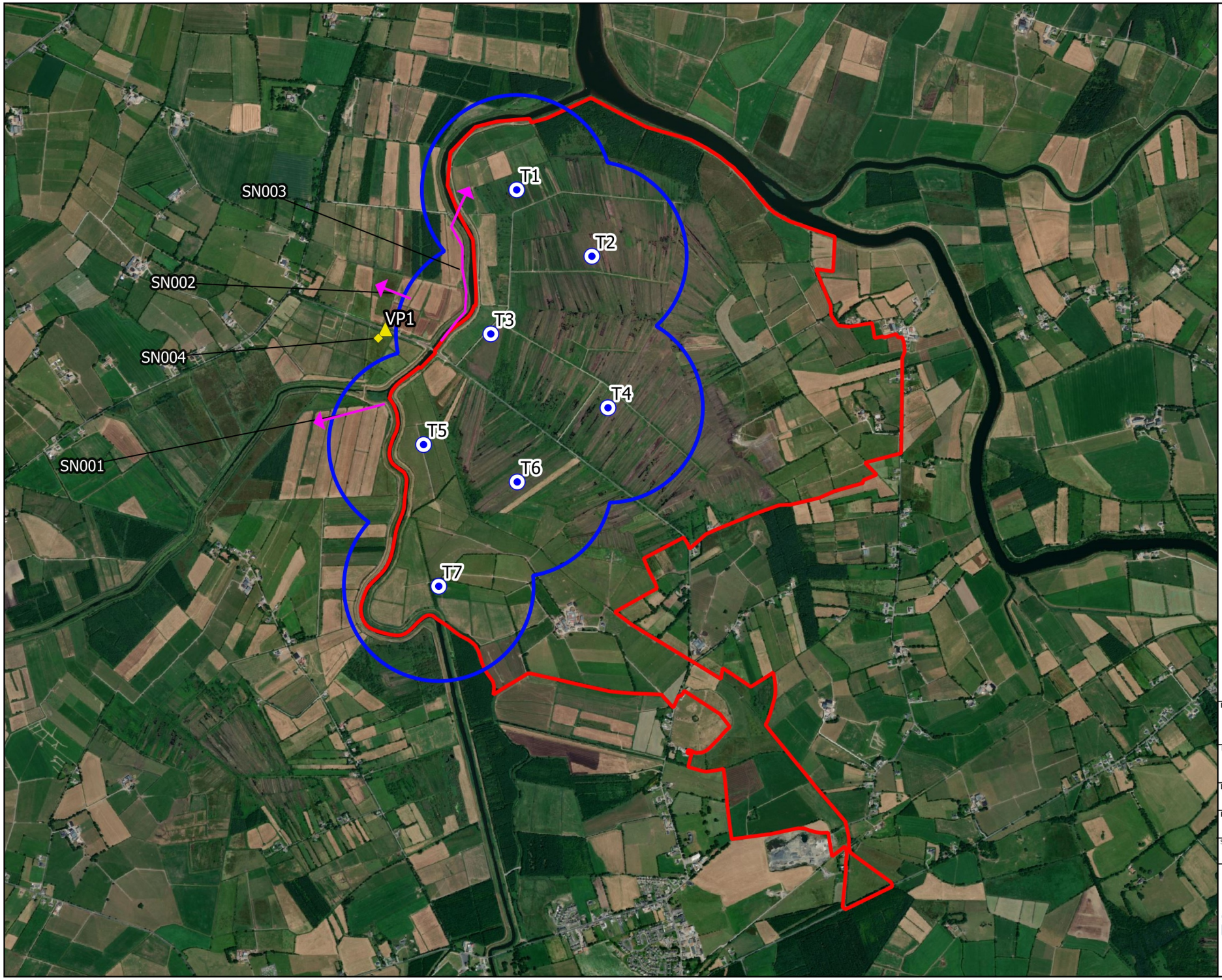
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	Ballyouneen	12/09/2019	not given	Snipe	1	improved agricultural grassland; flushed by surveyor	CMc
SN002	Ballyouneen	12/09/2019	not given	Snipe	2	improved agricultural grassland; flushed by surveyor	CMc
SN003	Ballyouneen	03/12/2019	not given	Snipe	2	improved agricultural grassland;	CMc
SN004	Ballyouneen	04/11/2020	12:43	Snipe	6	improved agricultural grassland; flushed	CMc
SN005	Ballynagare	18/12/2020	11:02	Snipe	1	improved agricultural grassland;	CMc
SN006	Rahoonagh	26/01/2021	11:56	Snipe	6	improved agricultural grassland;	CMc

Table 7 - 4 - 90 Incidental Snipe Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SN001	Vantage Point Survey, vp1	02/08/2019	not given	Snipe	1	improved agricultural grassland; heard callling after dark	CMc
SN002	Vantage Point Survey, vp3	22/10/2019	not given	Snipe	1	improved agricultural grassland; in dark, no visual	CMc

Table 7 - 4 - 91 Supplementary Snipe Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
SN001	VP3	22/10/2019	14:02	Snipe	7	69	13	34	22	0	grassland and marsh; flew around site and landed	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Snipe Flights at PCH
- Snipe Non-flights

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Drawing Title: Snipe Vantage Point Survey

Project Title: Ballynagare Wind Farm

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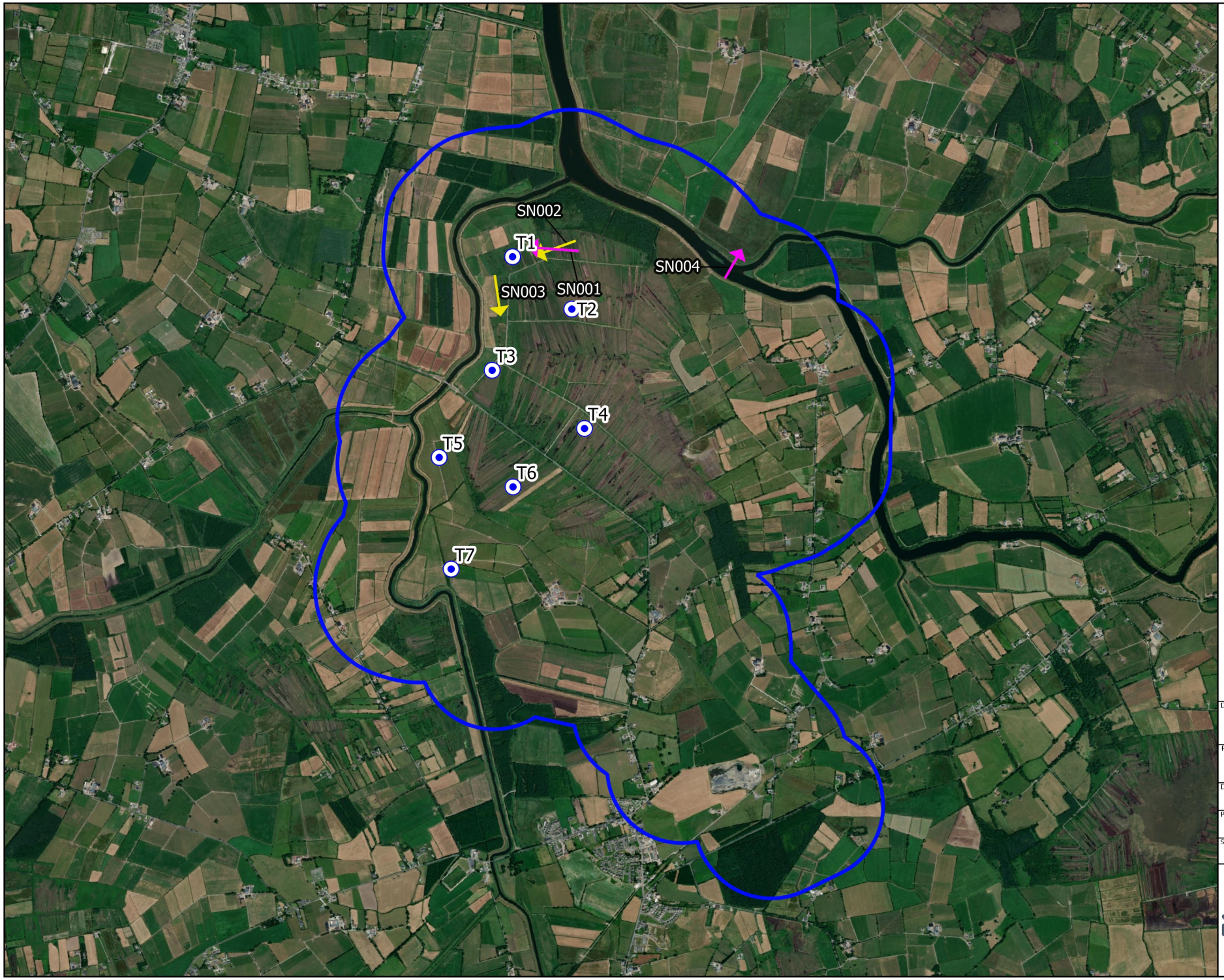

Map Legend

- 500m Survey Radius
- Turbine Location
- Snipe Observation (breeding season)
- Snipe Observation (winter season)

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Drawing Title: Snipe Walkover Survey

Project Title: Ballynagare Wind Farm

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Project No.	Drawing No.
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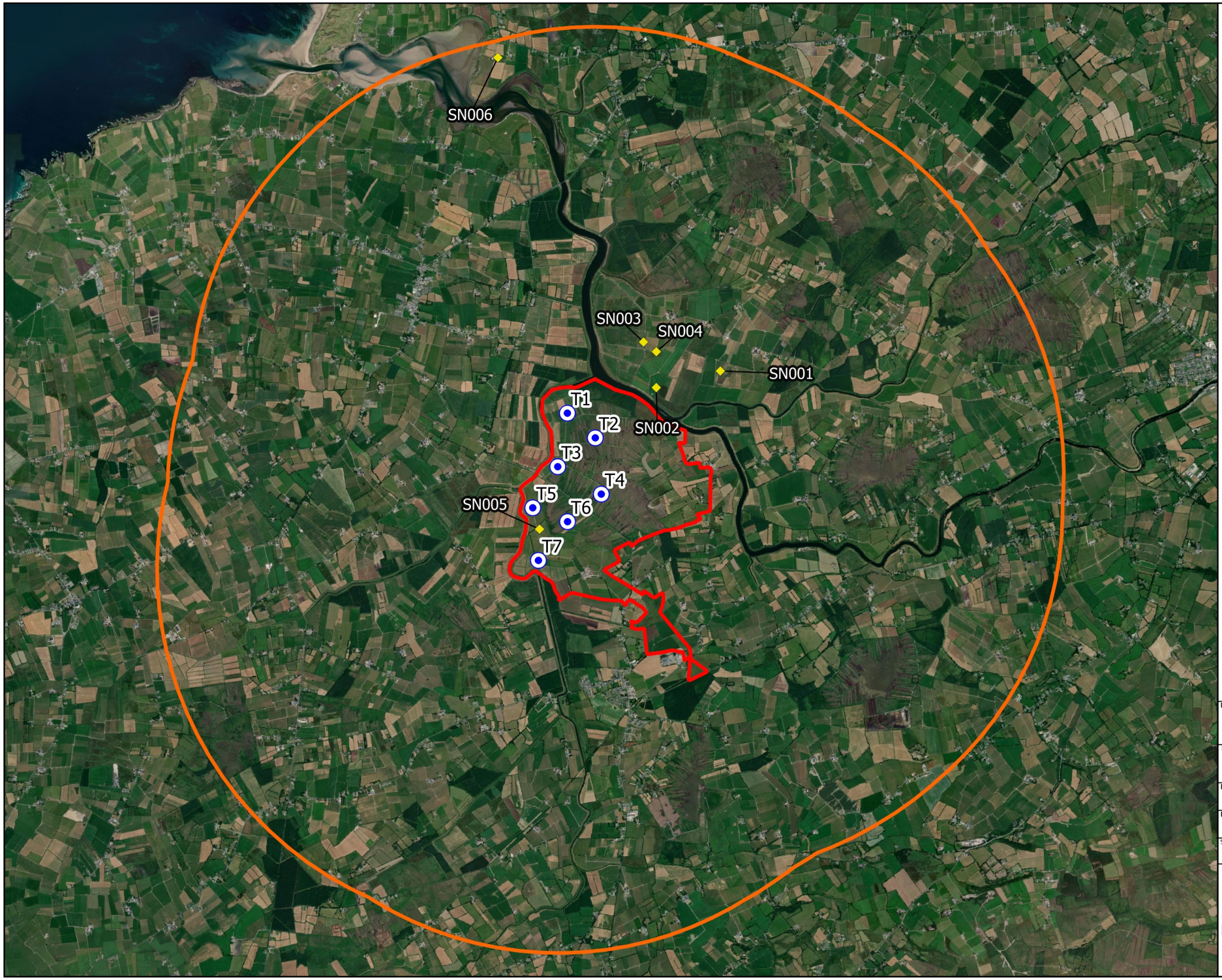

Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Snipe Observations

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Drawing Title: Snipe Waterbird Distribution Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-72
Scale	Date
1:70000	05.07.21

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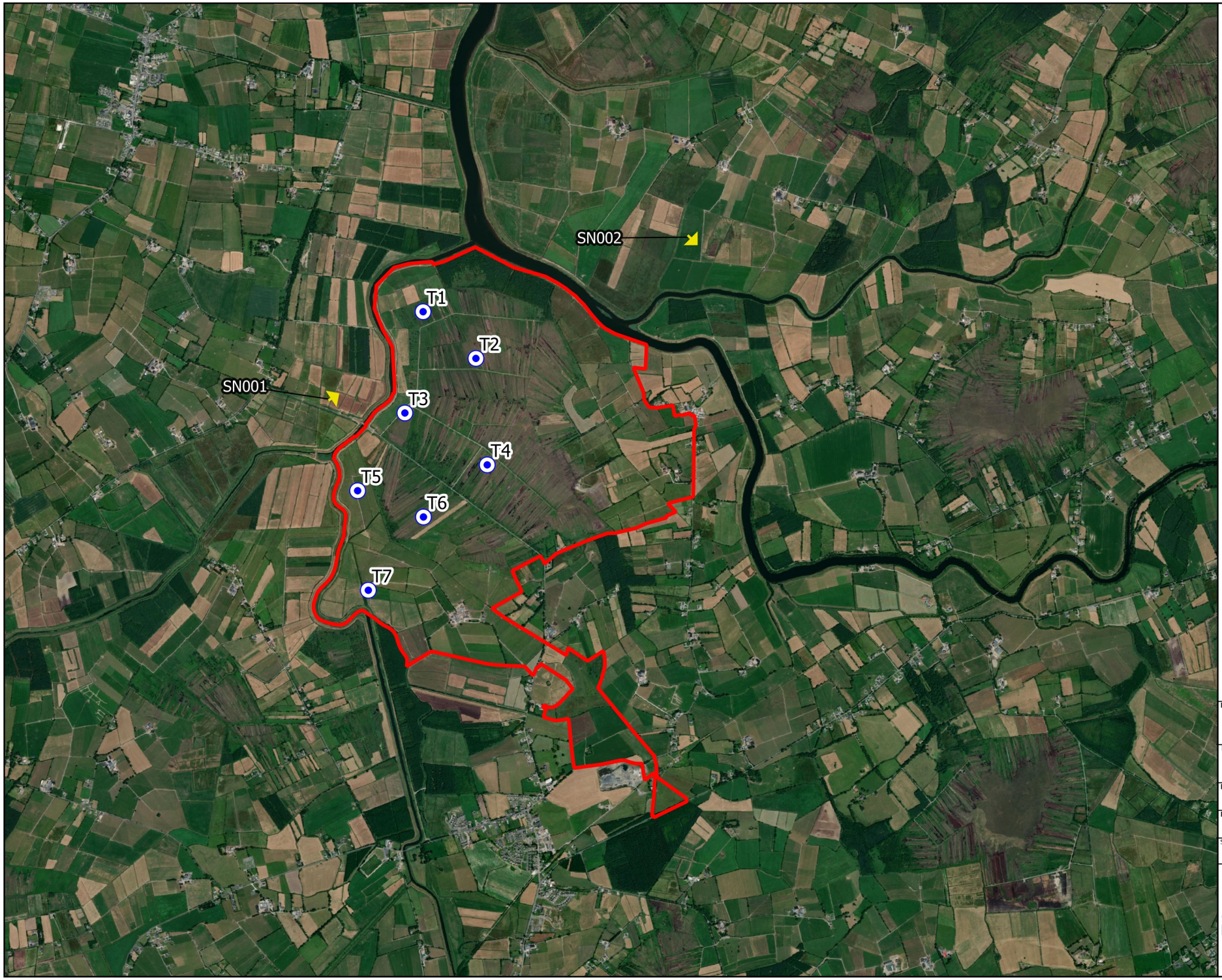

Map Legend

- Wind Farm Site
- Turbine Location
- Snipe Observations

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Drawing Title	Snipe Incidental Records
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-4-73
Scale: 1:37000	Date: 05.07.21

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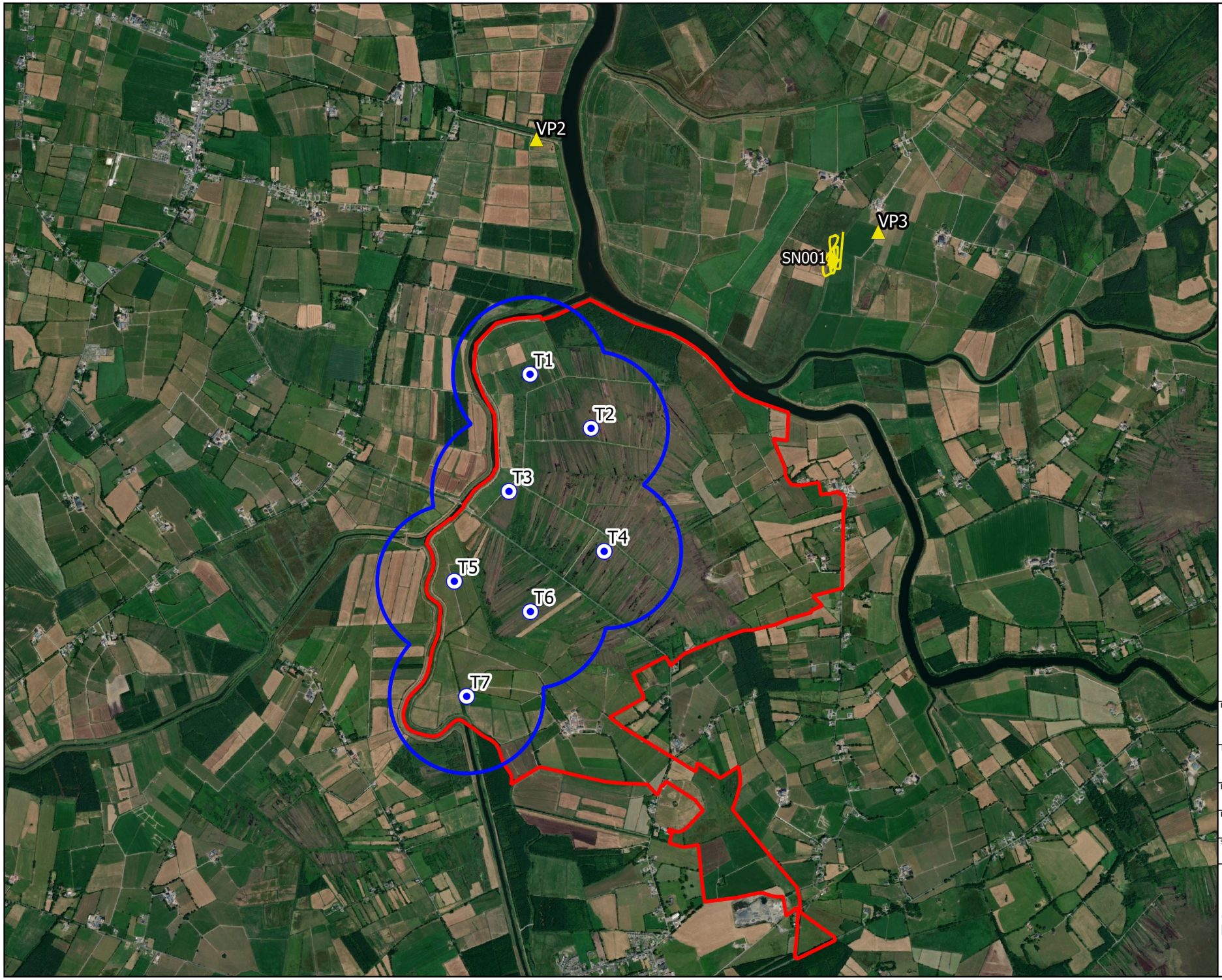

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Snipe Observations

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Drawing Title: Snipe Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-74
Scale	Date
1:32000	05.07.21

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1.26 Buzzard

Table 7 - 4 - 92 Buzzard Vantage Point Survey (lower height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
BZ001	VP1	05/06/2019	10:58	Buzzard	2	180	0	5	175	0	improved agricultural grassland; hovering in thermals and circling, before descending behind conifers	CMc
BZ002	VP1	02/09/2019	10:57	Buzzard	1	60	0	20	40	0	watercourses and conifer plantation; flying through, then mobbed by hooded crow	CMc

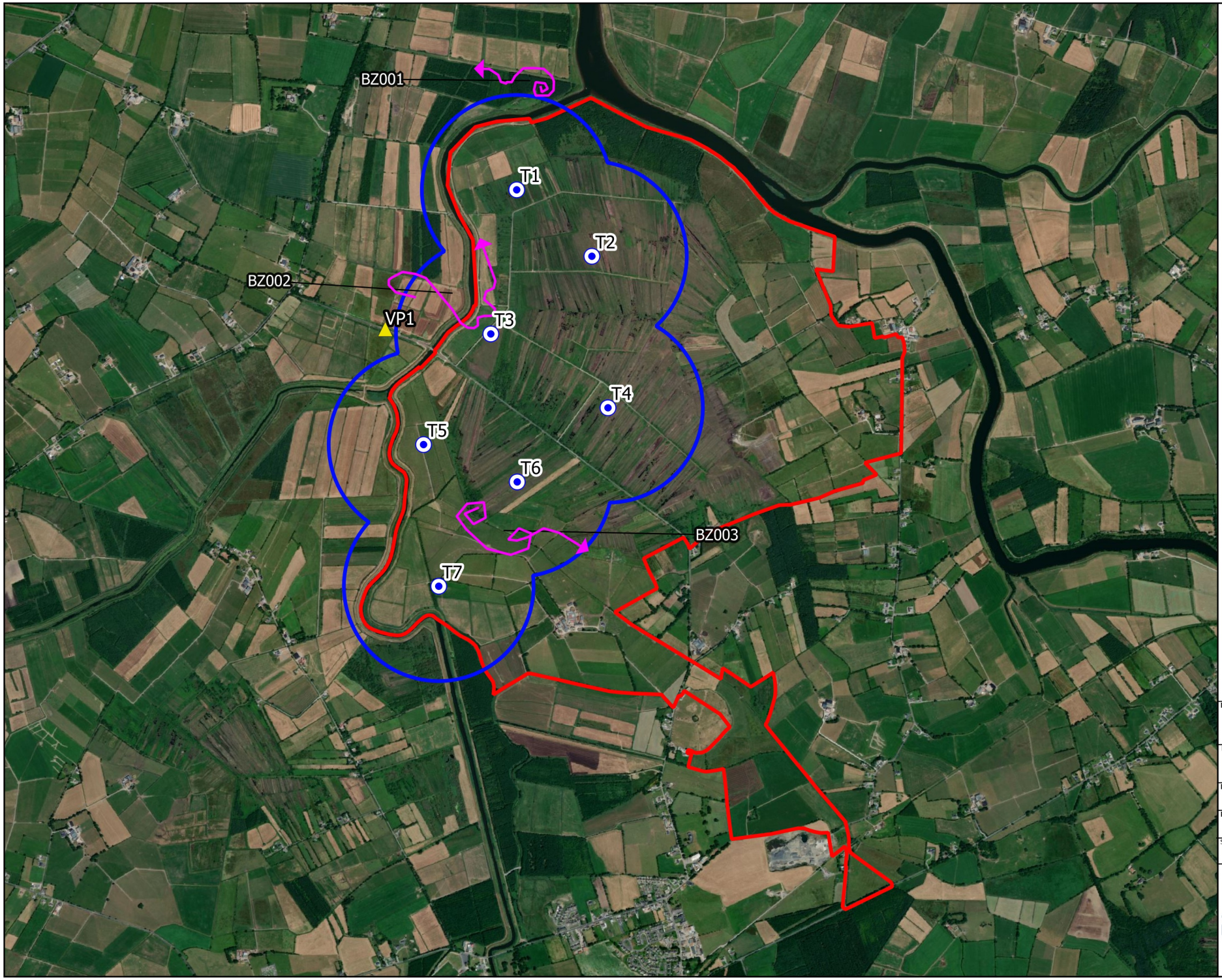
Table 7 - 4 - 93 Buzzard Vantage Point Survey (upper height bands)

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-15m)	Band 2 (15-25m)	PCH (25-200m)	Band 4 (>200m)	Habitat and activity	Surveyor
BZ003	VP1	16/09/2020	13:47	Buzzard	2	240	0	0	40	200	improved agricultural grassland; circling, high over the site	CMc

Table 7 - 4 - 94 Incidental Buzzard Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ001	Vantage Point Survey, vp2	10/06/2019	not given	Buzzard	5	improved agricultural grassland; before starting the watch, were heard calling and observed circling behind vp (off site and off map). they moved off to the west	CMc
BZ002	Waterfowl Distribution Survey, ferry bridge	29/10/2019	not given	Buzzard	1	improved agricultural grassland; in improved agricultural grassland	CMc
BZ003	Waterfowl Distribution Survey, ballynagare	17/11/2020	not given	Buzzard	1	improved agricultural grassland; flushed by surveyor	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
BZ004	Vantage Point Survey, ballynagare	17/12/2020	not given	Buzzard	1	improved agricultural grassland; perched on a tree, flushed and flew away. bird was still present 30 mins later	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Buzzard Flights at PCH

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Drawing Title: Buzzard Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-75
Scale	Date
1:26000	05.07.21

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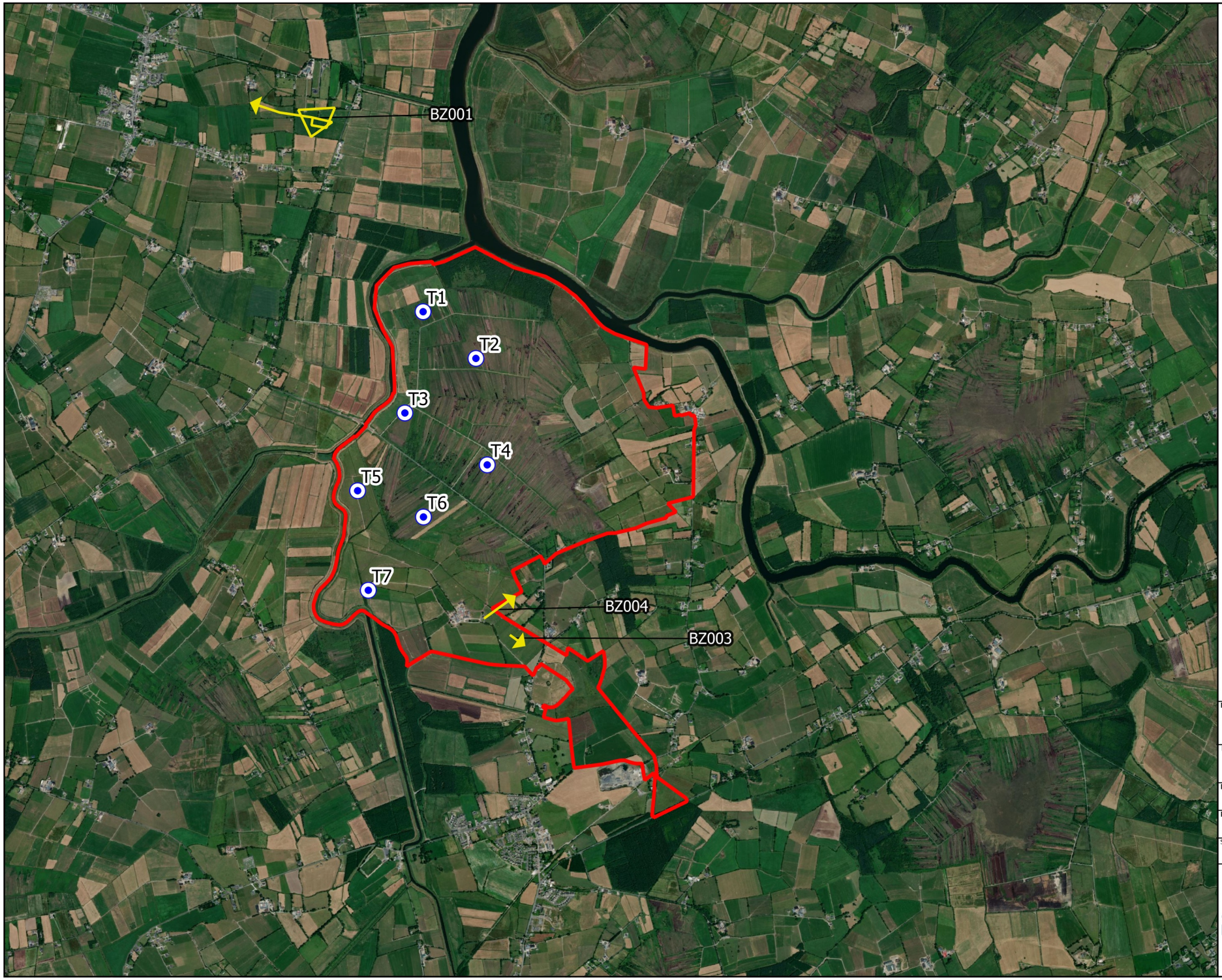

Map Legend

- Wind Farm Site
- Turbine Location
- Buzzard Observations

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Drawing Title: Buzzard Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-76
Scale	Date
1:37000	05.07.21

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1.27 Sparrowhawk

Table 7 - 4 - 95 Sparrowhawk Vantage Point Survey

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
SH001	VP1	05/06/2019	11:16	Sparrowhawk	1	198	0	3	190	5	estuaries and cutover bog; flying through the site	CMc

Table 7 - 4 - 96 Sparrowhawk Walkover Survey

Map Ref.	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	26/04/2019	12:12	Sparrowhawk	1	cutover bog and scrub/transitional woodland; flushed from willow and flew away, adult (suitable nesting habitat; possible breeder)	CMc

Table 7 - 4 - 97 Sparrowhawk Breeding Raptor Survey

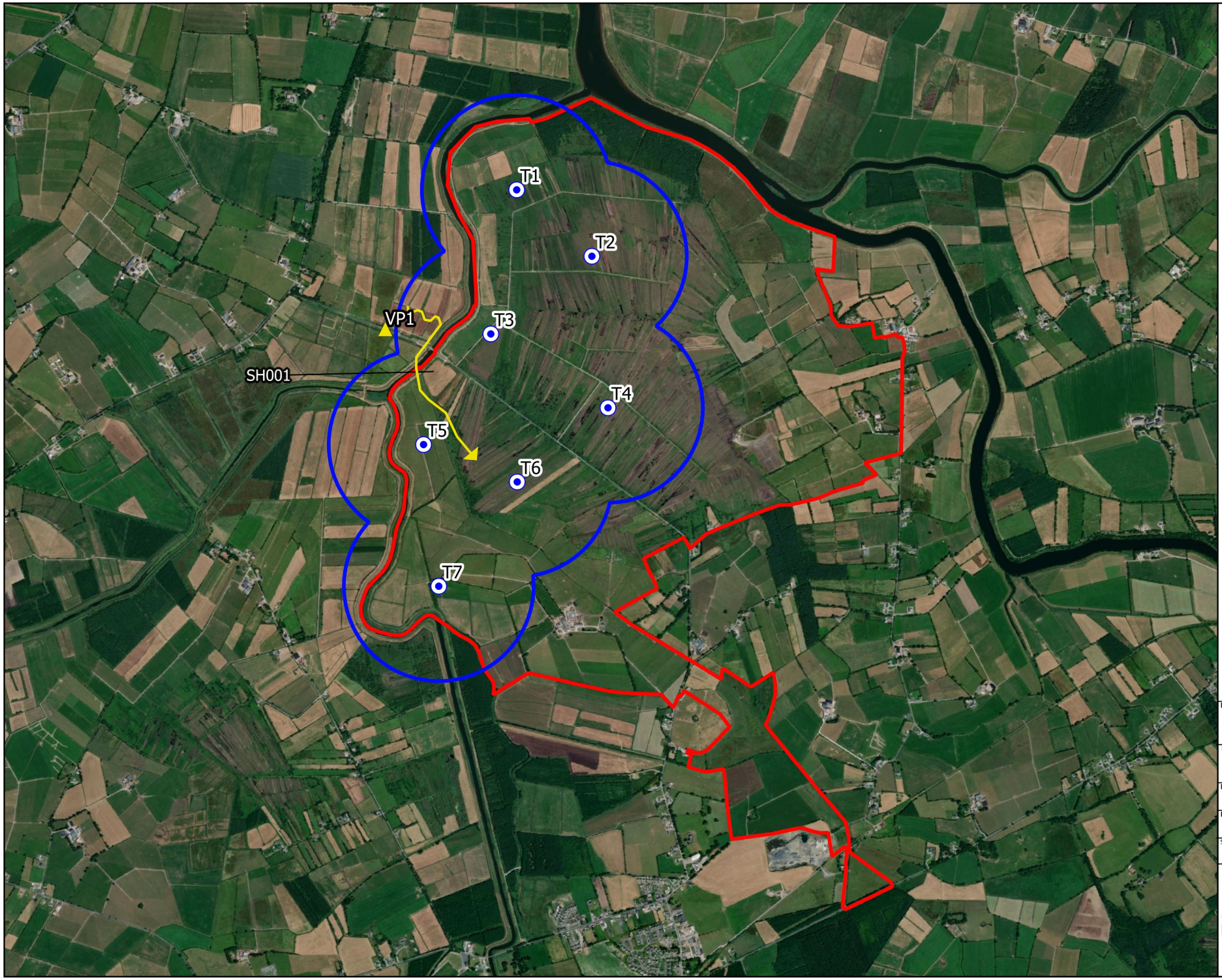
Map Ref.	BRVP	Date	Time	Species	Number	Habitat and activity	Breeding status	Surveyor
SH001	BRVP4	30/04/2019	17:59	Sparrowhawk	1	cutover bog, flying low across the bog <10m	suitable nesting habitat; possible breeder	CMc

Table 7 - 4 - 98 Incidental Sparrowhawk Records

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
SH001	Hen Harrier Roost Survey, hhvp1	20/02/2020	not given	Sparrowhawk	1	improved agricultural grassland; flying through at 0-15m	CMc

Table 7 - 4 - 99 Supplementary Sparrowhawk Data

Map Ref.	VP	Date	Time	Species	Number	Duration of flight (s)	Band 1 (0-10m)	Band 2 (10-25m)	PCH (25-175m)	Band 4 (>175m)	Habitat and activity	Surveyor
SH001	VP2	09/08/2019	17:00	Sparrowhawk	1	10	10	0	0	0	improved agricultural grassland; flying through the site	CMc



Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Vantage Point
- Sparrowhawk Flights

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Drawing Title: Sparrowhawk Vantage Point Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-77
Scale	Date
1:26000	05.07.21

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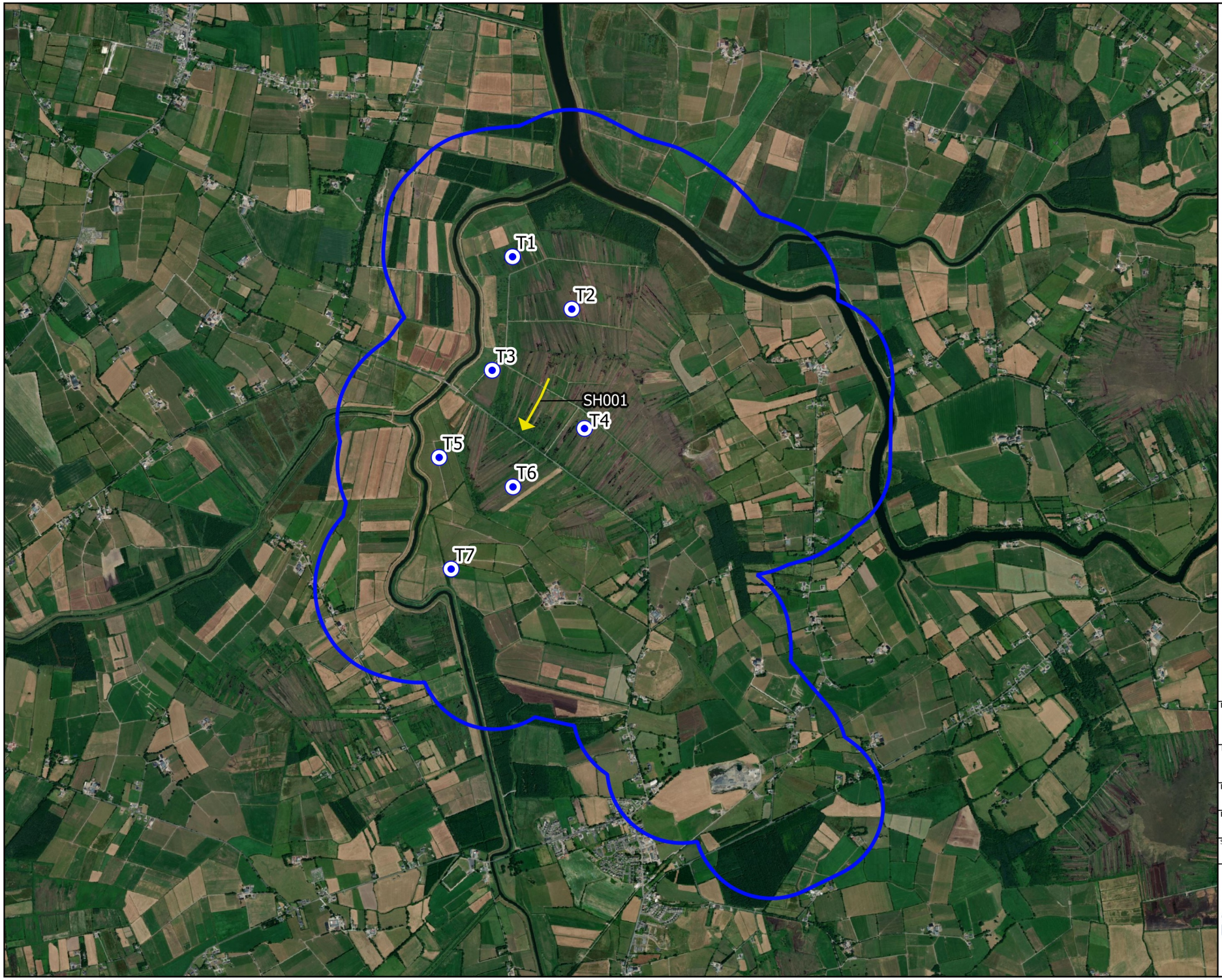

Map Legend

- 500m Survey Radius
- Turbine Location
- Sparrowhawk Observation (breeding season)

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Drawing Title: Sparrowhawk Walkover Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-78
Scale	Date
1:33000	05.07.21

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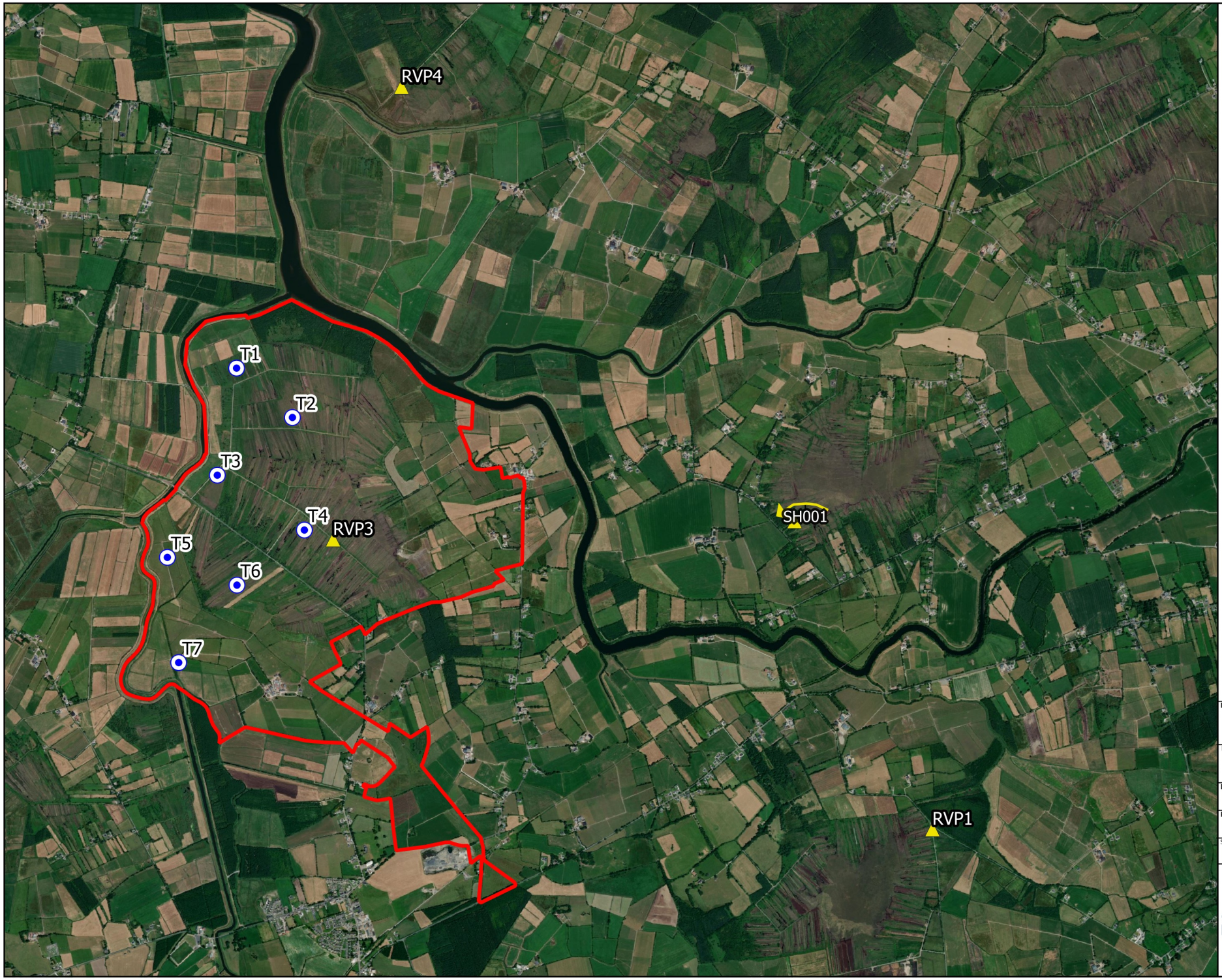

Map Legend

- Wind Farm Site
- Turbine Location
- Breeding Raptor Vantage Point
- Sparrowhawk Observations

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Drawing Title: Sparrowhawk Breeding Raptor Survey

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-79
Scale	Date
1:35000	05.07.21

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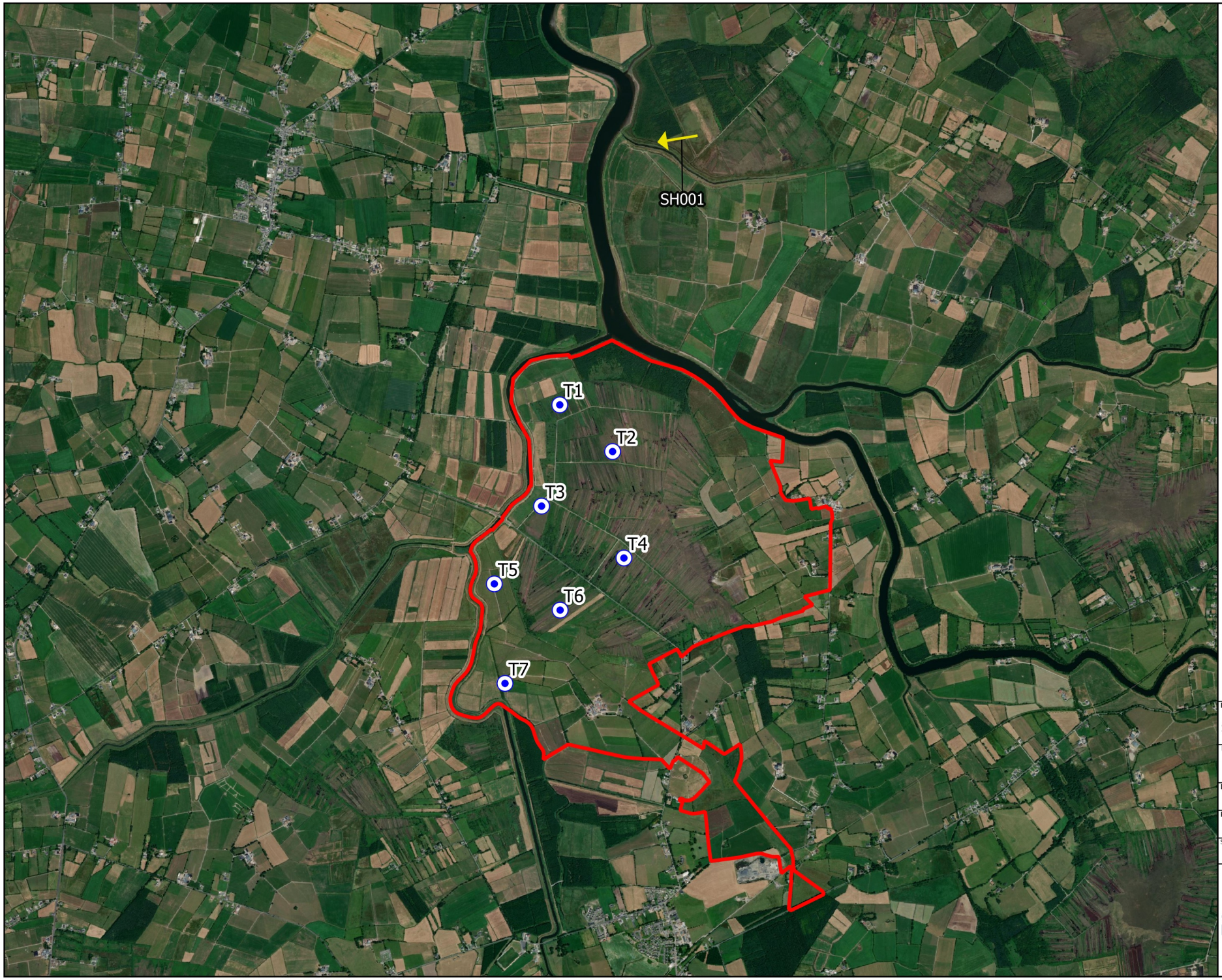

Map Legend

- Wind Farm Site
- Turbine Location
- Sparrowhawk Observations

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Drawing Title: Sparrowhawk Incidental Records

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-80
Scale	Date
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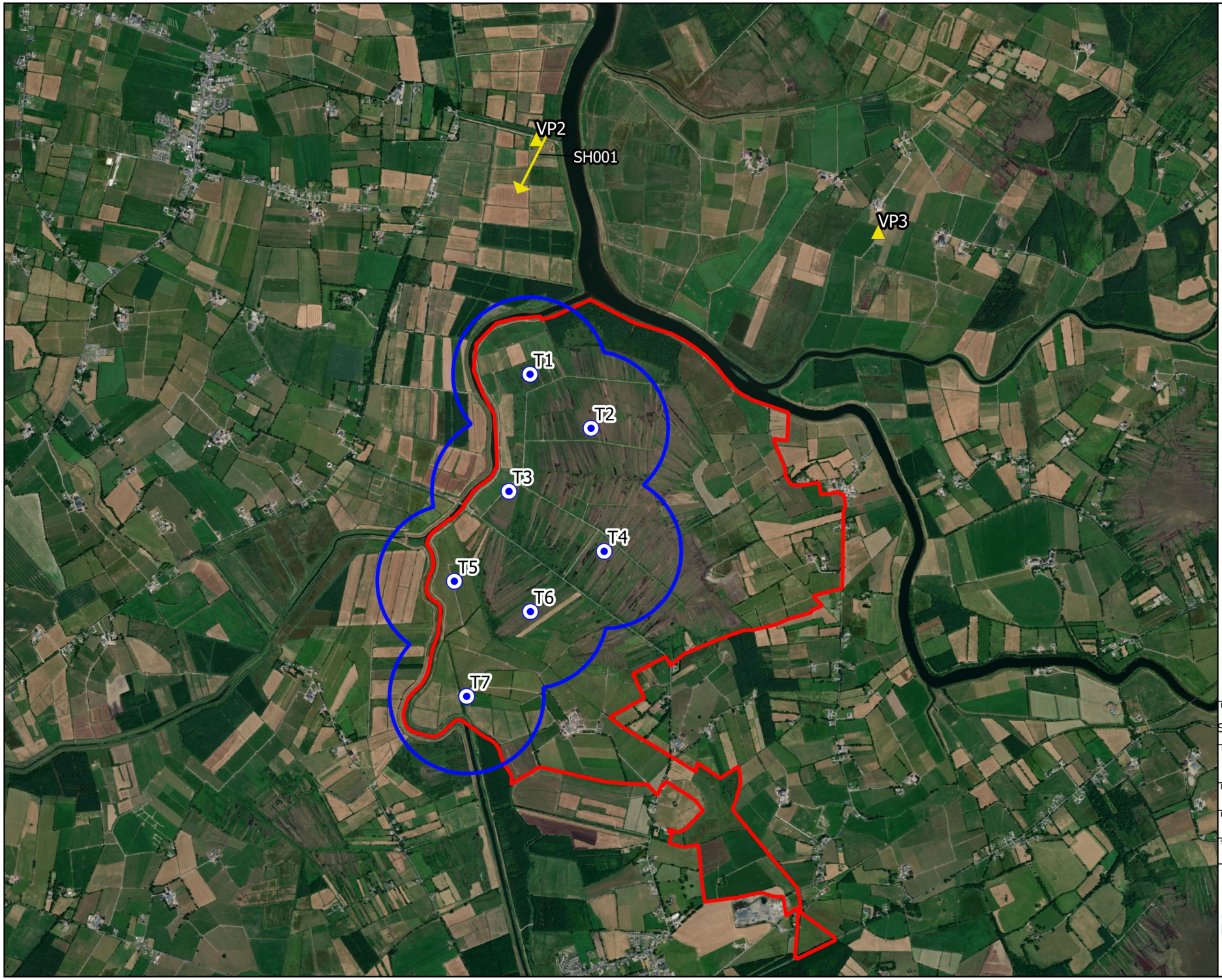

Map Legend

- Wind Farm Site
- 500m Radius of Turbines
- Turbine Location
- Supplementary Vantage Point
- Sparrowhawk Observations

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Drawing Title: Sparrowhawk Supplementary Data

Project Title: Ballynagare Wind Farm

Drawn By	Checked By
S Doyle	P Cregg
Project No.	Drawing No.
200512	Fig 7-4-81
Scale	Date
1:32000	05.07.21

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1.28 Meadow Pipit

Table 7 - 4 - 100 Meadow Pipit Vantage Point Survey

VP	Date	Time	Species	Number	Habitat and activity	Surveyor
VP1	04/10/2019	not given	Meadow Pipit	8	improved agricultural grassland; present	CMc
VP1	13/02/2020	not given	Meadow Pipit	4	improved agricultural grassland; present	CMc
VP1	17/03/2020	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP1	24/03/2020	not given	Meadow Pipit	1	improved agricultural grassland; present	CMc
VP1	15/04/2020	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP1	16/04/2020	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP1	01/05/2020	not given	Meadow Pipit	4	improved agricultural grassland; present	CMc
VP1	18/06/2020	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP1	28/07/2020	not given	Meadow Pipit	3	improved agricultural grassland; present	CMc
VP1	16/09/2020	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP1	26/11/2020	not given	Meadow Pipit	3	improved agricultural grassland; present	CMc
VP1	15/02/2021	not given	Meadow Pipit	1	improved agricultural grassland; present	CMc
VP1	22/03/2021	not given	Meadow Pipit	1	improved agricultural grassland; present	CMc

Table 7 - 4 - 101 Meadow Pipit Walkover Survey

Date	Time	Species	Number	Habitat and activity	Surveyor
26/04/2019	not given	Meadow Pipit	2	cutover bog; flight (flyover; non-breeding)	CMc
26/04/2019	not given	Meadow Pipit	1	buildings and artificial surfaces and improved agricultural grassland; flight (flyover; non-breeding)	CMc
26/04/2019	not given	Meadow Pipit	2	cutover bog; present (flyover; non-breeding)	CMc
26/04/2019	not given	Meadow Pipit	1	cutover bog; flight (flyover; non-breeding)	CMc

Date	Time	Species	Number	Habitat and activity	Surveyor
26/04/2019	not given	Meadow Pipit	5	cutover bog; flight (flyover; non-breeding)	CMc
27/05/2019	not given	Meadow Pipit	1	improved agricultural grassland, conifer plantation and estuaries; calling (suitable nesting habitat; possible breeder)	CMc
27/05/2019	not given	Meadow Pipit	1	improved agricultural grassland, conifer plantation and estuaries; calling (suitable nesting habitat; possible breeder)	CMc
27/05/2019	not given	Meadow Pipit	1	improved agricultural grassland, conifer plantation and estuaries; calling (suitable nesting habitat; possible breeder)	CMc
27/05/2019	not given	Meadow Pipit	1	improved agricultural grassland, conifer plantation and estuaries; flight (suitable nesting habitat; possible breeder)	CMc
27/05/2019	not given	Meadow Pipit	1	improved agricultural grassland, conifer plantation and estuaries; flight (suitable nesting habitat; possible breeder)	CMc
27/05/2019	not given	Meadow Pipit	1	improved agricultural grassland, conifer plantation and estuaries; flight (suitable nesting habitat; possible breeder)	CMc
27/06/2019	not given	Meadow Pipit	1	improved agricultural grassland; calling (suitable nesting habitat; possible breeder)	CMc
27/06/2019	not given	Meadow Pipit	1	improved agricultural grassland; flight (suitable nesting habitat; possible breeder)	CMc
27/06/2019	not given	Meadow Pipit	1	improved agricultural grassland; calling (suitable nesting habitat; possible breeder)	CMc
27/06/2019	not given	Meadow Pipit	1	improved agricultural grassland; present (suitable nesting habitat; possible breeder)	CMc
26/07/2019	not given	Meadow Pipit	1	improved agricultural grassland and cutover bog; in song (courtship and display; probable breeding)	CMc
26/07/2019	not given	Meadow Pipit	1	improved agricultural grassland and cutover bog; flight (suitable nesting habitat; possible breeder)	CMc
26/07/2019	not given	Meadow Pipit	1	improved agricultural grassland and cutover bog; calling (suitable nesting habitat; possible breeder)	CMc
26/07/2019	not given	Meadow Pipit	1	improved agricultural grassland and cutover bog; in song (courtship and display; probable breeding)	CMc
26/07/2019	not given	Meadow Pipit	1	improved agricultural grassland and cutover bog; in song (courtship and display; probable breeding)	CMc

Date	Time	Species	Number	Habitat and activity	Surveyor
26/07/2019	not given	Meadow Pipit	1	improved agricultural grassland and cutover bog; flight (suitable nesting habitat; possible breeder)	CMc
26/07/2019	not given	Meadow Pipit	2	improved agricultural grassland and cutover bog; flight (suitable nesting habitat; possible breeder)	CMc
04/03/2021	10:00	Meadow Pipit	1	improved agricultural grassland; calling (wintering)	CMc
04/03/2021	10:03	Meadow Pipit	1	cutover bog; flying, calling (wintering)	CMc
04/03/2021	10:13	Meadow Pipit	1	cutover bog; flying (wintering)	CMc
04/03/2021	10:16	Meadow Pipit	2	cutover bog; flying (wintering)	CMc
04/03/2021	11:46	Meadow Pipit	1	improved agricultural grassland; flying, calling (wintering)	CMc

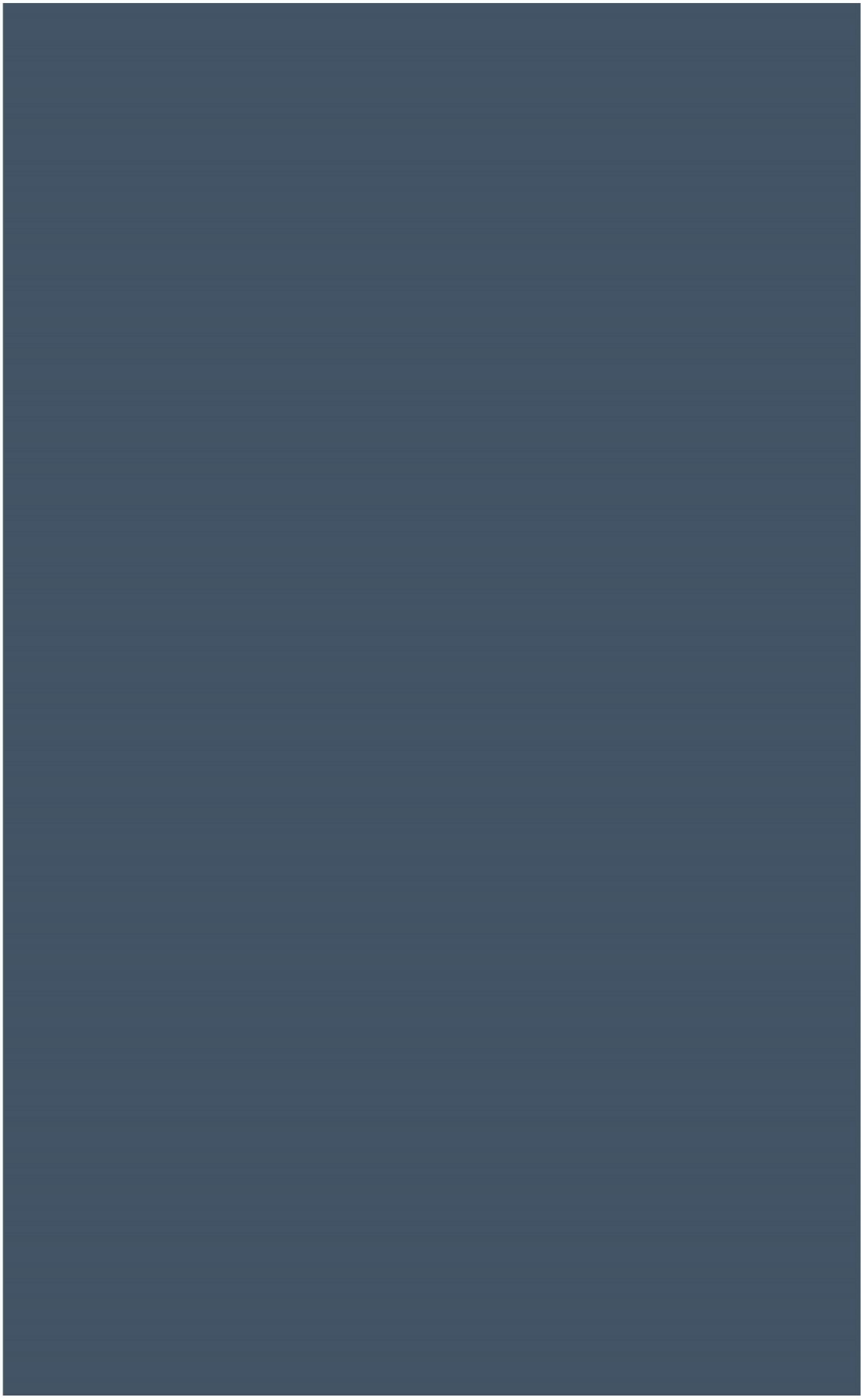
Table 7 - 4 - 102 Supplementary Meadow Pipit Data

VP	Date	Time	Species	Number	Habitat and activity	Surveyor
VP2	08/04/2019	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP3	16/05/2019	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP3	19/06/2019	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP3	12/08/2019	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP3	27/09/2019	not given	Meadow Pipit	4	improved agricultural grassland; present	CMc
VP3	22/10/2019	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc
VP3	20/11/2019	not given	Meadow Pipit	2	improved agricultural grassland; present	CMc

1.29 Grey Wagtail

Table 7 - 4 - 103 Supplementary Grey Wagtail Data

VP	Date	Time	Species	Number	Habitat and activity	Surveyor
VP3	12/12/2019	not given	Grey Wagtail	1	improved agricultural grassland; present	CMc



APPENDIX 7.5

COLLISION RISK ASSESSMENT

Appendix 7-5 – Collision Risk Assessment

Ballynagare Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Appendix 7-5 – Collision Risk Assessment**
Document File Name:	**Appendix 7-5 F 2021/10/08 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	08/10/2021	SD	PC

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2.4 Key Ornithological Receptors 5
2.5 Calculation Parameters 6
3. RESULTS 7
4. BIBLIOGRAPHY 8

1. INTRODUCTION

This document outlines the methodology used to assess the collision risk for birds at the proposed Ballynagare Wind Farm, Co. Kerry. The collision risk assessment is based on vantage point surveys undertaken at the wind farm site from April 2019 to March 2021 inclusive. This represents a 24-month survey period, consisting of two breeding seasons and two winter seasons, which is in full compliance with Scottish Natural Heritage guidance (SNH, 2017). Surveys were undertaken from one fixed vantage point (VP).

Collision risk is calculated using a mathematical model to predict the number of birds that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation is known as the Band Model (Band *et al.,* 2007) and has been used in a number of studies on bird collision with wind turbines (e.g. Chamberlain *et al.,* 2006; Drewitt and Langston, 2006; Fernley *et al.,* 2006; Madders and Whitfield, 2006). Note that these are theoretical predictions, therefore results must be interpreted with a degree of caution.

Two stages are involved in the Band Model. First, the number of bird transits through the air space swept by the rotor blades of the wind turbines per year is estimated. Then the collision risk for a bird passing through the rotor blades is calculated using a mathematical formula. The product of these provides a theoretical annual collision mortality rate. Finally, a bird avoidance rate is applied to the collision mortality rate to account for birds attempting to avoid collision. This final collision mortality rate informs the assessment of impacts of the wind farm development on key ornithological receptors (KORs) in the EIAR.

2. METHODOLOGY

2.1 The Band Model

The Band Model is used to predict the number of bird collisions that might be caused by a wind farm development. It uses species-specific information on bird biometrics, flight characteristics and the expected amount of flight activity, along with turbine-specific information on hub height, rotor diameter, pitch and rotational speed. The 7 No. turbines will be 95m at hub height, with 3 blades of a diameter between 149 and 150m, giving a maximum rotor height of between 169.5m and 170m and a minimum rotor height of between 20.5 and 20m. The model makes a number of assumptions on the turbine design and on biometrics of birds:

- Birds are assumed to be of a simple cruciform shape.
- Turbine blades are assumed to have length, depth and pitch angle, but no thickness.
- Birds fly through turbines in straight lines.
- Bird flight is not affected by the slipstream of the turbine blade.
- Because the model assumes that no action is taken by a bird to avoid collision, it is recognised that the collision risk figures derived are purely theoretical and represent worst case estimates

Two forms of collision risk modelling are outlined by Band *et al.* (2007): a **"Regular Flight Model"** and the **"Random Flight Model"**. A Regular Flight Model is generally applied to situations where flightlines form a regular pattern. This may occur, for example, when birds are using the wind farm site as a commuting corridor between roosting and feeding grounds or migratory routes, as is often observed in geese and swans. The Random Flight Model generally applied to situations where flightlines form no discernible patterns or routes. This is often observed, for example when raptors are in foraging or hunting flights.

The Regular Flight Model predicts the number of transits through a cross-sectional area of the wind farm which represents the width of the commuting corridor. A "risk window" is identified: a 2-dimensional line the width of the wind farm to a 500m buffer of the turbines, multiplied by the rotor diameter. All commuting flights which pass through this risk window within the rotor swept height (potential collision height; PCH) are included in collision risk modelling. Any regular flights more than 500m from the turbine layout can be excluded from analysis. There are a number of key assumptions and limitations:

- The turbine rotor swept area is 2-dimensional, i.e. there is a single row of turbines in the windfarm. This represents all turbines within the commuting corridor accounted for by a single straight-line.
- Bird activity is spatially explicit.
- Birds in an observed flight only cross the turbine area once and do not pass through the cross-section a second time (or multiple times).
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

The Random Flight Model predicts the number of transits through the wind farm while assuming that all flights within the vantage point viewshed are randomly occurring, ie. any observed flight could just as easily occur within the wind farm site as outside it. All flights within PCH inside the viewshed are included in the model. There are a number of key assumptions and limitations:

- Bird activity is not spatially explicit, i.e. activity is equal throughout the viewshed area and this is equal to activity in the windfarm area.
- Habitat and bird activity will remain the same over time and be unchanged during the operational stage of the windfarm.
- All flight activity used in the model occurred within the viewshed area calculated at the lowest swept rotor height.

More detail on both the Random and Regular Flight Model calculations are available from SNH: https://www.nature.scot/wind-farm-impacts-birds-calculating-theoretical-collision-risk-assuming-no-avoiding-action. In the case of Ballynagare wind farm, regular flights were observed in whooper swan and cormorant commuting along the River Brick, which forms the western boundary of the wind farm site. A Regular Flight Model was conducted for these species. For all other species recorded in flight in the wind farm study area, flights were randomly distributed. Therefore a Random Flight Model conducted for these species.

2.2 Modelling Process

The steps used in the Band Model to derive the collision mortality rate for each species observed at the wind farm site are outlined below.

- Stage 1: Estimate the number of bird transits through the air space swept by the rotor blades of the wind turbines. Transits are calculated using either the "Regular" or "Random" flight model (Band *et al.,* 2007), depending on flight distribution and behaviour.
- Stage 2: Calculate the collision risk for an individual bird flying through a rotating turbine blade. Collision risk is calculated using a formula which incorporates the number of bird transits (Stage 1), individual species' biometrics, individual species' flight speed and style, and the proposed turbine parameters. This formula is publicly available on the SNH website: https://www.nature.scot/wind-farm-impacts-birds-calculating-probability-collision. Biometrics are available from the British Trust of Ornithology (BTO, 2021) and flight speeds are available from Alerstam *et al.* (2007). For species that can both flap and glide, the mean of the collision risk for flapping and for gliding flight is taken.
- The product of the number of birds transits per year multiplied by the collision risk provides an annual collision mortality rate. Note that this is the worst-case scenario for collision mortality, as it assumes that birds flying towards the turbines make no attempt to avoid them.
- To account for birds attempting to avoid collision, an avoidance factor is applied to the annual collision mortality rate. This corrects for the ability of the birds to detect and manoeuvre around the turbines. Avoidance rates are available from SNH (2018). Bird avoidance rates are generally 98-99% or higher for most species, based on empirical evidence, targeted studies and literature reviews, and continue to be updated following further studies of bird behaviour and mortality rates at wind farm sites.

The final annual collision risk corrected for avoidance is a "real-world" estimation of the number of collisions that may occur at the wind farm, based on observed bird activity during the vantage point survey period.

2.3 Turbine specifications

Birds in flight within the viewshed at heights between 10-200m above ground level have been included in the collision risk model. The turbine specifications are available in Table 7-5-1.

Table 7 – 5 – 1 Turbine specifications at Ballynagare wind farm

Wind Farm Component	Scenario Modelled
Assumed turbine model	Vestas V150
Number of turbines	7
Blades per turbine rotor	3
Rotor diameter (m)	150
Rotor radius (m)	75
Hub height (m)	95
Swept height (m)	20-170
Pitch of blade (degrees)	6
Maximum chord (m) (i.e. depth of blade)	4.2
Rotational period (s)	6.417
*Turbine operational time	85%

***This operational period of 85% is referenced from a report by the British Wind Energy Association (BWEA) (2007) which identifies the standard operational period of the wind turbines in the UK to be roughly 85%.**

Using the above turbine parameters ensures the 7 No. turbines with a blade diameter between 149 and 150m, giving a maximum rotor height of between 169.5m and 170m and a minimum rotor height of between 20.5 and 20m are assessed in the analysis.

2.4 Key Ornithological Receptors

The key ornithological receptors (KORs) recorded within PCH during surveys at Ballynagare were:

- Buzzard
- Curlew
- Kestrel
- Little Egret
- Cormorant
- Hen Harrier
- Lapwing
- Mallard
- Snipe
- Sparrowhawk
- Whooper Swan
- Black-headed Gull
- Common Gull

A CRM was conducted for each of these species. It is acknowledged that the predicted number of transits, and hence predicted rate of collision, for snipe may be largely underestimated, as flight activity for this species is largely crepuscular in nature (during twilight) while the VP survey sample predominantly consists of hours during daylight period when visibility is not an issue. It is assumed that waterbirds (including snipe) are active for 25% of the night along with daylight hours (as per SNH guidance) and this is accounted for in the model.

2.5 Calculation Parameters

The calculation parameters for the vantage point are outlined in Table 7-5-2. Bird biometrics are presented in Table 7-5-3. Table 7-5-4 presents the model input values: bird seconds in flight at PCH (random model) or the number of birds crossing the risk window (regular models) observed from the vantage point during the relevant survey period. Bird seconds in flight at PCH is calculated by multiplying the number of birds observed per flight by the duration of the flight spent within PCH.

Table 7- 5 - 2 Ballynagare wind farm survey effort and viewshed coverage

Vantage Point	Visible Area at 15m	Risk Area	Turbines visible	Total Survey Effort
VP1	634.124ha	388.508ha	7	143hr

Table 7 – 5 – 3 Bird biometrics

Species	Body Length(m)	Wingspan(m)	Flight Speed(m/s)
Buzzard	0.54	1.2	13.3
Cormorant	0.9	1.45	15.2
Curlew	0.55	0.9	16.3
Hen Harrier	0.48	1.1	9.1
Kestrel	0.34	0.76	10.1
Lapwing	0.3	0.84	11.9
Little Egret	0.6	0.92	8.7
Mallard	0.58	0.9	20.8
Snipe	0.26	0.46	17.1
Sparrowhawk	0.33	0.62	10
Common Gull	0.41	1.2	13.4
Black-headed Gull	0.36	1.05	11.9
Whooper Swan	1.52	2.3	17.3

Table 7 – 5 – 4 Model input values

Species	Model	Period	Input value
Buzzard	random	Breeding	500 seconds
Cormorant	random	All	247 seconds
Curlew	random	July to March	3,626 seconds
Hen Harrier	random	September to March	30 seconds
Kestrel	random	All	591 seconds
Lapwing	random	August to March	11,150 seconds
Little Egret	random	All	660 seconds
Mallard	random	All	2,885 seconds
Snipe	random	Winter	92 seconds
Sparrowhawk	random	Breeding	193 seconds
Common Gull	random	Winter	260 seconds
Black-headed Gull	random	Winter	4,020 seconds
Whooper Swan	random	Winter	5,323 seconds
Cormorant	regular	All	6 birds
Whooper Swan	regular	Winter	90 birds

The avoidance rates applied to the collision risk were: 99.5% for whooper swan; 99% for hen harrier; 98% for buzzard, curlew, little egret, cormorant, lapwing, mallard, snipe, sparrowhawk, black-headed gull and common gull; and 95% for kestrel.

3. RESULTS

The predicted number of transits per year and the collision risk is presented in Table 7-5-5, along with the final predicted number of collisions per year. Note that for birds that both flap and glide, the average collision risk percentage between flapping and gliding is taken.

Table 7 – 5 – 5 Results of CRM

Species	Survey Period	Model	Transits	Collision Risk			Collision Rate			Estimated Collisions Over Lifetime of Wind Farm	One Bird Collision
				flapping	gliding	overall	without avoidance	avoidance factor	with avoidance		
Buzzard	Breeding	random	63.5	5.52%	5.31%	5.42%	3.44	98%	**0.07**	2.41 birds	15 years
Cormorant	All	random	35.4	6.38%	no gliding flight	6.38%	2.26	98%	**0.05**	1.58 birds	22 years
Curlew	Jul to Mar	random	533.26	5.11%	no gliding flight	5.11%	27.20	98%	**0.54**	19.04 birds	1.5 years
Hen Harrier	Sep to Mar	random	1.9	5.98%	5.84%	5.91%	0.11	99%	**0.001**	0.04 birds	913 years
Kestrel	All	random	48.2	5.05%	4.95%	5%	2.41	95%	**0.12**	4.22 birds	8 years
Lapwing	Aug to Mar	random	1160	4.75%	no gliding flight	4.75%	55.07	98%	**1.10**	38.55 birds	1 year
Little Egret	All	random	54.2	6.65%	no gliding flight	6.65%	3.61	98%	**0.07**	2.52 birds	14 years
Mallard	All	random	566.5	4.88%	no gliding flight	4.88%	27.64	98%	**0.55**	19.35 birds	2 years
Snipe	Winter	random	13.1	4.17%	no gliding flight	4.17%	0.55	98%	**0.01**	0.38 birds	92 years
Sparrowhawk	Breeding	random	18.4	4.98%	4.91%	4.94%	0.91	98%	**0.02**	0.64 birds	55 years
Common Gull	Winter	random	29	5.15%	4.86%	5.01%	1.45	98%	**0.03**	1.02 birds	34 years
Black-headed Gull	Winter	random	398.4	5.05%	4.84%	4.95%	19.71	98%	**0.39**	13.79 birds	3 years
Whooper Swan	Winter	random	767	7.88%	no gliding flight	7.88%	60.47	99.5%	**0.30**	10.58 birds	3 years
Cormorant	All	regular	89.7	6.38%	no gliding flight	6.38%	5.72	98%	**0.11**	4.01 birds	9 years
Whooper Swan	Winter	regular	589.4	7.88%	no gliding flight	7.88%	46.47	99.5%	**0.23**	8.13 birds	4 years

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APPENDIX 7.6

BIRD MONITORING PROGRAMME

Planning and Environmental Consultants

Appendix 7-6 – Bird Monitoring Programme

Ballynagare Wind Farm Development, Co. Kerry



DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd.**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Appendix 7-6 – Bird Monitoring Programme**
Document File Name:	**Appendix 7-6 F 11/08/2021 200512**
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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
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1. INTRODUCTION

This Bird Monitoring Programme has been prepared by MKO for the proposed Ballynagare wind farm, Co. Kerry. It provides a timeframe and monitoring schedule for the bird population in the study area during the construction and post-construction phase of the project, informed by surveys undertaken to date. Breeding and wintering bird surveys were undertaken from April 2019 to March 2021 inclusive, encompassing two breeding and two winter seasons, along with autumn and spring passage seasons, in line with Scottish Natural Heritage guidance (SNH, 2017) on recommended bird survey methods to inform impact assessment for onshore wind energy developments. Key ornithological receptors (KORs) in the study area were identified based on these surveys.

The objectives of the Bird Monitoring Programme are:

- To ensure any required pre-commencement/pre-construction phase monitoring is scheduled to avoid impacts on KORs and other birds of conservation concern during the construction phase.
- To record birds using the study area and their interaction with operating turbines during the post-construction phase.
- To monitor short-term and long-term effects on bird populations in the study area, with a particular emphasis on birds of high conservation concern (birds listed on Annex I of the EU Birds Directive or on the Red List of Birds of Conservation Concern in Ireland).
- To undertake collision monitoring and corpse searches for potential bird fatalities as a result of a collision with turbine blades.
- To report on the findings of post-construction monitoring at the end of Years 1, 2, 3, 5, 10 & 15 of the life-time of the wind farm.

2. MONITORING METHODOLOGY

2.1 Key Ornithological Receptors

Table 7-6-1 lists the KORs recorded within the study area during surveys conducted from April 2019 to March 2021 inclusive. These species form the basis of the Bird Monitoring Programme.

Table 7 – 6 - 1 Key Ornithological Receptors identified during surveys between April 2019 and March 2021

Species	Scientific Name	Conservation Status
Golden Plover	*Pluvialis apricaria*	Annex I of Birds Directive, SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Hen Harrier	*Circus cyaneus*	Annex I of Birds Directive, SCI of Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA and Schedule 4 of the Wildlife Acts
Little Egret	*Egretta garzetta*	Annex I of Birds Directive
Whooper Swan	*Cygnus cygnus*	Annex I of Birds Directive, SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Black-headed Gull	*Chroicocephalus ridibundus*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Common Gull	*Larus canus*	SCI of Tralee Bay Complex SPA
Cormorant	*Phalacrocorax carbo*	SCI of River Shannon and River Fergus Estuaries SPA
Curlew	*Numenius arquata*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Lapwing	*Vanellus vanellus*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Mallard	*Anas platyrhynchos*	SCI of Tralee Bay Complex SPA
Oystercatcher	*Haematopus ostralegus*	SCI of Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Redshank	*Tringa totanus*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA and Red List with respect to breeding and wintering populations
Teal	*Anas crecca*	SCI of River Shannon and River Fergus Estuaries SPA and Tralee Bay Complex SPA
Barn Owl	*Tyto alba*	Red List with respect to breeding population and Schedule 4 of the Wildlife Acts
Kestrel	*Falco tinnunculus*	Red List with respect to breeding population and Schedule 4 of the Wildlife Acts
Snipe	*Gallinago gallinago*	Red List with respect to breeding and wintering populations
Buzzard	*Buteo buteo*	Schedule 4 of the Wildlife Acts
Sparrowhawk	*Accipiter nisus*	Schedule 4 of the Wildlife Acts

2.2 Commencement and Pre-construction Bird Monitoring

Pre-commencement surveys will be undertaken prior to the initiation of construction works at the wind farm site. Pre-commencement surveys comprise a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows.

If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase respectively. If it is found to be active during the construction phase, no works shall be undertaken within a species-specific disturbance buffer (Forestry Commission Scotland, 2006; Ruddock and Whitfield, 2007) in line with industry best practice. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied. All site staff and sub-contractors will be made aware of any restrictions to be imposed by means of a toolbox talk and a map of the 'no-work zone'. The restricted area will also be marked off using hazard-tape fencing to alert all personnel on site to the suspension of works within that area.

During pre-commencement surveys at Ballynagare, the whooper swan enhancement lands will be visited to confirm that there is suitable high quality foraging habitat for swans. The lands should comprise dry agricultural pasture with a sward height of 30cm or less. There should be no disturbance (including livestock) between the start of October until the migration of the swans in spring. No works shall be permitted within the vicinity of T5 or T7 until it can be demonstrated that the enhancement lands are suitable for foraging whooper swan. Please refer to Appendix 7-7 for further details.

2.3 Post-construction Bird Monitoring

Post-construction monitoring will be undertaken in Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm, following SNH (2009) guidance. The surveys that will be undertaken at Ballynagare are:

- Monthly flight activity surveys: vantage point surveys
- Targeted bird collision surveys: corpse searches with trained dogs
- Hen harrier monitoring: roost surveys
- Whooper swan monitoring: enhancement land and adjacent Ballyouneen I-WeBS site visits

2.3.1 Vantage Point Surveys

Vantage point surveys will be undertaken monthly during operational Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Vantage point survey methodology will follow guidelines issued by SNH (2009; 2017): the pre-planning vantage point location at Ballynagare (VP1) will be visited once per month for a six-hour watch, amounting to 36 hours in the breeding season and 36 hours in the winter season. Surveys will be timed to provide a spread over the full daylight period, including dawn and dusk watches to coincide with the highest periods of bird activity from September to May inclusive. All bird flight activity will be recorded. Behavioural categories for bird interactions with operational turbines will be in line with terminology by Meredith *et al.* (2002).

2.3.2 Corpse Searches

Corpse searches for bird casualties will follow survey methods broadly based on guidelines issued by the SNH (2009) and search methods adopted by Duffy and Steward (2008). The study area will be visited

once per month during operational Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Results of bird casualties will be issued in a report at the end of each monitoring year.

During each visit, the base of each operating turbine will be searched for bird corpses. The area to be searched will depend on the constructed turbine size and surrounding landscape. A trained dog and handler should be used where possible to locate corpses.

If a bird corpse is found, the following details will be recorded: GPS location of each bird carcass, photographic record, carcass condition (intact - carcass that is completely intact or not badly composed; scavenged - evidence that the carcass was fed upon by a scavenger/predator; or feather spot - ten or more feathers indicating predation or scavenging or two or more primary feathers must be present to consider the carcass a casualty), distance from the turbine, date and time.

Carcass removal trials and searcher efficiency trials will be undertaken to account for the ability of the dog to find bird corpses and the likelihood of scavenging of corpses by animals. This is done to ensure a more accurate estimation of the total number of collision victims. During carcass removal trials, a carcass is placed in a study area periodically and is monitored for 30 days or until scavenger(s) remove the carcass, whichever comes first. A determination on carcass removal is made when no body parts containing flesh or bone or >10 disarticulated feathers could be found. During searcher efficiency trials, a number of corpses are placed in a study area by one worker, then searched for by the dog two days later. A 24-48 hour period between laying carcasses and searching for them will prevent the dog following the scent of the layer rather than the carcasses.

The result of these trials is a correction factor that can be appealed to the results of the corpse searches proper.

2.3.3 Hen Harrier Roost Surveys

This survey will aim to monitor the activity at the traditional roost to the north of the proposed development. Hen harrier roost surveys will be undertaken during operational Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Survey methodology will follow SNH (2017) and Gilbert *et al.* (1998). The pre-planning vantage point location at Ballynagare (HHVP1) will be visited once per month during the winter season (October to March inclusive). Roost watches of 2-3 hours will be conducted from dusk until the last visible light and all hen harrier activity recorded.

2.3.4 Enhancement land and IWeBS site visits

Post-construction monitoring of the whooper swan enhancement lands, as proposed in the Whooper Swan Enhancement Plan of the EIAR for this wind farm development, and whooper swan counts at the Ballyouneen IWeBS site (subsite 0KS02 of the Cashen River and Estuary IWeBS site) will be conducted during operational Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. The enhancement lands will be visited once per month during the winter season from October to March inclusive to ensure that there is suitable, attractive foraging habitat for whooper swan throughout. The IWeBS site will also be visited once per month from October to March inclusive to count the number of whooper swan present.

During the enhancement land visit, the surveyor will check that the lands consist of dry agricultural grassland habitat with a sward height of approximately 30cm or less (note that usual seasonal flooding, as is typical in Ballynagare, may occur). There should be no farming activity or livestock grazing disturbance on the lands. If whooper swan are present on the lands, the surveyor will record the number of birds and activity.

In addition, annual audits will be required to ensure the effectiveness of the enhancement plan. Please refer to Appendix 7-7 for further details.

2.3.5 Summary

Table 7-6-2 below summarises the proposed bird monitoring work schedule for each monitoring year for the proposed wind farm development.

Table 7 – 6 – 2 Proposed bird monitoring work schedule

Survey	Phase	Period	Visits	Survey Method
Vantage Point Surveys	Year 1, 2, 3, 5, 10 & 15	January – December inclusive	1 visit per VP per month (VP1)	6-hour vantage point watch
Corpse Searches	Year 1, 2, 3, 5, 10 & 15	January – December inclusive	1 visit to the wind farm per month	Targeted corpse searches at turbine bases
Hen Harrier Roost Surveys	Year 1, 2, 3, 5, 10 & 15	October – March inclusive	1 visit per HHVP per month (HHVP1)	Roost watch at dusk
Enhancement Land and Ballyouneen IWeBS Site Visits	Year 1, 2, 3, 5, 10 & 15	October – March inclusive	1 visit to the enhancement lands and IWeBS site per month	Visit and inspect habitat structure on enhancement lands and conduct counts at IWeBS site

3. REPORTING

A report summarising the findings of bird monitoring surveys will be submitted to the Planning Authority at the end of each monitoring year (ie. Year 1, 2, 3, 5, 10 & 15). The report will provide the results of the surveys (vantage point surveys, corpse searches and enhancement lands) and discuss potential impacts on birds (particularly KORs) and any recommendations that may inform additional mitigation measures during the operational phase of the wind farm project.

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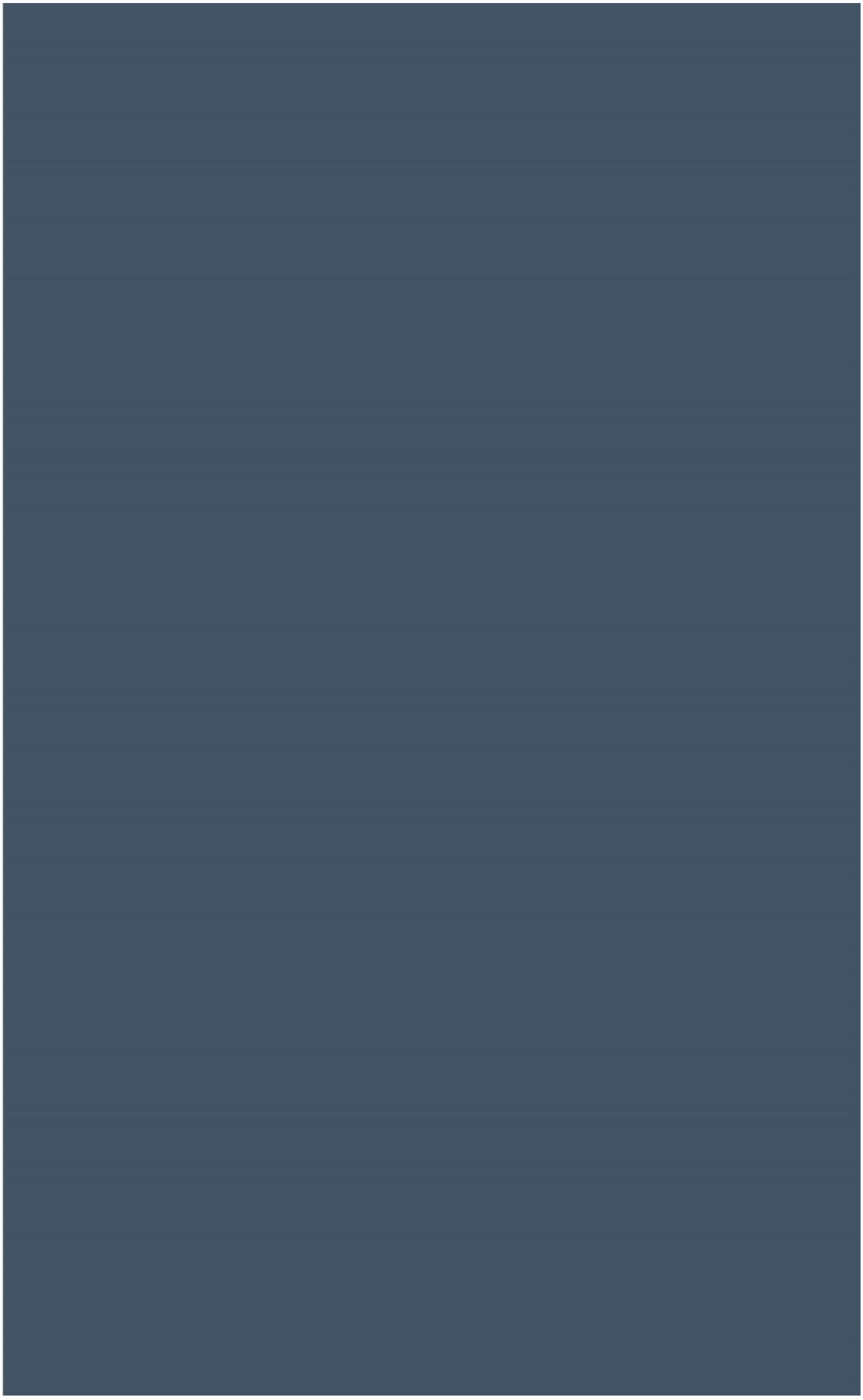

APPENDIX 7.7

WHOOPER SWAN ENHANCEMENT PLAN

Appendix 7-7 – Whooper Swan Enhancement Plan

Ballynagare Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd.**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Appendix 7-7 – Whooper Swan Enhancement Plan**
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1. INTRODUCTION

Nationally important numbers of whooper swan were observed roosting and foraging on improved agricultural farmland north of the proposed wind farm site during two winter seasons of bird survey in October 2019-March 2020 and October 2020-March 2021.

Whooper swan is listed on Annex I. It is an SCI of River Shannon and River Fergus Estuaries SPA (located 14.9km north-east of the wind farm study area) and Tralee Bay Complex SPA (located 12.9km from south-west of the wind farm study area). The whooper swan that were recorded during the surveys, were likely resident locally rather than associated with either SPA. The rationale for this was that throughout the winter months the birds were recorded foraging and roosting in the same locations within 5km of the wind farms site. Furthermore, no regular commuting/migratory flights were recorded that would constitute evidence of connectivity between the SPAs and the proposed development area. In addition, the distance between these SPAs and the wind farm study area is greater than the core foraging range of whooper swan, 5km (SNH, 2016).

The proposed Ballynagare Wind Farm development is located adjacent to a non-designated but nationally important area for whooper swan in Ballyouneen, Co. Kerry. As previously outlined, nationally important numbers of whooper swan were observed roosting and foraging on improved agricultural farmland in Ballyouneen during two winter seasons of bird survey in October 2019-March 2020 and October 2020-March 2021. In addition, flocks of up to 57 whooper swan (regionally important) considered to be associated with the nationally important population at Ballyouneen were observed foraging in the south-west area of the wind farm site.

The potential for effects on whooper swan at the wind farm site was assessed in full within the Ornithology chapter of the Ballynagare Wind Farm EIAR, including the potential loss of foraging habitat. Predicted effects on whooper swan are mitigated through project design: the turbine layout of the Proposed Development has been specifically designed to minimise impacts to whooper swan roosting and foraging sites in Ballyouneen. No turbine is located within 600m (the zone of sensitivity recommended by McGuinness *et al.,* 2015) of the Cashen River, which separates the wind farm site and Ballyouneen. As such, the Proposed Development is not expected to impact the foraging and roosting grounds at Ballyouneen. However, due to the presence of smaller foraging flocks in the south-west of the wind farm site, it is proposed to identify and manage 15.76ha of currently unused and suboptimal habitat in the area to enhance its foraging value for the Ballyouneen whooper swan population. This enhancement land and adjoining lands (totalling 21.02ha) will be managed for foraging whooper swan for the lifetime of the wind farm.

2. DETERMINATION OF ENHANCEMENT LANDS

The following sections outline the methodology used to quantify the quantum of foraging habitat proposed for enhancement and its location.

2.1 Quantum of land

Based on two years of data collected both at the wind farm site and in the wider surroundings, known whooper swan sites within the wind farm site to a 5km radius were identified (i.e. core foraging range; SNH, 2016). Using a combination of swan records and aerial maps, fields utilised for foraging and roosting were mapped using QGIS. This was done conservatively: fields with higher densities of records were mapped, while those with fewer records were not included to avoid inflating the area used by swans (which would dilute the magnitude of the impact of habitat loss). In total, approximately 373ha of land within the 5km radius is considered to be regularly used by whooper swan (Figure 7-7-1).

Within the wind farm site, whooper swan foraging activity was not evenly spatially distributed. Foraging flocks ranging from 1-57 birds were recorded on site but the majority of flocks (including the large flocks of >25 birds) were foraging in the vicinity of two proposed turbines, T5 and T7. Percival (2003) states that whooper swan will avoid habitat within 300m of wind turbines. To estimate the area of regularly used whooper swan foraging habitat that is within this avoidance zone, a 300m buffer was applied to T5 and T7 and the area of the suitable habitat within was calculated. In the present case, suitable foraging habitat was defined as fields in which whooper swan regularly foraged within 300m of T5 and T7 (almost all of which was improved agricultural grassland).

The area that is expected to be avoided was calculated as 30ha.

Following the magnitude of effects criteria outlined by Percival (2003), a low effect occurs when 1-5% of habitat is lost to a species (please refer to Section 7.2 of the EIAR for further details on Percival (2003) impact assessment criteria). According to Percival (2003), for a low effect on whooper swans at Ballynagare to occur, a maximum of 18ha of suitable foraging habitat could be removed (i.e. 5% of the regularly used habitat within 5km of the wind farm site). However, given that current survey data suggests that whooper swans are expected to avoid 30ha of suitable foraging habitat in the vicinity of proposed T5 and T7, mitigation is required for the remaining 12ha of land to ensure the magnitude of the (residual) predicted effect is low. Thus, a quantum of **15.76ha** of land is proposed for enhancement.

2.2 Location

In proposing lands for enhancement, regard was given to McGuinness *et al.* (2015), who assign a zone of sensitivity from wind farms of 600m to whooper swan occupied sites. The criteria used by McGuinness *et al.* (2015) for estimating a zone of sensitivity is based on a review of the behavioural, ecological and distributional data available for each species. Factors considered included (where available) collision risk, disturbance and core activity. In the present case, the zone of sensitivity for whooper swan (600m) exceeds predicted distances at which disturbance is expected (300m) as other factors (i.e. foraging range, barrier effect and collision risk) feed into the zone of sensitivity recommendations made by McGuinness *et al.* (2015). It is noted that foraging range, barrier effect and collision risk are all considered in detail in the whooper swan impact assessment provided in Section 7.5 of the EIAR.

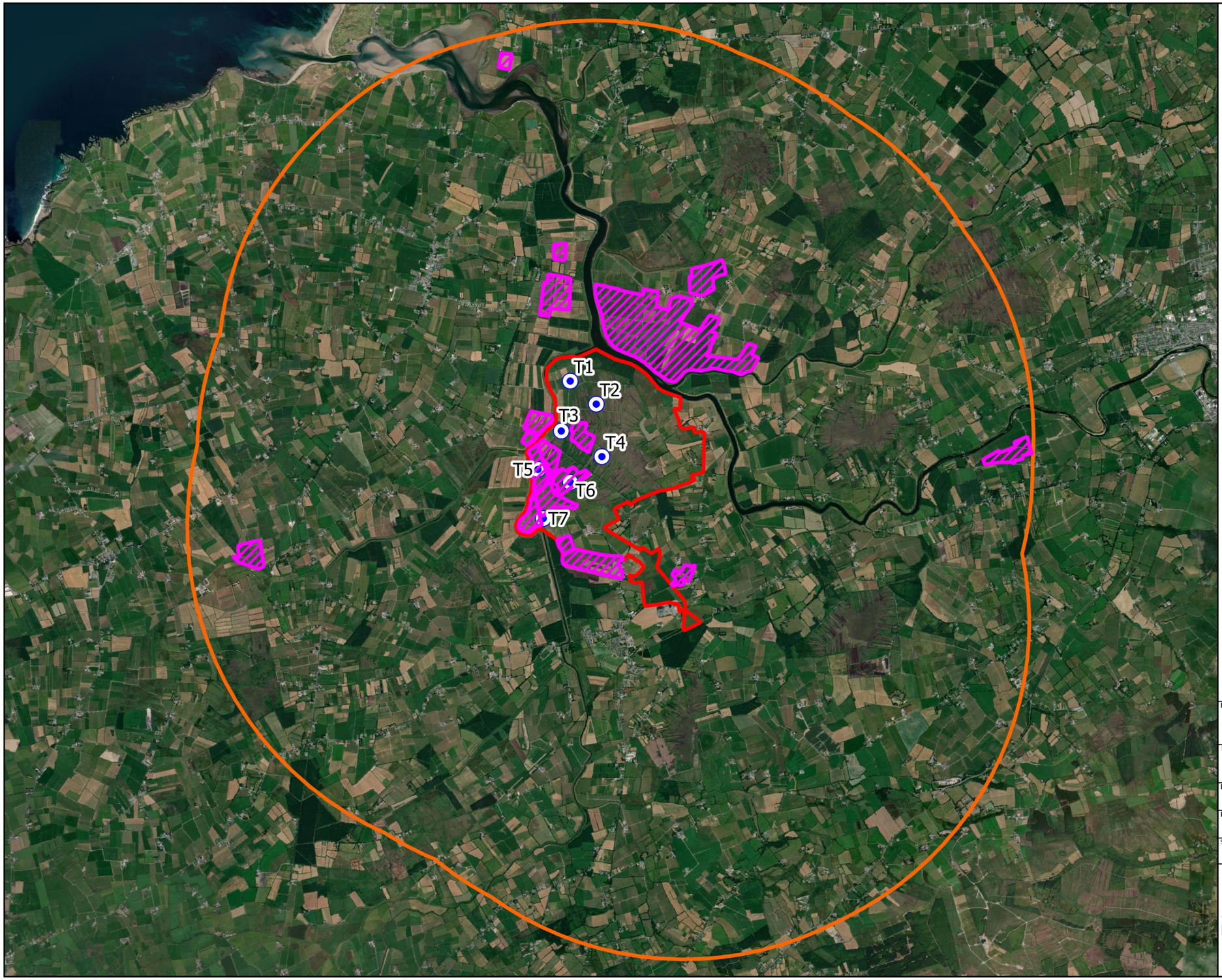
The below was considered when proposing lands for enhancement:

- To limit the potential for any negative effects from the proposed development to act on the enhancement area, these lands are proposed a minimum of 600m from the nearest turbines.

- The newly enhanced lands should be sited as close as possible to Ballyouneen, where the vast majority of the local wintering flock resides throughout the winter.

- Finally, Chisholm and Spray (2002) found that whooper swan favoured larger fields and those closer to water and that field boundary type did not influence field selection. Therefore, the largest available fields closest to a watercourse are the most preferable sites.

Taking into account the above, the proposed locations for enhancement are two sites: one to the north of the wind farm site boundary, along the Cashen River, and one on the southern boundary of the wind farm site in an area of pasture (Figure 7-1-2). These areas are suitably located further than 600m from the nearest turbines, yet close (850m and 2.6km) to the existing Ballyouneen roost site, therefore will not require excessive commuting distance, nor require swans to fly between turbines. Whooper swan have also been recorded using the adjacent suitable habitat. The sites are currently classed as Wet Grassland (GS4; Fossitt, 2000), which the local population have not been recorded to use for foraging (Plate 1, 2). The proposed habitat enhancement measures will increase the suitability of these lands for whooper swan.



Map Legend

- 5km radius of wind farm site
- Wind Farm Site
- Proposed turbine location
- Regularly used whooper swan area

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N

Drawing Title: Regularly used whooper swan area

Project Title: Ballynagare wind farm

Drawn by	Checked By
SD	PC
Project No.	Drawing No.
200512	Figure 7-7-1
Scale	Date
1:75000	20.07.21

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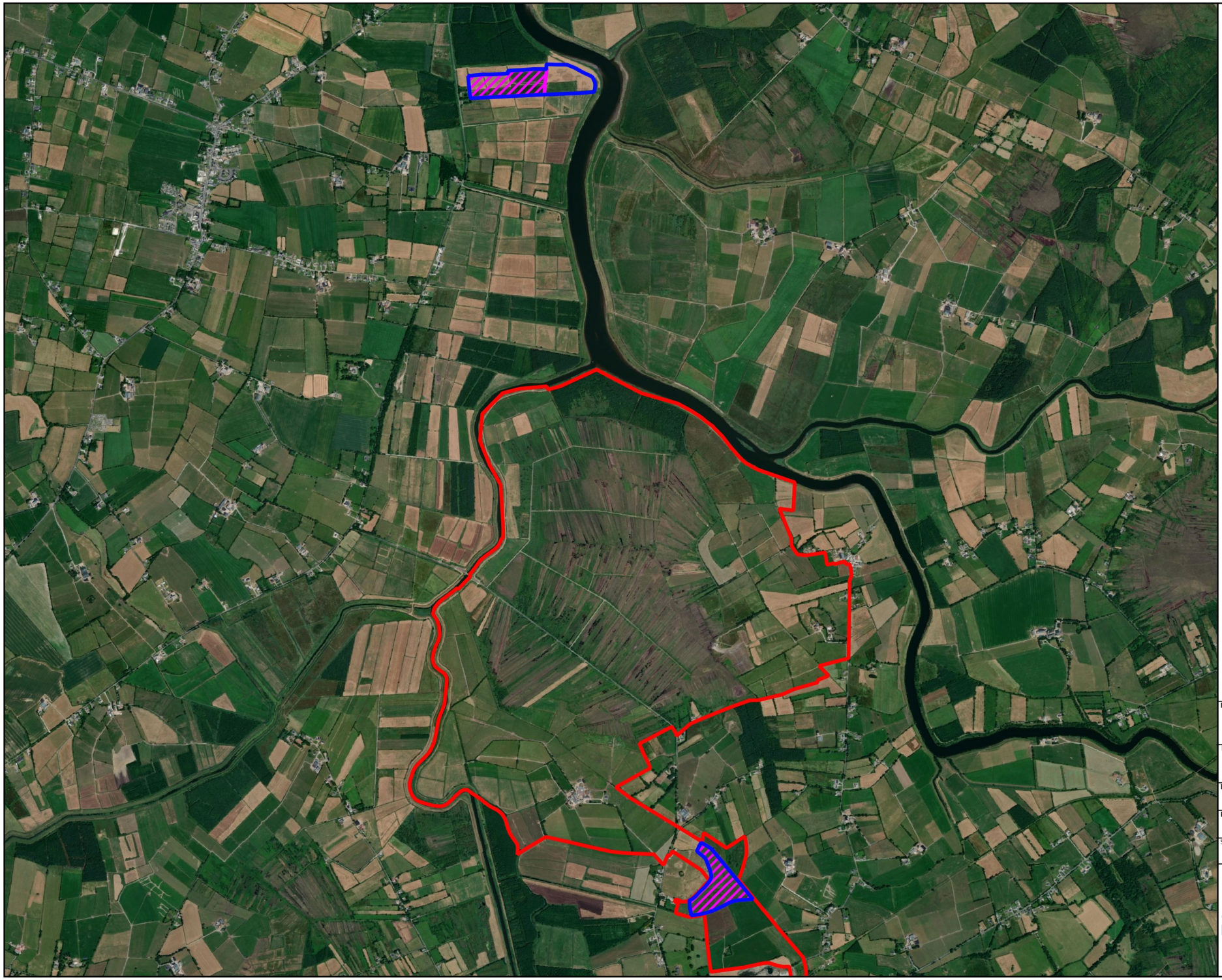

Map Legend

- Wind Farm Site
- Land Parcel
- Proposed Enhancement Area

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N

Drawing Title

Proposed enhancement land

Project Title

Ballynagare wind farm

Drawn by	Checked By
SD	PC
Project No.	Drawing No.
200512	Figure 7-7-2
Scale	Date
1:32000	18.11.21

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Plate 1 Proposed enhancement land to north of wind farm study area.



Plate 2 Proposed enhancement land in south of wind farm study area.

3. HABITAT ENHANCEMENT

3.1 Initial habitat creation

The majority of whooper swan in Ireland have been recorded on pasture - specifically, the swans appear to prefer dry, improved pasture (Hall *et al.,* 2012). Although whooper swan are often observed on arable land in Britain, with a preference for oilseed rape as a winter crop (Hall *et al.,* 2012; Chrisholm and Spray, 2002), use of arable land appears to be less common in Ireland. As such, enhancement measures will require the wet grassland habitat in the proposed enhancement lands to be converted to improved agricultural grassland.

Studies have found that the closely related Bewick's swan favours pasture with the highest biomass of green grass (Rees, 1990). Enhancement lands will require drainage and reseeding (proportional to its existing condition) to create a dry pasture of improved agricultural grassland (Rees, 1990; Hall *et al.,* 2012). Owen (1976) recommends a mixture of 50% perennial ryegrass (*Lolium perenne*), 20% creeping/strong red fescue (*Festuca rubra*), 10% chewings fescue (*Festuca rubra*) and 20% bent (*Agrostis tenuis*) for wildfowl. This mixture or similar may be used for reseeding.

Literature on crop management for wild swans is limited. However, literature is available on crop management in refuge areas for wild geese, which occupy a relatively similar ecological niche. A study by Vickery and Gill (1999) found that manipulation of sward height and fertiliser application held the greatest potential for maximising goose numbers on managed land. For geese (noting that these are smaller birds than swans), a sward height up to a maximum of 30cm is attractive (Owen, 1973). Fertilising with nitrogen has also been found to increase goose numbers on pastures (Owen, 1973).

3.2 Timing

Enhancement of the lands should be completed before construction activity commences at the wind farm site. This will mitigate the impact of disturbance displacement of whooper swans within the wind farm site during the construction phase. As such, suitable foraging habitat for whooper swan should be fully established on the enhancement lands by the 1st of October prior to construction Year 1 and managed thereafter for the lifetime of the wind farm, as discussed in Section 3.3 below.

3.3 Long-term management

The enhancement lands will require management for the lifetime of the wind farm to ensure they remain suitable and attractive for foraging whooper swan. A key aim of this enhancement plan is to guarantee that undisturbed suitable foraging habitat is available to whooper swans each winter. To further increase benefits to whooper swan, it is proposed to incorporate an additional 5.26ha of adjoining lands into the long-term management plan (Figure 7-7-2). The adjoining lands already comprise suitable foraging habitat. However, they will be managed in the same way as the enhancement lands to ensure a total of 21.02ha of foraging habitat for the lifetime of the wind farm.

Management prescriptions to be implemented by the applicant for the lifetime of the wind farm are listed below (summary in Table 7-1-1):

- The lands must remain undisturbed throughout winter each year until the whooper swans have departed on migration of their own accord in spring (typically late March/April). No livestock or farming activity may begin on the land until all swans have departed the enhancement area (with the exception of unusual cases where an individual or small number of swans do not migrate by the start of May).

- From the departure of the whooper swans (or the beginning of May, whichever comes first) until September each year, summer livestock grazing and/or cutting (including for silage/hay) may be used to ensure a sward height of 30cm or less is in place for the end of September.
- During summer each year, spring and summer fertilising may be used to maintain the sward quality (for both swans and livestock).
- In the event that late fertilisation is required in autumn to ensure a good grazing sward for swans (eg. if the grass is depleted for some reason), fertilisation must be completed by mid-September.
- To avoid disturbance, livestock must be removed from the fields before the end of September each year (ie. before the arrival of migrating whooper swan). All farming activity within the enhancement lands must also cease before the end of September each year.
- Any remnant tall rushes or grass above 30cm must be topped before the end of September each year (ie. before the arrival of migrating whooper swan).
- There will be no application of herbicides.

Table 7-7-1 Annual management schedule

Management			
	Swans absent		Swans present
Month	From departure of swans (or the start of May) to September	Before the end of September	October until departure of swans (or the start of May)
Management	Summer livestock grazing or cutting (including for silage or hay)	Field prepared for arrival of swans. Sward must be 30cm or lower. Fertiliser applied if grass is degraded	Fields empty and undisturbed by livestock or farming activity

4. IMPLEMENTATION

As previously discussed, this enhancement plan will be implemented prior to the commencement of construction of the proposed wind farm development. The enhancement plan will be implemented on an individual landowner-by-landowner basis as follows.

1. A meeting will be held with individual landowners to outline the general aims, objectives and requirements of the enhancement plan.

2. An audit of the individual landholdings will be conducted to establish the current land management practices, stocking rates, habitat conditions, opportunities for improvement of habitat, etc.

3. An individual farm plan will be prepared for each landowner contributing land to the project. The farm plans will outline the individual prescriptions required in each case to ensure the implementation of this habitat enhancement plan. Each farm plan will include a map of the relevant landholding, and a prescriptive list of actions to be undertaken, and the time of year when the necessary works and management measures are to be undertaken.

The prescriptions for the individual farm plans will be chosen from the various recommended management options and practices outlined in Section 3 of this report, above.

It is recommended that a suitably qualified environmental scientist or ornithologist/ecologist be engaged by the wind farm development company to oversee the implementation of this enhancement plan. The implementation is also likely to require the input of agricultural advisors including with regard to appropriate stocking levels.

5. MONITORING

The enhancement plan will be subject to ongoing monitoring to assess the effectiveness of the measures proposed and to contribute to advances in habitat management methods for future projects. Monitoring measures will include:

- The areas proposed for enhancement will be the subject of ongoing monitoring during the operational phase of the wind farm to ensure it is offering supporting habitat for foraging whooper swan during the winter season.

- A site visit will be conducted once per month from October to March inclusive. During this visit, the habitat will be inspected to ensure that it is improved agricultural grassland habitat, that the sward height is no higher than 30cm and that there is no farming activity or livestock grazing disturbance. The enhancement areas should be accurately mapped to check that the areas so covered have not altered in size and that the grazing regime that is in place is maintaining a favourable state of these habitats. As well as mapping, this monitoring should be recorded by means of fixed point photography. This is discussed in detail in Appendix 7-6 of the Ballynagare Wind Farm EIAR.

Reports detailing the monitoring works carried out, the results obtained and a review of their success, along with any suggestions for amendments to the plan will be prepared and submitted to the planning authority in years 1, 2, 3, 5, 10 and 15 following commencement of the plan

5.1 Auditing

The applicant will ultimately be responsible for the implementation of the management measures (as per Section 3) and audits. Audits will be required to ensure the effectiveness of the enhancement plan. They are essential to ensure adequate plan quality, compliance and control. Audits will be based on a field inspection and the assessment of the farm plans.

The audits will be undertaken each year and will assess:

- Objectives of the individual farm plan;

- Implementation of the plan; and

- Adherence to requirements of the farm plan.

Individual farm plans will be reviewed every five years.

6. CONCLUSION

The successful implementation of the measures outlined above will produce favourable foraging habitat for the Ballyouneen whooper swan population to mitigate the impact of the area of land the swans are expected to avoid as a result of the Proposed Development (please refer to Section 7.5 of the EIAR for further impact assessment details). Some of the lands proposed for enhancement are also located closer to the known Ballyouneen roost site than the habitat that will be (potentially) lost within the wind farm site. Following implementation, the management approach outlined above will be monitored to ensure as many benefits as possible are provided for whooper swan and to contribute to advances in habitat management methods. Overall, it is anticipated that the enhancement measures will safeguard a guaranteed 21.02ha of undisturbed wintering foraging ground for whooper swan for the lifespan of the proposed wind farm.

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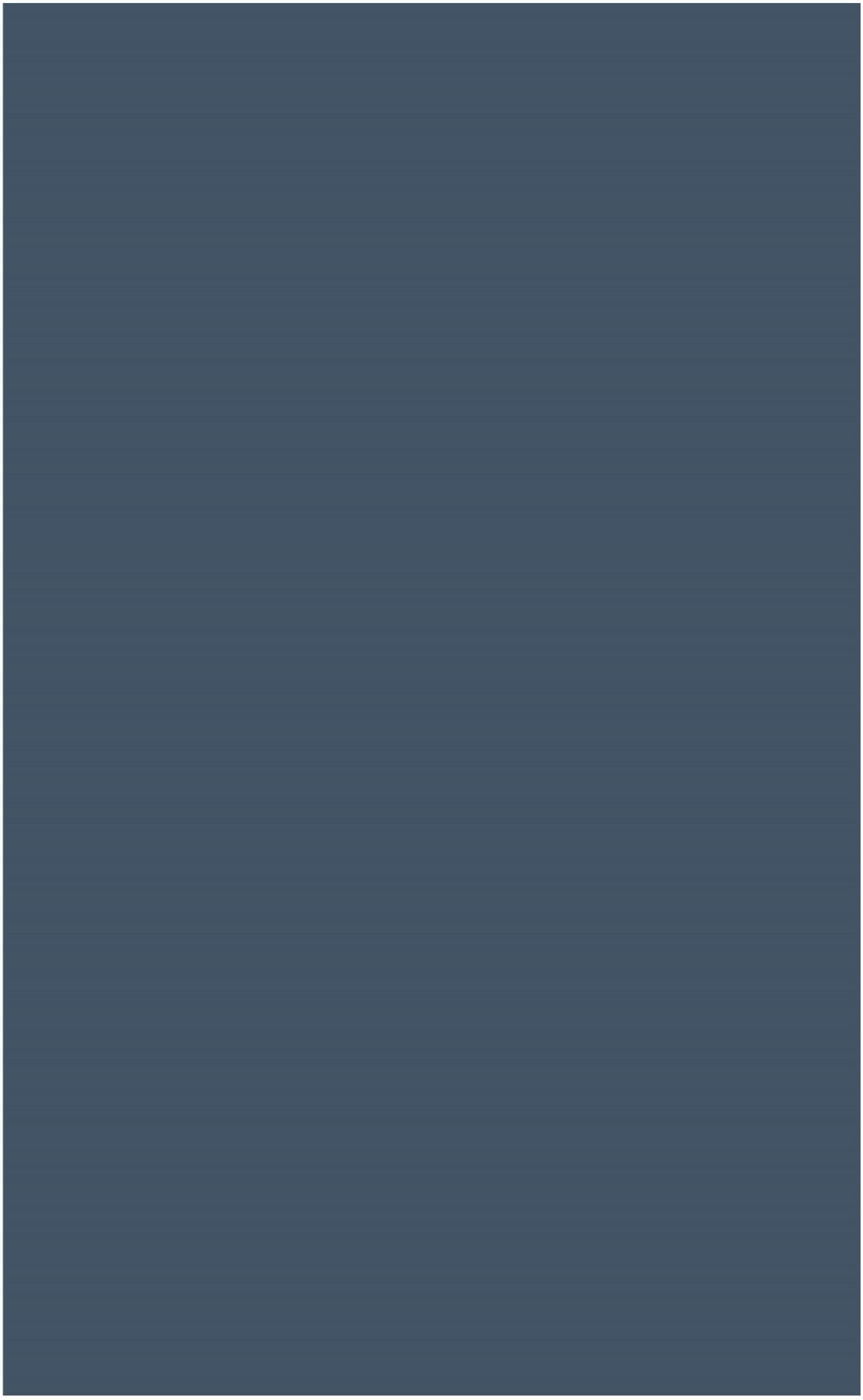


APPENDIX 7.8

CONFIDENTIAL APPENDIX

Planning and Environmental Consultants

Confidential Appendix 7-8

Ballynagare Wind Farm Development, Co. Kerry

DOCUMENT DETAILS

Client:	**Ballynagare Wind Farm Ltd**
Project Title:	**Ballynagare Wind Farm Development, Co. Kerry**
Project Number:	**200512**
Document Title:	**Confidential Appendix 7-8**
Document File Name:	**Appendix 7-8 F 2021/10/07 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	07/10/2021	SD	PC

Contents

1. HEN HARRIER 3
2. WHOOPER SWAN 7

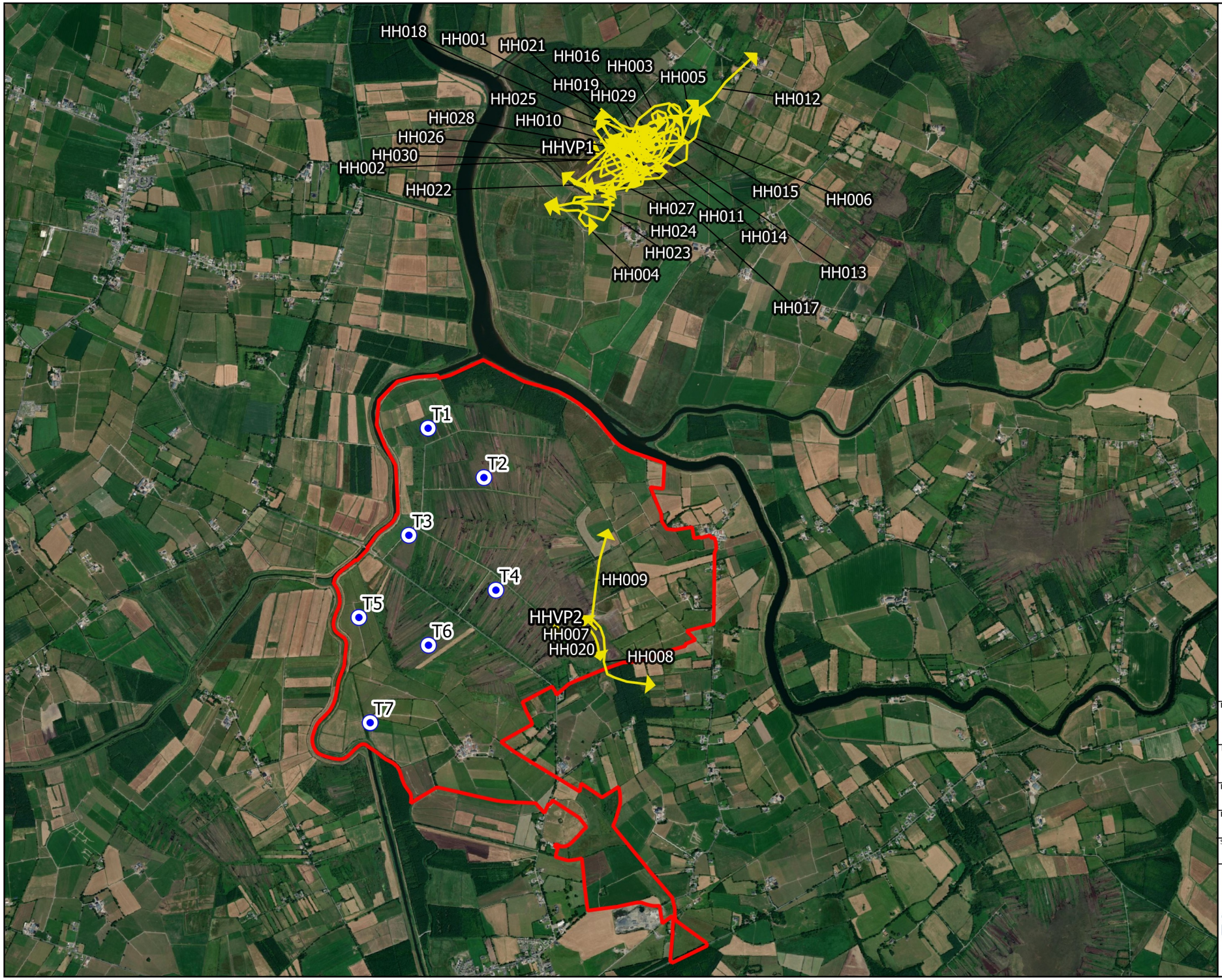
1. HEN HARRIER

Table 7 – 8 – 1 Hen Harrier Roost Survey

Map Ref.	HHVP	Date	Time	Species	Number	Habitat and activity	Surveyor
HH001	HHVP1	30/10/2019	15:12	Hen Harrier	1	conifer plantation and raised bog, flew into view from over conifers, dropped into the bog and was lost to sight in the heathers, adult female	CMc
HH002	HHVP1	30/10/2019	17:04	Hen Harrier	1	raised bog, flew into view low over the bog, dropped into the heathers, adult male	CMc
HH003	HHVP1	18/11/2019	15:31	Hen Harrier	1	lowland blanket bog and scrub/transitional woodland, adult male, flying low over the bog, lost to sight behind scrub, adult male	CMc
HH004	HHVP1	18/11/2019	16:53	Hen Harrier	2	lowland blanket bog and improved agricultural grassland, adult male, flying low over the bog and fields, followed quickly by and adult female, lost to sight behind scrub, adult male and adult female	CMc
HH005	HHVP1	20/12/2019	15:29	Hen Harrier	1	cutover bog and lowland blanket bog, flying very low (< 10m/ht)and hunting, excellent views of features and colour of plumage. a juvenile	GM
HH006	HHVP1	20/12/2019	16:49	Hen Harrier	1	cutover bog and lowland blanket bog, flying very low (< 10m/ht) and nunting, again excellent views of plumage. a juvenile bird and most likely the same bird as first observed at 15:29	GM
HH007	HHVP2	22/01/2020	16:20	Hen Harrier	2	cutover bog, female observed flying over the bog at 15-25m before dropping into the bog beside where a male was perched, female and male	CMc
HH008	HHVP2	22/01/2020	16:23	Hen Harrier	1	cutover bog and conifer plantation, the male took off from the bog, flying at 15-25m, then climed to 25-200 over conifer plantation chased by a rook, male	CMc

Map Ref.	HHVP	Date	Time	Species	Number	Habitat and activity	Surveyor
HH009	HHBP2	22/01/2020	16:54	Hen Harrier	1	cutover bog, took off from the bog and flew away chased by a corvid at 25-200m, female	CMc
HH010	HHVP1	20/02/2020	16:59	Hen Harrier	1	bogs, rose out of the scrub to approximately 2m high and dropped straight back down, female or a juvenile, wasn't in view long enough to determine which	CMc
HH011	HHVP1	06/10/2020	18:14	Hen Harrier	1	bogs, flying and landed, flying low over the bog then landed. adult female	CMc
HH012	HHVP1	06/10/2020	18:20	Hen Harrier	1	bogs, flying, adult female took off from the bog and flew away	CMc
HH013	HHVP1	06/10/2020	18:55	Hen Harrier	1	bogs, circling over the bog then landed, adult female	CMc
HH014	HHVP1	26/11/2020	16:54	Hen Harrier	3	bogs, circling, 2 females went to ground, 2 females 1 male	CMc
HH015	HHVP1	26/11/2020	16:55	Hen Harrier	1	bogs, flying, male split off from the two females, lost to sight against the backdrop in dusk	CMc
HH016	HHVP1	23/12/2020	16:10	Hen Harrier	1	cutover bog, flying and landed, female. flew arounf the bog for 10 mins before landing on the embanknent	CMc
HH017	HHVP1	23/12/2020	16:27	Hen Harrier	1	cutover bog, flying and went to ground, female. took off from embankment, flew around and went to ground by second female	CMc
HH018	HHVP1	23/12/2020	16:31	Hen Harrier	1	cutover bog, flying, female. flew around the bog and was lost to sight behind conifer plantation	CMc
HH019	HHVP1	23/12/2020	16:41	Hen Harrier	1	conifer plantation and cutover bog, flying and went to ground, female. flying and went to ground	CMc
HH020	HHVP2	07/01/2021	16:51	Hen Harrier	1	cutover bog, flying, male, flying low over the bog	CMc
HH021	HHVP1	28/01/2021	16:20	Hen Harrier	1	bogs, flying, went to ground, adult male	CMc
HH022	HHVP1	28/01/2021	16:51	Hen Harrier	1	improved agricultural grassland, flying, adult male, landed and female flew past	CMc
HH023	HHVP1	28/01/2021	16:52	Hen Harrier	1	improved agricultural grassland, flying, mobbed, female, lost to sight behind scrub	CMc
HH024	HHVP1	28/01/2021	17:04	Hen Harrier	1	improved agricultural grassland, mobbed, female being mobbed by 2 hooded crows	CMc
HH025	HHVP1	22/02/2021	16:32	Hen Harrier	1	bogs, flying, male, flying around bog, lost to sight behind conifers	CMc
HH026	HHVP1	22/02/2021	16:33	Hen Harrier	1	bogs, flying, flew quickly and low over the bog, only in sight breifly, lost behind scrub	CMc

Map Ref.	HHVP	Date	Time	Species	Number	Habitat and activity	Surveyor
HH027	HHVP1	22/02/2021	17:21	Hen Harrier	1	bogs, flying, went to ground, male, flew in low over the bog and went to ground	CMc
HH028	HHVP1	22/02/2021	17:29	Hen Harrier	1	bogs, flying, went to ground, male, flying low and slow over the bog and went to ground	CMc
HH029	HHVP1	22/02/2021	17:33	Hen Harrier	1	bogs, flying and landed, male, took off from the bog, moved north a little and went to ground again	CMc
HH030	HHVP1	22/02/2021	18:03	Hen Harrier	3	bogs, flying, went to ground, 2 females and 1 male. the birds flew around the bog for approx 5 mins snd went to ground separately	CMc



Map Legend

- Wind Farm Site
- Turbine Location
- Hen Harrier Vantage Point
- Hen Harrier Observations

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Drawing Title	Hen Harrier Roost Survey
Project Title	Ballynagare Wind Farm
Drawn By: S Doyle	Checked By: P Cregg
Project No.: 200512	Drawing No.: Fig 7-8-1
Scale: 1:35000	Date: 05.07.21

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2. WHOOPER SWAN

Table 7 – 8 – 2 Whooper Swan Waterbird Distribution Survey

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS001	Ballyouneen	11/10/2019	not given	Whooper Swan	54	improved agricultural grassland; feeding	CMc
WS002	Ballyouneen	29/10/2019	not given	Whooper Swan	75	improved agricultural grassland; present	CMc
WS003	Ballyouneen	29/10/2019	not given	Whooper Swan	231	improved agricultural grassland; present	CMc
WS004	Ballyouneen	29/10/2019	not given	Whooper Swan	51	improved agricultural grassland; present	CMc
WS005	Ballyouneen	29/10/2019	not given	Whooper Swan	33	improved agricultural grassland; present	CMc
WS006	Mac Elliots Bridge	29/10/2019	not given	Whooper Swan	16	improved agricultural grassland; present	CMc
WS007	Ballincrossig	29/10/2019	not given	Whooper Swan	5	improved agricultural grassland; present	CMc
WS008	Ballyhorgan Marshes	07/11/2019	not given	Whooper Swan	21	improved agricultural grassland; present	CMc
WS009	Ballyhorgan Marshes	07/11/2019	not given	Whooper Swan	76	improved agricultural grassland; present	CMc
WS010	Leagh Marshes	07/11/2019	not given	Whooper Swan	6	improved agricultural grassland; present	CMc
WS011	The Cashen	07/11/2019	not given	Whooper Swan	1	sea inlets and bays; present	CMc
WS012	Ballyouneen	07/11/2019	not given	Whooper Swan	168	improved agricultural grassland; present	CMc
WS013	Ballyouneen	07/11/2019	not given	Whooper Swan	90	improved agricultural grassland; present	CMc
WS014	Ballyouneen	07/11/2019	not given	Whooper Swan	31	improved agricultural grassland; present	CMc
WS015	Lixnaw Canal	07/11/2019	not given	Whooper Swan	19	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS016	Finuge	07/11/2019	not given	Whooper Swan	10	improved agricultural grassland; present	CMc
WS017	Finuge	21/11/2019	not given	Whooper Swan	26	improved agricultural grassland; present	CMc
WS018	Farrandeen	21/11/2019	not given	Whooper Swan	18	improved agricultural grassland; present	CMc
WS019	Ballincrossig	21/11/2019	not given	Whooper Swan	16	improved agricultural grassland; present	CMc
WS020	Ballinagare Bridge	21/11/2019	not given	Whooper Swan	4	improved agricultural grassland; present	CMc
WS021	Lixnaw Canal	21/11/2019	not given	Whooper Swan	32	improved agricultural grassland; present	CMc
WS022	Ballyouneen	21/11/2019	not given	Whooper Swan	143	improved agricultural grassland; present	CMc
WS023	Ballyouneen	21/11/2019	not given	Whooper Swan	35	improved agricultural grassland; present	CMc
WS024	Ballyouneen	21/11/2019	not given	Whooper Swan	12	improved agricultural grassland; present	CMc
WS025	Ballyouneen	21/11/2019	not given	Whooper Swan	68	improved agricultural grassland; present	CMc
WS026	Ballyouneen	21/11/2019	not given	Whooper Swan	67	improved agricultural grassland; present	CMc
WS027	Finuge	03/12/2019	not given	Whooper Swan	88	improved agricultural grassland; present	CMc
WS028	Ballyouneen	03/12/2019	not given	Whooper Swan	6	improved agricultural grassland; present	CMc
WS029	Ballyouneen	03/12/2019	not given	Whooper Swan	103	improved agricultural grassland; present	CMc
WS030	Ballyouneen	03/12/2019	not given	Whooper Swan	53	improved agricultural grassland; present	CMc
WS031	Ballyouneen	03/12/2019	not given	Whooper Swan	124	improved agricultural grassland; present	CMc
WS032	Ballyouneen	03/12/2019	not given	Whooper Swan	42	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS033	Lixnaw Canal	03/12/2019	not given	Whooper Swan	35	improved agricultural grassland; present	CMc
WS034	Ballincrossig	03/12/2019	not given	Whooper Swan	16	improved agricultural grassland; present	CMc
WS035	Leagh Marshes	17/12/2019	not given	Whooper Swan	2	improved agricultural grassland; present	CMc
WS036	Ballyhorgan Marshes	17/12/2019	not given	Whooper Swan	5	improved agricultural grassland; present	CMc
WS037	Ballyhorgan Marshes	17/12/2019	not given	Whooper Swan	6	improved agricultural grassland; present	CMc
WS038	Ballynagare Bridge	17/12/2019	not given	Whooper Swan	27	improved agricultural grassland; present	CMc
WS039	Ballynagare Bridge	17/12/2019	not given	Whooper Swan	14	improved agricultural grassland, watercourses and cutover bog; flying north-east over ballynagare bog	CMc
WS040	Ballynagare Bridge	17/12/2019	not given	Whooper Swan	22	improved agricultural grassland, watercourses and cutover bog; flying north-east over ballynagare bog	CMc
WS041	Ballynagare Bridge	17/12/2019	not given	Whooper Swan	31	improved agricultural grassland, watercourses and cutover bog; flying north-east near river brick	CMc
WS042	Ballynagare Bridge	17/12/2019	not given	Whooper Swan	16	improved agricultural grassland, watercourses and cutover bog; flying north-east over ballynagare bog	CMc
WS043	Ballyouneen	17/12/2019	not given	Whooper Swan	115	improved agricultural grassland; present	CMc
WS044	Ballyouneen	17/12/2019	not given	Whooper Swan	233	improved agricultural grassland; present	CMc
WS045	Finuge	17/12/2019	not given	Whooper Swan	14	improved agricultural grassland; present	CMc
WS046	Lixnaw Canal	17/12/2019	not given	Whooper Swan	39	improved agricultural grassland; present	CMc
WS047	Ballynagare Bridge	17/12/2019	not given	Whooper Swan	6	improved agricultural grassland; present	CMc
WS048	Lixnaw Canal	03/01/2020	not given	Whooper Swan	17	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS049	Finuge	03/01/2020	not given	Whooper Swan	69	improved agricultural grassland; present	CMc
WS050	Ballyouneen	03/01/2020	not given	Whooper Swan	57	improved agricultural grassland; present	CMc
WS051	Ballyouneen	03/01/2020	not given	Whooper Swan	54	improved agricultural grassland; present	CMc
WS052	Ballyouneen	03/01/2020	not given	Whooper Swan	16	improved agricultural grassland; present	CMc
WS053	Ballyouneen	03/01/2020	not given	Whooper Swan	61	improved agricultural grassland; present	CMc
WS054	Ballyouneen	03/01/2020	not given	Whooper Swan	46	improved agricultural grassland; present	CMc
WS055	Ballyouneen	03/01/2020	not given	Whooper Swan	8	improved agricultural grassland; present	CMc
WS056	Ballyouneen	03/01/2020	not given	Whooper Swan	25	improved agricultural grassland; present	CMc
WS057	Ballincrossig	03/01/2020	not given	Whooper Swan	33	improved agricultural grassland; present	CMc
WS058	Ballynagare Bridge	27/01/2020	not given	Whooper Swan	2	improved agricultural grassland; present	CMc
WS059	Lixnaw Canal	27/01/2020	not given	Whooper Swan	2	improved agricultural grassland; present	CMc
WS060	Ballyouneen	27/01/2020	not given	Whooper Swan	30	improved agricultural grassland; present	CMc
WS061	Ballyouneen	27/01/2020	not given	Whooper Swan	104	improved agricultural grassland; present	CMc
WS062	Ballyouneen	27/01/2020	not given	Whooper Swan	115	improved agricultural grassland; present	CMc
WS063	Ballyouneen	07/02/2020	not given	Whooper Swan	43	improved agricultural grassland; present	CMc
WS064	Ballyouneen	07/02/2020	not given	Whooper Swan	18	improved agricultural grassland; present	CMc
WS065	Ballyouneen	07/02/2020	not given	Whooper Swan	20	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS066	Ballyouneen	07/02/2020	not given	Whooper Swan	183	improved agricultural grassland; present	CMc
WS067	Ballyhorgan Marshes	07/02/2020	not given	Whooper Swan	19	improved agricultural grassland; present	CMc
WS068	Ballincrossig	07/02/2020	not given	Whooper Swan	23	improved agricultural grassland; present	CMc
WS069	Lixnaw Canal	07/02/2020	not given	Whooper Swan	33	improved agricultural grassland; present	CMc
WS070	Farrandeen	18/02/2020	not given	Whooper Swan	2	improved agricultural grassland; present	CMc
WS071	Lixnaw Canal	18/02/2020	not given	Whooper Swan	26	improved agricultural grassland; present	CMc
WS072	Ballynagare	18/02/2020	not given	Whooper Swan	14	improved agricultural grassland; present	CMc
WS073	Cloonlogher	18/02/2020	not given	Whooper Swan	2	improved agricultural grassland; present	CMc
WS074	Ballynagare Bridge	18/02/2020	not given	Whooper Swan	2	improved agricultural grassland; present	CMc
WS075	Ballyouneen	18/02/2020	not given	Whooper Swan	79	improved agricultural grassland; present	CMc
WS076	Ballyouneen	18/02/2020	not given	Whooper Swan	43	improved agricultural grassland; present	CMc
WS077	Ballyouneen	18/02/2020	not given	Whooper Swan	34	improved agricultural grassland; present	CMc
WS078	Ballyouneen	18/02/2020	not given	Whooper Swan	71	improved agricultural grassland; present	CMc
WS079	Ballyouneen	18/02/2020	not given	Whooper Swan	49	improved agricultural grassland; present	CMc
WS080	Lixnaw Canal	02/03/2020	not given	Whooper Swan	1	improved agricultural grassland; foraging in agricultural grassland	CMc
WS081	Ballynagare	02/03/2020	not given	Whooper Swan	18	improved agricultural grassland; foraging in agricultural grassland	CMc
WS082	Ballyouneen	02/03/2020	not given	Whooper Swan	22	improved agricultural grassland; foraging in agricultural grassland	CMc

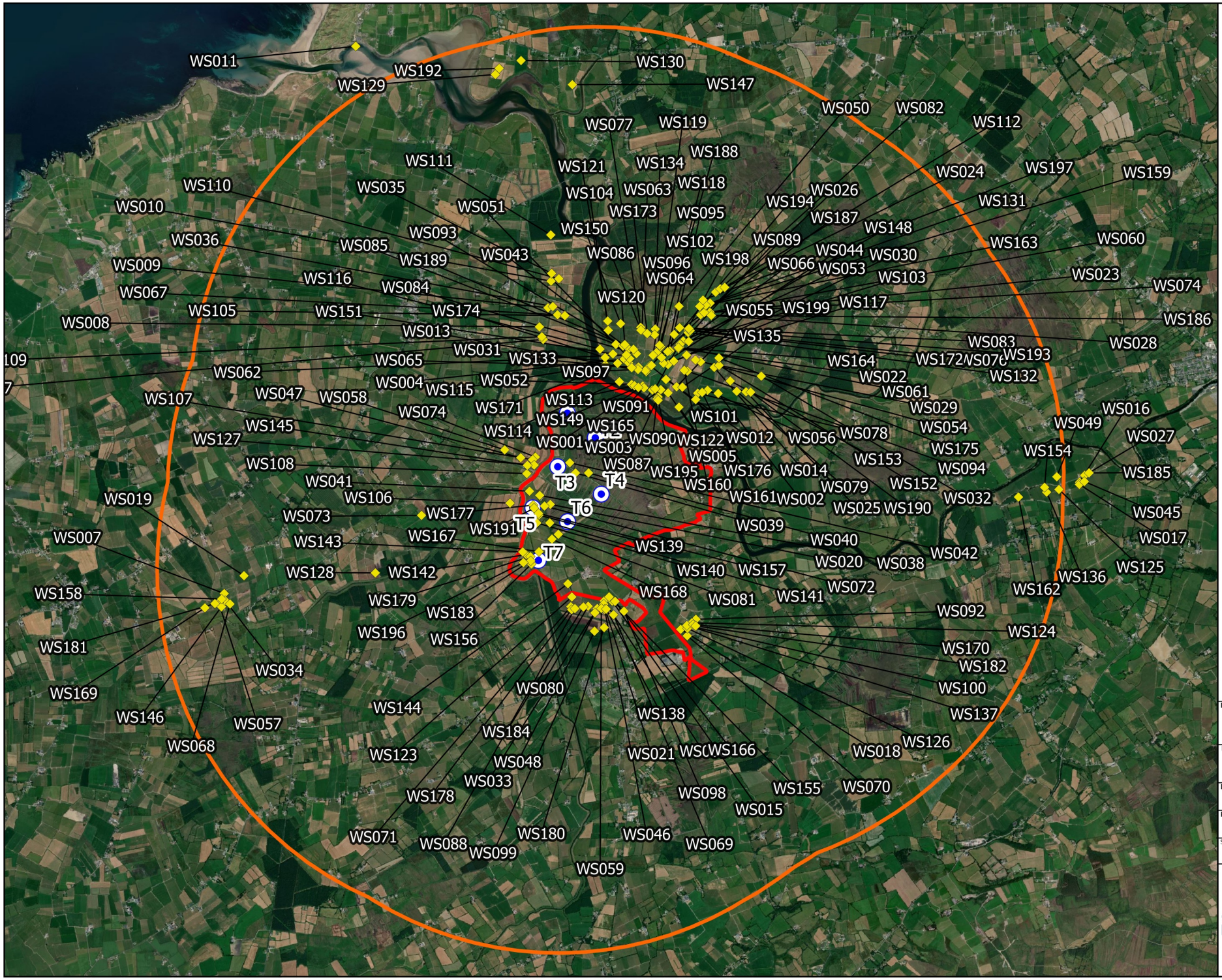
Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS083	Ballyouneen	02/03/2020	not given	Whooper Swan	157	improved agricultural grassland; foraging in agricultural grassland	CMc
WS084	Ballyouneen	02/03/2020	not given	Whooper Swan	5	improved agricultural grassland; foraging in agricultural grassland	CMc
WS085	Ballyouneen	02/03/2020	not given	Whooper Swan	9	improved agricultural grassland; foraging in agricultural grassland	CMc
WS086	Ballyouneen	02/03/2020	not given	Whooper Swan	10	improved agricultural grassland; foraging in agricultural grassland	CMc
WS087	Ballyouneen	02/03/2020	not given	Whooper Swan	133	improved agricultural grassland; foraging in agricultural grassland	CMc
WS88	Lixnaw Canal	02/03/2020	not given	Whooper Swan	1	improved agricultural grassland; present	CMc
WS089	Ballyouneen	23/03/2020	not given	Whooper Swan	53	improved agricultural grassland; foraging in agricultural grassland	CMc
WS090	Ballyouneen	23/03/2020	not given	Whooper Swan	142	improved agricultural grassland; foraging in agricultural grassland	CMc
WS091	Ballyouneen	02/05/2020	not given	Whooper Swan	3	improved agricultural grassland; present	CMc
WS092	Farrandeen	23/10/2020	10:03	Whooper Swan	9	improved agricultural grassland; present	CMc
WS093	Ballyouneen	23/10/2020	11:36	Whooper Swan	58	improved agricultural grassland; present	CMc
WS094	Ballyouneen	23/10/2020	11:37	Whooper Swan	61	improved agricultural grassland; present	CMc
WS095	Ballyouneen	23/10/2020	11:38	Whooper Swan	8	improved agricultural grassland; present	CMc
WS096	Ballyouneen	23/10/2020	11:38	Whooper Swan	13	improved agricultural grassland; present	CMc
WS097	Ballyouneen	23/10/2020	11:39	Whooper Swan	18	improved agricultural grassland; present	CMc
WS098	Lixnaw Canal	04/11/2020	10:37	Whooper Swan	4	improved agricultural grassland; flying towards farrandeen 25m	CMc
WS099	Lixnaw Canal	04/11/2020	10:58	Whooper Swan	8	improved agricultural grassland; foraging, flooded fields	CMc
WS100	Farrandeen	04/11/2020	11:38	Whooper Swan	9	improved agricultural grassland; foraging	CMc
WS101	Ballyouneen	04/11/2020	12:34	Whooper Swan	72	improved agricultural grassland; foraging	CMc
WS102	Ballyouneen	04/11/2020	12:35	Whooper Swan	2	improved agricultural grassland; foraging	CMc
WS103	Ballyouneen	04/11/2020	12:35	Whooper Swan	8	improved agricultural grassland; foraging	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS104	Ballyouneen	04/11/2020	12:57	Whooper Swan	103	improved agricultural grassland; foraging	CMc
WS105	Leagh Marshes	04/11/2020	13:36	Whooper Swan	2	improved agricultural grassland; foraging	CMc
WS106	Ballynagare	17/11/2020	09:55	Whooper Swan	2	improved agricultural grassland; foraging, flooded field	CMc
WS107	Ballynagare	17/11/2020	09:55	Whooper Swan	4	improved agricultural grassland; foraging, 2 adults, 2 juveniles	CMc
WS108	Ballynagare bridge	17/11/2020	10:13	Whooper Swan	5	improved agricultural grassland; foraging, 3 adults 2 juveniles	CMc
WS109	Ballyhorgan marshes	17/11/2020	10:23	Whooper Swan	2	improved agricultural grassland; foraging	CMc
WS110	Leagh Marshes	17/11/2020	10:35	Whooper Swan	40	improved agricultural grassland; foraging	CMc
WS111	Ardcullen marshes	17/11/2020	10:40	Whooper Swan	10	improved agricultural grassland; foraging	CMc
WS112	Ballyouneen	17/11/2020	10:54	Whooper Swan	2	improved agricultural grassland; foraging	CMc
WS113	Ballyouneen	17/11/2020	11:10	Whooper Swan	31	improved agricultural grassland; foraging	CMc
WS114	Ballyouneen	17/11/2020	11:11	Whooper Swan	5	improved agricultural grassland; foraging	CMc
WS115	Ballyouneen	17/11/2020	11:17	Whooper Swan	8	improved agricultural grassland; foraging	CMc
WS116	Ballyouneen	17/11/2020	11:18	Whooper Swan	9	improved agricultural grassland; foraging	CMc
WS117	Ballyouneen	17/11/2020	11:18	Whooper Swan	3	improved agricultural grassland; foraging	CMc
WS118	Ballyouneen	17/11/2020	11:19	Whooper Swan	40	improved agricultural grassland; foraging	CMc
WS119	Ballyouneen	17/11/2020	12:03	Whooper Swan	57	improved agricultural grassland; foraging	CMc
WS120	Ballyouneen	17/11/2020	12:05	Whooper Swan	30	improved agricultural grassland; foraging	CMc
WS121	Ballyouneen	17/11/2020	12:08	Whooper Swan	6	improved agricultural grassland; foraging	CMc
WS122	Ballyouneen	17/11/2020	12:24	Whooper Swan	76	improved agricultural grassland; foraging	CMc
WS123	Ballynagare	17/11/2020	14:02	Whooper Swan	3	improved agricultural grassland; foraging	CMc
WS124	Farrandeen	17/11/2020	14:15	Whooper Swan	42	improved agricultural grassland; foraging	CMc
WS125	Finuge	04/12/2020	10:03	Whooper Swan	15	improved agricultural grassland; present	CMc
WS126	Farrandeen	04/12/2020	10:16	Whooper Swan	29	improved agricultural grassland; present	CMc
WS127	Ballynagare Bridge	04/12/2020	11:31	Whooper Swan	2	improved agricultural grassland; present	CMc
WS128	Cloonlogher	04/12/2020	11:42	Whooper Swan	30	improved agricultural grassland; present	CMc
WS129	Rahoonagh	04/12/2020	12:28	Whooper Swan	28	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS130	Rahoonagh	04/12/2020	12:36	Whooper Swan	2	improved agricultural grassland; present	CMc
WS131	Ballyouneen	04/12/2020	12:48	Whooper Swan	25	improved agricultural grassland; present	CMc
WS132	Ballyouneen	04/12/2020	12:56	Whooper Swan	20	improved agricultural grassland; present	CMc
WS133	Ballyouneen	04/12/2020	13:21	Whooper Swan	86	improved agricultural grassland; present	CMc
WS134	Ballyouneen	04/12/2020	13:22	Whooper Swan	49	improved agricultural grassland; present	CMc
WS135	Ballyouneen	04/12/2020	13:22	Whooper Swan	16	improved agricultural grassland; present	CMc
WS136	Finuge	18/12/2020	09:59	Whooper Swan	10	improved agricultural grassland; present	CMc
WS137	Farrandeen	18/12/2020	10:21	Whooper Swan	3	improved agricultural grassland; present	CMc
WS138	Lixnaw Canal	18/12/2020	10:33	Whooper Swan	4	improved agricultural grassland; present	CMc
WS139	Ballynagare	18/12/2020	10:50	Whooper Swan	13	improved agricultural grassland; present	CMc
WS140	Ballynagare	18/12/2020	10:51	Whooper Swan	6	improved agricultural grassland; present	CMc
WS141	Ballynagare	18/12/2020	11:06	Whooper Swan	6	improved agricultural grassland; present	CMc
WS142	Ballynagare	18/12/2020	11:22	Whooper Swan	19	improved agricultural grassland; present	CMc
WS143	Ballynagare	18/12/2020	11:34	Whooper Swan	1	improved agricultural grassland; present	CMc
WS144	Ballynagare	18/12/2020	11:55	Whooper Swan	24	improved agricultural grassland; present	CMc
WS145	Ballynagare	18/12/2020	12:22	Whooper Swan	2	improved agricultural grassland; present	CMc
WS146	Clooneen	18/12/2020	12:30	Whooper Swan	30	improved agricultural grassland; present	CMc
WS147	Rahoonagh	18/12/2020	12:59	Whooper Swan	34	improved agricultural grassland; present	CMc
WS148	Ballyouneen	18/12/2020	13:18	Whooper Swan	71	improved agricultural grassland; present	CMc
WS149	Ballyouneen	18/12/2020	13:19	Whooper Swan	11	improved agricultural grassland; present	CMc
WS150	Ballyouneen	18/12/2020	13:41	Whooper Swan	25	improved agricultural grassland; present	CMc
WS151	Ballyouneen	18/12/2020	13:42	Whooper Swan	31	improved agricultural grassland; present	CMc
WS152	Ballyouneen	18/12/2020	14:11	Whooper Swan	106	improved agricultural grassland; present	CMc
WS153	Ballyouneen	18/12/2020	14:12	Whooper Swan	5	improved agricultural grassland; present	CMc
WS154	Finuge	08/01/2021	10:30	Whooper Swan	85	improved agricultural grassland; present	CMc
WS155	Lixnaw Canal	08/01/2021	11:17	Whooper Swan	22	improved agricultural grassland; present	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS156	Ballynagare	08/01/2021	11:50	Whooper Swan	1	improved agricultural grassland; present	CMc
WS157	Ballynagare	08/01/2021	15:54	Whooper Swan	12	improved agricultural grassland; present	CMc
WS158	Clooneen	08/01/2021	15:55	Whooper Swan	24	improved agricultural grassland; present	CMc
WS159	Ballyouneen	08/01/2021	15:56	Whooper Swan	72	improved agricultural grassland; present	CMc
WS160	Ballyouneen	08/01/2021	15:57	Whooper Swan	217	improved agricultural grassland; present	CMc
WS161	Ballyouneen	08/01/2021	15:57	Whooper Swan	27	improved agricultural grassland; present	CMc
WS162	Finuge	26/01/2021	10:50	Whooper Swan	30	improved agricultural grassland; present	CMc
WS163	Ballyouneen	26/01/2021	11:11	Whooper Swan	42	improved agricultural grassland; present	CMc
WS164	Ballyouneen	26/01/2021	11:20	Whooper Swan	111	improved agricultural grassland; present	CMc
WS165	Ballyouneen	26/01/2021	11:43	Whooper Swan	163	improved agricultural grassland; present	CMc
WS166	Lixnaw Canal	26/01/2021	12:46	Whooper Swan	16	improved agricultural grassland; present	CMc
WS167	Ballynagare	26/01/2021	12:59	Whooper Swan	21	improved agricultural grassland; present	CMc
WS168	Ballynagare	26/01/2021	13:13	Whooper Swan	19	improved agricultural grassland; present	CMc
WS169	Clooneen	26/01/2021	14:18	Whooper Swan	21	improved agricultural grassland; present	CMc
WS170	Farrandeen	26/01/2021	14:36	Whooper Swan	14	improved agricultural grassland; present	CMc
WS171	Ballyouneen	04/02/2021	11:26	Whooper Swan	8	improved agricultural grassland; foraging, field was very flooded	CMc
WS172	Ballyouneen	04/02/2021	11:37	Whooper Swan	45	improved agricultural grassland; foraging	CMc
WS173	Ballyouneen	04/02/2021	11:56	Whooper Swan	89	improved agricultural grassland; foraging	CMc
WS174	Ballyouneen	04/02/2021	11:56	Whooper Swan	3	improved agricultural grassland; foraging	CMc
WS175	Ballyouneen	04/02/2021	12:12	Whooper Swan	110	improved agricultural grassland; foraging	CMc
WS176	Ballyouneen	04/02/2021	12:13	Whooper Swan	17	improved agricultural grassland; foraging	CMc
WS177	Ballynagare	04/02/2021	13:33	Whooper Swan	34	improved agricultural grassland; foraging	CMc
WS178	Lixnaw Canal	04/02/2021	13:48	Whooper Swan	7	improved agricultural grassland; foraging	CMc
WS179	Ballynagare	04/02/2021	14:09	Whooper Swan	24	improved agricultural grassland; foraging	CMc
WS180	Lixnaw Canal	04/02/2021	14:26	Whooper Swan	4	improved agricultural grassland; foraging	CMc
WS181	Clooneen	04/02/2021	14:40	Whooper Swan	10	improved agricultural grassland; foraging	CMc

Map Ref.	Location	Date	Time	Species	Number	Habitat and activity	Surveyor
WS182	Farrandeen	04/02/2021	15:00	Whooper Swan	32	improved agricultural grassland; foraging	CMc
WS183	Ballynagare	19/02/2021	11:59	Whooper Swan	19	improved agricultural grassland; foraging	CMc
WS184	Lixnaw Canal	19/02/2021	12:13	Whooper Swan	12	improved agricultural grassland; foraging	CMc
WS185	Finuge	19/02/2021	13:30	Whooper Swan	34	improved agricultural grassland; foraging, just outside 5km	CMc
WS186	Ballyouneen	19/02/2021	13:52	Whooper Swan	2	improved agricultural grassland; foraging	CMc
WS187	Ballyouneen	19/02/2021	13:57	Whooper Swan	61	improved agricultural grassland; foraging	CMc
WS188	Ballyouneen	19/02/2021	13:59	Whooper Swan	9	improved agricultural grassland; foraging	CMc
WS189	Ballyouneen	19/02/2021	14:08	Whooper Swan	46	improved agricultural grassland; foraging	CMc
WS190	Ballyouneen	19/02/2021	14:40	Whooper Swan	25	improved agricultural grassland; foraging, mko dont have permission to access these lands, these birds were seen from the main road, but there were more hidden unable to count	CMc
WS191	Ballynagare	02/03/2021	10:22	Whooper Swan	46	improved agricultural grassland; foraging	CMc
WS192	Rahoonagh	02/03/2021	11:01	Whooper Swan	14	improved agricultural grassland; foraging	CMc
WS193	Ballyouneen	02/03/2021	11:15	Whooper Swan	27	improved agricultural grassland; foraging	CMc
WS194	Ballyouneen	02/03/2021	11:49	Whooper Swan	86	improved agricultural grassland; foraging	CMc
WS195	Ballyouneen	02/03/2021	12:14	Whooper Swan	265	improved agricultural grassland; foraging	CMc
WS196	Ballynagare	26/03/2021	09:40	Whooper Swan	10	improved agricultural grassland; foraging	CMc
WS197	Ballyouneen	26/03/2021	10:46	Whooper Swan	8	improved agricultural grassland; foraging	CMc
WS198	Ballynagare	26/03/2021	11:13	Whooper Swan	6	improved agricultural grassland; foraging	CMc
WS199	Ballyouneen	26/03/2021	11:13	Whooper Swan	34	improved agricultural grassland; foraging	CMc



Map Legend

- 5km Waterbird Distribution Survey Radius
- Wind Farm Site
- Turbine Location
- Whooper Swan Observations

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Drawing Title

Whooper Swan
Waterbird Distribution Survey

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
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Project No.	Drawing No.
200512	Fig 7-8-2
Scale	Date
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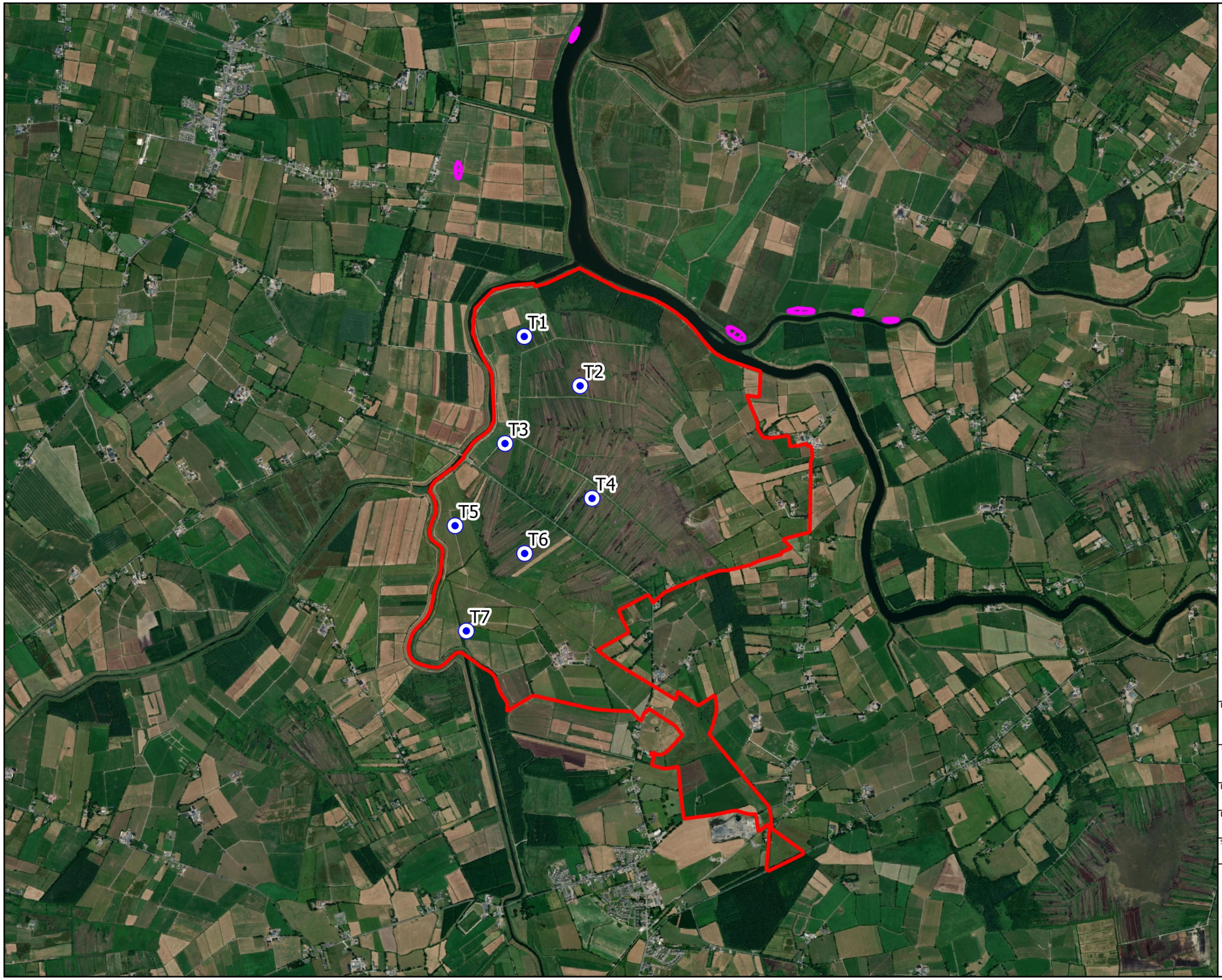

Map Legend

- Wind Farm Site
- Turbine Location
- Regularly used Whooper Swan Roost

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N

Drawing Title
Regularly used Whooper Swan Roosts

Project Title
Ballynagare Wind Farm

Drawn By	Checked By
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Scale	Date
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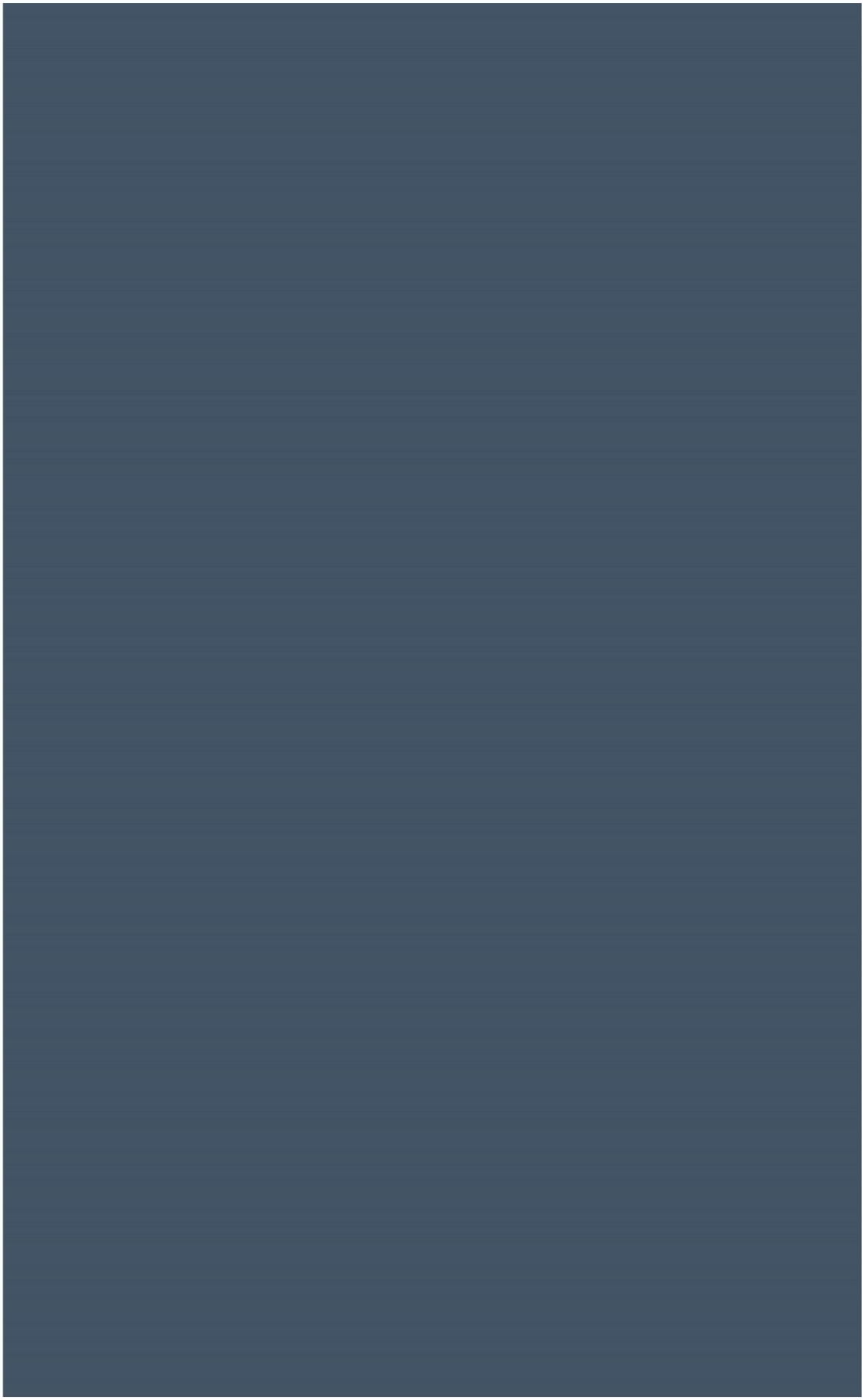

APPENDIX 8.1

PEAT AND OVERBURDEN MANAGEMENT PLAN

Peat and overburden management plan for Ballynagare Wind Farm

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Project Title:	Ballynagare Wind Farm
Report Title:	Peat and overburden management plan
Document reference:	20260-R-002-02

Client:	MKO Planning & Environmental Consultants
Essential Requirements:	This report is best viewed in colour

Document Control

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	Issued as draft			
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
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	Minor updates to layout and clients' comments			
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
02	26.10.2021	Emma Gallagher	Laura Burke	Laura Burke
	Minor updates to clients' comments			
Revision	**Date**	**Authored:**	**Checked:**	**Approved:**

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1 Introduction

Gavin and Doherty Geosolutions (GDG) was requested by MKO Planning & Environmental Consultants (MKO) to prepare a Peat and overburden Management Plan (PMP) as part of an application for planning permission for the Ballynagare Wind Farm.

GDG has been involved in many wind farm developments in both Ireland and the UK at various stages of development i.e. preliminary feasibility, planning, peat stability assessment, design, and construction. The GDG team, made up of engineering geologists, geomorphologists, geotechnical engineers, and environmental scientists, has developed expertise in the design and construction of developments in areas of peat.

This PMP and compliance with it shall not relieve the developer of its obligations to undertake detailed ground investigations or geotechnical design prior to construction or any obligations relating to other aspects of the environment.

1.1 Site description

The proposed site is located approximately 9km west of Listowel and 3km north of the village of Lixnaw, in the townlands of Ballynagare, Curraghcroneen, and Dysert Marshes, Co. Kerry. The approximate location of the windfarm site is shown in Figure 1-1 (Google Maps, 2021).



Figure 1-1: Ballynagare windfarm location (Google Maps, 2021)

The windfarm site is bounded to the west by the River Brick and the east by the Feale river. Access to the site can be gained via the R557 regional road, located to the south of the proposed development. Reference to aerial imagery indicates that the proposed development is situated in an area of agricultural grassland and bogland, as shown in Figure 1-2. The grid connection from the site will be constructed along the centre of a public road.



Figure 1-2: Site layout (Environmental Impact Assessment study area in red)

The proposed wind farm layout and peat depth plan is presented in Appendix A.

1.2 Proposed development

The full description of the proposed development is as follows:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Construction of 7 no. wind turbines with the following maximum and minimum parameters;
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres;
- Upgrade of existing roads and access junctions;
- Provision of new site entrances, roads and hardstand areas;
- 2 no. temporary peat storage areas;
- no. temporary construction compounds;
- 1 no. borrow pit;
- All site drainage works;

- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank;
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation;
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas;
- All ancillary site and ground works, apparatus and signage.

1.3 Code of practice

This PMP has been prepared with consideration of industry best practice relating to wind farm construction and peatlands. This best practice includes:

- Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government (2019);
- Good practice during wind farm construction. A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland (2015);
- Scottish Government, Guidance on Developments on Peatland – Site Surveys (2014);
- Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste, Scottish Renewables and SEPA (2012); and
- Floating Roads on Peat, Scottish Natural Heritage (2011).

Many of the publications listed above have been developed by the Scottish Government which are considered to be best practice in Ireland and are therefore appropriate for referring to within this PMP.

1.4 Scope of report

This report contains the following:

- A summary of construction activities on-site;
- A review of peat conditions on-site;
- Preliminary road construction types;
    - Methodologies for the construction of each type of access road and road construction details;
- Summary of the borrow pit on-site, temporary and permanent peat deposition areas and detail drawings;
- Guidelines for handling and storing of excavated peat;
- Preliminary earthworks volumes; and
- General recommendations for good construction practice.

1.5 Summary of construction activities

For the construction phase, the activities that are considered likely to generate peat and spoil are as follows:

1. The upgrade and widening of existing founded access roads.
2. The construction of new excavated roads. We note that floating road construction does not require peat excavation.
3. Excavations for turbine bases, hardstandings, met mast, substation, construction compounds and borrow pit.

An underground cable connection to the existing overhead line is proposed to be constructed along the centre of existing public roads. Considering the shallow depth of a cable trenches, it is not anticipated that this will generate peat.

2 Peat conditions and stability

Reference to the GSI geotechnical online viewer (GSI, 2021) indicates that the quaternary sediments at the location of the proposed development consist of cut over raised peat with areas of till derived from Namurian sandstones and shales to the east and south of the site.

GDG visited the site on two occasions to carry out a site walkover and peat probing. Firstly, on the 24th to the 26th of November 2020 and secondly on the 9th and 10th March 2021.

The depth of peat varies across the site. Readings typically ranged from 0.0m to 6.1m, with an average peat depth of 3.24m for the windfarm site. The peat probing interpolation drawing (GDG, 2021b) is included in appendix A of this report.

The walkover indicated that the peat is being harvested and has drained significantly with the observed peat classified as the catotelm layer. The surface condition of the peat can be described as being varied with some areas having bare peat at surface where cutting is active and other areas are vegetated with grass/rushes, as shown in Figure 2-1 and Figure 2-2.



Figure 2-1: Surface condition of peat vegetated with grass/rushes



Figure 2-2: Varied surface condition of peat on-site

Pooling/seasonal flooding of water noted in some locations to the north of the site where surface was very soft underfoot, as shown in Figure 2-3.



Figure 2-3: Pooling/seasonal flooding at the Ballynagare windfarm site

3 Road construction types

Existing roads will need to be upgraded and new access roads will need to be constructed at the Ballynagare Wind Farm. The following factors are considered in the preliminary proposals for road construction types:

- Constructability;
- Serviceability requirements for construction and wind turbine delivery and maintenance vehicles;
- Peat depth;
- Horizontal longitudinal and cross fall gradient of the roads;
- Minimisation of excavation arisings; and
- The requirement to minimise disruption to peat hydrology.

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road will be determined on the prevailing ground conditions encountered during the detailed site investigation and road design stages.

Floating roads minimise the impact on the peat, particularly peat hydrology as there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions, a founded type access road may be more suitable.

The preliminary road construction details proposed for the development are summarised below in Table 3-1. Details of the road construction types are included in Appendix B1 and a plan of road construction types across the development are included in Appendix B.2.

Table 3-1 Road construction types

Construction method	Detail reference	Construction type
Construction of new roads	A	Founded
	B	Floating
Upgrade of existing access roads	C	Founded
	D	Floating

It is anticipated that the majority of the roads will be a founded construction (Detail A and B), although a methodology and detail (Detail B and C) is provided for upgrading of floating access roads, to account for the unlikely case that is found to be necessary during detailed design or construction. The final road construction and extents of each construction type used will be determined at detailed design stage.

General construction methodologies are presented in the following sections. This methodology aims to minimise impacts on the stability of the peat. The proposed methodologies may be amended following detailed design and these proposed methodologies do not override the requirement for this detailed design. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations. Inspection and monitoring plans should be implemented during construction for each methodology to monitor peat stability.

3.1 Construction methodology for new roads

The general methodology to construct new founded roads (i.e. See Detail A of the road construction detail drawings presented in Appendix B) is presented below.

1. Excavation of the new access road to competent strata (see Section 6 for guidance on the correct handling and storage the different peat layers).
    a. For excavations in overburden and peat, side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes may be required if localised areas of weaker peat are encountered.
    b. Drainage shall be installed to divert surface and groundwater from the construction areas.
2. Placement of granular fill in layers following the designer's specification (typically 200mm, but which will be subject to detailed design).
3. Access roads to be finished with a layer of capping across the full width of the road.
    a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

The general methodology to construct new floating roads (i.e. See Detail B of the road construction detail drawings presented in Appendix B) is presented below. As noted, it is not anticipated that this will be necessary on site, but is included to account for the unlikely case that this construction is found to be necessary during detailed design or construction.

1. Placement of tree brash and/or a geotextile directly onto the peat surface, following the designer's specification.
2. Placement of granular fill and reinforcing geogrids in layers following the designer's specification, with due regard to any settlement of peat anticipated for the widened area.
    a. It may be necessary to stage the widening to maintain peat stability – i.e. to reduce rate of placement of fill to allow the peat layers to consolidate and increase in strength.
    b. Drains shall be installed within the road itself to divert surface and groundwater from upslope to downslope.
    c. Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road in a manner as to avoid excessive impact loading on the peat due to concentrated end-tipping. Direct tipping of stone onto the peat shall not be carried out.
3. Access roads to be finished with a layer of capping across the full width of the road.
    a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

No excavations (e.g. drainage, peat cuttings) shall be carried out within 5m distance of a completed floated access road edge, or at a distance determined following a site inspection.

The presence of excavations can destabilise the road. Temporary excavations, where required, should be excavated in short lengths and backfilled as soon as practicable.

Spoil materials can be side-cast on the upslope side of roads only, where slope and ground conditions allow. Side cast materials should be placed to heights of typically 1m and widths of 2 to 3m unless specific site-specific designs allow larger volumes of to be placed. Large stockpiles of materials shall not be placed on or adjacent to floated access roads. This is to avoid bearing failure of the underlying peat.

3.2 Construction methodology to upgrade existing roads

The general methodology to upgrade existing founded roads (i.e. See Detail C of the road construction detail drawings presented in Appendix B) is presented below.

1. Excavation on one or both sides of the existing access road to competent strata.
    a. For excavations in peat and overburden, side slopes shall not generally be greater than 1(V): 2 or 3(H), respectively. Slacker slopes will be required where areas of weaker peat are encountered.
2. Benching of existing road and placement of granular fill in layers, following the designer's specification.
3. Overlay of the existing access road with selected granular fill following the designer's specification.
    a. Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access road.
4. Access roads to be finished with a layer of capping across the full width of the road.

a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

The general methodology to upgrade existing floating roads (i.e. See Detail D of the road construction detail drawings presented in Appendix B) is presented below. As noted, it is not anticipated that this will be necessary on site, but is included to account for the unlikely case that this construction is found to be necessary during detailed design or construction.

4. Placement of tree brash and/or a geotextile onto on one or both sides of the existing access road directly onto the peat surface, following the designer's specification.
5. Benching of existing road and placement of granular fill and reinforcing geogrids in layers following the designer's specification, with due regard to any settlement of peat anticipated for the widened area.
    a. It may be necessary to stage the widening to maintain peat stability – i.e. to reduce rate of placement of fill to allow the peat layers to consolidate and increase in strength.
    b. It may be necessary to anchor the geogrids into the existing roads which would require significant benching of existing roads.
6. Overlay of the existing access road with selected granular fill following the designer's specification.
    a. Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access road.
    b. The surface of the existing access road should be graded/levelled before the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
7. Access roads to be finished with a layer of capping across the full width of the road.
    a. A layer of geogrid/geotextile may be required at the surface of the existing access road following the designer's specification.

Where there are cross slopes, any road widening works required should be carried out on the upslope side of the existing access road, where possible. Particular design details will be required at detailed design at the transitions between floating and founded roads to smooth out differentials settlements between the two construction types.

4 Temporary peat storage

Where peat is excavated that is suitable for reuse for landscaping purposes, small volumes of this can be temporarily stockpiled along the adjacent founded roads and crane hardstandings. However, temporary storage of significant amounts of surplus peat will likely be required during construction. There are two locations on site identified to be suitable for temporary surplus peat storage, these are shown earlier in the report in Appendix A. These areas are proposed for the storage of surplus peat in the short term only; this surplus peat will ultimately be moved to the borrow pit for permanent storage. Temporary peat storage areas will then be restored and seeded upon completion of construction works. A detail of a temporary peat storage area is shown in Appendix C.

5 Borrow pit

One borrow area is proposed for the development, as shown in Appendix A and D. The approximate area of the borrow pit is 24,000m^2. The peat depths within the development footprints of the borrow pits is estimated to be 0m. There were no peat probes conducted at this location.

The rock within each proposed borrow pit footprint will be removed by either breaking or blasting depending on its excavatability, which will be determined from a ground investigation carried out at the proposed borrow pit. The excavated rock from the borrow pit will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the windfarm. An anticipated excavation profile for the borrow pit is shown in Appendix D. Where necessary, the project design engineer will determine the appropriate depth of excavation.

Slopes within the excavated rock formed around the perimeter of the borrow pit should be formed at stable inclinations to suit local in-situ rock conditions. An interceptor drain should also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence, prevent water from ponding and lodging on the re-instated borrow pit area.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using surplus excavated peat and spoil. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to place peat to approximately 5m deep across the base of the borrow pit.

It may be necessary to construct cells/rock buttresses or leave upstands of intact bedrock within the borrow pit to help contain the reinstated peat and overburden. This will allow for the safe placement and grading of the materials using dumper trucks and excavators.

The layout of the borrow pit is presented in Appendix D.

6 Handling and storing excavated peat

- Care shall be taken during peat excavation to ensure it is segregated from other soil types, therefore, particular care should be taken to review recorded peat depths.
- Where possible, small volumes of excavated peat that are suitable for landscaping shall be stockpiled temporarily adjacent to founded roads on peat and crane hardstandings on peat and reused to restore peatland habitat.
- Two temporary peat storage areas are proposed for the storage of surplus peat in the short term only. Surplus peat stored in this manner will ultimately be moved to the borrow pit for permanent storage.
- The borrow pit will form the single location of permanent storage of surplus peat for the proposed development.
- Peat shall be separated and stored by type, namely the acrotelmic and catotelmic layers as distinguished by the Ecological Clerk of Works (ECoW).

    - Acrotelm (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall be undertaken before the main excavations.
    - Where possible, the acrotelm shall be always placed with the vegetation part of the sod facing the right way up to encourage the growth of plants and vegetation.
    - All catotelm peat (peat below about 0.3 to 0.4m depth) is unlikely to be reused for landscaping and will become surplus peat; it shall be transported immediately on excavation to the designated temporary peat storage areas or directly to the borrow pit for permanent storage, if appropriate.
- Construction sequence planning shall minimise the time that peat is stockpiled before reuse.
- Stockpiles of peat that is suitable for landscaping shall be located at least 50m away from watercourses, including site ditches/shucks, to reduce the potential for sediment to be transferred into the wider hydrological system.
- Peat stockpiles shall not be allowed to substantially erode or become dry.
- Peat management should limit re-handling as far as reasonably possible.
- The Contractor shall consult the site Geotechnical Engineer and review and take into account the Peat Stability Risk Assessment 20260-001 by GDG (2021), to avoid the risk of peat instability in peat excavations in areas underlain by peat.
- Run-off from temporary peat storage areas shall be directed through the temporary site drainage system that shall include silt fences, settlement ponds and other drainage measures as appropriate. This is detailed in the Contractor's Construction and Environmental Management Plan.

The following particular recommendations/best practice guidelines for the placement of peat & spoil which will be reused for landscaping alongside the founded roads and hardstands should be considered and taken into account during construction.

- Peat and spoil may be temporarily stockpiled along founded roads and hardstands only where it will be reused as landscaping and where it can be placed in a stable formation i.e. where the topography and ground conditions allow.
- Peat and spoil shall only be temporarily stockpiled to safe heights and slope angles, considering the topography and the ground conditions. This height shall generally be up to 1m, and the slopes shall be not greater than 1 (v): 2 or 3 (h) unless a site-specific assessment during detailed design indicates a greater height and angle is safe.

The following particular recommendations/best practice guidelines for the placement of peat in the borrow pit should be considered and taken into account during construction.

- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds may be required at the lower side/outfall location of the borrow pit.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pit may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be

required to develop the borrow pit in a way which will allow the excavated peat & spoil to be placed safely.

- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

7 Preliminary earthwork volumes

It is expected that peat excavation will be required for the following elements of the proposed development:

1. Founded access roads;
2. Turbine foundations and crane hardstandings;
3. Substation compound;
4. Construction compound;
5. Meteorological mast foundation; and
6. Borrow pit.

A preliminary estimate of the approximate volumes of excavation and fill needed to construct the development was carried out. This was produced using typical limits to road and hardstand gradients and using road and hardstanding thickness typical to the windfarm ground conditions. Peat probe depths were reviewed to assess the depth of peat across the site. The average peat depth of 3.24m across the site was incorporated into the model along with the site layout and preliminary alignment to estimate the volume of peat expected to be excavated. A breakdown of the estimated volumes are summarised in Table 7-1. Peat excavation will not be required for the underground grid connection cable as it will be constructed entirely within the centre of existing public roads.

Table 7-1: Summary of preliminary excavation volumes

Infrastructure Item	Excavated volume (m^3)		
	Peat *	Non-peat *	
		Overburden **	Rock **
Floated access roads	0	-	-
Founded access roads	11,059	-	-
Turbine foundations	7,576	6,013†	-
Crane hardstands	50,523	-	-
Compound North hardstand	0	-	-
Compound South hardstand	0	-	-
Substation hardstand	0	-	-
Met mast hardstand	1,968	-	-
Borrow Pit	0	0	144,000
Total	**71,127**	**6,013**	**144,000**

* The volume of peat versus non-peat material excavated has been estimated using the average peat depth calculated across the site to define the basal surface of the peat.
** The breakdown of the constituents of the non-peat materials excavated (i.e. the ratio of overburden to rock) is based on observations of rock and overburden exposures made during the site reconnaissance and desk study.
† Assuming overburden thickness of 3m.

Peat generated during construction can be reused or reinstated across the development. Peat may be reused for landscaping on edges of constructed infrastructure (including road verges, turbine foundations) and shall be placed as soon as reasonably practical after construction. This shall act as part of the landscaping restoration and tie-in with surrounding topography, reducing visual impacts and restore the existing habitat. 3m of excavated peat is proposed to be placed in the borrow pit as part of reinstatement. Potential peat reuse/reinstatement volumes have been estimated and are also presented in Table 7-2.

Table 7-2: Summary of preliminary reinstatement volumes

Infrastructure Item	Reinstatement volume (m^3)		Comments
	Peat	Overburden	
Access Roads	0	0	The peat and overburden may be used for landscaping across the development but a conservative approach has been adopted for this calculation which assumes that all of this material will be placed in the borrow pit and used around turbine and crane hardstands.
Turbine foundations and crane hardstandings	0	6,500	
Compound and substation hardstanding	0	0	
Met mast hardstanding	0	0	
Borrow Pit	72,000	0	
Total	**72,000**	**0**	

Table 7-3: Summary of preliminary fill volumes

Infrastructure Item	Total fill required (m^3)	Class 6 crushed stone material required (m^3)	General fill required (m^3)
Floated access roads	22,467	8,425*	14,042†
Founded access roads	30,428	7,264*	23,165†
Turbine foundations	15,593	13,589**	2,004‡
Crane hardstand	61,379	4,071*	57,308†
Compound North hardstand	4,451	1,669*	2,782†
Compound South hardstand	2,221	833*	1,388†
Substation hardstand	695	261*	434†
Met mast hardstand	2,511	204*	2,308†
Total	**139,746**	**36,351**	**103,431**

*Assuming capping material class 6F or similar with a thickness of 0.3m.
** Assuming structural upfill material class 6N from competent formation to underside of foundation.
† Assuming a general fill thickness of 0.5m.

‡ Assuming general fill thickness of 1m, used as ballast above foundation.

The summary of preliminary earthwork volumes indicates that the peat storage capacity of the development, namely that provided once the borrow pit is reinstated, is greater than the volume of peat excavated for the various infrastructures.

8 General recommendations for good construction practice

To minimise the risk of construction activity causing potential peat instability, it is recommended that the construction method statements for the project should also take into account, but not be limited, to the guidance listed in Section 1, the general recommendations below together with the specific recommendations above. Some of these general recommendations are already included in more detail within the specific recommendations but are reiterated again.

- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- All excavation shall be suitably supported to prevent collapse and development of tension cracks.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions.
- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by the contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc.).

References

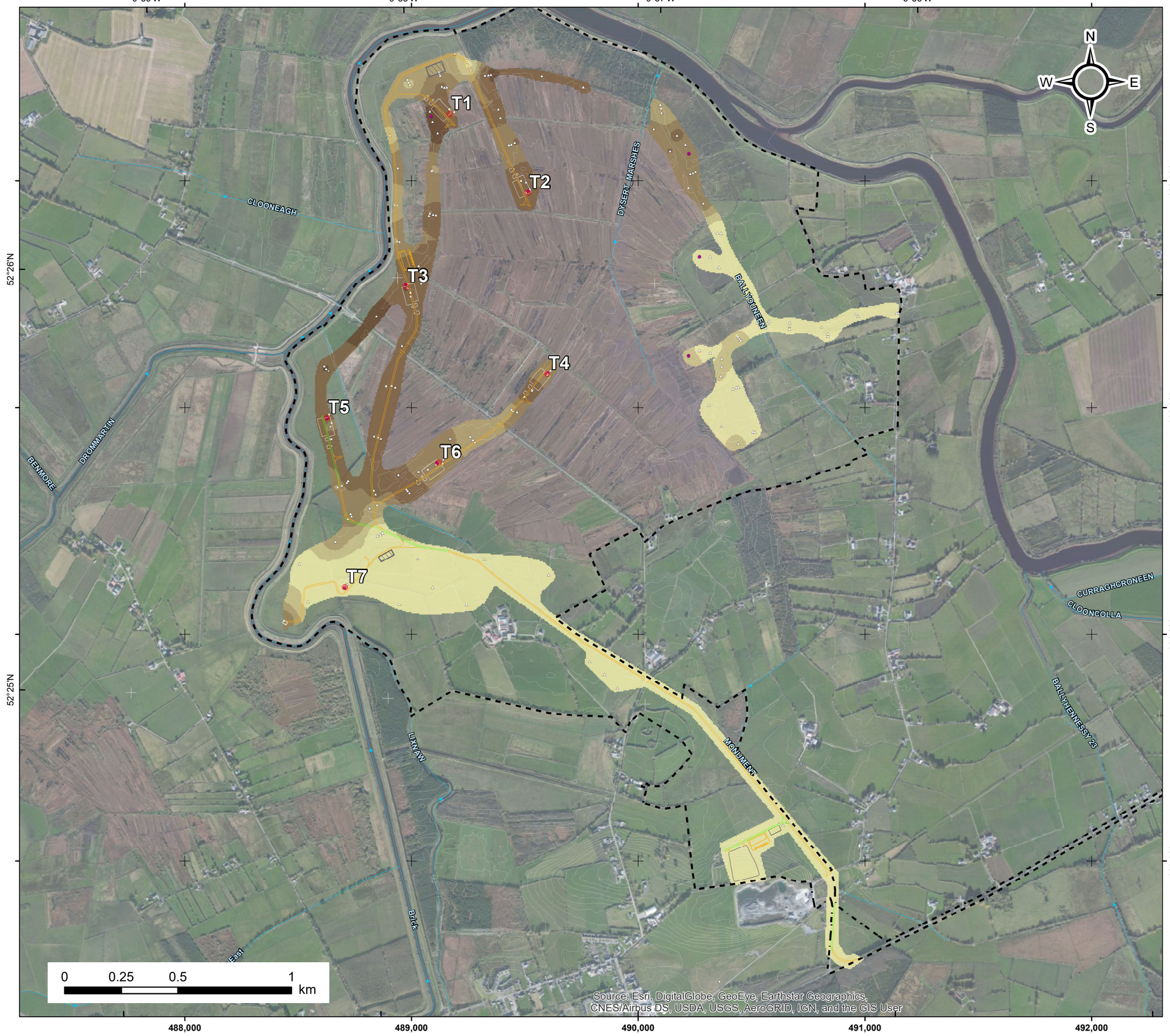
Google Maps (2021), Aerial map [online], available at: https://www.google.com/maps/@52.4355604,-7.5889807,14010m/data=!3m1!1e3 [accessed 16 June 2021].

GDG (2021a), Ground-based photos, *project no*. 20260.

GDG (2021b), GI Exe 1 & Exe 2 & PP interpolation, *project no*. 20260.

Geological Survey Ireland (2021), Geotechnical online map viewer [online], available at: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [accessed 21 June 2021]

Appendix A – Site layout and peat depth plan



Legend

WF layout (MKO,

- -Existing Road To Be Upgraded
- -Proposed Roads
- -Substation Elevation
- -Borrow Pit
- -Construction Compound
- -Crane Platform (Hardstanding)
- -Met Mast Platform
- -Soft Levelled Area
- -Substation Elevation
- -Turbine Foundation
- EIA study area (MKO,
- Proposed zone for peat storage (MKO-GDG, 2021.10.14)
- Contours 1 m (Bluesky,
- Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)
- Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6.9

- Rivers (WFD,

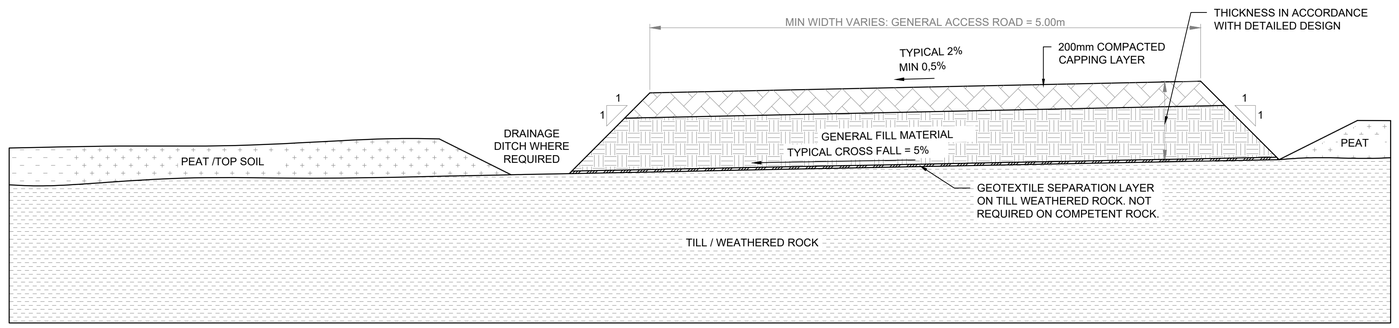
Background images: ESRI

Client: MKO	GDG Gavin & Doherty Geosolutions	
Project: Ballynagare wind farm		
Map title: Interpolated peat depth		
File: 20260 BWF - GI Exe1GDG, Exe2GDG & PP interpolation.pdf		
Sheet size: A3	CRS: 2157	Authored: EA
Date: 25/10/2021	Background: ESRI	Checked: LB

Appendix B – Road details

B.1 Road construction details

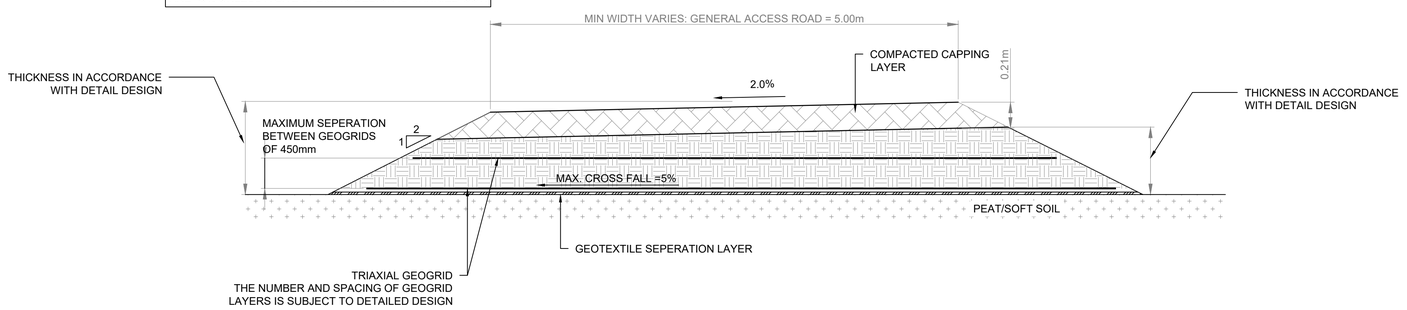
B.2 Plan of road construction types



SECTION THROUGH ACCESS ROADS NEW CONSTRUCTION-DETAIL A

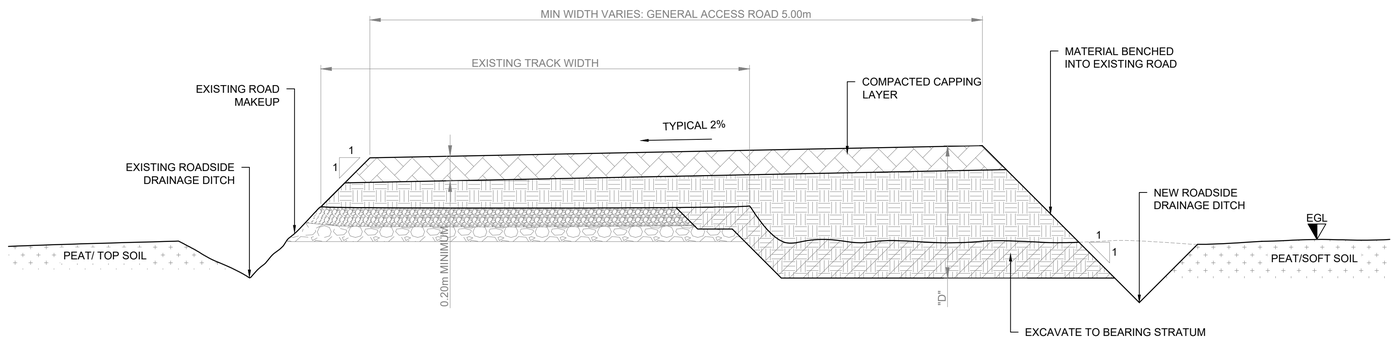
SCALE 1:25

FLOATING ROADS TO BE ONLY CONSTRUCTED WHERE CROSSFALLS ARE <5% AND LONGITUDINAL GRADIENTS ARE <5% UNLESS A SITE SPECIFIC DESIGN IS CARRIED OUT.



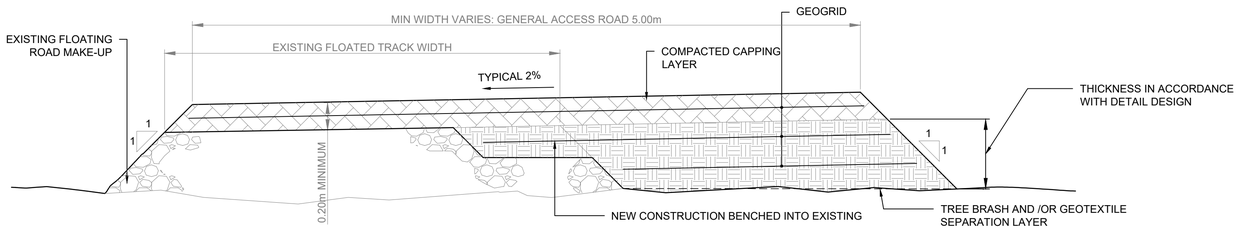
SECTION THROUGH ACCESS ROADS NEW CONSTRUCTION :FLOATING-DETAIL B

SCALE 1:25



CROSS SECTION-WIDENING OF EXISTING TRACK:FOUNDED-DETAIL C

SCALE 1:25



CROSS SECTION-WIDENING OF EXISTING TRACK:FLOATED-DETAIL D

SCALE 1:25

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED
2. USE DIMENSIONS ON DRAWINGS (DO NOT SCALE FROM DRAWINGS).
3. THE STRENGTH OF THE SUBFORMATION SOILS MUST BE ASSESSED BY A SUITABLY QUALIFIED GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF FILL.
4. DRAINAGE TO BE PROVIDED TO PREVENT WATER DEGRADATION OF THE SUBFORMATION SOILS.

HEALTH & SAFETY:

1. NO OPERATIVES TO ACCESS ANY UNSUPPORTED TRENCHES. TRENCHES TO BE ADEQUATELY BATTERED BACK OR SUPPORTED WHERE NECESSARY. SAFE TEMPORARY BATTER ANGLES TO BE ASSESSED IN ACCORDANCE WITH CIRIA REPORT 97 "TRENCHING PRACTICE".

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DRAWING No: 20260-GDG-XX-XX-DR-G-0200

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DRAWING TITLE: CROSS SECTION THROUGH GENERAL ACCESS TRACK DETAILS

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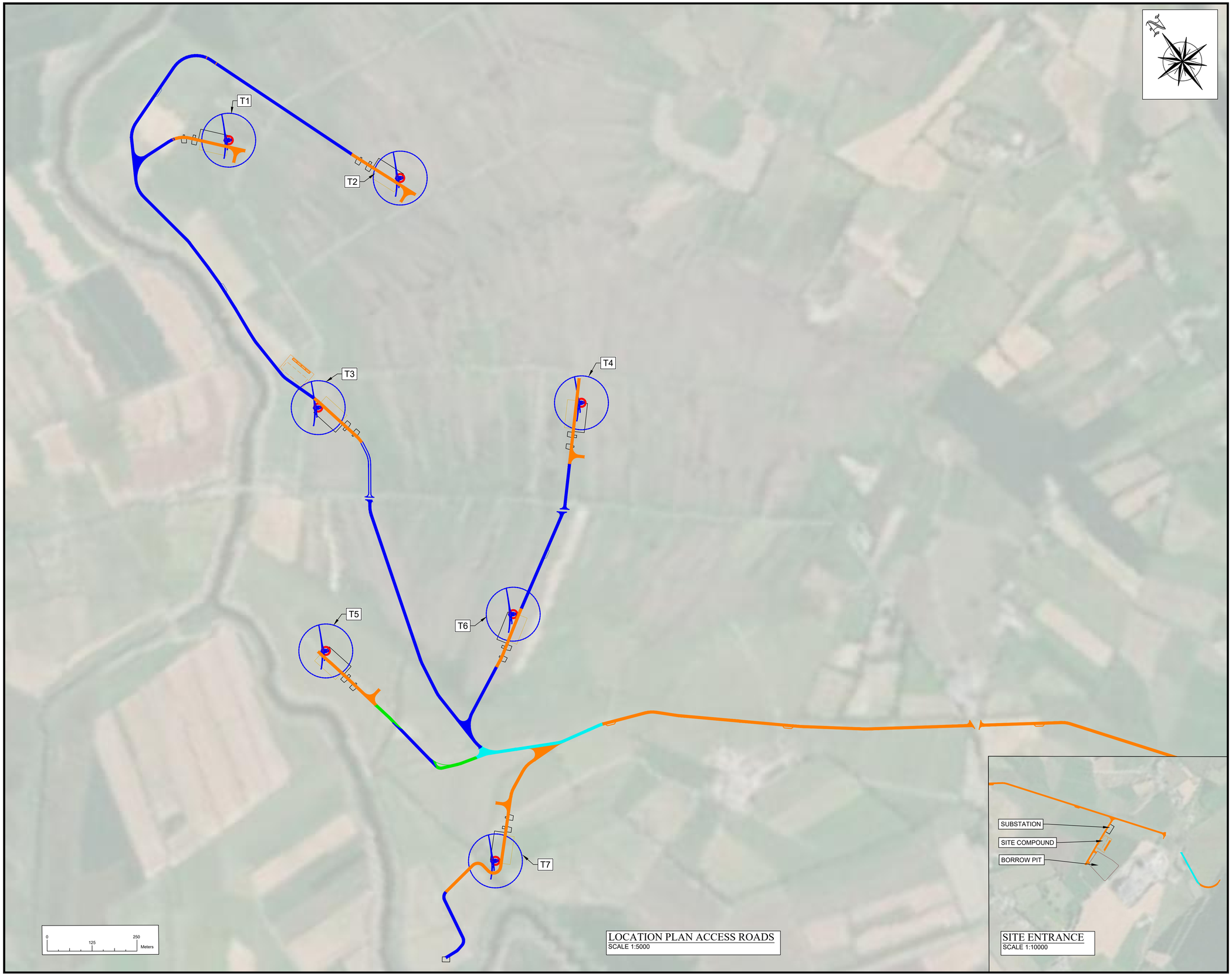

LOCATION PLAN ACCESS ROADS
SCALE 1:5000

SITE ENTRANCE
SCALE 1:10000

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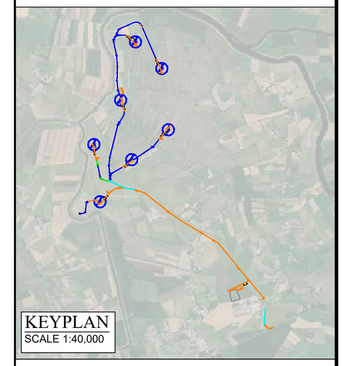

KEYPLAN
SCALE 1:40,000

LEGEND

- UPGRADE EXISTING ACCESS TRACKS (FOUNDED)
- UPGRADE EXISTING ACCESS TRACKS (FLOATED)
- NEW FOUNDED (EXCAVATE AND REPLACE)
- NEW FLOATED ACCESS ROAD

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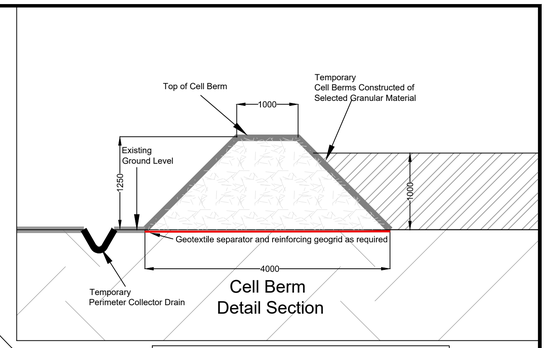
Appendix C – Borrow pit details



CELL BERM: DETAIL SECTION
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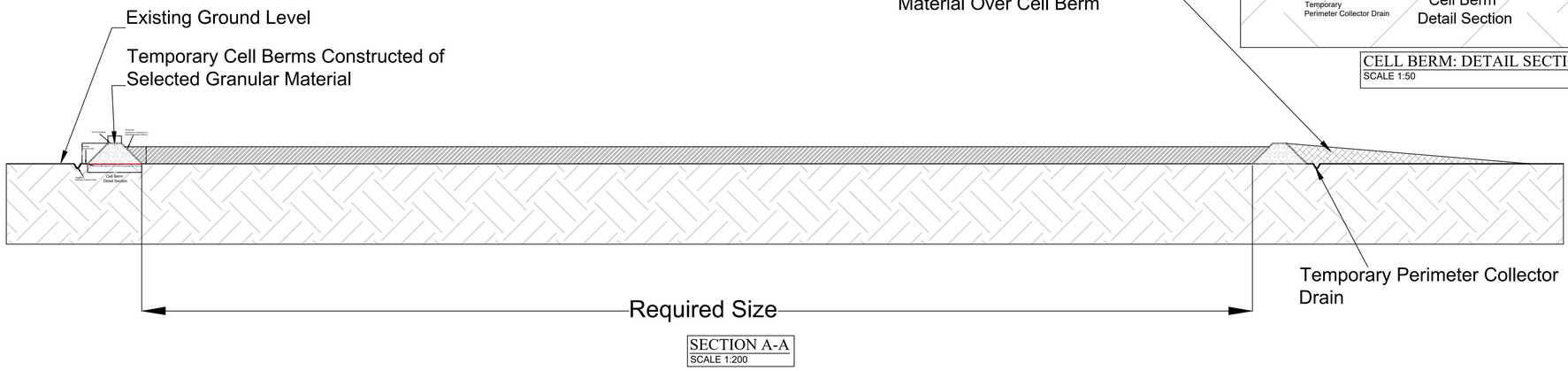
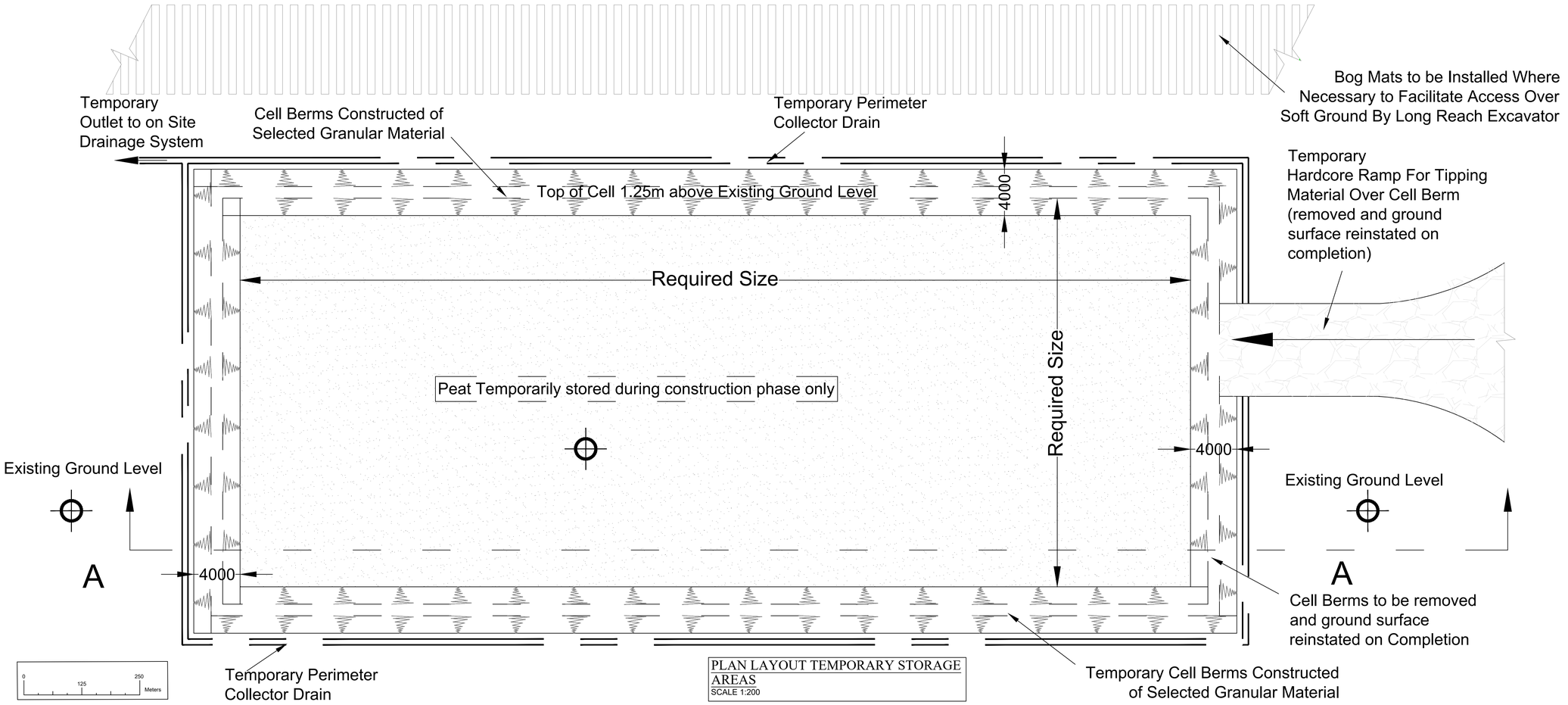


SECTION A-A
SCALE 1:200



PLAN LAYOUT TEMPORARY STORAGE AREAS
SCALE 1:200

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DRAWING TITLE: TEMPORARY PEAT STORAGE AREAS DETAILS

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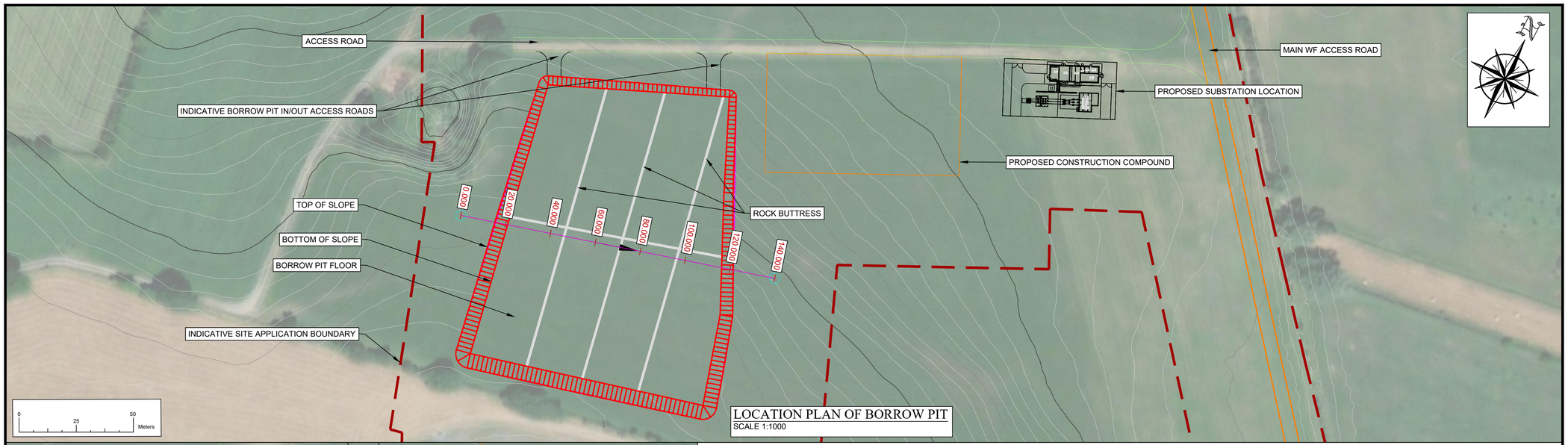
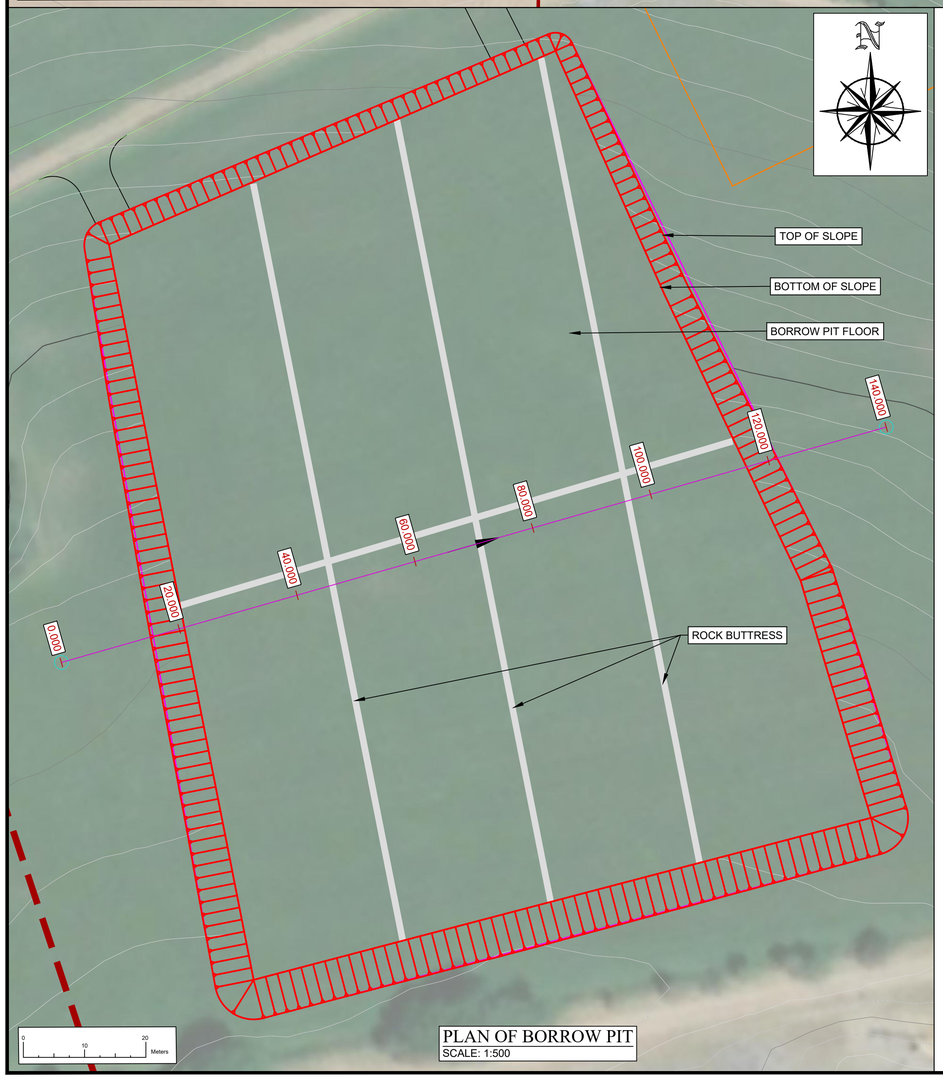
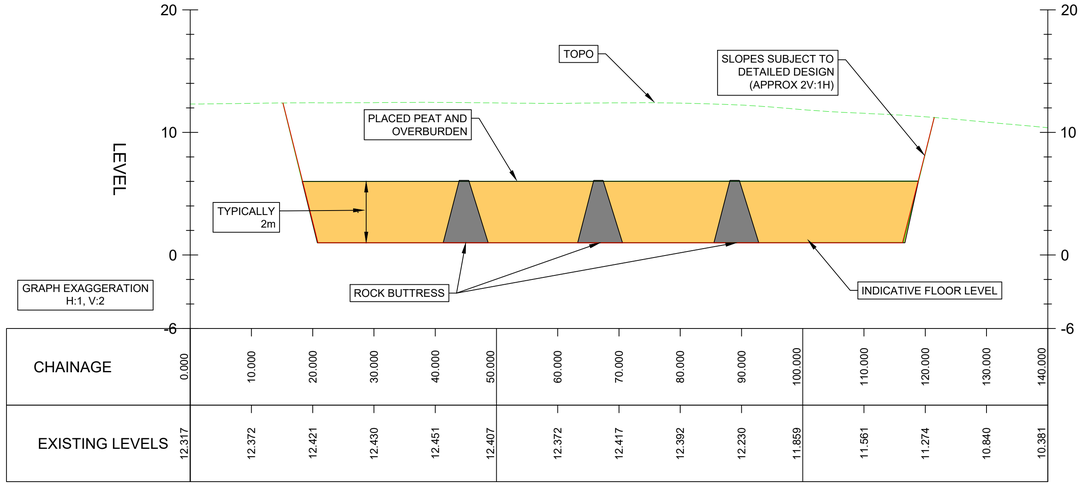
Appendix D – Temporary Peat Storage Area Details



LOCATION PLAN OF BORROW PIT
SCALE 1:1000



PLAN OF BORROW PIT
SCALE: 1:500



INDICATIVE LONG SECTION OF BORROW PIT
SCALE : 1:500

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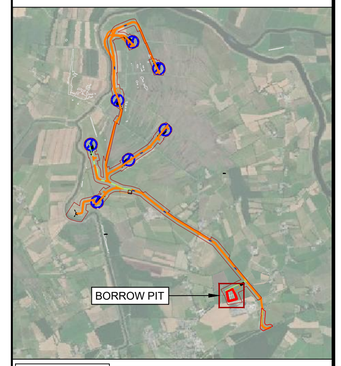
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. THE OUTLINE AND CROSS SECTIONS ARE INDICATIVE AND ARE SUBJECT TO DETAILED DESIGN AND SLOPE STABILITY ASSESSMENT.
4. EXPOSED ROCK SLOPES SHALL BE FORMED AT SHALLOWER INCLINATIONS (TYPICALLY 60°) WITH FACE LEFT IRREGULAR WITH DECLIVITIES TO PROMOTE RE-VEGETATION AND PROVIDE A NATURALISTIC APPEARANCE (SLOPE FACE EXAGGERATED IN SECTION).
5. ENGINEERED ROCK BUTTRESS MAY BE LEFT IN-SITU TO RESTRAIN CELLS OF PLACED PEAT OVERBURDEN.
6. EXCAVATION SHOULD BE OPTIMISED TO AVOID AREAS OF DEEPER PEAT.
7. IN-SITU ROCK SLOPE SHALL BE FORMED AT STABLE INCLINATIONS TO SUIT LOCAL ROCK CONDITIONS AND SUBJECT TO DETAILED DESIGN.
8. GEOGRID TO BE PLACED TO STRENGTHEN SURFACE OF PLACED PEAT & SPOIL, AS REQUIRED.
9. THE LOCATION OF THE ROCK BUTTRESSES SHOWN FOR THE BORROW AREAS ARE INDICATIVE ONLY AND MAY CHANGE SUBJECT TO LOCAL CONDITIONS ENCOUNTERED ON SITE DURING CONSTRUCTION.
10. THE EXCAVATABILITY OF THE ROCK AND DEPTH TO TOP OF ROCK WITHIN EACH OF THE BORROW AREAS WILL NEED TO BE DETERMINED FROM A GROUND INVESTIGATION.



KEYPLAN
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APPENDIX 8.2

PEAT STABILITY RISK ASSESSMENT

Peat Stability Risk Assessment (PSRA) for Ballynagare Wind Farm

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Report Title:	Peat Stability Risk Assessment (PSRA)
Document reference:	20260-R-001-01

Client:	MKO Planning & Environmental Consultants
Confidentiality:	
Essential Requirements:	This report is best viewed in colour

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Revision	**Date**	**Authored:**	**Checked:**	**Approved:**
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Executive summary

Gavin and Doherty Geosolutions (GDG) was commissioned by McCarthy Keville O'Sullivan (MKO) to undertake a Peat Stability Risk Assessment (PSRA) for the proposed Ballynagare wind farm development site. In accordance with planning guidelines compiled by the Department of the Environment, Heritage and Local Government (DoEHLG), where peat is present on a proposed wind farm development, a peat stability assessment is required.

The findings of the peat assessment showed that the site has an acceptable margin of safety and is suitable for the proposed wind farm development.

Peat depths across the site generally vary from 0.0 up to 6.9 m with peat being absent to the east and south (e.g., Turbine 7). At the other turbine locations, the peat depth ranges between 3.5 and 6 m. Some zones were not peat probed due to access problems (e.g., flooding) and peat depths are estimated through interpolation.

A desk study, a walkover including peat depth probing, shear vane testing, stability analyses and a risk assessment were carried out to assess the risks presented by peat failures. Based on the revision of the available data, the fieldwork and GDG's professional judgement, it is concluded that significant peat slides are unlikely on the site. The risks were assessed following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2017).

The stability analysis aims to determine the Factor of Safety (FoS) of the peat slopes. The FoS provides a direct measure of the degree of stability of a peat slope. A FoS of less than 1.0 indicates that a slope is unstable; a target FoS for slopes is 1.3 or greater.

A risk assessment was carried out considering the FoS value calculated in the stability analysis along with other factors that could influence the stability of peat, considering how damaging a peat slide would be to this particular site's environment.

The proposed wind farm elements (turbines, substation and construction compounds) were found to have both acceptable factors of safety and levels of risk against peat instability. Peat stability risk associated with the construction of the grid connection will also be negligible. The risk level for the proposed development is negligible and according to the guidance of the Scottish-Executive (2017), the project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate.

All earthworks shall be designed by a competent geotechnical designer which shall be informed by a detailed ground investigation. Construction works shall follow the recommendations of the peat and overburden management plan prepared for the site.

1. Introduction

1.1. Scope of work

Gavin and Doherty Geosolutions (GDG) was requested by MKO Planning & Environmental Consultants to undertake a Peat Stability Risk Assessment (PSRA) for the proposed Ballynagare Wind Farm (WF) development.

1.2. GDG experience in PSRA studies

GDG has been involved in many wind farm developments in both Ireland and the UK at various stages of development i.e., preliminary feasibility, planning, peat stability and risk assessment, design and construction. The GDG team, made up of engineering geologists, geomorphologists, geotechnical engineers, and environmental scientists, has developed expertise in landslide hazard mapping, including leading the GSI's recent landslide hazard mapping pilot study, which included extensive landslide runout and hazard mapping and calculation in Irish blanket peat.

1.3. Site location

The proposed development is located in Co. Kerry (Appendix A, Figure A-1**Error! Reference source not found.**) near to the towns of Lixnaw (2 km south) and Listowel (9.6 km east) (Figure 1-1). The WF site can be accessed from the south via the R557 regional road (Figure 1-1). The grid connection from the site to the existing Clahane 110kV substation will be constructed through the centre of public road.

The wind farm site is bounded to the west by the Brick river and the east by the Feale river (Figure H-1). There is a flood defence embankment along the Brick and Feale rivers flanks (Figure A-2).

Reference to aerial imagery (Figure 1-1, Figure A-2, Figure A-3) indicates that the proposed development is situated in an area of agricultural grassland and cutover bog.



Figure 1-1: Site location – Environmental Impact Assessment (EIA) study area in red (Google Earth, 2021)

1.4. Proposed development

The full description of the proposed development is as follows:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Construction of 7 no. wind turbines with the following maximum and minimum parameters;
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres;
- Upgrade of existing roads and access junctions;
- Provision of new site entrances, roads and hardstand areas;
- no. temporary peat storage areas;
- no. temporary construction compounds;
- 1 no. borrow pit;
- All site drainage works;

- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank;
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation;
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas;
- All ancillary site and ground works, apparatus and signage.

1.5. Overview of peat landslides

1.5.1. Peat landslide types

Two general groups of peat landslides are typically referred in the literature: peat slides and bog bursts. Some descriptions of each type are provided in Table 1-1.

Table 1-1: Peat landslide types

Characteristics	Peat slide	Bog burst
Outstanding characteristic	Shallow translational failures	Particularly fluid failures without necessarily a clear scar margin. The liquefied basal material is expelled through surface tears followed by settlement of the overlying mass.
Mechanism	Shear failure along discrete shear surfaces, typically at the peat-substrate interface	Subsurface creep, swelling
Peat depth	≤ 2 m	≥ 1.5 m
Slope angle	5 – 15º (moderate)	2 – 10º (gentle), where deeper peat is more likely

Similar erosive morphologies produced by other processes different from landslides (e.g., upwards gully erosion, downwards water runoff erosion, periglacial solifluction, biological weathering) are not considered peat failures. In Ballynagare study area, none of these landforms have been identified.

Evidence of past landslides have not been identified within the wind farm site and surroundings on the available Google Earth imagery (2010 onwards) nor during the fieldwork. This does not necessarily mean that landslides have never occurred on a site. Geomorphological features associated to peat landslides (peat slides and bog bursts) are softened with time through erosion, drying and re-vegetation (Feldmeyer-Christe & Küchler, 2002; Mills, 2003). Additionally, the human activity (e.g., grass land activity) may hamper the identification of possible landslides.

The occurrence of landslides in the Ballynagare wind farm site and grid connection route is very unlikely due to the very low slope angles at this estuary flat environment. The occurrence of landslides is further described in Section 2.8.

1.5.2. Controls of peat instability

The spatial and temporal occurrence of landslides, including peat landslides, is controlled by a combination of *conditioning* and *triggering factors*.

1.5.2.1. Conditioning factors

The conditioning factors explain the spatial distribution of landslides and are related to the inherent properties of the terrain such as curvature (convex / concave) of the slopes and drainage.

1.5.2.2. Triggering factors

The triggering factors explain the temporal distribution or frequency of landslides. They can be distinguished between fast and slow triggers:

- Fast triggers:
  - Intense rainfall (the most frequent trigger);
  - Snow melt (very frequent trigger);
  - Rapid ground accelerations (natural or man-made);
  - Peat undercut by natural processes (e.g., fluvial) or man-made; or
  - Loading the peat mass naturally (e.g., landslide mass) or man-made.
- Low-pace triggers:
  - Low intensity but constant rainfall;
  - Permafrost melting;
  - Increase in peat mass due to its formation;
  - Afforestation / Deforestation (wildfires, pollution-induced vegetation change); or
  - Weathering (physical, chemical, biological).

Low pace triggers can start landslides by themselves and can also act as *preparatory factors* for fast triggers by lowering their threshold to start landslides.

1.5.3. Pre-failures indicators

The presence of conditioning factors and low-pace triggers prior to failure are often indicated by ground conditions, features and morphologies that can be identified remotely or during the fieldwork by the geomorphologist or through basic monitoring techniques. According to the updated guidelines provided by the Scottish-Executive (2017), the following critical features are indicative of the susceptibility or propension to failure in peat environments:

- Presence of historical and recent failure scars and debris;
- Presence of features indicative of tension (e.g., cracks);
- Presence of features indicative of compression (e.g., ridges, thrusts, extrusion features);
- Evidence of peat creep (typically associated to tension and compression features);
- Presence of subsurface drainage networks or water bodies;
- Presence of seeps and springs;
- Presence of artificial drains or cuts down to substrate;
- Presence of drying and cracking features;

- Concentration of surface drainage networks;
- Presence of soft clay with organic staining at the peat and (weathered) bedrock interface; and
- Presence of iron pans or similar hardened layers in the upper part of the mineral substrate.

In this report, apart from pre-failure indicators, other evidence of peat instability not related to landslides has been considered, namely quaking peat in horizontal sectors with very low bearing capacity.

1.6. Peat Stability Risk Assessment workflow

GDG has carried out the PSRA for the Ballynagare wind farm site following the principles set out in the *Proposed electricity generation developments: peat landslide hazard best practice guide* (Scottish-Executive, 2017). This guide has been 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.

Figure 1-2Error! Reference source not found. shows a high-level workflow diagram showing the general methodology for the PSRA. The wind farm layout is optimised by following the following steps:

- Completion of the desk study in which existing data (e.g. geology, soils, topography, imagery, etc) is gathered and analysed.
- Site reconnaissance:
    - Geo-investigations especially concentrated at the sectors where the future wind farm elements (e.g., turbines) will be located;
        - Peat depths by means of peat probe testings;
        - Shear strength by means of shear vane testings;
    - Geomorphological features, including peat instability evidences;
    - Hydrologic and vegetation features; and
    - Existing assets (e.g., roads, buildings over-head lines).
- Risk assessment:
    - Interpolation of the peat probe values and generation of the peat depth map;
    - Creation of the Factor of Safety (FoS) maps using a deterministic approach (Bromhead, 1986) for drained and undrained conditions and for surcharge conditions;
    - Qualitative hazard assessment by combining the FoS with evidences of peat instability identified both on aerial imagery and during fieldwork. For this combination, all the instability factors are assigned a hazard rating between 0 and 3;
    - Qualitative consequences assessment by assigning subjective ratings values between 0 and 3;
    - Obtention of the peat landslide risk by multiplying hazard and consequences;

- Reclassification of the risk values in four classes:
  - Negligible;
  - Low;
  - Medium; and
  - Serious.

- Proposal of actions required for each wind farm element.

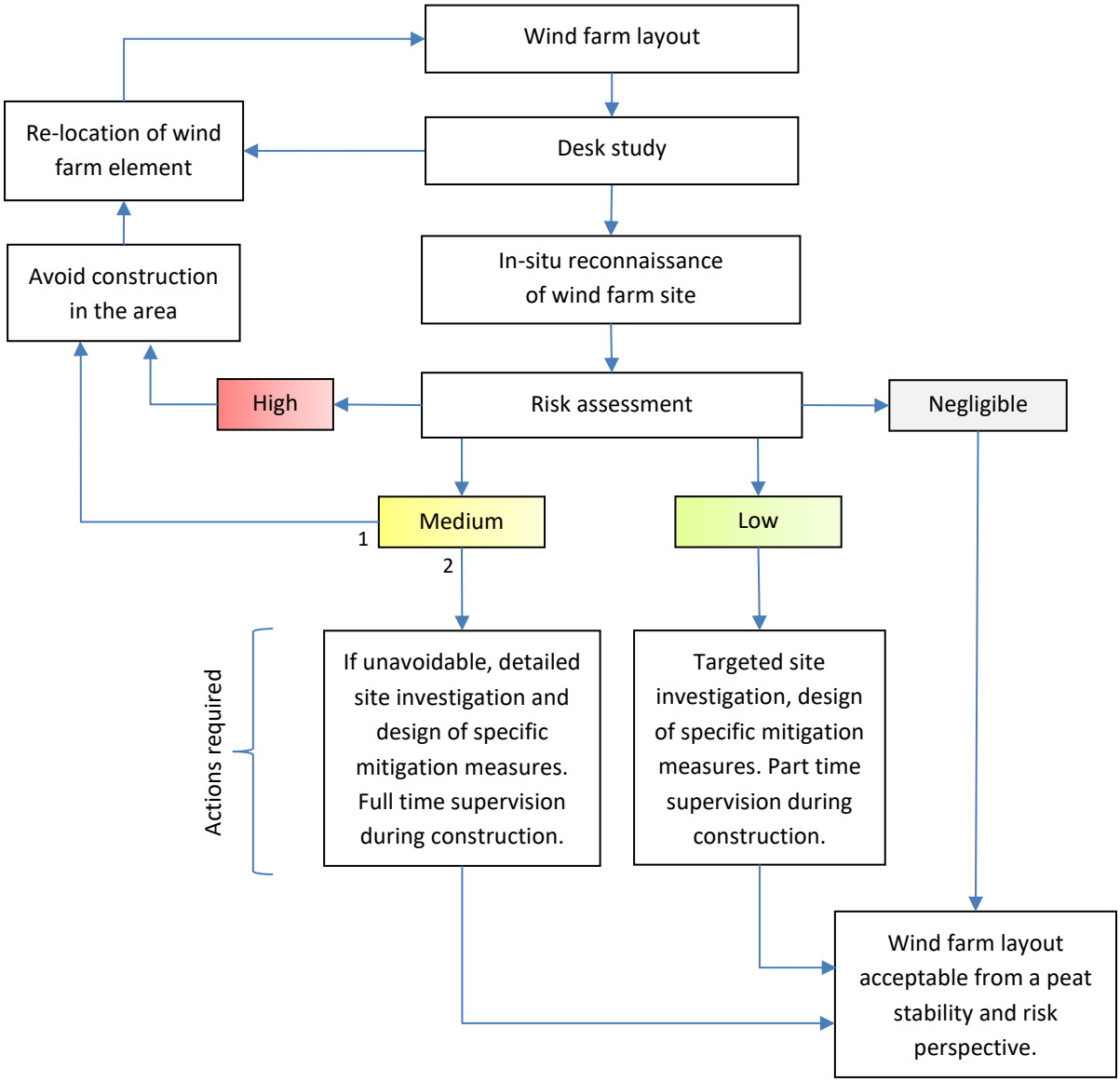

Figure 1-2: Workflow of the PSRA methodology for the acceptability of the wind farm layout

2. Desk study

For a preliminary site suitability analysis and background knowledge of local peat stability and ground conditions, the following aspects have been considered:

1. Previous ground investigations;
2. Topography;
3. Geology;
4. Soils;
5. Moisture;
6. Hydrogeology;
7. Multi-temporal aerial / satellite imagery;
8. Slope instability mapping;
9. Rivers and flooding;
10. Protected areas;
11. Land cover and land use; and
12. Relevant academic literature and publications.

2.1. Previous ground investigation

Existing publicly available ground investigations for the Ballynagare wind farm site have not been found. The Geotechnical Viewer of GSI only show available studies at Lixnaw and Ballyduff populations, located 2 and 3.7 km away from the wind farm site, respectively.

2.2. Topography

According to the digital elevation model (DEM) (Figure B-1) derived from the aerial survey carried out by BlueSky on April 2021 (provided by the client), the site topography can be described as almost horizontal for the turbine locations and undulated southwards.

Regarding the elevations:

- There are some sectors across the wind farm site with negative elevation (up to -0.95 m).
- The proposed sites for the wind turbines, crane hardstands, met mast, peat deposition areas and northern construction compound are located between 0 and 2 masl.
- The substation site is at 3.5 masl.
- The proposed southern construction compound and the borrow pit are located over 5 masl.
- Some portions of the flood defence embankments along the estuary flanks exhibit a height of 3 masl.

Regarding the slope angle (Figure B-2):

- All the proposed wind farm elements are designed on terrains with slope angle lower than 5°.

The proposed access road between the road joint and the turbines area is parallel to an existing water course (the Monument river). The southern flank of this small river exhibits slope angles of up to 20-30° at some points. However, there is no peat on this area.

2.3. Geology

According to the GSI bedrock geological map of Ireland at 1:100,000 scale (Figure C-1), the bedrock under the wind farm site is dark muddy limestone and shale from the Ballysteen Formation as well as massive unbedded lime-mudstone from the Waulsortian Formation. In the substation and borrow pit area, the bedrock is made of undifferentiated limestone from the Visean Formation. Despite the presence of underlying limestones in this marsh area of Kerry County, karst features have not been identified.

The GSI map of Quaternary sediments at 1:500,000 scale (Figure C-2) shows that the superficial materials across the wind farm site are cut over raised peat , alluvium and till derived from sandstones and shales. This till is very shallow at the borrow pit zone (southeast of the study area) where the limestone bedrock is almost outcropping.

2.4. Soils

The Irish soil map at 1:250,000 scale from Teagsac and EPA (2014) (Figure D-1) depicts that most of the wind farm site is covered by peat (soil associations “1xx”) and river alluvium (soil association 05RIV). The soil in the area of the borrow pit, southern compound and substation consists of coarse loamy drift with siliceous stones (soil associations 1100n).

Despite these regional scale maps of Figure C-2 (500k) and Figure D-1 (250k) indicate similar spatial distribution of peat (the latter showing slightly larger extent of peat), the presence or absence of peat cover indicated by these maps must not be taken as definitive statements. The depth and extent of peat deposits may vary sharply over short distances as a function of local underlying geology, past and ongoing geomorphological activity and management history. Therefore, these maps have been complemented by a site reconnaissance survey, in which peat spatial distribution and depth have been mapped by means of peat probes and field observations. The site reconnaissance and the results of the peat probe campaign are described in Section 3.

2.5. Moisture

Water reaching a slope can produce the following processes:

- Lubrication. It reduces the friction along discontinuities (joints or stratification) in rock or soil (Wu, 2003). In clay soils, lubrication is due to the presence of water that produces a repulsion or separation between the clay particles.
- Softening. It mainly affects to the physical properties of filler materials in fractures and fault planes in rocks.

- Pore pressure. Water in soil pores exerts pressures on soil particles, changing the effective pressure and the shear strength. The negative impact of pore pressure changes is particularly evident in partially saturated or unsaturated soils, where the increase in moisture content causes development of a wetting front that converts beneficial negative suction stresses within the capillary structure of the soil to a fully saturated positive pore pressure. When a soil is saturated, capillary stress and thus, adhesion between particles, diminishes and as a result, soil shear strength decreases.
- Subpressions. The confined underground water acts as a sub-pressure on the impermeable layers, decreasing the shear strength and producing hydrostatic pressures on the layers where permeability changes. These lifting stresses can cause material deformation or failure, and pore pressure decreases soil resistance.
- Fatigue failure due to fluctuations of the water table. Some landslides occur in episodes of rain with lower intensity than previous ones. This phenomenon is explained by Santos et al. (1997) as a case of soil fatigue due to the cyclical pore pressures. In temperate climates, seasonal variations in temperature can lead to slight variations in the water table. These changes are much more significant in tropical climates (Xue & Gavin, 2008).
- Washing away of cement material. The groundwater flow can remove the soluble cement (e.g., calcium carbonate) from the soil and thus, decreases the cohesion and the friction angle. This process is usually progressive.
- Density increase. The presence of water in soil pores increases the bulk density and weight of the materials in the slope. Therefore, shear stress increases and the slope safety factor decreases.
- Internal hydraulic forces. The movement of groundwater currents creates hydrodynamic pressure on the ground in the direction of flow. This force acts as a destabilising element on the ground mass and can appreciably decrease the safety factor of the slope. The hydrodynamic or seepage/flow force can also cause the movement of the particles and the destruction of the soil mass (piping).
- Collapse. Collapsible soils (alluvial soils deposited very rapidly and wind soils or loess) are very sensitive to changes in humidity. When water content increases, their volume decreases and microstructure collapses.
- Desiccation cracks. Changes in humidity can cause cracking, and these cracks can determine the extension and location of the surface of failure and have a very important effect on the safety factor or possibility of sliding.
- Piping in clays. Some clayey soils disperse and lose their cohesion when saturated. The result can be the total collapse of the soil structure and the activation of landslides.
- Chemical weathering: Processes of ion exchange, dissolution, hydration, hydrolysis, corrosion, oxidation, reduction and precipitation (Wu, 2003).
- Erosion. The detachment, dragging and deposition of soil particles by water flows, modifies the relief, the stresses on slopes, and can produce the activation of a landslide, especially when erosion undercuts slopes.

The *Normalized Difference Moisture Index Colorized* GIS service or the USGS has been used to estimate levels of moisture in the soil across the wind farm site. This service is based on the analysis of multispectral Landsat 8[1] OLI images. Using on-the-fly processing, the raw digital number (DN) values for each Landsat band are transformed to scaled (0 - 10000) apparent reflectance values and then, the Normalised Difference Moisture Index is obtained by means of Equation 2-1 (Gao, 1996):

$$NDMI = (Band\ 5^{2} - Band\ 6^{3}) / (Band\ 5 + Band\ 6) \qquad \textbf{Equation 2-1}$$

Figure E-1 illustrates the levels of estimated soil moisture across the wind farm site and grid connection route. Grassland and other vegetated areas with high levels of moisture appear as dark blue (e.g., in T5, T7, met mast, joint road) and drier sectors are represented in yellow to brown.

It is noted that RADAR images also provide estimates of terrain moisture. However, these have not been used in this report due to their high cost and the time frame or this project.

2.6. Hydrogeology

Regarding the hydrogeology, according to the GSI permeability map, the wind farm site is located in terrains of low and medium permeability (Figure F-1). In the latter, there are six wells in the vicinity of the wind farm site: 3 at the northeast and 3 in the south. At a shallow depth, the soil water content must be high across the whole site (even in the low permeability zones) because:

- The topography is almost horizontal, and this favours the infiltration; and
- As described in Section 2.2, most of the site is almost at the sea level, hence, the water table must be very shallow.

2.7. Multitemporal aerial/satellite imagery

Multitemporal satellite imagery brought by Google into Google Earth (1985 onwards) and recent images brought by ESRI into GIS software have been used on this report to:

- Try to identify the presence of existing failure scars and the extent of debris runout;
- Identify pre-conditioning factors for failure (where visible at the resolution of the imagery);
- Identify evidence of other pre-development ground conditions of relevance to ground works but not exclusively associated with landslides, including vegetation cover, drainage regime and dominant drainage pathways; and

[1] Landsat 8 includes 8-band multispectral scenes at 30-meter resolution which are typically used for mapping and change detection of agriculture, soils, moisture, vegetation health, water-land features and boundary studies.
[2] Near Infrared (NIR)
[3] Short Wave Infrared 1 (SWIR1)

- Identify evidence for land management practices with the potential to influence ground conditions (e.g., burning, artificial drainage, peat cutting, forestry). Figure 2-1 illustrates the little evolution of the harvested peat extent from 1985 to 2021 in the main sector of the wind farm site.

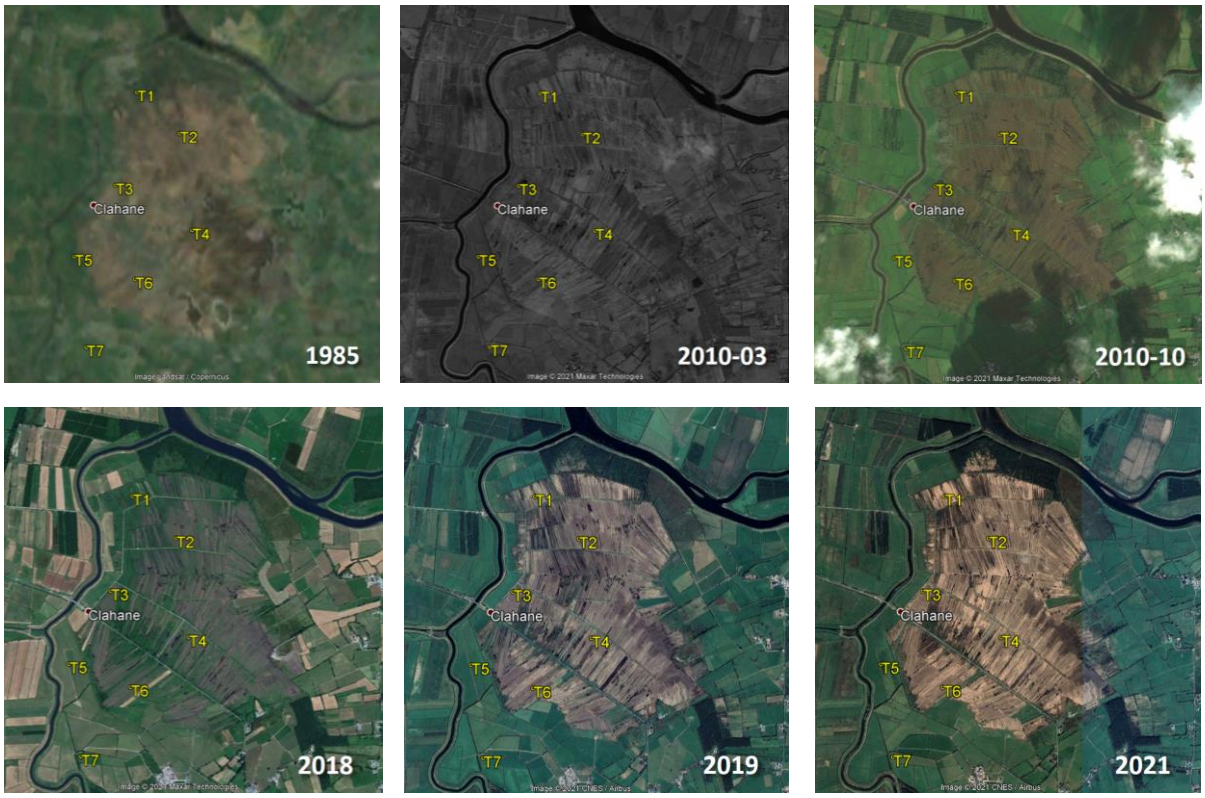

Figure 2-1: Peat cuts and harvesting in the main sector of the wind farm site

It is noted that the time lapse of the available imagery is too short as to identify old peat instability evidence that may have been eroded or re-vegetated with time or changes in the land management.

2.8. Slope instability mapping

The landslide inventory (GSI, 2016a, 2018b), the landslide susceptibility map (GSI, 2016b), the rainfall information of Met Eireann, the multi-temporal satellite imagery and the recent Blue Sky Top DEM have been used for this part of the desk study.

2.8.1. Landslide inventory

The project team has not identified any landslides during the desk study and fieldwork. Figure G-1 depicts the spatial relationship between the spatial distribution of landslides (GSI, 2016a, 2018b) and the spatial distribution of rainfall across Ireland (Met Eireann). The closest landslides according to the GSI inventory are located more than 10 km south. This is a preliminary favourable indicator of the site suitability.

2.8.2. Landslide susceptibility

The GSI landslide susceptibility map (Figure G-2) indicates that the susceptibility level is low across the wind farm site and southeast development zone. It should be noted that this map was obtained by using an empiric probabilistic method at national scale. This type of methods is not valid to provide input into site-specific scale engineering studies.

2.9. Rivers and flooding

The site is located almost at sea level, therefore, the erosive potential of the fluvial network must be low. As for the Ordnance Survey Ireland (OSi) shapefiles of rivers and lakes (Figure H-1), all the proposed wind farm elements are located more than 50 m away from the existing water courses. Only some stretches of the proposed access roads intersect or parallel the nearby 'Monument' river.

According to the National Catchment Flood Risk Assessment and Management (CFRAM) Programme, coastal flooding for a high-end future scenario (Figure H-2) would overtop the existing embankment flood defences and affect the southwest of the wind farm site. Namely, T5, T7, Met mast, the southern zone for peat storage and their corresponding access roads.

2.10. Protected areas

For the assessment of landslide consequences, the following datasets of protected areas have been considered:

- UNESCO sites
- Bio/Natura 2000 Dyna WM
- RAMSAR
- Designated areas from EMODnet (2020)
- Onshore and offshore Special Areas of Conservation (SAC) from DHLGH (2021)
- Special Protection Areas (SPA) from DHLGH (2019)
- Natural heritage areas (NHA) from DHLGH (2019); and
- Proposed natural heritage areas (pNHA) from DHLGH (2019)

Figure I-1 illustrate that the wind farm development and the grid connection route do not intersect any of the nearby protected area, namely a pNHA called "Cashen River Estuary", a SAC called "Lower River Shannon SAG" and a SPA called "Stack's to Mullaghareirk – West Limerick Hills and Mount Eagle".

2.11. Land cover and land use

According to the Corine Land cover map (Figure J-1), the wind farm site and the associated southeast development comprise peat bog, pastures and carboniferous forest. As shown in Figure 2-1, there is a vast zone of peat exploitation.

According to the EPA datasets of mining facilities and mine registers, there is an extractive facility at the WF access road junction area where the soil is shallow and the limestone almost outcrops (Figure

J-2). It is stressed that the proposed borrow pit is juxtaposed to the north limit of this quarry. Additionally, there is another extractive facility at the southern end of the grid connection route.

2.12. Relevant academic literature and publications

The relevant academic literature, reports, publications and maps used for this report are cited across this document and listed in the References section.

3. Site reconnaissance

As part of the assessment of potential peat instability at the wind farm site, the project team carried out a site reconnaissance. This comprised two walk-over inspections (2020/11/24-26 and 2021/03/09-10) with recording of geomorphological features with respect to the wind farm development and to provide peat thickness (peat probes) and preliminary assessment of peat strength.

3.1. General accessibility

The site is assessable from the local Ballynagare to Clahane road which dissects the site. The areas of the site on the peat bog area are accessible by various access tracks (Figure 3-1) and small pedestrian drain-crossing points. The agricultural areas to the south of the site were accessible by access tracks from the farmyard. The areas of cut peat bog are divided by deep wide drains (Figure 3-2), blocking access to some sections of the bog and navigating the breaks and bridges in these drains can make progress slow. Much of the northern and western areas of the site are subject to spot flooding (Figure 3-3) and flooding from the adjacent River Brick. During one of the site visits, in November 2020, several of the access tracks and proposed turbine locations were flooded with up to 0.5m of water, impeding access. An area of dense forest at the north of the site (Figure 3-4) was very difficult to access, the fire break which is present was flooded during the site visits and is composed of felled trees making walking down this impossible. The northern extent of the site is accessible by walking along the top of the embankment on the River Brick.



Figure 3-1: Access bog at the peat bog areas of the site



Figure 3-2: Flooded access track at the T1 and T2 locations

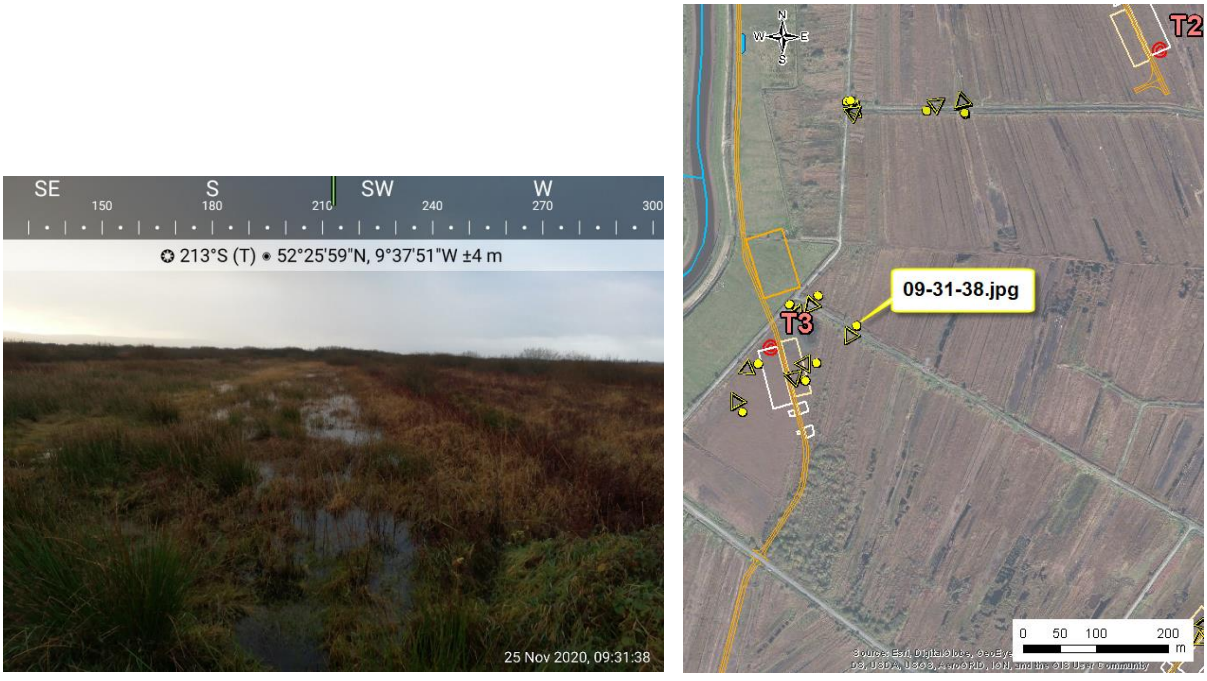

Figure 3-3: Spot flooding in peat bog areas of the site



Figure 3-4: Dense forestry at the north of the site

3.2. Peat geo-investigation

The peat ground-investigation (GI) was carried out in the following stages:

- 2020/11/24-26: A total of 108 probes and 8 shear vane tests were carried out by GDG;
- 2021/03/09-10: A total of 59 probes and 3 shear vane testes were executed by GDG; and
- Provided to GDG in 2021/07/01 by MKO: A total of 17 additional peat probes.

The spatial distribution of these ground-investigations (Figure K-1) followed these criteria:

- Spatial distribution of the wind farm elements: Peat probes and shear vane tests were carried out at/near to the proposed locations for the turbines, crane hardstands, met mast, substation, borrow pit, peat deposition, construction compounds and along access roads, in such a way to avoid later extrapolations beyond the area covered by real data;
- Distance between probe points: This is to avoid later over-interpolations across large distances between points;
- Changes in slope angle, as peat depths are likely to be shallower on steeper slopes;
- Changes in vegetation, as the physical characteristics of peat vary according to their hydrological setting, usually reflected in surface vegetation;
- Changes in hydrology conditions;
- Changes in land management as these disturb the peat (e.g., burnt areas, draining, cutting, etc); and

- Accessibility: Particular attention was paid to the safety of personnel carrying out the geo-investigation. In certain cases, some planned peat probe locations could not be reached for safety reasons and alternative peat probes were carried out in a close representative zone.

GDG applied an Inverse Distance Weighted (IDW)[4] interpolation method to the discrete peat depth values in order to create a continuous surface of the peat depth across the extent of the peat probe survey. This interpolated surface of peat depth has been saved in a raster format (.tif) and is represented in Figure K-1.

It is noted that the distance between peat probe points is sometimes larger than 100 m. A priori, this may be seen as a limitation. However, the geographical context, the spatial distribution of the measured values of peat depth and the analysis of satellite imagery suggest that the variability of peat depths across the site is smooth and thus, the interpolated values at distances larger than 100 m may be considered as plausible.

3.3. Results of the site reconnaissance

The site reconnaissance was used to update and optimise the original wind farm layout that was based on existing and publicly available regional scale data from official institutions (e.g., GSI, OSi, EPA).

Evidence of landslides were not identified during the site reconnaissance. It is recalled that no landslides were identified during the desk study either. Table K-1 through

Table **K-14** provide details on the site reconnaissance of the proposed zones for the turbines, crane hardstands, met mast, substation, borrow pit, temporary construction compound and peat storage areas.

[4] Among the variety of interpolation methods in GIS, IDW is, despite its simplicity, one of the most frequently interpolation methods used in many geo-science disciplines.

4. Peat stability assessment (FoS)

As described in the introduction, the peat stability assessment is one of the inputs required for the subsequent peat hazard assessment and risk calculation. This section presents:

- A review of the general approaches to assess peat stability;
- The concept of Factor of Safety;
- The methodology and parameters adopted for this report;
- The FoS results; and
- Safety buffers and side cast restrictions.

4.1. Main approaches to assess peat stability

The main approaches for assessing peat stability for wind farm developments include the following:

1. Qualitative geomorphological judgement; and
2. Quantitative assessment:
    a. Empirical probabilistic approach.
    b. Physically-based deterministic approach (Factor of Safety - FoS).

Approach 1) is subjective and thus not adopted for this study. Approach 2a) is objective and quantitative, but it is more appropriate for land planning and decisions making studies at regional scale. Additionally, it does not provide engineering indication of physical stability as approach 2b) does. In this report, the peat stability assessment is carried out by using a deterministic (FoS) approach (Bromhead, 1986).

4.2. Factor of Safety (FoS) concept

The factor of safety is a measure of the stability of a particular slope. For any slope, the degree of stability depends on the balance between the landslide driving forces (weight of the slope) and its inherent shear strength (Figure 4-1).

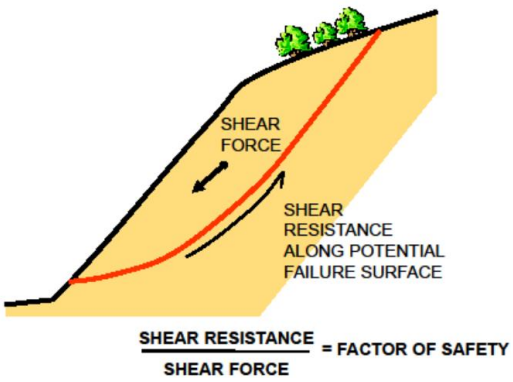

Figure 4-1: Balance of forces in a slope

Note: Taken from Scottish Executive (2017).

Therefore, the factor of safety provides a direct measure of the degree of stability of a slope by the ratio of the shear resistance along a potential surface of failure and the landslide driving forces acting on such surface. Multiple potential surfaces of failure are possible, but the FoS assigned to a slope is that of the surface of failure with the lowest value of FoS.

- FoS < 1 indicates a slope is unstable and prone to fail.
- FoS = 1 indicates a slope is theoretically stable, but not robust/safe.
- The acceptable safe range for FoS typically ranges from 1.3 to 1.4. The previous code of practice for earthworks BS 6031:1981 (BSI, 1981), provided advice on design of earthworks slopes. It stated that for a first-time failure with a good standard of site investigation the design FoS should be greater than 1.3. This way the slope is stable and safe.

As a general guide, the FoS limits for peat slopes assumed in this report are summarised in

Table 4-1: Factor of Safety limits assumed in this report.

Factor of Safety limits	Slope stability
FoS < 1	Unstable
1 ≤ FoS <1.3	Stable but not safe
FoS ≥ 1.3	Stable and safe

The spatial distribution of the FoS values discriminate between areas of stable and unstable peat, and areas of marginal stability where restrictions may apply. This allows for the identification of the most suitable locations for turbines, access roads and infrastructure.

4.3. Methodology adopted and parameters

Stability of a peat slope is dependent on several factors working in combination, namely the slope angle, the shear strength of peat, the depth of peat, the pore water pressure and the loading conditions. An adverse combination of these factors could potentially result in peat failure. It should be stressed that an adverse value of one of the above-mentioned factors alone is unlikely to result in peat failure. The infinite slope model (Skempton & DeLory, 1957) is used to combine these factors to determine a factor of safety for peat sliding in the study area. This model is based on a translational slide, which is a reasonable representation of the dominant mode of movement for peat failures.

To determine the stability of the peat slopes in the study area, an undrained (short-term stability during construction) and a drained (long-term stability during operation) analyses have been carried out.

The proposed grid connection route will require the excavation of a narrow shallow trench along public roads into which the cables will be installed. While a portion of the public road traverses a flat peatland area located in between the R557 and the N69 roads (Figure 4-2), the shallow trench will only encounter engineering fill that makes up the road embankment. Peat stability risk associated with the construction of the grid connection will be negligible and a quantitative analysis is not deemed to necessary.

4.3.1. Undrained conditions

The undrained loading condition applies in the short-term during construction and until construction induced pore water pressures dissipate.

Undrained shear strength values (c_u) for peat are used for the total stress analysis. Based on the findings of the Derrybrien failure, undrained loading during construction was found to be the critical failure mechanism.

The average shear strength value obtained by GDG by using the hand shear vane tests in the wind farm site is 60.7 kPa, being the lowest registered value 8 kPa. This lowest and conservative value has been adopted for the undrained calculation.

The formula used to determine the factor of safety for the undrained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c_u}{\gamma z sin\alpha cos\alpha} \qquad \textbf{Equation 4-1}$$

Where:

F = Factor of Safety;
c_u = Undrained strength (8 kPa in the study area);
γ = Bulk unit weight of material (assumed 10 kN/m^3);
z = Depth to failure plane assumed as depth of peat (this is the interpolated raster of peat depth); and
α = Slope angle (in each pixel of 5 m. This is obtained from the 1-m contour lines provided to GDG by the client and carried out by Blue Sky Top).

4.3.2. Drained conditions

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.

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 undertaken. Table 4-2 summarises published effective mechanical parameters of peat. According to this table, the values for c' range from 1.1 to 10 kPa and ø' ranges from 21.6 to 43°. The average values of c' and ø' are 5 kPa and 30°, respectively. Based on this, it was considered to adopt a conservative approach and to use design values below the averages, namely c' = 4 kPa and ø' = 25º.

The formula used to determine the factor of safety for the drained condition in the peat (Bromhead, 1986) is as follows:

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2 \alpha \tan \phi'}{\gamma z \sin \alpha \cos \alpha}$$ **Equation 4-2**

Where,

F = Factor of Safety;

c' = Effective cohesion (4 kPa);

γ = Bulk unit weight of material (10 kN/m^3);

z = Depth to failure plane assumed as depth of peat (this is the interpolated peat depth);

γ_w = Unit weight of water (9.81 kN/m^3);

h_w = Height of water table above failure plane (= z. Terrain completely saturated);

α = Slope angle (in each pixel. This is obtained from the 1-m contour lines provided by the client); and

ϕ' = Effective friction angle (25º).

Table 4-2: Effective cohesion and friction angle values from literature

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 13kPa
	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)

4.3.3. Assumptions summary

The following general assumptions were adopted in this analysis of peat slopes stability:

1. Peat depths are based on the maximum peat depth recorded in each probe from the walkover surveys.
2. The slope angles derived from the 1-m contour lines provided by the client are considered approximate, as such surveys are dependent on the density of survey data and do not always reflect minor variations in ground topography.
3. The surface of failure is ass assumed to be parallel to the ground surface.

4. A conservative value of the undrained shear strength (c_u = 8 kPa) in the wind farm site was adopted for the assessment. We use the term "conservative" because the peat exhibits a significant higher undrained shear strength in the rest of the study area, being the average 60.7 kPa.
5. The peat stability is calculated in pixels of 5 m across the fringe containing information of peat depth and the proposed wind farm elements.
6. Two scenarios are considered for the stability analysis:
   - No surcharging load; and
   - Surcharging load of 10 kPa, equivalent to 1 m of stockpiled peat assumed as a worst case. As it was explained before, an adverse value of one stability factor alone does not necessarily means a reduction of the slope FoS across the whole study area.

4.4. FoS results

The factors of safety (FoS) obtained at the wind farm site for the two different conditions (undrained and drained) and for the two different scenarios (no surcharge and 1-m of peat surcharge) are presented in Appendix L both in geographic or map format and in table format.

The two tables (one for undrained conditions and one for drained conditions) have been reduced to a limited number of rows due to a matter of size. The fringe analysed contains more than 40,500 pixels of 5 m and therefore, the complete tables contain more than 40,500 rows. One complete table only would require around 810 pages (assuming 50 rows per page). To avoid this, a reduced version of the undrained table (Table 6-1) and drained table (Table 6-2) are presented in Appendix L, containing only the rows corresponding to the pixels in which the turbines are located and the central pixels of the sites for the substations and construction compound.

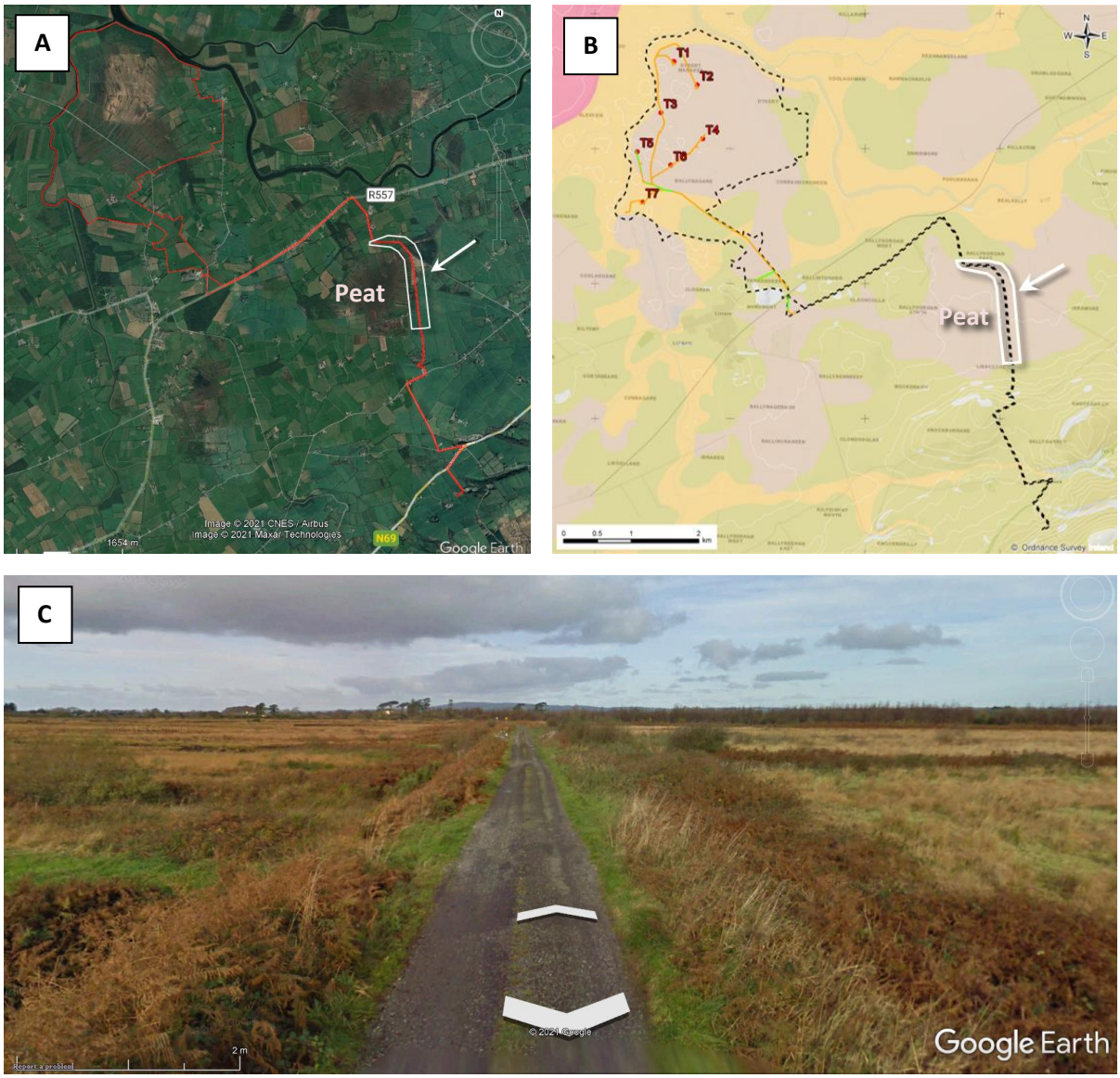

Figure 4-2: Horizontal peatland and the unpaved road that will accommodate the trench for the grid connection route. A: Google Earth satellite image. B: Quaternary sediments (GSI). C: Google Street View.

4.4.1. FoS for undrained conditions

Figure L-1 shows the spatial distribution of the FoS for undrained conditions and no surcharge. All the pixels exhibit a FoS > 1.3 (green).

4.4.2. FoS for undrained condition and peat stock surcharge of 10 kPa

Figure L-2 depicts the spatial distribution of the FoS for undrained conditions and with 1-m peat stock surcharge. Almost all the studied fringe is stable and safe (FoS > 1.3, green). There are two pixels located between T6 and T7 with FoS values between 1 and 1.3. These represent a small (<1m) escarpment of excavated peat or drains cut into peat and do not pose any landslide hazard.

4.4.3. FoS for drained conditions

Figure L-3 illustrates the spatial distribution of the FoS for long term drained conditions with no surcharge. Almost all the studied fringe is stable and safe (FoS > 1.3, green). There are eight minor zones containing pixels with FoS between 1 and 1.3 (yellow: stable but not safe) and even FoS <1 (red: not stable). These pixels are typically parallel small escarpments of excavated peat and drainage trenches within the peat and do not pose any landslide hazard.

4.4.4. FoS for drained condition and peat stock surcharge of 10 kPa

Figure L-4 shows the spatial distribution of the FoS for long term drained conditions and with 1-m peat stock surcharge. Almost all the studied fringe is stable and safe (FoS > 1). Again, the two pixels located along the escarpment of a peat trench/drainage located between T6 and T7 show a FoS between 1 and 1.3 but these do not pose any landslide hazard.

No safety buffers or peat side cast restriction areas are proposed.

5. Peat Stability Risk Assessment (PSRA)

5.1. Risk definition

Risk is the potential or probability of adverse consequences, including economic losses, environmental or social harm or detriment. Risk is expressed as the product of a hazard (e.g. peat landslide) and its adverse consequences (Lee & Jones, 2004; Corominas et al., 2014) (Equation 5-1). Some use approximate synomims and refer to risk as the product of the likelihood and the impact, or the product of susceptibility and the exposure.

$$\text{Risk} = (\text{Hazard}) \times (\text{Adverse Consequences}) \qquad \textbf{Equation 5-1}$$

5.2. General methods for risk assessment

There are various levels of risk assessment, ranging between:

- Detailed quantitative risk assessments (QRA) where the objective is to generate more precise measures of the risks (e.g., expressing risk as a specific probability of loss). These require a large amount of quantitative input and time; and
- High-level qualitative assessments where the objective is to develop an approximate estimate of the risks, particularly in relative terms (e.g., low, medium and high levels of risk).

Qualitative risk assessments are typically used for PSRA reports, given the availability of information and the time frame. In order to apply Equation 5-1, the quantitative (e.g., FoS) and the qualitative information (e.g., presence of peat cuts) that determine the hazard and the consequences need to be transformed into subjective rating values. The following sections address the obtention of the two risk components: hazard and consequences.

The proposed grid connection route will require the excavation of a narrow shallow trench along public roads into which the cables will be installed. Peat stability risk associated with the construction of the grid connection will be negligible and a detailed risk calculation is not required.

5.3. Hazard assessment

Landslide hazard is the likelihood or probability of landslide occurrence in a given site and in a given time period. For wind farms, a time period of 25 years can be chosen as this is their typical design life.

The likelihood or hazard of peat landslides at the main wind farm elements has been determined according to the guidelines for geotechnical risk management given by (Clayton, 2001), taking into account the approach of MacCulloch (2006), and using the available data from the desk study, site reconnaissance and site investigations.

The hazard is estimated by the combination of:

- The Factor of Safety stability analysis: This deterministic calculation was presented in Section 4.

- Secondary hazard factors related with the topography, hydrology, vegetation, peat workings, existing loads and slide history (Appendix M). These factors cannot be reasonably included in a stability calculation but nevertheless may contribute to the peat stability. A total of eighteen secondary factors have been complied based on GDG's experience on peat hazard assessment throughout Ireland and the UK and from the observations of the project team during the desk study and during the fieldwork.

5.3.1. Hazard factors considered for the PSRA

Table 5-1 presents a list of the hazard factors considered for the PSRA.

Table 5-1: Factors affecting peat stability and hazard.

Hazard factors			Role in peat stability	Weight
Factor of Safety			This is the most critical factor including the slope angle, the peat depth, the peat density, the peat cohesion in drain and undrained conditions as well as the effective friction angle. This is the most complete factor. See Section 4 for further details.	10
Secondary factors	Slide history	Distance to previous slides (km)	This suggests that if a peat slide has occurred at the site or within a 10-kilometre radius, then landslides at the site are likely. The weight assigned is the double than the weights for the other secondary factors.	2
		Evidence of peat movement (e.g., tension cracks, step features, compression features).	This factor evaluates the effect of any existing on-site peat movement indicators such as tension cracks. The weight assigned is the double than the weights for the other secondary factors	
	Topography	General curvature downslope	This represents the funnelling / dispersion and potential length of the run landslide runout.	1
		Distance to the convexity break (Only if previous factor is Convex)	Zones located close to the break are more prone to be affected by peat landslides.	
		Slope aspect	In high latitudes of the northern hemisphere (e.g., Ireland), slopes facing north tend to exhibit higher values of landslide risk as are in the shade most of the year and present more water content.	
	Hydrology	Distance from watercourse (m)	This tends to affect the likelihood of landslides especially in sectors where this distance is short.	
		Moisture index (NDMI)	This Landsat derived factor indicates the water content or moisture of the vegetation, which can be considered as a proxy of the terrain moisture.	
		Surface water	This factor indicates a high-water table level which can suggest a potential for failure.	

Hazard factors			Role in peat stability	Weight
		Evidence of piping	The presence of piping is a clear evidence of potential peat instability.	1
		Surface desiccation	Peat cracks after dry summer can become potential surfaces of failure during the wet season.	
		Direction of existing drainage ditches	Drainage ditches that are aligned cross slope can have an effect on the overall stability of a slope face.	
		Annual rainfall	It is a proxy of the peat/soil water content.	
	Vegetation	Bush	This is an indicator of the type of peat at the site and the hydrological nature of the site.	
		Forestry	The threes vigour is another indicator of peat stability, being stunted trees more frequent on unstable sectors.	
	Peat workings	Peat cuts presence	This factor evaluates the effect of various peat workings on the stability of the peat.	
		Peat cuts vs contour lines	Where the peat cuts parallel the contour lines the potential instability increases.	
	Existing loads	Roads	Side cast of solid roads and floating roads pose a load to the peat blanket.	
	Time of the year for construction		Late Summer and Autumn are typically the most wet periods and Spring the drier.	

5.3.2. Score of the hazard factors

Both the values of FoS and the eighteen secondary factors have been reclassified into four classes with rating values ranging from 0 to 3 (Appendix M). A rating of 0 indicates that the factor is not relevant, rating 1 indicates low propension to landslides and rating 3 indicates high propension to landslides. Additionally, different weighting values have been assigned to these factors to reflect their relative importance in peat stability (Table 5-1). Both the rating and the weighting values have been assigned according to the expert criteria of the project team and are presented in Appendix M. The score of each factor is the multiplication of its rating value and its weight value.

The hazard values for a given wind farm element is the sum of the scores of all the hazard factors. This total value is then divided by the maximum hazard value possible in order to obtain a normalised hazard value ranging from 0 to 1 (see tables in Appendix M). Hazard is grouped into four categories: Negligible, low, medium and high.

Some of the works for the proposed wind farm development (e.g., construction of access tracks, turbine bases and hardstandings) may imply:

- the removal of lateral support during excavation and removal of peat to full thickness;

- the obstruction or alteration of existing drainage pathways through the peat mass, leading to localised increases in porewater pressure; and
- the creation of tension cracks in the peat due to pressure relief, which may subsequently allow rain and snow melt water to percolate into the peat mass.

These works may thus increase the hazard or likelihood of peat instability within the site and in the surroundings, both during its construction (undrained conditions) and during operation (drained conditions). For this reason, four scenarios of hazard have been calculated for each wind farm element:

- Undrained;
- Undrained with surcharge of 1 m;
- Drained; and
- Drained with surcharge of 1 m.

The details of the physical and mechanical parameters used for each of the four scenarios are provided in Section 4.

5.4. Adverse consequences assessment

The impacts of peat landslides on the wind farm elements and surrounding environment and existing assets may typically generate a variety of adverse consequences. In this report, these consequences have been assessed in a qualitative way following the *Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments* (Scottish-Executive, 2017).

5.4.1. Consequences considered for the PSRA

Table 5-2Table 5-2 summarises the consequences considered for the PSRA of the Ballynagare wind farm.

Table 5-2: Consequences considered for the PSRA

Consequence factors	Description	Weight
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	This is the second most heavily weighted factor. It is estimated based on the distance from the nearest defined watercourse and the depth of peat in the area. The longer the distance and the deepest the peat depth, the larger landslide.	3
Downslope features	This factor accounts for the type / shape of down slope features that may hamper or favour the propagation downhill of the peat flow.	1

Consequence factors	Description	Weight
Proximity from defined valley (m)	This is the distance from the site to the nearest defined river valley. Rivers close to potential landslide sectors are more vulnerable to a landslide event.	
Downhill slope angle	This factor accounts for the runout distance as a matter of slope angle.	
Downstream protected zones	Reflects the severity of the impact of a peat slide event would have on the receiving protected environment.	
Public roads in potential peat flow path	Rates the impact of a peat slide striking a public road.	
Overhead lines in potential peat flow path	Rates the impact of a peat slide striking a service line.	
Buildings in potential peat flow path	Rates the impact of a peat slide striking a habitable structure.	
Capability to respond (access and resources)	Rates the capability of the site staff to respond to a peat instability event.	

5.4.2. Scores for the consequences

As for the hazard factors, the nine consequences factors considered have been reclassified into four classes with rating values ranging from 0 to 3 (Appendix M). A rating of 0 indicates that the factor is not relevant, rating 1 indicates low consequences and rating 3 indicates high consequences.

"Volume of potential landslide" has been assigned a weight of 3 to reflect its relative importance in the potential consequences. The rest of factors have been assigned a weight of 1. Both the rating and the weighting values have been assigned according to the expert criteria of the project team. The score of each consequence factor is the multiplication of its rating value and its weight value (Appendix M).

The consequences value for a given wind farm element is the sum of the nine scores of consequences. This total value is then divided by the maximum consequence value possible in order to obtain a normalised consequence value ranging from 0 to 1 (see tables in Appendix M). Consequences are grouped into four categories: Negligible, low, medium and high.

5.5. Risk calculation

Risk in each wind farm infrastructure is calculated with Equation 5-1, i.e. multiplying the scores of the hazard and the scores of the consequences. The risk rating ranges between 0 and 1 and the following levels of risk rating have been distinguished (Figure 5-1):

- Negligible (0 to 0.2): Project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate;

- Low (0.2 to 0.4): Project may proceed pending further investigation to refine assessment and mitigate hazard through relocation or re-design at these locations.
- Medium (0.4 to 0.6): Project should not proceed unless risk can be avoided or mitigated at these locations, without significant environmental impact, in order to reduce risk ranking to low or negligible.
- High (0.6 to 1): Avoid project development at these locations. Mitigation is generally not feasible.

Appendix M gathers the risk calculation process at each proposed wind farm element considering the four scenarios of hazard: Undrained; undrained with surcharge of 1 m; drained; and drained with surcharge of 1 m. Figure 5-1 summarises the risk rating obtained. All the proposed designs (turbines, substation, construction compounds) are located in sectors of negligible risk. It is noted that the resulting risk rating does not indicate a probability of losses due to landslides, it simply expresses a rating.

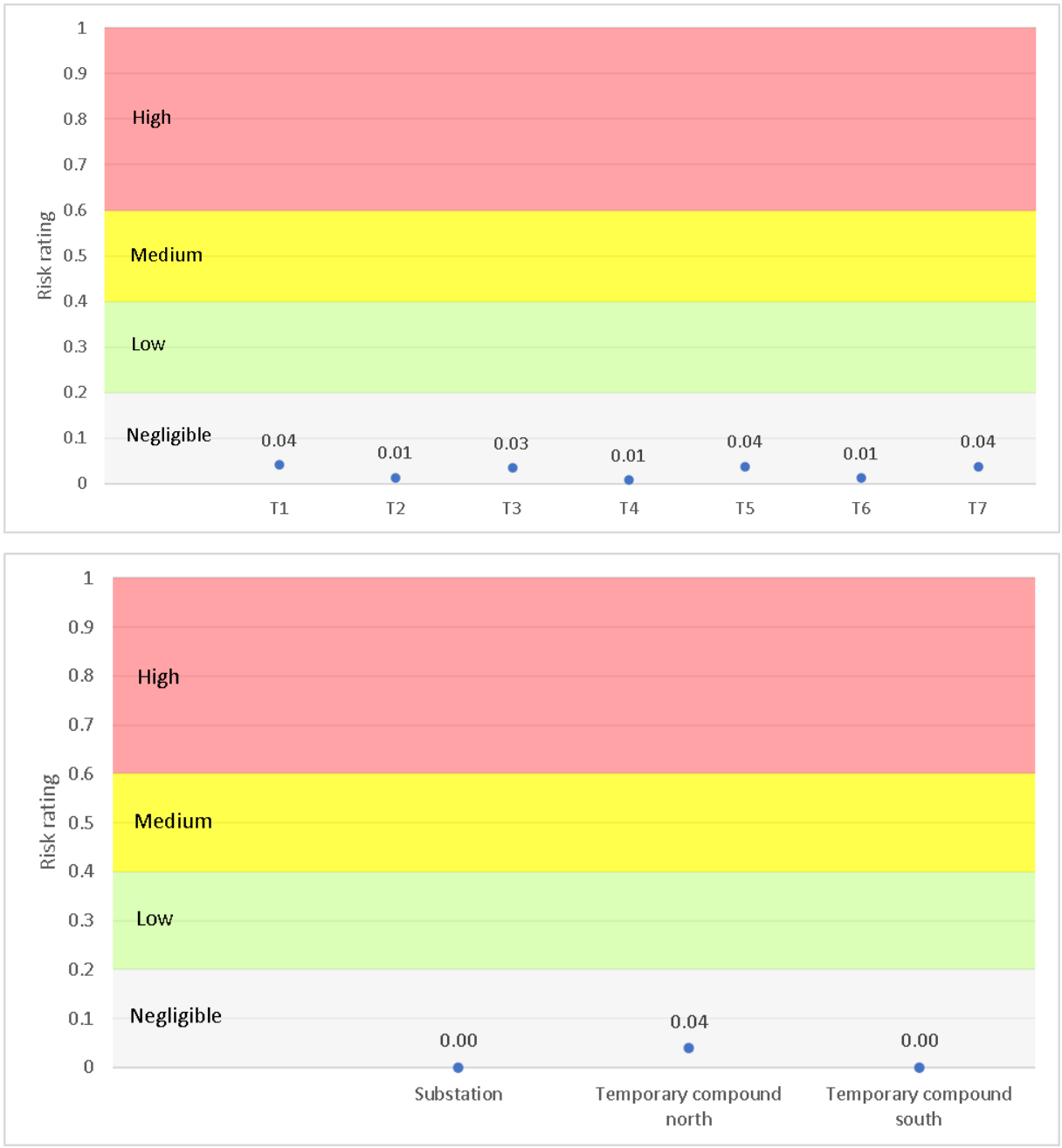

Figure 5-1: Risk ratings at the wind farm element sites.

Note: The values of risk for the four possible scenarios of hazard (undrained; undrained with surcharge of 1 m; drained; and drained with surcharge of 1 m) do not vary due to the reclassification of the Factor of Safety in each location (>1.3) to a score of 10 (see Appendix M for further details).

6. Conclusions and recommendations

Following the guidance of the Scottish-Executive (2017), a review of the published thematic geographic information (e.g. geology, soils, protected areas) and relevant background literature was undertaken for the proposed development. Site reconnaissance and site investigations were carried out to validate and enhance the desk study information. Based on the revision of the available data, the fieldwork and GDG's professional judgement, it is concluded that significant peat slides are unlikely on the site.

A deterministic Factor of Safety was satisfactorily calculated along the fringe containing the main wind farm elements. A robust and satisfactory peat stability risk assessment (PSRA) was performed. The findings of the peat assessment showed that the site has an acceptable margin of safety and is suitable for the proposed renewable energy development. Peat stability risk associated with the construction of the grid connection will be negligible.The risk level for the proposed development is negligible and according to the guidance of the Scottish-Executive (2017), the project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate.

All earthworks shall be designed by a competent geotechnical designer which shall be informed by a detailed ground investigation. Construction works shall follow the recommendations of the peat and overburden management plan prepared for the site.

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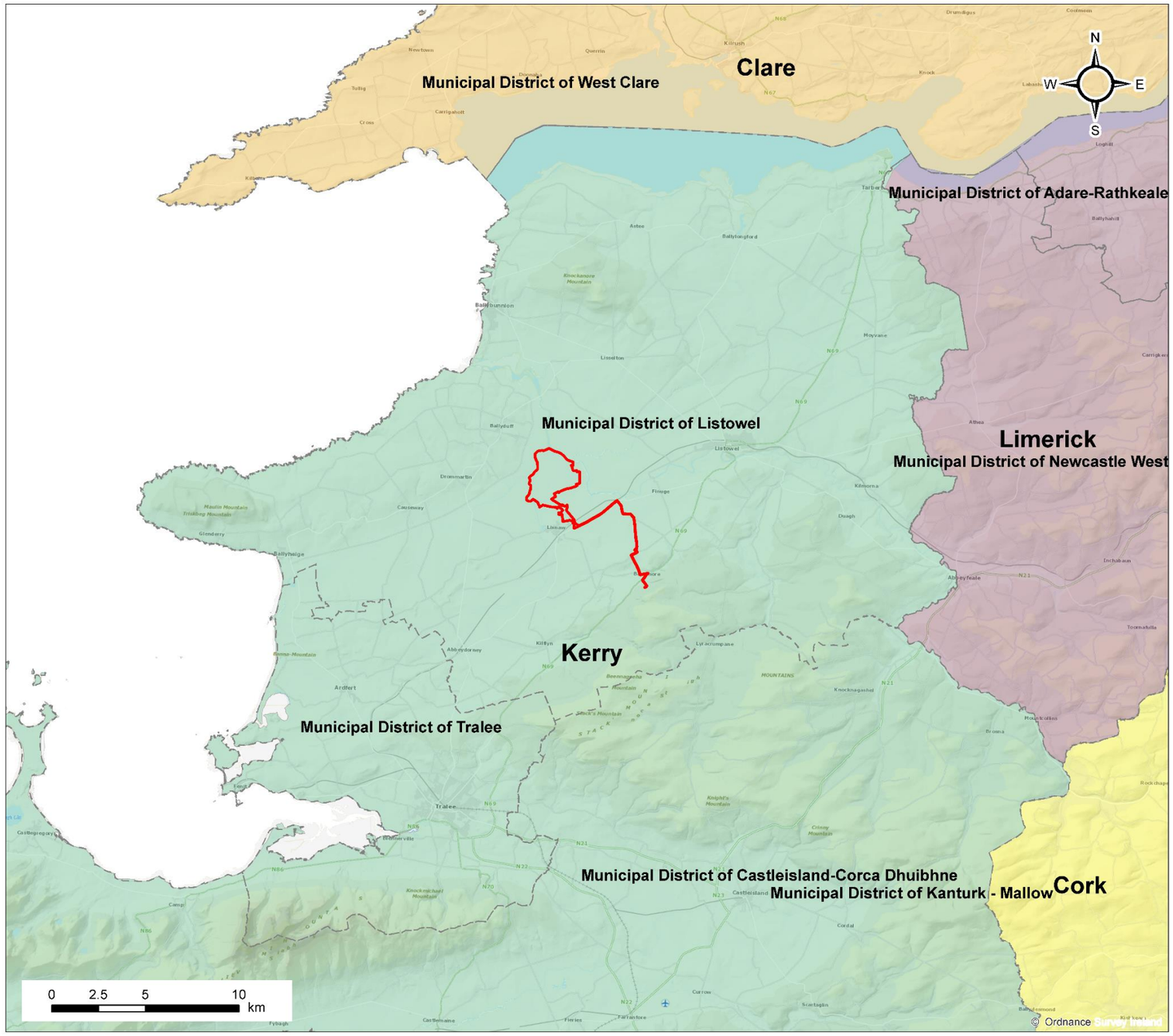
Appendix A Location and administrative limits





Legend

Ballynagare project boundary (MKO, 2021.09.20)

Municipal districts (OSi)

Counties (OSi)

County Clare

County Cork

County Kerry

County Limerick

Background images: ESRI, OSi, EMODnet

Client: MKO		GDG GAVIN & DOHERTY GEOSOLUTIONS
Project: Ballynagare wind farm		
Map title: Proposed Ballynagare wind farm location		
File: 20260 BWF - Location Admin.tif		
Sheet size: A3	CRS: 2157	Authored: EA
Date: 13/10/2021	Background: ESRI	Checked: LB

Figure A-1: General location of the wind farm site and administrative limits

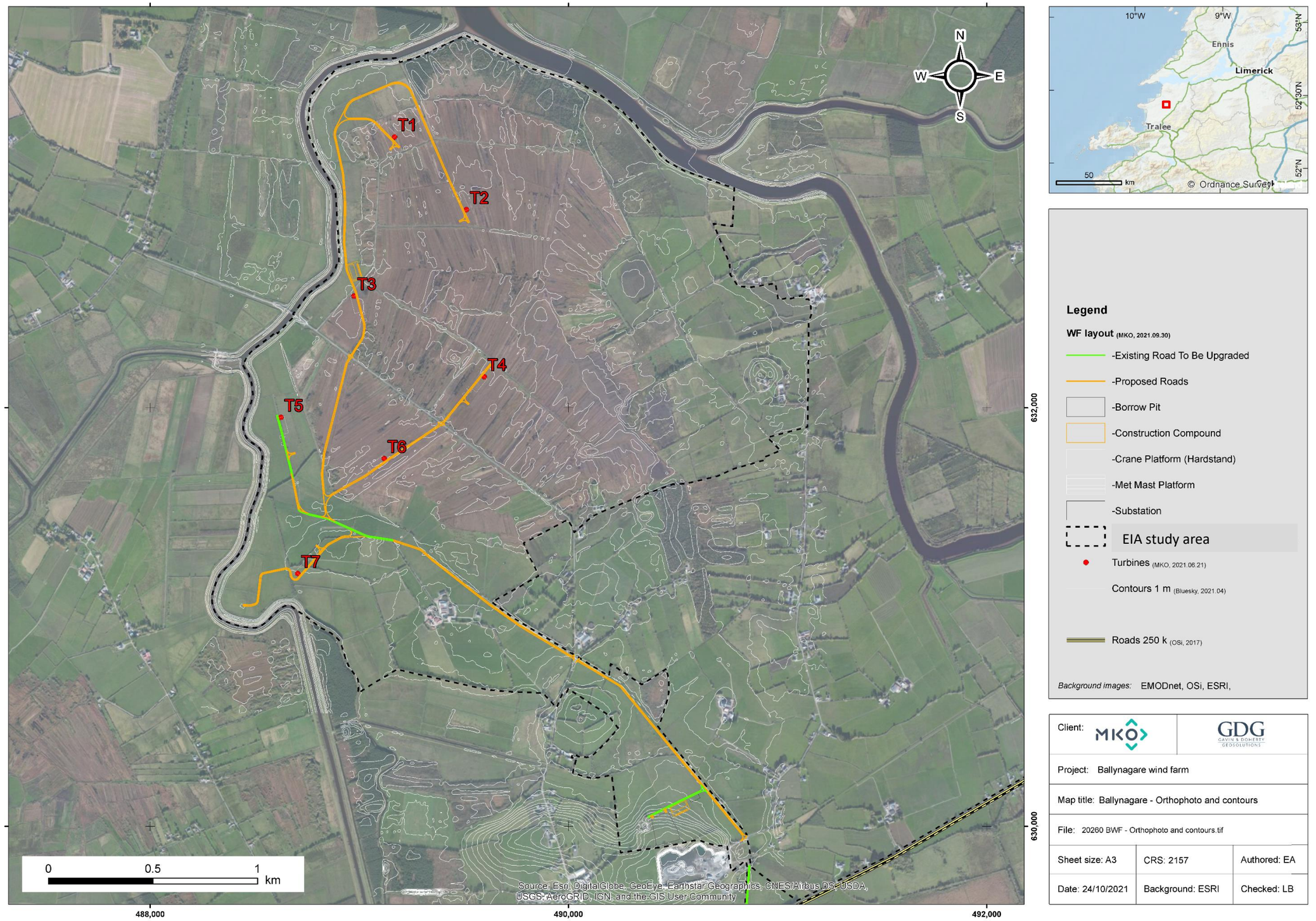


Figure A-2: Detailed location of the proposed wind farm site

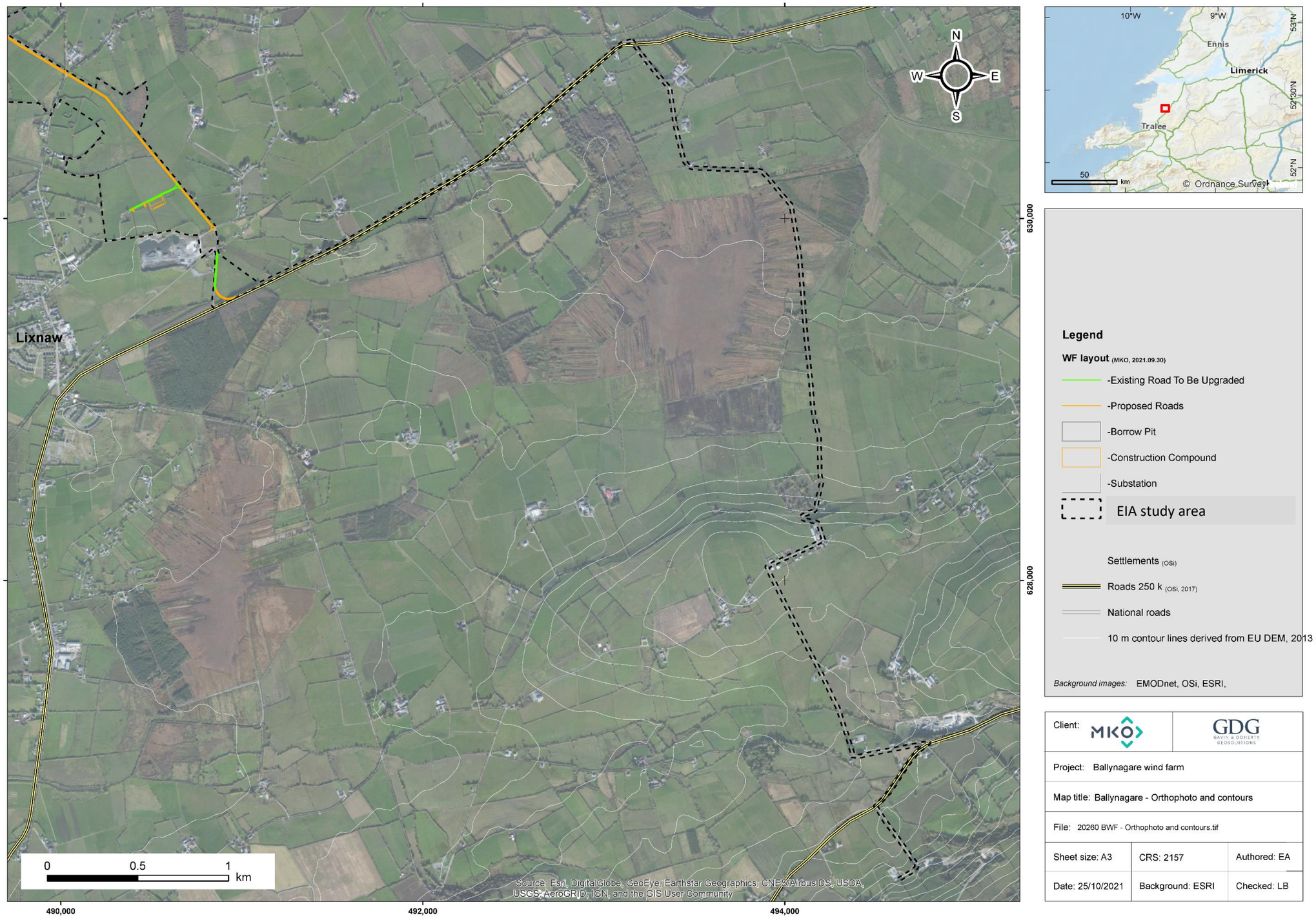
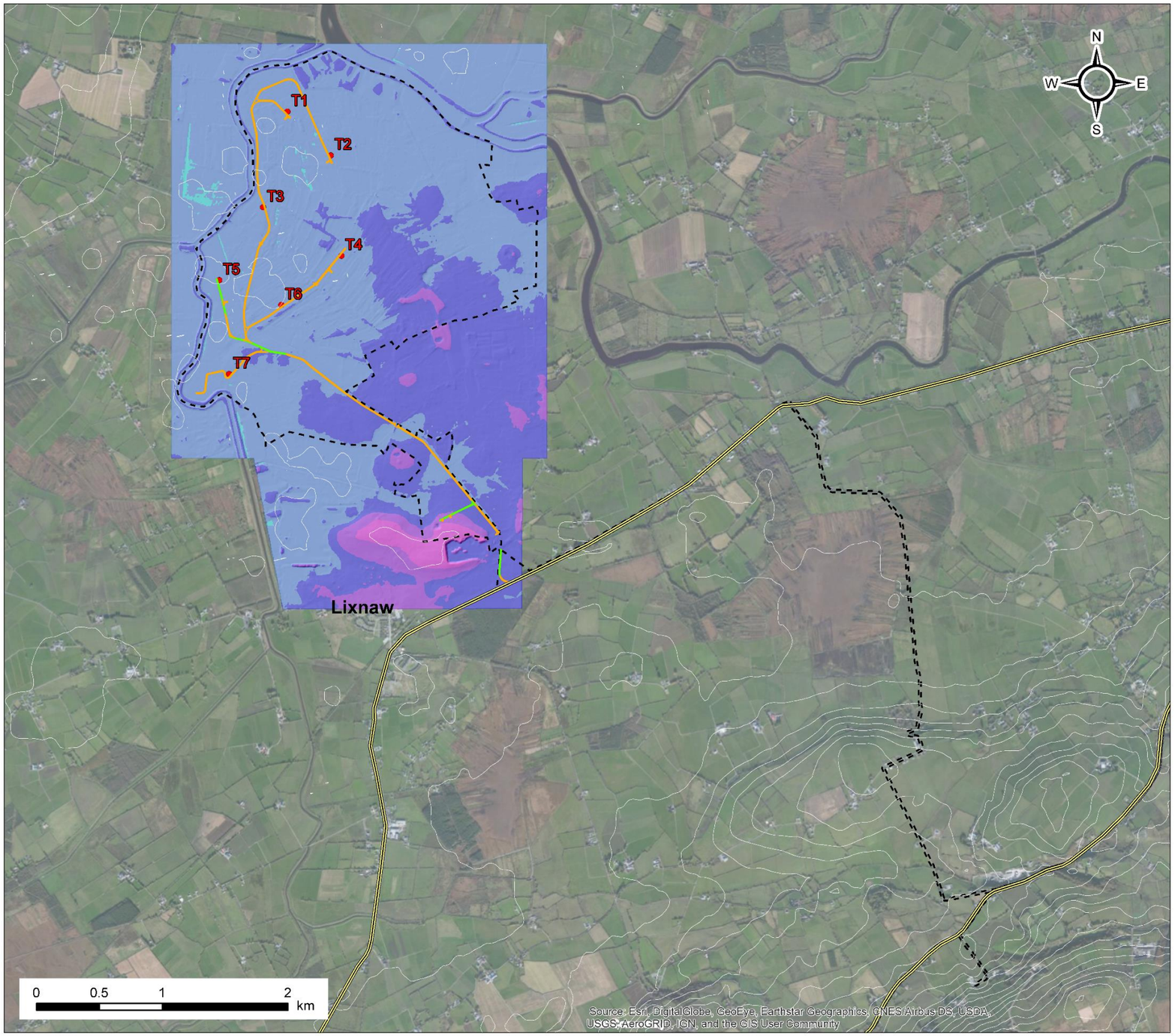


Figure A-3: Detailed location of the grid connection route

Appendix B Topography



Legend

Settlements (OSi)

Roads 250 k (OSi, 2017)

National roads

10 m contour lines (derived from EU DEM, 2013)

WF layout (MKO, 2021.09.30)

-Existing Road To Be Upgraded

-Proposed Roads

EIA study area

Turbine points (MKO, 2021.06.21)

DEM (m) (Bluesky, 2021.04)

-0.95 - 0

0 - 2

2 - 5

5 - 10

10 - 15.7

Background images: EMODnet, OSi, ESRI,

Client: MKO		GDG GAVIN & DOHERTY GEOSOLUTIONS
Project: Ballynagare wind farm		
Map title: Digital Elevation Model		
File: 20260 BWF - Digital Elevation Model.tif		
Sheet size: A3	CRS: 2157	Authored: EA
Date: 25/10/2021	Background: ESRI	Checked: LB

Figure B-1: Digital Elevation Model

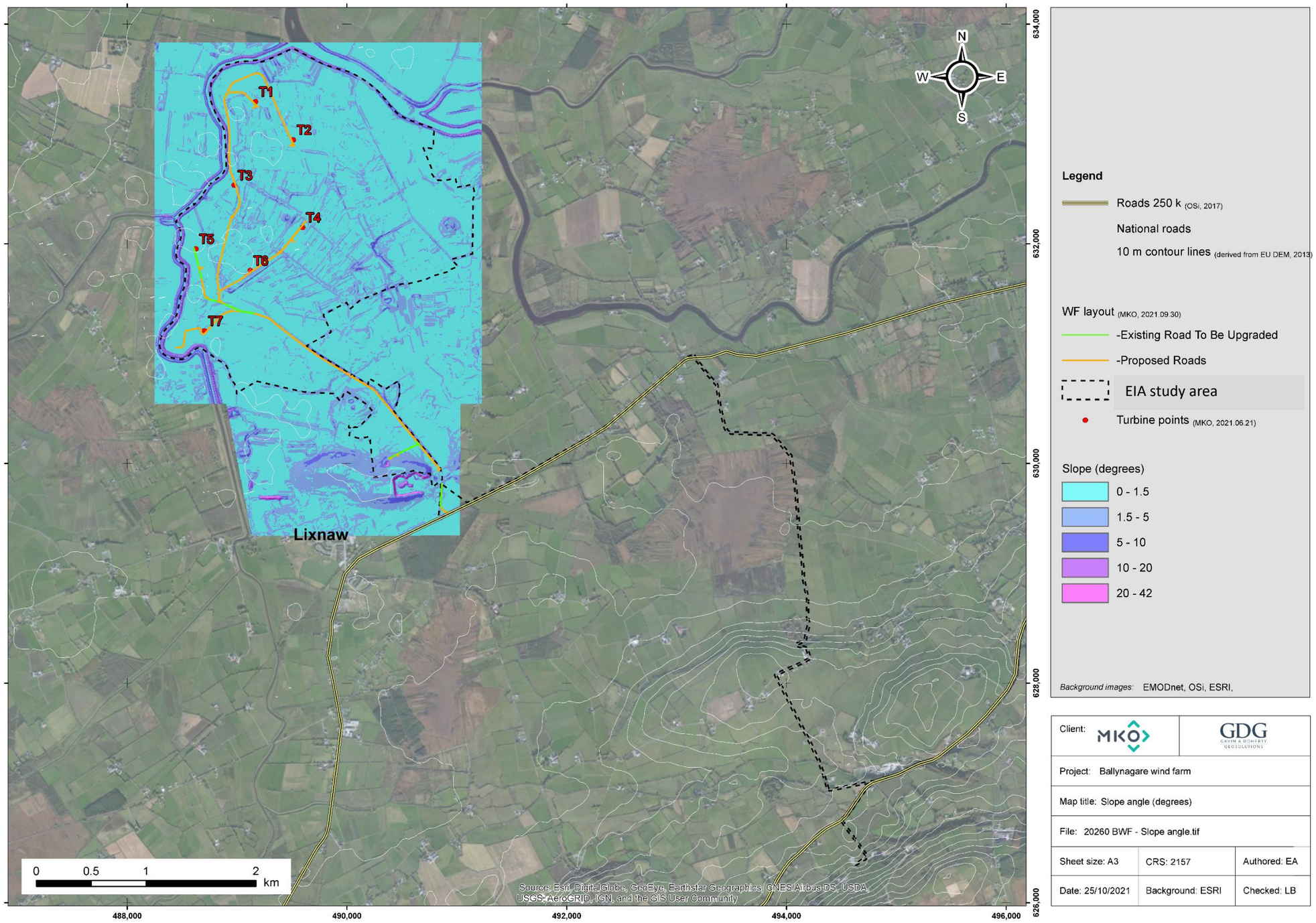


Figure B-2: Slope angle

Appendix C Geology

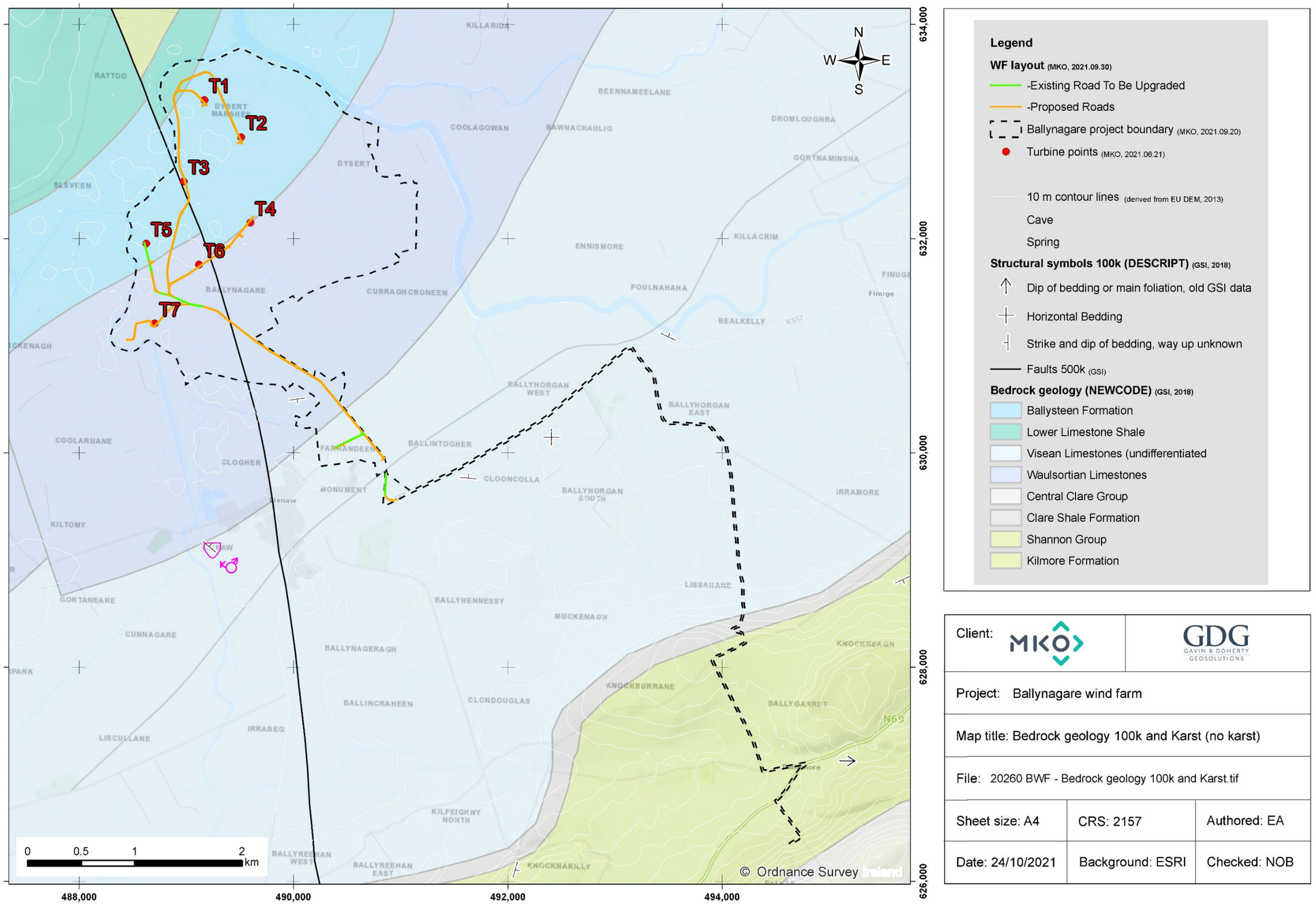


Figure C-1: Bedrock geology 100k and Karst (GSI). Source: GSI (2018a)

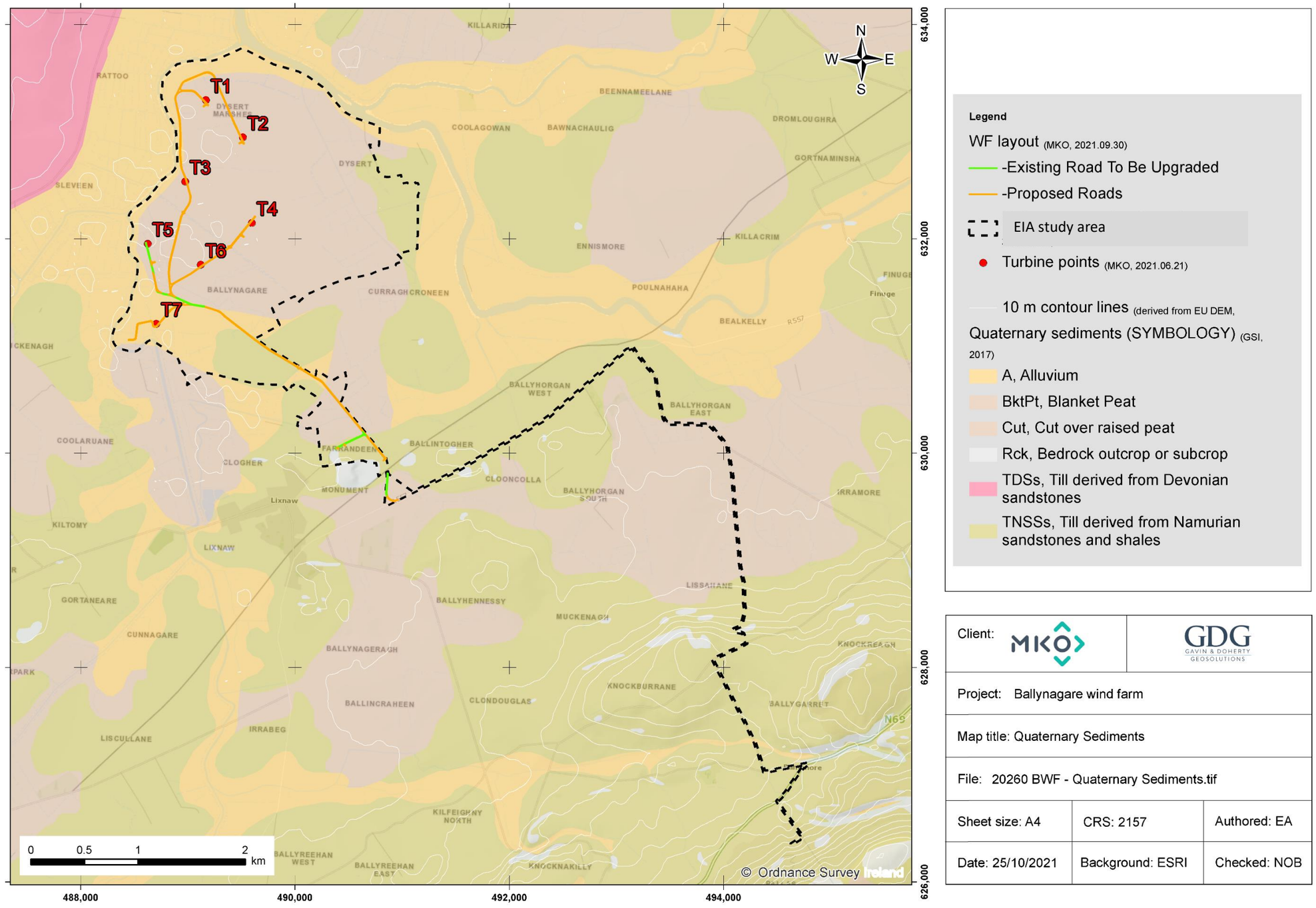
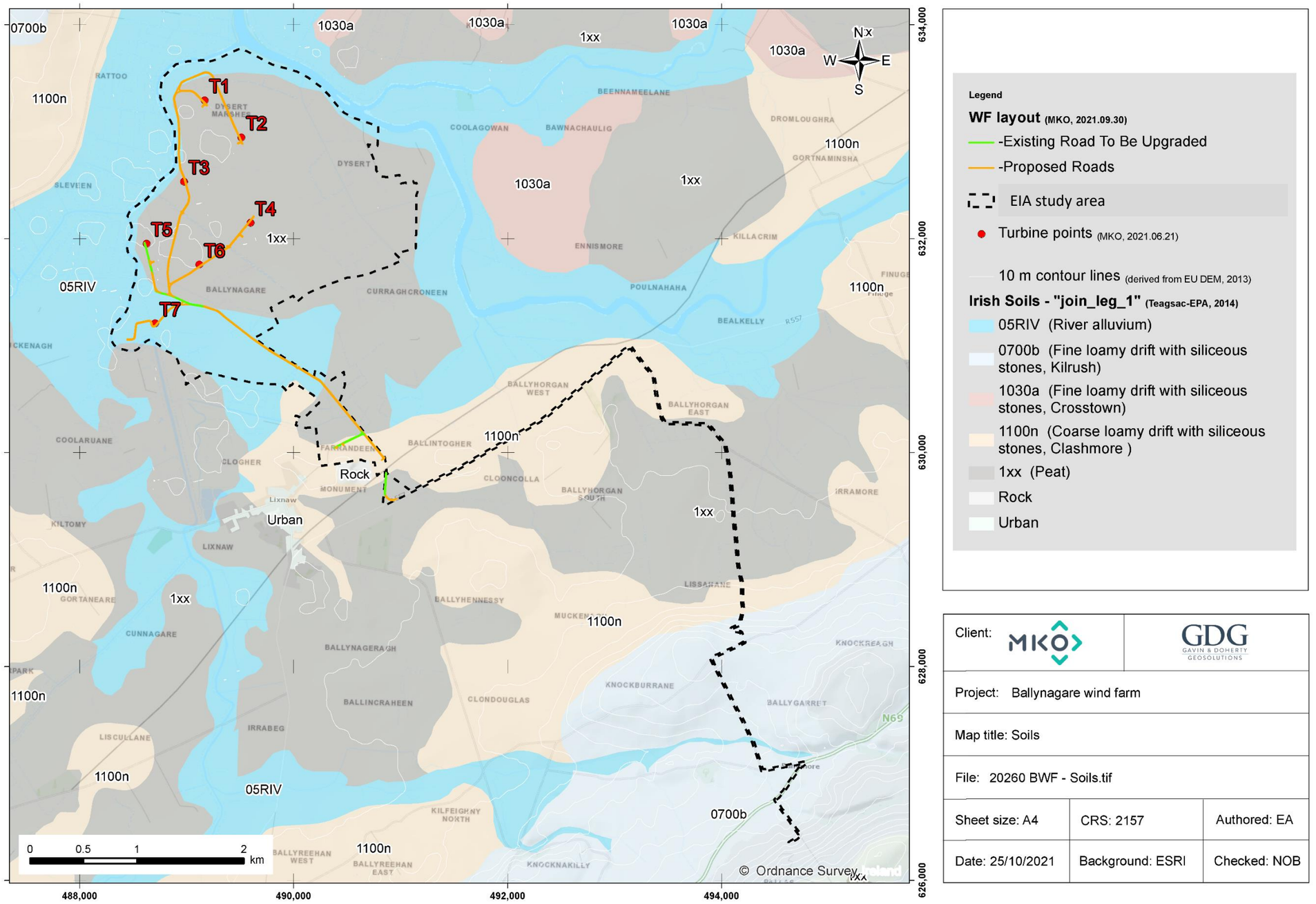


Figure C-2: Quaternary sediments (GSI). Source: GSI (2019)

Note: This is a regional scale map that does not represent the local details of the spatial distribution of the peat, which was enhanced for this project by means of fieldwork and peat probes.

Appendix D Soils



Legend

WF layout (MKO, 2021.09.30)

- -Existing Road To Be Upgraded
- -Proposed Roads
- EIA study area
- Turbine points (MKO, 2021.06.21)
- 10 m contour lines (derived from EU DEM, 2013)

Irish Soils - "join_leg_1" (Teagsac-EPA, 2014)

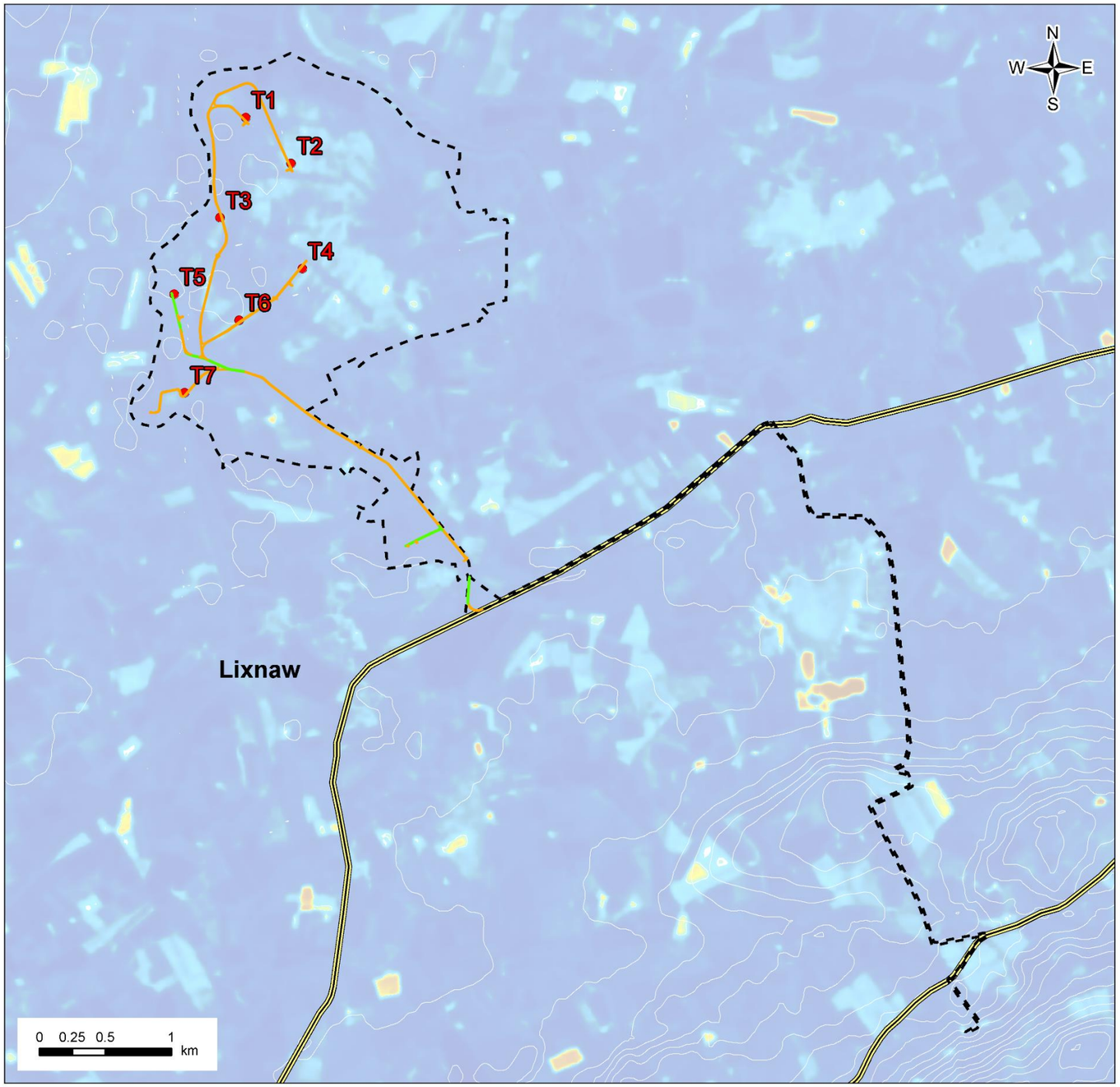
- 05RIV (River alluvium)
- 0700b (Fine loamy drift with siliceous stones, Kilrush)
- 1030a (Fine loamy drift with siliceous stones, Crosstown)
- 1100n (Coarse loamy drift with siliceous stones, Clashmore)
- 1xx (Peat)
- Rock
- Urban

Client: MKO / GDG GAVIN & DOHERTY GEOSOLUTIONS		
Project: Ballynagare wind farm		
Map title: Soils		
File: 20260 BWF - Soils.tif		
Sheet size: A4	CRS: 2157	Authored: EA
Date: 25/10/2021	Background: ESRI	Checked: NOB

Figure D-1: Soils. Source: EPA, Teagasc, & Cranfield University (n.d.)

Note: This is a regional scale map that does not represent the local details of the spatial distribution of the peat, which was enhanced for this project by means of fieldwork and peat probes.

Appendix E Moisture



Legend

WF layout (MKO,
-Existing Road To Be Upgraded
-Proposed Roads
EIA study area
Turbine points (MKO, 2021.06.21)
Roads 250 k (OSi, 2017)
10 m contour lines (derived from EU DEM,

Landsat 8: Normalised Difference Moisture Index
High : 255
Low : 0

Client: MKO		GDG GAVIN & DOHERTY GEOSOLUTIONS
Project: Ballynagare wind farm		
Map title: Moisture index Landsat 8		
File: 20260 BWF - Moisture index Landsat 8.tif		
Sheet size: A4	CRS: 2157	Authored: EA
Date: 25/10/2021	Background: ESRI	Checked: NOB

Figure E-1: Moisture Index. Source: USGS and Landsat 8

Appendix F Hydrogeology

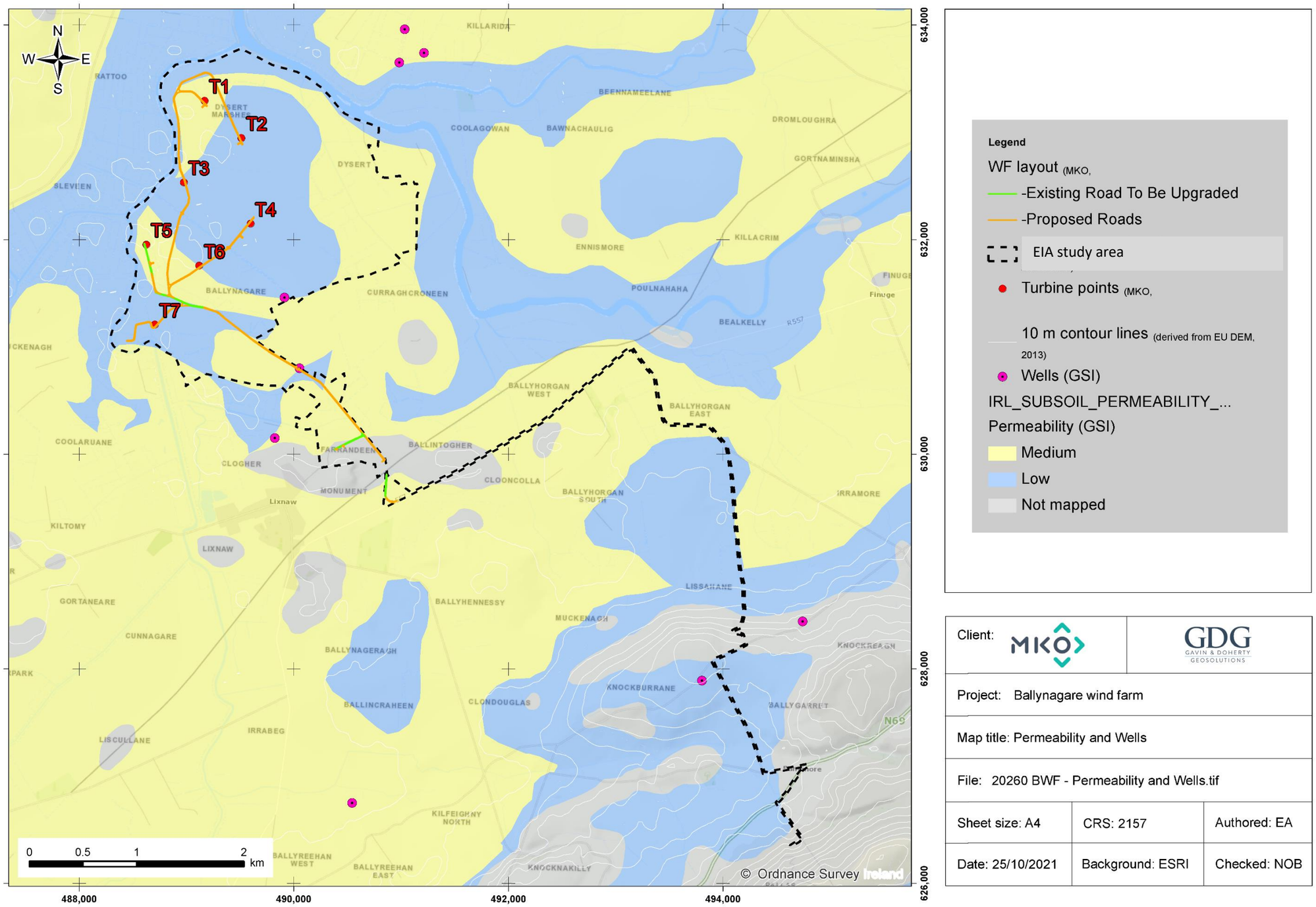
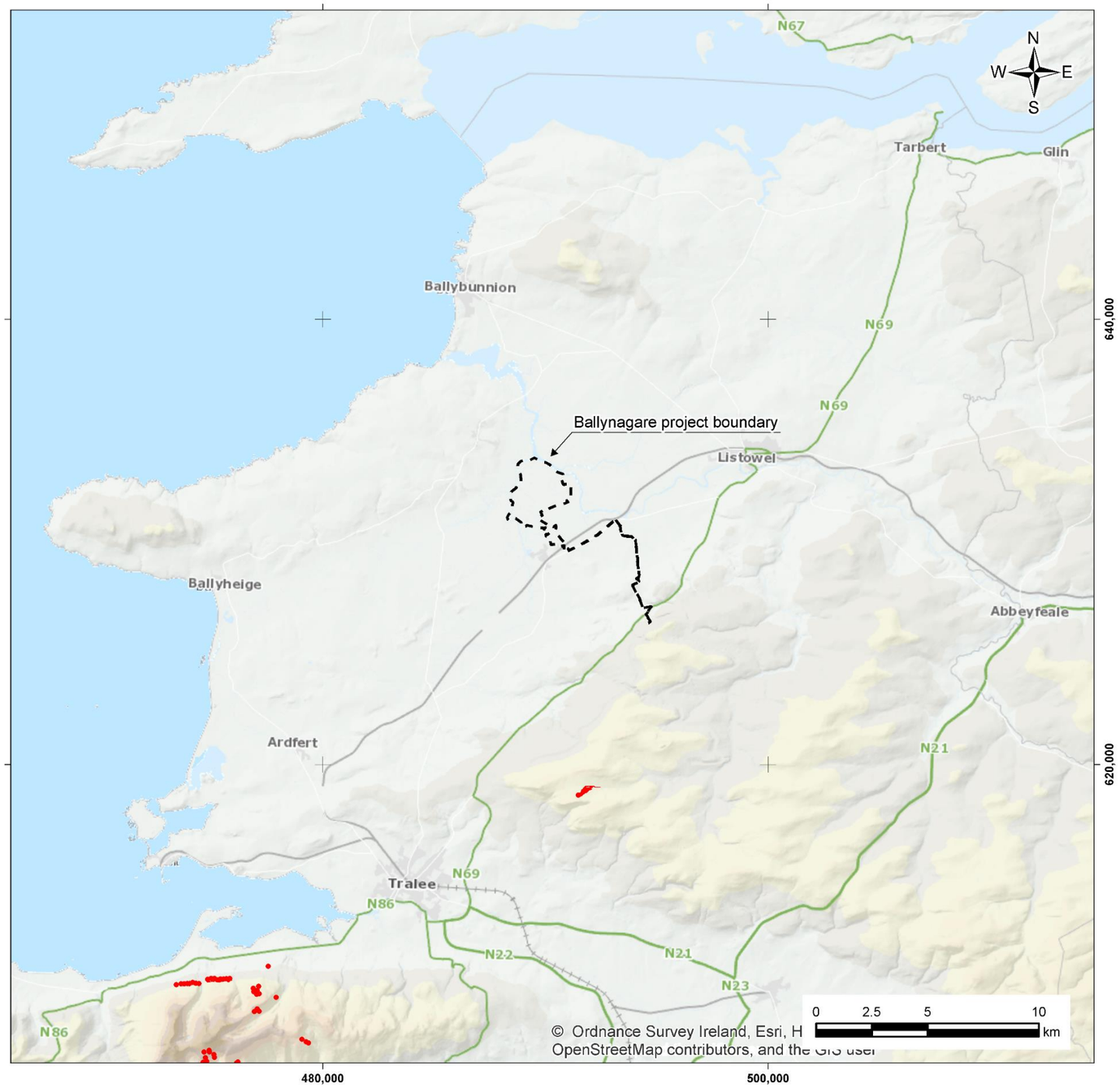
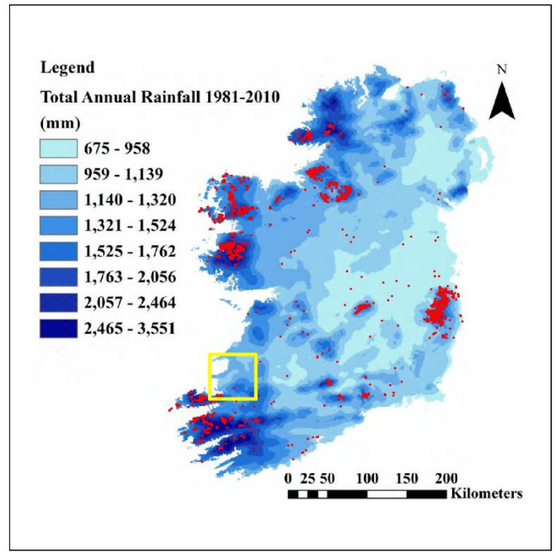
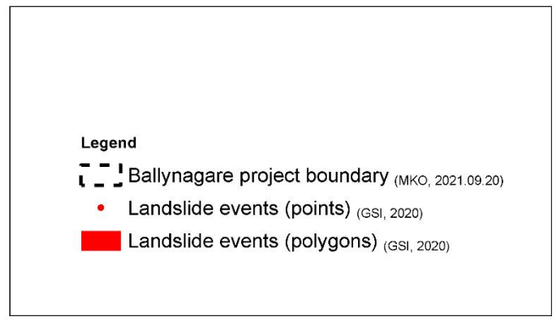


Figure F-1: Permeability and wells (GSI)

Appendix G Slope instability mapping

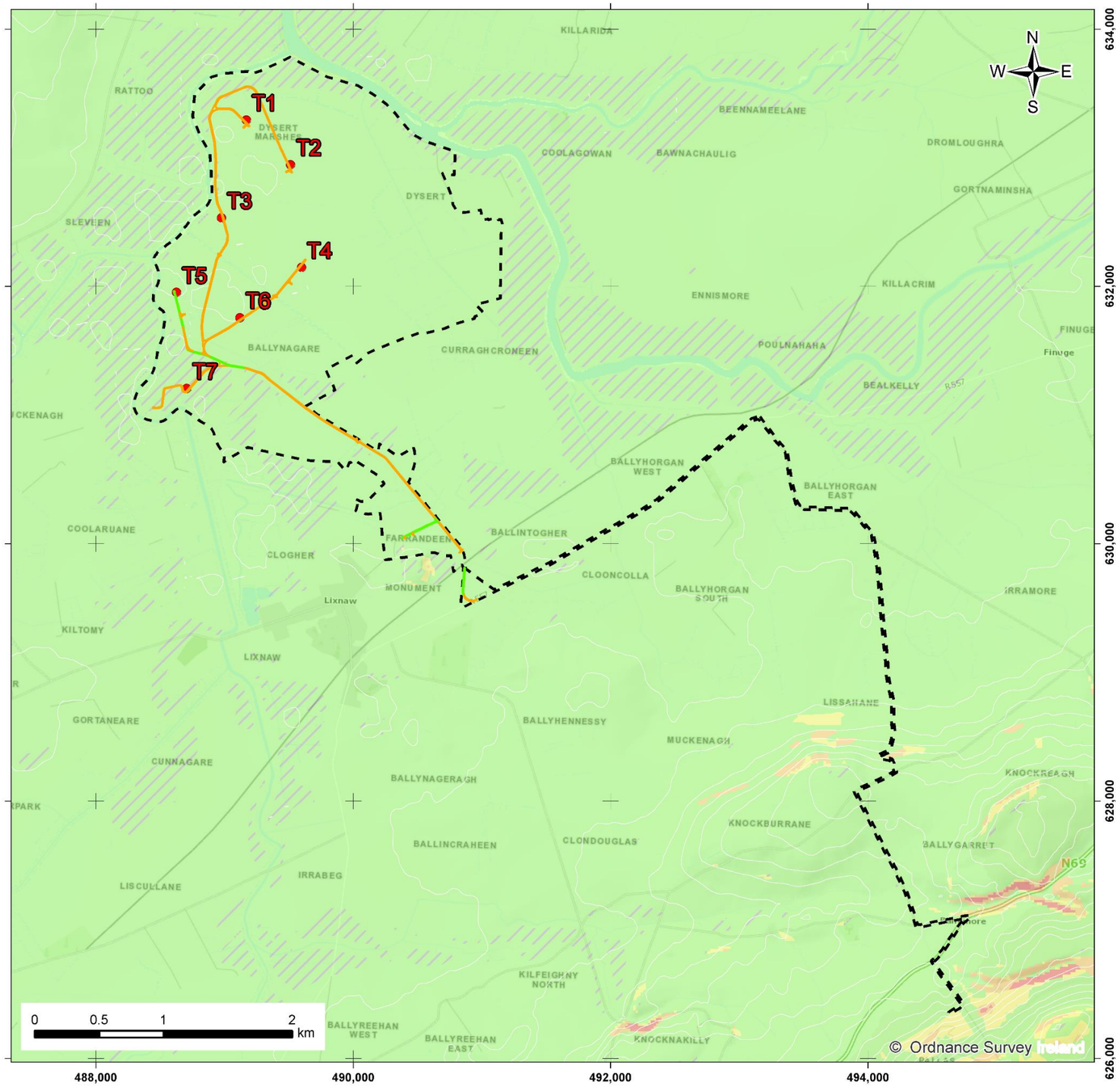






Client: MKO	GDG GAVIN & DOHERTY GEOSOLUTIONS	
Project: Ballynagare wind farm		
Map title: Landslides and Rainfall		
File: 20260 BWF - Landslides and Rainfall.tif		
Sheet size: A4	CRS: 2157	Authored: EA
Date: 14/10/2021	Background: OSi	Checked: NOB

Figure G-1: Landslides (GSI) and rainfall (Met Eireann)



Legend

WF layout (MKO,
- -Existing Road To Be Upgraded
- -Proposed Roads

EIA study area

Turbine points (MKO,

10 m contour lines (derived from EU DEM,

Landslide susceptibility (GSI, 2020)
- Low
- Low (inferred)
- Moderately Low
- Moderately Low (inferred)
- Moderately High
- High

Client: MKO / GDG Gavin & Doherty Geosolutions		
Project: Ballynagare wind farm		
Map title: Landslide Susceptibility		
File: 20260 BWF - Landslide Susceptibility.tif		
Sheet size: A4	CRS: 2157	Authored: EA
Date: 25/10/2021	Background: ESRI	Checked: NOB

Figure G-2: Landslide Susceptibility (GSI)

Appendix H Rivers and flooding

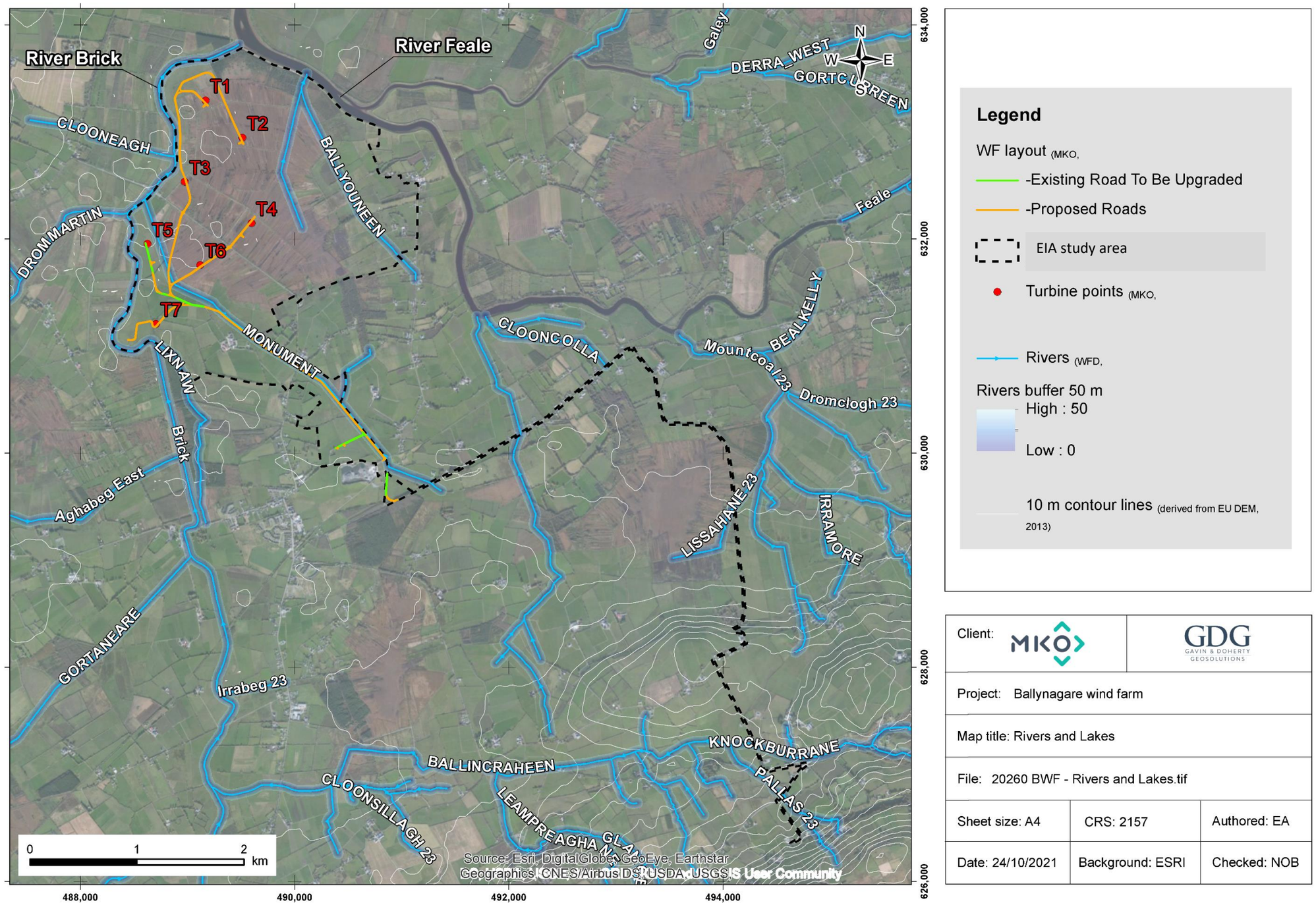


Figure H-1: Rivers

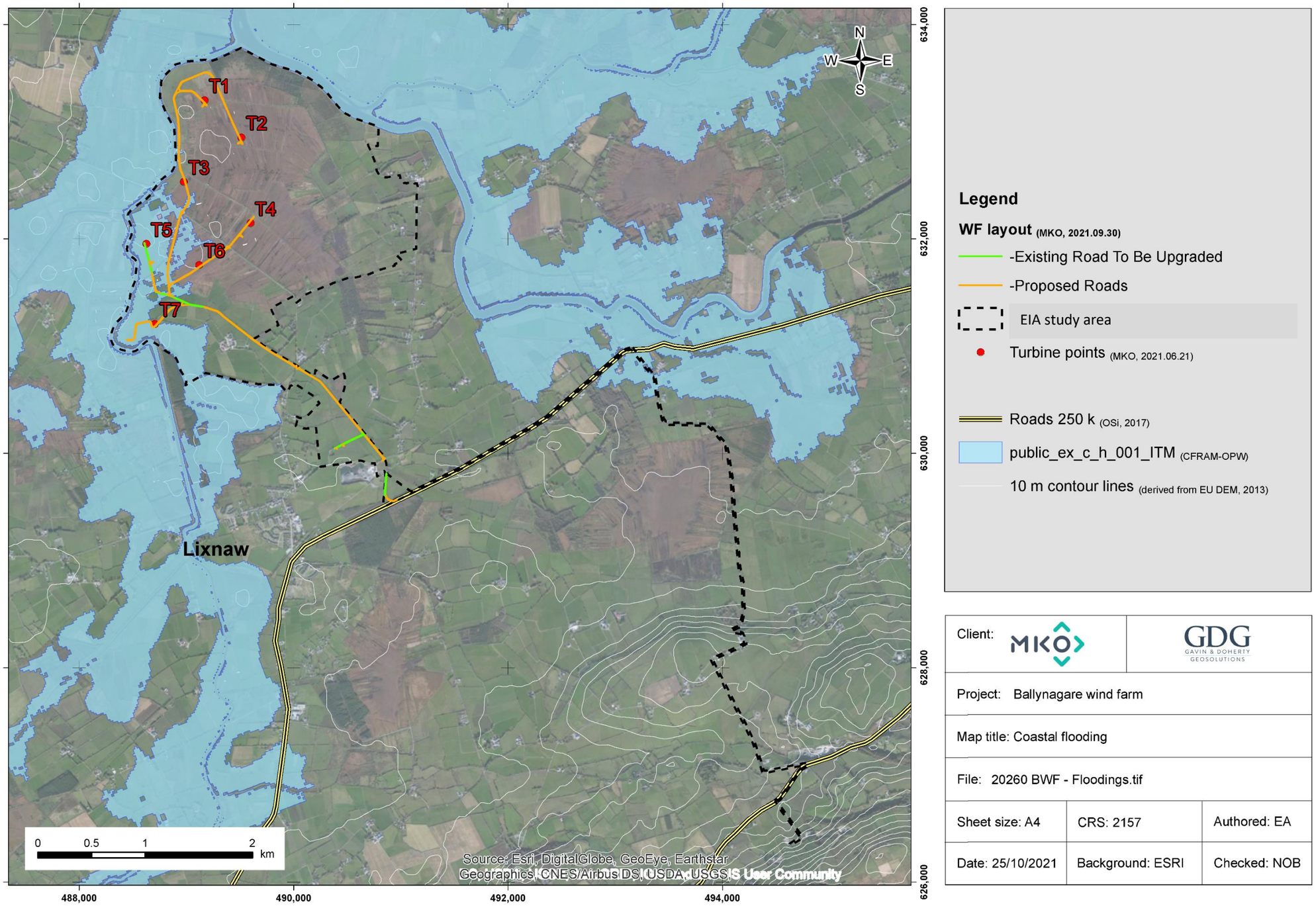


Figure H-2: Coastal flooding for a high-end future scenario

Appendix I Protected areas

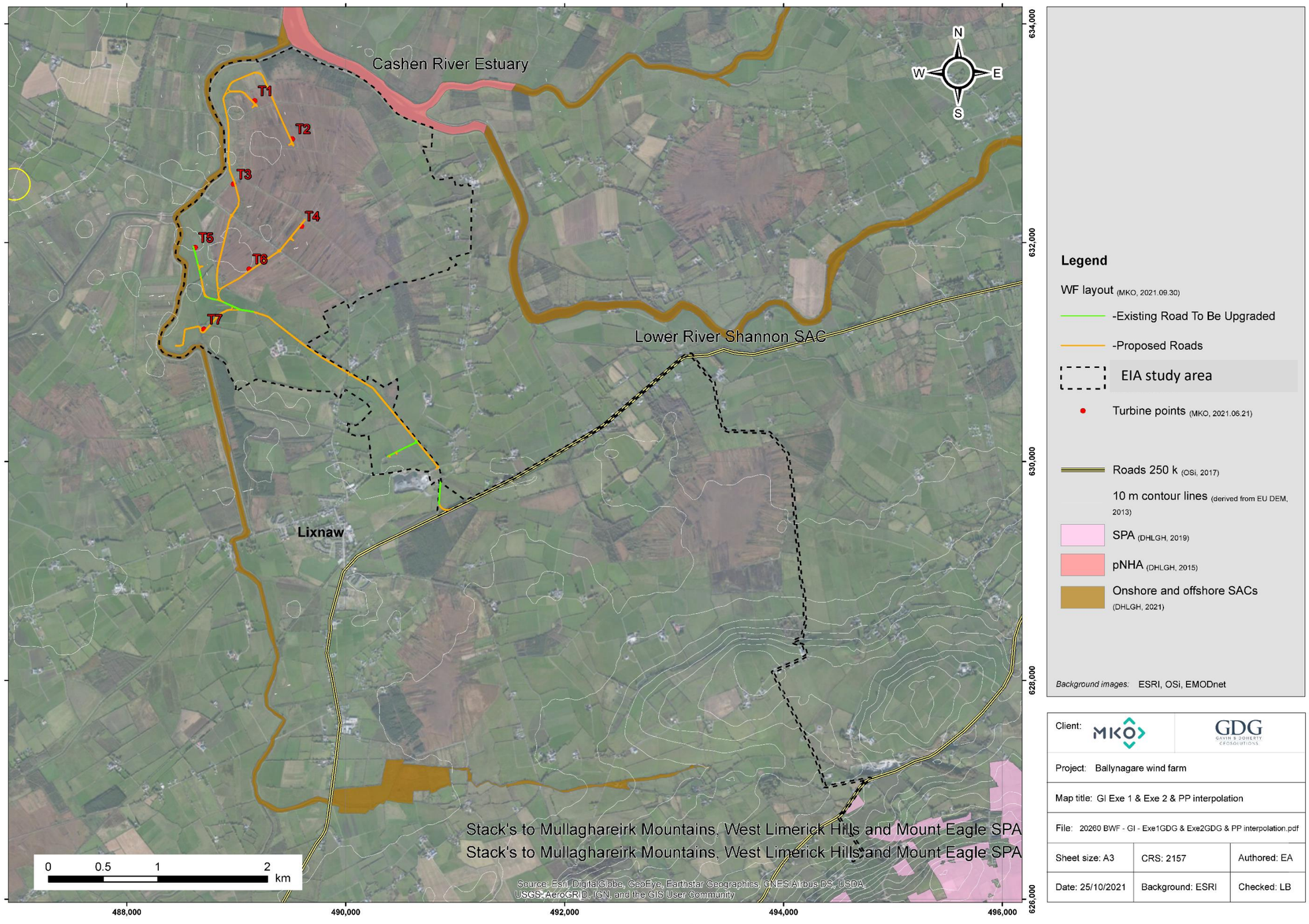


Figure I-1: Protected areas

Appendix J Land cover and land use

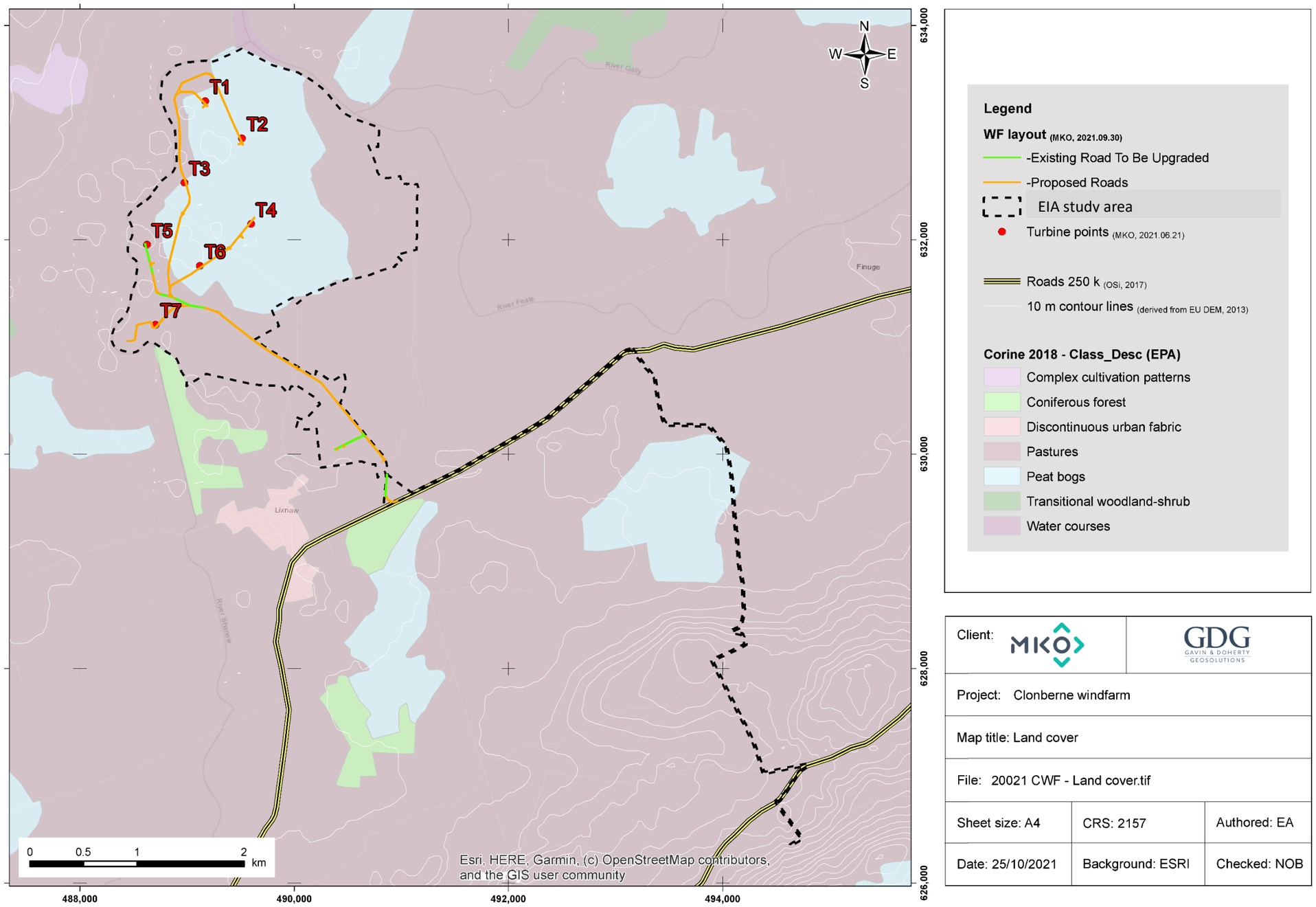


Figure J-1: Corine land cover map (2018)

Note: This is a regional scale map that does not represent the local details of the spatial distribution of the peat, which was enhanced for this project by means of fieldwork and peat probes.

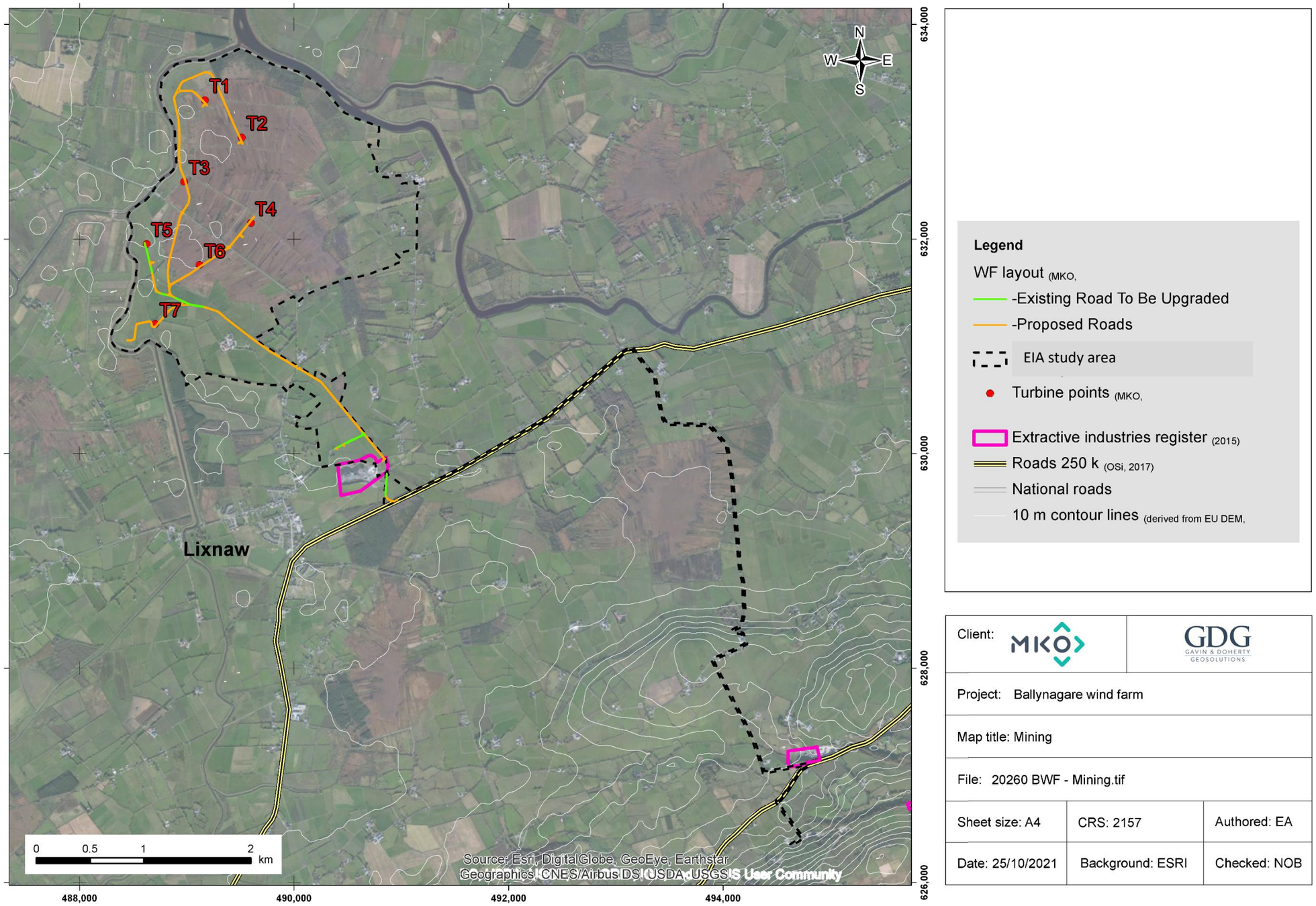


Figure J-2: Mining

Appendix K Geo-investigations and site description

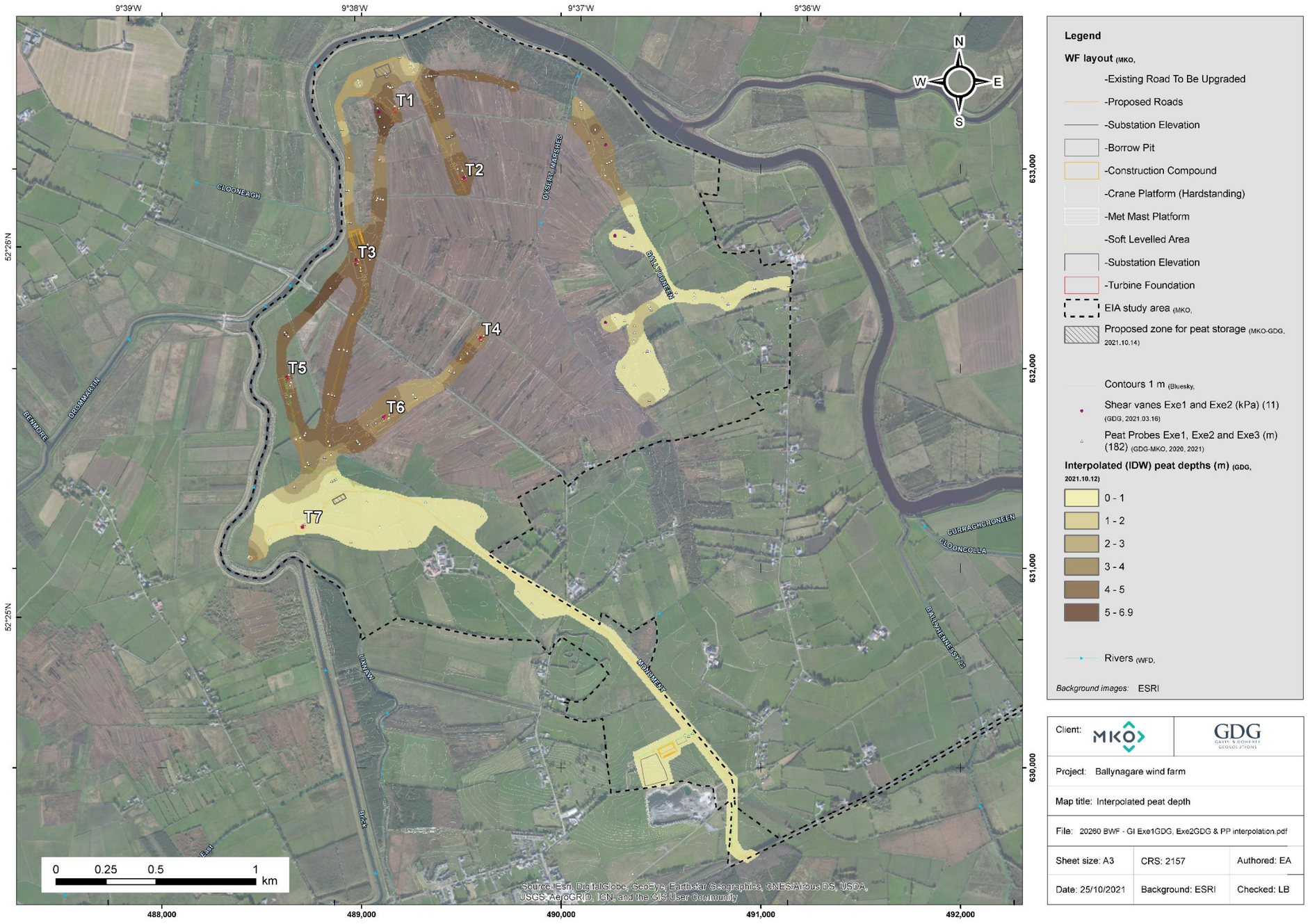
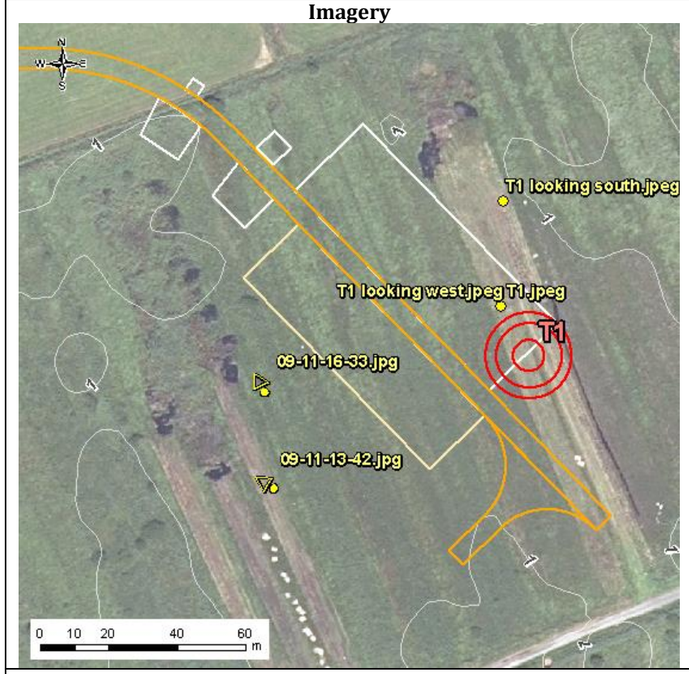


Figure K-1: Ground-investigation map

Note: The distance between peat probe points is sometimes larger than 100 m. A prioi, this may be seen as a limitation. However, the geographical context, the spatial distribution of the measured values of peat depth and the analysis of satellite imagery suggest that the variability of peat depths across the site is smooth and thus, the interpolated values at distances larger than 100 m may be considered as plausible.

Table K-1: Site reconnaissance for turbine 1

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Ground-based photos (MKO, 2021.07.02)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

2 - 3

3 - 4

4 - 5

5 - 6.9

09 11:16:33.jpg



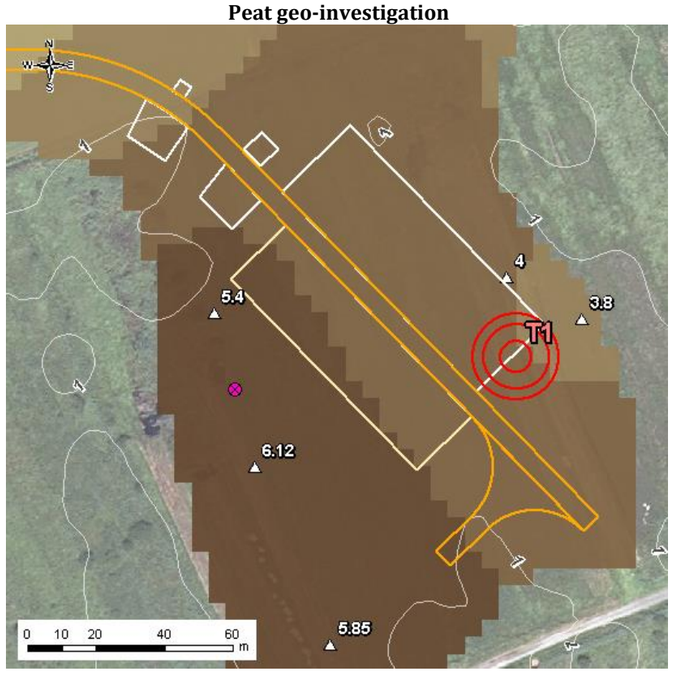
T1 looking south.jpeg



T1 looking west.jpeg



Peat geo-investigation



Description

Geomorphology: The terrain is horizontal and the elevation is around 1 masl. There were ponds at the time of the walkover.

Peat: The peat depth at the T1 site is estimated in ~5 m. The peat at the site had previously been harvested and the area is not overgrown with long wild grass. The remains of the peat cutting exists as steps of approximately 0.5m in height.

Note: The wind farm layout was modified after fieldwork. Hence, the current turbine and crane hardstand are not peat probed, and the photos taken are facing the wrong direction.

09 11:13:42.jpg

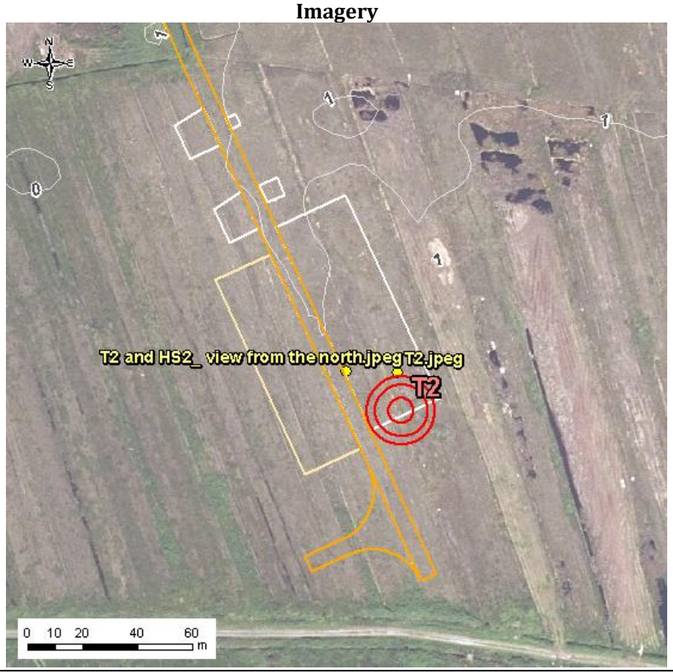


T1.jpeg



Table K-2: Site reconnaissance for turbine 2

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (MKO, 2021.07.02)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

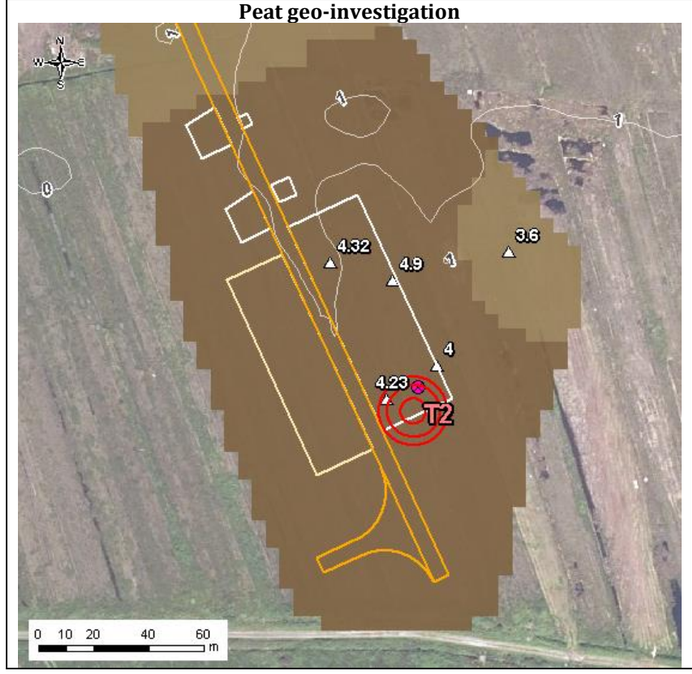
3 - 4

4 - 5

T2 and HS2_ view from the north.jpeg



Peat geo-investigation



Description

Geomorphology: The topography is almost horizontal and the elevation fluctuates around 1 masl.

Peat: The peat depth is 4.23 m at the T2 site and 4.32 m at the crane hardstand site.
The peat appears to have been harvested in row orientated in a NW-SE direction. From satellite imagery these cuttings do not appear to be recent, and they appear to be overgrown with wild grass. No ground-based inspection has been carried out so the full nature of these cuttings is not yet known.

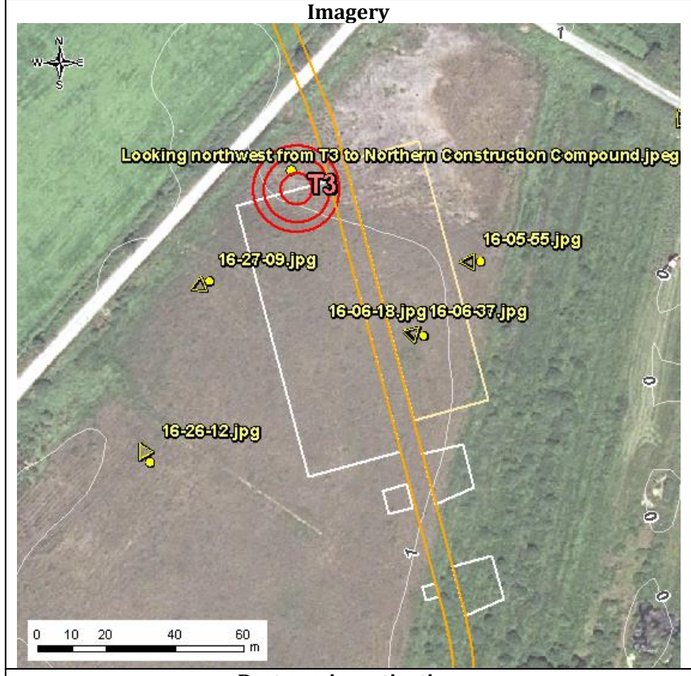
Note: There is not available ground-based imagery at the time of this draft report

T2.jpeg



Table K-3: Site reconnaissance for turbine 3

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Ground-based photos (MKO, 2021.07.02)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

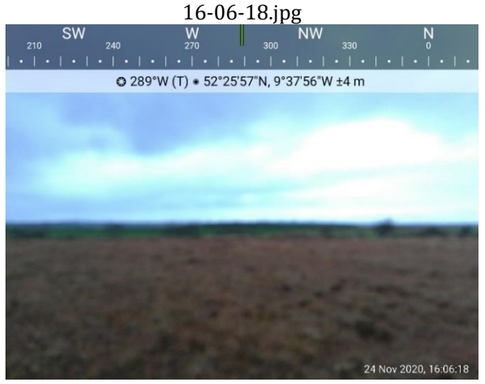
Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

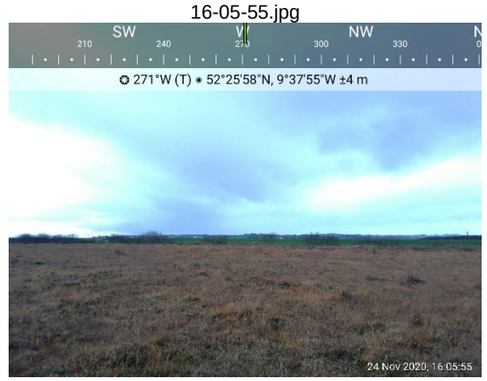
4 - 5

5 - 6.9

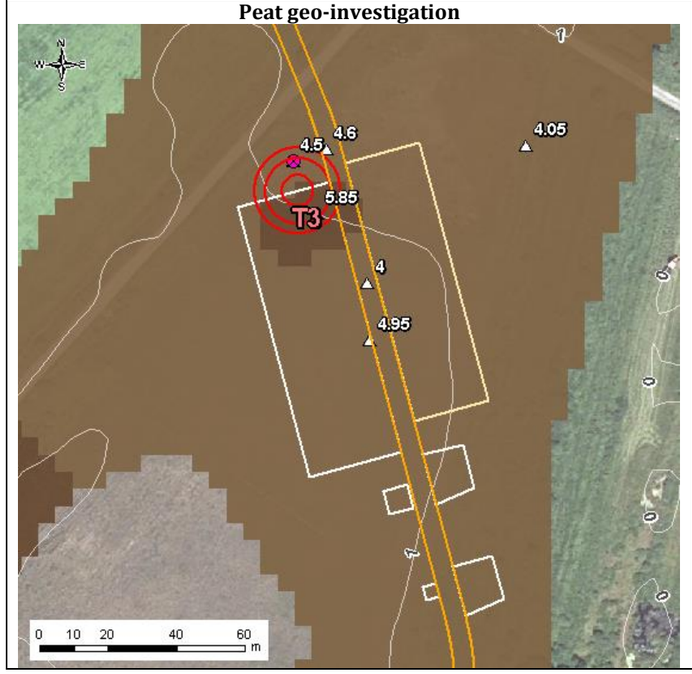
16-06-18.jpg



16-05-55.jpg



Peat geo-investigation

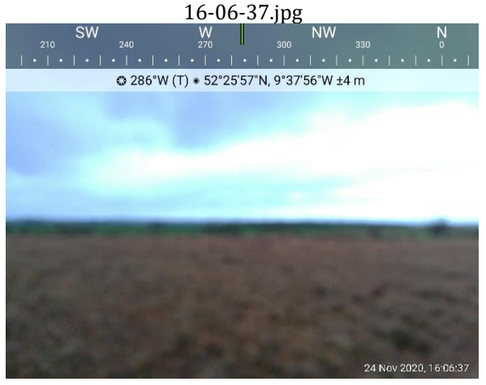


Description

Geomorphology: The topography is mainly flat and the elevation is around 1 masl.

Peat: The peat depth fluctuates between 4.5 and 5.85 m at the T3 site and 4.95 m at the crane hardstand site. This area of peat appears flat with few steps or cuttings within it.

16-06-37.jpg

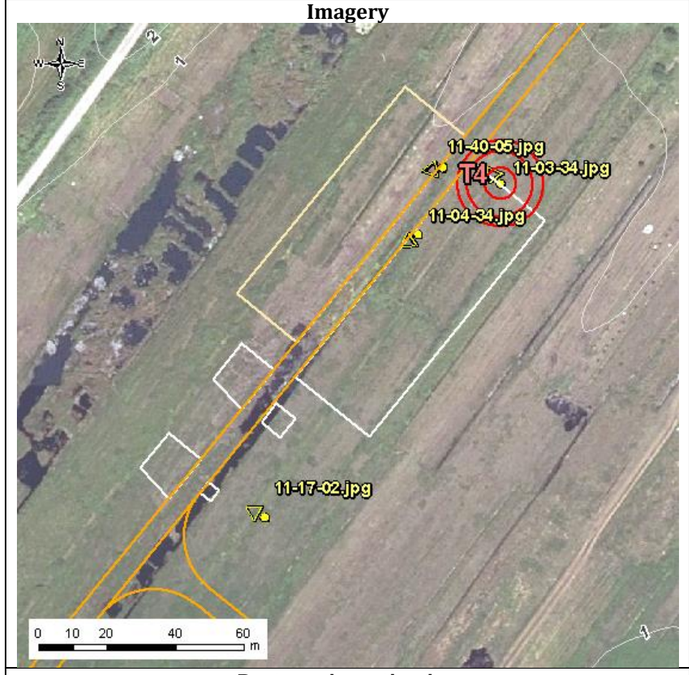


Looking northwest from T3 to Northern Construction Compound.jpeg



Table K-4: Site reconnaissance for turbine 4

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

2 - 3

3 - 4

4 - 5

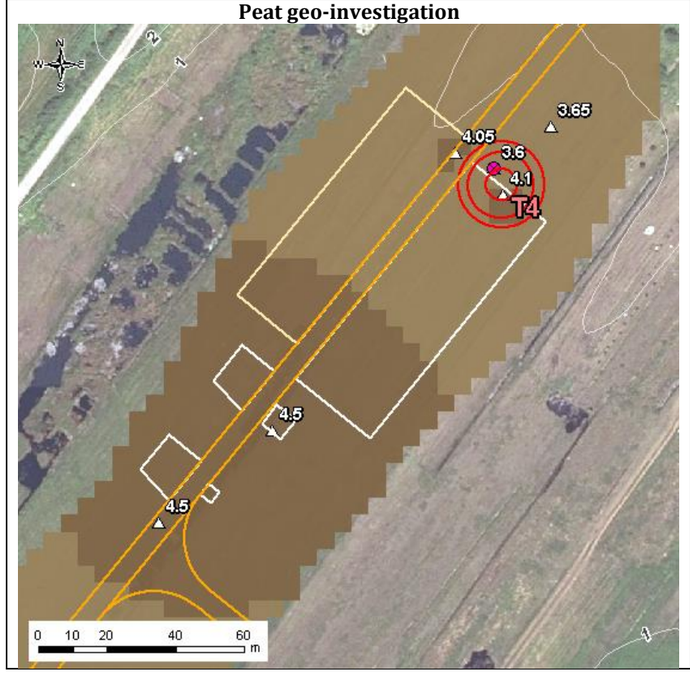
11-03-34.jpg



11-04-34.jpg



Peat geo-investigation



Description

Geomorphology: The topography is mainly flat and the elevation fluctuates around 1 masl. There are some ponded zones at the time of the walkover.

Peat: The peat depth is 3.6 m at the T4 site and increases up to 4.5 m towards the crane hardstand site. The peat in this area has been heavily cut, with drains and cutting throughout. Some areas here may have been cut recently but most of the area appears to have not been cut in some time.

11-40-05.jpg

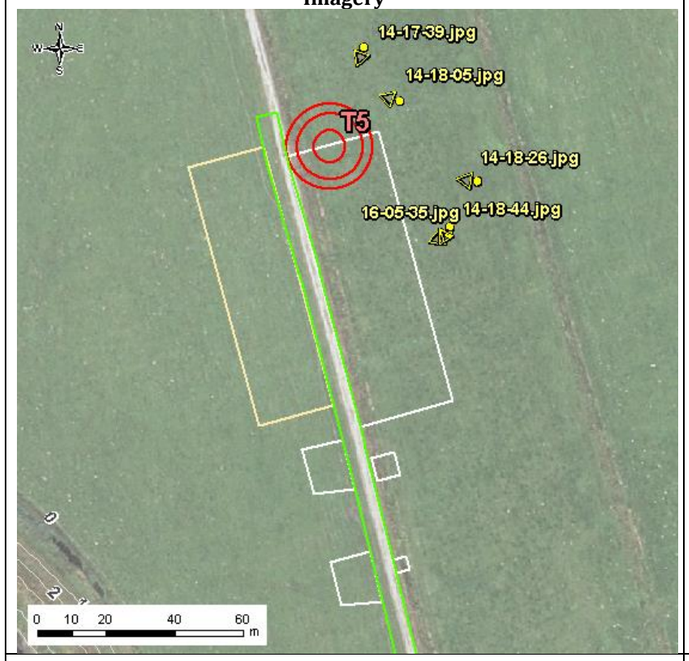


11-17-02.jpg



Table G-K-5: Site reconnaissance for turbine 5

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Existing Road To Be

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

3 - 4

4 - 5

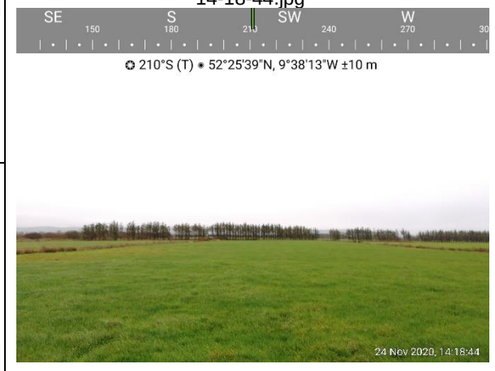
14-17-39.jpg



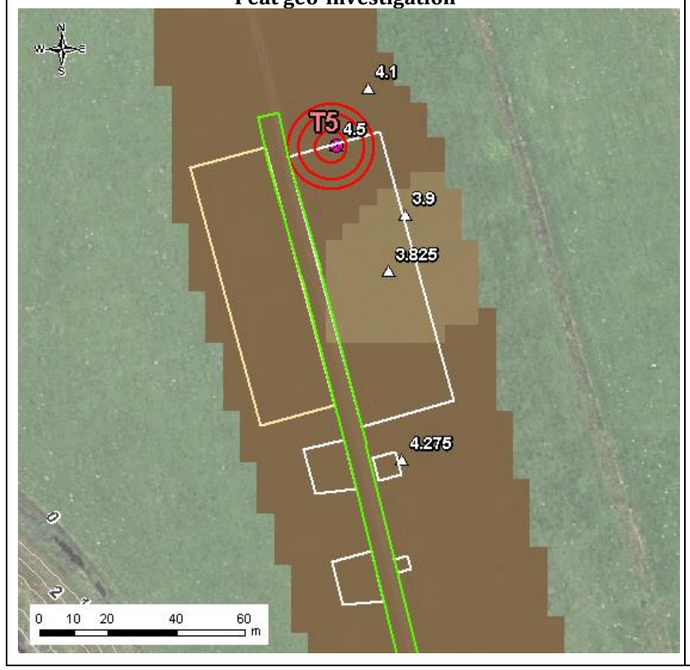
14-18-05.jpg



14-18-44.jpg



Peat geo-investigation



Description

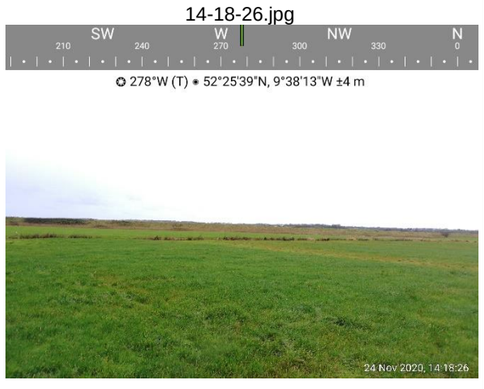
Geomorphology: The topography is mainly flat and the elevation fluctuates around 0 masl. There are some ponded zones at the time of the walkover.

There is a drain west of the T5 site, this drain was flooded at the time of the visit,

Peat: The peat depth is 4.5 m at the T5 site and 3.83 m at the crane hardstand site. It increases to the south up to 4.28 m.

Peat is not harvested at this site and the peat is covered by grass. It is likely that this area is reclaimed with a topsoil layer for agricultural use.

14-18-26.jpg

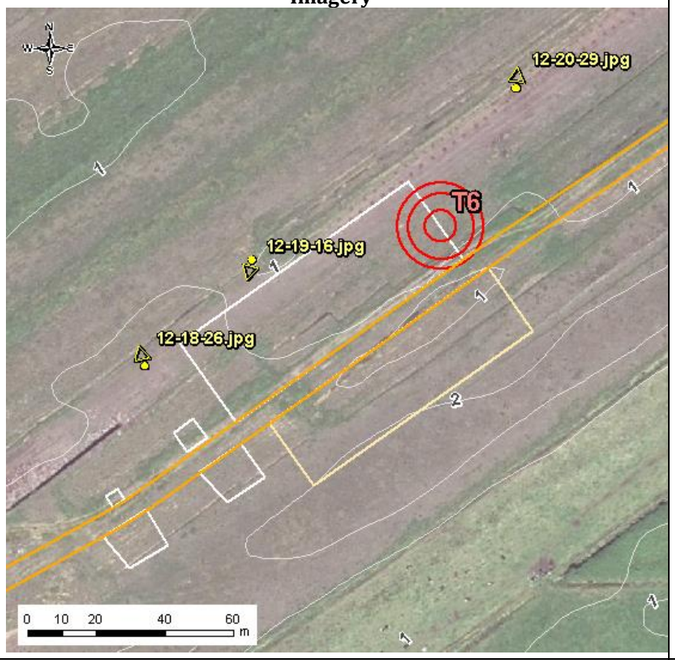


16-05-35.jpg



Table K-6: Site reconnaissance for turbine 6

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

3 - 4

4 - 5

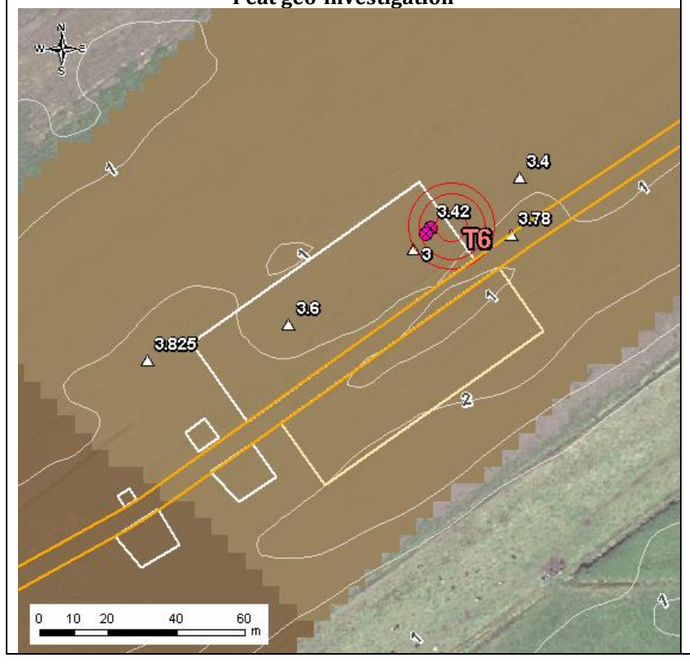
12-19-16.jpg



12-20-29.jpg



Peat geo-investigation



Description

Geomorphology: The topography is mainly flat and the elevation fluctuates around 1 masl. There are some ponded zones at the time of the walkover. There are several narrow (0.4 – 0.6m wide) drains cut in the peat orientated in a northeast to southwest direction. These drains are approximately 1 – 1.2m deep.

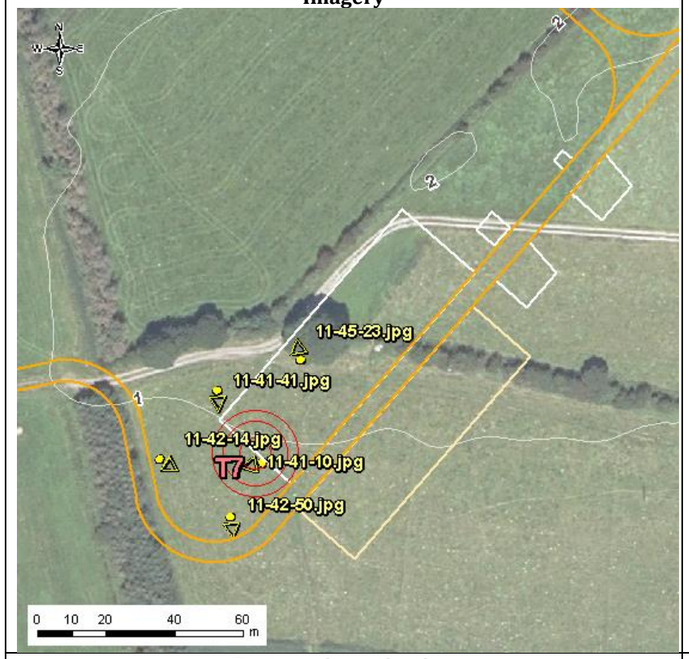
Peat: The peat depth is 3.42 m at the T6 site and 3.6 m at the crane hardstand site. The peat at this location has been heavily cut, with several cutting ledges at the turbine location approximately 0.5m in height.

12-18-26.jpg



Table K-7: Site reconnaissance for turbine 7

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

-Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Contours 1 m (Bluesky, 2021.04)

Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

0 - 1

1 - 2

11-41-10.jpg



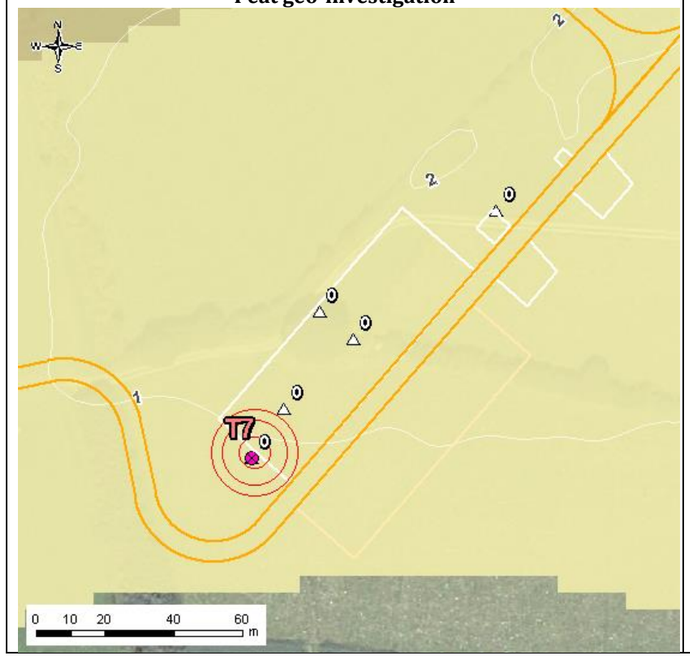
11-41-41.jpg



11-42-14.jpg



Peat geo-investigation



Description

Geomorphology: The topography is mainly flat and the elevation fluctuates between 1 and 2 masl. There are some ponded zones at the time of the walkover.

Peat: The peat depth is 4.5 m at the T5 site and 3.83 m at the crane hardstand site. It increases to the south up to 4.28 m.

Peat is not harvested at this site and the peat is covered by grass. It is likely that this area is reclaimed with a topsoil layer for agricultural use

11-45-23.jpg

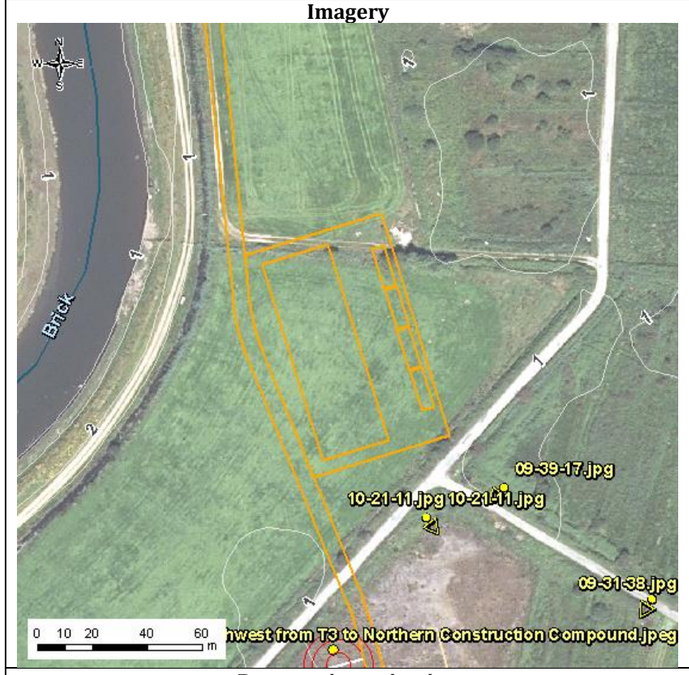


11-42-50.jpg



Table K-8: Site reconnaissance for the northern construction compound

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

- -Proposed Roads
- -Construction Compound
- -Crane Platform (Hardstanding)
- -Soft Levelled
- -Turbine Foundation

Ground-based photos (GDG, 2020, 2021)

Ground-based photos (MKO, 2021.07.02)

Contours 1 m (Bluesky, 2021.04)

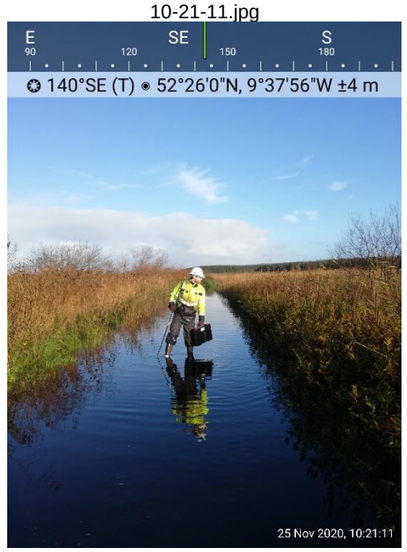
Shear vanes Exe1 and Exe2 (kPa) (11) (GDG, 2021.03.16)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

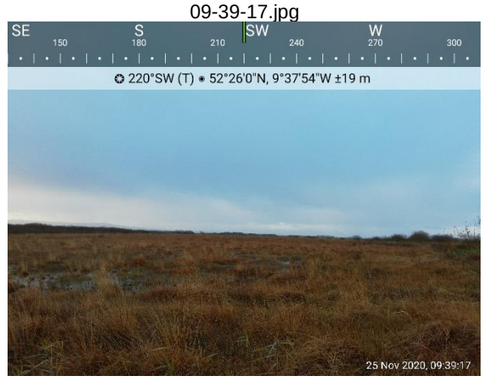
Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 6.9

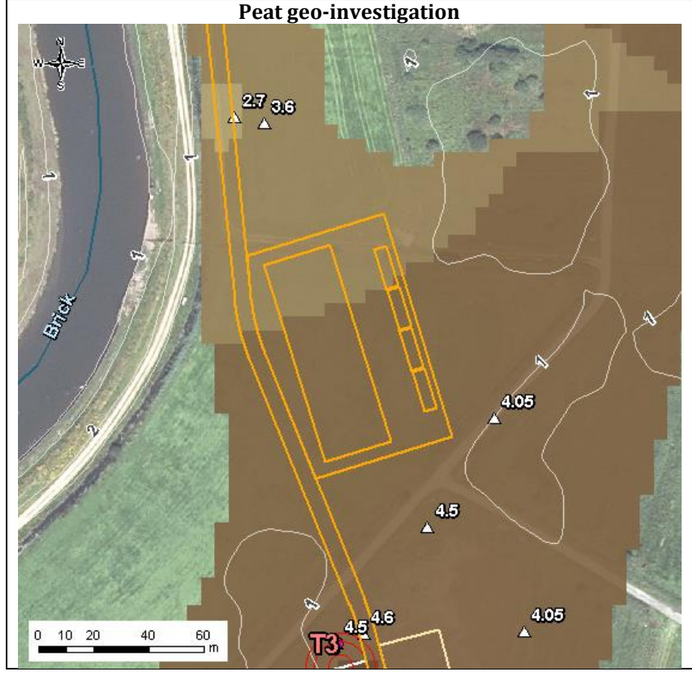
10-21-11.jpg



09-39-17.jpg



Peat geo-investigation



Description

Geomorphology: The topography is mainly flat and the elevation fluctuates between 0 and 1 masl.

Peat: No probing locations have been carried out at the location. The peat depth is estimated as3-4.5m, based on extrapolated neighbouring probes.

The area of the compound is on grass, likely reclaimed for agricultural use by the addition of a topsoil layer over the underlying peat.

The field is in an area within the flood defences embankment and may be liable to regular season flooding.

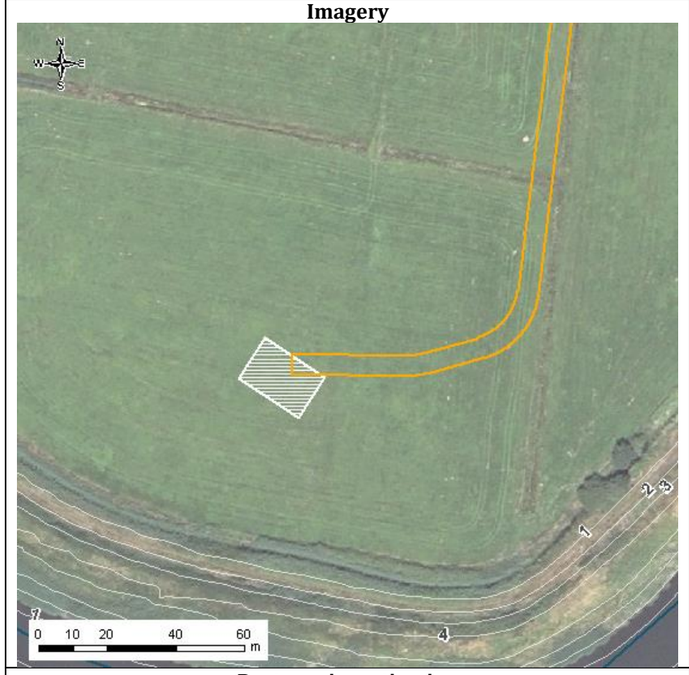
Note: There have been no ground-based investigations carried out at this location.

Looking northwest from T3 to Northern Construction Compound.jpeg



Table K-9: Site reconnaissance for the met mast

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Proposed Roads

-Met Mast Platform

Contours 1 m (Bluesky, 2021.04)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

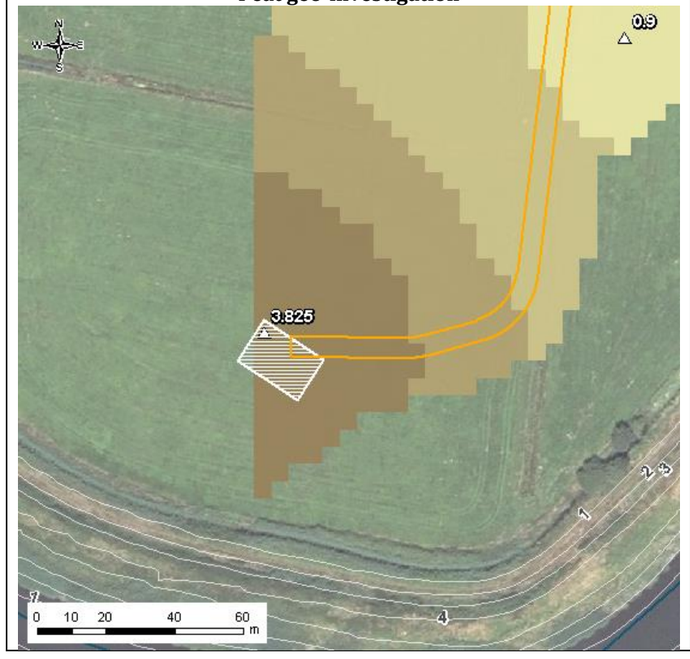
0 - 1

1 - 2

2 - 3

3 - 4

Peat geo-investigation



Description

Geomorphology: The topography is flat and the elevation is 0.3 masl.

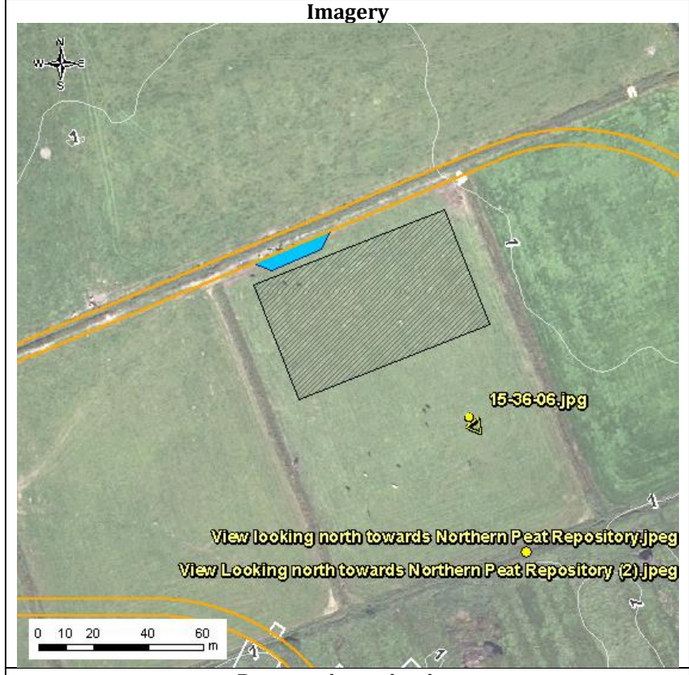
Peat: The peat depth is 3.83 m.

Peat is not harvested at this site and the peat is covered by grass. It is likely that this area is reclaimed with a topsoil layer for agricultural use

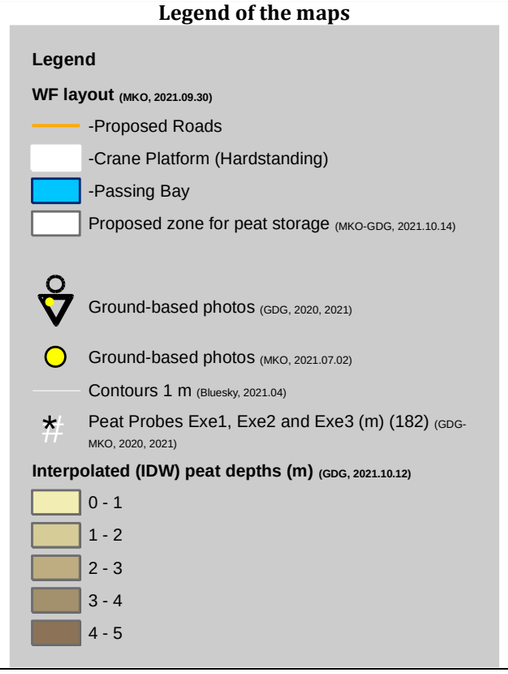
Note: There have been no ground-based investigations carried out at this location.

Table K-10: Site reconnaissance for the northern peat storage area

Imagery



Legend of the maps



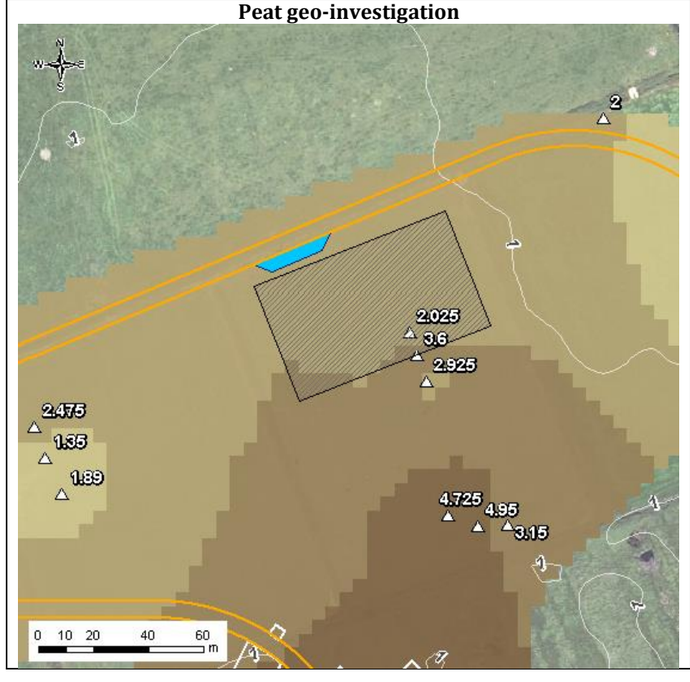
15-36-06.jpg



View looking north towards Northern Peat Repository.jpeg



Peat geo-investigation



Description

Geomorphology: The topography is flat and the elevation is around 0.7 masl.

Peat: The peat depth varies between 2.02 and 3.6 m.

Peat is not harvested at this site and the peat is covered by grass. It is likely that this area is reclaimed with a topsoil layer for agricultural use. There were cattle in these fields during the March field visit.

This area is adjacent to the flood defence embankment, and it is likely that it may be liable occasional or season flooding. There was some evidence of wet areas, and flooding in these fields such as changes in the type of grass and weeds, and soft surface areas.

09-14-36-42.jpg

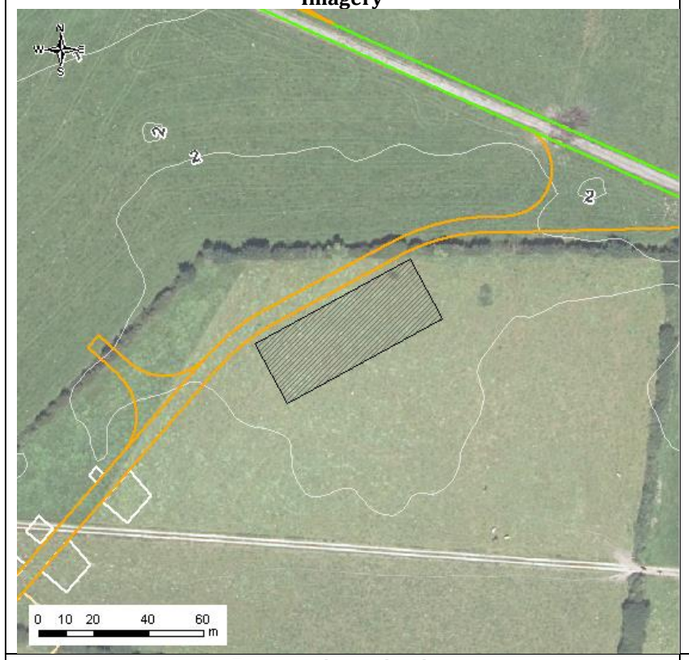


View looking north towards Southern Peat Repository.jpeg



Table K-11: Site reconnaissance for the southern peat storage area

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Existing Road To Be

-Proposed Roads

-Crane Platform (Hardstanding)

-Soft Levelled

Proposed zone for peat storage (MKO-GDG, 2021.10.14)

Contours 1 m (Bluesky, 2021.04)

Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)

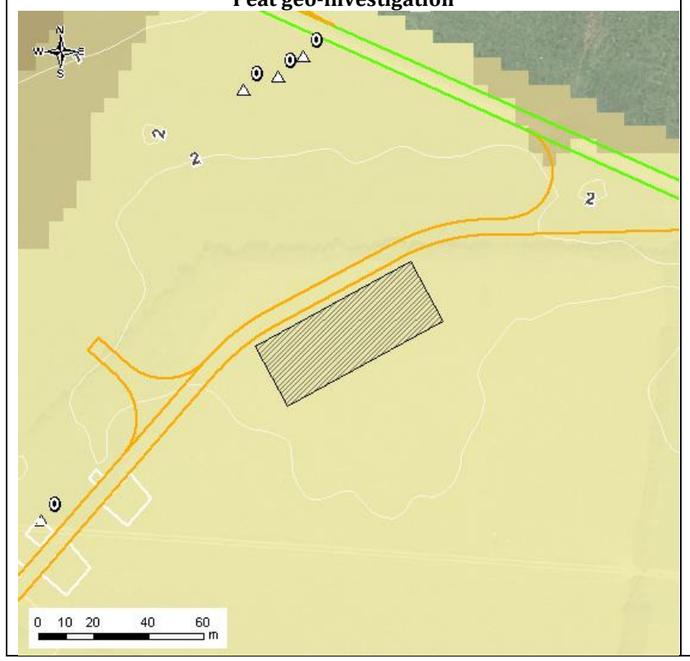
Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

0 - 1

1 - 2

2 - 3

Peat geo-investigation



Description

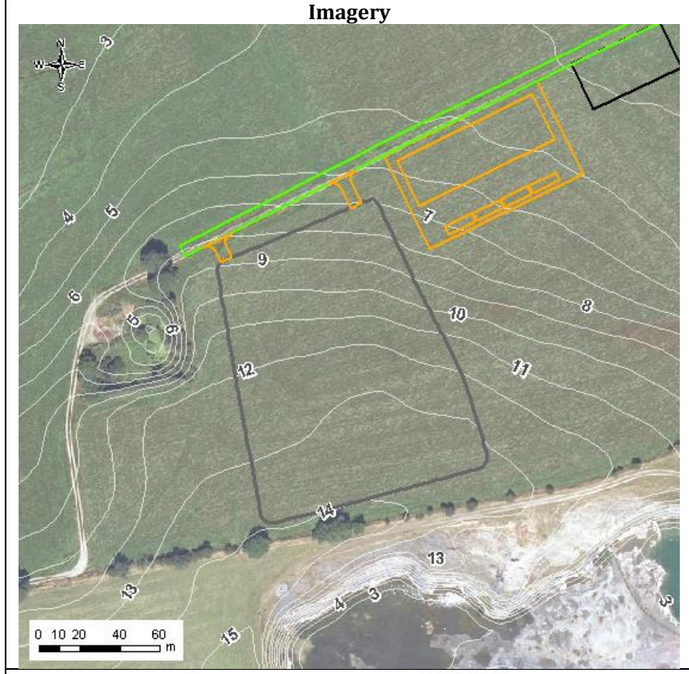
Geomorphology: The topography is flat and the elevation fluctuates between 1 and 2 masl.

Peat: As per the surrounding peat depths (0 m), the peat depth at the zone for peat storage must be 0 m too.

Note: There have been no ground-based investigations carried out at this location as this zone for peat storage was proposed after fiedlwork.

Table K-12: Site reconnaissance for the borrow pit

Imagery



Legend of the maps

Legend

WF layout (MKO, 2021.09.30)

-Existing Road To Be Upgraded

-Proposed Roads

-Substation Elevation

-Borrow Pit

-Construction Compound

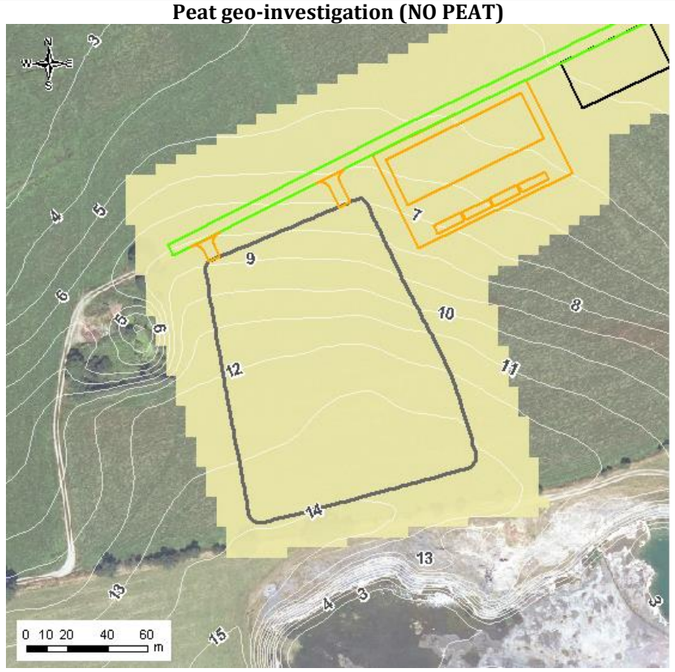
-Substation Elevation

Contours 1 m (Bluesky, 2021.04)

Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)

0 - 1

Peat geo-investigation (NO PEAT)



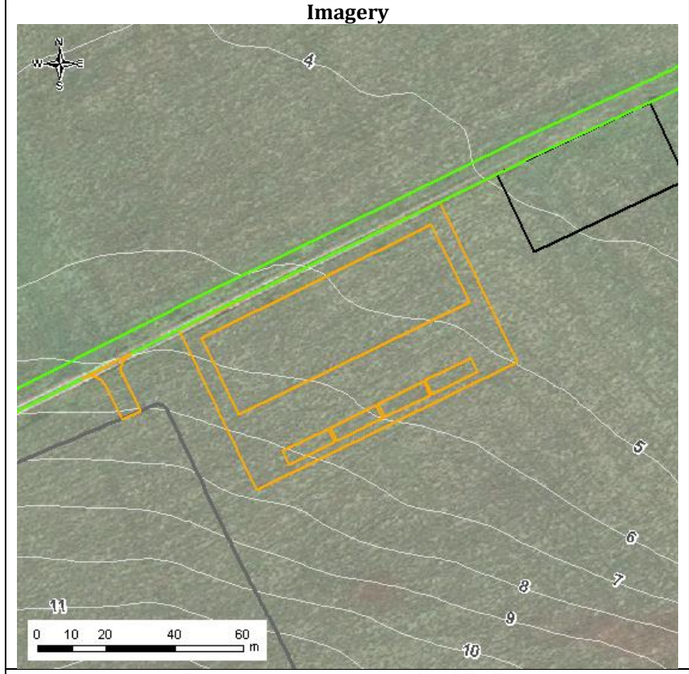
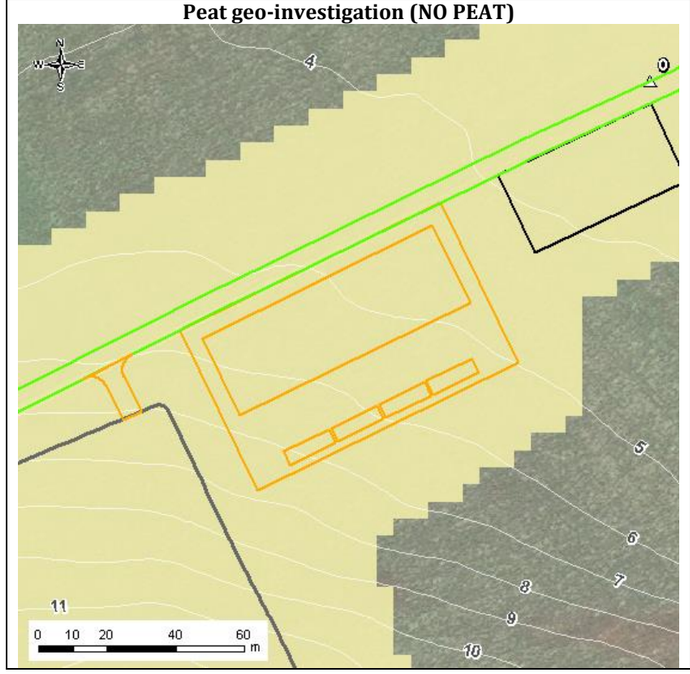
Description

Geomorphology: It is a hill slope. The elevation ranges between 6 m (north side) and 15 m (south side). The steepest slope angle is 5°. Close to the existing limestone quarry, the slope angle diminishes to 1.5°

Peat: There is no peat in this zone.

Note: There have been no ground-based investigations carried out at this location.

Table K-13: Site reconnaissance for the southern construction compound

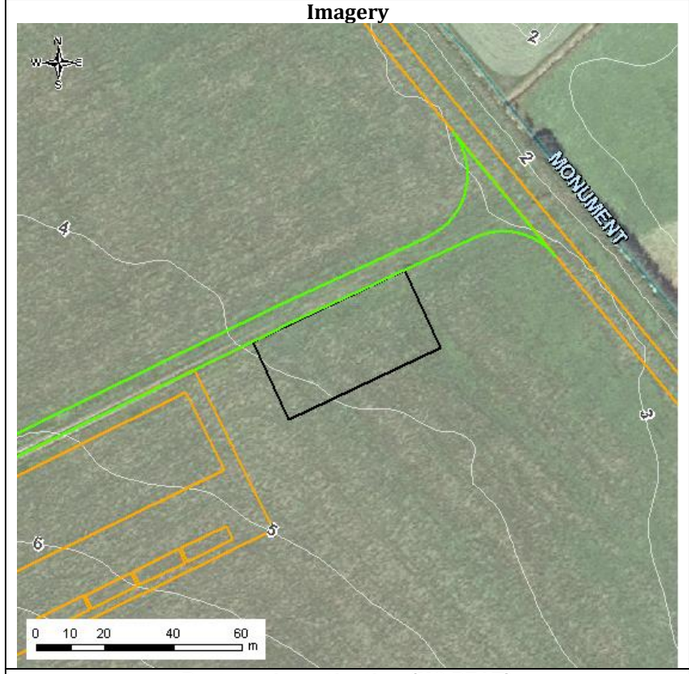
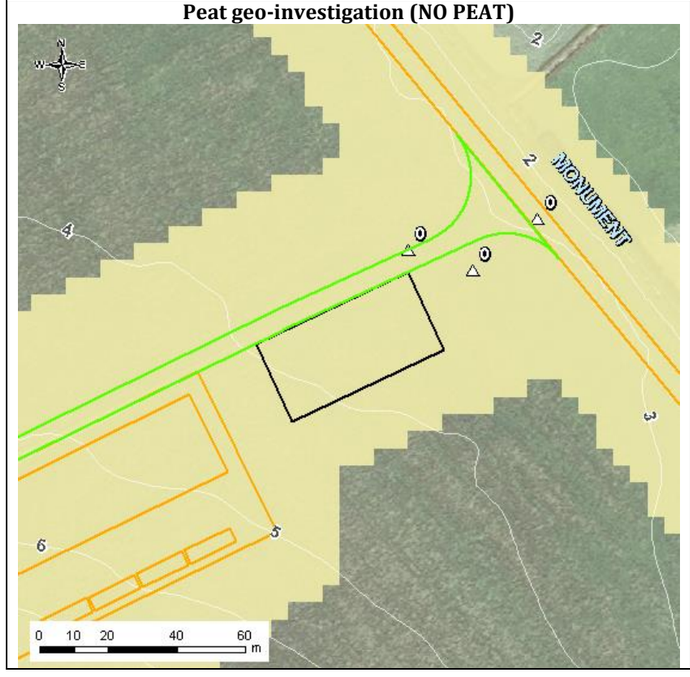
<table>
<tr>
<td>Imagery

</td>
<td>Legend of the maps
Legend
WF layout (MKO, 2021.09.30)
-Existing Road To Be
-Proposed Roads
-Substation Elevation
-Borrow Pit
-Construction Compound
-Substation Elevation
Contours 1 m (Bluesky, 2021.04)
Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021)
Interpolated (IDW) peat depths (m) (GDG, 2021.10.12)
0 - 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peat geo-investigation (NO PEAT)

</td>
<td>Description

Geomorphology: It is a hill slope. The elevation ranges between 4.5 m (north side) and 8 m (south side). The slope angle is lower than 3.5°.

Peat: There is no peat in this zone.

Note: There have been no ground-based investigations carried out at this location.</td>
<td></td>
<td></td>
</tr>
</table>

Table K-14: Site reconnaissance for the substation

Imagery 	**Legend of the maps** **Legend** **WF layout** (MKO, 2021.09.30) -Existing Road To Be Upgraded -Proposed Roads -Substation Elevation -Construction Compound -Substation Elevation Contours 1 m (Bluesky, 2021.04) Peat Probes Exe1, Exe2 and Exe3 (m) (182) (GDG-MKO, 2020, 2021) **Interpolated (IDW) peat depths (m)** (GDG, 2021.10.12) 0 - 1		
Peat geo-investigation (NO PEAT) 	**Description** **Geomorphology:** It is located at the toe of a small hill. The elevation fluctuates around 4 m. The slope angle is lower than 1.5°. **Peat**: There is no peat in this zone. **Note**: There have been no ground-based investigations carried out at this location.		

Appendix L Factor of Safety

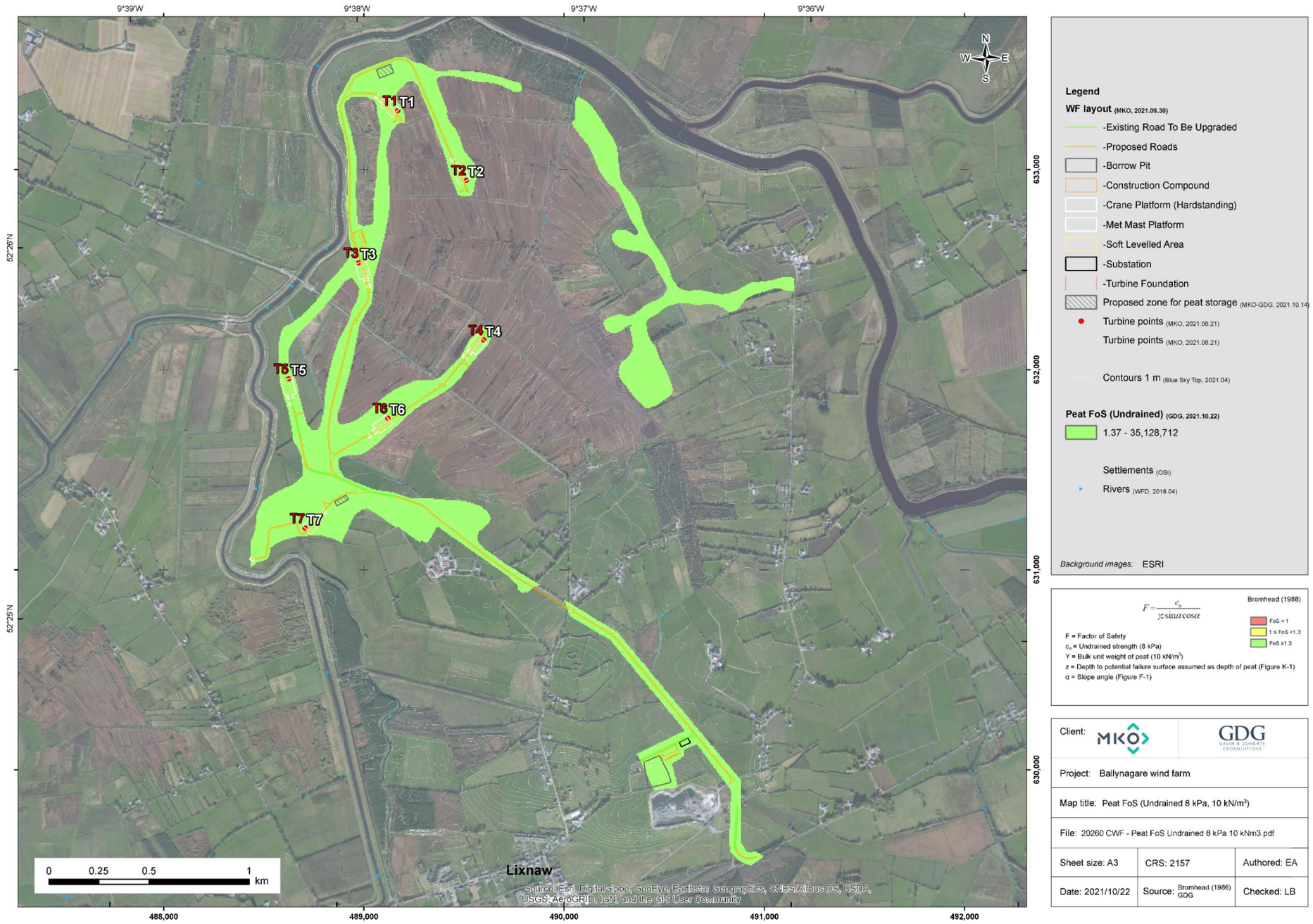


Figure L-1: FoS for undrained conditions

Note: According to the Bromhead equation, zones with no peat exhibit a peat FoS = ∞. This explains the gaps of FoS values in some zones of the surveyed area. Small groups of yellow and red pixels correspond to small flanks of drainages.

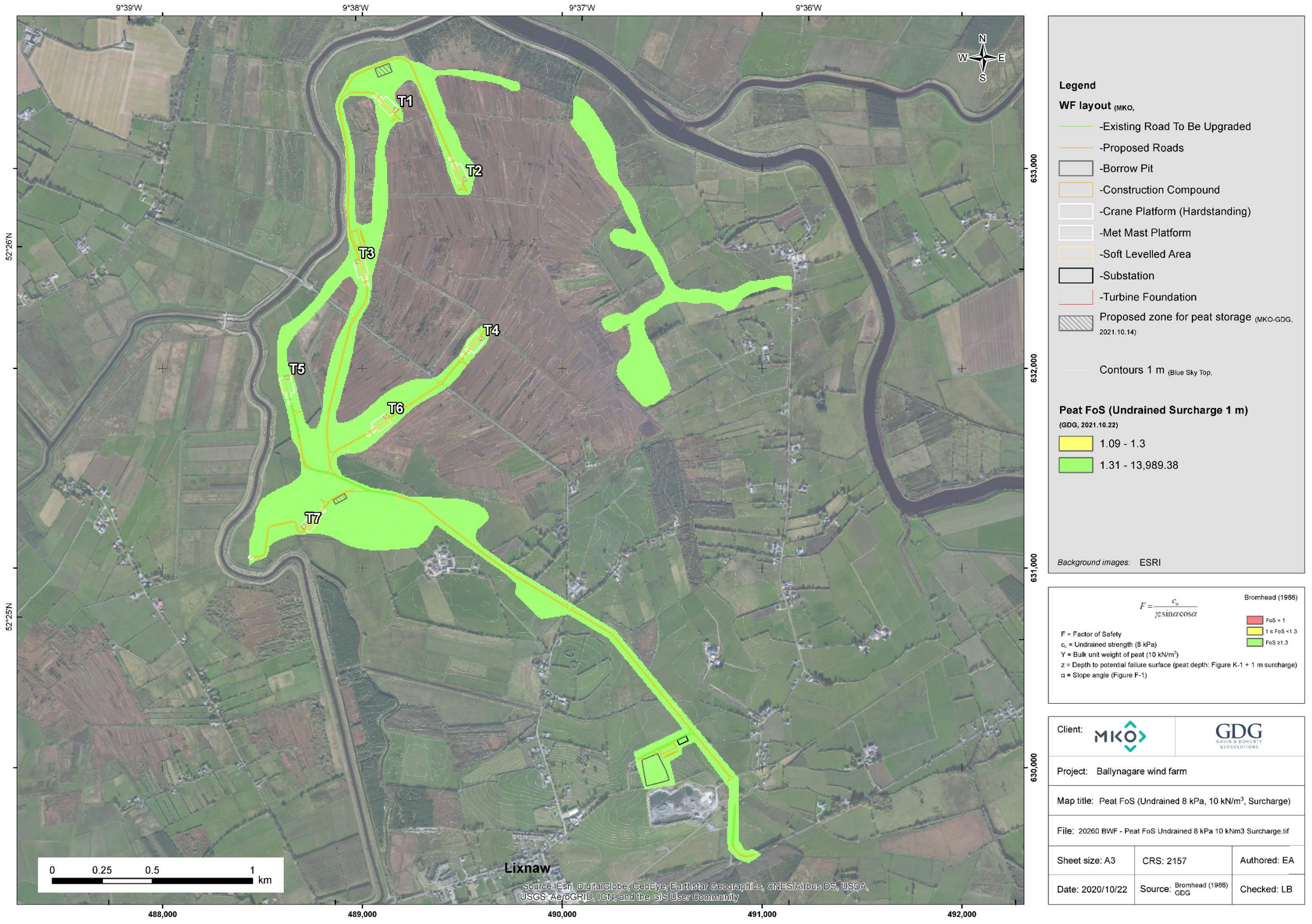

9°39'W
9°38'W
9°37'W
9°36'W
52°26'N
52°25'N
633,000
632,000
631,000
630,000
488,000
489,000
490,000
491,000
492,000
N
W
E
S
T1
T2
T3
T4
T5
T6
T7
Lixnaw
0 0.25 0.5 1 km
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Legend
WF layout (MKO,
-Existing Road To Be Upgraded
-Proposed Roads
-Borrow Pit
-Construction Compound
-Crane Platform (Hardstanding)
-Met Mast Platform
-Soft Levelled Area
-Substation
-Turbine Foundation
Proposed zone for peat storage (MKO-GDG, 2021.10.14)
Contours 1 m (Blue Sky Top,
Peat FoS (Undrained Surcharge 1 m)
(GDG, 2021.10.22)
1.09 - 1.3
1.31 - 13,989.38
Background images: ESRI
Bromhead (1986)
$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$
FoS < 1
1 ≤ FoS <1.3
FoS ≥1.3
F = Factor of Safety
c_u = Undrained strength (8 kPa)
Y = Bulk unit weight of peat (10 kN/m³)
z = Depth to potential failure surface (peat depth: Figure K-1 + 1 m surcharge)
α = Slope angle (Figure F-1)
Client: MKO GDG
Project: Ballynagare wind farm
Map title: Peat FoS (Undrained 8 kPa, 10 kN/m³, Surcharge)
File: 20260 BWF - Peat FoS Undrained 8 kPa 10 kNm3 Surcharge.tif
Sheet size: A3
CRS: 2157
Authored: EA
Date: 2020/10/22
Source: Bromhead (1986) GDG
Checked: LB

Figure L-2: FoS for undrained conditions and surcharge of 1 m

Table 6-1: FoS for undrained conditions with and without surcharge at the central pixels of the key proposed infrastructures

Proposed infrastructure	Slope (º)	Cos Slope	Sin Slope	Undrained shear strength Cu (kPa)	Bulk unit weight of Peat Y (kN/m^3)	Peat depth (m)	Factor of Safety	Surcharge (m)	FoS surcharge
BWF T1	0.1557	1.000	0.003	8	10	4.061959	**72.49**	1	**58.17**
BWF T2	0.7543	1.000	0.013	8	10	4.214168	**14.42**	1	**11.66**
BWF T3	1.1783	1.000	0.021	8	10	5.201217	**7.48**	1	**6.27**
BWF T4	0.5687	1.000	0.010	8	10	3.628692	**22.21**	1	**17.41**
BWF T5	0.8938	1.000	0.016	8	10	4.499726	**11.40**	1	**9.33**
BWF T6	1.114	1.000	0.019	8	10	3.501858	**11.75**	1	**9.14**
BWF T7	1.4744	1.000	0.026	8	10	0.002153	**14445.85**	1	**31.04**
Substation	0.3765	1.000	0.007	8	10	0	**NA**	1	**NA**
Compound north	0.7783	1.000	0.014	8	10	3.5	**16.83**	1	**13.09**
Compound south	2.099	0.999	0.037	8	10	0	**NA**	1	**NA**

$$F = \frac{c_u}{\gamma z \sin\alpha \cos\alpha}$$

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

Note: The wind farm layout was modified after the two walkovers and corresponding peat probe campaigns. As a result, the turbine no.1 and the construction compound north have no peat depth data. Interpolated values have been adopted despite the interpolated distance is significatively high. For a final report, it is recommended to carry out a third peat probe campaign across these un-probed sites.

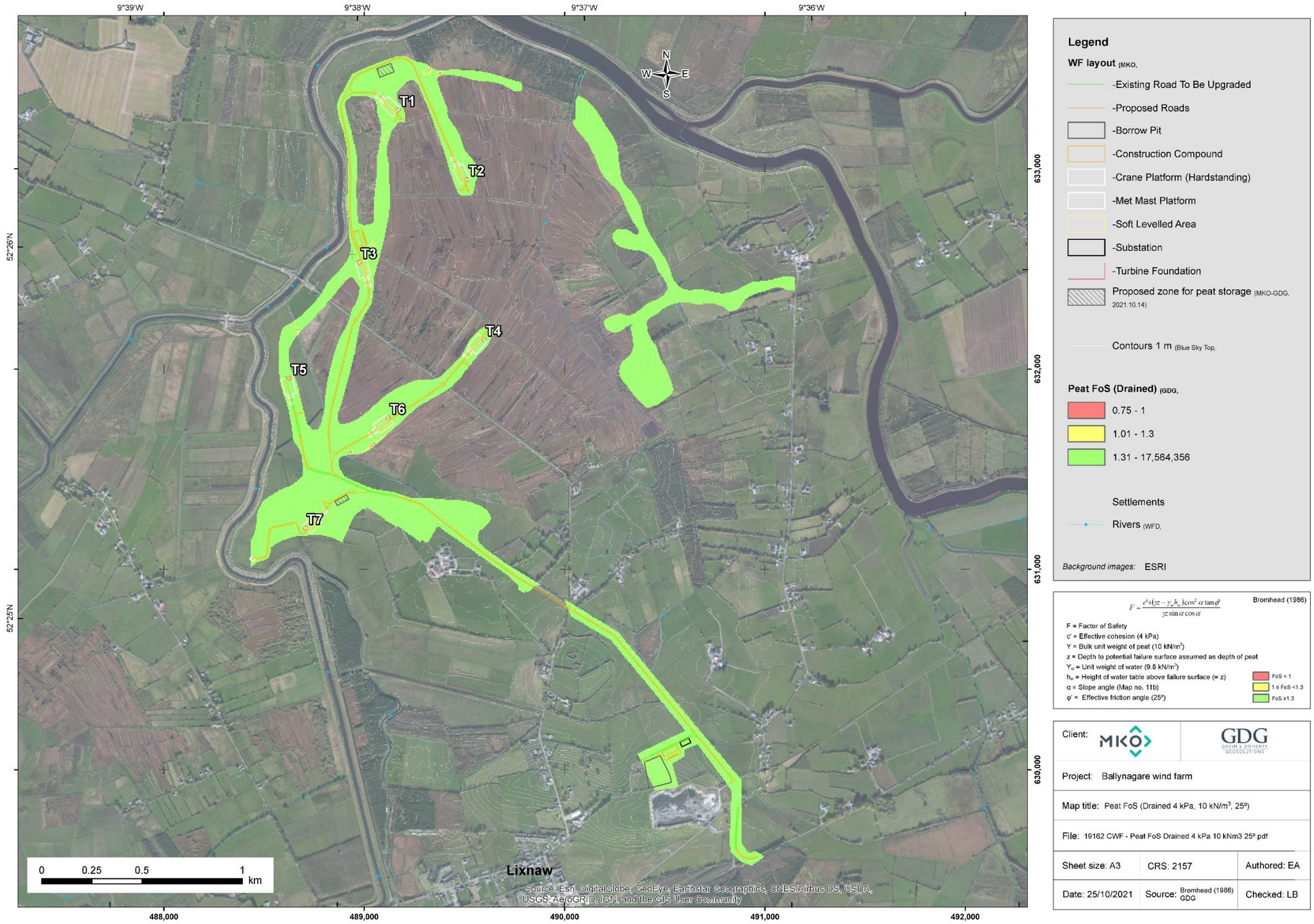


Figure L-3: FoS for drained conditions

Note: According to the Bromhead equation, zones with no peat exhibit a peat FoS = ∞. This explains the gaps of FoS values in some zones of the surveyed area. Small groups of yellow and red pixels correspond to small flanks of drainages.

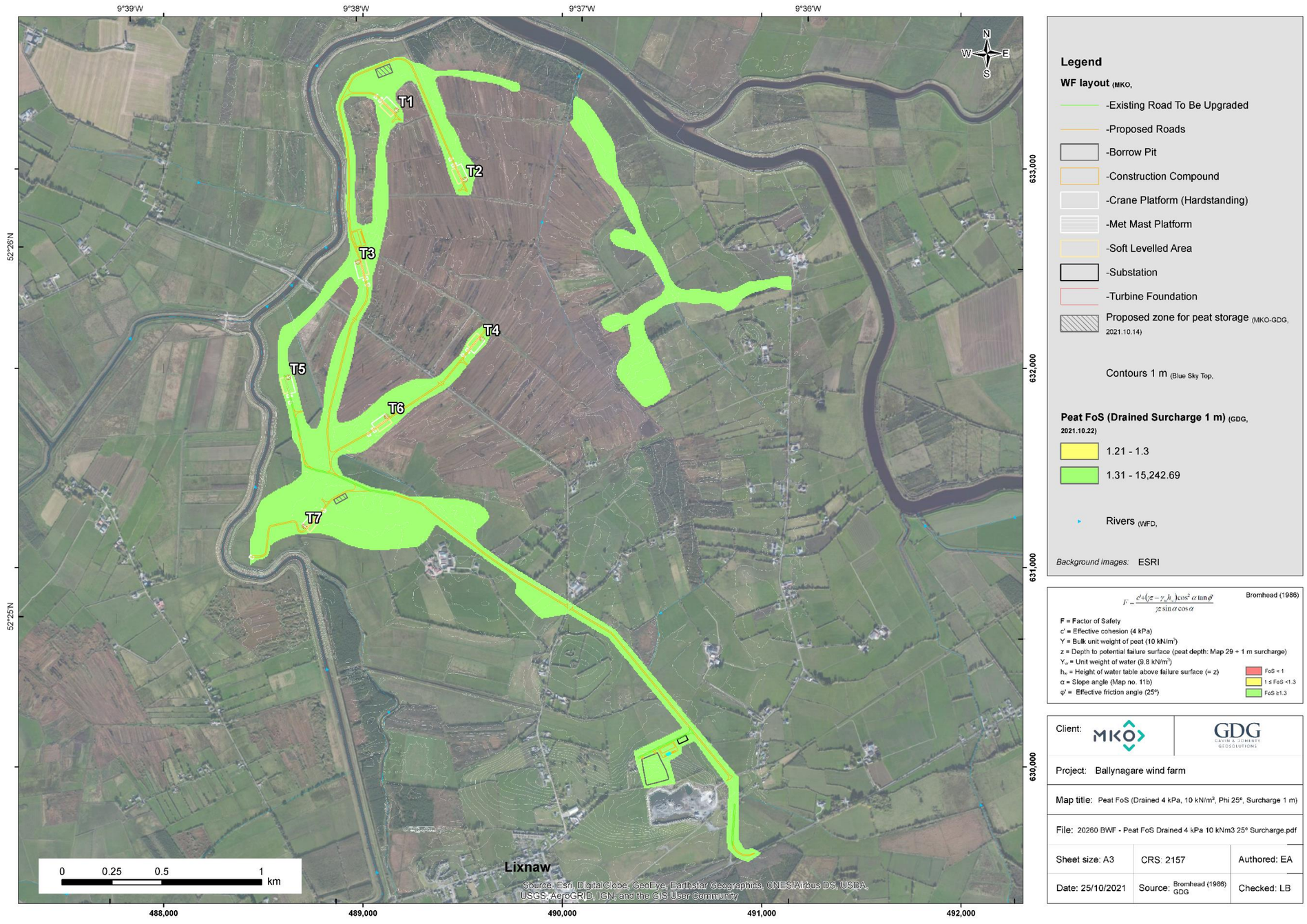


Figure L-4: FoS for drained conditions and surcharge of 1 m

Note: According to the Bromhead equation, zones with no peat exhibit a peat FoS = ∞. This explains the gaps of FoS values in some zones of the surveyed area. Small groups of yellow and red pixels correspond to small flanks of drainages.

Table 6-2: FoS for drained conditions with and without surcharge at the central pixels of the key proposed infrastructures

Proposed infrastructure	Drained shear strength Cu (kPa)	Bulk unit weight of Peat Y (kN/m^3)	Peat depth (clipped) (m)	Bulk unit weight of water Y (kN/m^3)	Height of water table above failure surface (m)	Slope (º)	Cos Slope	Sin Slope	ϕ'	Tan ϕ'	**FoS**	Surcharge (m)	**FoS Surcharge**
BWF T1	4	10	4.061959	9.8	4.061959	0.155667	1.000	0.003	25	0.466	**39.68**	1	**65.75**
BWF T2	4	10	4.214168	9.8	4.214168	0.754307	1.000	0.013	25	0.466	**7.92**	1	**13.19**
BWF T3	4	10	5.201217	9.8	5.201217	1.178308	1.000	0.021	25	0.466	**4.19**	2	**9.33**
BWF T4	4	10	3.628692	9.8	3.628692	0.568702	1.000	0.010	25	0.466	**12.05**	3	**27.86**
BWF T5	4	10	4.499726	9.8	4.499726	0.893845	1.000	0.016	25	0.466	**6.30**	4	**17.40**
BWF T6	4	10	3.501858	9.8	3.501858	1.113966	1.000	0.019	25	0.466	**6.36**	5	**16.72**
BWF T7	4	10	0.002153	9.8	0.002153	1.474406	1.000	0.026	25	0.466	**7223.29**	6	**20.70**
Substation	4	10	0	9.8	0	0.376533	1.000	0.007	25	0.466	**NA**	7	**NA**
Compound north	4	10	3.5	9.8	3.5	0.778335	1.000	0.014	25	0.466	**9.10**	1	**14.71**
Compound south	4	10	0	9.8	0	2.09898	0.999	0.037	25	0.466	**NA**	1	**NA**

$$F = \frac{c' + (\gamma z - \gamma_w h_w)\cos^2\alpha \tan\phi'}{\gamma z \sin\alpha \cos\alpha}$$

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

Note: The wind farm layout was modified after the two walkovers and corresponding peat probe campaigns. As a result, the turbine no.1 and the construction compound north have no peat depth data. Interpolated values have been adopted despite the interpolated distance is significatively high and this might lead to unlikely values. For a final report, it is recommended to carry out a third peat probe campaign across these un-probed sites.

Appendix M Peat stability risk calculation

Peat Stability Risk Assessment (PSRA)

Ballynagare renewable energy development site

Location:	**Turbine 1**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	24 to 26 of November 2020
Inspected by:	SC / TMG
Completed by:	EA
Date:	Dec-20

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			58.9	49.1	32.9	56	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~5 m. Slope angle: 0.16°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	0 - 96				NA	0 - 96	96 -135	135 - 174	1	1	1	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$ 23

Max. possible 102

Hazard $_{0\text{-}1}$ **0.23**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	Lower river Shannon SAC
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	-	NA	Farm out-houses	-	Dwelling	2	1	2	Flood defence
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$ 6

Max. possible 33

Consequences $_{0\text{-}1}$ **0.18**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.23	0.18	=	**0.04**

Table M-1: Peat risk assessment in <u>turbine 1</u> (Based on GIS only)

Peat Stability Risk Assessment (PSRA)	**Location:**	**Turbine 2**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
	Inspected by:	SC / TMG	
Ballynagare renewable energy development site	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			14.4	11.7	7.9	13.2	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 4.2 m. Slope angle: 0.75°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	0 - 96				NA	0 - 96	96 -135	135 - 174	1	1	1	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Machine cut				NA	-	Cutaway / Turbary	Machine cut	3	1	3	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$ 24

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 105

Hazard $_{0-1}$ 0.23

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	NA	NA	Non-sensitive	Sensitive	Drinking water supply	0	1	0	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$ 2

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 33

Consequences $_{0-1}$ 0.06

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.23 0.06 = **0.01**

Table M-2: Peat risk assessment in <u>turbine 2</u> (Based on GIS only)

Peat Stability Risk Assessment (PSRA)	**Location:**	**Turbine 3**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
Ballynagare renewable energy development site	Inspected by:	SC / TMG	
	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			7.5	6.3	4.2	7.2	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 5.2 m. Slope angle: 1.18°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$	24
Max. possible	105
Hazard $_{0-1}$	**0.23**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	Lower river Shannon SAC
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	-	NA	Farm out-houses	-	Dwelling	2	1	2	Flood defence
Capability to respond (access and resources)	Good	NA	Good	Fair	Poor	1	1	1	

Consequences $_{total}$	5
Max. possible	33
Consequences $_{0-1}$	**0.15**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.23	0.15	=	**0.03**

Table M-3: Peat risk assessment in <u>turbine 3</u> (Based on GIS only)

Peat Stability Risk Assessment (PSRA)	**Location:**	**Turbine 4**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
	Inspected by:	SC / TMG	
Ballynagare renewable energy development site	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value U	Value US	Value D	Value DS	0	Rating criteria 1	2	3	Rating value	Weighting	Score	Comment
Factor of Safety			1829	6.7	915	7.2	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 3.6 m. Slope angle: 0.6°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	200 - 300				NA	> 300	200 - 300	< 200	2	1	2	
		Surface moisture index (NDMI)	0 - 96				NA	0 - 96	96 -135	135 - 174	1	1	1	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	Floating				NA	Solid	-	Floating	3	1	3	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$	26
Max. possible	105
Hazard $_{0-1}$	**0.25**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	0	Rating criteria 1	2	3	Rating value	Weighting	Score	Comment
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	NA	NA	Non-sensitive	Sensitive	Drinking water supply	0	1	0	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Good	NA	Good	Fair	Poor	1	1	1	

Consequences $_{total}$	1
Max. possible	33
Consequences $_{0-1}$	**0.03**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.25	0.03	=	**0.01**

Table M-4: Peat risk assessment in turbine 4

Peat Stability Risk Assessment (PSRA)	**Location:**	**Turbine 5**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
	Inspected by:	SC / TMG	
Ballynagare renewable energy development site	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value U	Value US	Value D	Value DS	Rating criteria 0	1	2	3	Rating value	Weighting	Score	Comment
Factor of Safety			11.4	9.3	6.3	10.6	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 4.5 m. Slope angle: 0.9°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Grassland				NA	Dry heather	Grassland	Wetlands	2	1	2	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$ 22

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 105

Hazard $_{0-1}$ 0.21

Consequence factors	Value	Rating criteria 0	1	2	3	Rating value	Weighting	Score	Comment
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	Lower river Shannon SAC
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	-	NA	Farm out-houses	-	Dwelling	2	1	2	Flood defence
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$ 6

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 33

Consequences $_{0-1}$ 0.18

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.21 0.18 = **0.04**

Table M-5: Peat risk assessment in turbine 5

Peat Stability Risk Assessment (PSRA)	**Location:**	**Turbine 6**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
Ballynagare renewable energy development site	Inspected by:	SC / TMG	
	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value U	Value US	Value D	Value DS	0	1	2	3	Rating value	Weighting	Score	Comment
			Rating criteria											
Factor of Safety			1829	6.7	915	7.2	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: 3.5 m. Slope angle: 1.1°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	200 - 300				NA	> 300	200 - 300	< 200	2	1	2	
		Surface moisture index (NDMI)	96 -135				NA	0 - 96	96 -135	135 - 174	2	1	2	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Grassland				NA	Dry heather	Grassland	Wetlands	2	1	2	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$	21
Max. possible	105
Hazard $_{0-1}$	**0.20**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	0	1	2	3	Rating value	Weighting	Score	Comment
		Rating criteria							
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	NA	NA	Non-sensitive	Sensitive	Drinking water supply	0	1	0	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$	2
Max. possible	33
Consequences $_{0-1}$	**0.06**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.20	0.06	=	**0.01**

Table M-6: Peat risk assessment in turbine 6

Peat Stability Risk Assessment (PSRA)

Ballynagare renewable energy development site

Location:	**Turbine 7**
Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**
Inspected on:	24 to 26 of November 2020
Inspected by:	SC / TMG
Completed by:	EA
Date:	Dec-20

Hazard factors			Value U	Value US	Value D	Value DS	0	1	2	3	Rating value	Weighting	Score	Comment
Factor of Safety			14446	31	7223	33.6	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~0.002 m. Slope angle: 1.47°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	
												Hazard $_{total}$	22	

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 105

Hazard $_{0-1}$ 0.21

Consequence factors	Value	0	1	2	3	Rating value	Weighting	Score	Comment
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	Lower river Shannon SAC
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	-	NA	Farm out-houses	-	Dwelling	2	1	2	Flood defence
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	
							Consequences $_{total}$	6	

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 33

Consequences $_{0-1}$ 0.18

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.21 0.18 = 0.04

Table M-7: Peat risk assessment in turbine 7

Peat Stability Risk Assessment (PSRA)	**Location:**	**Proposed substation site**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
Ballynagare renewable energy development site	Inspected by:	SC / TMG	
	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			NA	NA	NA	NA	-	≥ 1.3	1.3 - 1.0	≤ 1.0	0	10	0	Peat depth: 0 m. Slope angle: 0.37°
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	> 300				NA	> 300	200 - 300	< 200	1	1	1	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Ponded in drains				NA	Localised	Ponded in drains	Springs	2	1	2	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$ 11

Max. possible 105

Hazard $_{0-1}$ **0.10**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	NA	NA	Non-sensitive	Sensitive	Drinking water supply	0	1	0	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	NA	NA	Good	Fair	Poor	0	1	0	

Consequences $_{total}$ 0

Max. possible 33

Consequences $_{0-1}$ **0.00**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.10	0.00	=	**0.00**

Table M-8: Peat risk assessment in central pixel of substation

Peat Stability Risk Assessment (PSRA)	**Location:**	**Temporary compound site north**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
Ballynagare renewable energy development site	Inspected by:	SC / TMG	
	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			16.8	13.1	9.1	14.7	-	≥ 1.3	1.3 - 1.0	≤ 1.0	1	10	10	Peat depth: ~3.5 m. Slope angle: 0.78°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	NA				NA	> 300	200 - 300	< 200	0	1	0	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	Localised				NA	Localised	Ponded in drains	Springs	1	1	1	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	Varied / Oblique				NA	Down slope	Varied / Oblique	Across slope	2	1	2	
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Wetlands				NA	Dry heather	Grassland	Wetlands	3	1	3	
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	
	Peat workings	Peat cuts presence	Cutaway / Turbary				NA	-	Cutaway / Turbary	Machine cut	2	1	2	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$	23
Max. possible	105
Hazard $_{0-1}$	**0.22**

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Consequence factors	**Value**	**Rating criteria**				**Rating value**	**Weighting**	**Score**	**Comment**
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	Sensitive	NA	Non-sensitive	Sensitive	Drinking water supply	2	1	2	Lower river Shannon SAC
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	-	NA	Farm out-houses	-	Dwelling	2	1	2	Flood defence
Capability to respond (access and resources)	Fair	NA	Good	Fair	Poor	2	1	2	

Consequences $_{total}$	6
Max. possible	33
Consequences $_{0-1}$	**0.18**

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Risk rating

Risk		**Action required**
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating =	Hazard *	Consequences		
Risk rating =	0.22	0.18	=	**0.04**

Table M-9: Peat risk assessment in central pixel of construction compound north (Based on GIS only)

Peat Stability Risk Assessment (PSRA)	**Location:**	**Temporary compound site south**	
	Conditions:	**Undrained (U), undrained surcharge (US), drained (D), drained surcharge (DS)**	
	Inspected on:	24 to 26 of November 2020	
	Inspected by:	SC / TMG	
Ballynagare renewable energy development site	Completed by:	EA	
	Date:	Dec-20	

Hazard factors			Value				Rating criteria				Rating value	Weighting	Score	Comment
			U	US	D	DS	0	1	2	3				
Factor of Safety			NA	NA	NA	NA	-	≥ 1.3	1.3 - 1.0	≤ 1.0	0	10	0	Peat depth: 0 m. Slope angle:2.1°.
Secondary factors	Slide history	Distance to previous slides (km)	NA				NA	5 - 10	< 5	On site	0	2	0	
		Evidence of peat movement (e.g. tension cracks, step features, compression features).	NA				NA	-	-	Yes	0	2	0	
	Topography	General curvature downslope	NA				NA	-	Planar	Convex	0	1	0	
		Distance to the convexity break (only if previous factor is Convex)	NA				NA	> 100 m	50 - 100 m	< 50 m	0	1	0	
		Slope aspect (for high latitudes in northern hemisphere)	NA				NA	SW, S, SE	W, E	NW, N, NE	0	1	0	
	Hydrology	Distance from watercourse (m)	NA				NA	> 300	200 - 300	< 200	0	1	0	
		Surface moisture index (NDMI)	135 - 174				NA	0 - 96	96 -135	135 - 174	3	1	3	
		Surface water (water table level indicator)	NA				NA	Localised	Ponded in drains	Springs	0	1	0	
		Evidence of piping (subsurface flow)	NA				NA	-	-	Yes	0	1	0	Existing hardstanding
		Significant surface desiccation (previous summer was dry?)	NA				NA	-	-	Yes	0	1.5	0	
		Existing drainage ditches	NA				NA	Down slope	Varied / Oblique	Across slope	0	1	0	Road and hardstanding ditches
		Annual rainfall	1000 - 1400 mm/yr				NA	< 1000 mm/yr	1000 - 1400 mm/yr	> 1400 mm/yr	2	1	2	
	Vegetation	Bush	Grassland				NA	Dry heather	Grassland	Wetlands	2	1	2	Existing hardstanding
		Forestry (if applicable)	NA				NA	Good growth	Fair	Stunted growth	0	1.5	0	Existing hardstanding
	Peat workings	Peat cuts presence	NA				NA	-	Cutaway / Turbary	Machine cut	0	1	0	
		Peat cuts vs contour lines	NA				NA	Perpendicular	Oblique	Parallel	0	1	0	
	Existing loads	Roads	NA				NA	Solid	-	Floating	0	1	0	
	Time of year for construction		NA				NA	Spring	Winter, Early Summer	Late Summer, Autumn	0	1	0	

Hazard $_{total}$ 7

Hazard	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 105

Hazard $_{0\text{-}1}$ 0.07

Consequence factors	Value	Rating criteria				Rating value	Weighting	Score	Comment
		0	1	2	3				
Volume of potential peat flow (function of distance from nearest watercourse and peat depth in the area)	NA	NA	Small	Medium	Large	0	3	0	
Downslope hydrology features	NA	NA	Bowl / contained	Minor undefined watercourse	Valley	0	1	0	
Proximity from defined valley (m)	NA	NA	> 500	200 - 500	< 200	0	1	0	
Downhill slope angle	NA	NA	Horizontal	Intermediate	Steep	0	1	0	
Downstream aquatic environment	NA	NA	Non-sensitive	Sensitive	Drinking water supply	0	1	0	
Public roads in potential peat flow path	NA	NA	Minor road	Local road	Regional road	0	1	0	
Overhead lines in potential peat flow path	NA	NA	Phone lines	Electricity (LV)	Electricity (MV, HV)	0	1	0	
Buildings in potential peat flow path	NA	NA	Farm out-houses	-	Dwelling	0	1	0	
Capability to respond (access and resources)	NA	NA	Good	Fair	Poor	0	1	0	

Consequences $_{total}$ 0

Consequences	
0.0 - 0.3	Negligible
0.3 - 0.5	Low
0.5 - 0.7	Medium
0.7 - 1.0	High

Max. possible 33

Consequences $_{0\text{-}1}$ 0.00

Risk rating

Risk		Action required
0.00 - 0.20	Negligible	Normal site investigation
0.20 - 0.40	Low	Targeted site investigation, design of specific mitigation measures. Part time supervision during construction.
0.40 - 0.60	Medium	Avoid construction in the area if possible. If unavoidable, detailed site investigation and design of specific mitigation measures. Full time supervision during construction.
0.60 - 1.00	High	Avoid construction in this area.

Risk rating = Hazard * Consequences

Risk rating = 0.07 0.00 = **0.00**

Table M-10: Peat risk assessment in central pixel of construction compound south (Based on GIS only)

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APPENDIX 9.1

FLOOD RISK ASSESSMENT

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PROPOSED WINDFARM DEVELOPMENT AT BALLYNAGARE, CO. KERRY

SITE SPECIFIC FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:
EMPower

Prepared by:
Hydro-Environmental Services

DOCUMENT INFORMATION

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Author(s):	**MICHAEL GILL** **CONOR MCGETTIGAN**
Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

Disclaimer:
This report has been prepared by HES with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client, and others in respect of any matters outside the scope of the above. The flood risk assessment undertaken as part of this study is site-specific, and the report findings cannot be applied to other sites outside of the survey area which is defined by the site boundary. This report is confidential to the client, and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO), acting on behalf of EMPower, to undertake a Stage II Flood Risk Assessment (FRA) for a proposed windfarm development at Ballynagare, Co. Kerry. A site location map is shown below as **Figure A.**

The proposed development at the site is a 7 no. turbine wind farm and associated access tracks, 2 no. construction compounds, 1 no. met mast, substation, borrow pit and other ancillary works. The proposed development also includes a proposed grid connection route between the proposed on-site substation and the 100kV substation at Clahane.

This FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009).

1.2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services ("HES") are a specialist hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core area of expertise and experience is hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

Michael Gill is an Environmental Engineer with 15 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. Michael has significant experience in surface water drainage issues, SUDs design, and flood risk assessment.

Conor McGettigan is a recent graduate, holding an M.Sc. in Applied Environmental Science (2020) from University College Dublin, graduating with a First-Class Honours degree. In recent times Conor has assisted in the preparation of several flood risk assessments for various proposed developments.

1.3 REPORT LAYOUT & METHODOLOGY

This FRA report has the following format:

- Section 2 describes the proposed site setting and details of the proposed development;
- Section 3 outlines the hydrological and geological characteristics of the local surface water catchment in the vicinity of the proposed development site;
- Section 4 deals with a site-specific flood risk assessment (FRA) undertaken for the proposed development which was carried out in accordance with the above-mentioned guidelines;
- Section 5 presents detailed site specific flood risk assessment analysis;
- Section 6 completes a Justification Test for the development; and,
- Section 7 presents the FRA report conclusions.

As stated above this FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). The assessment methodology involves researching and collating flood related information from the following data sources:

- Base maps – Ordnance Survey of Ireland;
- Flood Hazard Maps and flooding information for Ireland, www.floodmaps.ie;
- Office of Public Works (OPW);
- Geological Survey of Ireland (GSI) maps on superficial deposits;
- EPA hydrology maps;
- CFRAM Maps;
- Site walkover surveys and drainage mapping, and,
- Hydrological monitoring completed at the site and in the River Brick.

2. BACKGROUND INFORMATION

2.1 INTRODUCTION

This section provides details on the topographical setting of the proposed site along with a description of the proposed development.

2.2 SITE LOCATION AND TOPOGRAPHY

The proposed wind farm site is located approximately 500m northeast of Lixnaw village and 8.3km southwest of Listowel. The proposed wind farm study area has a total area of approximately 594 hectares and is located in the townlands of Ballynagare in the south, Dysert Marshes in the northwest and Dysert in the northeast. The northern section of the proposed wind farm site has historically been subject to peat harvesting while the southern section comprises improved agricultural lands with fields separated by hedgerows and drains. Access to the proposed wind farm site is via a road running to the northwest from Lixnaw village. This local road dissects the southwest of the proposed wind farm site before it crosses the Brick River further west. Several small access roads branch off this main road, criss-crossing the proposed wind farm site. A site location map is shown as **Figure A** below**.**

Topography at the proposed wind farm site is generally flat and low-lying with ground elevations ranging from 0-5m OD (metres above Ordnance Datum), with ground elevations increasing to the southeast (**Figure B**). The proposed wind farm site is bordered by two rivers, the Brick River to the west and the River Feale to the northeast, which confluence to the north of the site.

The proposed development includes an underground grid connection route comprising underground cabling within the carriageway of the existing public road network. The grid route is approximately 13.8km in length and would join the proposed Ballynagare wind farm substation with the Clahane 110kV substation in the townland of Pallas.

2.3 PROPOSED DEVELOPMENT DETAILS

The proposal consists of a windfarm with 7 no. turbines and associated access road construction and/or upgrading and other infrastructure including 2 no. construction compounds, 2 no. peat storage area, 1 no. borrow pit, 1 no. permanent meteorological mast, 1 no. on-site 38kV substation, and all associated underground electrical cabling connecting the turbines to the substation and the substation to the Clahane 110kV substation in the townland of Pallas.

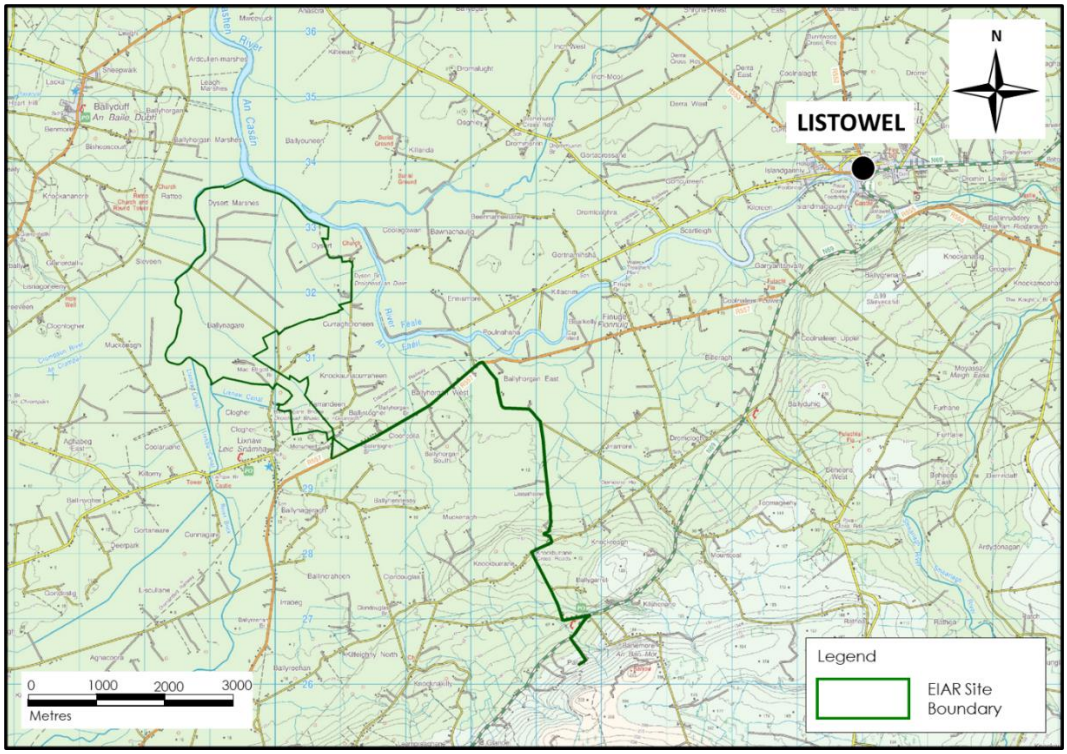

Figure A: Site Location Map

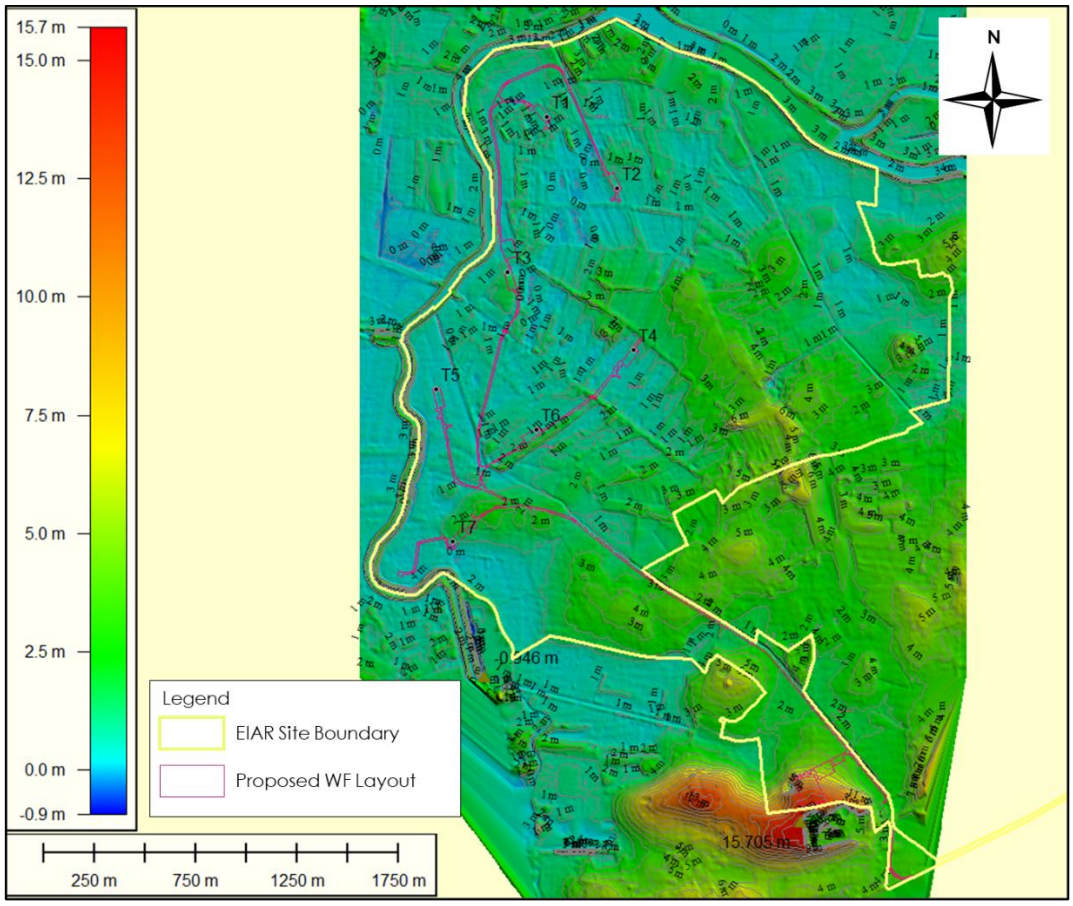

Figure B: Site Topography (mOD)

3. EXISTING HYDROLOGICAL ENVIRONMENT

3.1 INTRODUCTION

This section gives an overview of the hydrological and geological characteristics in the area of the proposed wind farm development.

3.2 BASELINE HYDROLOGY

3.2.1 Regional Hydrology

On a regional scale, the proposed wind farm site is located in the Tralee Bay-Feale surface water catchment within Hydrometric Area 23. On a more local scale the proposed wind farm site is located in the Brick River surface water sub-catchment (Brick_SC_020).

The Feale River (EPA Code: 23F01) forms the northeastern boundary of the proposed wind farm site. The Feale River rises near Rockchapel in north Co. Cork in the Mullaghareirk Mountains and flows to the northwest, and through the town of Abbeyfeale, Co. Limerick. Along its route it is joined by several tributaries including the Clydagh, Owveg, Allaghaun and Oolagh Rivers. Closer to the proposed wind farm site and grid connection route, the Feale is joined by the Smearlagh River to the south of Listowel. The Smearlagh River drains the central and eastern parts of the Stack's Mountains. The Feale then flows westwards collecting from the River Galey to the north and the River Brick to the south. The Brick River (EPA Code: 23B03) forms the western boundary of the proposed wind farm site. The Feale River is tidal in the vicinity of the proposed wind farm site, referred to as the Upper Feale Estuary and the Cashen River Estuary upstream and downstream of its confluence with the Brick River respectively. The tidal influence extends upstream of the proposed wind farm site as far as Finuge, located approximately 4km to the east. The Cashen River Estuary discharges into the Shannon Estuary approximately 3km south of Ballybunnion and 6km northwest of the proposed wind farm site.

On a regional scale the proposed grid route is located in the Tralee Bay-Feale surface water catchment. The route begins in the Brick River surface water sub-catchment (Brick_SC_020), entering the Feale River surface water sub-catchment (Feale_SC_040) to the west of the proposed wind farm site in the townland of Ballyhorgan. The route then veers to the south, entering the Brick River surface water sub-catchment (Brick_SC_010) in the townland of Lissahane.

A regional hydrology map is shown as **Figure C**.

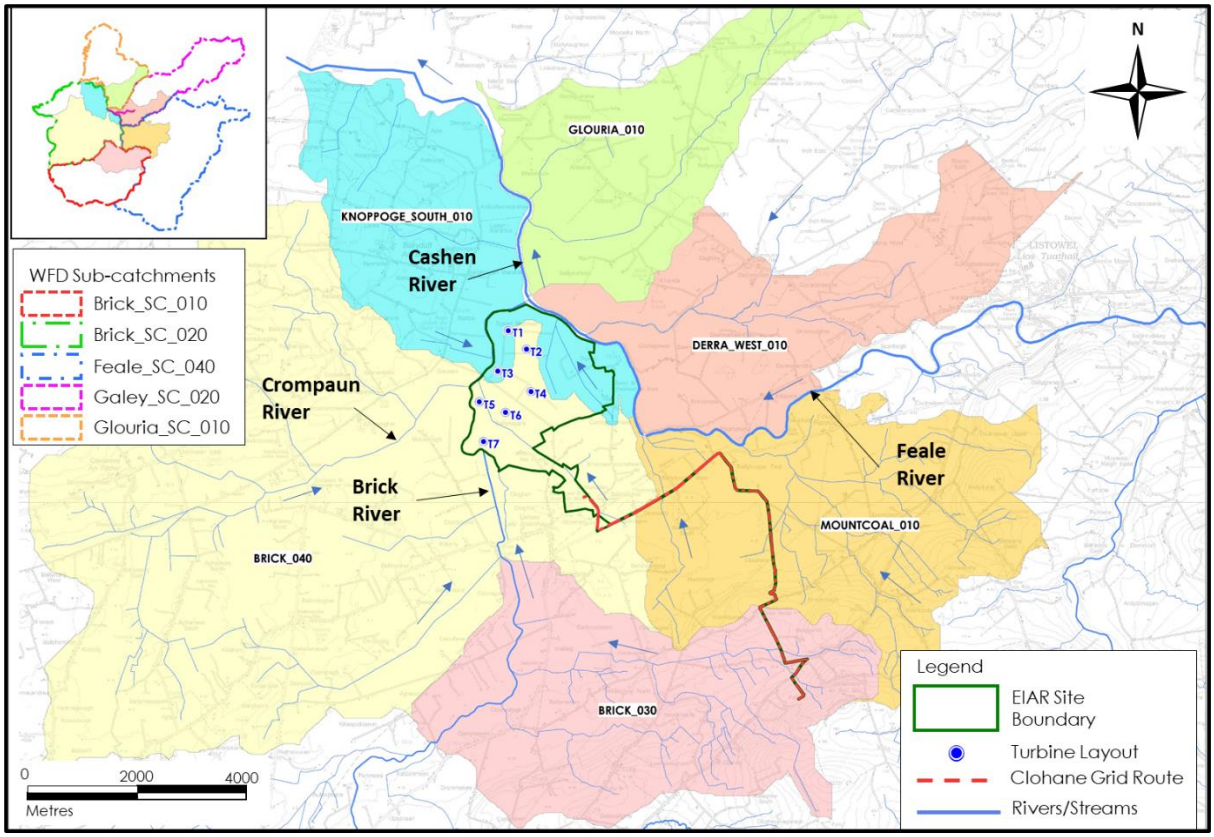

Figure C: Regional Hydrology Map

3.2.2 Wind Farm Site Drainage

On a more local scale, the south and centre of the site are mapped in the Brick_040 WFD River sub-basin (IE_SH_23B030700). In terms of key wind farm infrastructures: 5 no. turbines (T2, T4, T5, T6 & T7), the substation, the southern construction compound, borrow pit, met mast, the southern proposed peat repository and associated access roads are located in this WFD river sub-basin.

The EPA maps the Brick River to flow to the north, approximately 150m west of T5, 150m south of T7 and approximately 90m west of the proposed met mast. The EPA also maps a small stream/drain, referred to as Monument stream (EPA Code: 23M41), to dissect the western and southern sections of the site. The Monument stream flows to the northwest, approximately 60m east of the proposed substation location and adjacent and parallel to a proposed new access road for 1.8km. This stream then flows approximately 250m southwest of T6 and 90m east of T5 before discharging into the Brick River approximately 400m north of T5. The Brick River then continues to meander northwards before its confluence with the Feale River.

Meanwhile the northwest and east of the site are located in the Knoppoge_South_010 WFD River sub-basin (IE_SH_23K120820). In terms of key wind farm infrastructures, 2 no. turbines (T1 and T3), the northern temporary construction compound and the northern peat repository are mapped in this WFD river sub-basin. The EPA maps the presence of two streams/drains in the east of the site, referred to as the Dysert Marshes (EPA Code: 23D19) and Ballyouneen stream (EPA Code: 23B32). These drains flow to the north before discharging into the Feale River which flows approximately 60m northeast of the site. No wind farm infrastructures are located in the vicinity of these EPA mapped drains. Further west, the Brick River flows along the western boundary of the site, approximately 200m west of T3 and 400m west of T1.

The majority of the proposed wind farm site is located in a peat basin which has its own drainage system. The surface of the cutover bog is drained by a network of field drains, spaced every 15 to 20m along the boundary of peat cutting plots. These drains are orientated southwest to northeast in the south and centre of the site and in a northwest to southeast orientation towards the north. Surface water runoff collected in these drains is conveyed to larger main drains which typically run perpendicular to the smaller field drains and also along the edges of the internal bog track network. These main drains direct surface water to a boundary drain that outfalls via sluice gates to the bounding tidal rivers. There are 8 no. main outfalls to the west of the proposed wind farm site which discharge to the Brick River, with an additional 7 no. outfalls located along the Feale River (however no wind farm infrastructure is proposed in the area draining towards the Feale).

A summary of the local hydrology with respect the proposed windfarm infrastructure is shown in **Table A** below.

Table A: Summary of Local Hydrology and proposed Infrastructure

Sub-Catchment	River Sub-Basin	Proposed Development Infrastructure	Primary Drainage Features
Brick River Sub-Catchment	Knoppoge_South_010	2 no. turbines & northern construction compound	Brick River
	Brick_040	5. no turbines, construction compound, substation, met mast and borrow pit	Brick River & Monument Stream

3.2.3 Grid Connection Route Drainage

As stated above the grid connection route is located in the Brick River surface water sub-catchment (Brick_SC_020). In the vicinity of the site, the grid route is located in the Brick_040 WFD River sub-basin, with the grid route mapped to cross the Monument stream (EPA Code: 23M41) along the R557. Further east in the townlands of Ballyhorgan West, Ballyhorgan East and south to Lissahane, the route is mapped in the Feale River surface water sub-catchment (Feale_SC_040) and the Mountcoal_010 WFD River sub-basin. Here surface water flows northwards towards the Feale River, with the grid route crossing the Ballyhennessy stream in the west and the Lissahane stream, a tributary of the Mountcoal River, further east. Finally in the townlands of Ballygarret, Banemore and in the vicinity of Clahane 110kV substation the route is located in the Brick River surface water sub-catchment (Brick_SC_010) and the Brick_030 WFD River sub-basin. In this region, drainage is directed to the west towards the Brick River. The grid route is mapped to cross both the Knockburrane stream (EPA Code: 23K73) and the Pallas stream (EPA Code: 23P07).

The drainage density along the proposed grid connection route is relatively high. According to EPA mapping, there are a total of 5 no. main watercourse crossings along the grid route with all crossings occurring in the carriageway of existing public roads.

3.3 RAINFALL AND EVAPORATION

The SAAR (Standard Average Annual Rainfall) recorded at Ballyduff (ING: 163875, 184453), which is located approximately 2km northwest of the proposed site, is 1,073mm (**www.met.ie**). The average potential evapotranspiration (PE) at Shannon Airport, approximately 50km northeast of the proposed site, is taken to be 543mm (**www.met.ie**). The actual

evapotranspiration ("AE") is calculated to be 516mm (95% PE). Using the above figures the effective rainfall ("ER")[1] for the area is calculated to be (ER = SAAR – AE) 557mm.

Table B below presents return period rainfall depths for the area of the proposed Ballynagare wind farm site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 5-year, 30-year, 100-year).

Table B: Rainfall return periods for the Ballynagare WF Site

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.5	5.6	9.2	12.5
15 mins	5.7	9.2	15.1	20.5
1 hour	9.7	14.8	22.8	29.8
6 hours	19.4	27.3	38.8	51.9
12 hours	25.4	34.6	47.7	58.1
24 hours	33.2	44.0	58.6	70.1
2 days	42.5	54.8	71.1	83.6

3.4 GEOLOGY

3.4.1 Soils & Subsoils

3.4.1.1 Wind Farm Site

The published soils maps (www.epa.ie) show that cutaway peat (Cut) is mapped as the topsoil across the north of the proposed wind farm site. On the northern and western boundaries extensive areas of mineral alluvium (AlluvMin) are mapped along Feale and Brick Rivers. Further south the EPA map areas of poorly drained mineral soils with peaty topsoil (AminPDT), acid deep poorly drained mineral soils (AminPD) and basic shallow poorly drained mineral soils (BminSP).

In terms of key wind farm infrastructure, 6 no. turbines, the northern construction compound and the southern peat repository are mapped on peat. Meanwhile T7, the met mast and the northern peat repository are located on mineral alluvium in the vicinity of the Brick River. Further south the substation, borrow pit and southern construction compound are mapped on acid deep poorly drained mineral soils. Soils mapped in the surrounding lands are generally the same as that recorded within the wind farm site but with widespread alluvium cover along the Brick and Feale Rivers and along the Cashen River Estuary.

The published subsoil maps (www.gsi.ie) for the proposed wind farm site show that it is underlain largely by cut over raised peat (Cut) with alluvium (A) mapped in the west and pockets of till derived from Namurian sandstones and shales (TNSSs) in the south. In terms of key wind farm infrastructure, 6 no. turbines are mapped on cut over raised peat while T7 in the west of the site is mapped on alluvium. Further south the substation, borrow pit and construction compound are mapped to be underlain by tills derived from Namurian sandstones and shales. Subsoils in the surrounding lands include till derived from Namurian sandstones and shales, cut over peat with widespread alluvium along the nearby watercourses. Further west the GSI map shows a large area of till derived from Devonian sandstones (TDSs). The presence and distribution of peat was confirmed by intrusive site investigations. A local subsoils map is included as **Figure D.**

[1] *ER – Effective Rainfall is the excess rainfall after evaporation which produces overland flow and recharge to groundwater.*

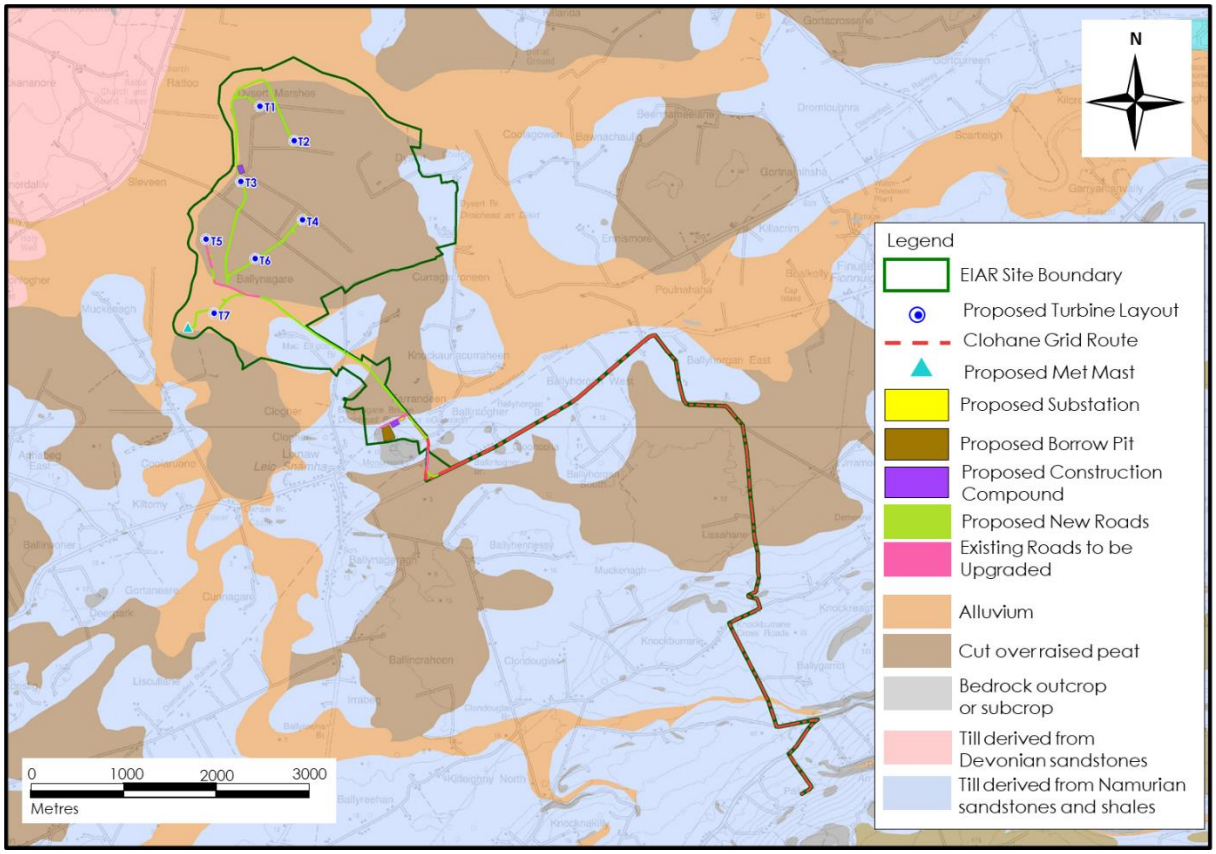

Figure D: Local subsoils map

3.4.1.2 Grid Connection Route

The published soils map (www.epa.ie) for the area shows that acid deep poorly drained mineral soils (AminPD) and cutover peat (Cut) dominate the northern section of the grid route. While the southern section of the route is also dominated by acid deep poorly drained soils, the EPA also map small pockets of acid shallow poorly drained mineral soils (AminSP) and mineral alluvium (AlluvMin) along Knockburrane River. Soils in the vicinity of Clahane 110kV substation are mapped as acid deep well drained mineral soils (AminDW).

The published subsoils map (www.gsi.ie) for the area shows that the grid route is underlain largely by till derived from Namurian sandstones and shales (TNSSs). Cut over raised peat (Cut) is mapped to the east of Lixnaw village and along small local roads running from the townland of Ballyhorgan East to Lissahane. Other subsoils mapped along the grid route include small pockets of bedrock outcrop (Rck) and alluvium (A) along the Knockburrane River just north of Banemore Cross.

3.4.2 Bedrock Geology

3.4.2.1 Wind Farm Site

The GSI map the bedrock geology underlying the proposed wind farm site as Dinantian Sandstones, Shales and Limestone (DESSL) in the northwest and Dinantian Lower Impure Limestones (DLIL) and Dinantian Pure Unbedded Limestones (DPUL) underlying the remainder of the site.

The Lower Limestone Shale comprising sandstone, mudstone and thin limestones is mapped to underlie the north-western section of the site. However, no key wind farm infrastructures are mapped in this area of the site. The Ballysteen Formation underlies much of the north and west

of the proposed wind farm site. In terms of key wind farm infrastructure, 5 no. turbines and the northern construction compound are underlain by the Ballysteen Formation, comprising dark muddy limestone and shales. Meanwhile, Waulsortian Limestones are mapped to underlie the much of the centre of the proposed wind farm site. In terms of key wind farm infrastructure, 2 no. turbines are mapped on Waulsortian Limestones, comprising dominantly pale-grey massive, unbedded lime mudstones. Further south, the proposed substation location, borrow pit and construction compound are underlain by undifferentiated Visean Limestones. A bedrock geology map is included as **Figure E.**

The dominant geological structure in the region is a large anticline which plunges to the East-Northeast and bedding dipping steeply to the north and south on either side of the fold axis (GSI, 2004). The proposed wind farm site is located on the southern limb of this anticline and bedding will therefore dip steeply to the south. Large Northwest – Southeast orientated faults cross-cut the fold axis, one of which is mapped to run through the proposed wind farm site, in close proximity to T3 and to the north of T6. A second fault of similar orientation is mapped further west.

The GSI do not record the presence of any bedrock outcrop within the proposed wind farm site. However, several bedrock outcrops are mapped immediately to the south of the site, near the proposed borrow pit and substation locations.

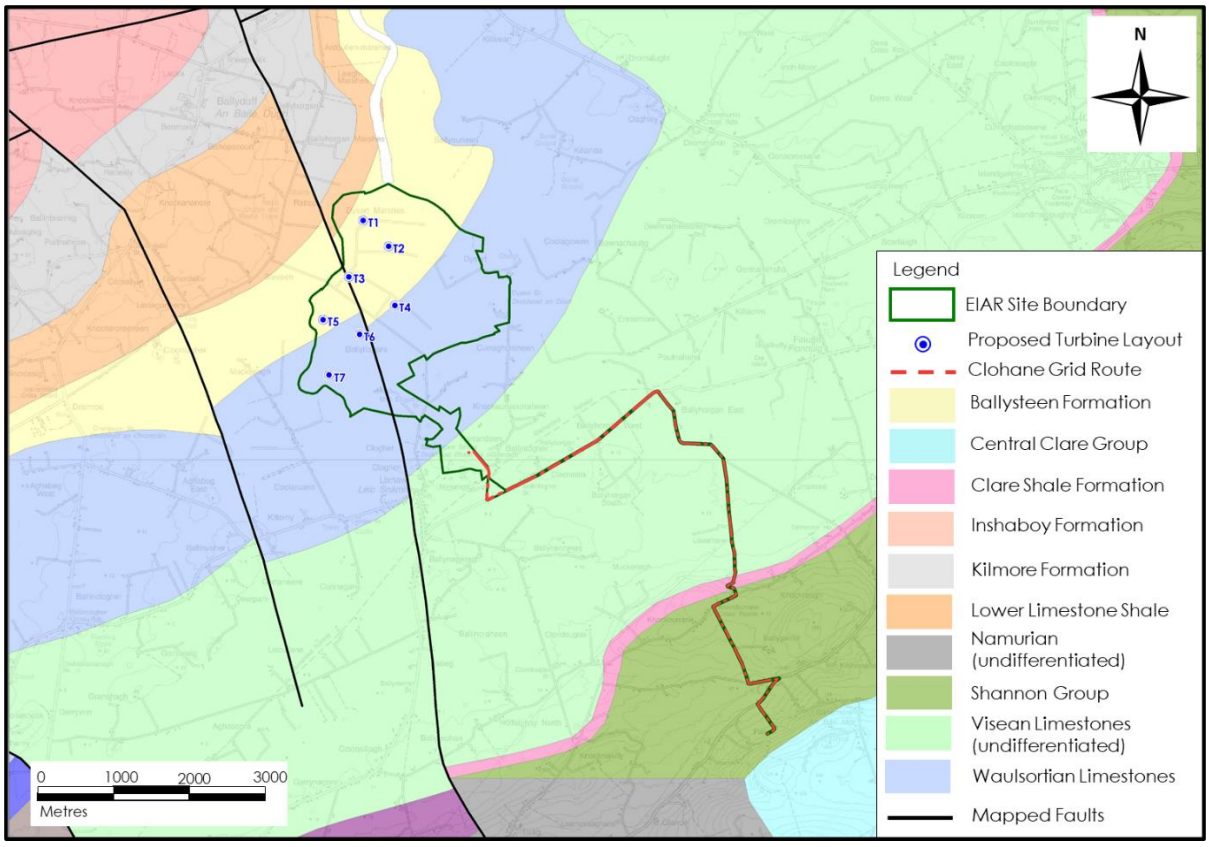

Figure E: Local Bedrock Geology map

3.4.2.2 Grid Connection Route

The western and northern sections of the grid route are underlain by Undifferentiated Visean Limestones. Namurian Shales (NSH) of the Clare Shale Formation are mapped to the south, in the townland of Lissahane. This is a small bedrock formation comprising mudstone which is cherty in nature at its base. The GSI provide the following lithological description: "*the formation consists of a condensed sequence of black shales with closely spaced layers rich in goniatites, underlain by shales with phosphatic horizons. Nodules and bands of clay ironstone*

occur near the top of the formation". The remainder of the grid route is mapped to be underlain by Namurian Undifferentiated (NU) rocks of the Shannon Group comprising mudstones, sandstones and siltstones.

3.5 DESIGNATED SITES & HABITATS

3.5.1.1 Wind Farm Site

Designated sites include National Heritage Areas (NHAs), Proposed Natural Heritage Areas (pNHAs) Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). The proposed wind farm is not located within the boundaries of any designated conservation site.

However, the site borders the Proposed Natural Heritage Area of the Cashen River Estuary (Site Code: 001340) to the north and the Lower River Shannon SAC (Site Code: 002165) to the north and west, along the Feale and Brick Rivers.

The Lower River Shannon SAC is a large area of conservation stretching along the Shannon Valley from Killaloe Co. Clare to Loop Head. This special area of conservation includes the freshwater stretches of the Feale catchment which exhibit all the aspects of river from source to sink and has also been recognised for its importance for several fish listed on Annex II of the Habitats Directive including spring Salmon. The River Feale has been designated as a Salmonid Water under the E.U. Freshwater Fish Directive.

The proposed wind farm site drains to the Lower River Shannon SAC and the Cashen River Estuary pNHA via the Brick River and Feale Rivers. Therefore, the proposed wind farm site is hydraulically connected to these designated sites.

3.5.1.2 Grid Connection Route

The grid route encroaches onto the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161) along the N69.

All surface waters draining the grid route flow downstream into the Lower River Shannon SAC and the Cashen River Estuary pNHA.

4. SITE SPECIFIC FLOOD RISK ASSESSMENT

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

A stage 1 assessment of flood risk requires an understanding of where the water comes from (*i.e.* the source), how and where it flows (*i.e.* the pathways) and the people and assets affected by it (*i.e.* the receptors). It is necessary to identify whether there may be any flooding or surface water management issues related to the proposed site that may warrant further detailed investigation.

As per the guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site; and,
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development.

Further to this, a stage 2 assessment involves the confirmation of sources of flooding, appraising the adequacy of existing information and determining what surveys and modelling approach may be required for further assessment.

4.2 FLOOD ZONE MAPPING

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. There are three types or levels of flood zones defined according to OPW guidelines:

- Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% AEP or 1 in 100 for river flooding or 0.5% AEP or 1 in 200 for coastal flooding);
- Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% AEP or 1 in 1000 and 1% AEP or 1 in 100 for river flooding and between 0.1% AEP or 1 in 1000 year and 0.5% AEP or 1 in 200 for coastal flooding); and,
- Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% AEP or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

4.3 FLOOD RISK IDENTIFICATION

4.3.1 Soils Maps – Fluvial Maps

4.3.1.1 Wind Farm Site

A review of the soil types in the vicinity of the proposed site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers, deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas.

Based on the EPA/GSI soil map for the area it appears that there are areas of mineral alluvium soils (fluvial deposits) mapped along the Feale and Brick Rivers as discussed above. Significant areas of alluvium are mapped to the north and west of the proposed wind farm site, including the proposed T7 location and the location of the met mast.

In general, alluvium deposition is more widespread to the west of the Brick River and to the north of the River Feale. This indicates that although large areas in this region appear prone to flooding and that flood plains are extensive, the rivers preferentially flood areas to the west and north of the proposed wind farm site.

4.3.1.2 Grid Connection Route

Alluvium deposits are mapped along the Knockburrane river towards the south of the grid route just north of Banemore Cross. In general, there are no areas of widespread alluvium deposition along the grid route which would be indicative of a floodplain.

4.3.2 Historical Mapping

4.3.2.1 Wind Farm Site

Text on historical maps of the area were consulted to identify those areas which are prone to flooding. Text on the Historical 6" Map of the area (1837 – 1842) identifies the north of the proposed wind farm site as an area which is "*liable to flooding*".

4.3.2.2 Grid Connection Route

No text was observed on historic maps that would indicate that areas prone to flooding occur along the proposed grid route.

4.3.3 OPW National Flood Hazard Mapping

4.3.3.1 Wind Farm Site

Several recurring and historic flood events are recorded in the vicinity of the site (www.floods.ie). A recurring flood event is mapped near Ballyhorgan, approximately 1 km north of the site, described as flooding of marshland along the Cashen River Estuary. At its closest, the Feale is approximately 200m north of the site (refer to **Figure G** below).

A second recurring flood event is recorded to the west of the site along the Brick River at Sleveen. Flooding is noted to occur "two to three times per year on the L6047 which links Lixnaw to Sleveen" due to "rainfall/runoff exacerbated by tide/wind". Recurring flood events are also reported further upstream on the Brick River west of Lixnaw village.

A significant historic local flood event dating from January 1998 resulted in widespread flooding along the Brick and Feale Rivers. This event encroached onto the proposed wind farm site, with flooding along the Brick River (foreground of picture below) and in the north of the proposed wind farm site, as seen in **Figure F**.



Figure F: Flooding along River Brick, 1998 (Engineers Report, www.Floodmaps.ie).

The wind farm site is also located within the Tralee Bay-Feale arterial drainage scheme (ADS) with several ADS channels, areas of bogland and benefited land. The land surrounding the site to the west and north along the Brick and Feale Rivers is mapped as OPW Drainage District, *i.e.* an area where drainage schemes to improve land for agricultural purposes were constructed or as Benefiting Lands, *i.e.* land identified by the OPW as potentially benefitting from the implementation of Arterial (Major) Drainage Schemes and used as an indicator of land subject to flooding and poor drainage. In addition, earthen flood defences have been installed along the Brick and Feale rivers in the form of embankments as discussed in **Section 4.3.4**.

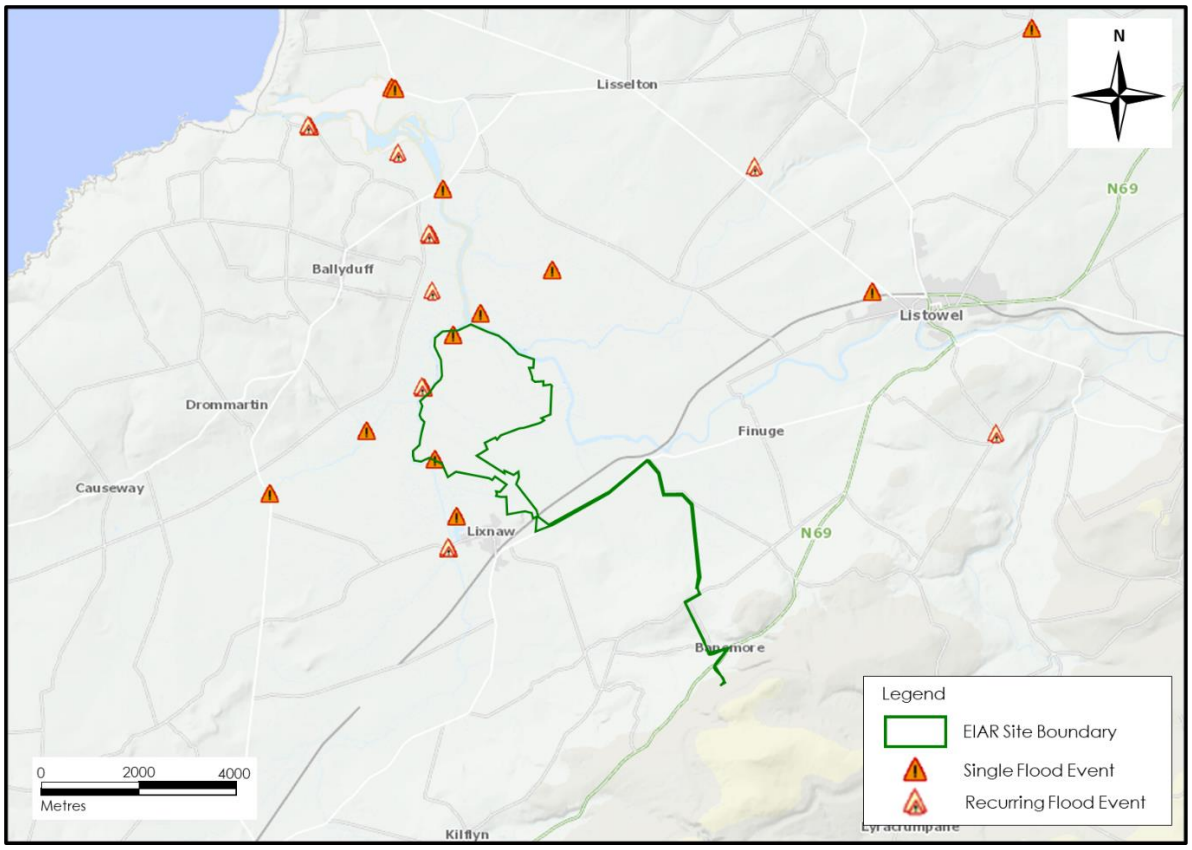

Figure G: OPW Indicative Floods Map (www.floods.ie)

4.3.3.2 Grid Connection Route

No historic or recurring flood events are mapped along the proposed grid route.

Much of the northern section of the grid route is mapped within the Tralee Bay-Feale arterial drainage scheme (ADS) with ADS channels, areas of bogland and benefited lands. The grid route is mapped to run through this drainage scheme as far south as the townland of Lissahane.

4.3.4 CFRAM Maps – Fluvial and Tidal Flooding

4.3.4.1 Wind Farm Site

Catchment Flood Risk Assessment and Management (CFRAM)[2] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA maps. CFRAM mapping has been completed for the area of the proposed wind farm site.

The CFRAM map for the area indicates that the proposed wind farm site does not appear within the 10-year, 100-year (Flood Zone A) or 1,000-year (Flood Zone B) fluvial flood zones (**Figure H**). The nearest area which is at a high risk of fluvial flooding is mapped ~4.3km to the west, along the Feale River, near Finuge. Please note this is likely a function of the available mapping, rather than the actual flood risks associated with the wind farm site.

Coastal CFRAM mapping shows that large areas of land to north and west of the proposed wind farm site are vulnerable to coastal flooding. The proposed development site however is mapped outside the 10-year and 200-year tidal flood extents (again this is likely a function of the available mapping and is not a true representation of actual coastal flood risk at the site). These mapped coastal flood zones from CFRAM mapping are shown on **Figure I** below. The modelled coastal flood extents at Moneycashen, approximately 5.5km downstream of the site, show flood levels of 3.28 and 3.45m OD for the 100-year and 1,000-year flood events respectively (**Table C**). Based on lidar data, such water levels would flood the majority of the proposed wind farm site (i.e., in the absence of the existing flood defences).

Despite large areas of land to the north and west of the site being vulnerable to flooding, according to the OPW maps the site is not mapped as being susceptible to fluvial or coastal flooding. This is likely to be a direct consequence of the flood defences which have been installed along the Brick and Feale rivers. While the maps (www.floodmaps.ie) indicate that embankments have been installed along both sides of each river, according to these flood maps the Brick and Feale rivers preferentially flood to the north, away from the proposed wind farm site. Several drainage channels are present in the site, with much of the land surrounding the Brick and Feale rivers mapped as 'Benefited land' i.e. land that was drained as part of an Arterial Drainage Scheme. Towards the centre and east of the site the land is mapped as 'Bogland', which identifies areas of bog which were drained to facilitate historic peat extraction (refer to **Figure J**).

The GSI Winter 2015/2016 Surface Water Flood Map shows fluvial and pluvial floods during the 2016/2016 flood event (other data sources outlined above do not reference this specific event). This map shows that areas in the west of the site along the Brick River flooded during the 2015/2016 flood event. Elsewhere, localised pockets of surface water flooding occurred throughout the site.

Due to the low permeability of the soils and subsoils across much of the site, surface water ponding is likely to occur following periods of intense and/or prolonged rainfall. However, the current drainage network removes this surface water from the wind farm site, discharging it

[2] *CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.*

into the Feale and Brick Rivers. In addition, observations on site during field surveys suggest that the general drainage pattern is unlikely to be susceptible to localised pluvial flooding.

Table C: Coastal and Fluvial modelled water levels (www.floodmaps.ie)

Coastal Flooding				
Node	**Location Description**	**10% AEP WL (mOD)**	**0.5% AEP WL (mOD)**	**0.1% AEP WL (mOD)**
O1CHA0199	Moneycashen ~5.5km downstream	2.93	3.28	3.45
Fluvial Flooding				
Node	**Location Description**	**10% AEP WL (mOD)**	**1% AEP WL (mOD)**	**0.1% AEP WL (mOD)**
02FEL05140	Listowel ~7.7km east, on the Feale River	13.36	14.21	14.47
01BRK11636u	Abbeydorney ~6.5km southwest, on the Brick River	5.22	4.41	5.46

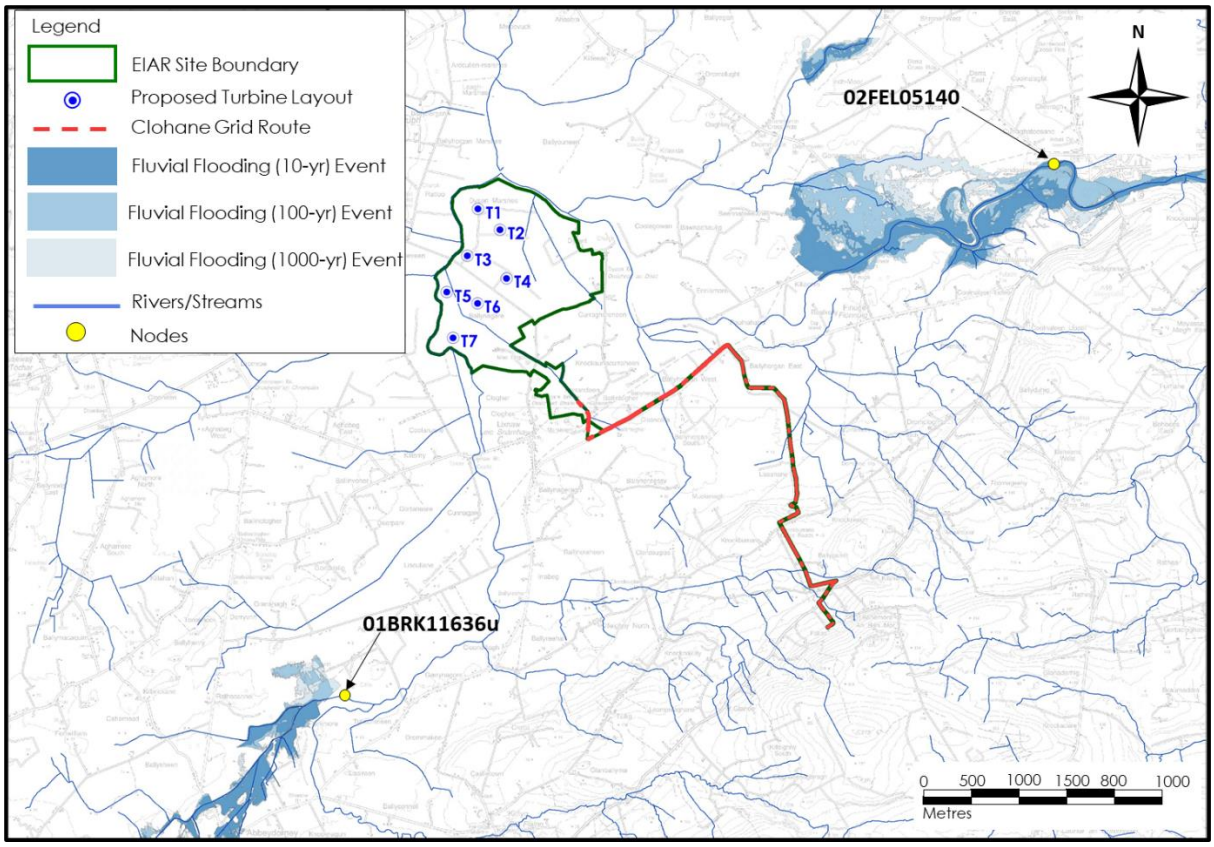

Figure H: Indicative Fluvial Flood Zones (www.floods.ie)

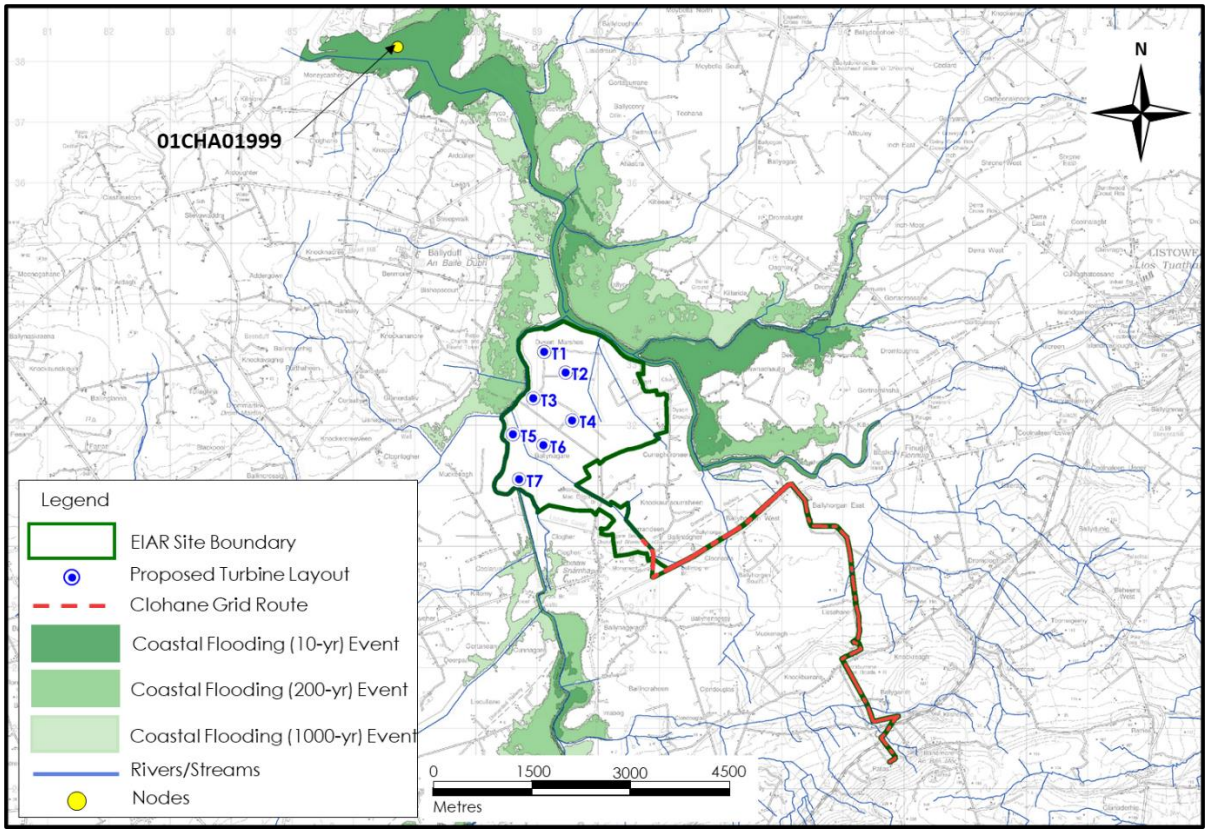

Figure I: Indicative Coastal Flood Zones (www.floods.ie)

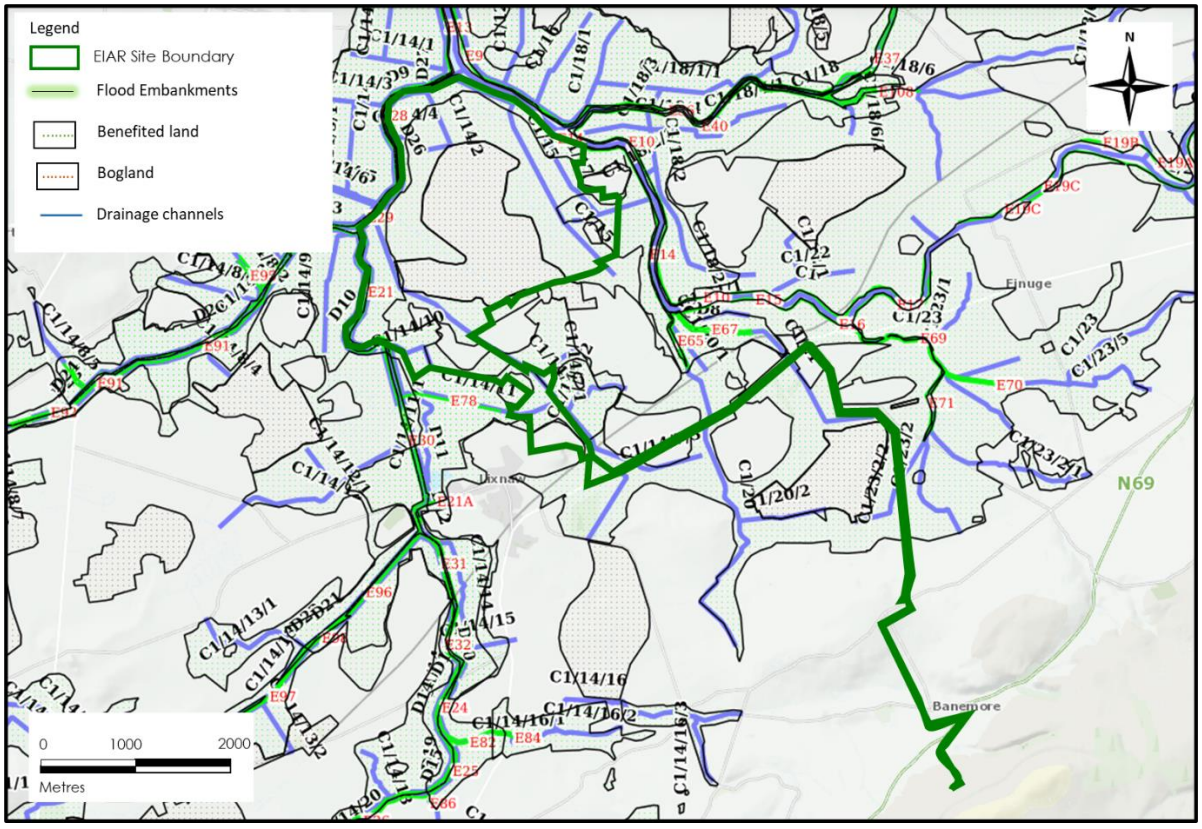

Figure J: Arterial Drainage Schemes (ADS) (*www.floodmaps.ie*) showing flood embankments.

4.3.4.2 Grid Connection Route

The PFRA and CFRAM mapping shows that no areas along the proposed grid route lie within the 10-year, 100-year (Flood Zone A) or 1,000-year (Flood Zone B) fluvial flood zones.

In addition, no area of the proposed grid route are mapped to have flooded during the winter 2015/2016 flood event.

4.3.5 ICPSS Maps – Coastal Flooding

Additional modelling of coastal flooding has been undertaken as part of the Irish Coastal Protection Strategy Study (ICPSS)[3]. These maps show the modelled extent of land that might be flooded by the sea in extreme flood events. As part of the Strategic Assessment of Coastal Flooding and Erosion Extents on the South West Coast, the area from Moneycashen to Finuge was identified as one of the primary areas of potential coastal flooding. As seen in **Figure K**, the majority of the proposed wind farm site has been mapped within the 1 in 200-year coastal flood extent associated with tidal flooding along the Cashen River Estuary. The modelled flood depths associated with a flood event of this magnitude are estimated to be between 1 and >2m across much of the proposed wind farm site (**Figure L**).

Only a small section along the quarry road at the start of the grid route is mapped in this coastal flood zone.

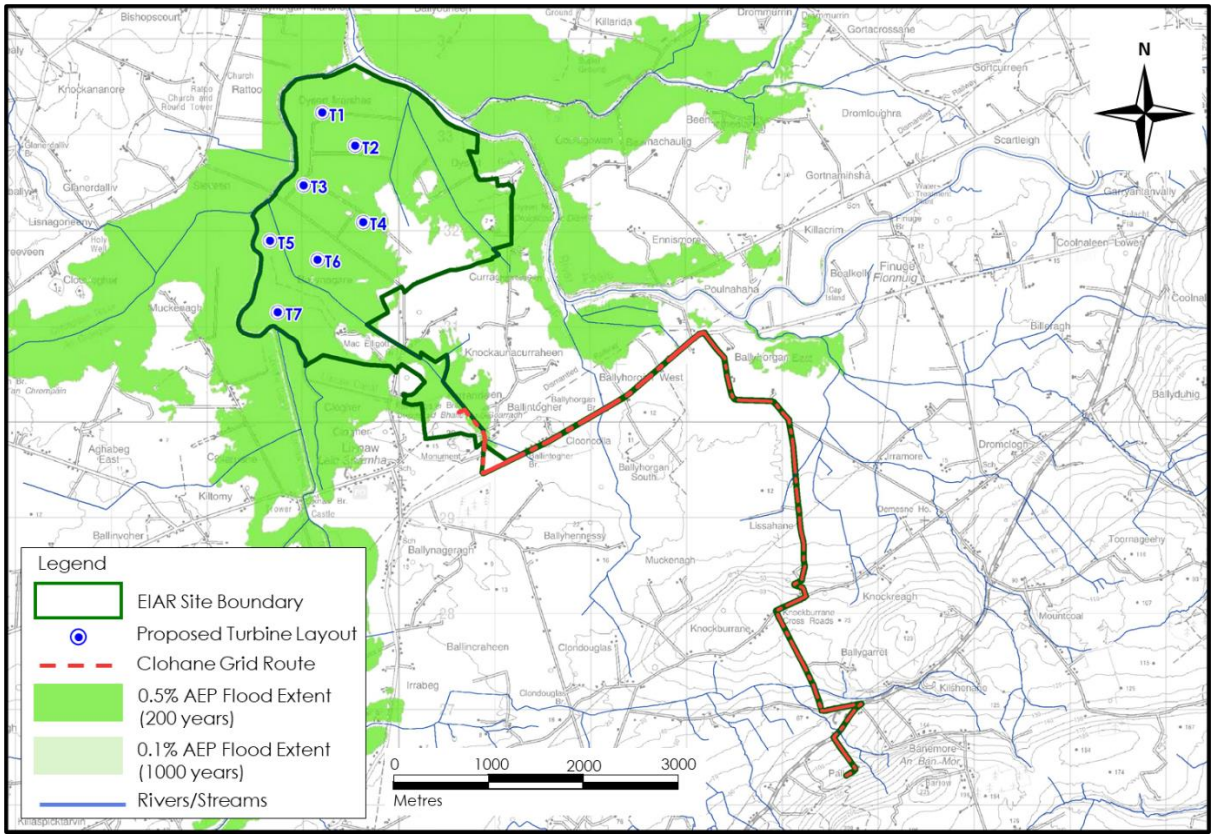

Figure K: Coastal Flood Map (ICPSS) (OPW, 2013)

[3] https://www.gov.ie/en/publication/eed0fb-irish-coastal-protection-strategy-study-icpss/

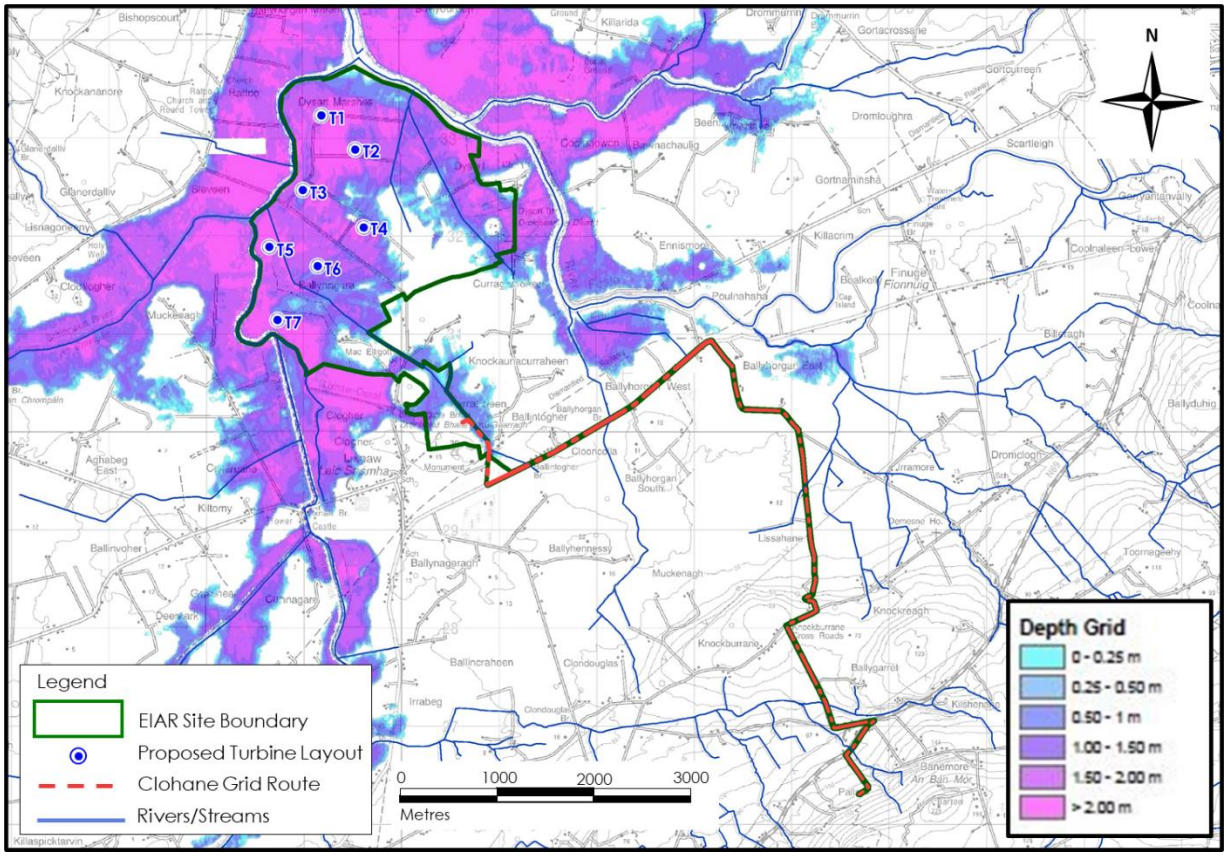

Figure L: Flood Depth Map for 0.5% AEP (OPW, 2013)

4.3.6 Summary – Flood Risk Identification

Based on the information gained through the flood identification process it would appear that the proposed wind farm site is located within an area associated with historic coastal flooding. The site is mapped within the ICPSS 0.5% AEP (1 in 200-year) flood extent. Water levels associated with such an event are modelled at 3.28 mOD at Moneycashen, which is up to 1.0-2.5 metres higher in elevation than much of the wind farm site. However, the risk of coastal flooding has been reduced with the addition of flood embankments around the land of the proposed wind farm. While sluice gates will hold back the tidal/coastal water, they are likely to contribute to creating localised pluvial flooding and surface water ponding within the wind farm site during high tides.

4.4 INITIAL FLOOD RISK ASSESSMENT

4.4.1 Site Walkover Survey

Detailed site walkover survey of the proposed wind farm site and proposed infrastructure locations were conducted by HES on 1st July 2021. The days leading up to the site visit were dry and mild with the day itself being dry and sunny.

5 no. turbines (T1, T2, T3, T4 and T6) and both peat repositories are located on cutover bog. The remainder of the key infrastructures were noted to be located on agricultural pastures. Several drains were noted throughout the bog area while drains also separated fields in the agricultural land. A large drain, i.e. the Monument stream, was observed to the northeast of T5.

4.4.2 Existing Site Drainage

As discussed, the majority of the proposed wind farm development site is located in a peat basin which has its own drainage system. According to Corine land-use (2018), 5 of the proposed 7 turbines are located on cut-over peat, while the remaining 2 are located on agricultural land (T5 and T7).

The surface of the cutover bog is drained by a network of field drains that are typically spaced every 15 to 20m along the boundary of existing/and remnant peat cutting plots. These field drains are orientated southwest-northeast towards the centre of the site and in a northwest-southeast towards the north. Surface water runoff collected in these drains is conveyed to larger main drains which typically run perpendicular to the smaller field drains and also along the edges of the internal bog track network. These main drains direct surface water to boundary drains that outfall via sluice gates to the bounding tidal rivers. There are 8 no. main outfalls to the west of the proposed wind farm site which discharge into the Brick River, with an additional 7 no. outfalls located along the Feale River.

Meanwhile, much of the south and west of the site are located on agricultural pastures. Drainage in these agricultural areas is via drains along field boundaries which discharge into a common boundary drain with the peat bog. These boundary drains run along the embankments constructed on the Brick and Feale Rivers. A total of 8 no. discharge outlets have been identified on the Brick River to the west of the proposed wind farm site. An additional 7 no. discharge points are located further east on the Feale River.

The site drainage map is shown on **Figure M.**

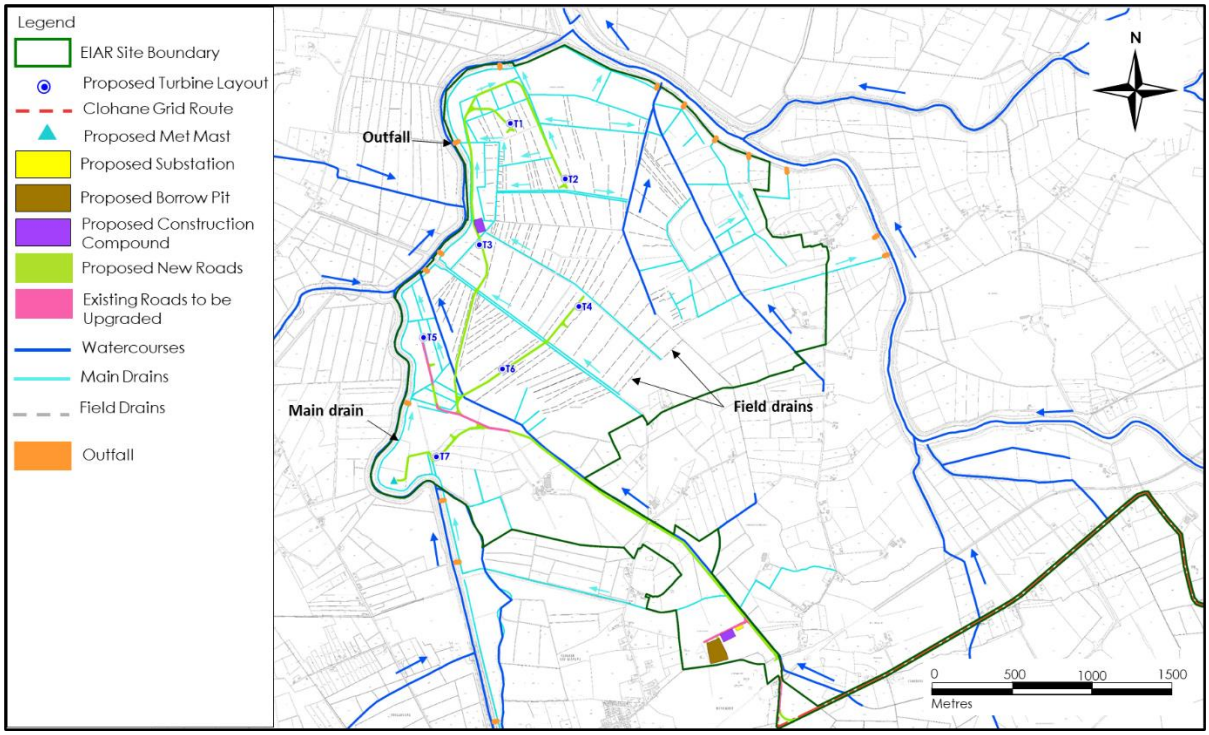

Figure M: Site Drainage Map

4.4.3 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the proposed site can be described using the Source – Pathway – Receptor Model ("S-P-R"). The primary potential source of flooding in this area, and the one with most consequence for the proposed site, is pluvial under normal conditions. The proposed development site has surrounding flood defences to protect the land from coastal flooding (from the Cashen Estuary), and if these (embankments) were to fail under extreme conditions then the site would be at risk from coastal flooding. The potential receptors in the area are infrastructure and land as outlined below.

4.4.4 Summary – Initial Flood Risk Assessment

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it would appear that flooding is likely to be problematic at the wind farm site and downstream of the site. The potential sources of flood risk for the proposed site are outlined and assessed in **Table D**.

Table D: S-P-R Assessment of Flood Sources for the proposed site

Source	Pathway	Receptor	Comment
Tidal	Flooding of the Cashen River Estuary	Land and infrastructure.	Based on ICPSS, the wind farm site lies within a coastal flood zone associated with flooding of the Cashen River Estuary. The low elevation of the site (<5mOD) and its geographical location means that it has been mapped within the 1 in 200-year coastal flood event zone. While this risk has been reduced due to the presence of flood embankments, a failure of these flood defences would lead to coastal flooding vulnerability at this site. Apart from a small section of the grid route in the vicinity of the wind farm site the route is not mapped within the 200-year coastal flood zone. Therefore, the grid route is not susceptible to coastal flooding.
Fluvial	Overbank flooding of the Brick and Feale Rivers.	Land and infrastructure.	There are several turbines close to the Brick and Feale Rivers. The GSI Winter 2015/2016 flood map shows areas of surface water flooding along the Brick River in the west of the site at the location of T7. The grid route is not mapped within the 1,000-year fluvial flood zone and is therefore not susceptible to fluvial flooding
Pluvial	Ponding of rainwater on site	Land and infrastructure.	Pluvial flooding at the site is likely after heavy or prolonged periods of rainfall. The GSI Winter 2015/2016 flood map shows areas in the centre of the peat bog in the vicinity of T3 and T4 which likely records historic pluvial flooding. There is little risk of pluvial flooding along the grid route as drainage will move relatively freely off sloping ground.
Surface water	Surface ponding/ Overflow	Land and infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land and infrastructure.	Based on the local hydrogeological regime and CFAM mapping, there is no apparent risk from groundwater flooding at the wind farm site or along the grid route.

4.4.5 Requirement for a Justification Test

A matrix of vulnerability versus flood zone is shown in

Table E. This table is used to illustrate appropriate development types or indicate when a Justification Test[4] is required.

The majority of the proposed development infrastructure is located in fluvial Flood Zone A and B, although the site is protected by flood defences. Based on this a Justification Test is required and is provided below at **Section 6**.

Table E: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	**Justification test**	**Justification test**	Appropriate
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	Appropriate	Appropriate	Appropriate

Note: *Taken from Table 3.2 (DoEHLG, 2009)*
Bold: *Applies to this project.*

[4] *A 'Justification Test' is an assessment process designed to rigorously assess the appropriateness, or otherwise, of particular developments that are being considered in areas of moderate or high flood risk, (DoEHLG, 2009).*

5. DETAILED FLOOD RISK ASSESSMENT

5.1 INTRODUCTION

This section assesses the flood risk of the proposed development with regard to Section 5.28 of the Flood Risk Management Guidelines. The assessment is made based on the CFRAM/ICPSS flood zone mapping as this is currently the only available published flood mapping for the site.

5.2 RELEVANT LOCAL AUTHORITY SUDS GUIDANCE

Guidance in relation to surface water management and sustainable urban drainage is provided in the Kerry County Development Plan 2015-2021. Section 13.1 of the development plan states that:

> "Developments are required to incorporate sustainable storm water management systems for the disposal of surface water arising from the development. A Sustainable Urban Design System (SUDS) will be required for all new developments. Details must be submitted as part of the planning application. Where possible the full suite of SUDS measures should be considered."

Further objectives are defined as;

> "Ensure that new developments do not increase flood risk elsewhere, including that which may arise from surface run-off and / or flow obstruction."

> "Ensure that all new developments of significance located upstream of flood risk or vulnerable areas, provide stormwater attenuation measures so as to restrict water flows from the proposed development."

The drainage elements of the proposed development will comply with the above requirements.

5.3 REDUCTION IN FLOODPLAIN STORAGE AND FLOOD LEVEL IMPACTS

Construction of new permanent above-ground structures within floodplains have the potential to reduce the storage capacity of the floodplain and increase flood risk locally or downstream. In this scenario the downstream receiving water is a tidal estuary, so in this scenario water levels in the estuary are controlled by the sea level and not by pluvial flooding from rainfall within the site (i.e. there is infinitely more water in the estuary than can be generated by rainfall within the study area).

The proposed development includes the construction of turbine foundations, access roads, construction compounds, and the installation of a permanent meteorological mast and 7 no. turbines. As seen in **Figure K**, the vast majority of the site is mapped within fluvial/coastal flood zones. The site is protected from coastal flooding by the existing flood defences which flank the Brick River and the Feale River.

Key infrastructure (substation, main site compound) are situated in Flood Zone C, i.e. at a ground level above 3.45mOD. A freeboard of 300mm will be applied at the substation, so formation level will be above 3.75mOD.

During normal conditions the flood defences work, and the wind farm site is protected from coastal flooding. In wetter conditions (lower) parts of the wind farm site can experience shallow flooding from pluvial water collecting in low points. This water does not have sufficient time between tidal cycles to drain fully from the land.

To counter this localised and shallow winter flood, it is proposed to raise proposed access roads and hardstands slightly by 800mm above existing ground level. This will effectively ensure access to turbine locations under normal conditions.

Therefore, during these normal winter pluvial flood events the proposed wind farm site has the potential to be flooded by pluvial standing water. The proposed infrastructures will displace this flood water, increasing the flood depth local to the wind farm development footprint. Based on flood volume and displacement volume analysis, the increase in depth in pluvial flood water locally will be <39mm, and will not extend beyond existing areas already prone to flooding. A summary of this analysis is provided in **Table F**. The worst-case scenario occurs when flooding reaches 1.0mOD. Above that elevation the volume of flood displacement is negligible in comparison to the flood volume.

Table F: Flood displacement impact assessment

Flood Elevation (mOD)	Flooded Area (Ha)	Flood Volume (m^3)	Volume Displaced (m^3)	Increase in Flood Depth (mm)
0.5mOD	58.3	99,574	2,880	5mm
1.0mOD	180.24	713,760	70,132	39mm
1.5mOD	239.51	1,786,053	70,132	29mm

In an extreme coastal flood condition, i.e. a scenario where the flood defences fail, the wind farm site is no longer protected from coastal flooding and water levels across the wind farm site will rise and fall with the tide, until such time as the embankment breech has been mended. Given the unlimited quantity of water available from the estuary, and the aerial extent of flooding that would occur in such a scenario, the potential effect of the displacement volume (arising from the access track and hardstand placements as outlined above) is infinitely small in comparison to the available flood volume, therefore there is negligible additional risk arising from the presence of the wind farm footprint.

The potential for flooding to effect the proposed development is assessed below at Section 5.5.

5.4 INCREASED STORMWATER RUNOFF RATES

The development of the site means that there will be a reduction in green areas/permeable surfaces and an increase in hardstand/roofed areas. The existing green areas at the site are formed from peat soils with a high runoff potential.

The proposed wind farm site is relatively flat, and the slope of the ground will effect the potential for runoff.

Given the slope (or lack thereof) of the site, the tidal nature of surface water drainage, the small area of proposed development relative to the larger site area, there is limited to no potential for increase in runoff as a result of the proposed new access tracks/ hardstands areas etc (i.e. the proposed development footprint). Any potential small increase in runoff will be local to the development footprint, and any such small increases will be buffered/eliminated by the lack of gradient, and the tidal nature of the local drainage.

The proposed development will not have any potential to impact on surface water flowpaths/hydromorphology in the area of the site or the Brick River. There are no proposed above-ground structures within 20m of the Brick River channel or any outfall pipe through the flood embankments. All existing drainage pathways will be maintained. As such there is no potential to impede surface water flow. Also, the proposed development will not impede access to the Brick or Feale Rivers or its flood plain for maintenance purposes.

5.5 FLOOD RESILIENCE PROPOSALS

The applicant is aware that turbines are proposed in a defended (by flood protection embankments) coastal flood zone.

Turbine cabling and access track infrastructure can be submerged temporarily without any impact on their function.

The proposed substation is located on land above the 0.01% AEP flood elevation.

However, there are elements of the turbine setup that are water sensitive, and we have outlined the flood resilience design response to same below.

5.5.1 Turbines

Under normal flood conditions, there is no risk to turbine infrastructure from pluvial flooding. Based elevations are above existing ground level.

In the extreme scenario, where coastal flood defences fail, the turbines are at risk from coastal flooding during high tides.

A custom design for the turbine interior has been proposed whereby the switchgear (normally located in the basement level of the tower with the entrance hatch located 3m above) will be raised to a level above the hatch entrance. This level would be at an elevation of greater than 7 metres above ground level and therefore above any potential future extreme coastal flood elevation. This design will keep all sensitive equipment above the level of any flooding. A schematic of this proposal is illustrated on **Figure N**.

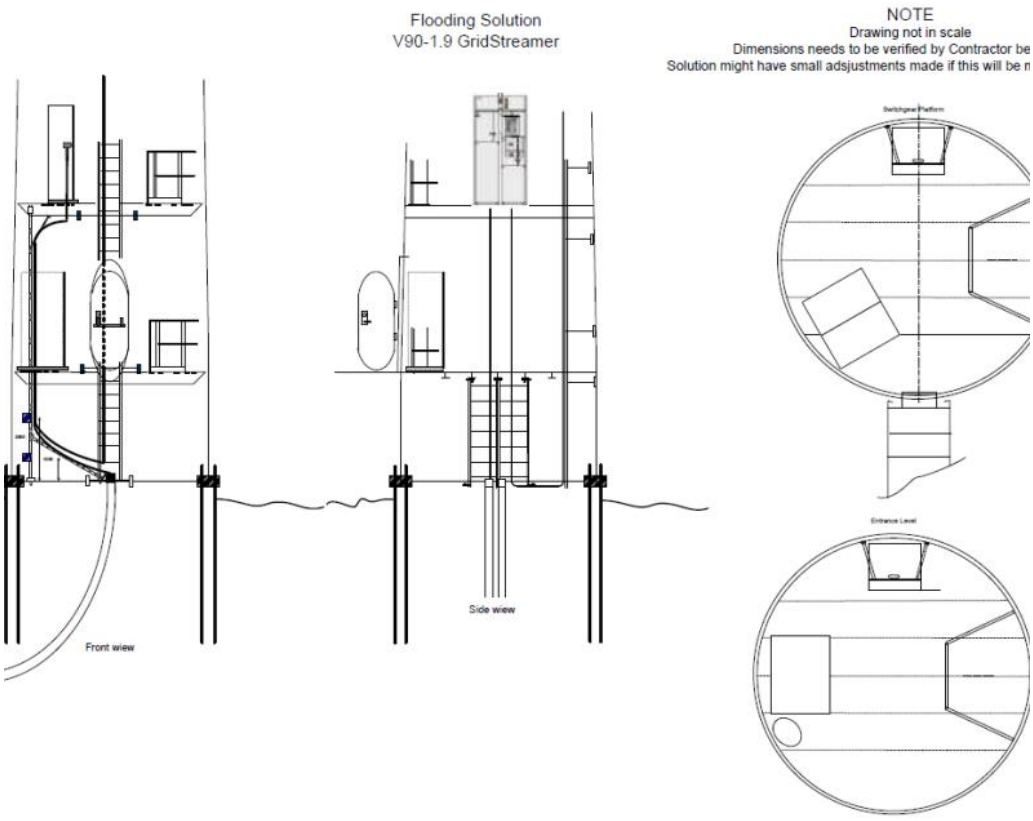

Figure N: Turbine flood resilience proposal

5.5.2 Flood Warning and Emergency Response

During the construction phase the observation of weather forecasts should be completed on a daily and weekly basis. Construction works will be scaled back or halted in the event of predicted extreme weather/tidal scenarios, and in line with weather warnings issued by Met Eireann.

During the operational phase, access to the site will be infrequent, and will be only done for maintenance works. Again, in advance of scheduled site visits review of weather and tidal forecasts will be completed and works will be postponed, and thereafter rescheduled to avoid high risk periods and weather warning events.

Access and egress routes from the site will be clearly marked. The proposed access point for emergency access is from the southern end of the proposed wind farm site which is unlikely to be affected during flood events.

6. JUSTIFICATION TEST

Box 5.1 (**Table G** below) of "The Planning System and Flood Risk Management Guidelines" (PSFRM Guidelines) outlines the criteria required to complete the "Justification Test".

Table G: Format of Justification Test for Development Management

Box 5.1 Justification Test for Development Management (to be submitted by the applicant)
When considering proposals for development, which may be vulnerable to flooding, and that would generally be inappropriate as set out in Table 3.2, the following criteria must be satisfied: 1. The subject lands have been zoned or otherwise designated for the particular use or form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines. 2. The proposal has been subject to an appropriate flood risk assessment that demonstrates: i. The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk; ii. The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; iii. The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and iv. The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes. The acceptability or otherwise of levels of residual risk should be made with consideration of the type and foreseen use of the development and the local development context.

Note: *this table has been adapted from Box 5.1 of "The Planning System and Flood Risk Management Guidelines", (2009).*

Referring to Point 1 and Points 2 (i) to (iv) inclusive in Figure 20 [of PSFRM guideline document]:

1. The proposed development is currently in the planning process and has been deemed suitable for development by the applicant. The applicant is aware of the coastal and pluvial flood risks associated with the proposed site, and they have included design responses to ensure flood resilience for sensitive elements of the proposed infrastructure. The proposed substation location is located in Flood Zone C, and is located above predicted extreme coastal flood elevations.
2. The proposal for 7 no. turbine wind farm and associated access tracks, construction compounds, sub-station, 1 no. met mast, cable trench route, grid connection, and other ancillary works has been the subject of a Stage III flood risk assessment (this report) and this assessment has shown that:
    i. The development has been assessed to have no impact on flood risk elsewhere in the locality.
    ii. The proposed development will not impede the flow of surface water during extreme flood events. Drainage designs for the proposed development follows SuDS principles. We conclude that the proposed development presents minimal risk to people, property, the economy and the environment. In addition, volumetric modelling has demonstrated that the proposed substation site is above the 1000-yr flood elevation. There will be no increase in flood risk on lands upstream or downstream of the proposed development site;
    iii. The flood assessment has shown that there will be negligible residual risks to the proposed development or the local area. Flood resilience proposals for sensitive components of the turbines are outlined above. Other elements of the development proposal are less sensitive to extreme flooding (cabling, access tracks, hardstands etc); and,

iv. With respect to the above (flood risk management proposals) the proposed development is therefore compatible with the wider planning objectives of the area. It does not alter the flood risk upstream or downstream of the proposed application site.

With regards to the proposed development site, it will for the large part remain flood free, but on rare occasions there is a minor risk of shallow inundation from pluvial flooding. Surface water discharges from the site will be attenuated and will be buffered by the tidal drainage and the low drainage gradients already present.

The potential for extreme coastal flooding scenario has been addressed within the flood resilience proposals.

Finally, we point out that wind turbines can be constructed offshore, and such developments are resilient/protected from extreme sea conditions and wet conditions. We also note there are examples from the UK and Ireland, whereby wind turbines have been developed in known coastal floodplains (defended from extreme future flood risk scenarios similar to the Ballynagare site). Some examples include Peel Wind Farm, Frodsham[5]; and, Richfield, Co. Wexford[6].

[5] https://www.bing.com/maps?osid=5a2f23e7-5c87-4c68-9bc5-7d63f04ec567&cp=53.300277~ 2.768404&lvl=16&style=h&v=2&sV=2&form=S00027
[6] https://www.bing.com/maps?osid=84c64be5-63f1-4aa5-a91b-2b413c4315a1&cp=52.213862~-6.598631&lvl=16&style=h&v=2&sV=2&form=S00027

7. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the proposed wind farm development at Ballynagare, Co. Kerry. From this study:
    - Several instances of historic and recurring flooding were identified on OPW maps within and adjacent to the proposed site;
    - Subsoil alluvium, often used as an indicator of past flooding is mapped by the GSI in the south of the site at T7;
    - The site is not mapped within any fluvial flood zones; however,
    - The majority of the proposed site is mapped with the 1 in 200-year flood zone associated with tidal flooding of the Cashen River Estuary (ICPSS).
    - The proposed site is defended from coastal flooding by existing flood embankments along the Brick and the Feale Rivers.
- Based on the flood risk identification process, and considering the temporary and transient nature of the grid route construction process, and its below ground reinstated finish, we consider there are no significant flood risk issues arising from or along the proposed grid route;
- Arising from the flood risk identification process, HES has completed a Stage III flood risk assessment for the wind farm site;
- The wind farm layout design has been iterative and cognisant of the local pluvial and coastal flood risks associated with the proposed development site;
- The proposed substation location is located in Flood Zone C, and is located above predicted extreme coastal flood elevations;
- The remainder of the proposed development is defended from coastal flood risk by the existing flood protection embankments. Irrespective of this, we have assessed the development area for flood risk based on the normal defended scenario, and the extreme undefended scenario (breech of flood embankments) as per the Guideline requirements;
- A Justification Test has been completed for areas of the development that are located within Flood Zone A and Flood Zone B;
    - Flood resilience proposals are outlined for sensitive turbine elements of the development
    - Hardstands and access roads are less sensitive, and very infrequent and intermittent flooding of same will not effect the operator's ability to maintain and manage the proposed wind farm
    - Proposals for use of flood warning and emergency response access are outlined for the construction and operational phases of the development (see Section 5.5.2)
- A volume displacement analysis has demonstrated that the construction of the wind farm access tracks and hardstone within Flood Zone A and B will have negligible impact on flood water depths local to the development footprint (i.e., <40mm increase) in normal pluvial conditions;
- Our assessment has also demonstrated that the potential presence of the wind farm footprint will have negligible additional risk in an extreme coastal flood scenario (breech of the flood embankment), as the flood storage volume displaced by the presence of the wind farm footprint is infinitely small in comparison to the available flood volume from the Cashen Estuary;

- Drainage proposals for the wind farm development will be completed in line with Kerry County Council requirements (refer to Section 5.2). Our assessment concludes there will be no increase in runoff volumes from the development footprint, and there is no potential for any elements of the proposed development to block existing surface water drainage pathways; and,
- At the end of Section 6 we have identified permitted and constructed wind farm developments that have similar, current and future, flood risks as the proposed wind farm development at Ballynagare.

* *

8. REFERENCES

AGMET	1996	Agroclimatic Atlas of Ireland.
DOEHLG	2009	The Planning System and Flood Risk Management.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
OPW	2013	Strategic Assessment of Coastal Flooding and Erosion Extents South West Cost – Bantry Bay to Ballyvaghan Bay

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APPENDIX 9.2

WATER QUALITY REPORTS

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www.alsglobal.ie

Report No: HYDR-051020721
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 02/07/2021
Date Reported 19/07/2021
Order Number P1531

For the Attention of: Hydro Environmental Services

Sample Reception 5 sample(s) received in good condition.

Comments N/A

Report Authorised by: Rosemary Thomas

Rosemary Thomas
Environmental Chemistry Manager

Conditions:
1. Results in this report relate only to the items tested
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
*4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method*
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test*
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: HYDR-051020721

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 02/07/2021
Date Reported 19/07/2021
Order Number P1531

Sample Type Surface Water
Client ID Ballynagore SW1
Date Tested 02/07/2021
ALS ID 4553905

Test	Result	Unit	Method
Suspended Solids	64	mg / l	P202
Phosphorus	0.14	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.03	mg/l P	P281
Chloride	5582.1	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.49	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

Sample Type Surface Water
Client ID Ballynagore SW2
Date Tested 02/07/2021
ALS ID 4553906

Test	Result	Unit	Method
Suspended Solids	90	mg / l	P202
Phosphorus	0.10	mg/l P	P207
BOD 5 day Total with ATU	16	mg/l O2	P280*
Orthophosphate	<0.02	mg/l P	P281
Chloride	9919.4	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.33	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

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ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.166T

Report No: HYDR-051020721

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 02/07/2021
Date Reported 19/07/2021
Order Number P1531

Sample Type Surface Water
Client ID Ballynagore SW3
Date Tested 02/07/2021
ALS ID 4553908

Test	Result	Unit	Method
Suspended Solids	14	mg / l	P202
Phosphorus	0.60	mg/l P	P207
BOD 5 day Total with ATU	4	mg/l O2	P280
Orthophosphate	0.60	mg/l P	P281
Chloride	46.1	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	3.73	mg/l NH3-N	P281
Nitrogen (Total)	2.9	mg/L N	P285

Sample Type Surface Water
Client ID Ballynagore SW4
Date Tested 02/07/2021
ALS ID 4553909

Test	Result	Unit	Method
Suspended Solids	<10	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.02	mg/l P	P281
Chloride	37.0	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.04	mg/l NH3-N	P281
Nitrogen (Total)	1.6	mg/L N	P285

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Report No: HYDR-051020721

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CERTIFICATE OF ANALYSIS

Date Received 02/07/2021
Date Reported 19/07/2021
Order Number P1531

Sample Type Surface Water
Client ID Ballynagore SW5
Date Tested 02/07/2021
ALS ID 4553910

Test	Result	Unit	Method
Suspended Solids	<10	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	9.7	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	0.02	mg/l NH3-N	P281
Nitrogen (Total)	<1.0	mg/L N	P285

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Report No: HYDR-535130721
Document No: EF0011

CERTIFICATE OF ANALYSIS

Client **Hydro Environmental Services**
22 Lower Main Street
Dungarvan
Co. Waterford

Date Received 13/07/2021
Date Reported 22/07/2021
Order Number 13107

For the Attention of: Hydro Environmental Services

Sample Reception 5 sample(s) received in good condition.

Comments N/A

Report Authorised by: David Kinsella

David Kinsella
Deputy Environmental Chemistry Manager

Conditions:
1. Results in this report relate only to the items tested
2. Reports may not be reproduced except in full without the approval of ALS Life Sciences Ltd
3. All queries regarding this report should be addressed to the Technical Manager at the above address
*4. A * next to a method reference signifies that ALS Life Sciences Ltd is NOT INAB accredited for this method*
5. Results reported as CFU/cm² are calculated based on information supplied by customer regarding area swabbed
6. SUBCON indicates analysis subcontracted to approved subcontractors who do not hold accreditation for this test*
7. SUBCON^ indicates analysis subcontracted to approved subcontractors who hold accreditation for this test
8. Where sampling is undertaken by ALS personnel, sampling activities are outside the scope of INAB accreditation
9. Dil next to a method reference indicates that a dilution of the water sample was undertaken during testing

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Report No: HYDR-535130721

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 13/07/2021
Date Reported 22/07/2021
Order Number 13107

Sample Type Surface Water
Client ID Ballynagare SW1
Date Tested 14/07/2021
ALS ID 4569447

Test	Result	Unit	Method
Suspended Solids	27	mg / l	P202
Phosphorus	0.20	mg/l P	P207
BOD 5 day Total with ATU	6	mg/l O2	P280
Orthophosphate	0.05	mg/l P	P281
Chloride	60.6	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.9	mg/L N	P285

Sample Type Surface Water
Client ID Ballynagare SW2
Date Tested 14/07/2021
ALS ID 4569448

Test	Result	Unit	Method
Suspended Solids	20	mg / l	P202
Phosphorus	0.17	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.06	mg/l P	P281
Chloride	226.8	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	0.05	mg/l NO2	P281
Ammonia	0.15	mg/l NH3-N	P281
Nitrogen (Total)	2.5	mg/L N	P285

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Report No: HYDR-535130721

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 13/07/2021
Date Reported 22/07/2021
Order Number 13107

Sample Type Surface Water
Client ID Ballynagare SW3
Date Tested 14/07/2021
ALS ID 4569449

Test	Result	Unit	Method
Suspended Solids	12	mg / l	P202
Phosphorus	0.25	mg/l P	P207
BOD 5 day Total with ATU	2	mg/l O2	P280
Orthophosphate	0.11	mg/l P	P281
Chloride	33.5	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	0.06	mg/l NO2	P281
Ammonia	0.06	mg/l NH3-N	P281
Nitrogen (Total)	3.1	mg/L N	P285

Sample Type Surface Water
Client ID Ballynagare SW4
Date Tested 14/07/2021
ALS ID 4569450

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	<1	mg/l O2	P280
Orthophosphate	0.04	mg/l P	P281
Chloride	25.6	mg/l Cl	P281
Nitrate	5.9	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	2.2	mg/L N	P285

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Report No: HYDR-535130721

Document No: EF0011

CERTIFICATE OF ANALYSIS

Date Received 13/07/2021
Date Reported 22/07/2021
Order Number 13107

Sample Type Surface Water
Client ID Ballynagare SW5
Date Tested 14/07/2021
ALS ID 4569451

Test	Result	Unit	Method
Suspended Solids	<5	mg / l	P202
Phosphorus	<0.10	mg/l P	P207
BOD 5 day Total with ATU	1	mg/l O2	P280
Orthophosphate	<0.02	mg/l P	P281
Chloride	17.5	mg/l Cl	P281
Nitrate	<5.0	mg/l NO3	P281
Nitrite	<0.05	mg/l NO2	P281
Ammonia	<0.02	mg/l NH3-N	P281
Nitrogen (Total)	1.5	mg/L N	P285

Report Authorised by: David Kinsella

David Kinsella
Deputy Environmental Chemistry Manager

APPENDIX 10.1

CARBON LOSS AND SAVINGS CALCULATION

Payback Time

Payback Time
Payback Time - ChartsInput Data
1. Windfarm CO2 emission saving 2. CO2 loss due to turbine life 3. CO2 loss due to backup 4. Loss of CO2 fixing potential 5. Loss of soil CO2 (a,b) 5

1. Windfarm CO2 emission saving over...	Exp.	Min.	Max.
...coal-fired electricity generation (t CO2 / yr)	118,470	107,413	121,855
...grid-mix of electricity generation (t CO2 / yr)	32,654	29,606	33,587
...fossil fuel-mix of electricity generation (t CO2 / yr)	57,947	52,539	59,603
Energy output from windfarm over lifetime (MWh)	4,507,020	4,086,365	4,635,792

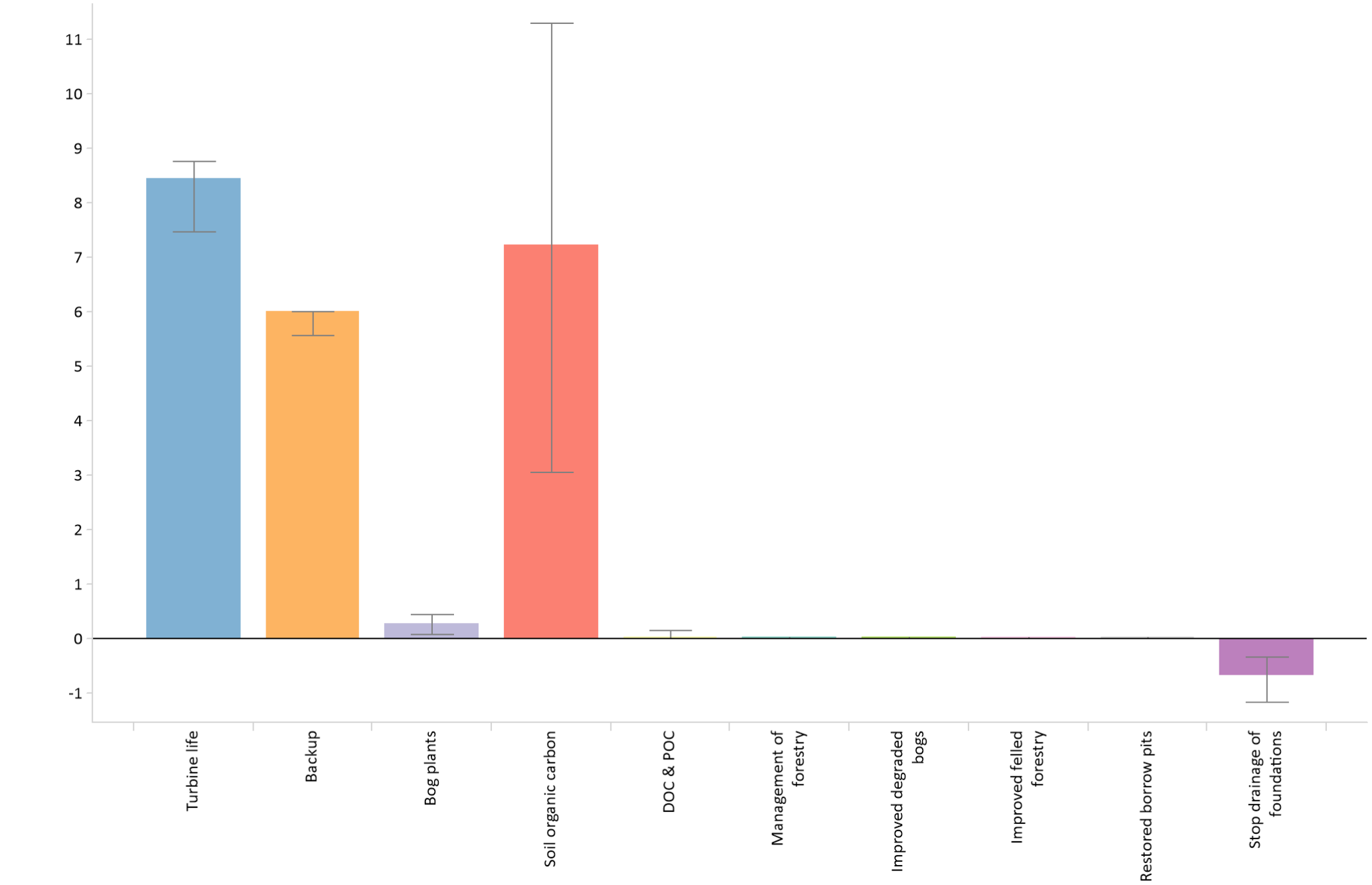
Total CO2 losses due to wind farm (tCO2 eq.)	Exp.	Min.	Max.
2. Losses due to turbine life (eg. manufacture, construction, decomissioning)	40,710	36,514	42,290
3. Losses due to backup	28,974	27,042	28,974
4. Lossess due to reduced carbon fixing potential	1,224	442	2,138
5. Losses from soil organic matter	34,889	16,636	55,116
6. Losses due to DOC & POC leaching	2	653	4
7. Losses due to felling forestry	0	0	0
Total losses of carbon dioxide	105,798	81,287	128,522

8. Total CO2 gains due to improvement of site (t CO2 eq.)	Exp.	Min.	Max.
8a. Change in emissions due to improvement of degraded bogs	0	0	0
8b. Change in emissions due to improvement of felled forestry	0	0	0
8c. Change in emissions due to restoration of peat from borrow pits	0	0	0
8d. Change in emissions due to removal of drainage from foundations & hardstanding	-3,182	-901	-4,745
Total change in emissions due to improvements	-3,182	-901	-4,745

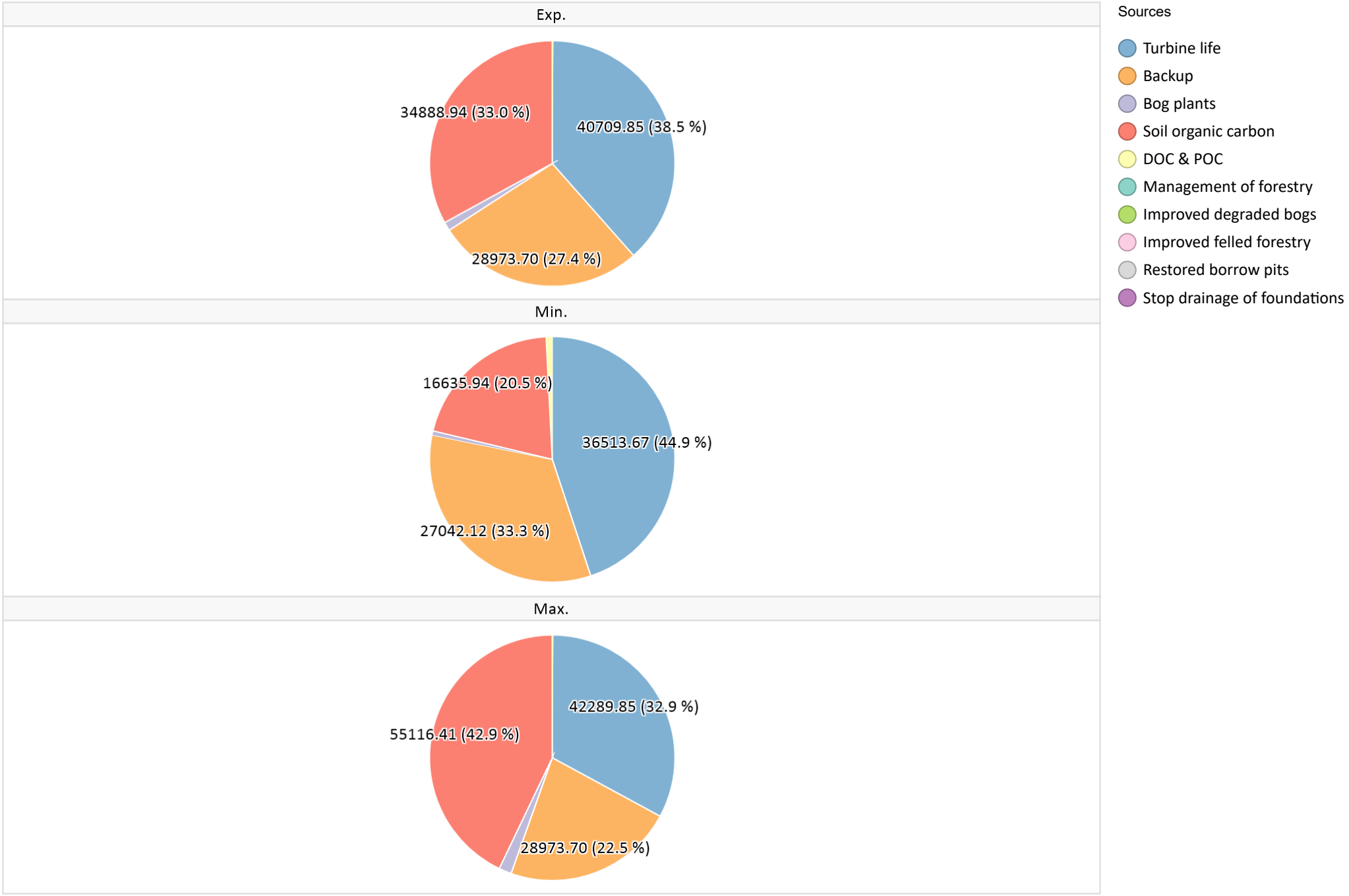
RESULTS	Exp.	Min.	Max.
Net emissions of carbon dioxide (t CO2 eq.)	102,616	76,542	127,621
Carbon Payback Time			
...coal-fired electricity generation (years)	0.9	0.6	1.2
...grid-mix of electricity generation (years)	3.1	2.3	4.3
...fossil fuel-mix of electricity generation (years)	1.8	1.3	2.4
Ratio of soil carbon loss to gain by restoration (not used in Scottish applications)	10.96	3.64	61.18
Ratio of CO2 eq. emissions to power generation (g/kWh) (for info. only)	22.77	16.51	31.23

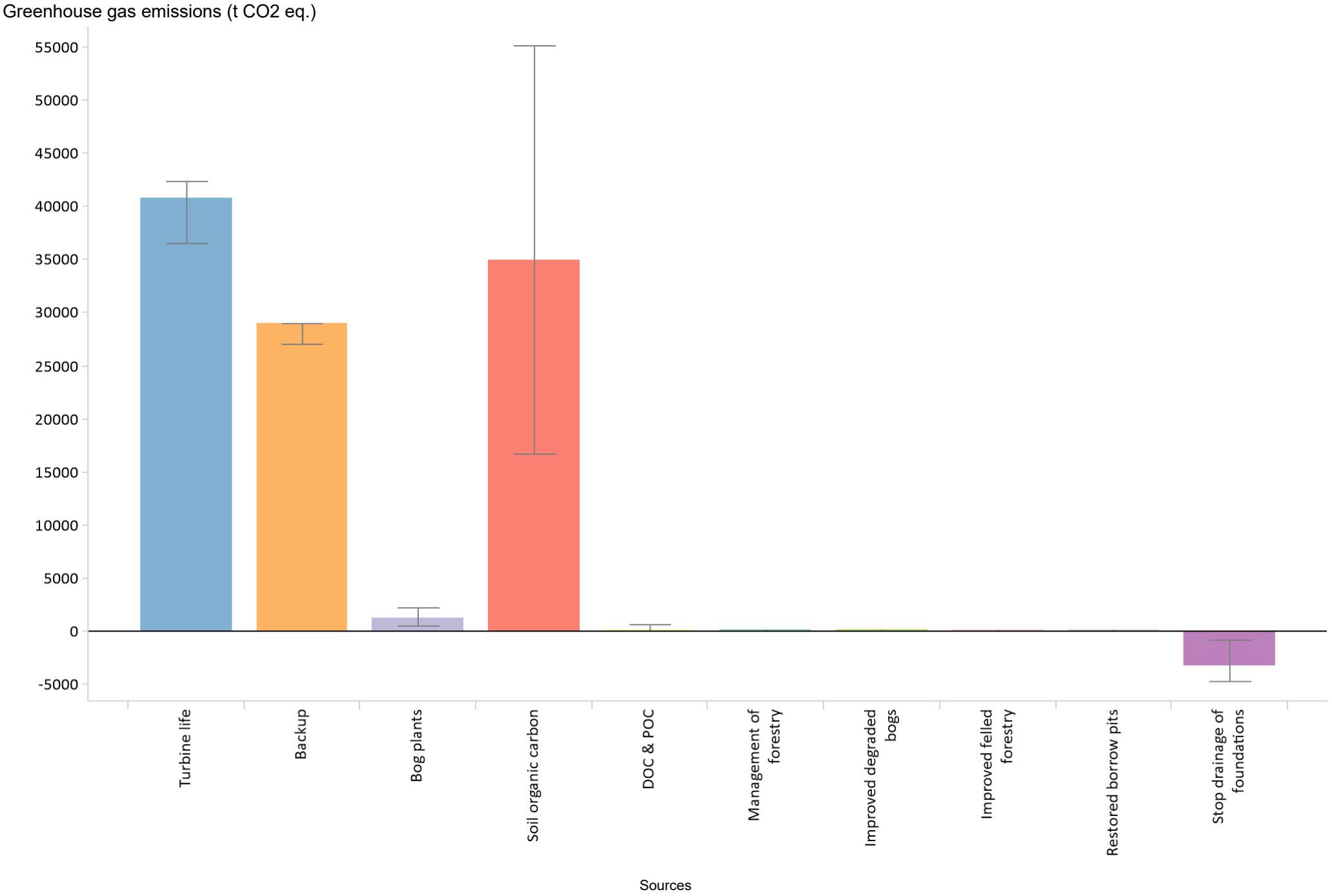
Payback Time and CO_2 emissions • OQ32-Y42H-NZ8A v4

Carbon payback time (months) using fossil-fuel mix as conterfactual



Proportions of greenhouse gas emissions from different sources




Greenhouse gas emissions (t CO2 eq.)
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
Turbine life
Backup
Bog plants
Soil organic carbon
DOC & POC
Management of forestry
Improved degraded bogs
Improved felled forestry
Restored borrow pits
Stop drainage of foundations
Sources

Carbon Calculator v1.6.1

Ballynagare Windfarm Location: 52.406461 -9.618128

EMPower

Core input data

Input data	Expected value	Minimum value	Maximum value	Source of data
Windfarm characteristics				
Dimensions				
No. of turbines	7	7	7	Chapter 4
Duration of consent (years)	35	35	35	Chapter 1
Performance				
Power rating of 1 turbine (MW)	6	5.6	6	Chapter 5
Capacity factor	35	34	36	Chapter 1
Backup				
Fraction of output to backup (%)	5	5	5	SNH Guidance
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed
Total CO2 emission from turbine life ($tCO2\ MW^{-1}$) (eg. manufacture, construction, decommissioning)	Calculate wrt installed capacity	Calculate wrt installed capacity	Calculate wrt installed capacity	
Characteristics of peatland before windfarm development				
Type of peatland	Acid bog	Acid bog	Acid bog	Chapter 8 (soils
Average annual air temperature at site (°C)	10.7	10.6	10.8	Ch 10 Air & climate
Average depth of peat at site (m)	2.6	2	6	Chapter 8 soils
C Content of dry peat (% by weight)	55	50	60	Default
Average extent of drainage around drainage features at site (m)	15	5	20	Chapter 9 Hydrology
Average water table depth at site (m)	0.5	0.1	1	Chapter 9 Hydrology
Dry soil bulk density ($g\ cm^{-3}$)	0.1	0.09	0.11	Default Value
Characteristics of bog plants				
Time required for regeneration of bog plants after restoration (years)	10	5	15	Best Practice in Raised Bog Restoration in Ireland
Carbon accumulation due to C fixation by bog plants in undrained peats ($tC\ ha^{-1}\ yr^{-1}$)	0.25	0.2	0.3	SNH Guidance Default
Forestry Plantation Characteristics				

Input data	Expected value	Minimum value	Maximum value	Source of data
Area of forestry plantation to be felled (ha)	0	0	0	Chapter 4
Average rate of carbon sequestration in timber (tC ha^{-1} yr^{-1})	3.6	3.5	3.7	N/A
Counterfactual emission factors				
Coal-fired plant emission factor (t CO2 MWh^{-1})	0.92	0.92	0.92	
Grid-mix emission factor (t CO2 MWh^{-1})	0.25358	0.25358	0.25358	
Fossil fuel-mix emission factor (t CO2 MWh^{-1})	0.45	0.45	0.45	
Borrow pits				
Number of borrow pits	1	1	2	CHapter 4
Average length of pits (m)	120	119	121	Chapter 4
Average width of pits (m)	95	94	96	Chapter 4
Average depth of peat removed from pit (m)	0	0	0	Chapter 4
Foundations and hard-standing area associated with each turbine				
Average length of turbine foundations (m)	19	18	20	PMP
Average width of turbine foundations (m)	19	18	20	PMP
Average depth of peat removed from turbine foundations(m)	3	2	5	PMP
Average length of hard-standing (m)	25	25	25	Chapter 4
Average width of hard-standing (m)	53	53	53	Chapter 4
Average depth of peat removed from hard-standing (m)	5.4	5.4	5.4	PMP
Volume of concrete used in construction of the ENTIRE windfarm				
Volume of concrete (m^3)	15000	10000	20000	PMP
Access tracks				
Total length of access track (m)	9320	9207	9413	Chapter 4
Existing track length (m)	1110	1000	1200	Chapter 4
Length of access track that is floating road (m)	4600	4599	4601	chapter 4
Floating road width (m)	6	5	6	Chapter 4
Floating road depth (m)	0.75	0.7	0.8	Chapter 4
Length of floating road that is drained (m)	4600	4599	4601	Chapter 4
Average depth of drains associated with floating roads (m)	1	0.9	1.1	Chapter 4

Input data	Expected value	Minimum value	Maximum value	Source of data
Length of access track that is excavated road (m)	600	599	601	Chapter 4
Excavated road width (m)	6	5	6	Chapter 4
Average depth of peat excavated for road (m)	3.07	3	4	Chapter 4
Length of access track that is rock filled road (m)	3010	3009	3011	chapter 4
Rock filled road width (m)	6	5	6	chapter 4
Rock filled road depth (m)	1	0.9	1.1	Chapter 4
Length of rock filled road that is drained (m)	0	0	0	Chapter 4
Average depth of drains associated with rock filled roads (m)	0	0	0	Chapter 4
Cable trenches				
Length of any cable trench on peat that does not follow access tracks and is lined with a permeable medium (eg. sand) (m)	0	0	0	Chapter 4
Average depth of peat cut for cable trenches (m)	0	0	0	
Additional peat excavated (not already accounted for above)				
Volume of additional peat excavated (m^3)	1968	1967	1969	PMP
Area of additional peat excavated (m^2)	625	624	626	Chapter 4
Peat Landslide Hazard				
Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments	negligible	negligible	negligible	Fixed
Improvement of C sequestration at site by blocking drains, restoration of habitat etc				
Improvement of degraded bog				
Area of degraded bog to be improved (ha)	0	0	0	Chapter 4
Water table depth in degraded bog before improvement (m)	0	0	0	
Water table depth in degraded bog after improvement (m)	0	0	0	
Time required for hydrology and habitat of bog to return to its previous state on improvement (years)	0	0	0	
Period of time when effectiveness of the improvement in degraded bog can be guaranteed (years)	0	0	0	

Input data	Expected value	Minimum value	Maximum value	Source of data
Improvement of felled plantation land				
Area of felled plantation to be improved (ha)	0	0	0	Chapter 4
Water table depth in felled area before improvement (m)	0	0	0	
Water table depth in felled area after improvement (m)	0	0	0	
Time required for hydrology and habitat of felled plantation to return to its previous state on improvement (years)	0	0	0	
Period of time when effectiveness of the improvement in felled plantation can be guaranteed (years)	0	0	0	
Restoration of peat removed from borrow pits				
Area of borrow pits to be restored (ha)	0	0	0	Chapter 4
Depth of water table in borrow pit before restoration with respect to the restored surface (m)	0	0	0	
Depth of water table in borrow pit after restoration with respect to the restored surface (m)	0	0	0	
Time required for hydrology and habitat of borrow pit to return to its previous state on restoration (years)	0	0	0	
Period of time when effectiveness of the restoration of peat removed from borrow pits can be guaranteed (years)	0	0	0	
Early removal of drainage from foundations and hardstanding				
Water table depth around foundations and hardstanding before restoration (m)	1.5	1.4	1.6	chapter 9
Water table depth around foundations and hardstanding after restoration (m)	0.5	0.4	0.6	Chapter 9
Time to completion of backfilling, removal of any surface drains, and full restoration of the hydrology (years)	5	4	5	default
Restoration of site after decomissioning				
Will the hydrology of the site be restored on decommissioning?	No	Yes	No	
Will you attempt to block any gullies that have formed due to the windfarm?	Yes	Yes	No	Ch 4
Will you attempt to block all artificial ditches and facilitate rewetting?	No	Yes	No	Ch 4

Input data	Expected value	Minimum value	Maximum value	Source of data
Will the habitat of the site be restored on decommissioning?	Yes	Yes	No	
Will you control grazing on degraded areas?	Yes	Yes	No	Ch 4
Will you manage areas to favour reintroduction of species	Yes	Yes	No	Ch 4
Methodology				
Choice of methodology for calculating emission factors	IPCC default			

Forestry input data

N/A

Construction input data

N/A

APPENDIX 11.1

GLOSSARY OF ACOUSTIC TERMINOLOGY

APPENDIX 11.1

GLOSSARY OF ACOUSTIC TERMINOLOGY

A variety of acoustic parameters and terminology are used throughout this chapter. Significant definitions are identified at this stage to inform the reader.

A – Weighting	The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing.
Background Noise	The noise level rarely fallen below in any given location over any given time period, often classed according to day time, evening or night time periods. The LA90,10min is the parameter that is used to define the background noise level in this instance. LA90 is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
dB (decibel)	The unit normally employed to measure the magnitude of sound. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μPa).
dB(A)	An 'A-weighted decibel' – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A – Weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hub Height Wind Speed	The wind speed at the centre of the turbine rotor.
Hertz (Hz)	The unit of sound frequency in cycles per second.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).The closer the LAeq value is to either the LAF10 or LAF90 value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{AF90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the "Fast" time weighting.
L_{den}	Refers to the LAeq noise levels over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator.

GLOSSARY OF ACOUSTIC TERMINOLOGY (Continued)

Low Frequency Noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.
Noise	Sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
Pascal (Pa)	Pascal is a unit of pressure and so sound pressures are measured in Pascals.
Sound Power Level (L_W)	The sound power level radiated by a source is defined as: $L_p = 10 \times \log_{10}(W/W_o)$ dB. Where W is the acoustic power of the source in Watts (W) and W_o is a reference sound power chosen in air to be 10^{-12}W.
Sound Pressure Level (L_p)	The sound pressure level at a point is defined: $L_p = 20 \times \log_{10}(P/P_o)$ dB. Where P is the sound pressure and P^o is a reference pressure for propagation of sound in air and has a value of $2x10^{-5}$Pa.
Tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.
10 Minute Average Wind Speed (m/s)	The wind speed measured by an anemometer at a specified height above ground level, averaged over a 10-minute period.
Wind Shear	The increase of wind speed with height above ground.

APPENDIX 11.2

CALIBRATION CERTIFICATES

APPENDIX 11.2

CALIBRATION CERTIFICATES – MONITORING EQUIPMENT

MEASUREMENT SYSTEMS

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 05 May 2020

Certificate Number: UCRT20/1392

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	AWN Consulting The Tecpro Building IDA Business and Technology Park Clonshaugh Dublin 17

Order No.	RM/20/Cal019			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00186670
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76820
	Rion	Microphone	UC-59	12816
	Brüel & Kjær	Calibrator	4231	2205805
		Calibrator adaptor type if applicable		UC 0210
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	30 April 2020	ANV Job No.	UKAS20/04240	
Date Calibrated	05 May 2020			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	20 April 2018	UCRT18/1435	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT20/1392

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	UC 0210		
Calibrator cal. date	06 December 2019		
Calibrator cert. number	UCRT19/2333		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.95	dB	Calibration reference sound pressure level
Calibrator frequency	999.97	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.56	23.46	± 0.30 °C
Humidity	36.7	35.9	± 3.00 %RH
Ambient Pressure	101.08	101.12	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.1	dB	Adjusted indicated level	93.9	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.1	dB	UR	15.6	dB	UR	21.2	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: B. Bogdan R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
None

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 21 August 2020 **Certificate Number: UCRT20/1795**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	AWN Consulting Limited The Tecpro Building IDA Business and Technology Park Clonshaugh Dublin 17 Ireland			
Order No.	PO 2062			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	01076328
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76545
	Rion	Microphone	UC-59	17212
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49 *Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	19 August 2020	ANV Job No.	UKAS20/08452	
Date Calibrated	21 August 2020			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	15 August 2018	UCRT18/1836	0653

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CERTIFICATE OF CALIBRATION

Certificate Number	
UCRT20/1795	
UKAS Accredited Calibration Laboratory No. 0653	Page 2 of 2 Pages

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NL-42 / NL-52	
SLM instruction manual ref / issue		11-03	
SLM instruction manual source		Manufacturer	
Internet download date if applicable		N/A	
Case corrections available		Yes	
Uncertainties of case corrections		Yes	
Source of case data		Manufacturer	
Wind screen corrections available		Yes	
Uncertainties of wind screen corrections		Yes	
Source of wind screen data		Manufacturer	
Mic pressure to free field corrections		Yes	
Uncertainties of Mic to F.F. corrections		Yes	
Source of Mic to F.F. corrections		Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002		Yes	
Specified or equivalent Calibrator		Specified	
Customer or Lab Calibrator		Lab Calibrator	
Calibrator adaptor type if applicable		NC-74-002	
Calibrator cal. date		19 August 2020	
Calibrator cert. number		UCRT20/1789	
Calibrator cal cert issued by		0653	
Calibrator SPL @ STP		94.02 dB	Calibration reference sound pressure level
Calibrator frequency		1001.89 Hz	Calibration check frequency
Reference level range		25 - 130 dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	22.72	23.10	± 0.30 °C
Humidity	64.7	62.8	± 3.00 %RH
Ambient Pressure	98.89	98.98	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0 dB		Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.0	dB	UR	14.5	dB	UR	20.8	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: B. Giles R 1

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
Prior to calibration the instrument's microphone was replaced and the meter was re-aligned.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 12 May 2020

Certificate Number: UCRT20/1415

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	AWN Consulting The Tecpro Building IDA Business and Technology Park Clonshaugh Dublin 17

Order No.	RM/20/Cal019			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00186671
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76821
	Rion	Microphone	UC-59	16877
	Brüel & Kjær	Calibrator	4231	2205805
		Calibrator adaptor type if applicable		UC 0210
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	30 April 2020	ANV Job No.	UKAS20/04240	
Date Calibrated	12 May 2020			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	20 April 2018	UCRT18/1437	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT20/1415

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	UC 0210		
Calibrator cal. date	06 December 2019		
Calibrator cert. number	UCRT19/2333		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.95	dB	Calibration reference sound pressure level
Calibrator frequency	999.97	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End		
Temperature	21.16	21.27	± 0.30	°C
Humidity	41.1	37.8	± 3.00	%RH
Ambient Pressure	100.91	100.90	± 0.03	kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.3	dB	Adjusted indicated level	93.9	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	12.6	dB	UR	16.6	dB	UR	22.4	dB	UR
Uncertainty of the electrical self generated noise ±						0.12		dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: B. Giles R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
Prior to calibration the instrument's microphone was replaced and the meter was re-aligned.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 07 May 2020

Certificate Number: UCRT20/1406

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

Customer	AWN Consulting The Tecpro Building IDA Business and Technology Park Clonshaugh Dublin 17

Order No.	RM/20/Cal019			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	00998409
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	98623
	Rion	Microphone	UC-59	15915
	Brüel & Kjær	Calibrator	4231	2205805
		Calibrator adaptor type if applicable		UC 0210
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49			
	Procedures from IEC 61672-3:2006 were used to perform the periodic tests.			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	30 April 2020	ANV Job No.	UKAS20/04240	
Date Calibrated	07 May 2020			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	22 January 2020	UCRT20/1097	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT20/1406

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	UC 0210		
Calibrator cal. date	06 December 2019		
Calibrator cert. number	UCRT19/2333		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	93.95	dB	Calibration reference sound pressure level
Calibrator frequency	999.97	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	23.35	23.47	± 0.30 °C
Humidity	38.1	38.2	± 3.00 %RH
Ambient Pressure	101.19	101.14	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	93.9	dB	Adjusted indicated level	93.9	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.7	dB	UR	15.3	dB	UR	20.9	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: B. Bogdan R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
Prior to calibration the instrument's main PCB was replaced and the meter was re-aligned.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 20 October 2020

Certificate Number: UCRT20/2020

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory



K. Mistry

Customer	AWN Consulting Limited The Tecpro Building IDA Business and Technology Park Clonshaugh Dublin 17 Ireland			
Order No.	PO-2083			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	*Manufacturer*	*Instrument*	*Type*	*Serial No. / Version*
	Rion	Sound Level Meter	NL-52	01076330
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	87063
	Rion	Microphone	UC-59	13407
	Brüel & Kjær	Calibrator	4231	3010369
		Calibrator adaptor type if applicable		UC 0210
Performance Class	1			
Test Procedure	TP 2.SLM 61672-3 TPS-49 *Procedures from IEC 61672-3:2006 were used to perform the periodic tests.*			
Type Approved to IEC 61672-1:2002	YES	Approval Number	21.21 / 13.02	
	If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003			
Date Received	19 October 2020	ANV Job No.	UKAS20/10584	
Date Calibrated	20 October 2020			

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	03 April 2019	UCRT19/1402	0653

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CERTIFICATE OF CALIBRATION

UKAS Accredited Calibration Laboratory No. 0653

Certificate Number
UCRT20/2020

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter NL-42 / NL-52		
SLM instruction manual ref / issue	11-03		
SLM instruction manual source	Manufacturer		
Internet download date if applicable	N/A		
Case corrections available	Yes		
Uncertainties of case corrections	Yes		
Source of case data	Manufacturer		
Wind screen corrections available	Yes		
Uncertainties of wind screen corrections	Yes		
Source of wind screen data	Manufacturer		
Mic pressure to free field corrections	Yes		
Uncertainties of Mic to F.F. corrections	Yes		
Source of Mic to F.F. corrections	Manufacturer		
Total expanded uncertainties within the requirements of IEC 61672-1:2002	Yes		
Specified or equivalent Calibrator	Specified		
Customer or Lab Calibrator	Customers Calibrator		
Calibrator adaptor type if applicable	UC 0210		
Calibrator cal. date	03 March 2020		
Calibrator cert. number	UCRT20/1259		
Calibrator cal cert issued by	0653		
Calibrator SPL @ STP	94.17	dB	Calibration reference sound pressure level
Calibrator frequency	999.96	Hz	Calibration check frequency
Reference level range	25 - 130	dB	

Accessories used or corrected for during calibration - Extension Cable & Wind Shield WS-15
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	23.60	23.70	± 0.30 °C
Humidity	54.2	52.8	± 3.00 %RH
Ambient Pressure	98.98	98.98	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.2	dB		Adjusted indicated level	94.2	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±					0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	11.3	dB	UR	15.2	dB	UR	22.4	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

..... END .....

Calibrated by: B. Bogdan

R 2

Additional Comments The results on this certificate only relate to the items calibrated as identified above.
Prior to calibration the instrument's microphone and pre-amp were swapped and the meter was re-aligned.

APPENDIX 11.3

NOISE MODEL ASSUMPTIONS

APPENDIX 11.3

NOISE MODEL ASSUMPTIONS

Prediction calculations for turbine noise have been conducted in accordance with ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, 1996. Guidance in terms of the calculation settings has been obtained from the Institute of Acoustics (IoA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IoA GPG) and its associated supplementary guidance notes. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation)

Noise Calculations have been conducted using a source height corresponding to the hub height of the proposed turbines, a receiver height of 4m and an assumed ground factor of G=0.5.

Geometrical DivergenceThis term relates to the spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log(d) + 11$$

where d = distance from the source

A wind turbine may be considered as a point source beyond a distance corresponding to one rotor diameter.

Atmospheric Absorption: Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies.

In accordance with the guidance set out in the IoA GPG for calculations, a temperature of 10°C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.

Barrier Attenuation: The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO9613 model have been shown to be significantly greater than that measured in practice under down wind conditions.

APPENDIX 11.4

PREDICTED OPERATIONAL NOISE LEVELS

APPENDIX 11.4

PREDICTED OPERATIONAL NOISE LEVELS

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
H001	Dwelling	28.1	31.4	35.6	39.1	40.2	40.3	40.3
	Daytime Criterion	45	45	45	45	45	45	46.2
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.1
	Night-time Excess	--	--	--	--	--	--	--
H002	Dwelling	27.9	31.1	35.3	38.8	39.9	40	40
	Daytime Criterion	45	45	45	45	45	45	46.2
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.1
	Night-time Excess	--	--	--	--	--	--	--
R003	Dwelling	27.6	30.8	35	38.5	39.6	39.7	39.7
	Daytime Criterion	45	45	45	45	45	45	46.2
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.1
	Night-time Excess	--	--	--	--	--	--	--
R004	Dwelling	26.5	29.7	33.9	37.4	38.5	38.6	38.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R005	Dwelling	25.2	28.5	32.7	36.2	37.2	37.4	37.4
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R006	Dwelling	26.4	29.6	33.8	37.3	38.4	38.5	38.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R007	Dwelling	24.7	27.9	32.2	35.7	36.7	36.9	36.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R008	Dwelling	26.2	29.5	33.7	37.2	38.3	38.4	38.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Excess	--	--	--	--	--	--	--
R009	Dwelling	25.2	28.5	32.7	36.2	37.2	37.4	37.4
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R010	Dwelling	24.5	27.8	32	35.5	36.6	36.7	36.7
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R011	Dwelling	26.9	30.2	34.4	37.9	38.9	39.1	39.1
	Daytime Criterion	45	45	45	45	45	45	46.2
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	45.1
	Night-time Excess	--	--	--	--	--	--	--
R012	Dwelling	26.3	29.6	33.8	37.3	38.3	38.5	38.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R013	Dwelling	26.1	29.3	33.6	37	38.1	38.3	38.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R014	Dwelling	23.9	27.2	31.4	34.9	35.9	36.1	36.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R015	Dwelling	24.7	27.9	32.2	35.6	36.7	36.8	36.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R016	Dwelling	24.3	27.6	31.8	35.3	36.3	36.5	36.5
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R017	Dwelling	24.8	28	32.3	35.7	36.8	36.9	37

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R018	Dwelling	23.3	26.6	30.8	34.3	35.3	35.5	35.5
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R019	Dwelling	25	28.2	32.5	36	37	37.2	37.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R020	Dwelling	24.6	27.9	32.1	35.6	36.6	36.8	36.8
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R021	Dwelling	24.8	28.1	32.3	35.8	36.8	37	37
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R022	Dwelling	22.9	26.2	30.4	33.9	35	35.1	35.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R023	Dwelling	24.4	27.7	31.9	35.4	36.4	36.6	36.6
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R024	Dwelling	25.7	29	33.2	36.7	37.7	37.9	37.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R025	Dwelling	25.8	29	33.2	36.7	37.8	37.9	37.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R026	Dwelling	22.8	26	30.2	33.7	34.8	34.9	35
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R027	Dwelling	25.7	29	33.2	36.7	37.7	37.9	37.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R028	Dwelling	25.6	28.9	33.1	36.6	37.6	37.8	37.8
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R029	Dwelling	24.7	27.9	32.2	35.6	36.7	36.8	36.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R030	Dwelling	24.4	27.7	31.9	35.4	36.4	36.6	36.6
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R031	Dwelling	25.2	28.5	32.7	36.2	37.2	37.4	37.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R032	Dwelling	22.4	25.7	29.9	33.4	34.4	34.6	34.6
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R033	Dwelling	24.3	27.6	31.8	35.3	36.3	36.5	36.5
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
R034	Dwelling	24.3	27.5	31.7	35.2	36.3	36.4	36.4
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R035	Dwelling	24.9	28.1	32.4	35.8	36.9	37.1	37.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R036	Dwelling	25.1	28.3	32.6	36	37.1	37.2	37.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R037	Dwelling	24.1	27.3	31.6	35	36.1	36.2	36.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R038	Dwelling	25.1	28.3	32.6	36	37.1	37.2	37.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R039	Dwelling	22.4	25.6	29.9	33.3	34.4	34.5	34.6
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R040	Dwelling	24.9	28.2	32.4	35.9	36.9	37.1	37.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R041	Dwelling	23.9	27.1	31.4	34.9	35.9	36.1	36.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R042	Dwelling	24.7	27.9	32.2	35.6	36.7	36.8	36.9
	Daytime Criterion	40	40	40	40	45	45	45

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R043	Dwelling	23.6	26.9	31.1	34.6	35.6	35.8	35.8
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R044	Dwelling	23.8	27.1	31.3	34.8	35.8	36	36
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R045	Dwelling	22	25.3	29.5	33	34	34.2	34.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R046	Dwelling	21.9	25.1	29.3	32.8	33.9	34	34
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R047	Dwelling	21.2	24.4	28.7	32.1	33.2	33.3	33.4
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R048	Dwelling	23.8	27.1	31.3	34.8	35.8	36	36
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R049	Dwelling	21.7	25	29.2	32.7	33.7	33.9	33.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R050	Dwelling	23	26.2	30.4	33.9	35	35.1	35.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Excess	--	--	--	--	--	--	--
R051	Dwelling	21.3	24.5	28.8	32.3	33.3	33.5	33.5
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R052	Dwelling	23.2	26.4	30.6	34.1	35.2	35.3	35.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R053	Dwelling	20.7	23.9	28.2	31.6	32.7	32.8	32.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R054	Dwelling	21.1	24.4	28.6	32.1	33.1	33.3	33.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R055	Dwelling	20.6	23.9	28.1	31.6	32.6	32.8	32.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R056	Dwelling	23	26.3	30.5	34	35	35.2	35.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R057	Dwelling	22.1	25.3	29.5	33	34.1	34.2	34.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R058	Dwelling	21.1	24.4	28.6	32.1	33.1	33.3	33.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R059	Dwelling	22.6	25.8	30	33.5	34.6	34.7	34.8

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R060	Dwelling	22.4	25.7	29.9	33.4	34.4	34.6	34.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R061	Dwelling	22.4	25.6	29.9	33.3	34.4	34.5	34.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R062	Dwelling	20.5	23.8	28	31.5	32.5	32.7	32.7
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R063	Dwelling	21	24.2	28.5	31.9	33	33.1	33.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R064	Dwelling	22.1	25.3	29.5	33	34.1	34.2	34.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R065	Dwelling	22.4	25.7	29.9	33.4	34.4	34.6	34.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R066	Dwelling	20.9	24.1	28.3	31.8	32.9	33	33.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R067	Dwelling	22.3	25.6	29.8	33.3	34.3	34.5	34.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R068	Dwelling	22.2	25.5	29.7	33.2	34.2	34.4	34.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R069	Dwelling	20.2	23.5	27.7	31.2	32.2	32.4	32.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R070	Dwelling	22	25.3	29.5	33	34	34.2	34.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R071	Dwelling	22.3	25.5	29.8	33.2	34.3	34.4	34.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R072	Dwelling	22.2	25.4	29.6	33.1	34.2	34.3	34.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R073	Dwelling	22.5	25.8	30	33.5	34.5	34.7	34.7
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R074	Dwelling	22.1	25.3	29.5	33	34.1	34.2	34.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R075	Dwelling	20	23.3	27.5	31	32	32.2	32.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
R076	Dwelling	22	25.2	29.5	32.9	34	34.1	34.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R077	Dwelling	21.5	24.8	29	32.5	33.5	33.7	33.7
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R078	Dwelling	22.1	25.4	29.6	33.1	34.1	34.3	34.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R079	Dwelling	21.7	24.9	29.1	32.6	33.7	33.8	33.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R080	Dwelling	19.6	22.8	27.1	30.5	31.6	31.7	31.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R081	Dwelling	21.4	24.7	28.9	32.4	33.4	33.6	33.6
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R082	Dwelling	21.2	24.4	28.7	32.1	33.2	33.3	33.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R083	Dwelling	21	24.3	28.5	32	33	33.2	33.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R084	Dwelling	20	23.3	27.5	31	32	32.2	32.2
	Daytime Criterion	40	40	40	40	40	45	45

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R085	Dwelling	21	24.3	28.5	32	33	33.2	33.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R086	Dwelling	20.7	23.9	28.1	31.6	32.7	32.8	32.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R087	Dwelling	21	24.2	28.5	31.9	33	33.1	33.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R088	Dwelling	20.6	23.8	28	31.5	32.6	32.7	32.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R089	Dwelling	20.6	23.9	28.1	31.6	32.6	32.8	32.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R090	Dwelling	20.9	24.2	28.4	31.9	32.9	33.1	33.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R091	Dwelling	21	24.2	28.4	31.9	33	33.1	33.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R092	Dwelling	19.8	23	27.2	30.7	31.8	31.9	32
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Excess	--	--	--	--	--	--	--
R093	Dwelling	20.7	23.9	28.1	31.6	32.7	32.8	32.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R094	Dwelling	20.7	23.9	28.2	31.6	32.7	32.8	32.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R095	Dwelling	20.6	23.8	28.1	31.5	32.6	32.7	32.8
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R096	Dwelling	20.4	23.7	27.9	31.4	32.4	32.6	32.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R097	Dwelling	20.9	24.1	28.4	31.8	32.9	33	33.1
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R098	Dwelling	18.9	22.1	26.4	29.8	30.9	31	31.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R099	Dwelling	20.7	24	28.2	31.7	32.7	32.9	32.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R100	Dwelling	18.9	22.1	26.3	29.8	30.8	31	31
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R101	Dwelling	19.5	22.8	27	30.4	31.5	31.7	31.7

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R102	Dwelling	19.6	22.9	27.1	30.6	31.6	31.8	31.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R103	Dwelling	20.9	24.1	28.4	31.8	32.9	33	33.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R104	Dwelling	20.2	23.4	27.6	31.1	32.1	32.3	32.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R105	Dwelling	19.5	22.7	26.9	30.4	31.4	31.6	31.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R106	Dwelling	20.2	23.4	27.6	31.1	32.1	32.3	32.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R107	Dwelling	18.7	22	26.2	29.7	30.7	30.9	30.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R108	Dwelling	19.1	22.3	26.5	30	31	31.2	31.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R109	Dwelling	19.5	22.8	27	30.5	31.5	31.7	31.7
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R110	Dwelling	20.1	23.3	27.5	31	32	32.2	32.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R111	Dwelling	20	23.2	27.4	30.9	32	32.1	32.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R112	Dwelling	20.4	23.7	27.9	31.4	32.4	32.6	32.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R113	Dwelling	20.1	23.3	27.5	31	32.1	32.2	32.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R114	Dwelling	19	22.2	26.4	29.9	31	31.1	31.2
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R115	Dwelling	20	23.3	27.5	31	32	32.2	32.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R116	Dwelling	20	23.2	27.4	30.9	31.9	32.1	32.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R117	Dwelling	20	23.2	27.5	30.9	32	32.1	32.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
R118	Dwelling	19.4	22.6	26.9	30.3	31.4	31.5	31.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R119	Dwelling	18.8	22.1	26.3	29.8	30.8	31	31
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R120	Dwelling	19.9	23.2	27.4	30.9	31.9	32.1	32.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R121	Dwelling	19.7	23	27.2	30.7	31.7	31.9	31.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R122	Dwelling	19.9	23.1	27.4	30.8	31.9	32	32.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R123	Dwelling	18.7	22	26.2	29.7	30.7	30.9	30.9
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R124	Dwelling	20.2	23.4	27.7	31.1	32.2	32.3	32.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R125	Dwelling	18.6	21.9	26.1	29.6	30.6	30.8	30.8
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R126	Dwelling	19.8	23	27.2	30.7	31.8	31.9	32
	Daytime Criterion	40	40	40	40	40	45	45

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R127	Dwelling	19.8	23	27.2	30.7	31.7	31.9	31.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R128	Dwelling	20.3	23.5	27.7	31.2	32.3	32.4	32.4
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R129	Dwelling	19.7	22.9	27.1	30.6	31.6	31.8	31.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R130	Dwelling	20.4	23.6	27.8	31.3	32.4	32.5	32.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R131	Dwelling	19.5	22.7	26.9	30.4	31.4	31.6	31.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R132	Dwelling	19.2	22.4	26.6	30.1	31.2	31.3	31.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R133	Dwelling	18.2	21.5	25.7	29.2	30.2	30.4	30.4
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R134	Dwelling	18.7	21.9	26.1	29.6	30.7	30.8	30.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Excess	--	--	--	--	--	--	--
R135	Dwelling	19.4	22.7	26.9	30.4	31.4	31.6	31.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R136	Dwelling	18.8	22	26.2	29.7	30.7	30.9	30.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R137	Dwelling	19.8	23	27.3	30.7	31.8	31.9	32
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R138	Dwelling	18.2	21.5	25.7	29.2	30.2	30.4	30.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R139	Dwelling	18.6	21.9	26.1	29.6	30.6	30.8	30.8
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R140	Dwelling	19.4	22.7	26.9	30.4	31.4	31.6	31.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R141	Dwelling	19.4	22.6	26.8	30.3	31.3	31.5	31.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R142	Dwelling	18.2	21.4	25.7	29.1	30.2	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R143	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.3

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R144	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R145	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R146	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R147	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R148	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R149	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R150	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R151	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R152	Dwelling	18.1	21.3	25.5	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R153	Dwelling	18.5	21.8	26	29.4	30.5	30.7	30.7
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R154	Dwelling	19.3	22.5	26.7	30.2	31.3	31.4	31.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R155	Dwelling	18.1	21.3	25.6	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R156	Dwelling	20.3	23.6	27.8	31.3	32.3	32.5	32.5
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R157	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R158	Dwelling	18.1	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R159	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
R160	Dwelling	18.5	21.7	25.9	29.4	30.4	30.6	30.6
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R161	Dwelling	18	21.2	25.5	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R162	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R163	Dwelling	18	21.2	25.4	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R164	Dwelling	19.2	22.4	26.6	30.1	31.1	31.3	31.3
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R165	Dwelling	18.7	22	26.2	29.7	30.7	30.9	30.9
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R166	Dwelling	17.9	21.2	25.4	28.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R167	Dwelling	18	21.2	25.4	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R168	Dwelling	18.4	21.6	25.9	29.3	30.4	30.5	30.6
	Daytime Criterion	40	40	40	40	40	45	45

Name	Description	dB $L_{A90,10min}$ at Various Standarised Wind Speeds (m/s)						
		3	4	5	6	7	8	9
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
R169	Dwelling	18.8	22.1	26.3	29.8	30.8	31	31
	Daytime Criterion	40	40	40	40	40	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.5	21.7	25.9	29.4	30.4	30.6	30.7
	Daytime Criterion	40	40	40	40	40	45	45
H170	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.4	28.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H171	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.6	25.8	29.3	30.3	30.5	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H172	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.4	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H173	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.6	25.8	29.3	30.3	30.5	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H174	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.4	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H175	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.6	21.8	26.1	29.5	30.6	30.7	30.8
	Daytime Criterion	40	40	40	40	40	45	45
H176	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.4	28.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H177	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H178	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.6	25.8	29.2	30.3	30.5	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H179	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43

	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H180	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.2	25.4	28.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H181	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H182	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.6	25.8	29.3	30.3	30.5	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H183	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.8	29.2	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H184	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.4	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H185	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H186	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.8	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H187	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.8	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H188	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.7	29.2	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H189	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H190	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H191	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.8	29.2	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H193	Daytime Excess	--	--	--	--	--	--	--

	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.7	29.2	30.2	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H194	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.5	25.7	29.2	30.2	30.4	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H195	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.5	25.7	29.2	30.2	30.4	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H196	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21	25.2	28.7	29.7	29.9	30
	Daytime Criterion	40	40	40	40	40	45	45
H197	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.5	25.7	29.1	30.2	30.4	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H198	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.7	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H199	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.7	29.2	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H201	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21	25.2	28.7	29.8	29.9	30
	Daytime Criterion	40	40	40	40	40	45	45
H202	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.4	25.7	29.1	30.2	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H203	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21	25.2	28.7	29.8	29.9	30
	Daytime Criterion	40	40	40	40	40	45	45
H204	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.4	21.6	25.8	29.3	30.3	30.5	30.6
	Daytime Criterion	40	40	40	40	40	45	45
H206	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21	25.2	28.7	29.7	29.9	30
	Daytime Criterion	40	40	40	40	40	45	45
H207	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45

H208	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.8	22.1	26.3	29.8	30.8	31	31
	Daytime Criterion	40	40	40	40	40	45	45
H210	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.4	25.6	29.1	30.2	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H213	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.4	25.6	29.1	30.1	30.3	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H214	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H215	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.6	25.8	29.3	30.3	30.5	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H216	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H217	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.9	22.1	26.4	29.8	30.9	31	31.1
	Daytime Criterion	40	40	40	40	40	45	45
H218	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H219	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H220	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.8	22	26.3	29.7	30.8	30.9	31
	Daytime Criterion	40	40	40	40	40	45	45
H221	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H222	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.8	29.2	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H223	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30	30.2	30.2

	Daytime Criterion	40	40	40	40	40	45	45
H224	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.4	25.6	29.1	30.1	30.3	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H225	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.6	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H226	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.4	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H228	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.6	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H229	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H230	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.6	21.8	26	29.5	30.5	30.7	30.8
	Daytime Criterion	40	40	40	40	40	45	45
H233	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.8	22.1	26.3	29.7	30.8	31	31
	Daytime Criterion	40	40	40	40	40	45	45
H234	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.2	25.4	28.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H235	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.7	22	26.2	29.7	30.7	30.9	30.9
	Daytime Criterion	40	40	40	40	40	45	45
H237	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H238	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H239	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.7	21.9	26.2	29.6	30.7	30.8	30.9
	Daytime Criterion	40	40	40	40	40	45	45
H240	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--

	Dwelling	18.1	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H241	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.4	28.9	29.9	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H242	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.4	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H246	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.4	28.9	29.9	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H247	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.2	25.4	28.8	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H249	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	19.1	22.4	26.6	30.1	31.1	31.3	31.3
	Daytime Criterion	40	40	40	40	40	45	45
H250	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.5	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H251	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.5	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H252	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.3	25.5	28.9	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H253	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.2	25.4	28.9	29.9	30.1	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H254	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.2	21.5	25.7	29.2	30.2	30.4	30.4
	Daytime Criterion	40	40	40	40	40	45	45
H255	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.7	22	26.2	29.6	30.7	30.9	30.9
	Daytime Criterion	40	40	40	40	40	45	45
H256	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.6	21.8	26	29.5	30.6	30.7	30.8
	Daytime Criterion	40	40	40	40	40	45	45
H261	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43

	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H264	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H266	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.7	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H270	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.6	21.9	26.1	29.6	30.6	30.8	30.8
	Daytime Criterion	40	40	40	40	40	45	45
H273	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.4	28.8	29.9	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H274	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.2	25.4	28.9	30	30.1	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H276	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.6	21.8	26	29.5	30.6	30.7	30.8
	Daytime Criterion	40	40	40	40	40	45	45
H278	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.8	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H281	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H286	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H292	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H294	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.8	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H295	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.5	21.8	26	29.5	30.5	30.7	30.7
	Daytime Criterion	40	40	40	40	40	45	45
H298	Daytime Excess	--	--	--	--	--	--	--

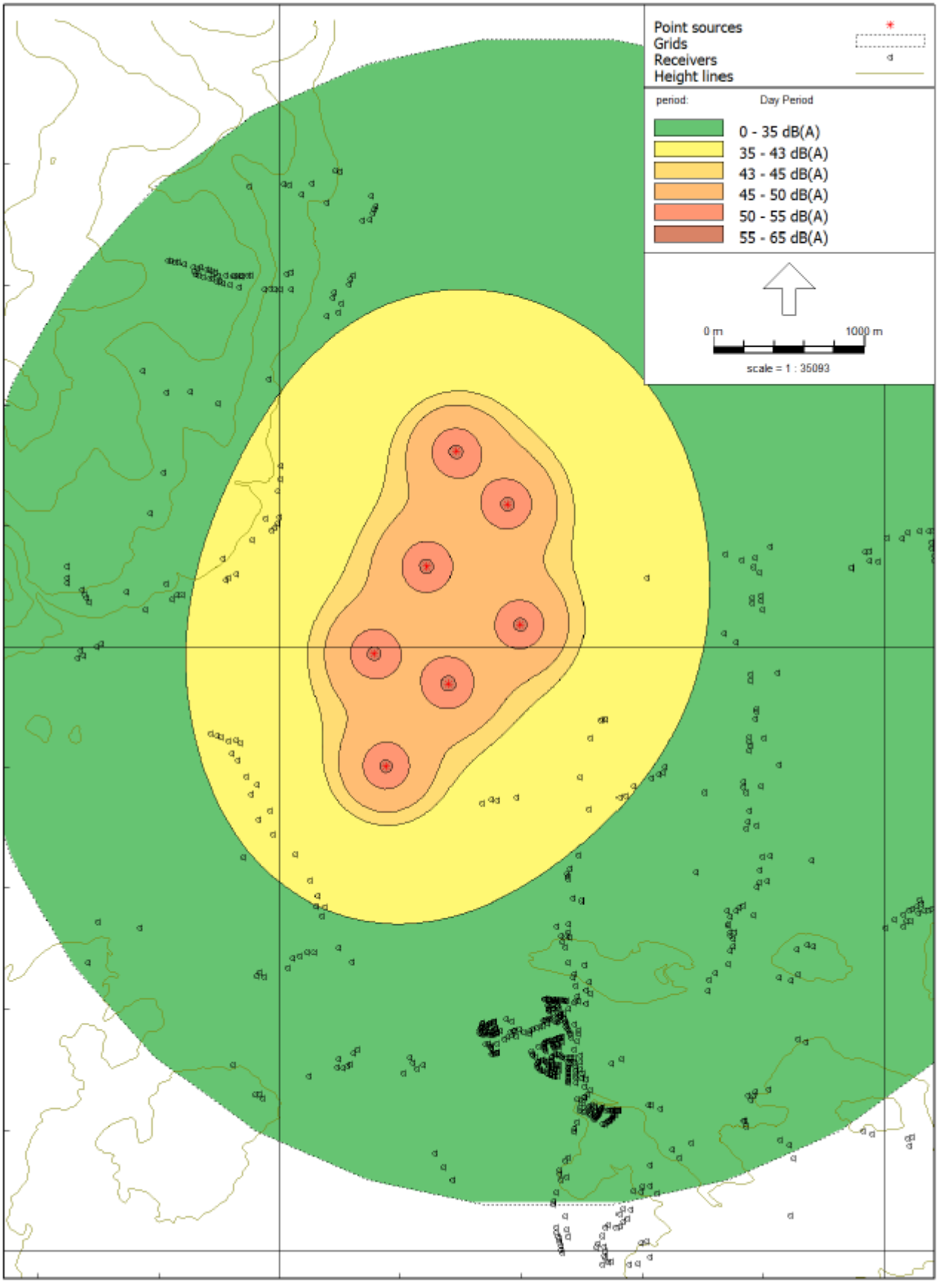
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.9	22.2	26.4	29.9	30.9	31.1	31.1
	Daytime Criterion	40	40	40	40	40	45	45
H299	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.8	21.1	25.3	28.8	29.8	30	30
	Daytime Criterion	40	40	40	40	40	45	45
H308	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	17.9	21.1	25.3	28.8	29.8	30	30.1
	Daytime Criterion	40	40	40	40	40	45	45
H315	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.3	21.5	25.7	29.2	30.3	30.4	30.5
	Daytime Criterion	40	40	40	40	40	45	45
H329	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.6	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H340	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30.1	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H343	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18	21.3	25.5	29	30	30.2	30.2
	Daytime Criterion	40	40	40	40	40	45	45
H358	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
	Dwelling	18.1	21.3	25.5	29	30	30.2	30.3
	Daytime Criterion	40	40	40	40	40	45	45
H376	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--

APPENDIX 11.5

OMNIDIRECTIONAL RATED POWER NOISE CONTOUR

Appendix 11.5

Omnidirectional Rated Power Noise Contour – Ballynagare Windfarm



APPENDIX 12.1

SITE DESCRIPTION

Appendix 12.1 Site Description

Ballynagare Wind Farm, Co. Kerry

12.1 Site Description

A description of the turbine locations and associated infrastructure is presented here in addition to any archaeological monuments visited as part of the walk-over survey. Field survey of the proposed turbines, hardstands, access tracks and grid connection route was carried out over two days in March 2021 in varying weather conditions.

12.1.1 Turbine 1

Turbine 1 and associated hardstand is located at the north-west side of the proposed wind farm site in heather and grass-covered bog. The proposed turbine is situated a short distance south-west of KE009-088– Road – unclassified togher, while the northern corner of the proposed hardstand is situated immediately adjacent to the suspected line of the togher. Ground conditions and vegetation cover at the time of field survey meant that the togher was not visible at this location, however, it was apparent as a low rise in the field immediately to the north-west. This demonstrates the survival of the monument above-ground within the proposed wind farm site and while it was not discernible in the area immediately adjacent to T1 it must be assumed that the monument survives in some form either above or below ground.

The proposed access road to T1 is located c. 11m south-west of the togher where the monument is apparent as a low rise in improved pastureland. The proposed road extends from T3 at the west side of the proposed development site. From T3 it extends through improved agricultural land and partially along an existing track.



Plate 1: Hardstand for T1, looking NW.



Plate 2: Hardstand for T1, looking NW. Note Rattoo round tower on skyline (arrow).



Plate 3: Low rise of KE009-088 Road – unclassified togher in pasture immediately north-west of hardstand for T1, looking NNW.



Plate 4: Low rise of togher KE009-088 to north of proposed road to T1, looking NNE.



Plate 5: Route of proposed road to T1, north of T3, looking north.



Plate 6: Route of proposed road to T1 further north of T3, looking north.

12.1.2 Turbine 2

T2 and its associated hardstand are located in grass-covered bog south-east of T1. The proposed road to T2 extends from the north through the bog and improved pastureland and crosses the aforementioned recorded monument KE009-088– Road – unclassified togher at two locations namely to the north-west of T1 and further to the south-east south of an existing track. At the north-west the togher survives above-ground as a low rise with differential grass growth, however, further to the south-east the monument could not be traced on the ground dur to ground conditions and vegetative cover.



Plate 7: Location of T2, looking west.



Plate 8: Proposed hardstand for T2, looking NW.



Plate 9; General view of proposed road to T2 in improved pasture north-west of T1 and in vicinity of KE009-088–, looking east.



Plate 10: Route of proposed road to T2 at northern portion of wind farm site, looking NE.



Plate 11: General view of route of proposed road to T2 at northern end of proposed wind farm site, looking SE.



Plate 12: Route of proposed road to T2 through grass-covered bog, looking N.



Plate 13: General view of route of proposed road to T2 through grass-covered bog, looking south-east towards T2.

12.1.3 Turbine 3

T3 and associated hardstand are located in grass-covered bog at the west side of the proposed wind farm site. The proposed road to T3 extends from the public road to the south through overgrown bog.



Plate 14: General view of T3 and associated hardstand, looking south.



Plate 15: General view of T3 and hardstand, looking NW.



Plate 16: Roue of proposed road to T3 from public road to south, looking NE.

12.1.4 Turbine 4

T4 and its associated hardstand are located to the south-east of T3 in grass-covered bog. It will be accessed by a proposed road which will extend from the public road to the south-west.



Plate 17: Location of T4, looking SE,



Plate 18: Proposed hardstand for T4, looking SW.



Plate 19: General view of proposed road to T4, looking SW.



Plate 20: Proposed road to T4 from public road, looking north-east.

12.1.5 Turbine 5

T5 and associated hardstand are located towards the south-west side of the proposed wind farm in improved pastureland. An existing farm track extends along the route of the proposed road to T5.



Plate 21: Existing farm track along route of proposed road to T5, looking NW.



Plate 22: General view of proposed hardstand or T5, looking SE.



Plate 23: Location of T5 in pasture, looking NE.

12.1.6 Turbine 6

T6 and associated hardstand are located to the south-east of T5 in grass-covered bog. The proposed access road to T6 will extend from the public road to the north-east, continuing through the hardstand in a south-westerly direction where it meets the proposed road to T3.



Plate 24: Route of proposed road to T6 looking SW from public road.



Plate 25: Proposed road to north-east of T6, looking NE.



Plate 26: General view of T6 and associated hardstand, looking NE.



Plate 27: Route of proposed road to south-west of T6, looking SW.

12.1.7 Turbine 7

T7 and associated hardstand are situated at the south-west side of the proposed wind farm site in improved pastureland.



Plate 28: Route of proposed road to north-east of T7, looking NE.



Plate 29: Proposed road to T7, looking SW.



Plate 30: T7, looking south.



Plate 31: Proposed hardstand for T7, looking NE.

12.1.8 Met Mast

The proposed met mast is located to the south-west of T7 in improved pasture. The proposed road to the met mast will extend partially along an existing farm track.



Plate 32: Route of proposed road to met mast along existing farm track, looking SW.



Plate 33: Proposed road to met mast through improved pasture, looking south.



Plate 34: General view of proposed met mast location, looking SW.

12.1.9 Substation, Compound and Borrow Pit

A proposed road will extend from north-east of T7 over a distance of c. 1.9km to the proposed substation, construction compound and borrow pit. The proposed road extends along an existing farm track and through improved pasture to the east of ecclesiastical enclosure KE016-004001- and enclosure KE016-005– before reaching an existing farm track which will provide access to the substation, compound and borrow pit.



Plate 35: General view of route of proposed road within the proposed wind farm site, looking south-east.



Plate 36: Route of proposed road along existing farm track, looking south-east.



Plate 37: Mac Elligot's Bridge adjacent to proposed road at public road.



Plate 38: Route of proposed road south-east of Mac Elligot's Bridge, looking SE.



Plate 39: Route of proposed road in pasture to ENE of ecclesiastical enclosure KE016-004001-, looking NW.



Plate 40: Route of proposed road in pasture to east of ecclesiastical enclosure KE016-004001-, looking NW.



Plate 41: Route of proposed road in pasture to south-east of enclosure KE016-005–, looking NW.



Plate 42: General view of proposed substation.



Plate 43: General view towards proposed compound, looking NE.



Plate 44: Proposed borrow pit, looking NE.

12.2 Proposed Grid Connection Route

The proposed grid connection route to Clahane substation was subject to assessment and a windscreen survey where located within public roads.



Plate 45: Proposed grid connection route where it extends through pasture south-east of the proposed substation, looking NW.



Plate 46: Proposed grid connection route along public road at Ballyhorgan West td.



Plate 47: Proposed grid connection route at Ballyhorgan East td., looking NE.



Plate 48: Proposed grid connection route where it enters Pallas Wind Farm at Pallas td.

APPENDIX 13.1

LANDSCAPE AND VISUAL IMPACT ASSESSMENT METHODOLOGY

APPENDIX 13-1

LVIA METHODOLOGY

13. LVIA METHODOLOGY

13.1 Scope and Definition of Landscape and Visual Impact (LVIA) Study Area

For the purposes of this chapter, where the 'proposed development site' or 'the site' is referred to, this relates to the primary study area for the proposed development, as shown on Figure 13-1. The proposed development site is discussed in some detail in terms of its landscape character.

However, the landscape and visual baseline mapping and viewpoint selection are based on wider study areas. On the basis of the desktop study and survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards (Appendix 3, DoEHLG 'Draft Revised Wind Energy Development Guidelines' 2019 and GLVIA 2013, see below) the LVIA study area has been chosen as 20 kilometres for visual and landscape effects and 15 kilometres from the proposed wind turbines for effects on landscape character. These are the study areas for which the baseline maps and viewpoint locations are produced and are referred to as the 'study area'. Furthermore, on the basis of desk studies and survey work undertaken, the professional judgement of the assessment team, experience from other relevant projects and policy guidance or standards, the following topic areas have been scoped out of the assessment:

- Effects on landscape and visual receptors that have minimal or no theoretical visibility (as predicted by the ZTV) and/or very distant visibility, and are therefore unlikely to be subject to significant effects;
- Effects on designated landscapes beyond a 20km radius from the proposed development, from where it is judged that potential significant effects on key characteristics and/or special qualities, or views are judged unlikely to occur;
- Effects on landscape character beyond a 15km radius from the proposed development, where it is judged that potential significant effects on landscape character are unlikely to occur;
- Effects on visual receptors beyond a 20km radius from the proposed development, where it is judged that potential significant effects are unlikely to occur;
- Cumulative effects in relation to single turbines (except where otherwise stated);
- Cumulative landscape effects beyond a 15km radius and cumulative visual effects beyond a 20km radius from the proposed development, where it is judged that potential significant effects on landscape character are unlikely to occur;

13.2 Zone of Theoretical Visibility Mapping

The Zone of Theoretical Visibility (ZTV) represents the area over which a development can theoretically be seen and is based on a Digital Terrain Model (DTM), overlaid on a map base. A DTM refers to the way in which a computer represents a piece of topography in three dimensions as a digital model. ZTV maps provide the following information:

- Indicates broad areas where visibility of a wind energy development is most likely to occur;
- How much of the wind energy development is likely to be visible (using different coloured bands for different numbers of turbines);
- The extent and pattern of visibility.

Production of ZTV maps is usually one of the first steps of Visual Impact Assessment, helping to inform the selection of the Study Area in which impacts will be considered in more detail and the identification of sensitive vantage points. (Visual Representation of Wind Farms, Scottish Natural Heritage, 2017).

13.2.1 Limitations of ZTV Mapping

The Scottish Natural Heritage guidelines referred to above acknowledge the following limitations inherent to the use of theoretical visibility mapping:

- The ZTV presents a 'bare ground' scenario, i.e. visibility of the proposed development in a landscape without screening structures or vegetation. This includes trees, hedgerows, buildings and small-scale landform or ground surface features. The ZTV also does not take into account the effects of weather and atmospheric conditions, and therefore can be said to represent a 'worst-case' scenario, that is where the wind farm could potentially be seen given no intervening obstructions and favourable weather conditions.
- The ZTV indicates areas from where a wind farm may be visible, but cannot show how it will look, nor indicate the nature or magnitude of visual impacts. The visibility of the turbines will decrease with the distance from which they are viewed, but this is not accounted for in the ZTV. Figure 1-1 below provides an illustration of the differences in view relative to the distance from a turbine.



Figure 13-1 The effect of distance on visibility of wind turbines (Illustrative Purposes Only)

- A ZTV is only as accurate as the data on which it is based. It is not easy to test the accuracy of a ZTV in the field, although some verification will occur during the assessment of viewpoints.
- In order to handle large areas of terrain, the DTM data is based on information that does not allow detail to be distinguished below a certain level. There are also differences in the way that the software package 'interpolates' between heights in the calculations made.

13.2.2 ZTV Methodology

The ZTV maps presented in the EIAR show visibility of the proposed wind farm using the half blade height of the wind turbines as points of reference. The maps also show the visibility of the proposed wind farm in addition to visibility of other existing and permitted wind farms in the area. The area covered by the ZTV maps has a radius of 20 kilometres from the outer-most proposed turbines.

ZTV maps assume a worst-case or 'bare ground' scenario, i.e. no land-cover. They represent visibility of the proposed wind farm in the absence of all natural and manmade features from the landscape, including vegetation, houses and other buildings. In reality, such features will restrict or limit visibility of the wind turbines, due to the screening effects of vegetation, for example forestry and road-side hedgerows and trees, and buildings, particularly within towns and villages.

Separate colour bands are used on each ZTV map to indicate the number of turbines which will potentially be visible to half blade i.e. only half a blade might be visible over the topography as opposed to seeing a full turbine. The legend on each map shows the number of visible turbines for each corresponding colour.

13.2.3 Route Screening Methodology - Roads

In order to comprehensively demonstrate the varying characteristics of screening existent on roads proximate to the proposed development and to record the actual visibility in comparison to the theoretical visibility, a methodology was developed. This is termed Route Screening Analysis and it was undertaken from all public roads within a 3 km radius of the proposed turbines. Additionally, public roads within the 5km radius were driven where visual receptor sensitivity was considered high (from nearby towns or villages, scenic routes and the Wild Atlantic Way).

Route Screening Analysis as its name suggests considers the actual visibility of the proposed wind turbines from surrounding roads. The landscape surrounding the Proposed Development comprises rolling agricultural land, a network of trees and hedgerows, and settlements. In order to get a clearer understanding of visibility and screening, and to bridge the gap for the assessor between the computer-generated ZTV maps and the actual nature of visibility in the study area, Route Screening Analysis was undertaken.

Every public road was driven within 3 km radius of the proposed turbines. The extent of roadside screening was recorded digitally on a tablet/GPS device as the route is driven. In addition, dashcam video footage was recorded along the routes to allow later confirmation of mapping, and to methodically record the views along the route. All routes were driven slowly. Using the tablet device, screening was logged as one of three categories:

- Little/No Screening – mainly open and with some very light vegetation
- Intermittent/Partial Screening – light deciduous roadside vegetation and vegetation with short gaps which would allow intermittent or partial views
- Full Screening – vegetation, topography and built structure which are dense enough to block views (e.g. coniferous forestry).

The Route Screening Analysis surveys were conducted in July 2021. Screening between the wind farm site and the relevant side of the road was recorded. In cases where the road travels directly in the direction of the proposed wind farm or between the two turbine clusters, screening of the lowest classification was recorded (least amount of screening). Great care was taken to ensure recording of screening accounted for seasonal variation, particularly the condition of deciduous vegetation (lack of leaves and growth) in winter months. The screening data was then mapped and validated against the georeferenced dashcam footage.

13.3 Viewpoint Photomontages

13.3.1 Viewpoint Identification

The viewpoints or photo locations were selected following guidance contained in the DoEHLG *'Wind Energy Development Guidelines for Planning Authorities'* (2006), the *'Guidelines for Landscape and Visual Impact Assessment'* (2013) and in the *'Visual Representation of Wind Farms'* (Scottish Natural Heritage, 2017). The selection of photo locations is designed to give a representative range of views of the proposed development.

Viewpoints, the photo locations from which the photomontages are produced, were chosen after compiling the Visual Baseline. The main purpose of establishing the visual baseline is to identify the key visual receptors that should be considered for viewpoint selection. To this end the following have been identified in order of priority:

- Designated Scenic Routes and Scenic Views
- Settlements
- Recreational Routes and Tourist Destinations

- Waymarked Walking Routes
- Cycle Routes
- Scenic Drives
- Tourist Routes

- Viewing Points (e.g. marked on OS Maps)
- Transport Routes

These visual receptors are listed in tables under the sections identified above along with theoretical visibility at those locations indicated by the ZTV maps.

After all key visual receptors are identified, a Visual Receptor Preliminary Assessment is carried out to eliminate the visual receptors for the following reasons:

- No or very limited theoretical visibility indicated on the ZTV map for the visual receptor
- Designated views and scenic routes as well as OSi Viewing Points that are nor directed towards the proposed development
- Visual receptors visited on site, where views towards the turbines were either entirely screened or substantially screened and distance from the proposed development site would mitigate any visual effects

All other key visual receptors were selected as viewpoint locations. In addition, viewpoints were selected in close proximity to the proposed turbines, where turbines are likely to be most visible and hence visual effects may be greatest.

Viewpoints were chosen having regard to the SNH Guidance (2017) which advises that a range of views should be shown at a range of distances and aspects, as well as at varying elevations and showing both where the development will be completely visible as well as partially visible. Consideration was also given to ensure that photomontages captured other wind farms in order to assess cumulative visual effects.

13.3.2 Photomontages

Photomontages are visualisations that superimpose an image of a proposed development upon a photograph or series of photographs. They are intended as graphical representations of how a proposed development will appear in the existing landscape and are used as a tool in the LVIA process. A series of photomontages has been prepared as part of this assessment and are presented in a separate Volume 2 Photomontage Booklet to be submitted along with this EIAR.

13.3.2.1 Photomontage Limitations

Photographs, and therefore photomontages, are subject to a range of limitations, as stated in *'Visual Assessment of Wind Farms'* (Scottish Natural Heritage, 2014):

- Visualisations provide a tool for assessment that can be compared with an actual view in the field; they should never be considered as a substitute to visiting a viewpoint in the field.
- Neither photographs nor visualisations can replicate a view as seen in reality by the human eye.
- Visualisations are only as accurate as the data used to construct them.
- Visualisations can only represent the view from a single location at a particular time and in particular weather conditions.
- Static visualisations cannot convey the effect of turbine blade movement.

Although the scale, siting and geometry of photomontages are based on technical data, the other qualities of the image are open to judgments. The guidance also notes that interpretation of visualisations also needs to consider additional information including variable lighting, movement of turbine blades, seasonal differences and the movement of the viewer through the landscape. However, accepting these limitations, the SNH guidelines state that photomontages are useful tools in the Visual Impact Assessment of wind turbines.

Furthermore, with regard to the representation of cumulative visual effects, existing and permitted turbines are also shown in the photomontages. The representation of existing turbines relies on photographs taken on site, while permitted and proposed turbines are images of turbines superimposed into the image. As such there can be a discrepancy in the lighting and sharpness between these two different representations.

Photomontages are 2D representations of 3D views and thus cannot convey the perspective and depth of view of seeing the actual objects with the naked eye. One of the areas that this limitation affects cumulative visual effects is where proposed turbines are proposed to be located in front or behind existing or permitted turbines. In the field this physical separation may be obvious, while on the photomontage the turbines may appear as one wind farm.

13.3.2.2 Photomontage Presentations

The viewpoints presented in the accompanying Photomontage Booklet show several views from each viewpoint location. These include:

1. **Overview Sheet** – Viewpoint details include location description, grid reference distance from nearest turbine and technical data in relation to photography. Three maps at varies scales show the viewpoint location. A 120 -degree existing view image without any proposed and permitted turbine. Existing turbines visible in the landscape may appear within the image and the horizontal extent of the 90-degree and 53.5-degree image to be presented in subsequent images is also framed.
2. **Visual Baseline** - 90-degree existing view image without any proposed or permitted turbines and a matching wireframe image of the same view which includes any existing turbines visible in the landscape. If turbines are already existing in the landscape, these are visible on the photograph and are rendered in the wireframe.
3. **Proposed View (90 degrees)** – Showing a 90-degree photomontage image with the proposed wind farm and all other existing and permitted wind farms within the viewpoint. A matching wireframe image shows the turbines of all proposed, permitted and existing wind farms individually coloured and labelled for ease of identification.
4. **Proposed View (53.5 degrees)** – Showing a photomontage image of the proposed turbines and any existing and permitted turbines in a 53.5-degree horizontal field of view.
5. **Proposed Wireframe (53.5 degrees)** - Showing a wireframe image of the proposed turbines and any existing and permitted turbines in a 53.5-degree horizontal field of view. The proposed turbines and any other existing wind farms are individually coloured and labelled for ease of identification.

The viewpoint images contained in the booklet are devised to be viewed at arm's length.

13.4 Landscape and Visual Impact Assessment Methodology

13.4.1 Identification of Landscape Receptors

The landscape receptors were selected following guidance contained the *'Guidelines for Landscape and Visual Impact Assessment'* (2013) and in the *'Visual Representation of Wind Farms'* (Scottish Natural Heritage, 2017).

The following landscape receptors are identified in the landscape baseline:

- **Landscape Designations** based on:
  - The Kerry County Development Plan 2015-2021 (Kerry County Council, 2015).
  - Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012).
  - Landscape Character Assessment prepared for the Renewable Energy Strategy 2012 & Adopted / Proposed Archaeological Landscapes (Kerry County Council, 2012).
  - The Clare County Development Plan 2017-2023 (As Varied)
  - Clare County Development Plan 2017-2023 Volume 5- Clare Wind Energy Strategy
- **Landscape Character of the proposed development Site** and its immediate environment based on:
  - Landscape Type identified using Draft Revised Wind Energy Development Guidelines (Department of Housing, Planning and Local Government, 2019)
  - Site Visits.
- **Landscape Character of the Study Area** based on:
  - The Kerry County Development Plan 2015-2021 (Kerry County Council, 2015).
  - Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012).
  - Landscape Character Assessment prepared for the Renewable Energy Strategy 2012 & Adopted / Proposed Archaeological Landscapes (Kerry County Council, 2012).

After all landscape receptors are identified, a Landscape Receptor Preliminary Assessment is carried out to eliminate the landscape receptors, where no or very limited theoretical visibility has been indicated on the ZTV map.

All other landscape receptors were selected for further assessment of landscape effects.

13.4.2 Assessing Landscape Effects

The methodology uses qualitative methods in order to arrive at an assessment, which is based on the Landscape and Landscape Assessment (2000) Guidelines as well as the GLVIA (2013), and the DoEHLG (2006) Guidelines were also considered.

Landscape effects can be described as changes which affect the landscape as a resource. This includes how the proposal will affect the elements that make up the landscape, the aesthetic and perceptual aspects and its landscape character. Landscape effects also relate to changes in the structure of the landscape. Under the GLVIA (2013), the assessment of likely significant effects on landscape receptors includes a judgement on both the sensitivity of the receptor as well as magnitude of the change.

13.4.2.1 Assessing Landscape Sensitivity

Landscape Sensitivity, which is described in the GLVIA (2013) as a combination of the landscape's susceptibility to change as well as the value attached to the landscape.

Susceptibility to change can be described as the ability of the landscape receptor (either the overall character, quality of the landscape or a particular landscape feature) to accommodate the proposed development without undue consequences for the maintenance of the baseline (existing) landscape and/or the aims of landscape planning policies and strategies. Landscape value is a combination of values which are assessed in the landscape baseline, combining any formal landscape designations.

For the purposes of this LVIA and the assessment of landscape sensitivity, the following landscape sensitivity ratings assigned to the landscape character areas were identified based on The Kerry County Development Plan (2015) and The Clare County Development Plan 2017-2023 (As Varied). This process resulted in the following landscape sensitivity classifications:

- Very High
- High
- Moderate
- Low

13.4.2.2 Assessing Magnitude of Change in the Landscape

The magnitude of change in each landscape character area is a combination of the visual presence - size and scale - of the change, the extent of the area to be affected, and the duration and reversibility of the effect. The magnitude of change for each landscape character area was assessed using the definitions outlined in **Error! Reference source not found.** below.

Table 1- 1: Magnitude of Landscape Change Assessment Criteria

Magnitude of Change	Description
Substantial	Where a landscape will experience the loss of key landscape features or the introduction of uncharacteristic additions over a large area. The changes to the landscape are prominent and large in scale. The level of change has an effect on the overall landscape character. The effects are likely long term and may be irreversible.
Moderate	A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not affect key characteristics. The effects could be long to medium term and/or partially reversible.
Slight	Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Negligible	A change affecting smaller areas of landscape character including the loss of some landscape elements or the addition of features or elements which are either of low value or hardly noticeable. The effects could be short term and/or reversible.

13.4.2.3 Landscape Effects Assessment Matrix

The significance of landscape effect was arrived at by combining the magnitude and sensitivity classifications, using the assessment matrix in **Error! Reference source not found.** below, where landscape sensitivity is shown in the left-hand first column and magnitude of change is shown in the first row at the top of the table.

Table 1- 2: Landscape effects significance assessment matrix

	Substantial	Moderate	Slight	Negligible
Very High	Major	Major/Moderate	Moderate	Moderate/Minor
High	Major/Moderate	Moderate	Moderate/Minor	Minor
Moderate	Moderate	Moderate/Minor	Minor	Minor/Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible

The determination of significance uses a seven-point scale, ranging from Major to Negligible. This seven-point scale is translated to the EPA impact assessment classifications of significance, as outlined in **Error! Reference source not found.** below.

Table 1- 3: EPA Impact Assessment Significance Classification for Landscape Effects

Matrix Classification Significance	EPA Significance Classification	EPA (2017) Definition of Significance
Major	Profound	An effect which obliterates sensitive characteristics
Major/Moderate	Very significant	An effect, which by its character, magnitude, duration or intensity alters most of a sensitive aspect of the environment
Moderate	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate/Minor	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Minor	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Minor/Negligible	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Negligible	Imperceptible	An effect capable of measurement but without significant consequences

13.4.3 Assessing Visual Effects

Visual effects relate to changes in views and visual amenity of the surroundings of individuals or groups of people. These may result from changes in content and character of views as a result in changes to the landscape. The assessment of visual effects is based on views shown in photomontages and the potential visibility indicated by the ZTV maps as well as actual visibility on the ground.

It should be noted that in assessing visual effects, there are different types of visual effects:

- **Visual obstruction:** This occurs when there is an impact on a view which blocks the view.
- **Visual intrusion:** This occurs when there is an impact on a view but which does not block the view.

Due to the nature of the development and the appearance of wind turbines, visual intrusion occurs more frequently than obstruction.

The likely significant effects of the proposed development in terms of visual and landscape effects are informed by the ZTV and photomontages. Visual effects relate to changes in views and visual amenity of the surroundings of individuals or groups of people. These may result from changes in content and character of views because of changes to the landscape. The significance of the effect on visual receptors is a combination of the sensitivity of the receptor as well as the magnitude of the change.

13.4.3.1 Visual Receptor Sensitivity

Visual Receptor Sensitivity depends on the occupation or activity of the people, as well the extent to which the attention is focused on views and visual amenity, according to the GLVIA Guidelines (2013). Visual receptor sensitivity is assessed as either being High, Medium or Low, based on the definition of descriptions and examples set out in **Error! Reference source not found.** below.

Table 1- 4: Visual Receptor Sensitivity Assessment Criteria

Sensitivity of Visual Receptor(s)	Description
Very High	Included in this category are viewers that are primarily focused on views from this particular location, such as visitors to popular destinations identified for their outstanding views or residents in close proximity or medium proximity whose primary views will be in the direction of the development.
High	Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes
Medium	Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Low	Includes viewers engaged in activities where the focus is not on the landscape or view. These including those travelling along a busy route, viewers at work or engaged in sport not related to views or experience of the landscape.

13.4.3.2 Magnitude of Visual Change

The magnitude of the visual change resulting at each viewpoint is a combination of scale of the change, the extent of the area to be affected and the duration and reversibility of the effect, determined by reviewing the photomontage and wireframe images for each viewpoint. The magnitude of change is determined in accordance with the definitions and descriptions included in **Error! Reference source not found.** below.

Table 1- 5: Magnitude of Visual Change Assessment Criteria

Magnitude of Change	Description
Substantial	Substantial change, where the proposals would result in large-scale, prominent or very prominent change, leading to substantial obstruction of existing view or complete change in character and composition of the baseline though removal of key elements or addition of uncharacteristic elements which may or may not be visually discordant. This includes viewpoints where the proposed development is fully or almost fully visible over a wide extent, at close proximity to the viewer. This change could be long term or of a long duration.
Moderate	The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Slight	The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Negligible	Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.

13.4.3.3 Visual Effects Assessment Matrix

Error! Reference source not found. below shows the significance of visual effects, arrived at by combining the visual receptor sensitivity and the magnitude of change classifications. Visual receptor sensitivity is shown in the left-hand first column and magnitude of visual change is shown in the first row at the top of the table.

Table 1- 6: Visual effects significance assessment matrix

	Substantial	Moderate	Slight	Negligible
Very High	Major	Major/Moderate	Moderate	Moderate/Minor
High	Major/Moderate	Moderate	Moderate/Minor	Minor
Medium	Moderate	Moderate/Minor	Minor	Minor/Negligible

	Substantial	Moderate	Slight	Negligible
Low	Moderate/Minor	Minor	Minor/Negligible	Negligible

The determination of significance uses a seven-point scale, ranging from Major to Negligible. This seven-point scale is translated to the EPA impact assessment classifications of significance, as outlined in **Error! Reference source not found.** below.

Table 1- 7: EPA Impact Assessment Significance Classification for Visual Effects

Matrix Classification Significance	EPA Significance Classification	EPA (2017) Definition of Significance
Major	Profound	An effect which obliterates sensitive characteristics
Major/Moderate	Very significant	An effect, which by its character, magnitude, duration or intensity alters most of a sensitive aspect of the environment
Moderate	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Moderate/Minor	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
Minor	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Minor/Negligible	Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Negligible	Imperceptible	An effect capable of measurement but without significant consequences

13.4.3.4 Residual Visual Effect

After determining the significance of the visual effect using the above visual effects assessment matrix, mitigating factors are taken into consideration to arrive at the final residual effect. In some cases, mitigating factors merit a reduction in classification.

13.4.4 Assessing Cumulative Landscape and Visual Effects

13.4.4.1 Cumulative Landscape Effects

The SNH 2017 publication *Assessing the Cumulative Impact of Onshore Wind Energy Developments* identifies two principal areas of cumulative landscape effects, on the physical fabric of the landscape and on the landscape character, which state:

- *Cumulative effects on the **physical fabric** of the landscape arise when two or more developments affect landscape components such as woodland, dykes, rural roads or hedgerows. Although this may not significantly affect the landscape character, the cumulative effect on these components may be significant – for example, where the last remnants of former shelterbelts are completely removed by two or more developments.*
- *Cumulative effects on **landscape character** arise when two or more developments introduce new features into the landscape. In this way, they can change the landscape character to such an extent that they create a different landscape character type, in a similar way to large scale afforestation. That change need not be adverse; some derelict or degraded landscapes may be enhanced as a result of such a change in landscape character.*

Potential changes to the physical fabric outlined above are predominantly restricted to the proposed development site and the LCAs in which the site is located. Therefore, these landscape receptors will be assessed for cumulative landscape effects on the physical fabric of the landscape arising from the proposed development.

Cumulative effects on the landscape character will be assessed in the Landscape Character Areas (LCAs) that have theoretical visibility of the proposed development with particular emphasis on the LCA in which the proposed turbines will be located.

Error! Reference source not found. below taken from *Cumulative Impact of Wind Turbines on Landscape and Visual Amenity* (Carmarthenshire County Council, 2013) will be used to assign a current status of the LCAs and whether the addition of the proposed turbines will change the status of any of the LCAs.

Table 1- 8: Landscape types with regard to wind turbine development descriptions (Source Guidance on cumulative impact of wind turbines on landscape and visual amenity

	Landscape Status	Description
1	Landscape character area with no wind turbines	No turbines within an area and not visible except at a distance where they are very small or inconspicuous.
2	Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s	Turbines are visible but are not at a scale, number, spacing or extent that makes them a defining/key characteristic. Turbines might be seen occasionally at close quarters but more often within background views.
3	Landscape character area with wind turbines	Turbines are located and visible and are at a scale and/or a spacing that makes them one of the defining/key characteristics. Turbines might be seen in the foreground, mid-ground or background. However, there would be other key characteristics which would be strong and there would be sufficient separation between turbines for views without turbines and other characteristics remaining dominant in these parts of the area.
4	Wind turbine landscape	Turbines are frequent and may include extensive wind farms and are the dominant, defining characteristic but there is separation between groups of turbines. However, within these areas wind turbines are likely to be visible.
5	Windfarm	Landscape fully developed as a wind farm with no clear separation between groups of turbines.

Cumulative landscape effects are included in LCA Assessment Tables in Appendix 13-2 and summarised in the LVIA Chapter of the EIAR.

13.4.4.2 Cumulative Visual Effects

For this assessment, the SNH (2012) definition of cumulative effects as additional changes caused by a proposed development in conjunction with other similar developments, is used, however, this assessment also considers other types of developments. The definition in the DoEHLG Guidelines (2006) defines cumulative impacts in terms of wind farms, as the perceived effect on the landscape of two or more wind energy developments visible from any one place.

The GLVIA (2013) and SNH (2012) guidance also note cumulative visual effects can be experienced in combination, where two or more developments are visible from one viewpoint, as well as sequentially, where a viewer moves to another viewpoint and sees the same or different developments. The photomontage viewpoints illustrate combined visibility and analysis of the photomontages and route screening allows sequential visibility to be assessed.

The guidance on cumulative effects given in the DoEHLG 2019 '*Draft Revised Wind Energy Development Guidelines'* relating to the proposed development site is as follows:

- *Similarity in the siting and design approach is preferred where a number of wind energy developments are located in the same landscape character area, particularly within the same viewshed. However, an alternative approach where a particular aesthetic effect is sought may be acceptable.*
- *Different wind energy developments can appear as a single collective unit if located near each other.*
- *It is preferable to avoid locating turbines where they can be seen one behind another, when viewed from highly sensitive key viewpoints (for example, viewing points along walking or scenic routes, or from designated views or prospects), as this results in visual stacking and, thus, confusion. This may not be critical, however, where the wind energy development to the rear is in the distant background.*
- *Wind energy developments within relatively close proximity to one another, while in different landscape character contexts, may be so close as to be within the same visual unit and, therefore, should involve the same siting and design approach.*

The SNH 2017 publication *Siting and Designing Wind Farms in the Landscape* states that *'introducing turbines that are not similar in form, design, colour and scale may increase visual complexity and clutter'*.

Therefore, the cumulative assessment will concentrate on the following issues:

- Whether the proposed turbines increase the spatial extent of turbines in the view
- Whether the different wind energy developments can appear as a single collective unit or there is separation
- Whether 'visual stacking' occurs
- Whether the contrast of different size and design between different wind developments creates visual clutter.

As cumulative visual effects depend on the aspect from which the turbines will be seen various viewpoints were selected to give a thorough overview of the how the proposed turbines will appear in conjunction to turbines already present.

The assessment of cumulative effects was included in the viewpoint assessment tables in Appendix 13-3 and summarised in the LVIA Chapter of the EIAR.

APPENDIX 13.2

LANDSCAPE CHARACTER ASSESSMENT TABLES

APPENDIX 13-2

Landscape Character Assessment Tables

13. LANDSCAPE CHARACTER ASSESSMENT TABLES

LCA 3 – Cashen River	
Distance from site to Nearest/Furthest Area of LCA	All 7 No. turbines are located within this LCA.
LCA Key Characteristics **Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012)**	› **Landscape Type:** Hilly and Flat Farmland, Coastal › **Landform:** Flat, rising to southeast. › **Landcover:** Improved and semi-improved pasture. Parts of this area would also be marshy. › **Enclosure:** Enclosure of pasture within stone hedgebanks. › **Human Influence:** High. It is a managed landscape. There are also numerous dwellings located outside of settlements in the area. › **Quality of Landscape:** The quality of this rural coastal landscape has been significantly undermined by the number and disposition of residential development. While being an attractive landscape, it is typical of many areas in North Kerry. The views from the Ferry Bridge add significantly to the quality of the landscape and are of sufficient high quality to be important to the overall amenity of the area. › **Prominent Feature(s):** Cashen River, Stacks Mountains, Knockanore Mountain, Slieve Mish Mountains and Kerry Head › **Landscape Designations:** A zone of Rural Secondary Special Amenity at the Cashen Estuary south of Ballybunion and also an area of Rural Prime Special Amenity along the Dune Complex south of Ballybunion.
Visibility within LCA	The ZTV indicates that there is widespread full theoretical visibility within this LCA and a small patch of partial to no visibility along the western coast.
Cumulative Baseline	No other wind farms are located within this LCA.
Cumulative Landscape Status	1. Landscape character area with no wind turbines
Cumulative Landscape Effects	The proposed development will change the status identified above to: 2. Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s Therefore, the cumulative landscape effects are considered to be **Moderate.**
Landscape Sensitivity to Wind Farm Development	Despite this LCA containing landscapes of designated Secondary Amenity located along River Cashen and the coast, they are not within the site boundary, therefore the LCA is assigned a **Medium** landscape sensitivity.

Magnitude of Change	**Slight:** The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Medium x Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Mitigation Factors	› Visibility of the proposed development from the high landscape receptors located on the western coast is reduced significantly by vegetation screening. › The flat nature the LCA means that perception of the scale of the proposed turbines will reduce significantly with distance. › Treelines and vegetation along the Cashen Riverbank mitigate views towards the proposed development, including from Scenic Route 1 off the Ferry Bridge. › Several man-made elements including telecommunication poles and one-off residential bungalows are common features in this landscape.

LCA 5 – Listowel Plain	
Distance from site to Nearest/Furthest Area of LCA	This LCA is approximately 1 kilometre away from the nearest turbine at its closest point, and 22.2 kilometres at its furthest.
LCA Key Characteristics Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012)	› **Landscape Type:** Hilly and Flat Farmland Coastal. › **Landform:** Relatively flat. Low hills near coast; Generally flat with some undulations. › **Landcover:** Pasture and arable lands. It is an open landscape with limited trees. There is a large central area of raised peatbog and grassland. The frequency of woodland increase to the east towards Listowel. › **Enclosure:** Enclosure of pasture predominates with the incidence of hedgerows and woodland decreasing to the west. Pasture is enclosed by sparsely vegetated or stone hedgebanks. Grassland is enclosed within raised hedgebanks with mature vegetation in the central part of the area. › **Human Influence:** High. This is a managed landscape. Increase in the level of one-off housing. › **Perception:** It is a busy landscape due to the number of roads, the spread of farms and the number of farms. › **Quality of Landscape:** Coastal landscape with important monastical sites at Ardfert, the setting of which should be protected. Inland - Generally flat and pastoral with no features of note in the landscape. The open nature of the landscape does allow long-range views of distant hills. Very open landscape. Although an attractive landscape, it has no important qualities that need to be protected.

	It is a well-defined farming landscape with long range views towards Kerry Head and the coast. › **Prominent Feature(s):** Kerry Head, Knockanore Mountain › **Landscape Designations:** One small area of Rural Secondary Special Amenity to the north east of the LCA, east of Listowel. No other Landscape Zoning Designations located in both the LCA and the LVIA Study Area for landscape.
Visibility within LCA	There is predominantly full theoretical visibility of the proposed development from most areas in this LCA that are also in the LVIA Study Area. There are several small pockets of no theoretical visibility to the south and south-west and larger pockets of no theoretical visibility surrounding Ardfert.
Cumulative Baseline	Turbines from the propsoed Ballyhorgan wind farm; and half the turbines from the Clahane-Pallas; Clahane-Pallas Extension; Tursillagh I & Tursillagh II; Maghanknockane and Beenageeha wind farms are located along the southern extent of this LCA.
Cumulative Landscape Status	2. Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s.
Cumulative Landscape Effects	The proposed development will not change the status identified above, therefore the cumulative landscape effects are considered **Low.**
Landscape Sensitivity to Wind Farm Development	A large portion of this LCA is designated as an Open to Consideration Wind Energy Deployment Zone, and the LCT description includes a highly managed, settled, working landscape of low to moderate quality and value. Landscape resources of high value, quality and sensitivity are located at the coast of this LCA and are not located within the LVIA Study Boundary, therefore the LCA is assigned a **Low** landscape sensitivity.
Magnitude of Change	**Moderate:** A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not affect key characteristics. The effects could be long to medium term and/or partially reversible.
Significance of Effect	**Low x Moderate = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› The flat nature of the coastal plain comprising this LCA means that perception of the scale of the proposed turbines will reduce significantly with distance. › The presence of mature vegetation in this busy landscape provide a significant amount of intermittent screening of the proposed development. › North-east of this LCA is a highly managed, settled, working landscape; Man-made vertical elements within the landscape such as telecommunication poles, overhead power lines, water towers and residential dwellings are common features populating views within this landscape.

LCA 4 – Inner River Plain	
Distance from site to Nearest/Furthest Area of LCA	This LCA is approximately 8.4 kilometres away from the nearest turbine at its closest point, and 22.9 kilometres at its furthest.
LCA Key Characteristics **Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012)**	› **Landscape Type:** Hilly and Flat Farmland; Transitional marginal Land › **Landform:** Flat in the western part but rises up to the east. › **Landcover:** Some moorland on the higher ground in the area with pasture lower down. The flat lands in the centre of the area are pasture. There is some peatbog in places. › **Enclosure:** Pasture is enclosed within hedgerows and hedgebanks. Mature hedgerows are also present around settlements. › **Human Influence:** High. It is a managed landscape. Numerous dwellings are also located in the countryside. › **Quality of Landscape:** This is a marginal area which is generally flat which results in the area not having any particular qualities. › **Prominent Feature(s):** Knockanore Mountain › **Landscape Designations:** No Landscape Zoning Designations.
Visibility within LCA	ZTV mapping shows a linear pocket of full theoretical visibility towards to the north-east.
Cumulative Baseline	Turbines from the Sharonowen; Aghanamore North; Carhooearagh/Moyvane (permitted); as well as some turbines from Ballylongford; Leanamore; Kilathmoy-Beenanaspuck; Carhooearagh/Moyvane (existing) and Tullahennell South wind farms are all located within this LCA.
Cumulative Landscape Status	3. Landscape character area with wind turbines.
Cumulative Landscape Effects	The proposed development will not change the status identified above, therefore the cumulative landscape effects are considered **Low.**
Landscape Sensitivity to Wind Farm Development	A large portion of this LCA is designated as a Strategic Search Site Wind Energy Deployment Zone, therefore it is assigned a **Low** landscape sensitivity.
Magnitude of Change	**Negligible:** The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Low x Negligible = Negligible = Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences

Mitigation Factors	› There is limited visibility of the proposed development from this LCA, any areas of visibility are significantly mitigated by roadside hedgerows and mature hedgebanks surrounding settlements.

LCA 6 – Smearlagh River Valley	
Distance from site to Nearest/Furthest Area of LCA	This LCA is approximately 8.4 kilometres away from the nearest turbine at its closest point, and 19.6 kilometres at its furthest.
LCA Key Characteristics **Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012)**	› **Landscape Type:** Hilly and Flat Farmland; Transitional Marginal Land. › **Landform:** Hilly with a river valley bisecting the area. › **Landcover:** Moorland in the southwest, coniferous plantation, and the slopes of the valley has improved pasture. › **Enclosure:** Stone hedgebanks enclose the pasture. › **Human Influence:** Medium. Parts of the area are relatively free from human influence, while other areas are comprised of managed agricultural landscape. Areas of forestry are also evidence of human influence. › **Perception:** Given the relatively small number of dwellings the area presents as a peaceful rural landscape. › **Quality of Landscape:** The area is elevated and while attractive but it is not of significant amenity value. › **Prominent Feature(s):** Wind turbines in the south west. › **Landscape Designations:** No Landscape Zoning Designations.
Visibility within LCA	Topographical landform screens much of the proposed development from within this LCA. ZTV mapping shows that there in only one large area of full visibility of the proposed turbines located on the higher elevations to the east of this LCA. Actual visibility in areas of full theoretical visibility is mitigated by undulating landform and mature vegetation screening.
Cumulative Baseline	Turbines from the Clahane-Pallas; Clahane-Pallas Extension are located in this LCA. Several other wind farms can be seen from this LCA to in LCA-24 located to the south-west. Wind turbines are a prominent feature in the landscape.
Cumulative Landscape Status	3. Landscape character area with wind turbines
Cumulative Landscape Effects	As the proposed development will not be seen from many areas within this landscape, the proposed development will not change the status identified above, therefore the cumulative landscape effects are considered **Low.**
Landscape Sensitivity to Wind Farm Development	There is little amenity value or landscape importance attributed to this LCA and it does not contain any areas zoned as sensitive landscape designations. Also, The Renewable Energy Strategy for County Kerry states that there is '*Significant capacity for wind energy in this area'* and that the LCA is '*considered suitable for wind energy development',* therefore a **Low** landscape sensitivity is assigned to this LCA.

Magnitude of Change	**Slight:** The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Low x Slight = Minor/Negligible = Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.
Mitigation Factors	› Visibility of the proposed development is significantly mitigated by the changes in topography of the valley and undulating landscape of the LCA. › Stands of commercial forestry provide screening of the proposed development in the elevated areas where there is theoretical visibility of the proposed turbines.

LCA 7 – River Feale Valley	
Distance from site to Nearest/Furthest Area of LCA	This LCA is approximately 11.1 kilometres away from the nearest turbine at its closest point, and 21.3 kilometres at its furthest.
LCA Key Characteristics **Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012)**	› **Landscape Type:** Hilly and Flat Farmland. › **Landform:** Hilly with a river valley in between. › **Landcover:** Some isolated patches of moorland on the summits of the hills. Improved and semi-improved pasture extends over much of the high topography and coniferous plantation is also present. Unimproved wet pastures dominate the flat valley. › **Enclosure:** Hedgebanks are generally well vegetated. › **Human Influence:** High. It is a managed landscape. Coniferous forestry is evidence of human influence and there are also dwellings located in the countryside. › **Perception:** It is a peaceful landscape. › **Quality of Landscape:** The river valley provides an attractive focal point as the land slopes towards the valley. The views along the River Feale contribute to the visual amenity of the area. However, taken as a whole this landscape can be described as ordinary and not of high amenity value. › **Landscape Designations:** A small area of Rural Secondary Amenity in the north-west of the LCA as the River Feale approaches the town of Listowel.
Visibility within LCA	Topographical landform screens much of the proposed development from all central and southern areas of this LCA. ZTV mapping shows that full theoretical visibility of the proposed turbines occurs in the north of the LCA at high elevations either side of the Feale Valley.

Cumulative Baseline	Three Turbines from the Kilathmoy-Beenanaspuck Wind Farm are the only existing and permitted wind farm developments in this LCA.
Cumulative Landscape Status	2. Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s.
Cumulative Landscape Effects	As the proposed development will not be seen from many areas within this landscape, the proposed development will not change the status identified above, therefore the cumulative landscape effects are considered **Low.**
Landscape Sensitivity to Wind Farm Development	There is little amenity value or landscape importance attributed to this LCA. Also, The Renewable Energy Strategy for County Kerry reports that '*There is significant capacity for wind energy development in this area'*, therefore LCA has a **Low** landscape sensitivity to wind farm development.
Magnitude of Change	**Slight:** The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Low x Slight = Minor/Negligible = Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.
Mitigation Factors	› Visibility of the proposed development is significantly mitigated by the changes in topography in the vast majority of this LCA. › Stands of commercial forestry and well vegetated hedgebanks provide intermittent screening of the proposed development from many areas within the LCA. › Any actual visibility of the proposed turbines is significantly mitigated by distance from the proposed development site.

LCA 23 – Kerry Head and Causeway Coast	
Distance from site to Nearest/Furthest Area of LCA	This LCA is approximately 3.7 kilometres away from the nearest turbine at its closest point, and 21.2 kilometres at its furthest.
LCA Key Characteristics **Draft Renewable Energy Strategy 2012 (Kerry County Council, 2012)**	› **Landscape Type:** Hilly and Flat Farmland; Mountain Moorland; Coast. › **Landform:** Consists of two hills which slope down to the sea. › **Landcover:** It comprises improved and semi-improved pasture. There is bog on the hill tops. An absence of notable trees, therefore the presence of trees is minimal. › **Enclosure:** Fields are enclosed within sparsely vegetated stone hedgebanks. Some dry-stone walling is also present on lower slopes.

	› **Human Influence:** High. It is a managed landscape. There are also numerous dwellings located outside of the main settlements in the area. › **Prominent Feature(s):** Kerry Head to west and Ardoughter Water Tower to east. › **Perception:** It is an attractive and peaceful landscape. › **Quality of Landscape:** This is a scenic coastal landscape of significant value to the local area and the wider North Kerry landscape. › **Landscape Designations:** there are several landscape zoning designations (Rural Prime & Rural Secondary Special Amenity) surrounding Kerry Head to the south west of the LCA. The high value landscape receptors are located out with the LVIA study area for landscape.
Visibility within LCA	ZTV mapping demonstrates that south-eastern portions of the LCA has areas with full theoretical visibility of the proposed development. There is no theoretical visibility of the proposed turbines from the coastline or within 1km inland of the coastline. The whole western area of this LCA is located outside of the 15km LVIA study area, therefore distance to the proposed development will significantly mitigate visibility of the proposed development and any perceived landscape effects from high value coastal landscape receptors.
Cumulative Baseline	No wind farm developments in the LCA.
Cumulative Landscape Status	1. Landscape character area with no wind turbines
Cumulative Landscape Effects	Where the proposed development will be seen in areas to the east of the LCA the cumulative landscape status may be altered to the status below: 2. Landscape character area with occasional wind turbines in it and/or intervisible in another landscape character area/s. The cumulative effects will be slight and are significantly mitigated by distance, therefore the cumulative landscape effects are considered **low.**
Landscape Sensitivity to Wind Farm Development	The Renewable Energy Strategy for County Kerry reports that '*there is no capacity for windfarm development in this part of the area due to the impact that turbines would have on this open and scenic coastal landscape'*, therefore the LCA has a **High** landscape sensitivity to wind farm development.
Magnitude of Change	**Negligible:** A change affecting smaller areas of landscape character including the loss of some landscape elements or the addition of features or elements which are either of low value or hardly noticeable. The effects could be short term and/or reversible.
Significance of Effect	**High x Negligible = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Mitigation Factors	› Visibility of the proposed development is significantly mitigated by distance from the LCA.

	› The highly sensitive landscape areas in the western portion of the LCA are highly mitigated by changes in topography distance from the proposed site boundary. Additionally, roadside vegetation screening and mature hedgerows further reduce visibility of the proposed development.

APPENDIX 13.3

ASSESSMENT OF PHOTOMONTAGES

APPENDIX 13-3

Viewpoint Assessment Tables

Table Error! No text of specified style in document.-1 Viewpoints

VP No	Description	Grid Ref.
1	View from the Rattoo Church and Round Tower in the townland of Clooneagh, approximately 1.3 km northeast from the nearest turbine.	E 487,776 N 633,611
2	View from a L-1032 just off the Wild Atlantic Way in the townland of Cloghane, approximately 4 km northwest from the nearest turbine.	E 485,883 N 635,751
3	View from R551 and Wild Atlantic Way in the townland of Derryco, approximately 3.2 km north of the nearest turbine. Designated as Scenic Route 1 (Ferry Bridge).	E 489,030 N 636,566
4	View from local road in the townland of Ballyeagh, which is also located in an area of Secondary Special Amenity, approximately 6.3 km northwest from the nearest turbine.	E 486,181 N 638,925
5	View from L-2002 in the townland of Cloonconeen, which is also located within a Co. Clare Heritage Landscape, approximately 17.9 km northwest of the nearest turbine.	E 482,240 N 649,884
6	View from the local road and Shannon Way in the townland of Dromin, approximately 8.4 km northwest from the nearest turbine.	E 487,497 N 641,534
7	View from local road off the R553 in the townland of Farranastack, approximately 8.7 km northeast of the nearest turbine. Designated as Scenic Route 5.	E 492,953 N 641,450
8	View from R553 in the townland of Ballydonohough, approximately 6.5 km northeast from the nearest turbine.	E 493,047 N 638,507
9	View from local road off the R557 in the townland of Dysert, approximately 1.3 km east from the nearest turbine.	E 491,284 N 632,737
10	View from the Great Southern Trail in the townland of Listowel Rural, approximately 7.5 km east from the nearest turbine.	E 496,949 N 633,949
11	View from local road just off the R555 in the townland of Rathea, approximately 12.5 km west of the nearest turbine. Designated as Scenic Route 3.	E 501,731 N 629,013
12	View from N69 in the townland of Pallas, approximately 7.3 km southeast of the nearest turbine.	E 494,378 N 626,696
13	View from local road off R554 in the townland of Glanerdalliv, approximately 1.8 km east from the nearest turbine.	E 486,833 N 632,061
14	View from the Ballyduff local road in the townland of Aghabeg East, approximately 2.6 km southwest from the nearest turbine.	E 486,942 N 629,466
15	View from Banna Strand in the townland of Ballinprior, which is also located in an area of Secondary Special Amenity and along the North Kerry Way, approximately 15.3 km northwest from the nearest turbine.	E 474,982 N 624,700

VP No	Description	Grid Ref.
16	View from local road just off the R551, which is also part of the Wild Atlantic Way and North Kerry Way, in the townland of Glenlea, approximately 13.8 km west of the nearest turbine. Designated as Scenic Route 23.	E 474,849 N 630,566

1.1 Visual Effects: Mitigating Factors:

The locations chosen for photomontages follow a detailed and extensive process including review of baseline information, site visits and high-quality photo taking at multiple locations within the LVIA study area.

In general, Hilly and Flat Farmland windfarm sites tend to be capable of absorbing suitably designed wind farm projects of similar scale to the proposed Ballynagare development. Key reasons enabling the proposed wind energy development to be effectively absorbed by the landscape of the site and surrounding area are outlined below and will be evident in the photomontages:

Flat Topography of the site and Listowel Plain to the north, west and south-west.
The low-lying elevation and relatively flat topography of the Ballynagare site and surrounding Listowel Plain, contributes to the landscape's capacity to accommodate a wind farm. This is shown in the photomontages created from Viewpoints 1, 2, 5 and 11. The low-level terrain in which the proposed development is sited results in an even overall height of all the wind turbines, this means that visual confusion caused by turbines at various heights does not arise. For Ballynagare, most visual receptors to the north, west and south-west are also of similar elevation to the base level of the proposed turbines i.e. the turbines are not situated on elevated lands and so the potential for clear and open views of the project from receptors at lower elevations does not arise. This topographic feature of the Ballynagare site and surrounds mitigates the potential for overbearing or domineering effects provided sufficient setback from receptors is designed into the project. It also means that separation distances between receptors and turbines becomes important as the turbines appear smaller in scale quickly when viewed in this planar view.

Highly Vegetated Nature of the Landscape
The landscape surrounding this site is often seen as a patchwork of agricultural fields bordered by lines of trees, hedgerows and pockets of woodland shrub. In close proximity to the site, mature hedgerows and mature treelines reduce the potential for clear and open views and any associated potential domineering effects. As demonstrated by the route screening analysis, these vegetation types are highly evident alongside most of the roads surrounding the proposed development. Located between visual receptors and the proposed turbines, these vegetational elements of the landscape provide screening, obscuring large numbers of turbines or making those views of the turbines intermittent in nature. The ZTV does not take into account this screening and hence ZTV mapping can only be considered accurate where no visibility is indicated. In areas where theoretical visibility is indicated, actual visibility on the ground is diminished by screening factors, as was evident in the results of the route screening analysis.

A Highly Managed and Settled Working Landscape
The site of the proposed Ballynagare development and the wider study area is considered a rural area, however, a significant human influence is evident within the landscape. This can be attributed to relatively intensive agricultural and residential developments throughout North Kerry. This is reflected in the landscape designations which have been attributed to the landscape.

Viewpoint 1 - Clooneagh			
Viewpoint Description and Details	› View taken from the Rattoo Church and Round Tower in the townland of Clooneagh. › Grid Reference: E 487,776, N 633,611 › Approximately 1.3 km northeast from the nearest turbine › No. of turbines visible: 7/7.		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Visitors (Rattoo Church and Round Tower) - **High** Residents – **High** Road users – **Low**
Description of 'Do Nothing' Scenario	View taken from a cul-de-sac local road at the Rattoo Church and Round Tower. Views from this location are wide and expansive. The foreground comprises of the Rattoo Church and Round Tower to the left and a highly vegetated embankment approximately 1 metre in height to the right of the image. Beyond this, open and expansive views of the lower Listowel Plain are seen throughout much of the midground. One-off housing and farmsteads are slightly visible scattered throughout much of the landscape in this view. The vegetated embankment in the foreground reduces visibility of the low-land valley beyond. The background of the view is framed by the Stack's Mountains as it extends across the flat flood plain of the River Feale. In the 'Do Nothing Scenario' several other wind farms are slightly seen along the skyline but are indiscernible due to distance.		
Proposed Photomontage Description	All seven turbines will be seen from this viewpoint. Four turbines will be almost fully visible in the centre of the image. Two turbines will be partially screened by the stone wall to the Rattoo Church wall. One turbine is slightly visible behind the dense row of vegetation in the foreground of the image. The proposed Met Mast will be partially visible on the right side of the image but is partially screened by the vegetation in the foreground of the view. The spatial extent of the proposed turbines within the view is moderate to high as the intervening distance is c. 1.3km from this location. The proposed Ballynagare turbines will increase the vertical and horizontal extent of turbines within the view. While the turbines will be visible over a wider extent than in the 'Do Nothing' scenario, the open expansive view allows the proposed turbines to be absorbed into the landscape without creating a domineering effect.		
Cumulative Effects	The proposed Ballyhorgan turbines appear behind the proposed Ballynagare turbines from this viewpoint location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate**. **Mitigation Factors include:** › The existing, permitted and proposed wind turbines appear as three separate groups on the ridgeline rather than one continuous line Distance greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known		

	heritage or popular tourist or recreational areas, viewers along scenic or tourist routes.
Magnitude of Change	**Moderate:** The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Significance of Effect	**High X Moderate = Moderate = Significant (EPA, 2017)** An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Partial screening of the turbines by the built infrastructure of the Rattoo Church and Round Tower and vegetated embankment on the right side of the image. › The sensitivity of the viewpoint is considered High, due to the alignment of the local road, as the key intended focus of the view is the Rattoo Round Tower and not of the proposed turbines. › Viewpoint is in close proximity to the Village of Ballyduff, therefore visual receptor sensitivity is considered High. › The turbines appear relatively large to the receptor from this location due to the intervening distance (c 1.3 km). › Coherent wind farm layout, reading as one coherent project. › The Rattoo Church and Round Tower is not listed as a popular tourist designation and is likely a local visitor attraction. › Sparsely populated local road, hence very few residential visual receptors.
Residual Effect (incl. mitigating factors)	**Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.

Viewpoint 2 - Cloghane			
Viewpoint Description and Details	› View from the L-1032 just off the Wild Atlantic Way in the townland of Cloghane. › Grid Reference: E 548,637, N 755,343 › Approximately 4 km northwest from the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Village of Ballyduff (nearby) – **Medium** Tourist Route: Wild Atlantic Way (nearby) – **High** Residences – **High** Road users - **Medium**

Viewpoint 2 - Cloghane	
Description of 'Do Nothing' Scenario	This viewpoint was chosen as it is considered to have moderate visual receptor sensitivity due to its proximity to the Wild Atlantic Way and Village of Ballyduff. The foreground of this view consists of a vegetated grass embankment approximately 1 metre in height, which runs parallel along the L-1032. Beyond this, grass fields are outlined by mature hedgerows and tree lines. One-off residential dwellings and farmhouses are scattered throughout much of the foreground and midground of the view. From this viewpoint the local landscape is relatively flat, the view extends to the higher elevations of the Stack's Mountains in the distant south (centre of image) although these views are intermittently screened by clusters of trees and residential buildings. Electrical powerlines are a common feature throughout much of this view. The 'Do-Nothing Scenario' would see several wind farms discreetly visible on the along the ridgeline in the horizon, although they are at a great distance and are not distinctive features of the landscape. From this viewpoint location, the proposed Ballyhorgan wind farm is located in the centre of the image behind the proposed Ballynagare turbines. The presence of treelines and hedgerows, which are commonplace along the L-1032, resume beyond this location as evident to the left and right of view. This will aid in keeping visibility of the proposed turbines from this location to a minimum.
Proposed Photomontage Description	The proposed turbines will appear as a relatively coherent cluster within the background of this view. All of the proposed turbines will be seen from approximately mid-tower upwards in the distance. The vegetated embankment in the foreground mitigates views of the proposed turbines. There is visual stacking of two turbines in this view. The spatial extent of the wind farm within the view is moderate given the intervening distance is c.4 km from this location. Overall, the turbines appear as one coherent cluster and will add to the cumulative windfarms seen along the skyline of the view. The proposed Met Mast will be partially visible on the right side of the image but is partially screened by the vegetated embankment in the foreground of the view.
Cumulative Effects	Several wind farms are discreetly visible on the along the ridgeline in the horizon, although they are at a great distance and are not distinctive features of the landscape. The proposed Ballyhorgan wind farm is visible to the left of the proposed Ballynagare turbines but are at a lower elevation and therefore do not appear as the same project. The horizonal and vertical extent of turbines within the centre of this view is slightly increased with the addition of the proposed Ballynagare turbines. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate.** **Mitigation Factors include:** › The existing, permitted and proposed wind turbines that are visible along the ridgeline are indiscernible due to distance across the flat landscape.

Viewpoint 2 - Cloghane	
	› The proposed Ballyhorgan wind farm has sufficient separation distance from the proposed Ballynagare turbines. Distance between the wind farm projects greatly mitigates the potential for cumulative visual effects.
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes
Magnitude of Change	**Slight:** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Significance of Effect	**High X Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Visual receptor sensitivity is High due to close proximity to Wild Atlantic Way and the village of Ballyduff. › Partial screening by hedgerow and tree lines along the L-1032. Screening by vegetation is more common along the Wild Atlantic Way, therefore this location was chosen to give a 'worst case' scenario due to the open and expansive views. › View of turbines is adjacent to the direction of travel, hence the turbines will not be in the direct line of vision. › Coherent wind farm layout reading as one coherent project. › The residential properties have sufficient separation distance from the proposed turbines to ensure residential visual amenity is not affected. In addition to this, the residences along this roadway are screened either to the front of rear of the dwellings by either mature tree lines, hedgerows or farm buildings, restricting potential views of the site. › Intervening distance and the lower elevation of the site means that views are restricted (c 4 km). › Road users will be travelling at speeds close to the speed limit of 80kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.

Viewpoint 3 - Derryco			
Viewpoint Description and Details	› View from R551 and Wild Atlantic Way in the townland of Derryco. › Designated as Scenic Route 1 (Ferry Bridge). › Grid Reference: E 489,030, N 636,566 › Approximately 3.2 km north of the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Tourist Route: Wild Atlantic Way – **High** Scenic Route 1 (Ferry Bridge) - **High** Village of Ballyduff (nearby) – **High** Residences – **High** Road users (R551) - **Medium**
Description of 'Do Nothing' Scenario	This view was taken along Ferry Bridge and the Wild Atlantic Way, which forms part of Designated Scenic Route 1. The foreground of this view shows the Cashen River surrounded by coniferous forestry plantation on either side. From this viewpoint the local landscape is relatively flat, the view extends to the higher elevations of the Stack's Mountains in the distant south (centre of image) although these views are intermittently screened by the coniferous forestry plantations throughout much of the landscape. The 'Do-Nothing Scenario' would see turbines of several existing and permitted wind farm visible on the horizon, although they are at a great distance and are not distinctive features of the landscape. The presence of dense coniferous forestry plantation will aid in keeping visibility of the proposed turbines from this location to a minimum.		
Proposed Photomontage Description	From this location looking southwards, the proposed Ballynagare turbines are in the centre of the image. Seven turbines will be visible from approximately mid tower upwards and three turbines will only be visible from mid-blade due to screening by coniferous plantation found in the midground of the view. The intervening distance from this location is c.3.2 km. The cumulative wind farms within the study area can be discreetly visible along the southern horizon of this view. Given the proximity of this viewpoint location to the site, the scale and extent of the turbines is not incongruous and is readily absorbed into what is a relatively open expansive view with the patches of man-made coniferous forestry plantation on either side of the Cashen River.		
Cumulative Effects	Cumulatively, the addition of the proposed Ballynagare turbines increases the number of turbines visible in the centre of the image while increasing the spatial extent of the wind turbines. Other existing, permitted and proposed wind farms in the study area are indiscernible in the skyline due to distance.		
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		

Viewpoint 3 - Derryco	
Magnitude of Change	**Moderate:** The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Significance of Effect	**High X Moderate = Moderate = Significant (EPA, 2017)** An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › The turbine bases are at a similar level to the receptor which means the intervening distance (c 3.2 km) mitigates the potential for domineering impacts. › The sensitivity of the viewpoint is considered High, due to the designation in the CDP (Scenic Route 1 with panoramic views on either side of Ferry Bridge). › The coniferous forestry plantation is a man-made element and reduces the overall aesthetic quality of the view and obscures some of the turbines. › Coherent wind farm layout reading as one coherent project. › The key visual characteristic in this view is Cashen River in the foreground and Stack's Mountain in the skyline, therefore allowing the turbines to not be the central focus of this view and thus have the ability to be absorbed in the landscape. › View of turbines is perpendicular to the direction of travel. Hence, the turbines will not be in the direct line of vision of road users. › Road users will be travelling at speeds close to the speed limit of 100 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends

Viewpoint 4 – Ballyeagh			
Viewpoint Description and Details	› View from local road in the townland of Ballyeagh. › Located in an area of Secondary Special Amenity. › Grid Reference: E 486,181, N 638,925 › Approximately 6.3 km northwest from the nearest turbine. › No. of turbines visible: 4/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape	**Visual Receptor(s) and Sensitivity**	Residences – **Medium** Road users – **Low** Tourism Designation:

Viewpoint 4 – Ballyeagh			
	Sensitivity (RESCK, 2015-2021)		Ballybunion Beach (nearby)- **High** Landscape Designation: Secondary Special Amenity Area - **High**
Description of 'Do Nothing' Scenario	The viewpoint was taken in front of a row of residential properties to the southeast, as they overlook the lower valley of the Cashen River to the south. The foreground and midground of the view comprise of one-off residential bungalows and field boundaries outlined by hedgerows. The landscape in the foreground is flat and expansive, forming undulating hills towards the skyline. The higher mountainous landscape of Stack's mountains can be seen in the far distance. Short dense shrubs outlining field boundaries and electrical powerlines are a common landscape element in this view. Several other wind farms are theoretically visible from this location along the skyline of this image, but visibility of them is greatly mitigated by distance.		
Proposed Photomontage Description	Given the spatial extent and angle of view from this direction, the turbines appear in a relatively coherent cluster. Four of the proposed Ballynagare turbines will be seen from this viewpoint. The remaining three turbines will be screened by the residential property on the right side of the image. The four turbines will be visible by approximately mid tower upwards. The spatial extent of the wind farm within the view is moderate given the intervening distance is c 6.3 km from this location. Local rises in topography and vegetation in the background screen portions of the turbines within the view. Electrical power lines are a common vertical element found throughout this view. The cumulative projects within the skyline will allow the proposed Ballynagare turbines to be absorbed into the landscape and are seen in a coherent layout with the other wind farms in the study area.		
Cumulative Effects	The proposed Ballyhorgan turbines will appear to the left of the Ballynagare turbines and are the second most visible turbines from this viewpoint location. The proposed Ballyngare turbines will not increase the horizontal or vertical extent of turbines within the view. The Ballynagare turbines that are visible are at a slightly higher elevation to the proposed Ballyhorgan turbines and several other wind farms appear within the skyline behind the Ballyngare turbines. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Low.**		
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes		
Magnitude of Change	**Slight:** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		

Viewpoint 4 – Ballyeagh	
Significance of Effect	**High X Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › The turbine bases are at a similar level to the receptor which means the intervening distance (c 6.3 km) mitigates the potential for domineering impacts. › A number of turbines will be entirely screened by the built environment in this view › Coherent wind farm layout reading as one coherent project. › The proposed Ballynagare turbines do not appear incongruous and do not obstruct views of Cashen River or Stacks Mountain. › Although the turbines appear over the ridgeline in the skyline, screening by undulating landform and vegetation in the background allow the turbines to only be visible from half-hub upwards, and therefore do not alter the character or sensitivities of this view. › View of turbines is adjacent to the direction of travel, hence the turbines will not be in the direct line of vision. › Road users will be travelling at speeds close to the speed limit of 80 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

Viewpoint 5- Cloonconeen			
Viewpoint Description and Details	› View from L-2002 in the townland of Cloonconeen. › Located within a designated Co. Clare Heritage Landscape. › Grid Reference: E 482,240, N 649,884 › Approximately 17.9 km northwest of the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 21 – Loop Head – **Low/Moderate** Landscape Sensitivity (LCACC, 2004)	**Visual Receptor(s) and Sensitivity**	Tourist and Recreational Destination: Loop Head Heritage Trail and Rinevella Bay- **High** Landscape Designation: Heritage Landscape – **High** Residences – **Medium** Road users - **Low**

Viewpoint 5- Cloonconeen	
Description of 'Do Nothing' Scenario	The view is from Rinevella Bay looking south over the River Shannon. The intervening distance of c.17.9 km mitigates potential for visual impacts across the River Shannon towards the Kerry coast. Residential properties are seen dotted across the east and west of this view (left and right of image). On a clear day, potential visibility of the other existing, permitted and proposed wind farms can be seen along the ridgeline that stretches across the skyline of the view but visibility from such distances will be almost imperceptible.
Proposed Photomontage Description	There will be very little change to the 'Do Nothing' scenario. The proposed development will be barely visible due to the distance across such a flat landscape.
Cumulative Effects	Cumulative visual effects will be very minor from this viewpoint as the other existing, permitted and proposed wind farms will be indiscernible across the flat coastal landscape.
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Negligible:** Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.
Significance of Effect	**Medium X Negligible = Minor/Negligible = Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.
Mitigation Factors	› Intervening distance c 17.9km.
Residual Effect (incl. mitigating factors)	**Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences.

Viewpoint 6 – Dromin			
Viewpoint Description and Details	› View from the local road and Shannon Way in the townland of Dromin. › Grid Reference: E 487,497, N 641,534 › Approximately 8.4 km northwest from the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Recreational Route: Shannon Way- **High** Residences - **Low** Road Users - **Low**

Viewpoint 6 – Dromin	
Description of 'Do Nothing' Scenario	In a 'Do Nothing Scenario' several existing, permitted and proposed wind farms are visible along the Stack's Mountain in the skyline. The view from where this image was taken looks out onto a lower valley landscape characterised by grass agricultural fields outlined by hedgerows and treelines and the Cashel River in the centre of the view. The view is dominant of several man-made elements such as one-off residential bungalows, farmhouses and electrical powerlines. Vegetated roadside embankments approximately 1 metre in height, run parallel along the road from where this image was taken. The elevated position of the view overlooking the flat Listowel Plain allows for expansive views towards the proposed development site. Stack's Mountains and the Cashel River floodplain are key visual features in this view.
Proposed Photomontage Description	From this location, the proposed Ballynagare turbines to the southeast are located in the background. There is visual stacking of 4 No turbines within this view. Although the turbines will be visible from half-tower upwards, the Ballynagare turbines appear progressively more obscured with distance. The view is open and expansive and the reduction in scale of the Ballynagare turbines with distance mitigates any potentially domineering or incongruous effects. Stacks Mountain is the key visual feature in the skyline of the view and its aesthetic scenic view is not affected as a result of the addition of the Ballynagare turbines. The proposed Met Mast will be partially visible in the centre of the view to the right of the turbine cluster.
Cumulative Effects	Several wind farms are discreetly visible on the along the ridgeline in the horizon, although they are at a great distance and are not distinctive features of the landscape. The proposed Ballyhorgan wind farm is visible to the left of the proposed Ballynagare turbines and appear at a similar size and scale. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Moderate.** **Mitigation Factors include:** › The existing, permitted and proposed wind turbines that are visible along the ridgeline are indiscernible due to distance across the flat landscape. › The proposed Ballyhorgan wind farm has sufficient separation distance from the proposed Ballynagare turbines. Distance between the wind farm projects greatly mitigates the potential for cumulative visual effects.
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Slight:** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view

Viewpoint 6 – Dromin	
	may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Significance of Effect	**Medium X Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Screening obscures views of the project and distance over the flat landscape reduces the perceived scale. › The turbine bases are at a similar level to the receptor which means the intervening distance (c 8.4 km) mitigates the potential for domineering impacts. › Mature hedgerows outlining field boundaries between the viewer and the turbines restrict views of the turbines. › The residential properties have sufficient separation distance from the proposed turbines to ensure residential visual amenity is not affected. › View of turbines is adjacent to the direction of travel. Hence, the turbines will not be in the direct line of vision of road users. › Road users will be travelling at speeds close to the speed limit of 80 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 7 - Farranastack			
Viewpoint Description and Details	› View from local road off the R553 in the townland of Farranastack. › Designated as Scenic Route 5 (east direction). › Grid Reference: E 492,953, N 641,450 › Approximately 8.7 km northeast of the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Scenic Route 5- **High** Residences - **Low** Road Users – **Low**
Description of 'Do Nothing' Scenario	View taken along a local road and Scenic Route 5 (east direction) looking southwards. The 'Do Nothing Scenario' shows an open and expansive view from an elevated position over the flat landscape of the River Feale flood plain. The landscape of the lowlands comprises of large agricultural fields bordered by hedgerows and treelines. The view is occasionally populated by houses and farmsteads across the landscape. Stack's Mountain is just discernible in the background of the view as the landform rises to the southeast. At this distance it is very difficult to identify any other wind farms in the image that may be theoretically visible from this view.		

Viewpoint 7 - Farranastack	
Proposed Photomontage Description	The Ballynagare project introduces new turbines within the centre of the image in the lower Cashen River valley. The elevated position of this viewpoint location allows for extensive views of the Ballynagare turbines. In general, the photomontage shows that the turbines, from a landscape perspective, read as one coherent layout of turbines (cluster) with no differences in layout, scale or design. While the turbines will be visible over a wider extent than in the 'Do Nothing' scenario, the open expansive view can accommodate the addition of the proposed Ballynagare turbines. The distance of this location to the site means that the turbines will not be incongruous or domineering from this location. Although the turbines will be visible from half-tower upwards, the Ballynagare turbines appear progressively more obscured with distance. Landscape elements consisting of grass fields outlined by field boundaries add to the aesthetic quality of this view, allowing the turbines to not be of central focus and can readily be absorbed into the view. The view towards the Stacks Mountains will not be obstructed or obscured by the proposed turbines and do not materially impact on the view. The proposed Met Mast will be partially visible in the centre of the view between the turbine cluster.
Cumulative Effects	Several wind farms are discreetly visible on the along the ridgeline in the horizon, although they are at a great distance and are not distinctive features of the landscape. The proposed Ballyhorgan wind farm is visible to the left of the proposed Ballynagare turbines and appear at a similar scale. The proposed Ballyanagre turbines appear as a standalone project with other wind farms in the study area. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Low.** **Mitigation Factors include:** › The existing, permitted and proposed wind turbines that are visible along the ridgeline are indiscernible due to distance across the flat landscape. › The proposed Ballynagare turbines are seen as a standalone project not associated with other wind farms and therefore do not cause visual confusion. Distance between the wind farm projects greatly mitigates the potential for cumulative visual effects.
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes
Magnitude of Change	**Slight:** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view

Viewpoint 7 - Farranastack			
	may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.		
Significance of Effect	**High X Slight = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.		
Mitigation Factors	› The turbines appear as one coherent cluster and do not dominate over the skyline views of Stacks Mountain ridgeline thus allowing the turbines to be absorbed in the landscape. › Field patterns outlined by mature hedgerows and treelines are a common landscape element in this view and mitigate visual effects of the turbines. › Open and expansive view in a location designated as Open to Consideration for wind turbines. › The sensitivity of the viewpoint is considered High, due to the designation in the CDP. The proposed layout does not obscure or obstruct the views over the designated scenic route as the designated scenic route is east facing and this view is directed southwards. › Turbines appear at a lower elevation than Stack's Mountain ridgeline and thus do not dominate views of the skyline. › Road users will be travelling at speeds close to the speed limit of 80 kmph on this straight section of road, hence any views are likely to be fleeting.		
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.		

Viewpoint 8 - Ballydonohough			
Viewpoint Description and Details	› View from R553 in the townland of Ballydonohough. › Grid Reference: E 493,047, N 638,507 › Approximately 6.5 km northeast from the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021	**Visual Receptor(s) and Sensitivity**	Residents – **Medium** Road Users (R553) - **Medium**
Description of 'Do Nothing' Scenario	This view was chosen as it is representative of visual receptors traveling along the R553 from the village of Listowel to Ballybunion. The character of the view is rural in nature. This view is typical of the landscape elements in the study area, where open and expansive views across a flat landscape ending in a dense hedgerow or treeline is common. Several residential bungalows and farmhouses are dotted throughout the landscape in this view. The landscape in this view is flat, becoming more accentuated and forming higher ridgelines in the skyline where the Stack's Mountain can be		

Viewpoint 8 - Ballydonohough	
	seen. Electricity powerlines and associated infrastructure are a common vertical element within this view. Several other existing turbines are theoretically visible within the skyline of the view and appear as a separate project from the proposed Ballynagare wind farm (as per the wireframe and photomontage) but no cumulative visibility is anticipated on the ground.
Proposed Photomontage Description	All seven turbines will be visible from this viewpoint from the mid-tower upwards and there is visual stacking of two turbines from this view. Vegetation within the background will mitigate views of the proposed turbines. Man-made elements including electrical powerlines and one-off residential bungalows are common within this view. The vertical extent of the proposed development is acceptable given the turbines do not create an overbearing effect over the ridgeline. Stacks Mountain is a key visual skyline feature, thus allows the proposed Ballynagare turbines to not appear incongruous and seen as one coherent cluster. The spatial extent is considered low from this location. The proposed Met Mast will be partially visible in the centre of the view between the turbine cluster but is partially screened by distance and the mature vegetation in the background of the view.
Cumulative Effects	The proposed Ballynagare turbines are seen as a single wind farm project, with no other wind farms are visible in the immediate surrounds. Other existing, permitted and proposed projects are seen on the far-left side of the image. The proposed Ballyhorgan wind farm appears at a relatively similar scale and size to the Ballynagare turbines. There is a **High** visual separation between existing and proposed turbines and the difference in scale is **Low.**
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Slight** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Significance of Effect	**Medium X Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Open and expansive view in a location designated as Open to Consideration for wind turbines. › Coherent wind farm layout reading as one coherent project.

Viewpoint 8 - Ballydonohough	
	› The turbine bases are at a similar level to the receptor which means the intervening distance (c 6.5 km) mitigates the potential for domineering impacts. › Screening obscures views of the project and distance over the flat landscape reduces the perceived scale. › View of turbines is perpendicular to the direction of travel, hence the turbines will not be in the direct line of vision. › Road users will be travelling at speeds close to the speed limit of 80 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 9– Dysert			
Viewpoint Description and Details	› View from a local road off the R557 in the townland of Dysert. › Grid Reference: E 491,284, N 632,737 › Approximately 1.3 km east from the nearest turbine. › No. of turbines visible: 4/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Residents – **Medium**
Description of 'Do Nothing' Scenario	The image was taken from a cul-de-sac local road in front of a local cemetery looking west. In the 'Do Nothing Scenario' the local landscape is moderately undulating, especially considering the vegetated embankment approximately 1 to 2 metres in height, which form the foreground of this view therefore enclosing views towards the skyline. The landcover comprises of a patchwork of pastoral and arable agricultural land bordered by low hedgerows and tree lines. The view is occasionally populated by houses and farmsteads across the landscape. At this distance, other cumulative wind farms within the study area are barely visible.		
Proposed Photomontage Description	Three of the seven turbines will be visible from approximately mid-tower upwards in the centre of this viewpoint location. 1 No turbines will be visible from approximately mid blade behind the farm buildings infrastructure on the left side of the view. The remaining three turbines will be screened by the farm buildings and the vegetated embankment in the foreground of the view. The spatial extent of the proposed turbines within the view is moderate due to the intervening distance of c. 1km. The vertical extent of the turbines in this view is large, however, the man-made grass embankment in the foreground allows for shortened views and reduces visibility of the turbines.		
Cumulative Effects	Cumulative visual effects do not arise at this viewpoint.		

Viewpoint 9– Dysert	
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Moderate:** The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Significance of Effect	**Medium X Moderate = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Partial screening of the turbines by local topography and buildings › Coherent wind farm layout with no other permitted or proposed projects anticipated from this view. › View of the photomontage is not the key intended view, as the view is directed west and not in the direction of the local cemetery (east). › Open and expansive view in a location designated as Open to Consideration for wind turbines. › The turbines appear relatively large to the receptor from this location due to the intervening distance (c 1.3 km). › Sparsely populated local road, hence very few residential visual receptors. › The magnitude of change of the viewpoint is considered Moderate, due to the intervening distance of c.1.3? km to the closest turbine.
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.

Viewpoint 10- Listowel Rural			
Viewpoint Description and Details	› View from the Great Southern Trail in the townland of Listowel Rural. › Grid Reference: E 496,949, N 633,949 › Approximately 7.5 km east from the nearest turbine. › No. of turbines visible: 6/7		
LCA and Sensitivity	LCA 5 - Listowel Plain – **Low/Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Recreational Designation: Great Southern Trail - **High** Residents – **Medium**

Viewpoint 10- Listowel Rural	
Description of 'Do Nothing' Scenario	This view was taken along the recreational route Great Southern Trail near the Regional Town of Listowel. The foreground of this view comprises of a large agricultural field (centre of image) boarded by mature hedgerows and tree lines on either side. Man-made elements consisting of electrical powerlines and one-off residential bungalows are dotted throughout much of this view. The landscape in this view is flat and rural in character. Densely vegetated treelines and hedgerows are a common landscape feature in this view, creating enclosure and predominantly screening views of Stack's Mountains in the skyline. No turbines are visible in the 'Do Nothing' Scenario due to screening by mature vegetation.
Proposed Photomontage Description	Six turbines will be visible from approximately mid-tower upwards in the distance and one turbine will be entirely screened by vegetation. 1 No turbines is completely screened by the mature vegetation found in the centre of the view. The intervening distance is c.7.5 km from the nearest turbine. Densely vegetated hedgerows and treelines are a common landscape element along this walkway, thereby mitigating views of the proposed turbines. The turbines do not appear incongruous from this location as visibility is greatly mitigated by dense vegetation screening.
Cumulative Effects	Cumulative visual effects do not arise in this viewpoint due to densely vegetated hedgerows and treelines mitigating views.
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Slight:** The proposals would be partially visible or visible at sufficient distance to be perceptible and result in a low level of change in the view and its composition and a low degree of contrast. The character of the view may be altered but will remain similar to the baseline existing situation. This change could be short term or of a short duration.
Significance of Effect	**Medium X Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Wind farm layout reading as one coherent project. › The turbine bases are at a similar level to the receptor which means the intervening distance (c 7.5 km) mitigates the potential for domineering impacts. › Sparsely populated residential road with very few residential receptors. › Dense screening by vegetation is common along the Great Southern Trail, therefore this location was chosen to give a 'worst case' scenario due to the open views towards the site. › The flatness of the landscape and screening by vegetation within the view allows the turbines to be absorbed into the wider landscape

Viewpoint 10- Listowel Rural	
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 11 - Rathea			
Viewpoint Description and Details	› View from local road just off the R555 in the townland of Rathea. › Designated as Scenic Route 3 (west direction). › Grid Reference: E 501,731, N 629,013 › Approximately 12.5 km west of the nearest turbine. › No. of turbines visible: 3/7		
LCA and Sensitivity	LCA 6 – Smearlagh River Valley **Low** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Scenic Route 3- **High** Residences - **Low** Road Users – **Low**
Description of 'Do Nothing' Scenario	The view is directed west along a local road off the R555 and is also along Designated Scenic Route 3 (west direction). The road is outlined by relatively low grass embankments over which the there is a wide and expansive view of the landscape beyond. The topography from this viewpoint location slopes down into a valley and rises in elevation towards the skyline and adjacent Stack's Mountain. Man-made elements of telecommunication poles and one-off residential bungalows are prominent in the immediate landscape. Middle distance views consist of a patchwork of fields interspersed with vegetation and occasional settlements. In the 'Do Nothing' Scenario the existing Pallas Clahane and Pallas Ext. wind farm is seen on the left side of the image.		
Proposed Photomontage Description	There will be very little change to the 'Do Nothing' scenario. The proposed development will be just discernible due to the screening by local rises in topography and mature vegetation to eliminate potential views along the skyline. The intervening distance is c.11.9 km from this location to the nearest turbine. Three of the turbines will be visible from approximately mid blade. The turbines do not appear incongruous from this view and are seen as one coherent turbine layout. Seasonal vegetation will further screen visibility of the turbines in the background.		
Cumulative Effects	The existing Pallas Clahane wind farm is seen on the far-left side of the view. The proposed Ballynagare turbines appear as an extension to the proposed Ballyhorgan turbines as they are at a similar scale and size. The horizontal extent of turbines within this view will be increased slightly with the addition of the proposed Ballynagare turbines to the adjacent proposed Ballyhorgan turbines. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Low.** **Mitigation Factors include:**		

Viewpoint 11 - Rathea	
	› The existing, permitted and proposed wind turbines that are visible in the centre of the view are significantly screened by the ridgeline in the background › The existing Pallas Clahane has sufficient separation distance from the proposed Ballynagare turbines › The size and scale of the proposed Ballynagare turbines is similar to the proposed Ballyhorgan turbines Distance greatly mitigates the potential for cumulative visual effects.
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes.
Magnitude of Change	**Negligible:** Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.
Significance of Effect	**High X Negligible = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.
Mitigation Factors	› The turbine bases are at a similar level to the receptor which mitigates the potential for domineering impacts. › Mature vegetation within the landscape mitigates views of the turbines. › The alignment and orientation of the local road which is a scenic route is such that it does not allow direct views in the direction of the proposed development site. › Intervening distance (c 12.5 km) significantly reduces visibility of the turbines. › Road users will be travelling at speeds close to the speed limit of 80 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Imperceptible (EPA, 2017)** An effect capable of measurement but without significant consequences.

Viewpoint 12 - Pallas			
Viewpoint Description and Details	› View from the N69 in the townland of Pallas. › Grid Reference: E 494,378, N 626,696 › Approximately 7.3 km southeast of the nearest turbine. › No. of turbines visible: 6/7		
LCA and Sensitivity	LCA 5 - Listowel Plain – **Low/Moderate**	**Visual Receptor(s) and Sensitivity**	N69 Road Users – **High**

Viewpoint 12 - Pallas			
	Landscape Sensitivity (RESCK, 2015-2021)		Residences - **Low**
Description of 'Do Nothing' Scenario	The view was taken along the N69 directed northwest. To the right of the image and along the skyline, Knockanore Mountain can be seen slightly. The landscape from the road from where this image was taken gently slopes downwards into a large grass field, characterised by scrub, low-lying vegetation and hedgerows. The character of the landscape in the image is similar to that in much of the study area, where agricultural grass fields outlined by hedgerows and low undulating hills are a prominent feature. Telecommunication poles and overhead electrical powerlines are prominent vertical elements in the immediate landscape. Middle distance views consist of a patchwork of fields interspersed with vegetation and occasional settlements. Long distance views are shortened as the landscape slopes up towards the skyline and limits views beyond. In the 'Do Nothing Scenario' the proposed Ballyhorgan wind farm appears in front of the Ballynagare turbines, however the majority of the wind farms within the study area will not be seen in this view as they are located to the south from where this image was taken.		
Proposed Photomontage Description	The proposed development will be slightly visible along the skyline, however, local rises in topography from this location significantly mitigates visibility of the turbines within the background of the view. The intervening distance of c.6.8 km allows the turbines to not appear incongruous from this view and read, from a landscape perspective, as one coherent turbine layout. The telecommunication structures within this view significantly reduce the overall aesthetic quality of the view.		
Cumulative Effects	The proposed Ballyhorgan wind farm will appear larger and in front of the proposed Ballynagare turbines from this viewpoint location. The proposed Ballynagare wind farm is visible to the left of the proposed Ballyhorgan turbines but are at a lower elevation and therefore do not appear as the same project. The horizonal and vertical extent of turbines within the centre of this view is slightly increased with the addition of the proposed Ballynagare turbines. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Low.** **Mitigation Factors include:** › Visibility of other existing, permitted and proposed wind farms in the study area is greatly mitigated by the ridgeline in the foreground. › The proposed Ballyhorgan wind farm has sufficient separation distance from the proposed Ballynagare turbines. Distance between the wind farm projects and local rises in topography greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local		

Viewpoint 12 - Pallas	
	recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Slight** The loss of or change to landscape features of limited extent, or changes to landscape character in smaller areas. Changes would not affect key characteristics. The addition of any new features or elements to the landscape would only result in low-level changes to the overall aesthetics of the landscapes. Changes to the landscape are more evident at a local level and not over a wide geographical area. The effects could potentially be medium to short term and/or reversible.
Significance of Effect	**Medium X Slight = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › The undulating topography mitigates views of the turbines. › Th existing 22kv electricity line and towers form part of the existing view and lowering the aesthetic quality of the view › View of turbines is perpendicular to the direction of travel. Hence, the turbines will not be in the direct line of vision of road users › Road users will be travelling at speeds close to the speed limit of 100 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 13 - Glanerdalliv			
Viewpoint Description and Details	› View from local road off R554 in the townland of Glanerdalliv. › Grid Reference: E 486,833, N 632,061 › Approximately 1.8 km east from the nearest turbine. › No. of turbines visible: 6/7		
LCA and Sensitivity	LCA 3 – Cashen River **Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Residents – **Medium** Road users - **Low**
Description of 'Do Nothing' Scenario	The view in a 'Do Nothing Scenario' shows a flat landscape consisting of an agricultural field enclosed by a stand of mature trees and hedgerows. The local road from where this image was taken is commonly vegetated on either side, therefore this viewpoint location was chosen to give a 'worst case' scenario of open and expansive views towards the site. An overhead powerline and associated utility poles are a distinctive feature in the landscape from this viewpoint. The proposed Ballyhorgan wind farm is located in the centre of the view behind the Ballynagare turbines. The		

Viewpoint 13 - Glanerdalliv	
	existing Cloghboola and Pallas Clahane wind farms are just visible in the distant skyline on the elevated land to the south-east of the view (right of the image). The background of the view is framed by the Stack's Mountains as it extends across the flat flood plain of the River Feale.
Proposed Photomontage Description	Six of the seven turbines will be visible from this location. The turbines will be almost entirely visible due to the vast open landscape within this view. One turbine will be entirely screened by existing roadside vegetation found on the left side of the view. The proposed Met Mast will be visible on the right side of the image but is partially screened by the vegetation in the background of the view. The intervening distance is c 1.8 km from this location. The proposed turbines appear relatively large in this view as the spatial extent is high given the proximity to the site. The proposed project will introduce new turbines into the landscape.
Cumulative Effects	Several wind farms are discreetly visible on the along the ridgeline in the horizon, although they are at a great distance and are not distinctive features of the landscape. The proposed Ballyhorgan wind farm is visible in the centre of the image behind the Ballynagare turbines. Other wind farms in the study area are screened from view due to the mature vegetation found on the left side of the image. The vertical extent of turbines within the centre of this view is increased with the addition of the proposed Ballynagare turbines and the Ballynagare turbines appear quite prominent as the intervening distance is c.1km from this location. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **High.** **Mitigation Factors include:** › The existing, permitted and proposed wind turbines that are visible along the ridgeline are indiscernible due to distance across the flat landscape. › The proposed Ballyhorgan wind farm has sufficient separation distance from the proposed Ballynagare turbines. › The proposed Ballyhorgan wind farm is visible from this view but is acceptable given the cumulative effects for Flat Peatland landscape type as outlined in the 2019 DoHPLG. Distance between the wind farm projects greatly mitigates the potential for cumulative visual effects.
Sensitivity of Visual Receptor(s)	**Medium:** Includes viewers who may have some susceptibility to a change in view, such as those from views which are not designated but may have local recreational uses or those travelling along routes or at view which are considered moderately scenic.
Magnitude of Change	**Moderate:** A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not

Viewpoint 13 - Glanerdalliv			
	affect key characteristics. The effects could be long to medium term and/or partially reversible.		
Significance of Effect	**Medium X Moderate = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.		
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Open and expansive views in a location designated as Open to Consideration for wind turbines. › Coherent wind farm layout, cumulatively reading as one coherent project. › The turbines appear relatively large to the receptor from this location due to the intervening distance (c 1.8 km). › Sparsely populated road therefore the visual receptor sensitivity is Low. › 'Worst case' scenario viewpoint location due to the mature vegetation that exists along this road which will mitigate views of the turbines. › The residential properties have sufficient separation distance from the proposed turbines to ensure residential visual amenity is not affected. In addition to this, the residences along this roadway are screened either to the front of rear of the dwellings by either mature tree lines, hedgerows or farm buildings, restricting potential views of the site. › Road users will be travelling at speeds close to the speed limit of 80kmph on this straight section of road, hence any views are likely to be fleeting.		
Residual Effect (incl. mitigating factors)	**Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends		

Viewpoint 14 – Aghabeg East			
Viewpoint Description and Details	› View from the Ballyduff local road in the townland of Aghabeg East. › Grid Reference: E 486,942, N 629,466 › Approximately 2.6 km southwest from the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 5 - Listowel Plain – **Low/Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Residents - **Medium** Road Users - **Low**
Description of 'Do Nothing' Scenario	This image was taken along the Ballyduff local road north-west of the village of Lixnaw. The landscape in this view is vast and open with long-distance views towards the skyline. The foreground comprises of a large open field, bordered by hedgerows on either side and single-strand trees dotted throughout. One- off housing and electricity powerlines are a common man-made feature from the local road where this image was taken. Roadside		

Viewpoint 14 – Aghabeg East	
	vegetation and single-strand trees are seen throughout much of this view. The Stacks Mountain is a prominent feature in the skyline of this view.
Proposed Photomontage Description	All seven turbines will be entirely visible from this location. The landscape within this view is vast and open. The intervening distance from this location is c.2.6 km. The photomontage shows that the proposed Ballynagare turbines read, from a landscape perspective, as one coherent layout of turbines (cluster). The spatial extent of the proposed turbines is high given the proximity from this location. The proposed Met Mast will be visible in the centre of the view between the turbine cluster. Due to the flatness and openness of the landscape within the view, the proposed turbines will not appear incongruous from this location. The treelines in the background and Stacks Mountain within the skyline create a visual backdrop to the view.
Cumulative Effects	The proposed Sharonowen turbines are theoretically visible on the right-side of the proposed Ballynagare wind farm (as per the wireframe and photomontage) but no cumulative visibility is anticipated on the ground due to distance across the flat landscape. Theoretical visibility of the Ballyhorgan turbines are slightly visible on the far-right side of the image but no cumulative visibility is anticipated. There is a **Low** visual separation between existing and proposed turbines and the difference in scale is **High.**
Sensitivity of Visual Receptor(s)	**Medium:** A more limited loss of or change to landscape features over a medium extent which will result in some change to landscape features and aesthetics. Could include the addition of some new uncharacteristic features or elements that would lead to the potential for change in landscape character in a localised area or part of a landscape character area. Would include moderate effects on the overall landscape character that do not affect key characteristics. The effects could be long to medium term and/or partially reversible.
Magnitude of Change	**Moderate:** The change in the view may involve partial obstruction of existing view or partial change in character and composition of the baseline through the introduction of new elements or removal of existing elements. Likely to occur at locations where the development is partially visible over a moderate or medium extent, and which are not in close proximity to the development. Change may be readily noticeable but not substantially different in scale and character from the surroundings and wider setting.
Significance of Effect	**Medium X Moderate = Moderate/Minor = Moderate (EPA, 2017)** An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends.
Mitigation Factors	› Siting and design were developed in accordance with the guidelines for hilly and flat farmland landscape character type. › Coherent wind farm layout, cumulatively reading as one coherent project. › The turbines appear relatively large to the receptor from this location due to the intervening distance (c 2.6 km).

Viewpoint 14 – Aghabeg East	
	› Open and expansive view in a location designated as Open to Consideration for wind turbines. › Pockets of mature trees and hedgerows along this roadway between the viewer and the turbines limit views of the turbines and creates visual diversion. › The residential properties have sufficient separation distance from the proposed turbines to ensure residential visual amenity is not affected. In addition to this, the residences along this roadway are screened either to the front of rear of the dwellings by either mature tree lines, hedgerows or farm buildings, restricting potential views of the site. › View of turbines is perpendicular to the direction of travel. Hence, the turbines will not be in the direct line of vision of road users. › Road users will be travelling at speeds close to the speed limit of 80kmph on this straight section of road, hence any views are likely to be fleeting. › The flat and open expansive views allow the turbines to be absorbed into the landscape without creating domineering effects.
Residual Effect (incl. mitigating factors)	**Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities

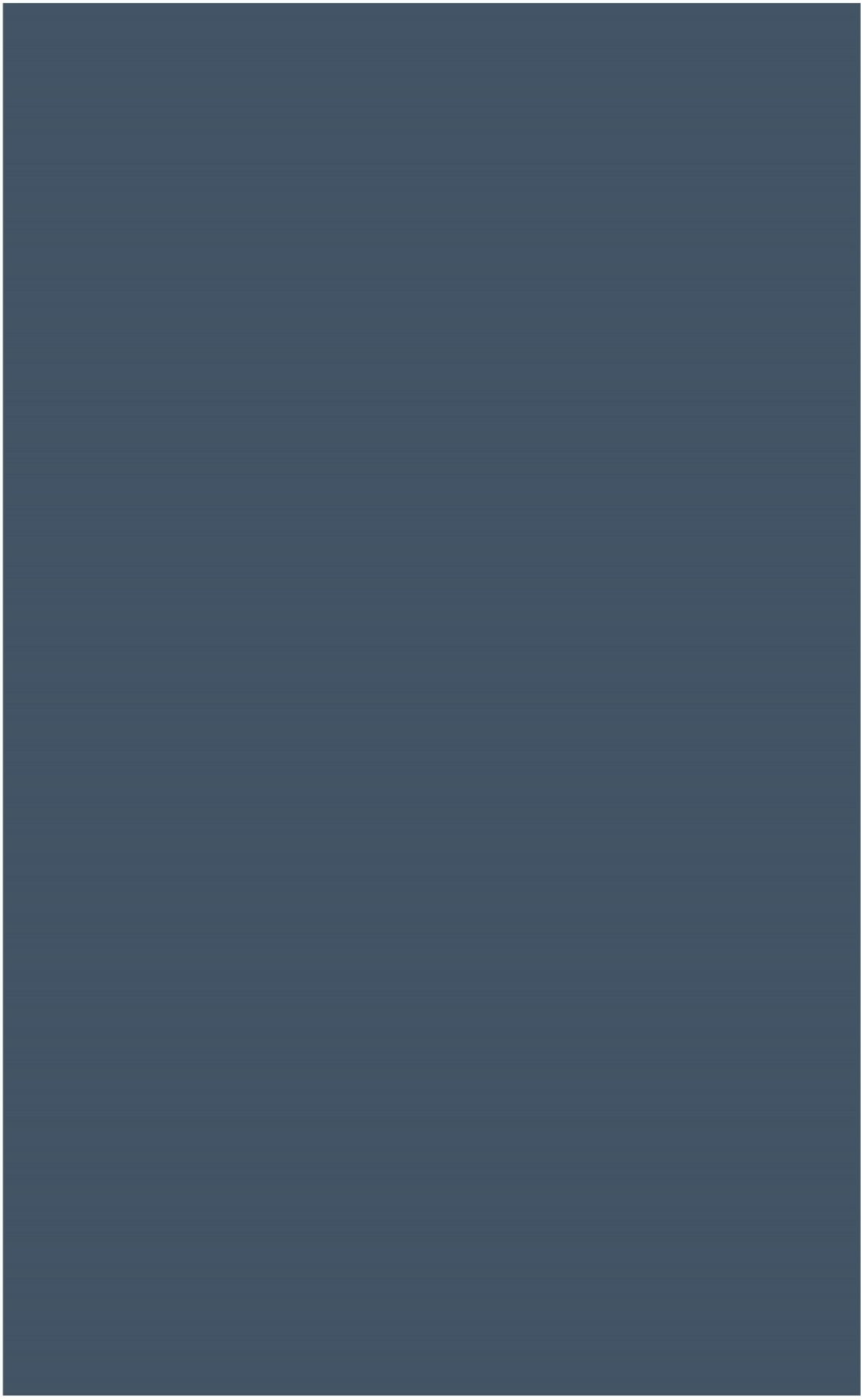
Viewpoint 15 - Ballinprior			
Viewpoint Description and Details	› View from Banna Strand in the townland of Ballinprior. › Located in an area of Secondary Special Amenity and along the North Kerry Way. › Grid Reference: E 474,982, N 624,700 › Approximately 15.3 km northwest from the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 5 - Listowel Plain – **Low/Moderate** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Designation: Area of Secondary Amenity and Banna Beach- **High** Recreational: North Kerry Way- **High** Visitors - **High**
Description of 'Do Nothing' Scenario	The image of this 'Do Nothing Scenario' was taken along the North Kerry Way, from the top of one of the grass mounds/embankments surrounding Banna Beach. This location was chosen in order to obtain the most open views towards the proposed development or 'worst case' scenario from an elevation position near the tourist site of Banna Beach. From this viewpoint location, the landscape slopes down into a lowland valley, where agricultural fields outlined by hedgerows and tall vertical structures of electrical powerlines are common. Residential bungalows and farmhouses are dotted throughout much of the view. Cumulative wind farms within the study area will be indiscernible from this location due to distance.		

Viewpoint 15 - Ballinprior	
Proposed Photomontage Description	There will be no change to the 'Do Nothing' scenario. The proposed development will not be visible due to the distance across such a flat landscape and the disproportionate effect of even low-rise screening to eliminate potential views.
Cumulative Effects	Cumulative visual effects will be very minor from this viewpoint as the other existing, permitted and proposed wind farms will be indiscernible across the flat landscape.
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes
Magnitude of Change	**Negligible:** Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.
Significance of Effect	**High X Negligible = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Mitigation Factors	› The intervening distance of 15.3km over the flat landscape › Screening by vegetation and buildings. › Visual receptor sensitivity is Low as the direction of scenic amenity is south towards Banna Beach and not in the direction of the proposed development (northeast).
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.

Viewpoint 16 - Glenlea			
Viewpoint Description and Details	› View from local road just off the R551, which is also part of the Wild Atlantic Way and North Kerry Way, in the townland of Glenlea. › Designated as Scenic Route 23. › Grid Reference: E 474,849, N 630,566 › Approximately 13.8 km west of the nearest turbine. › No. of turbines visible: 7/7		
LCA and Sensitivity	LCA 23 – Kerry Head and Causeway Coast **High** Landscape Sensitivity (RESCK, 2015-2021)	**Visual Receptor(s) and Sensitivity**	Destination: Scenic Route 23 and North Kerry Way - **High** District Town of Ballyheigue (nearby) – **High** Tourist Route: Wild Atlantic Way – **High**

Viewpoint 16 - Glenlea			
			Recreational Route: North Kerry Way- **High** Residences – **Low** Road users – **Low**
Description of 'Do Nothing' Scenario	Several existing, permitted and proposed wind farm developments are theoretically visible in the 'Do Nothing Scenario'. The view from this location is from a slightly elevated road looking down across a flat plain. Large agricultural fields outlined by mature hedgerows are a key landscape feature in this view. The middle ground comprises a patchwork of agricultural fields bordered by hedges and clusters of trees; residential dwellings are intermittently seen within the undulating landscape. Electrical powerlines are a common man-made vertical element within this view. Stack's Mountain can be seen in the skyline to the southeast (right of image). The view towards the west and north-west are directed at the coast, however, even from this elevated viewpoint location the northwest Kerry coastline is not distinguishable due to distance.		
Proposed Photomontage Description	There will be very little change to the 'Do Nothing' scenario. The proposed development will not be visible due to the distance across such a flat landscape and the disproportionate effect of even low-rise screening to eliminate potential views.		
Cumulative Effects	Several other existing, permitted and proposed wind farms are theoretically visible within the skyline of this. Even in clear weather, visibility of other wind farms will be indiscernible due to distance across the flat landscape. The wireframe and photomontages show that the proposed Ballyhorgan and Ballynagare wind farms appear at a similar scale and size but there is sufficient separation distance between the projects. There is a **Medium** visual separation between existing and proposed turbines and the difference in scale is **Low.** Distance between the wind farm projects greatly mitigates the potential for cumulative visual effects.		
Sensitivity of Visual Receptor(s)	**High:** Includes viewers at designated views or landscapes. Viewers such as residents in medium proximity to the viewpoint; viewers at well-known heritage or popular tourist or recreational areas, viewers along scenic or tourist routes.		
Magnitude of Change	**Negligible:** Any change would only be barely distinguishable from the status quo "do-nothing scenario" in the surroundings. The composition and character of the view would be substantially unaltered, approximating to little or no change.		
Significance of Effect	**High X Negligible = Minor = Slight (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.		
Mitigation Factors	› The turbine bases are at a lower level to the receptor which mitigates the potential for domineering impacts.		

Viewpoint 16 - Glenlea	
	› Topography and mature vegetation within the landscape mitigates views of the turbines. › The alignment and orientation of the local road which is a scenic route is such that it does not allow direct views in the direction of the proposed development site. › Intervening distance (c 13.8 km) significantly reduces visibility of the turbines. › Road users will be travelling at speeds close to the speed limit of 80 kmph on this straight section of road, hence any views are likely to be fleeting.
Residual Effect (incl. mitigating factors)	**Not Significant (EPA, 2017)** An effect which causes noticeable changes in the character of the environment but without significant consequences.



APPENDIX 13.4

ZTV MAP (A0 SIZE)

County Clare

5km
10km
15km
20km

VP1 VP2 VP3 VP4 VP5 VP6 VP7 VP8 VP9 VP10 VP11 VP12 VP13 VP14 VP15 VP16

No Vis. VP1 No Vis. VP2 No Vis. VP3 No Vis. VP8

Carrigaholt
Bromore Cliffs
Ballylongford
Ballybunion
Ballybunion Beach
Ballyduff
Listowel
Listowel Castle
Lixnaw
Causeway
Duagh
Ballyheigue
Ballyheigue Beach
Banna Strand
Ardfert
Abbeydorney
Kilflyn
Tralee
Tralee Wind Hill

Map Legend

- Site Boundary
- Ballynagare Turbine Locations
- National Roads
- Regional Roads
- Ireland Rail Line
- The Wild Atlantic Way - Tourist Route
- Clare Scenic Routes
- Kerry Scenic Routes - 2 way
- Kerry Scenic Routes- 1 way
- Tourism Designations
- WAW Points
- Clare Heritage Landscapes
- Kerry Primary Special Amenity Area
- Kerry Secondary Special Amenity Area
- Clare - Loop Head Heritage Trail
- Kerry Walking Trails
- North Kerry Way
- Co. Kerry LCAs

Co. Clare Settlements in Study Area

- Large Village

Co. Kerry Settlement Hierarchy

- Hub Town
- Regional Town
- District Town
- Village

ZTV colours

- 1-2 Turbines
- 3-5 Turbines
- 6-7 Turbines

Cumulative WFs in study area

- Aghanamore North- Permitted
- Ballincollig Hill- Existing
- Ballyhorgan- Proposed
- Ballylongford- Permitted
- Beale Hill- Existing
- Beenageeha- Existing
- Carhooearagh / Moyvane- Existing
- Carhooearagh / Moyvane- Permitted
- Cloghaneleskirt- Existing
- Cloghboola- Existing
- Curraghderrig- Existing
- Dromadda Beg- Under Construction
- Dromadda More- Existing
- Glashantooreen- Permitted
- Kilathmoy - Beenanaspuck- Existing
- Kilathmoy - Toberatooreen- Existing
- Knocknagoum- Existing
- Larha- Existing
- Leanamore- Existing
- Maghanknockane- Existing
- Muingnaminnan- Existing
- Muingnatee- Existing
- Pallas / Clahane- Existing
- Pallas / Clahane Extension- Existing
- Sharonowen- Proposed
- Stack's Mountain- Existing
- Tullahennell- South- Existing
- Tullahennell-North- Existing
- Tursillagh 1- Existing
- Tursillagh 2- Existing
- Tylagh- Existing

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N

Drawing Title

Landscape and Visual Baseline- A0

Project Title

Ballynagare Wind Farm

Drawn By	Checked By
AW	TB
Project No.	Drawing No.
200512	Figure A0
Scale	Date
1:55000	29.03.2021

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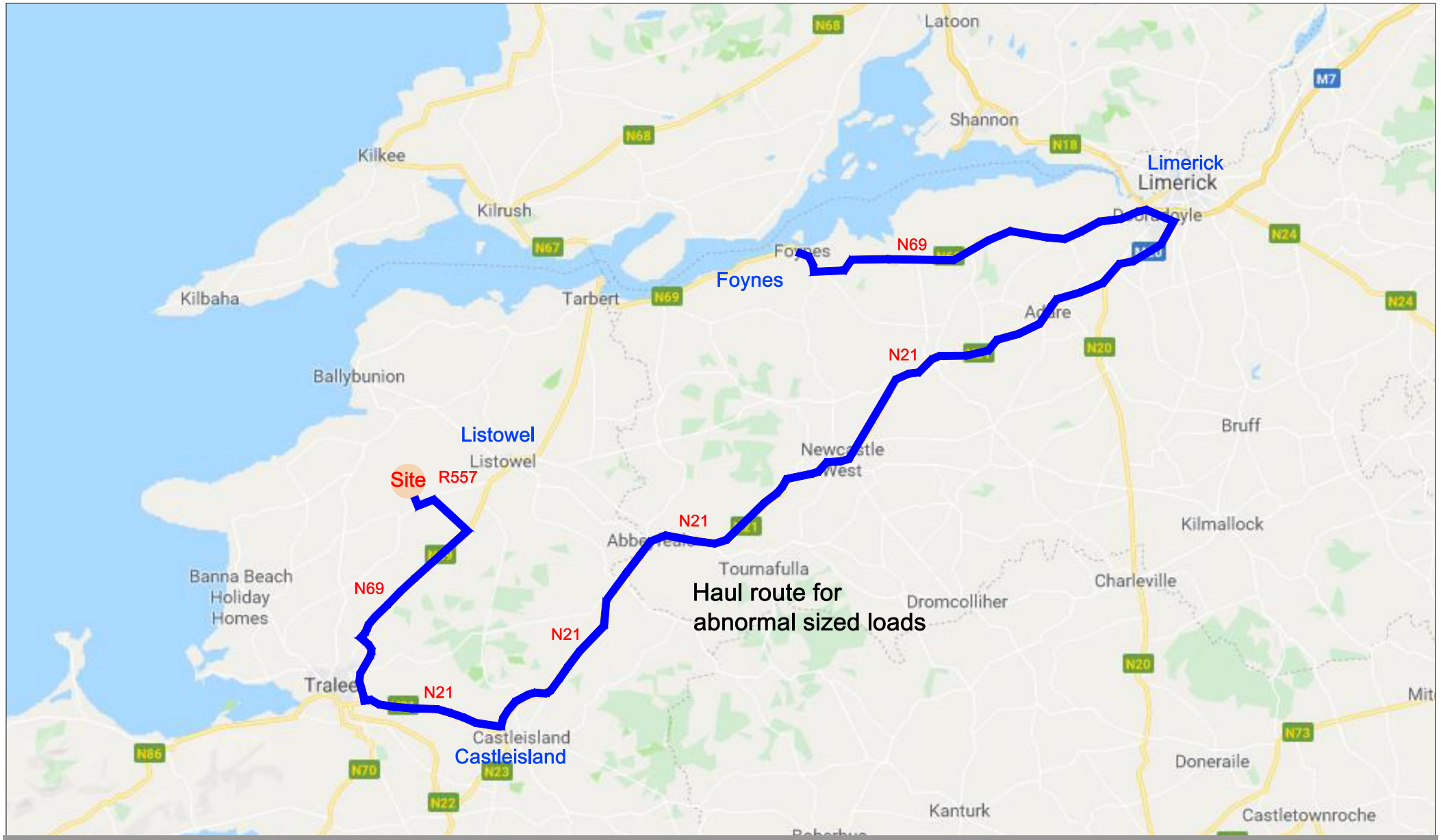
APPENDIX 14.1

TURBINE DELIVERY ROUTE AUTOTRACK ASSESSMENT



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure A14.2.1 Haul route, national road network

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Windfarm Ltd	SCALE:	NTS
PROJECT NO: 8890	DATE: 16.08.21	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

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Figure A14.2.2 Route assessment location map, national road network

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Windfarm Ltd	SCALE:	NTS
PROJECT NO:	8890	DATE: 16.08.21	DRAWN BY: AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

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Figure A14.2.3 Location A - N21 / N23 roundabout, Castleisland, blade extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO:	8890	DATE: 16.08.21	DRAWN BY: AL

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NOTES:

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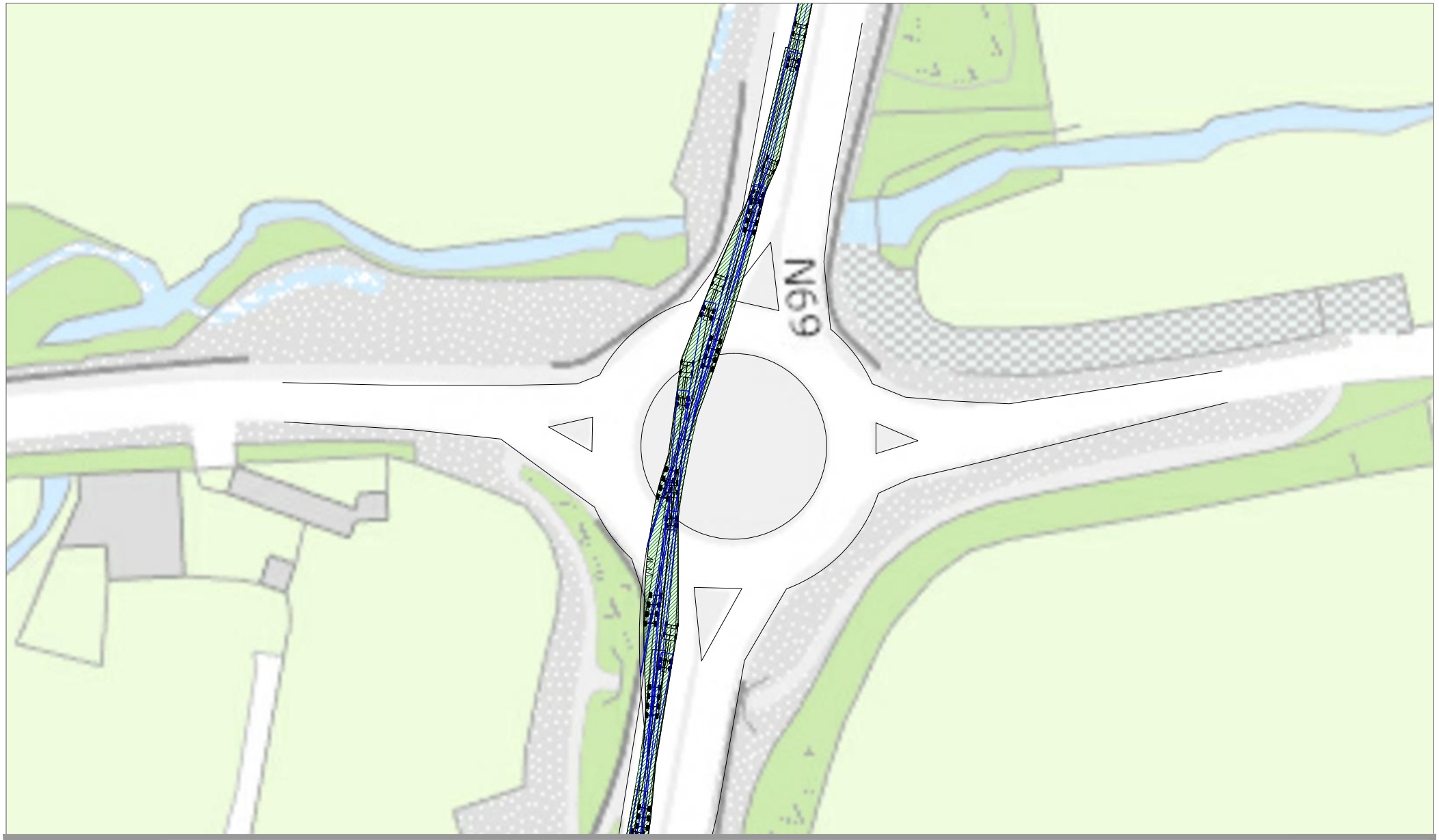
Figure A14.2.4 Location B - N21 / N69 roundabout, Tralee, blade extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO:	8890	DATE: 16.08.21	DRAWN BY: AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure A14.2.5 Location C - N69 / L2015 roundabout, Tralee, blade extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd	SCALE:	1:1000
PROJECT NO: 8890	DATE: 16.08.21	DRAWN BY:	AL

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NOTES:

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Figure A14.2.6 Location D - N69 / R878 roundabout, Tralee, blade extended artic

PROJECT:	Ballynagare Wind Farm		
CLIENT:	Ballynagare Wind Farm Ltd		SCALE: 1:1000
PROJECT NO: 8890	DATE: 16.08.21		DRAWN BY: AL

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APPENDIX 14.2

EMI IMPACT ASSESSMENT STUDY

Report

Ballynagare Wind Farm
EMI Impact Assessment Study

Document Number:				
Author:	D.McG			
Approved for Release:	Rev 1.0	KH	**Date:**	05/005/2021
Document Filename:	*Ballynagare Wind Farm EMI Impact Assessment Study Report*			

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Executive Summary

Ai Bridges was commissioned to assess the possible interference impacts that the proposed wind farm at Ballynagare, Co Kerry could have on the telecommunications networks operated by Ivertec Ltd. It was also required to conduct a detailed EMI Impact Assessment of the potential interference impacts on the wireless internet service network which had been identified during the consultation process with the EIAR Consultant in 2020.

Based on consultations carried out in 2020 and 2021 by the EIAR Consultant and prior to the commencement of this report, Ivertec, confirmed that they have service coverage in the vicinity of the proposed windfarm.

Field surveys of the Ivertec network was carried out in April 2021 and then a new round of consultations with this operators was undertaken.

- Ivertec Ltd identified during consultations in August 2020 that there would be a significant interference impact caused by the proposed wind farm. They stated that the proposed development could affect approximately 100 customers in their service coverage area. A further detailed consultation process was commenced in April 2021.

A detailed EMI Impact Assessment Analysis was carried out on the wireless internet service network operated by Ivertec in the vicinity of the proposed wind farm. The results of the detailed technical analysis indicated that it is unlikely that any Ivertec customers would be impacted by the proposed wind farm development.

Also it has been identified that any potential impacts on the wireless broadband service coverage can be mitigated by re-directing service from an alternative Ivertec basestation in the vicinity of the wind farm. As a contingency a mitigation measure proposal including the construction of a relay basestation is also recommended and this would require further engagement with Ivertec closer to the operational phase of the wind farm.

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Appendix

Appendix A – Ballynagare Wind Farm Turbine Coordinates……...….....27

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Section 1 - Wind Farm Site Information

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1. Introduction

In this section a brief summary of the proposed wind farm site is provided. Details regarding the site's geographic location and the proposed turbine dimensions are presented.

1.1 Wind Farm Site Information

The proposed wind farm development is located approximately 8 km southwest of Listowel in County Kerry. The proposed turbine tip heights and rotor diameters of the turbines are shown below in Table 1. The co-ordinates of the turbines are listed in Appendix A.

Wind Farm	No. of Turbines	Turbine Tip Height	Turbine Rotor Diameter
Ballynagare	10	170 m	155 m

Table 1. Ballynagare Wind Farm Turbine Details

The location of the proposed wind farm at Ballynagare, Co Kerry is shown below in Figure 1.

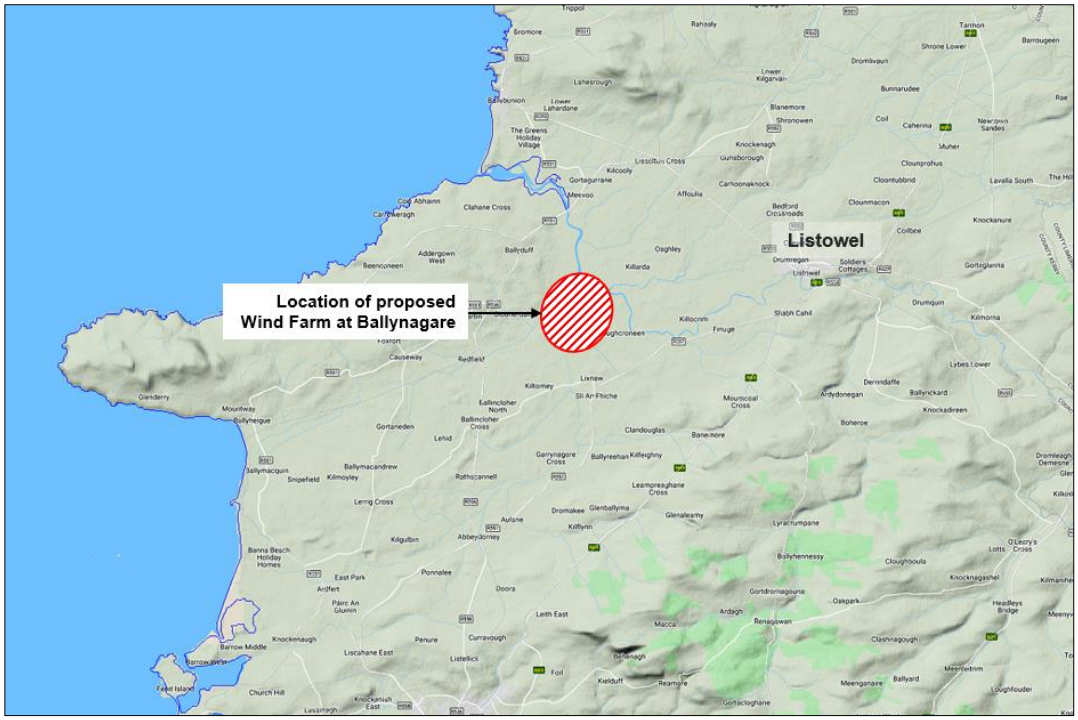

Figure 1. Location of the proposed Ballynagare Wind Farm.

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Section 2 - Methodology

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2. Introduction

In this section a brief summary of the Telecommunications Impact Study Methodology is provided.

2.1 Methodology

The primary stages in preparing and compiling this telecommunications impact study were:

- Telecom Operator Consultations
- Desktop Survey Network Modelling and Analysis
- Report Generation

A summary of each of these stages is provided below:

Telecom Operator Consultations

An initial round of consultations with telecom operators was undertaken by the EIAR consultants in 2020 and 2021 requesting them to raise any concerns they had regarding the impact of the proposed wind farm on their networks. Ivertec Ltd identified that their telecommunications network would be impacted. The consultation process was used to assist in identifying telecommunications infrastructure that could be impacted by the proposed wind farm development. Where the Telecoms Operators identified a potential impact on their network additional rounds of consultation were required.

Desktop Survey and Analysis

An initial desktop survey and analysis was carried out to plot the wind turbine network using a radio planning software tool. The radio planning tool uses GIS and terrain mapping databases to enable accurate modelling of the telecom operator radio links across all radio technologies. A selection of mast-site coordinates were obtained within a study area in the vicinity of the proposed wind farm development. These co-ordinates were obtained from a database of national telecoms networks and also from information received from the various operators \ service providers during the consultation process. These were then converted from Irish National Grid (Easting and Northing in meters) to degrees minutes seconds format and then imported into the radio planning tool. This provided a means of graphically showing the telecommunications sites in the vicinity, relative to the proposed wind farm.

Figure 2 below shows the proposed Ballynagare Wind Farm turbines plotted in the radio planning tool. There are three telecommunication mast-sites identified in the vicinity of the proposed wind farm. The mast-sites have been plotted relative to the proposed turbines and are also shown in Figure 2.

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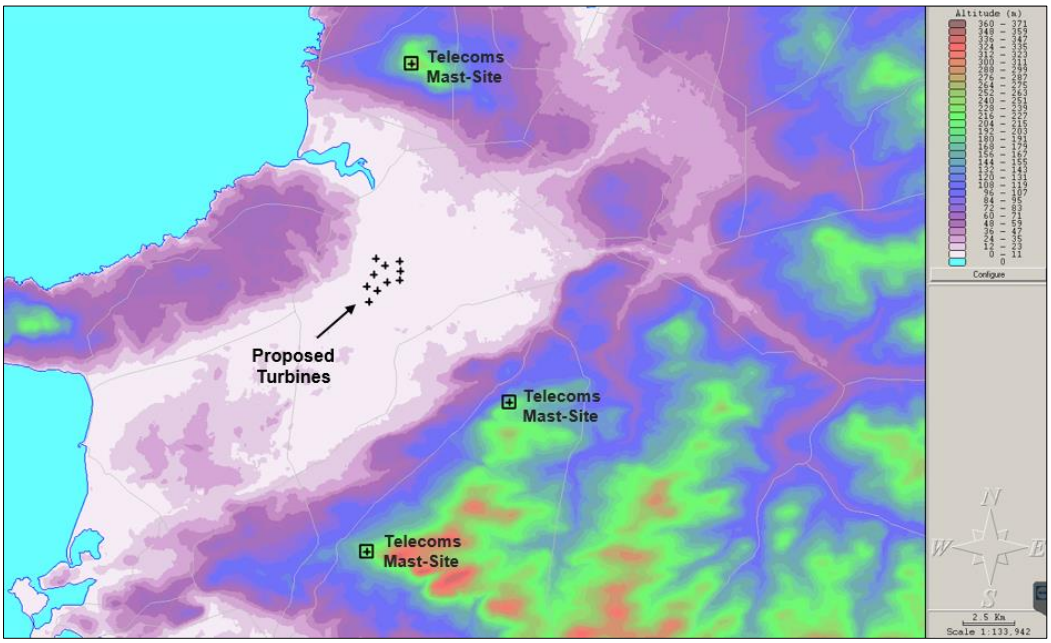

Figure 2. Proposed Ballynagare Wind Turbines plotted in Radio Planning Software

Report Generation

When the impact analysis was completed the results were collated for inclusion in this report. This report includes all consultations, results of desktop surveys and all further analysis as well as the proposed mitigation measures to remediate potential wind farm interference impacts where appropriate.

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Section 3 - Telecom Operator Consultations

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3. Introduction

In this section the consultation process undertaken with the telecom operators is described and detailed. The response received from each of the operators is also provided.

3.1 Telecom Operator Consultations

In August, 2020 consultations with Telecom Operators were undertaken by MKO and Ivertec Ltd. Identified that the proposed wind farm development could have an impact on their wireless internet service access network operating in the Ballynagare area. There were a number of consultations with the operator up to January 2021. Relevant extracts from the consultations between the EIAR Consultant and Ivertec Ltd are provided in Sections 3.1.1 that follows.

In April 2021 Ai Bridges Ltd was subsequently requested to assess the potential impact of the proposed wind turbines on the Ivertec network. There were a number of consultations with the operator in April of 2021. Relevant extracts from these consultations between AI Bridges and Ivertec Ltd are provided in Section 3.1.2 that follows.

ID	Operator	Operator Description	Response Received (Yes/No)	Issues raised by Operator \ Observations.
4	Ivertec Ltd.	Internet Service Provider	Yes	During the initial consultations between the EIAR Consultations in August 2020, Ivertec stated that approximately 100 properties could be impacted by the proposed wind farm development. Ai Bridges Ltd commenced additional consultations in April 2021 where Ai Bridges presented a detailed technical impact analysis and it was subsequently agreed with Ivertec Ltd that there would be no impacts from the proposed wind farm development on the Ivetec telecommunications network. A mitigation measure process was proposed in the event of wind turbine interference on residential broadband services during the operational phase of the wind farm. Any reported impacts would be screened and assessed and valid complaints would be remediated.

3.1.1. MKO Consultations with Ivertec (Sept 2020 – Jan 2021)

The EIAR Consultant for the Ballynagare Wind Farm development project sent initial consultations to Ivertec in September 2020. Ivertec Ltd responded stating that approximately 100 residences could be impacted by the proposed wind farm. The resulting consultation requests and responses have been included herein.

19/08/20 – MKO email to Ivertec ltd.

> *"Dear Jimmy,*
> *We are working on a constraints study for a proposed wind farm site near Lixnaw, Co. Kerry, located approximately 10km west of Listowel, Co. Kerry. The Grid Ref coordinates for the site centre are ITM E489,406 N632,311. A site location map and associated shapefiles are attached showing the proposed windfarm location and area of search.*
> *Could you please let me know if Imagine Network Services has any links in this area? If so we will incorporate these into our constraints map.*

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If you have any queries, please do not hesitate to contact me.

Regards,
Thomas Blackwell"

14/09/20 – Ivertec Response

"Hi Thomas.

Ivertec runs a wireless broadband service from 3 towers to the North, South and South-East of the proposed wind farm.
Customers could lose service as a clear line of sight is required to provide a reliable wireless connection. The customer base includes large and small businesses, national schools under contract form the department of education, homes, farmers and tele-workers.
As rural areas go this part of North Kerry is relatively heavily populated. Ivertec has a customer base of approx. 2,000 customers in the North Kerry area and significant percentage of these could potentially be impacted by the wind farm development.
See map attached of potentially affected areas.

Regards,
Jimmy."

29/09/20 – MKO email to Ivertec ltd.

"Hi Jimmy,

Thanks for your response. Would you be able to provide us with coordinates and elevation data for your towers so we can assess the likely extent of any potential interference from the proposed turbines?

Regards,
Thomas"

02/10/20 – Ivertec Response

"Thomas,

3 towers in KMV files attached. All at 8 meters above ground level."

02/10/20 – MKO email to Ivertec ltd.

"Hi Jimmy,

Thanks for sending those over. Would you have any availability next week for a phone call to discuss potential measures to mitigate for any potential impacts? We would like to engage with you on a strategy to ensure that the project does not negatively effect your customers.

Regards,

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Thomas"

13/10/20 – Ivertec Response

"Hi Thomas,

My colleague Jimmy requested that I engage with you regarding any strategy you propose. Feel free to phone me on 0872128195 for a chat.

Regards
Gerard."

25/11/20 – MKO email to Ivertec ltd.

"Hi Gerard,

Sorry that I have not been in touch for a while. We have had a few minor changes to the proposed project layout that I wanted to get sorted to avoid doubling up on work. I have attached a GIS shapefile of the proposed turbine locations. The turbines will have a tip height of 165 metres (Rotor diameter of 150m with a hub height of 90m. If you could have a look and see if this information will allow you to make a determination on the potential effects of the project on your customers that would be great. Let me know if there is any addition information that would be helpful at this time.

Regards,
Thomas"

25/11/20 – Ivertec Response

"Hi Thomas

Thank you for your email. I can't seem to view those file types. Any chance you can send GPS coordinates?
Kind Regards,

Gerard O Sullivan
Business Development Manager"

25/11/20 – MKO email to Ivertec ltd.

"Gerard,
Here are is a google earth KML with the turbine locations. I have also attached an excel file with the coordinates given in Irish Transverse Mercator (ITM). Will these work for you?

Thanks,
Thomas"

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25/11/20 – Ivertec Response

"That's perfect, thanks Thomas. I will try get a handle on the volume of customers that will be impacted by this proposed project.
I will hopefully respond within 3-5 working days,

Gerard O Sullivan
Business Development Manager"

10/01/21 – Ivertec Response

"Hi Thomas

As my colleague Jimmy mentioned last October, Ivertec have over 2,000 customers in the North Kerry area and significant percentage of these could potentially be impacted by the wind farm development. I'm expecting this windfarm to cause disruption and potentially loss of service for at least 30% of this figure. This will cause major business disruption not to mind the impact that it will have on the homes and businesses.
I will confirm my figures later this later this month,

Gerard O Sullivan
Business Development Manager"

25/01/20 – Ivertec Response

"Hi Thomas

I've completed further analysis to get a greater handle on the possible disruption that this windfarm development may cause. I've attached a screenshot of my work taken from Google Earth.

- *There are close to 100 properties that will have LOS obstructed/impacted by the proposed development.*
- *Loss of service will not alone cause major issues for the customers, but it will see us loose annual revenue amounting to €60,000.*

Can you advise me when the planning application for this windfarm is expected to be submitted?,



Gerard O Sullivan
Business Development Manager"

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3.1.2. Ai Bridges Ltd Consultations with Ivertec (April 2021)

In April 2021 the EIAR Consultant commissioned Ai Bridges to conduct an EMI Impact Assessment Analysis of the potential wind farm interference on Ivertec telecommunications network. Ai Bridges also commenced consultations with Ivertec. The resulting consultation requests and responses have been included herein.

09/04/21 – Ai Bridges Ltd Email to Ivertec

"Hello Jimmy,

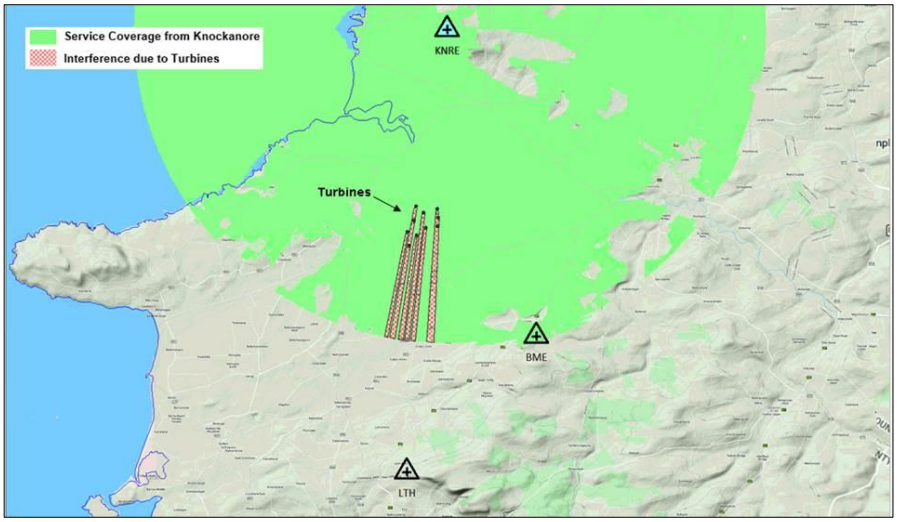
I am following up from our recent call in relation to the proposed wind farm development at Ballynagare.

As discussed our engineers have completed detailed technical analysis of the Ivetec Wireless Broadband service coverage as requested by MKO, the environmental consultants for the project. The analysis has been carried out on the transmitters that are operated by Ivertec at Knockanore, Banemore and Leith.

As you can see below our engineers have now completed the service coverage predictions from the three Transmitters that you have identified in your consultations with the environmental consultants. They have also identified the possible interference impacts zones of the proposed turbines . We have also shown that in the event of interference on service from any of the masts that there is alternative service coverage from another transmitter.

In the event that there are any potential impacts of the proposed wind farm network on the wireless internet subscribers the wind farm (i.e. complaints would be screened during the operations phase of the wind farm and should there be a case of valid interference) then the costs of delivering a service from an alternative mast would be covered by the wind farm operator. The wind farm operator would look to cover cost of once-off re-location charge of the CPE equipment and operator would continue to charge the end-user for service and thus no loss of recurring revenue.

Would you be able to confirm your availability for a call tomorrow to discuss?



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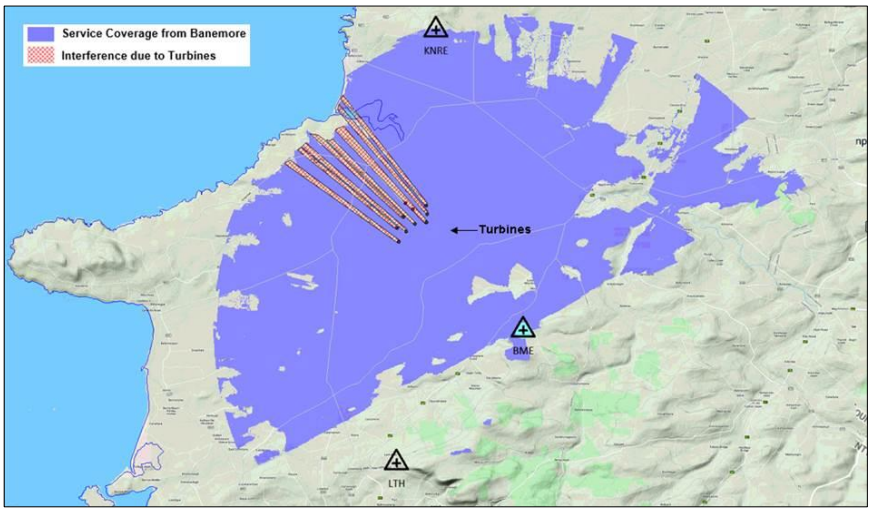

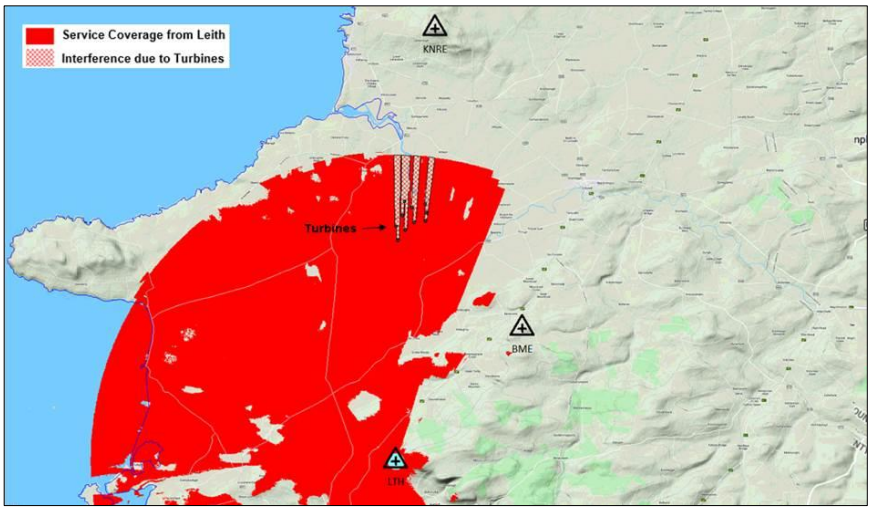

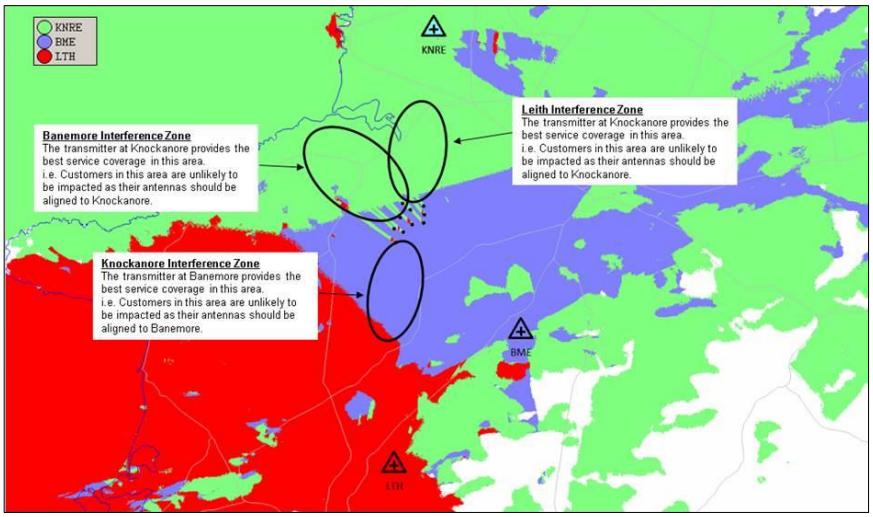

Best Regards,
Kevin Hayes,
Ai Bridges Ltd.,"

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19/04/21 – Ivertec Response

"Hi Kevin

I will be assisting Jimmy with this, and he has asked me to chat to you tomorrow. I'm free all day, so please send an invitation for anytime that works for you.

Kind Regards,
Gerard O Sullivan
Business Development Manager"

20/04/21 - Ai Bridges Ltd Email to Ivertec

Hello Gerard,

Thank you for your prompt response.

Would you be available for a call sometime after 9:30AM this morning.

Best Regards,
Kevin Hayes,

20/04/21 – Ivertec Response

"Hi Kevin

Would 4pm suit you?

Kind Regards,
Gerard O Sullivan
Business Development Manager"

20/04/21 - Ai Bridges Ltd Email to Ivertec

"Hello Gerard,

I will be on online meetings for most of the day from 10AM onwards.

Would you be available for a brief call now ?

Best Regards,
Kevin Hayes,"

20/04/21 – Ivertec Response

"Sorry Kevin, not free to take a call at the minute.
How about tomorrow at 11am or 4pm?

I use Microsoft Teams?

Kind Regards,
Gerard O Sullivan

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Business Development Manager"

20/04/21 - Ai Bridges Ltd Email to Ivertec

"Hello Gerard,

I will be unavailable tomorrow, apologies as I understood that from your email below you were available all day today. I have now freed up my schedule your original suggested time of 4pm for this evening

I am happy to discuss our findings as discussed with Jimmy last month. As discussed with Jimmy at the time we explained that the nature of interference on 5GHz ISM band if not caused by the blades but by the shadowing effect of the turbine hubs and our interference analysis shows the potentially impacted areas.

Just to confirm that our analysis was based on the mast site information that we received from the environmental consultants i.e. as per mast image sites below.

Mast A





Mast B



Mast C

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Best Regards,
Kevin Hayes,"

20/04/21 – Ivertec Response

"No bother. Let's go for 4pm. My number is 0872128195

Kind Regards,
Gerard O Sullivan
Business Development Manager"

21/04/21 - Ai Bridges Ltd Email to Ivertec

"Hello Gerard,

Thank you for taking my call yesterday evening.

As discussed we will look to revert with details of mitigation measure options in the event that there would be potential interference by a successful planning application \ development of a wind farm at Ballynagare.

Also as discussed any potential interference impacts at the construction stage of the proposed wind farm would be screened and in the case of valid interference that one of the mitigation measures below would be implemented

Option 1 :

- *Re-align existing CPE to an alternative base station transmitter*

Option 2 :

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- *Provision of a relay base station \ transmitter site that could be used to provide service in the affected region*

Based on our conversation yesterday the optimal site location of a base station \ transmitter would be in the area of Ballyheigue, North Kerry. Also the only existing transmitters that may be impacted would be Knockanore and Banemore and that the existing transmitter at Leith would not likely be impacted by potential wind turbine interference.

We hope to revert to you by today and the details of the proposed mitigation measures and the cats that would be covered under agreement by the wind farm operator.

Best Regards,
Kevin Hayes,"

21/04/21 – Ivertec Response

"Great stuff. It might also be worthwhile adding a 3rd option, to include a payment to Ivertec per customer in the case of lost business"

Kind Regards,
Gerard O Sullivan
Business Development Manager"

21/04/21 - Ai Bridges Ltd Email to Ivertec

"Hello Gerard,

We are putting together costs now.

In relation to mitigation measure solutions we have seen that most wind farm operators would typically look for mitigation measure solutions for each and every case of valid interference as opposed to compensation.

This may include additional relay base stations if required to provide ubiquitous coverage of Ivertec wireless broadband services ,

In the event of a successful planning application it would be likely that a wind farm development would like go into operation by April 2023 by which time an option for fibre broadband from Ivertec under the NBI plan may become available, as discussed yesterday.

Best Regards,
Kevin Hayes,"

21/04/21 – Ivertec Response

"All good, thanks"

Kind Regards,
Gerard O Sullivan
Business Development Manager"

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Section 4 - Desktop Analysis

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4. Introduction

Based on the findings obtained during field surveys and the telecom operator consultation process, an analysis of Ivertec's License-Exempt networks in the vicinity of the proposed Ballynagare Wind Farm was carried out.

The License-Exempt telecommunication networks that required a desktop analysis are shown below in Table 3. The results of the desktop analysis for these networks are provided in Section 4.1 to 4.3

Network ID	Operator	Description
1	Ivertec	License-Exempt telecommunication network operating from Knockanore
2	Ivertec	License-Exempt telecommunication network operating from Banemore
3	Ivertec	License-Exempt telecommunication network operating from Leith

Table 2. License-Exempt Telecommunications requiring Analysis

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4.1 Network 1 Analysis (Knockanore Basestation)

Figure 4 below the predicted network coverage from the Knockanore basestation and predicted area of interference due to the proposed wind turbines.

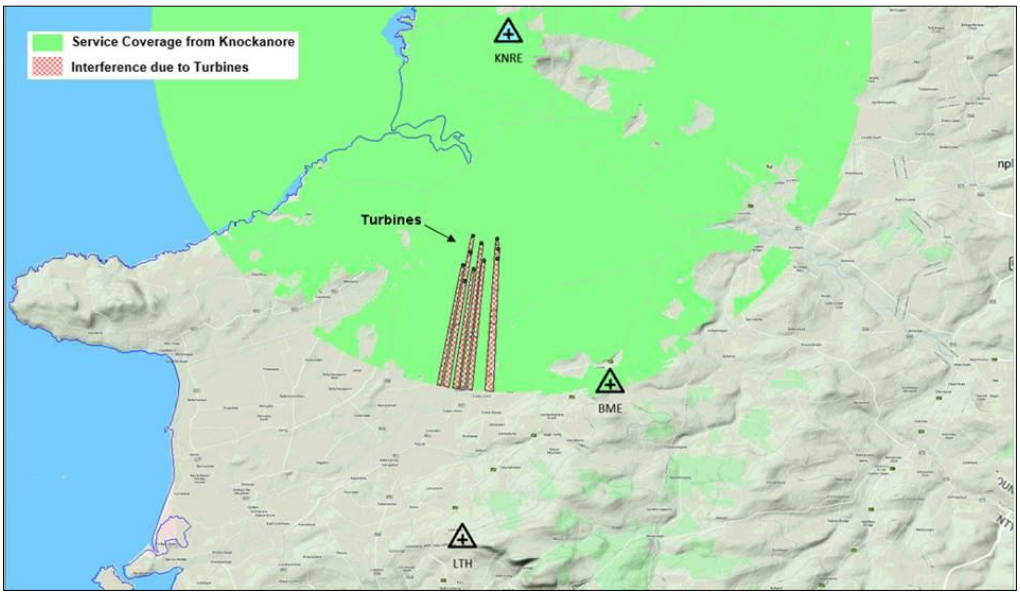

Figure 3. Wireless Internet Service Coverage Prediction (including wind turbine blockage impacts) - Knockanore Basestation

It should be noted that residences in the area of interference to the south of the wind farm are unlikely to be impacted as the coverage prediction plot shown in Figure 7 indicates that Ivertec customers in this area should be obtaining a service from the Banemore basestation.

In the unlikely event of complaints during the operational phase of the proposed wind farm these would have to be screened as valid Ivertec billing customers.

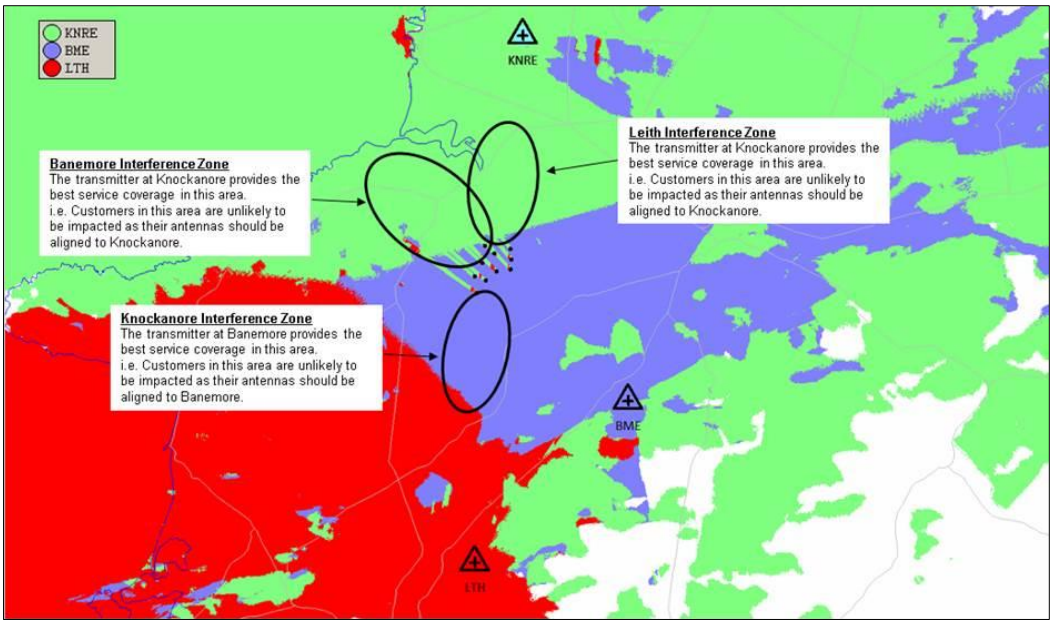

Figure 4. Wireless Internet Service Best Server Coverage Prediction – Knockanore, Banemore and Leith Basestation

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4.2 Network 2 Analysis (Banemore Basestation)

Figure 6 below the predicted network coverage from the Banemore basestation and predicted area of interference due to the proposed wind turbines.

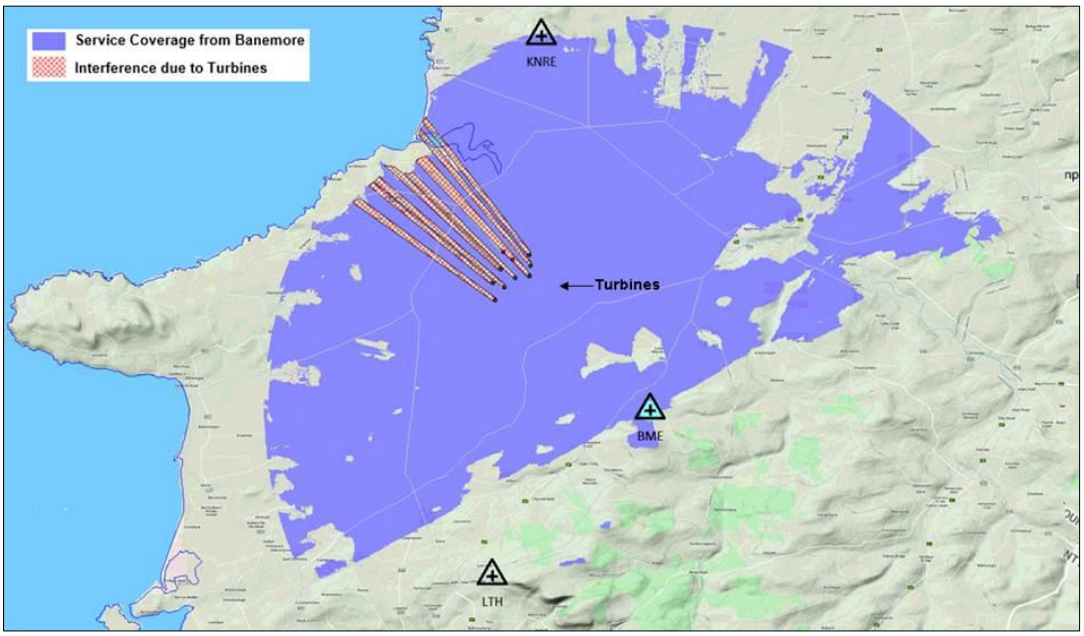

Figure 5. Wireless Internet Service Coverage Prediction (including wind turbine blockage impacts) - Banemore Basestation

It should be noted that residences in the area of interference to the northwest of the wind farm are unlikely to be impacted as the coverage prediction plot shown in Figure 7 indicates that Ivertec customers in this area should be obtaining a service from the Knockanore basestation

In the unlikely event of complaints during the operational phase of the proposed wind farm these would have to be screened as valid Ivertec billing customers

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4.3 Network 3 Analysis (Leith Basestation)

Figure 8 below the predicted network coverage from the Leith basestation and predicted area of interference due to the proposed wind turbines.

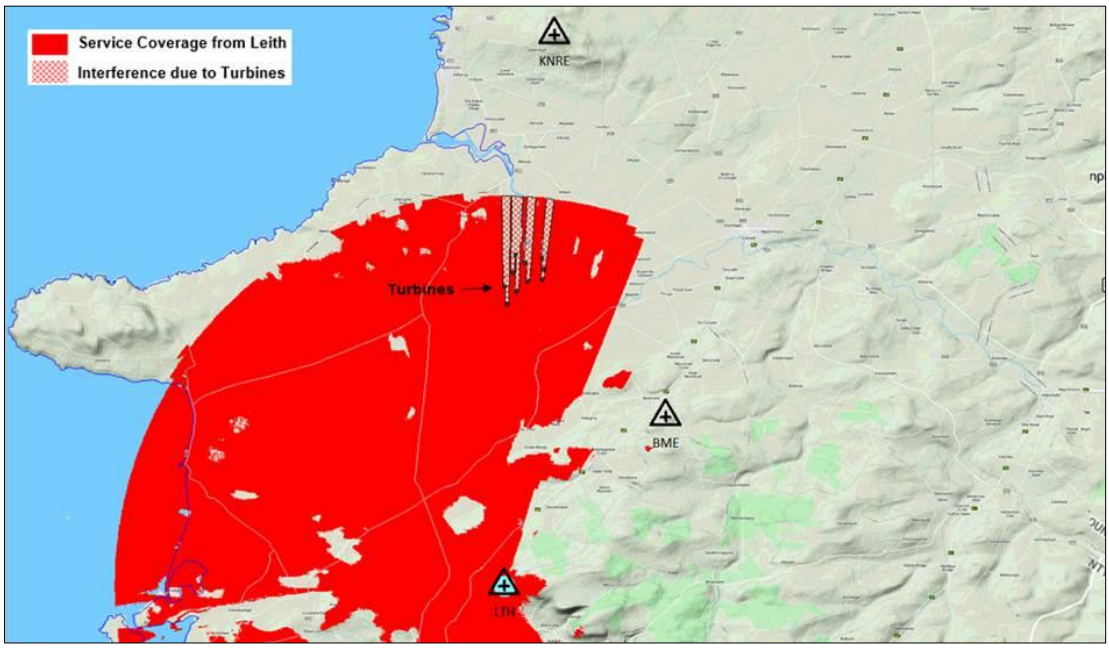

Figure 6. Wireless Internet Service Coverage Prediction (including wind turbine blockage impacts) - Leith Basestation

It should be noted that residences in the area of interference to the north of the wind farm are unlikely to be impacted as the coverage prediction plot shown in Figure 7 indicates that Ivertec customers in this area should be obtaining a service from the Knockanore basestation.

In the unlikely event of complaints during the operational phase of the proposed wind farm these would have to be screened as valid Ivertec billing customers

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Section 5 - Conclusions

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5. Conclusions

From the findings of this report, it can be concluded that there will be no interference impacts from the proposed Ballynagare Wind Farm development on Ivertec's License-Exempt telecommunication network and that no mitigation measures are required.

A series of consultations were carried out with Ivertec who operate internet services from telecommunication mast sites at Knockanore, Banemore and Leith. It was confirmed that no mitigation measures were required without the requirements for a detailed EMI Impact Assessment Analysis.

A detailed technical analysis was carried out to include interference service predictions for the Ivertec wireless internet service that operates from the Knockanore, Banemore and Leith Telecommunications Mast Sites.

Based on the findings it can be concluded that there will be no impacts on the Ivertec wireless internet service network. Any potential complaints in the operational phase would have to be screened and validated as Ivertec billing customers.

A series of mitigation measures were presented to Ivertec however following a review of the EMI Impact Analysis carried out by Ai Bridges, the recommended mitigation solution would be to re-align subscriber antenna to an alternative Ivertec transmitter site.

It has also been proposed that a relay basestation could be deployed at a suitable location in the vicinity of the proposed wind farm (e.g. Ballyheigue, North Kerry) that would provide additional contingency wireless service coverage from Ivertec to service subscribers within the vicinity of the windfarm.

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Appendix A – Ballynagare Wind Farm Turbine Co-ordinates

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A.1 Ballynagare Wind Farm Turbine Co-ordinates

The turbine co-ordinates for the Ballynagare wind farm studied in this report are listed below in Table A-1.

Turbine_ID	X_ITM	Y_ITM
T01	489112.4005	633297.6851
T02	489512.6918	632946.9757
T03	490219.7187	633120.0796
T04	488970.9004	632542.5902
T05	490269.4657	632663.8517
T06	488625.6129	631954.4156
T07	489597.5548	632148.4197
T08	490223.3408	632222.9719
T09	489119.2683	631757.5397
T10	488705.6813	631207.8471

Table A-1 Ballynagare Wind Farm Turbine Co-ordinates

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