Plate 13-3: Interior of Cashel, National Monument 277 at Castleore.

Plate 13-4: View in the direction of the proposed windfarm (south-east) from highest point within the monument.

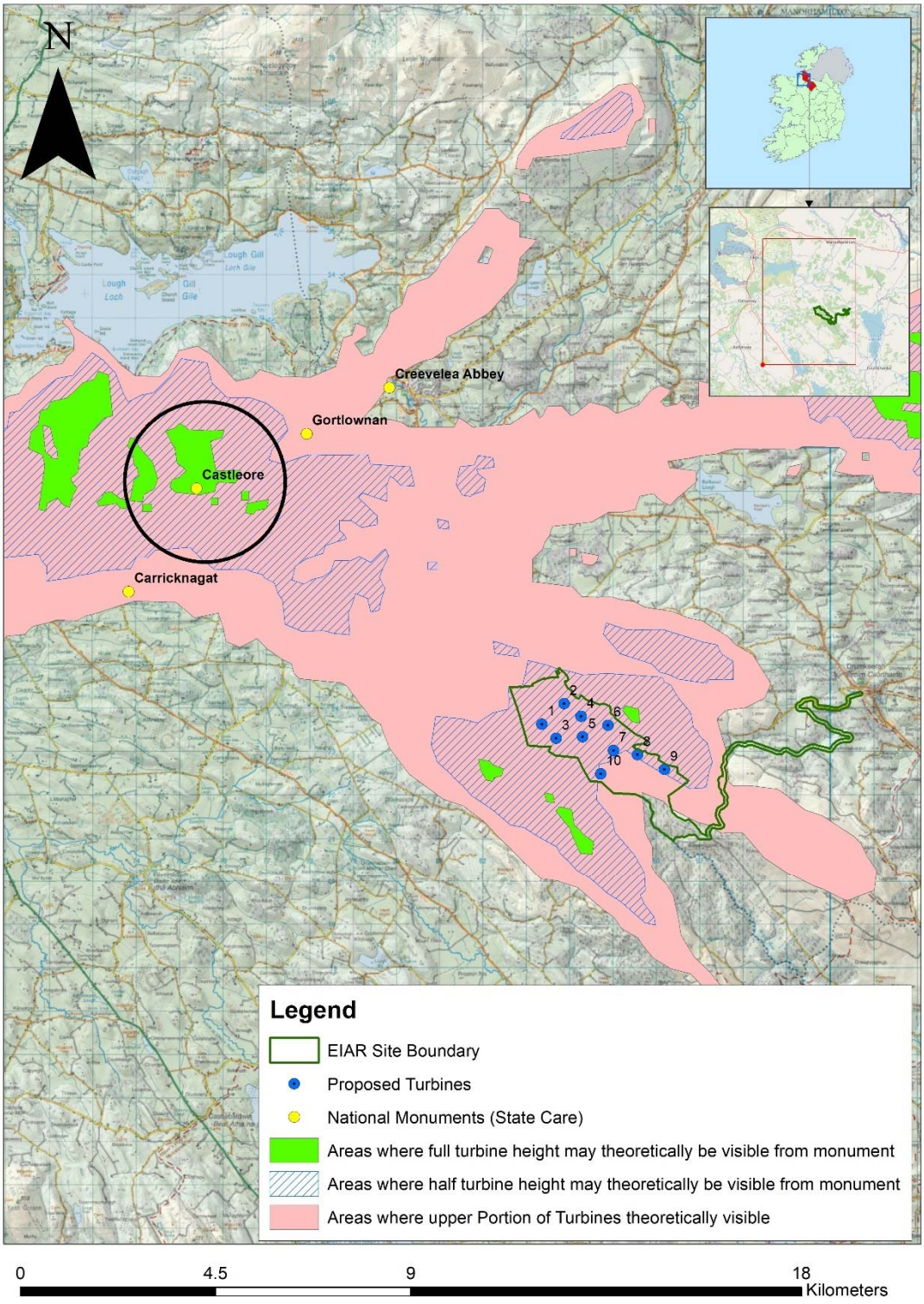

Figure 13-5: Viewshed Analysis showing theoretical visibility from Castleore Cashel

NM 277 Carricknagat Megalithic Tombs SL021-062, SL021-104

SL021-062 is described in the Archaeological Inventory of County Sligo as follows: On a rocky rise, in rush-grown pasture. An orthostat (L 1.3m; T 0.3m; H 1.3m if upright) aligned SW-NE and leaning to the S is the only set stone here. In addition, four large slabs lie at the site. One (max. dim. 2.7m) adjoins the NE end of the orthostat and beyond this is another slab of similar size. Immediately S of the orthostat there is a large slab (max. dim. 2m) and alongside this to the SW there is another. There are also seven smaller prostrate stones at the site. The stones seem to represent the remains of a megalithic tomb or perhaps an abandoned attempt to build one (Ó Nualláin 1989, 53, no. 83). The presence of two large slabs one resting above the other some 15m to the S is cited as support for the view that construction of the monument may not have been completed. A court tomb (SL021-104—) lies c. 50m to ENE. This is a national monument in State care (no. 277).

SL021-104 is described as follows: On a poorly drained low-lying patch of ground about 50m ENE of an unclassified megalithic tomb (SL021-062). The inner end of a SSE-facing gallery (L 4m; max. Wth 2.6m) is divided by segmenting jambs inset in the gallery walls into a well-preserved rear chamber (L c. 2m) and an outer chamber now represented by two opposed sidestones. The status of an upright stone between these two sidestones and crossing the gallery is unclear. Some 2m to the W of the gallery there is a lone kerbstone and 2-3m E of the gallery there are three others. The alignment of these kerbstones suggest that the structure stood in a cairn of trapezoidal plan. There is some cairn fill in the gallery and between it and the kerbstones. There are a number of displaced stones at the site including a group of four large examples just S of the surviving gallery structure. (Ó Nualláin 1989, 53-4, no. 84).

Viewshed analysis from this monument suggests that theoretically one to three turbines (T1, T4 and T5) may be visible in full and that the remainder may be visible from mid-shaft upwards (50%) (Figure 13-6)). This theoretical visibility does not assume the presence of natural screening, vegetation or forestry and is based on a bare landscape and therefore a worse-case scenario. The Zone of Theoretical Visibility suggests that 9-10 turbines may be visible from this location, not assuming vegetation / tree cover.

No public access to the megalithic tombs could be located. A site visit to the nearest point on the public road suggests that any potential views may be obscured by vegetation. The distance, together with the natural intervening vegetation suggests that the impacts on the setting of the National Monument will be ‘not significant’.

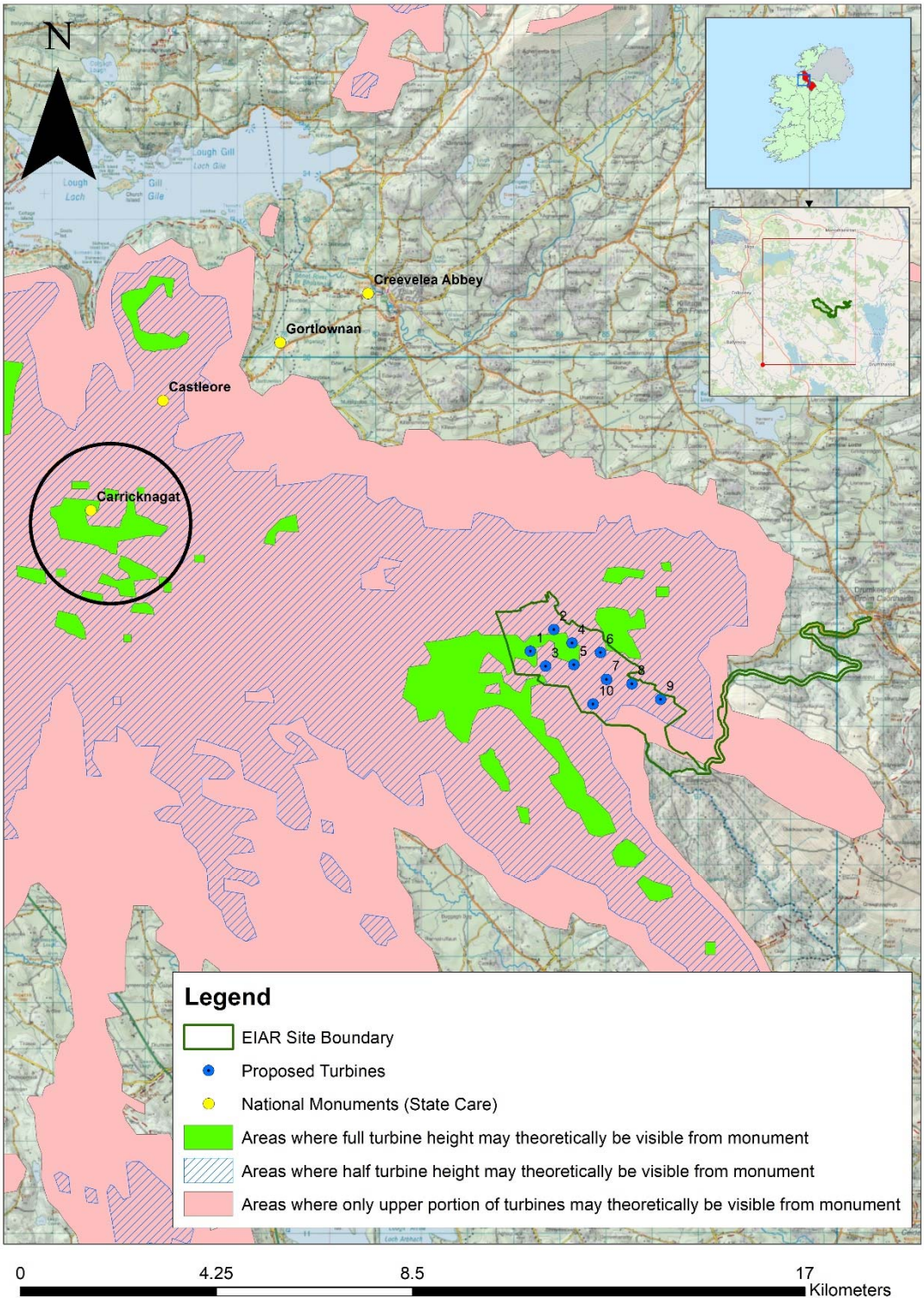

Figure 13-6: Viewshed Analysis showing theoretical visibility from Carrignagat Megalithic tombs

NM 152 Heapstown Cairn SL034-128

In level pasture, 750m N of Lough Arrow. This is a massive round cairn (diam. 62m N-S, 60m E-W; H c. 6m) retained by a kerb of substantial kerbstones. Twenty-three are exposed from S around to NW and seven more are visible from N around to SE. Considerable quarrying has taken place along the perimeter of the site. (Ó Nualláin 1989, 94). A possible rath (SL034-128—) lies c. 90m to NE. This is a national monument (No. 152) in state care.

Viewshed analysis from this National Monument shows no visibility in the direction of the proposed turbines. Views from the adjacent public road shows that this large mound of stones is located to the rear of a small farmhouse and is surrounded by trees on all sides. Intervening topography is such that no visibility of the location of the proposed windfarm is possible from this location. The ZTV also suggests that no turbines would be visible from this location. In this regard the impacts on setting will not occur, therefore.

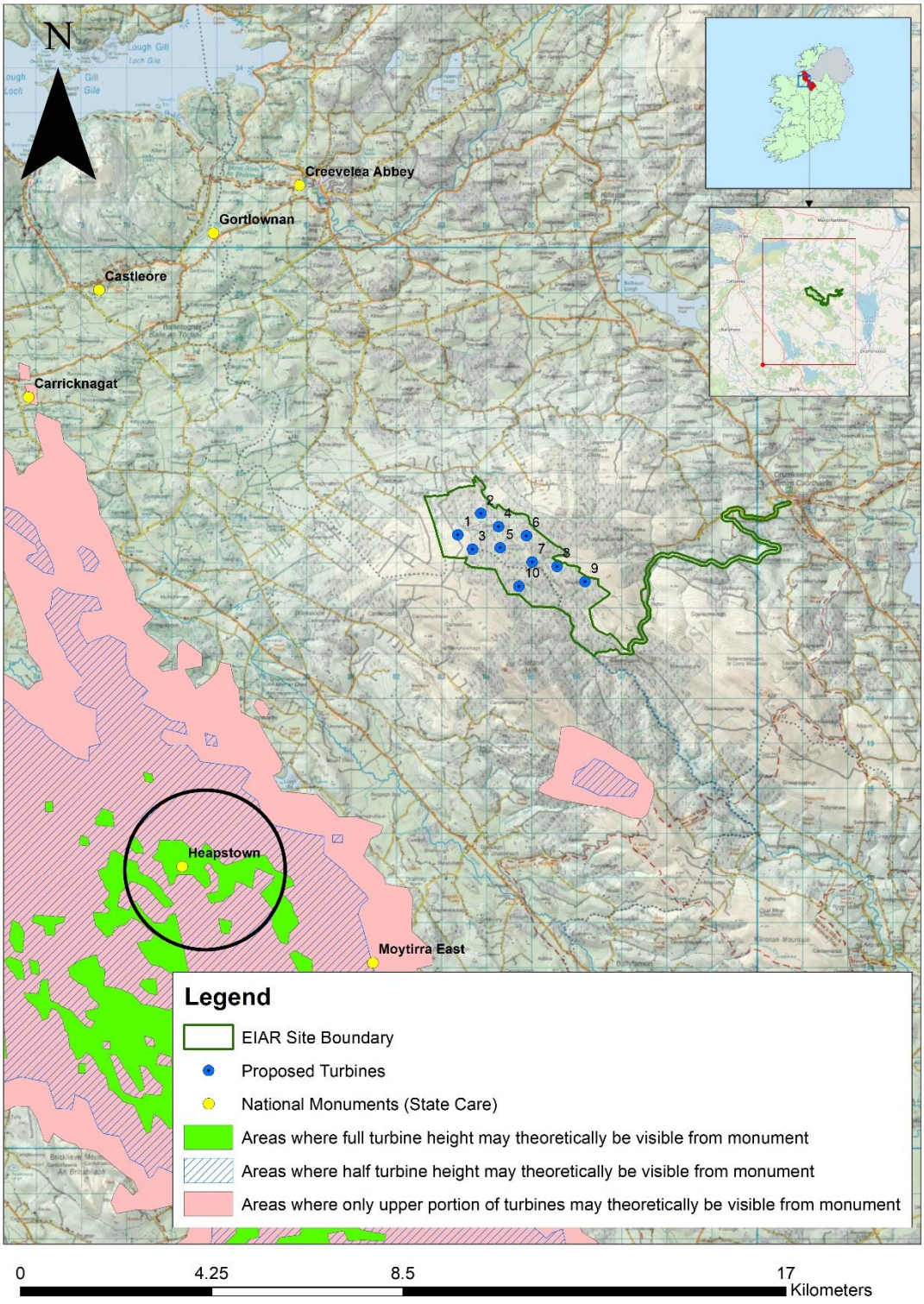

Figure 13-7 Viewshed Analysis showing theoretical visibility from Heapstown Cairn

NM 465 Moytirra Court Tomb SL035-079

On rocky pasture commanding an extensive outlook to the S. A U-shaped open court (L c. 7m) at the NNE leads to a well-preserved gallery (L 13m; Wth 1.5-2.9m) of four chambers. There are some poorly defined traces of mound around the structure. The two entrance jambs of the gallery function as courtstones and, in addition, one orthostat of the more westerly arm of the court survives and two remain on the other side. At the outer end of this side of the court there is a low moss-covered courtstone and just beyond and at right angles to it another low stone, apparently part of the tomb facade. A stone, split in two, and set more or less along the main axis of the structure stands in the gallery entrance and divides it in two. Another stone at right angles to the last closes the eastern half of the entrance gap. The divisions between the first three chambers are marked by single jambs, in each case at the W. The third and fourth chambers are separated by a sillstone. The chamber sidestones and the backstone of the gallery survive intact. There are three blocks of stone of uncertain origin between 1m and 9m beyond the back of the gallery. A stone wall extends NE-SW across the W arm of the court. A large limestone block on top of a smaller stone lies c. 30m to SW and is known locally as the 'Rocking stone'. An unclassified megalithic tomb (SL035-078—) lies c. 200m to W. (Ó Nualláin 1989, 68-9, no. 110). This is a national monument in State care (no. 465).

Viewshed analysis from this monument shows that theoretically only the upper portions of one to four turbines (T1, T3, T5 and T10) may be visible. There may be no visibility of the remainder of the turbines (Figure 13-6). This theoretical visibility does not assume the presence of natural screening, vegetation or forestry and is based on a bare landscape and therefore a worse-case scenario. The Zone of Theoretical Visibility suggests that 1-3 turbines may be visible, a similar conclusion drawn by the Viewshed model.

A site visit to the nearest publicly accessible point to the court tomb on the adjacent road shows that views in the direction of the wind farm are possible towards the north-east and therefore some visibility of turbines may occur. The distance, together with the intervening natural vegetation and topography suggests that the impacts on the setting of the National Monument will be ‘not significant’.

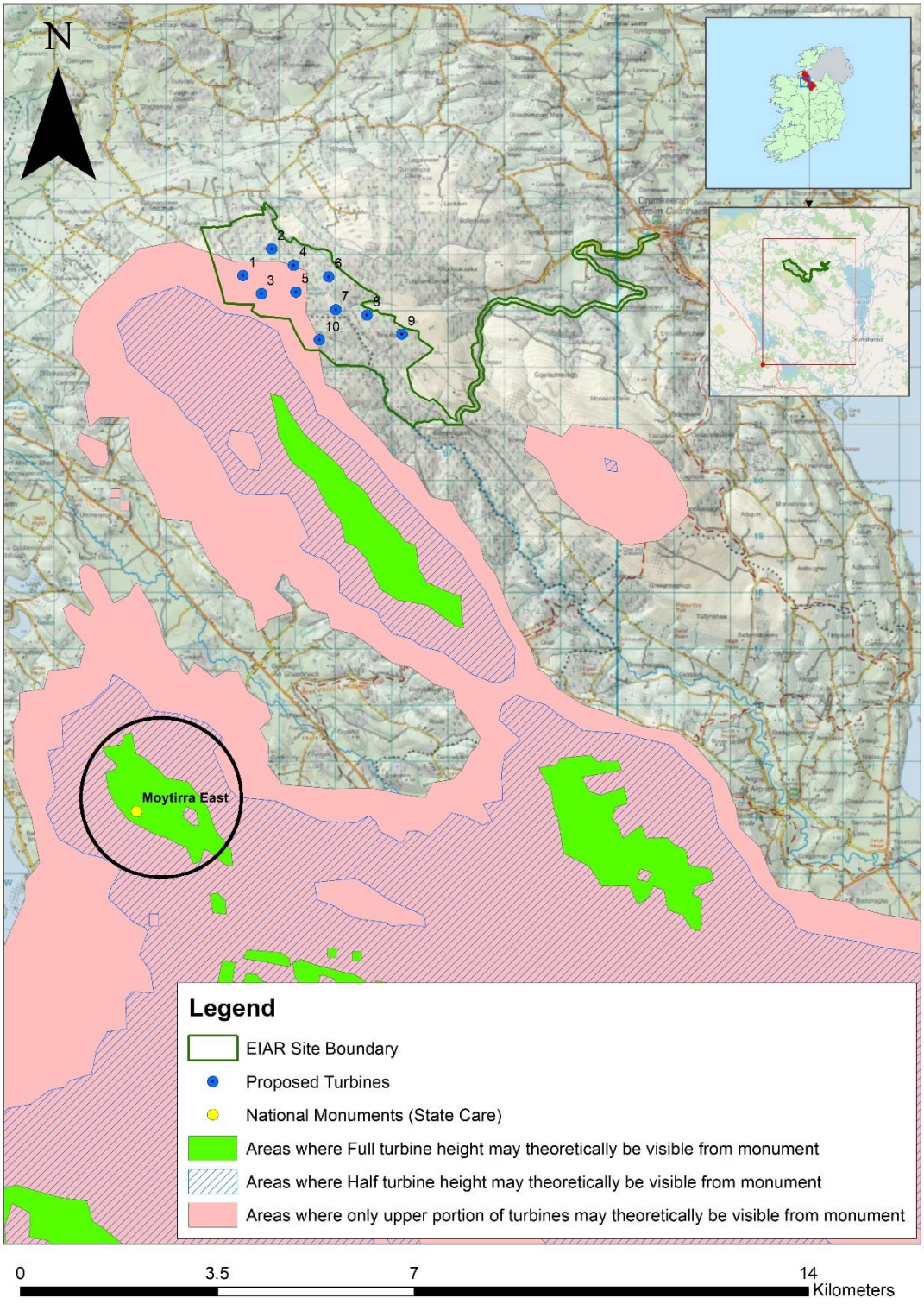

Figure 13-8 Viewshed Analysis showing theoretical visibility from Moytirra Court Tomb

13.3.1.2 Recorded Monuments within the site boundary

No monuments subject to statutory protection as defined in the Record of Monuments and Places or Sites and Monument Record are located within the EIAR site boundary for the proposed wind farm. Furthermore none are located adjacent to the EIAR site boundary (Figure 13-9).

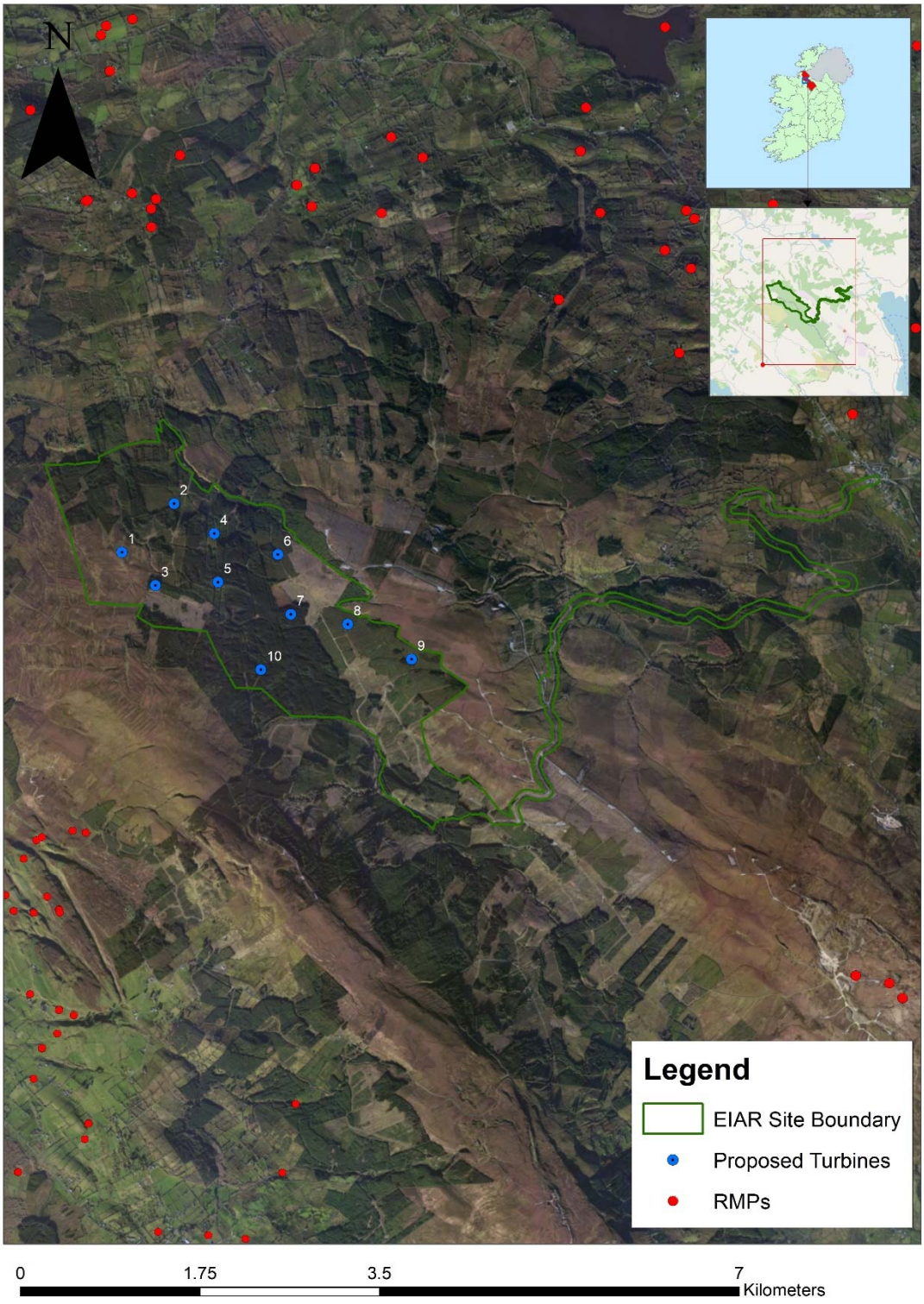

Figure 13-9 Note no RMPs within the EIAR site boundary or immediately adjacent to same.

13.3.1.3 Recorded Monuments within 5km of the proposed Turbines

Ninety-five monuments are located within 5km of the nearest proposed turbine and these are detailed below in

Table 13-3. Monuments within 5km of the nearest proposed turbines are included here for purposes of assessing impact on setting in the wider landscape setting, outside the EIAR site boundary (See Section 13.2.5 for methodology). The monuments are labelled from 1-95 for ease of reference on Figure 13-10. Monuments within 5 kilometres of the proposed turbines are included here for purposes of assessing potential visual impacts in the wider landscape setting. No monuments are located within 1km of the nearest proposed turbines. Only one monument (1%) is located between 1 and 2km of the nearest proposed turbine. Eleven monuments (12%) are located between 2 and 3km with 38 monuments located between 3 and 4km representing 40%. The majority of monuments are located between 4 and 5km representing 47% of the total. The immediate setting of the recorded monuments will not therefore be negatively impacted. Figure 13-10 demonstrates that the majority of the recorded monuments are located at a remove from the proposed turbines with a notable dearth of monuments within close proximity to the site.

Table 13-3: RMPs within 5km of the nearest proposed turbines

Map ID	RMP NO.	DESCRIPTION	Td.	ITM E	ITM N	WTG ID	DISTANCE (M)
1	SL035-027	Sweathouse	Ballynashee	584886	817585	10	4912
2	LE015-137	Enclosure	Beagh	583604	826983	2	2880
3	LE017-003	Redundant record	Beagh	583607	826806	2	2703
4	LE015-169	Sweathouse	Beagh	583650	827080	2	2974
5	LE015-134	Ringfort - rath	Caddagh Glebe	582429	827947	2	4083
6	LE015-131	Ringfort - rath	Carrigeen	580935	827354	2	4347
7	SL035-022002	Souterrain	Carrowcashel	583000	818067	10	4733
8	SL035-022001	Ringfort - rath	Carrowcashel	582994	818062	10	4740
9	SL035-023	Ringfort - rath	Carrowcashel	582961	817912	10	4892
10	SL028-006	Ringfort - rath	Carrowmore	582489	820829	3	2742
11	SL028-016001	Moated site	Carrowmore	581526	820011	3	3926
12	SL028-016002	Hut site	Carrowmore	581526	820011	3	3926
13	SL028-017	Ringfort - cashel	Carrowmore	581928	820188	3	3568

Map ID	RMP NO.	DESCRIPTION	Td.	ITM E	ITM N	WTG ID	DISTANCE (M)
14	SL035-003	Hut site	Carrowmore	581899	819759	10	3897
15	SL028-023	Cliff-edge fort	Carrowmore	582595	820270	10	3045
16	SL028-009	Redundant record	Carrowmore	582971	820902	10	2332
17	SL028-005	Ringfort - cashel	Carrowmore	582365	820650	10	2956
18	SL028-007	Ringfort - rath	Carrowmore	582544	820859	10	2686
19	SL028-008	Redundant record	Carrowmore	582843	820921	10	2415
20	SL028-018	Redundant record	Carrowmore	582190	820284	10	3326
21	SL028-019	Megalithic tomb - court tomb	Carrowmore	582265	820133	10	3374
22	SL028-020	Redundant record	Carrowmore	582462	820113	10	3251
23	SL028-021001	Ringfort - cashel	Carrowmore	582708	820147	10	3062
24	SL028-021002	Souterrain	Carrowmore	582713	820139	10	3065
25	SL028-021003	Enclosure	Carrowmore	582716	820114	10	3082
26	SL035-002	Ringfort - cashel	Carrowmore	581866	819818	10	3880
27	SL035-004	Ringfort - rath	Carrownadargny	581908	819465	10	4103
28	SL035-005001	Ringfort - cashel	Carrownadargny	582100	819518	10	3935
29	SL035-005002	Souterrain	Carrownadargny	582090	819510	10	3948
30	SL035-006	Ringfort - rath	Carrownadargny	581902	818821	10	4602
31	SL035-007	Ringfort - rath	Carrownadargny	582430	819322	10	3886
32	SL035-008001	Ringfort - cashel	Carrownadargny	582712	819172	10	3858
33	SL035-008002	House - early medieval	Carrownadargny	582712	819167	10	3863

Map ID	RMP NO.	DESCRIPTION	Td.	ITM E	ITM N	WTG ID	DISTANCE (M)
34	SL035-009	Redundant record	Carrownadargny	582855	819117	10	3836
35	SL035-010	Ringfort - rath	Carrownadargny	582695	818939	10	4069
36	SL035-011001	Ringfort - rath	Carrownadargny	582544	818792	10	4271
37	SL035-011002	Hut site	Carrownadargny	582545	818798	10	4265
38	SL035-012	Redundant record	Carrownadargny	582462	818500	10	4566
39	SL028-011	Ringfort - rath	Carrownagilty	581134	820065	3	4108
40	SL028-001	Cairn - unclassified	Carrownagilty	582066	822036	3	2034
41	SL028-002	Ringfort - rath	Carrownagilty	581032	820847	3	3596
42	SL028-012	Castle - motte	Carrownagilty	581214	820086	3	4043
43	SL028-013	Graveyard	Carrownagilty	581203	820042	3	4085
44	SL028-014	Castle - motte and bailey	Carrownagilty	581231	820056	3	4057
45	SL028-022002	Hut site	Carrownyclowan	581473	820303	3	3714
46	SL028-022001	Ringfort - cashel	Carrownyclowan	581472	820293	3	3723
47	SL028-010001	Ringfort - cashel	Carrownyclowan	581392	820357	3	3719
48	SL028-003	Redundant record	Carrownyclowan	582129	821314	3	2511
49	SL028-010002	Souterrain	Carrownyclowan	581394	820369	3	3709
50	SL028-004	Ringfort - rath	Carrownyclowan	582069	820737	3	3022
51	SL028-015	Ritual site - holy well	Carrownyclowan	581422	820096	3	3913
52	LE015-145	Ringfort - rath	Cloonagh	587786	827545	6	4910
53	LE015-138	Ringfort - rath	Cloonbannive	583887	827507	2	3395

Map ID	RMP NO.	DESCRIPTION	Td.	ITM E	ITM N	WTG ID	DISTANCE (M)
54	LE015-132	Ringfort - rath	Corglancey	581805	827623	2	4054
55	LE015-133	Ringfort - rath	Corglancey	581907	827466	2	3867
56	LE017-001	Ringfort - rath	Corglancey	581442	826597	2	3447
57	LE017-008	Ritual site - holy well	Corralustia	589526	825393	9	4389
58	LE017-012	Burnt mound	Corralustia	588748	825580	9	3961
59	LE015-139	Ringfort - unclassified	Corratimore Glebe	585023	827216	2	3325
60	LE015-140	Ringfort - rath	Corratimore Glebe	585200	827380	2	3543
61	LE015-141	Redundant record	Corratimore Glebe	585170	827009	2	3191
62	LE015-143	Ringfort - rath	Corratimore Glebe	585850	826943	6	3477
63	LE017-009	Burial ground	Derrinurn	589722	825375	9	4531
64	LE017-011	Ringfort - rath	Derrinweer	590437	824981	9	4912
65	LE015-130	Ringfort - rath	Dromore	581052	828194	2	4938
66	LE015-122	Ringfort - rath	Drumany (Drumahaire By.)	583203	828327	2	4262
67	SL027-160001	Ringfort - rath	Drummacool	580362	820145	3	4565
68	SL027-160002	Souterrain	Drummacool	580368	820131	3	4571
69	SL027-128	Sweathouse	Drumnasoohy	579972	821294	1	4089
70	SL027-157001	Sweathouse	Drumnasoohy	579158	821129	1	4862
71	SL027-157002	Well	Drumnasoohy	579233	821141	1	4792
72	SL027-158	Redundant record	Drumnasoohy	579265	820929	1	4879
73	LE015-120	Ringfort - rath	Flughanagh	583168	828767	2	4702

Map ID	RMP NO.	DESCRIPTION	Td.	ITM E	ITM N	WTG ID	DISTANCE (M)
74	LE015-121	Ringfort - rath	Flughanagh	583116	828677	2	4621
75	LE015-123	Ringfort - rath	Flughanagh	583422	828834	2	4740
76	LE015-136	Redundant record	Garvagh Glebe	583418	827134	2	3050
77	LE015-146	Ringfort - unclassified	Glasdrumman More	587979	826945	6	4575
78	LE017-005	Designed landscape - tree-ring	Glasdrumman More	588607	826581	9	4686
79	LE017-007	Designed landscape - tree-ring	Glasdrumman More	588864	826403	9	4680
80	SL027-115	Enclosure	Glen	579112	821722	1	4626
81	LE014A002	Ringfort - rath	Greaghnafarna	579391	825832	1	4501
82	LE014A003	Ringfort - rath	Greaghnafarna	579561	825824	1	4350
83	LE015-115	Ringfort - rath	Killeen	581988	828684	2	4929
84	LE017-004001	Ringfort - rath	Lugmeeltan	587575	826096	6	3691
85	LE017-004002	House - indeterminate date	Lugmeeltan	587575	826101	6	3695
86	LE014A001	Ringfort - rath	Rathbaun, Sracummer	580292	826810	1	4386
87	SL027-100	Enclosure	Rooghan	578673	822462	1	4796
88	SL035-123	Sweathouse	Straduff	585015	818253	10	4254
89	LE015-142	Ringfort - rath	Sweetwood Upper	585942	827683	2	4148
90	LE015-170	Sweathouse	Treannadullagh	586252	827484	6	4117
91	LE015-135001	Ringfort - rath	Tullycoly	582969	827060	2	3071

Map ID	RMP NO.	DESCRIPTION	Td.	ITM E	ITM N	WTG ID	DISTANCE (M)
92	LE015-135002	Bullaun stone	Tullycoly	582986	827066	2	3072
93	LE017-002	Earthwork	Tullynascreen	581905	825583	1	2406
94	LE017-013	Mass-rock	Tullynascreen	582088	824819	1	1707
95	SL034-063	Ringfort - rath	Ummeryroe	580337	819663	3	4929

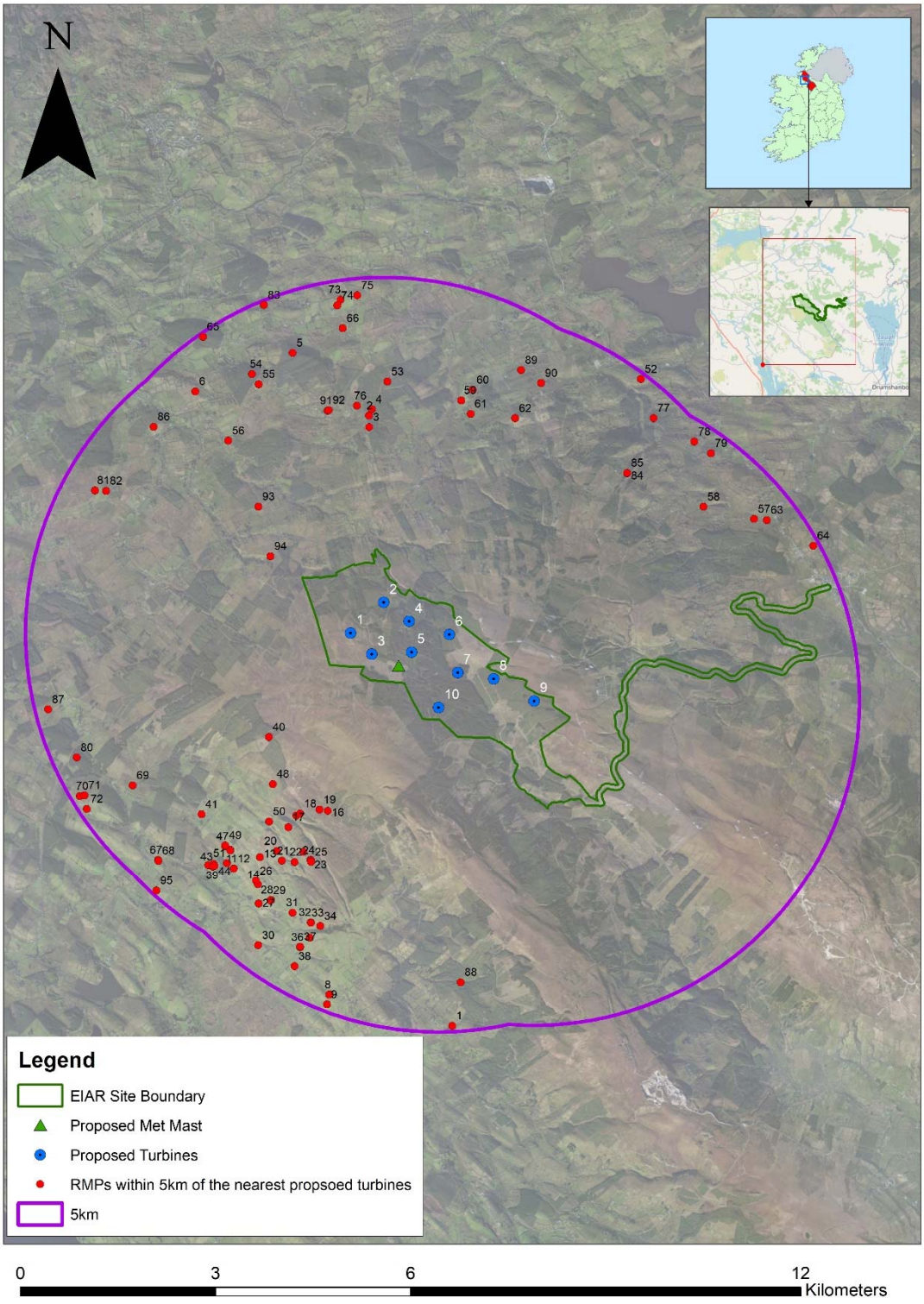

Figure 13-10 RMPs within 5km of the nearest proposed turbine.

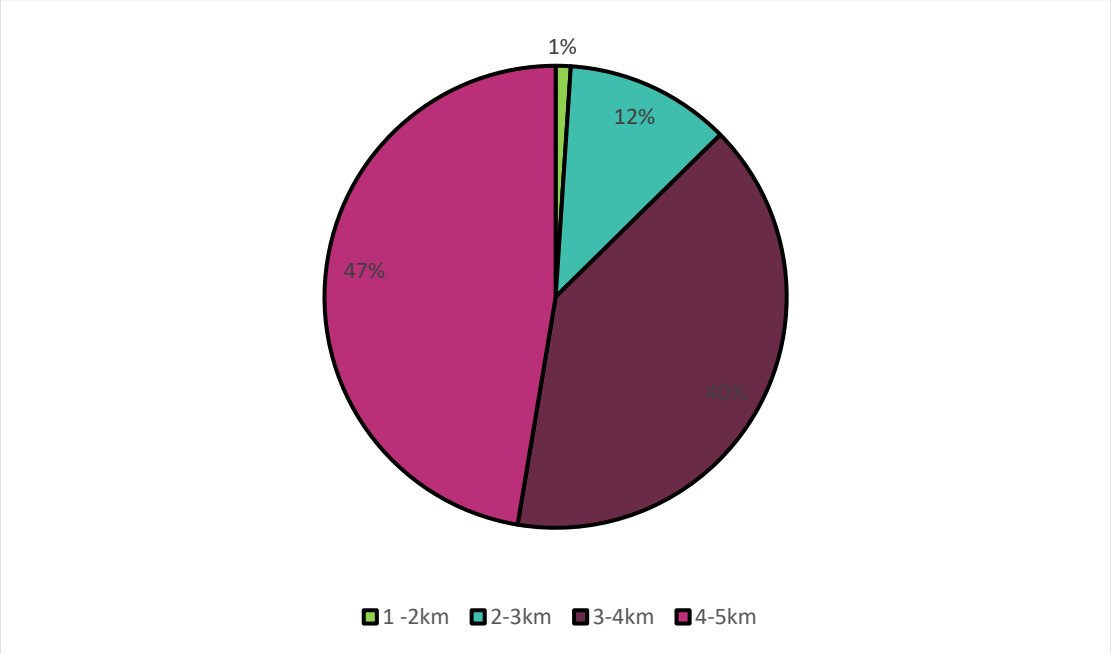

Figure 13-11: Percentages of monuments within 5km of the nearest proposed turbines

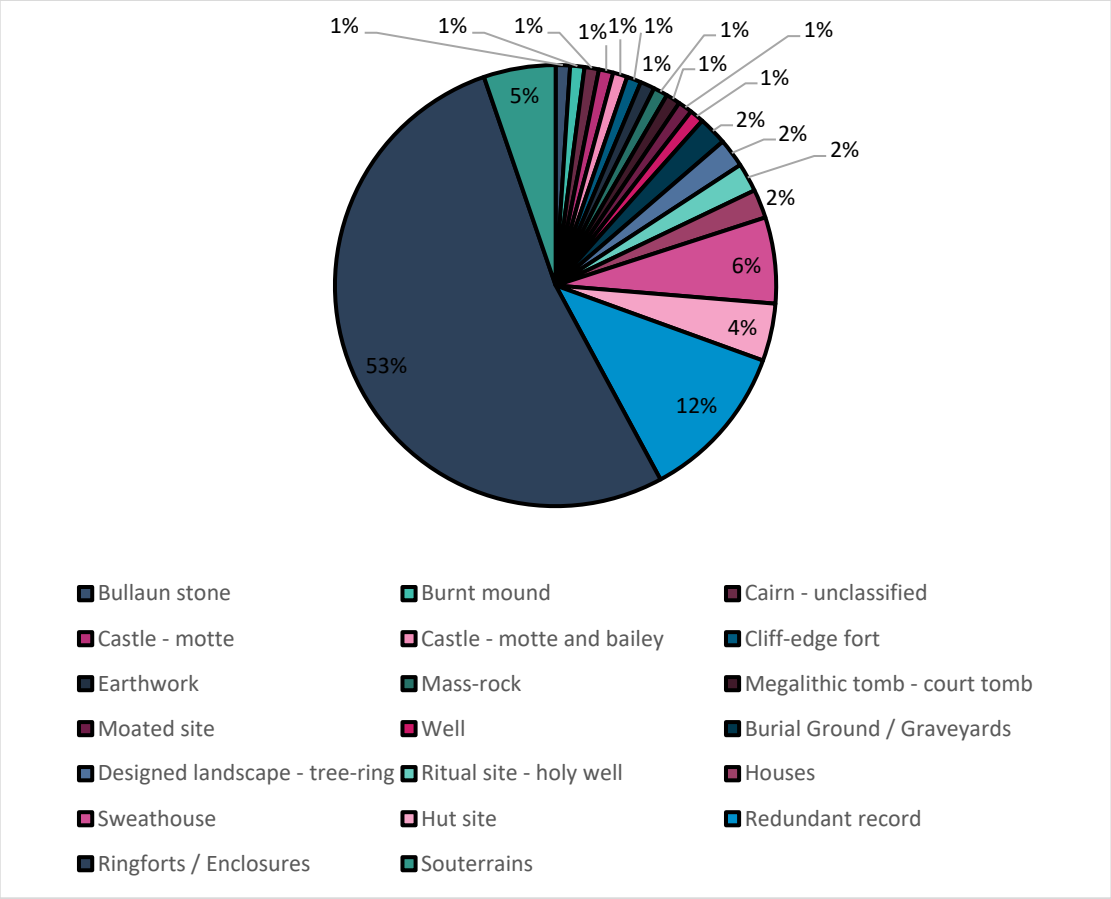

Figure 13-12: Percentages of monuments types within 5km of the nearest proposed turbines

13.3.1.3.1 The Prehistoric Period

The prehistoric period is poorly represented in the 5km study area with only one monument that can definitively be attributed to this period. Megalithic tombs are burial chambers, sometimes with an antechamber or small closed end-chamber. They are roofed by slabs laid directly on the side-walls which often have one or more rows of outer- walling. Unclassified examples of megalithic tombs cannot be classified as a court tomb, portal tomb, passage tomb or wedge tomb. These may date from the Neolithic to the Bronze Age (c. 4000 - c. 500 BC).

The megalithic tomb at Carrowmore is described as being located on a tract of level pasture on the lower W-facing slopes of a hill-range along the boundary between counties Sligo and Leitrim. The tomb is in an oval mound (21m E-W; max. 13.5m N-S; H 0.75m.). A fence runs into the N side of the mound from E and W. The remains of a gallery are preceded at the E by the S arm of an open court (L 6m), represented by four stones, which joins two stones of a flat facade. A single courtstone flanking the gallery entrance survives on the opposite side. Two jambs form the entrance to the gallery. A stone jammed between them is not in situ. The N side of the gallery is represented by an irregular line of stones extending for 5.5m to the W. Three stones at the opposite side of the gallery show that it extended at least 1m further in the same direction. (Ó Nualláin 1989, 59, no. 94).

A number of other monuments may date to the prehistoric period but their dates can span from prehistory through to the Medieval period (

Table 13-3, Figure 13-10 and Figure 13-12). One such site type is Hut sites 4% of which are located within 5km of the turbines. The primary function and date of hut sites is slightly ambiguous. Examples of hut sites are known throughout the country, particularly in upland regions, and are frequently associated with the practice of transhumance or booleying. Transhumance refers to the practice of the seasonal movement of people and their livestock typically to higher pastures in the summer and lower valleys in the winter. In Ireland this practice is known as booleying and is believed to date to the early medieval period, although it continued well into the nineteenth and early twentieth century.

Other uses for hillside huts has been noted at Mount Brandon, County Kerry, where it is suggested that they functioned as temporary habitations for seabourne pilgrims. It is also thought that they were used as habitation sites such as booleying huts during the year when pilgrimage was not taking place. An extensive series of pre-bog walls was also noted on the southern slopes of Mount Brandon. It is noted in that instance that although pre-dating the bog, the peat may still have been growing well into the medieval period. In this regard such walls could be early medieval in date rather than prehistoric (Archaeology Ireland Heritage Guide No. 29). Furthermore, the potentially lengthy chronology of hut sites means that while some may be prehistoric others may date to the early or later medieval period or indeed to more modern times (ibid.).

The site of an earthwork LE017-002 is located at Tullnascreen and is described as being located on a grass and rush-covered plateau, which is at the bottom of a N-facing slope. It is depicted faintly as a small circular area (diam. c. 20m) only on the 1835 edition of the OS 6-inch map. No feature is visible at ground level, and it is possible that a pond was intended. Earthworks are an anomalous earthen structure, usually raised and occurring in a variety of shapes and sizes, that on field inspection was found to possess no diagnostic features which would allow classification within another monument category. These may date to any period from prehistory onwards.

A burnt mound at Corralustia townland is situated in the S bank of a small WSW-ENE stream or drain on a gentle N-facing slope. An area of burnt stone in a black soil matrix (L 5m; T 1m) lies exposed along the bank of the stream. Again, this monument type may span from the Bronze Age (c. 2400-500 BC) to the early medieval period (5th - 12th century AD. They consist of a circular or irregularly shaped mound of material consisting of burnt stones, ash and charcoal with no surface evidence of a trough or depression. Levelled examples can appear as a spread containing burnt stones.

13.3.1.3.2 The Early Medieval Period

The majority of monuments (55%) consist of those which may be definitively attributed to the Early Medieval period and ringforts, enclosures and souterrains dominate the archaeological landscape within the 5km study area. Ringforts comprise earthen monuments while cashels take a similar form to the latter but are constructed using stone. Enclosures may represent the remains of ringforts or cashels but may not retain enough features to classify them as such or fall outside the acceptable size range for these monuments. Ringforts consist of a circular or roughly circular area enclosed by an earthen bank formed by material thrown up from the digging of a concentric ditch on its outside. Ringforts are usually enclosed by a single bank (univallate) while bivallate or trivallate ringforts i.e. those enclosed by double or triple rings of banks are less common. The number of banks and ditches enclosing these monuments are considered to reflect the status of the site, rather than the strengthening of its defences. Archaeological excavation has shown that the majority of ringforts functioned as enclosed farmsteads, built during the Early Christian period (5th – 9th century A.D.). Excavation within the interior of the monuments has traced the remains of circular and rectangular dwelling houses as well as smaller huts probably used to stall animals. The enclosing earthworks would also have protected domestic livestock from natural predators such as wolves and foxes. Souterrains are frequently associated with ringforts, cashels and enclosures. Souterrains derive their name from the French sous terrain meaning 'under ground' and comprise an underground structure consisting of one or more chambers connected by narrow passages or creepways, usually constructed of drystone-walling with a lintelled roof over the passages and a corbelled roof over the chambers. Most souterrains appear to have been built in the early medieval period by ringfort inhabitants (c. 500 - 1000 AD) as a defensive feature and/or for storage.

Within the study area a number of enclosures are located at Tullynascreen, Beagh, Carrowmore, Glen and Rooghan townlands. Ringforts are located in numerous townlands including Carrowmore, Carrownyclowan, Carrownadargny, Tullycoly, Cloonbannive, Corratimore Glebe, Carrownagilty, Lugmeeltan, Corglancey, Caddagh Glebe, Sweetwood Upper, Drumany, Carrigeen, Greaghnafarna, Rathbaun/ Sracummer, Greaghnafarna, Drummacool, Flughanagh, Carrowcashel, Cloonagh, Derrinweer, Ummeryroe, Killeen, Dromore, Killanummery, Glasdrumman More and Corralustia thus representing a wide geographic area for settlement.

13.3.1.3.3 Sites with religious or ritual association

A holy well (SL028-015) is located at Carrownyclowan and is located in pasture, at the base of a ridge. A clear spring rises at the base of the ridge and flows S. Modern holy plaques and statues indicate that this well is still visited. A recently built stone wall encloses it. In 1836 it was noted that the Patron day was 25th July and that 'stations' were still performed at it (OSL, 245). In 1942-4 a local tradition was recorded that the well was moved by a local friar from a site beside Geevagh Creamery, c. 3.5km to SE, to its present location after the landowner objected to pilgrims visiting it (ITA). A tree now grows adjacent to the well. These sites comprise a well or spring, though in some unusual cases a natural rock basin, which usually bears a saint's name and is often reputed to possess miraculous healing properties. Holy wells may have their origins in prehistory but are associated with devotions from the medieval period (5th-16th centuries AD) onwards.

A second Holy Well LE017-008 is located at Corralustia and is situated in the valley of a small W-E stream on the N bank and probably at a point E of where a small NW-SE stream joins it. Tober Beoaid is listed amongst the holy places of north Leitrim in a seventeenth century manuscript (Mooney 1946, 67), and it was still frequented in the nineteenth century (O' Flanagan 1929, 134). It was associated with St Beoaidh of Ardcarn, Co. Roscommon (RO006-103002-) (Ó Riain 2011, 103). The well might still be extant, although it was not recognised in 1991.

A bullaun stone (LE015-135002) is located at Tullycoly and is situated on top of a drumlin. A D-shaped stone (dims 0.75m x 0.65m; H 0.15m plus) with a single basin (diam. 0.35m; D 0.12m) is set in the ground c. 4m E of the perimeter of rath (LE015-135001-). The lip of the basin is damaged at one edge. Bullaun stones may also have religious associations. The term 'bullaun' (from the Irish word 'bullán',

which means a round hollow in a stone, or a bowl) is applied to boulders of stone or bedrock with hemispherical hollows or basin-like depressions, which may have functioned as mortars. They are frequently associated with ecclesiastical sites and holy wells and so may have been used for religious purposes. Other examples which do not appear to have ecclesiastical associations can be found in bedrock or outcrop in upland contexts, often under blanket bog, and are known as bedrock mortars. They date from the prehistoric period to the early medieval period (5th-12th centuries AD).

13.3.1.3.4 *Miscellaneous Monuments*

A number of other site types within various periods are also represented and seem to occur in isolation with only one of each monument type represented (Figure 13-12). Eleven of these are now redundant records.

13.3.1.4 Archaeological Investigations undertaken within or adjacent to the proposed EIAR site boundary

Each townland within the proposed development site and adjacent to same was checked in the database of Irish excavations to ascertain if any archaeological investigations produced positive results. Two townlands produced results although no archaeological features were uncovered during monitoring. The following are extracts from the database of excavations.

2008:756 - Garvagh Glebe and Tullynahaw, Leitrim

County: Leitrim Site name: Garvagh Glebe and Tullynahaw
Sites and Monuments Record No.: N/A
Licence number: 08E0770
Site type: No archaeological significance
ITM: E 592203m, N 817549m

'Monitoring was undertaken from August to December 2008 at a development which involves the construction of two wind farms in counties Roscommon and Leitrim. The County Leitrim site, known as Garvagh Glebe, is split into a northern and southern section. The proposals include the construction of seven turbines in the northern section and six in the southern section. Eleven turbines are to be constructed at the Tullynahaw site in Co. Roscommon (see No. 1047 below). Both sites also require the construction of access roads and substations. The wind farm sites are located along a ridge which straddles County Leitrim to the north and County Roscommon to the south and which forms Corrie Mountain.
Monitoring was undertaken during the excavation of the 6m-wide access roads, the 40m by 20m hardstanding areas at the ends of the roads, and the area corresponding to a proposed electrical control building. No archaeological deposits have been encountered at Garvagh Glebe. Groundworks are expected to recommence in 2009 and the associated excavations will be monitored'.

2010:437 - Garvagh Glebe (Leitrim) and Tullnahaw (Roscommon), Leitrim

County: Leitrim Site name: Garvagh Glebe (Leitrim) and Tullnahaw (Roscommon)
Sites and Monuments Record No.: N/A Licence number: 08E0770
Site type: No archaeological significance
ITM: E 583254m, N 824731m
Latitude, Longitude (decimal degrees): 54.171278, -8.256469

'Monitoring was undertaken from August 2008 until July 2010 at a development which involves the construction of two wind farms in County Roscommon and County Leitrim. The County Leitrim site, known as Garvagh Glebe, was split into a northern and southern section. The proposals included the construction of seven turbines in the northern section and six in the southern section. Eleven turbines are to be constructed at the Tullynahaw site in County Roscommon. Both sites also required the construction of access roads and substations. The wind farm sites are located along a ridge which

straddles County Leitrim to the north and County Roscommon to the south and which forms Corrie Mountain. Monitoring was undertaken during the excavations but no archaeological deposits were encountered at either Tullynahaw or Garvagh Glebe and the groundworks have now been completed'.

13.3.1.5 Townlands and administrative boundaries

Townlands and administrative boundaries may indicate the presence of archaeological features within a development site. Administrative counties are subdivisions of pre-established counties which were formed for administrative purposes in the nineteenth and twentieth centuries. Baronies are administrative units larger than civil parishes and originally established as the primary subdivision of counties by the British administration in Ireland. Irish baronies which were formed at the time of the Norman conquest were usually named either after Irish territories, or from places which had been of importance in pre-Norman times. Irish baronies came into existence at different periods. The division of Ireland into counties and baronies was a process which continued down to the reign of James I. The original baronies in Ireland were the domains of the Norman barons; in the final stage of development they were divisions of counties created merely for greater convenience of administration. The word barony is of feudal origin, and was applied to a tenure of a baron, that is, of one who held his land by military service, either directly from the king, or from a superior feudal lord who exercised royal privileges. The origin of the Irish barony (a division of land corresponding to the English hundred) is to be found in the grants of lands which were made to the barons of Leinster and the barons of Meath (Liam Price, 'Ráith Oinn', Éigse VII, lch. 186-7). Civil parishes are administrative units larger than townlands and based on medieval ecclesiastical parishes. Civil parishes, modern Catholic parishes and Church of Ireland parishes may differ in extent and in nomenclature. Counties are administrative units larger than baronies and originally established by the British administration in Ireland between the twelfth and the seventeenth centuries. Some of these were subsequently subdivided into smaller administrative county units.

Townlands are the smallest land units which were determined and established in the Irish administrative system in the first half of the nineteenth century. Many of the townlands were in existence prior to that. Townland names are a valuable source of information, not only on the topography, land ownership and land use within the landscape, but also on its history, archaeological monuments and folklore.

The following townlands are those which are located within the EIAR site boundary for the main core wind farm site.

County	Leitrim
Electoral district -	Garbhach/Garvagh
Barony	Droim Dhá Thiar (Drumahaire)
Civil parish	Cill an Iomaire (Killanummery)
Townland:	Garbhach/Garvagh meaning Rough land. Talamh garbh, rough, uneven land. Coarse soil, or land of a rocky nature.

County	Leitrim
Electoral district -	Garbhach/Garvagh
Barony	Droim Dhá Thiar (Drumahaire)
Civil parish	Cill an Iomaire (Killanummery)
Townland:	Gléib Gharbhach/Garvagh Glebe also meaning Rough land.

County	Sligo
Barony	Tír Oirill/Tirerrill
Civil parish	Seanchuach/Shancough
Townland	Ceathrúin Uí Chlúmháin/Carrownyclowan (sub unit of townland refers to St James Well). According to the Ordnance Parish Namebooks there is a holy well at the south corner of the townland called St James's Well, at which stations are performed by the Roman Catholics. This well is described in Section 13.3.1.3.3 above.

County	Sligeach/Sligo
Electoral district	Seanchuach/Shancough
Barony	Tír Oirill/Tirerrill
Civil parish	Seanchuach/Shancough
Townland	An Cheathrú Mhór/Carrowmore meaning 'great quarter'

County	Sligeach/Sligo
Barony	Tír Oirill/Tirerrill
Civil parish	Seanchuach/Shancough
Townland	Ceathrú na Dairgní/Carrownadargny meaning quarter of the oak grove. There is also a reference to 'Old Forts' in the south of the townland in the Ordnance Survey Parish Namebooks (1836) '*There are two forts and two limestone quarries at the south end of the townland*'.

Although no locational information exists as to where the ringforts are located, a number of ringforts (RMPs) are situated in the southern half of the townland and these are discussed in Section 0 above.

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Buaile Mhig Uidhir/Boleymaguire meaning cattle-fold or summer-pasture or 'Mac Guire's Dairy place'.

The word Booley may suggest the presence of hut sites used for booleying. Examples of hut sites are known throughout the country, particularly in upland regions, and are frequently associated with the practice of transhumance or booleying. None are included in the RMP in the 5km study area however.

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Bráid Pháirce/Braudphark meaning neck or gorge of the park. Field of the gorge or pass. Brágha, means the neck or throat. In place-names it is often applied to a deep glen or deep pass

13.3.1.6 Topographical Museum Files

No finds spots within or immediately adjacent to the proposed development site were noted.

13.3.1.7 Cartographic Evidence

13.3.1.7.1 *Down Survey maps*

The Down Survey is a mapped survey undertaken in the mid-17th century. Using the Civil Survey as a guide, teams of surveyors, mainly former soldiers, were sent out under Petty's direction to measure every townland to be forfeited to soldiers and adventurers. The resulting maps, made at a scale of 40 perches to one inch (the modern equivalent of 1:50,000), were the first systematic mapping of a large area on such a scale attempted anywhere. The primary purpose of these maps was to record the boundaries of each townland and to calculate their areas with great precision. The maps are also rich in other detail showing churches, roads, rivers, castles, houses and fortifications. Most towns are represented pictorially and the cartouches, the decorative titles, of each map in many cases reflect a specific characteristic of each barony.

The Down survey Map for the parish of Killanummery (Leitrim) shows the area of the proposed wind farm as mountainous and bog and depicted as Protestant lands. The section of the site in Sligo (Barony of Tirrarril) is also depicted as boggy and mountainous.

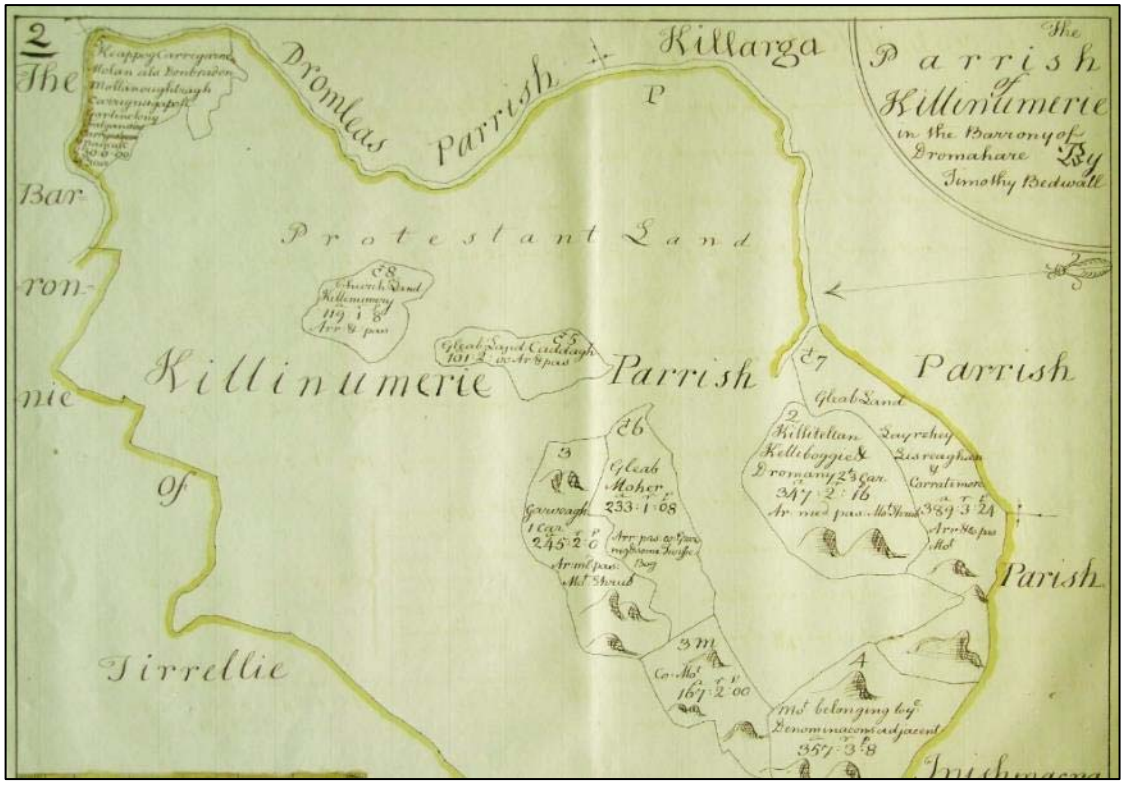

Figure 13-13 Down Survey map (http://downsurvey.tcd.ie/down-survey-maps.php#bm=Drumaheir&c=Leitrim&p=Killarga)

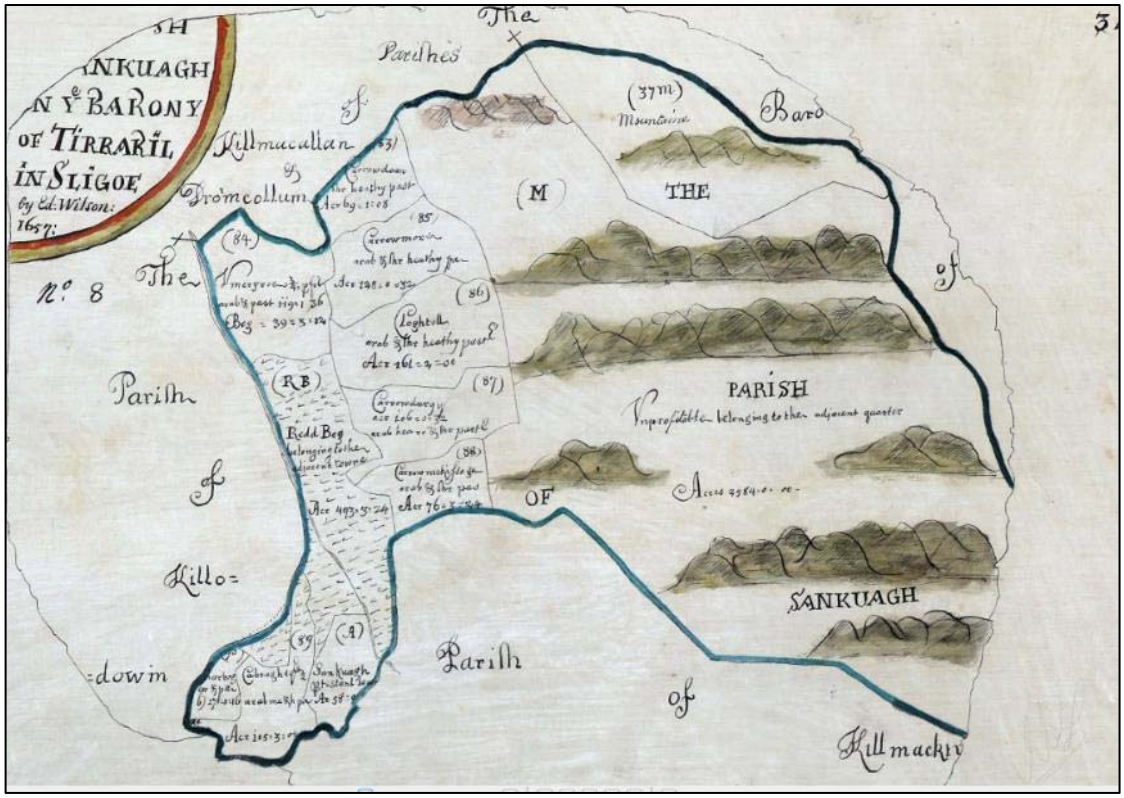

Figure 13-14 Down Survey map of 1657 showing the south-western section of the site in bog and mountainous pasture.

The Barony of Tirrarril (Sligo) is described in the Down Survey as follows: '*The Barony of Tirerill Part of this barony is course Mountaneous Pasture and at the South End thereof hath some wood affording*

Timber for ordinary Buildings. The rest of this Barony consisteth of moist ground there being in every part or hill of Land for the most part Arable Meadow and pasture in some parts healthy and in some parts woody with Red Bog in some parts necessary fore fireing But in other parts too great abundance thereof altogether unprofitable. The East part of the Barony from Killery Southward is fittest for grazeing and sowing of Oates, but the best for all other sorts of Grayne. There is not any considerable River in the barony but the River called Vnshinagh comeing out of Logharnagh and running through the said barony [and meeting the rivers of] Owenmore and Owenslew at the Castle of Cowloong where the two Baronies of Tirerill and Leyney meet together and from thence into the sea being only a mile distant from the place where the two Rivers meet'.

13.3.1.7.2 1st and 2nd Edition OS maps

The Ordnance Survey came to Ireland in 1824 in order to carry-out a precise admeasurement of the country's 60,000 or so townlands as a preliminary to the larger task of reforming Ireland's local taxation system. The townland boundaries were demarcated by a Boundary Commission, and the Ordnance Survey had the task of measuring them. In addition to boundaries the maps are truly topographical in content. Drawn at the large scale of six inches-to-one-mile (1:10,560) it was important to mark all buildings, roads, streams, placenames, etc, that were required for valuation purposes. Ultimately the maps were used as a basis for the rateable valuation of land and buildings in what became known as Griffith's Valuation. Working from north to south, the survey began in Antrim and Derry in 1829 and was completed in Kerry in 1842. It was published as thirty-two county maps between 1832 and 1846, the number of sheets per county varied from 153 for County Cork to 28 for Dublin, each of the 1,994 sheets in the series depicting an area 21,000 by 32,000 feet on the ground. Each county was projected on a different central meridian and so the maps of adjacent counties do not fit neatly together at the edges. Map content stops at the county lines.

The First Edition

The early Ordnance Survey maps are an unrivalled source for the period immediately before the Great Irish Famine (1847-50) when the population was at the highest level ever recorded. The maps depict a densely settled, highly articulated landscape.

The Second Edition

When the original survey began it did not include field boundaries and they did not appear on the maps. This policy was reversed in 1838 after a number of northern counties had been published. Therefore when the country was completed in 1846 the counties of Antrim, Armagh, Derry, Donegal, Down, Fermanagh, Monaghan, and Tyrone were resurveyed to add field boundaries. Subsequently this general revision was extended to other counties because of change in the post- Famine landscape. Survey work was curtailed in 1887 when the government agreed to survey the country at the larger scale of 1:2,500.

The 1st edition OS map was consulted to ascertain the presence or otherwise of additional features of potential archaeological value (not documented thus far). No features were noted and the lands appeared to be largely unenclosed with few features of note. The 2nd edition OS map shows a change within the area of the proposed development with many more boundaries and small settlements within the site.

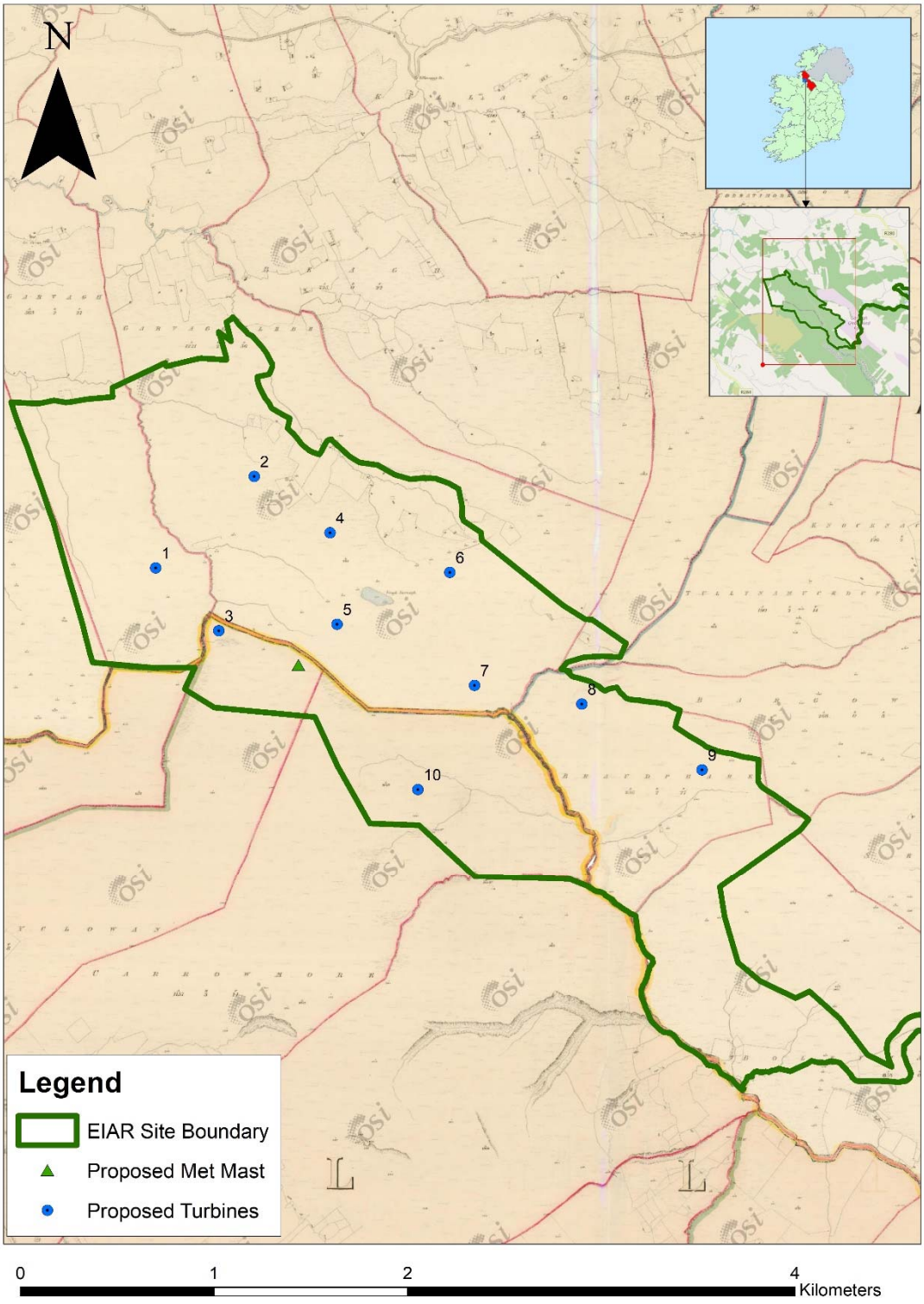

Figure 13-15 1st Edition OS map (1835-6) in the area of the proposed turbines.

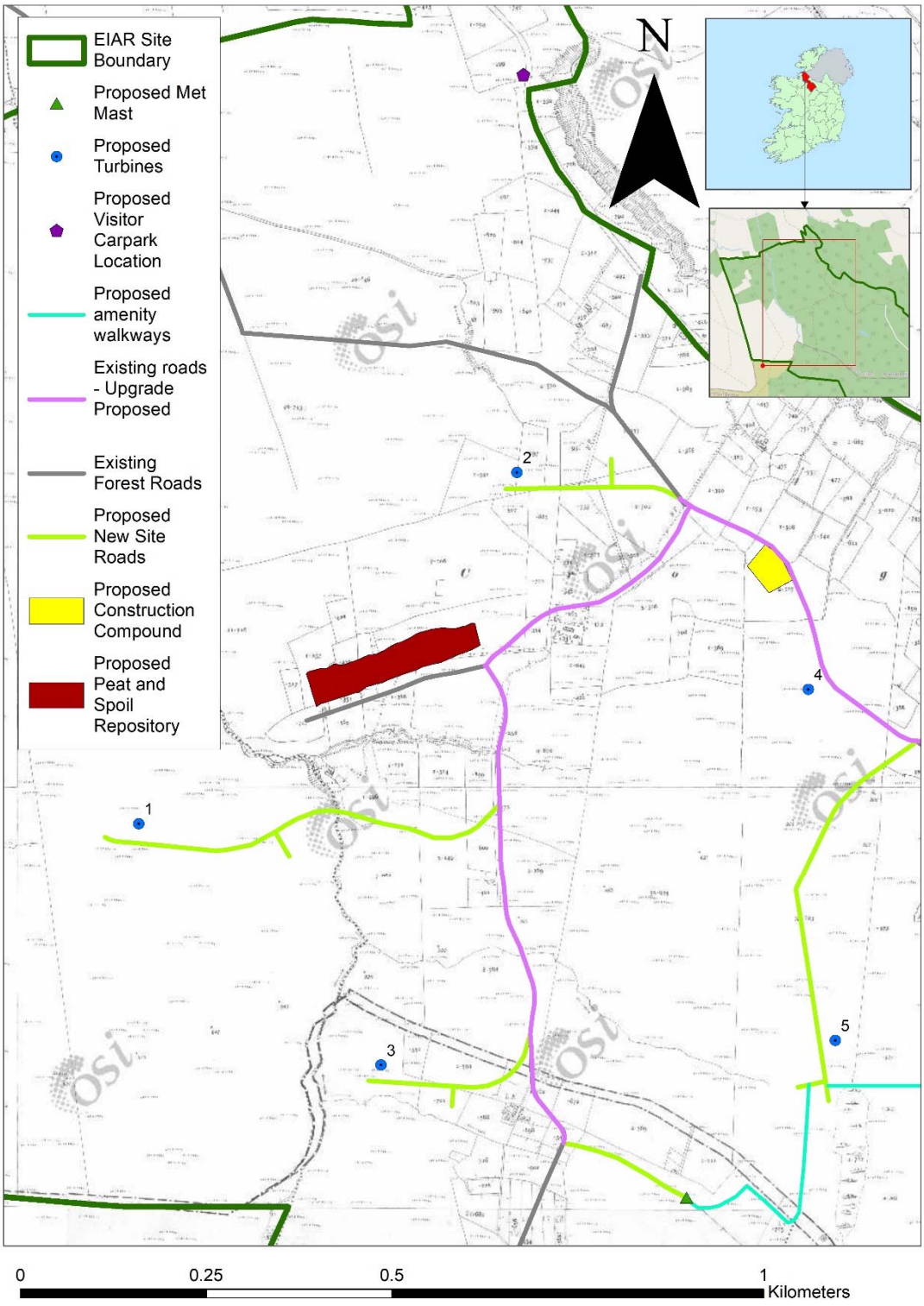

Figure 13-16 2nd edition 25 inch OS map (north-west) (1882-7)

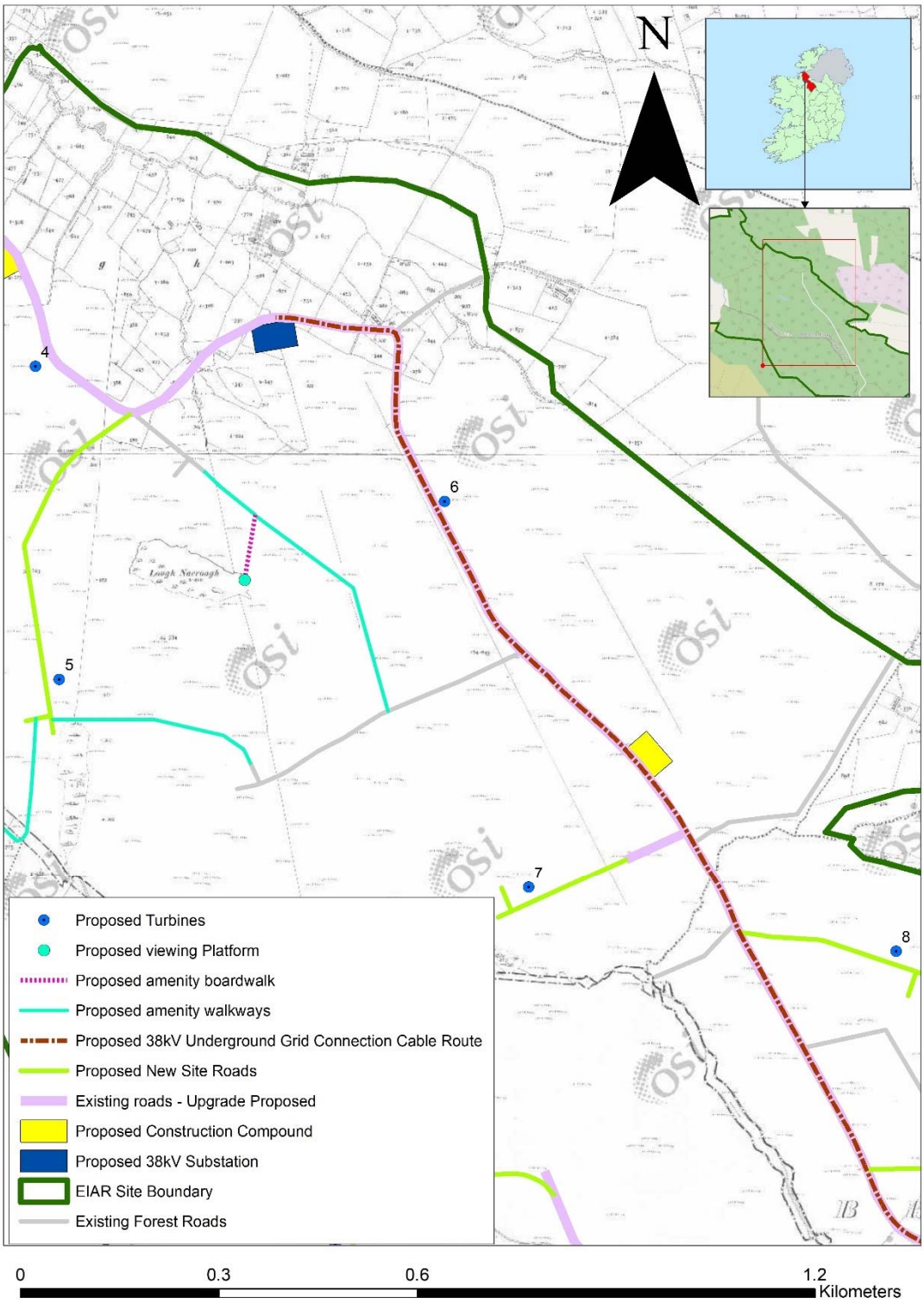

Figure 13-17 25 inch OS map (centre)

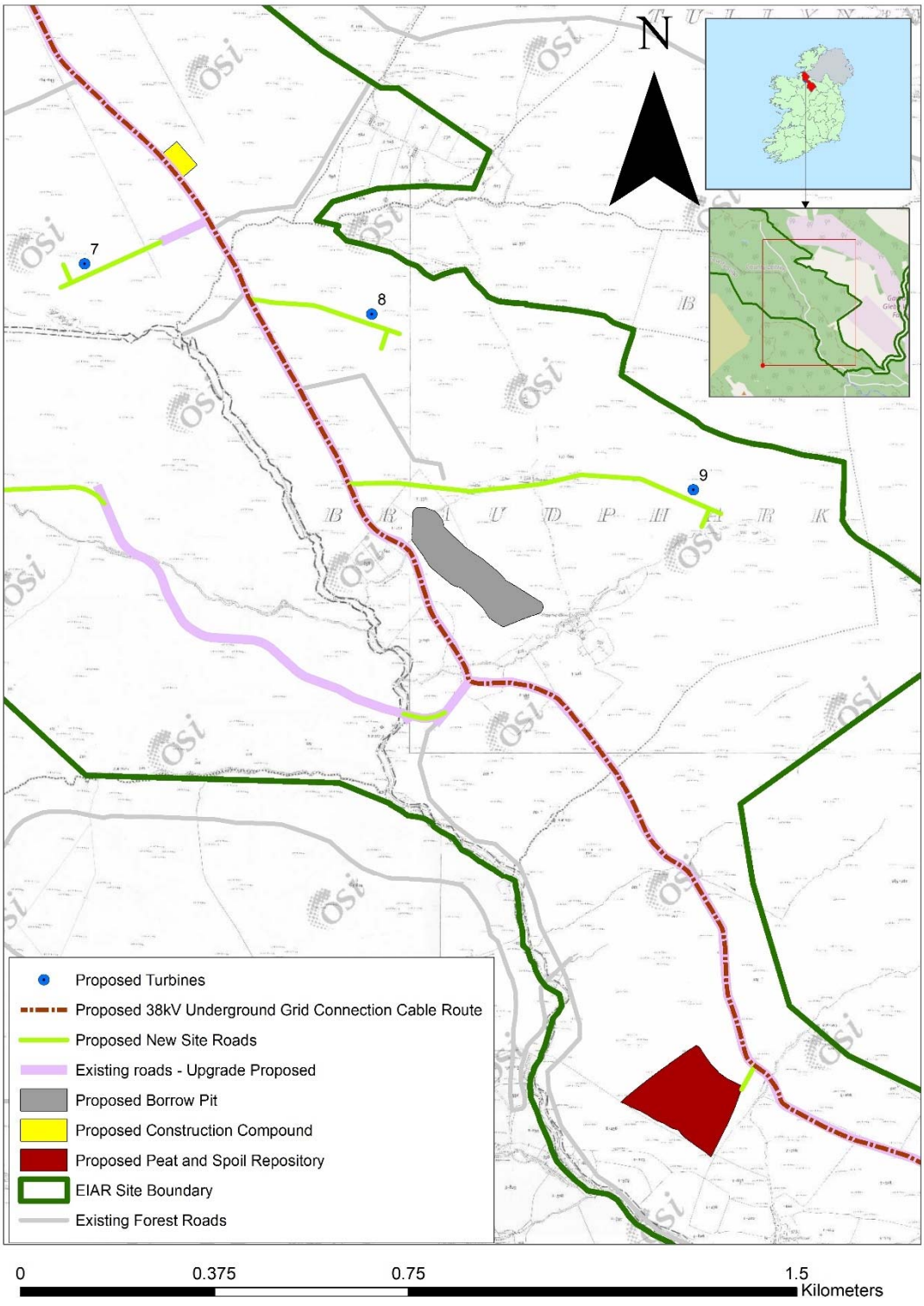

Figure 13-18 25 inch OS map (south-east)

13.3.1.8 Lewis Topographical Dictionary of Ireland

The south-western portion of the site is within County Sligo in the parish of Shancough. One reference to St James Well is mentioned in this description. '*A parish, in the barony of TIRAGHRILL, county of SLIGO, and province of CONNAUGHT, 9 miles (N. by E.) from Boyle, on the road from Sligo to Ballyfarnon; containing 1208 inhabitants. It is situated on the confines of the county of Leitrim, and comprises S909¾ statute acres, as applotted under the tithe act, of which a large portion consists of mountain and bog; some of the land, however, is good; limestone bounds, and iron-ore is supposed to exist in the mountains. It is a vicarage, in the diocese of Elphin, forming part of the union of Kilmactraney; the rectory is impropriate in Alex. Perceval, Esq. The tithes, amounting to £33. 4. 7½., are payable in equal portions to the impropriator and vicar. In the R. C. divisions also the parish forms part of the union or district of Kilmactrany. A "Patron" is annually held on July 25th at St. James's Well*'.

13.3.1.9 Description of the proposed EIAR study area

It is proposed to upgrade approximately 11.1km of existing roads/tracks and to construct approximately 7.5km of new wind farm site roads. The recreation and amenity proposals include the construction of 1.1km of new amenity walkways (3m wide, floating road construction), 100m of wooden board walk leading to a proposed viewing area next to Lough Nacroagh and a proposed visitor car park located adjacent to an existing access road approx.. 540m north of T2. It is proposed that amenity traffic will access the site from the north and that no upgrade is required to the existing junction or access road leading to the car park. The proposed borrow pit measures approximately 20,930 sq. metres, the northernmost peat repository area measures approx. 9,760 sq. metres and the southernmost peat repository measures approx. 24,770 sq. metres (as described in Chapter 4 of the EIAR).

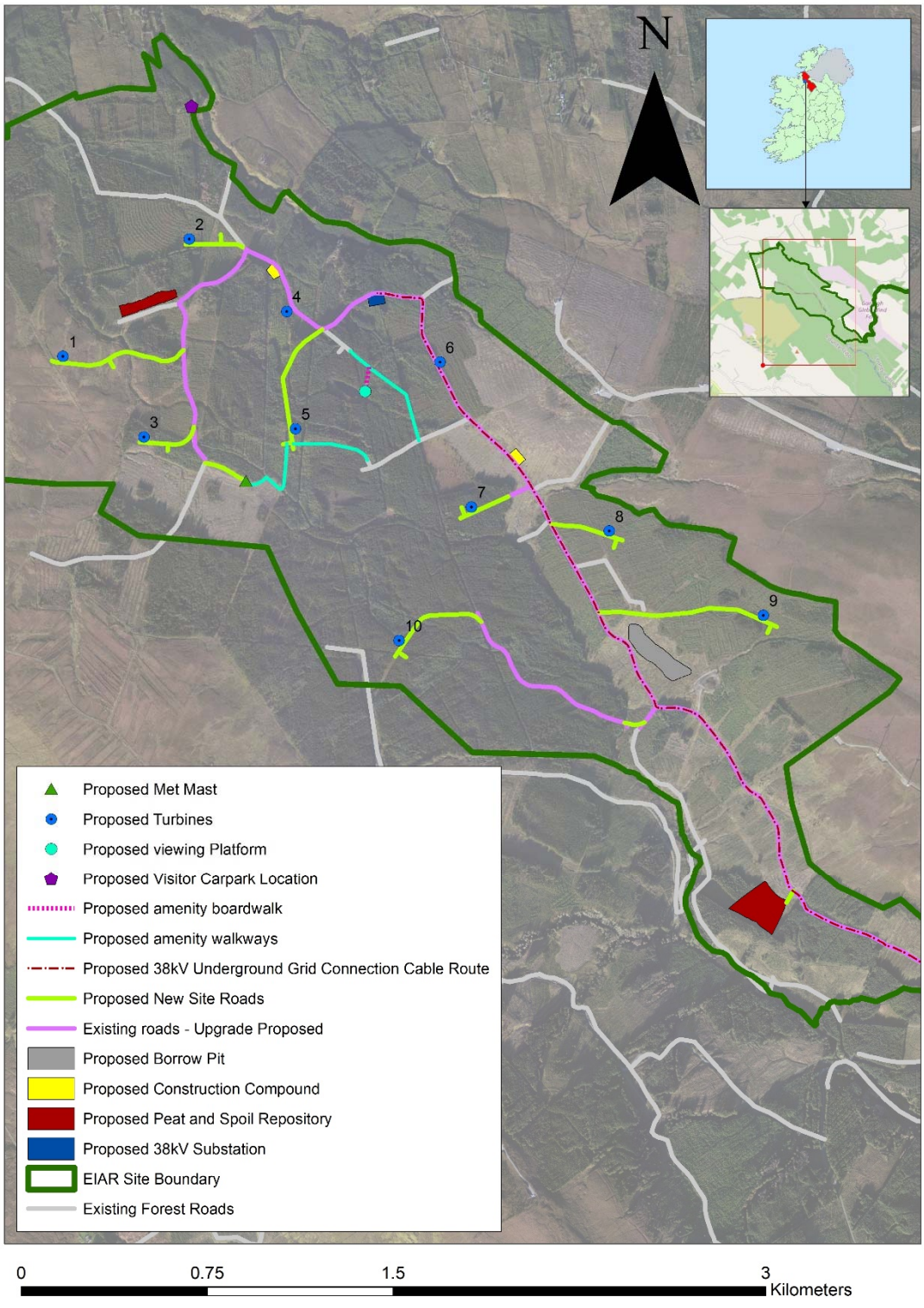

Figure 13-19 Site layout – see descriptions below.

13.3.1.9.1 Turbine 1

This is located in open bog land in the western side of the planning application site boundary. The proposed road extends through open land from forestry further to the east.

Plate 13-5 Location of Turbine 1 looking NW.

Plate 13-6 Area through which new proposed road will extend from forestry as far as Turbine 1.

13.3.1.9.2 Turbine 2

This is located approximately 690m to the north-east of T1 and within forestry.

Plate 13-7 Proposed new road from existing forestry road to T2 looking East.

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Plate 13-8 Continuation of new road to T2

13.3.1.9.3 Turbine 3

This is located 460m to the south-east of Turbine 1 and is situated in forested ground. The proposed road also extends through forestry from an existing forest road to the east.

Plate 13-9 Vicinity of Turbine 3 looking south.

13.3.1.9.4 Turbine 4

This is also located in mature forestry and is situated adjacent to an existing forest road to the east.

Plate 13-10 Vicinity of Turbine 4 looking south-west

13.3.1.9.5 Turbine 5

This is located in dense forestry *c.* 470m to the south of T4. Approximately 500m of new road is required to be constructed from the north for access to Turbine 5.

Plate 13-11 Terrain through which new road to T5 is required to be constructed, looking south

Plate 13-12 Clear felled and re-planted ground through which new road to T5 will be constructed, looking West.

Plate 13-13 Proposed location of T5 looking north

13.3.1.9.6 Compounds

Two temporary construction compounds are proposed to be located within the site, one to the north of T4 situated adjacent to an existing forest road and a second to the north-east of T7.

Plate 13-14 Southern construction compound looking north.

Plate 13-15 Southern construction compound towards the centre looking NNW.

Plate 13-16 Northern compound looking W.

Plate 13-17 Southern compound from existing track looking W.

13.3.1.9.7 Turbine 6

This is proposed to be located within forestry to the east of an existing forest road.

Plate 13-18 Existing forest road adjacent to T6. Arrow indicates location of T6 (approx.).

13.3.1.9.8 Borrow Pit

One borrow pit is proposed to be located to the west of T9 turbine.

Plate 13-19 Proposed borrow pit looking south from northern extent.

Plate 13-20 Borrow pit looking south/south-east.

Plate 13-21 Borrow pit looking NE.

13.3.1.9.9 Turbine 7

Turbine 7 is proposed to be located in clear felled ground. The proposed road will extend from an existing forest road to the east/northeast also through clear-felled ground.

Plate 13-22 Proposed road to T7 looking south-west

Plate 13-23 Hardstand of turbine 7 looking southwest.

13.3.1.9.10 Turbine 8

This is located 560m to the east of Turbine 7 on the eastern side of the existing forest road.

Plate 13-24 Area of proposed road to Turbine 8 looking north-west

Plate 13-25 Continuation of new road through forestry looking south-east

Plate 13-26 Vicinity of proposed turbine looking west.

13.3.1.9.11 Turbine 9

This is located in forestry and is accessed by a new road which will be constructed through forestry also.

Plate 13-27 Location of T9 looking south-east.

Plate 13-28 Hardstand of Turbine 9 looking west.

Plate 13-29 Proposed new road to T9 looking west.

Plate 13-30 Proposed new road to T9 looking west

13.3.1.9.12 Turbine 10

Plate 13-31 View towards Turbine 10 in forest fire-break.

13.3.1.9.13 Proposed peat Repository areas

The northern peat repository area consists of both clear-felled sections and mature forest.

Plate 13-32 Northern Peat Repository looking west.

Plate 13-33 View of western section of proposed peat repository area looking NE.

Plate 13-34 Track to the south of the peat repository area looking E.

Plate 13-35 General context of proposed southern peat repository area looking south consisting of both young and mature forestry.

Plate 13-36 Proposed southern peat repository area from the east looking west.

13.3.1.9.14 Proposed Met Mast

The proposed met mast is located to the south-west of turbine 5 in an area of young forestry.

Plate 13-37 General area of the proposed met mast looking SE from proposed road to the NW.

13.3.1.9.15 Proposed Amenity Areas

A number of amenity walkways and a viewing point are proposed as well as a visitor carpark in the northern section of the EIAR site boundary. The amenity link roads are proposed to be located in the general vicinity of Turbines 4-6.

Plate 13-38 Proposed location of boardwalk looking S

Plate 13-39 Proposed location of viewing platform looking west from eastern side.

Plate 13-40 Proposed location of viewing platform looking west from eastern side.

Plate 13-41 Section of amenity walkway to the east of the viewing platform, looking NW along firebreak.

Plate 13-42 Continuation of proposed amenity walkway in a southerly direction.

Plate 13-43 Proposed amenity track looking north where it meets an existing forest track.

Plate 13-44 Section of proposed amenity track to the SE of T5 through clear-felled forestry looking W.

Plate 13-45 Same section of proposed amenity trail looking East through clear-felled and drained forest.

Plate 13-46 General vicinity of proposed visitor car park in the northern section of the EIAR site boundary.

13.3.1.9.16 *Proposed Electricity Substation*

The proposed electricity substation is located to the south of an existing road which is due for upgrade. The site is largely inaccessible due to mature forestry. Extensive views to the north are possible from this location as some clear-felling has taken place to the north of the existing road.

13.3.2 Architectural and Cultural Heritage – The proposed wind farm

13.3.2.1 Protected Structures and NIAH within the proposed windfarm site boundary

No built heritage structures which are subject to legal protection are located within the wind farm site boundary.

13.3.2.2 Protected Structures and NIAH within 5km of the nearest proposed turbines

The RPS for Counties Leitrim and Sligo are largely based on the NIAH and therefore the NIAH structures within 5km are presented here with their distances to the nearest proposed turbines.

Table 13-4: NIAH within 5km of the nearest proposed turbines

NIAH	NAME	TOWNLAND	ITM E	ITM N	Distance to Turbine
30917001	Glasdrumman House	Glasdrumman More	588720	826734	4.8km to T9
30807001	water pump	Drumkeeran [Drum. By.]	590413	824618	4.8km to T9
30807003	Kelly House	Lugmeen	590642	824410	4.8km to T9
30807005	House (Sheena)	Sheena	590769	824220	4.9km to T9
30807006	Drumkeeran Church of Ireland Church	Sheena	590873	824089	4.9km to T9
30807004	Drumkeeran Court House	Lugmeen	590718	824360	4.9km to T9
32402709	Saint Columbs Roman Catholic Church	Drumnasoohy	579305	820913	4.9km to T3

The distance of the proposed turbines from the structures is such that no direct impacts will occur. The setting of the buildings within Drumkeeran village does not extend beyond the urban limits of village itself. The ZTV suggests that 3 turbines may theoretically be visible from Drumkeeran but this is based on a bare landscape model with no vegetation or tree cover. Impacts on setting are considered to be 'not significant' as discussed in detail in section 13.4.3 below.

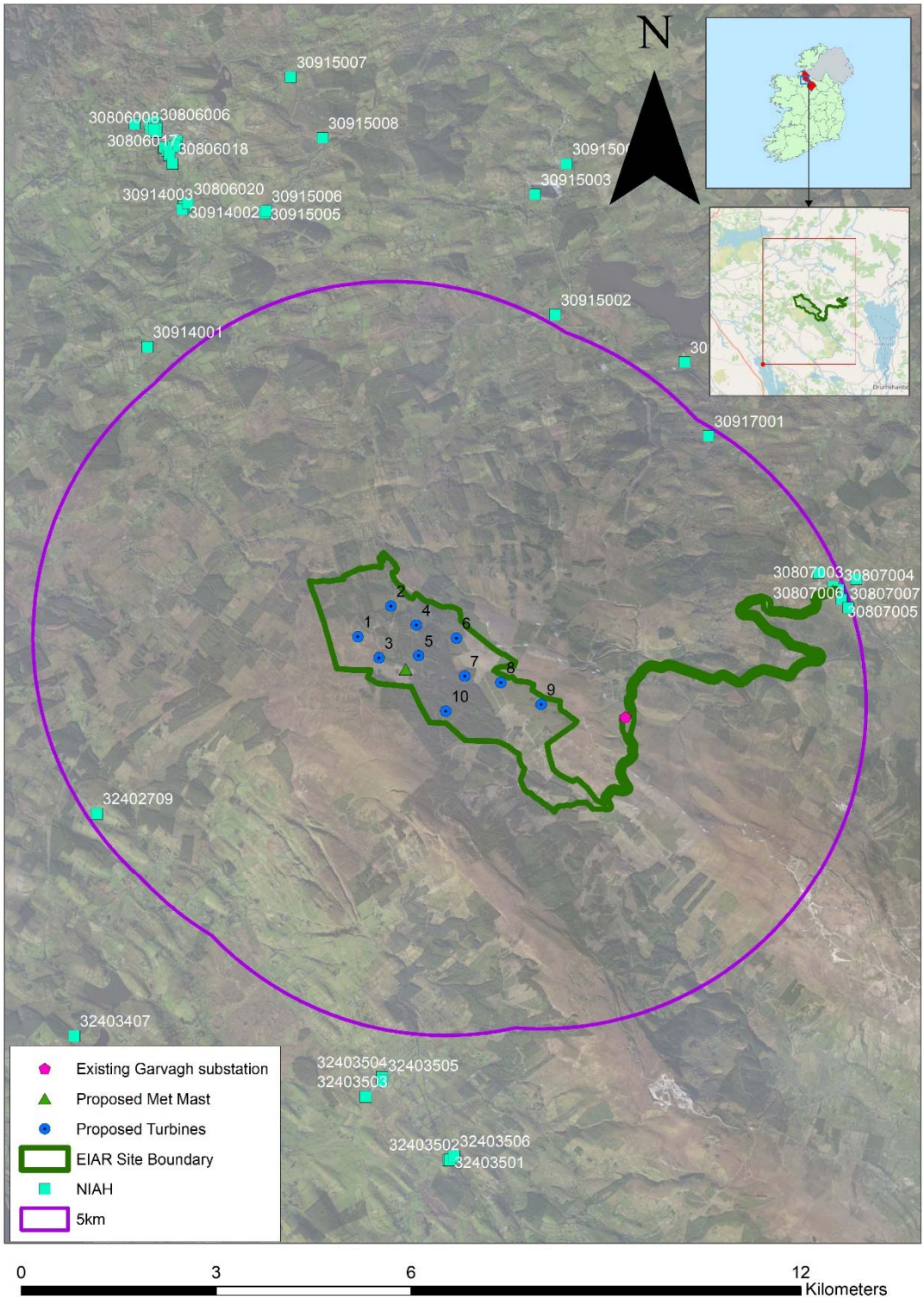

Figure 13-20 Built Heritage within 5km of the nearest proposed turbine

13.3.2.3 Local Cultural Heritage Features

A derelict stone house is located on high ground to the north of the existing road (ITM E586746, N821241) towards the south-eastern end of the site. This structure is marked only on the 2nd edition OS map and not the earlier 6 inch 1st edition. This structure will be preserved in situ as no infrastructure is proposed to be located in the vicinity. No mitigation measures are required.

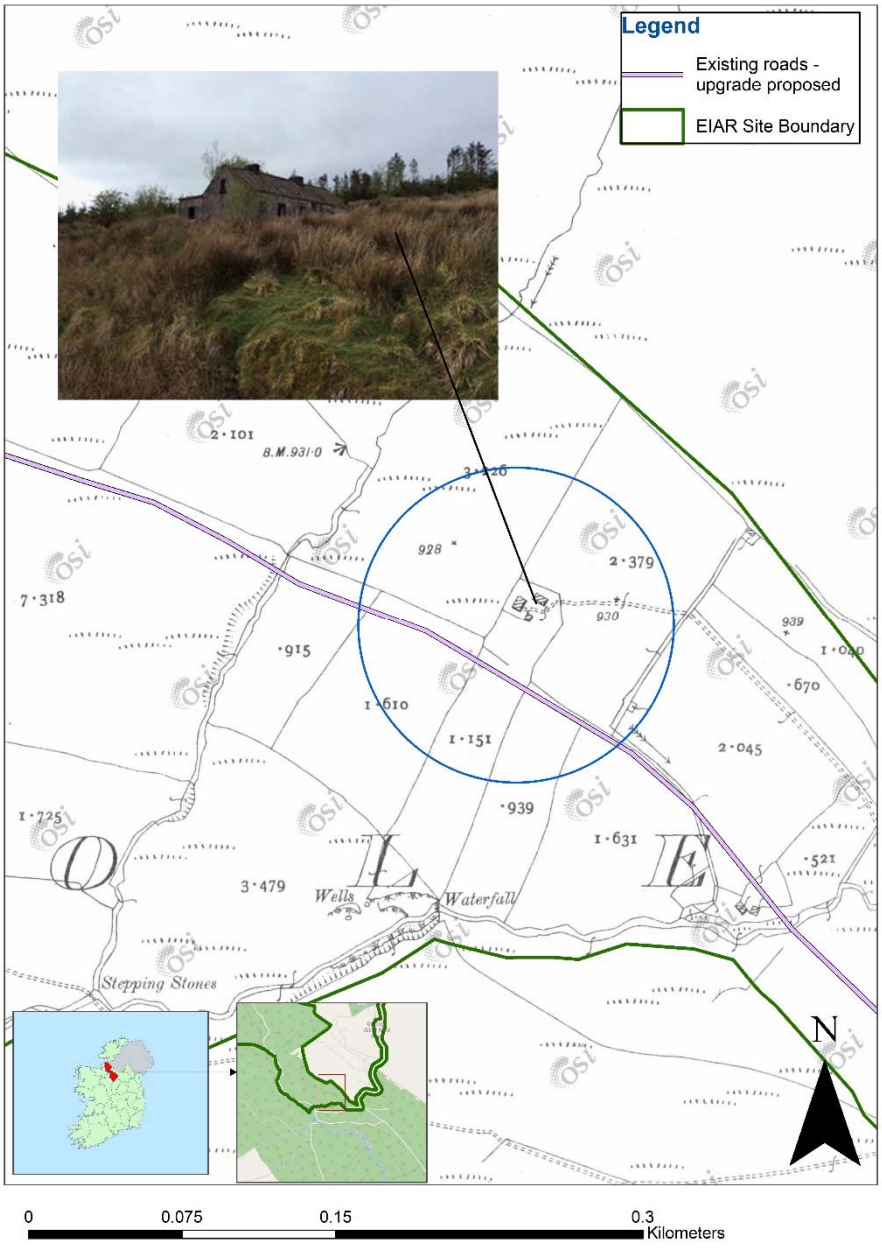

Plate 13-47 House marked on 2nd Edition OS map of late 1800s.

13.3.3 The Proposed Underground Grid Connection Cable Route

A grid connection route was assessed as part of the EIAR and extends from the proposed substation within the EIAR site boundary to the existing substation at Garvagh (to the East of the proposed wind farm). Constraints within 100m of either side of the proposed cable route were considered in the assessment. Monuments whose physical extents are within the 100m study area but whose centre points (National Monuments Service centre point red dots) are outside the 100m are included in the assessment. The route is located in County Leitrim and extends through Boleymaguire, Braudphark, Garvagh Glebe and Seltan townlands.

13.3.3.1.1 *Archaeology*

No National Monuments in State Care or Recorded Monuments are located along the proposed Grid connection cable route. No impacts to the known recorded archaeological resource will occur therefore. The route is located along an existing forest road within the site boundary and thereafter along a public road as far as the existing Garvagh substation.

13.3.3.1.2 *Architectural and Cultural Heritage*

No known structures listed in the statutory list of Protected Structures are located along the proposed grid connection route. Furthermore, no structures listed in the NIAH are located along the route. One structure (19th century house/settlement) is depicted on the 25 inch Historic map in the townland of Garvagh Glebe and is situated just to the north of the existing forest road to the east of the proposed substation site. This area is now under forest cover. The house was not located during survey and it is likely that the structure is no longer extant (Plate 13-56).

13.3.3.1.3 *Description of the route*

Plate 13-48 Existing Garvagh substation looking north

Plate 13-49 Existing road along grid connection cable route looking south

Plate 13-50 same as above looking south

Plate 13-51 Grid connection cable route looking south

Plate 13-52 Continuation of proposed grid connection cable route looking north (within site boundary)

Plate 13-53 Continuation of proposed grid connection cable route looking north (within site boundary)

Plate 13-54 Continuation of proposed grid connection cable route looking north (within site boundary)

Plate 13-55 Continuation north of proposed grid connection cable route looking north (within site boundary)

Plate 13-56 No surface trace of house structure marked on 25 inch historic map

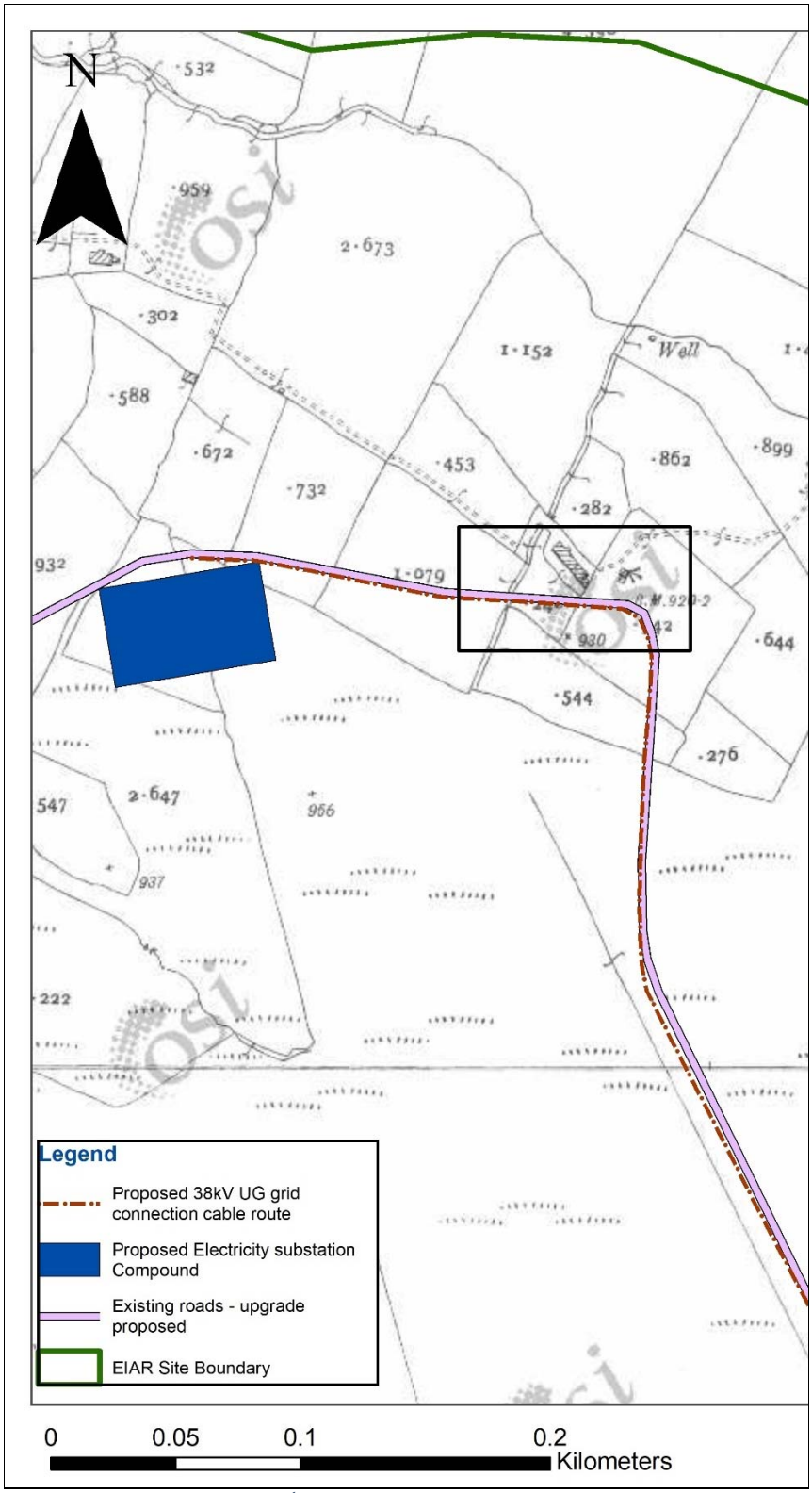

Figure 13-21 Location of 'site of' 19th century dwelling house to north of grid connection cable route.

Plate 13-57 Route of proposed grid connection cable route looking west before it reaches the site of the proposed substation

13.3.4 Construction Access Road

HGVs and vehicles delivering large turbine components and other abnormal loads to the site of the proposed development will turn west off the R280, in Drumkeeran village, into an existing farmyard. In this yard, there will be partial demolition of a small agricultural storage building and the removal of the rear wall of the larger, livestock shed to allow vehicles to continue through the yard. Once through the larger shed, the vehicles will continue west on a proposed new road, measuring approximately 260m, through agricultural land before turning south onto the L4282 in the Derryboffin. The vehicles will travel west along the L4282 before turning south at the new proposed construction site entrance in the townland of Derrycullinan. (Note: Road widening works will take place in agricultural land between the two 90-degree bends on the L4282 just before the construction site entrance. This is required to facilitate the delivery of large turbine components and other abnormal loads. The field boundary will be reinstated using stockproof fencing and the hardcore area will be allowed to revegetate)

The vehicles will continue south along a combination of proposed new site roads and existing forestry roads that will be upgraded before turning west in the townland of Derreens.

The route is also described in detail in Chapter 4 of the EIAR and below.

13.3.4.1 National Monuments in State Care, Recorded Monuments, RPS and NIAH

No documented constraints are located along the section of the proposed access road from the core wind farm site as far as the regional road R280.

13.3.4.2 Townland Boundaries

Townland names can be a valuable source of information, not only on the topography, land ownership and land use within the landscape, but also on its history, archaeological monuments and folklore. A number of townland boundaries are located along the route of the proposed construction access road and these are as follows:

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Dereens meaning Little oakwoods

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Barragh Mor meaning great bare land, shorn land

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Drummanacappul (Droimne an Chapaill) meaning ridge of the horse

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Tinnybeg (An Tinne Beag) meaning little field (1836).

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Bargowla (Barr Gabhla) meaning Top of the fork or forked place.

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Seltan (Sailtean) meaning A place of willows or sally trees. Sailtean, according to Dr. Joyce, is a diminutive form of sail, a willow, an osier. "Sailtean – seven townlands in Co. Leitrim named Seltan.

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland:	Lisfuiltaghan (Lios Phuilteacháin) meaning Lios-Fhuilteacháin = Foltaghan's fort or ring-fort of (the) marshy place

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	DERRYCULLINAN (Doire Chuileannáin) meaning O'Cullenan's oak-wood.

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Derryboffin, Doire Bó Finne meaning wood of the white cow

County	Liatroim/Leitrim
Barony	Droim Dhá Thiar/Drumahaire
Civil parish	Inis Mac Rá/Inishmagrath
Townland	Sheena, Siánaigh meaning place of fairy mounds, hillocks. There are references to Folklore in the Schools Collection on Logainmn.ie. There is a reference to forts in the townland of Sheena and Modorragh (to the east of the latter). The forts are described in the following extract '*There are 3 or 4 forts in this district. They are called forts. Number 1 is in the townland of Sheena. Number II is also near the school in the townland of Madarragh, and is in view of number 1. Number III is in the district of Kilmore in a field belonging to a man called Campbell. It is a long distance from this school, and no person knows the name of the townland Name since found Lisnanerris. Number IV is about 3 miles north west from here on the road leading to Dromahaire in a field belonging to a man the name of Gillooly In the parish of Killargue. they are all circular in shape, there is a hedge around them. No entrance is in the centre or elsewhere, no body has ever gone down through the hole or explored the*

interior. Once there was a man passing by number IV and he was put astray' (The Schools' Collection, Volume 0204, Page 043).

One enclosure (LE018-033) is located 900m to the SE of the proposed construction access road so no impacts will occur.

Impacts are addressed in Section 13.4.2.8 below.

13.3.4.3 Water Crossings

Rivers, streams and their banks have a high level of archaeological potential. Sites adjacent to watercourses have been favoured since prehistoric times for their proximity to food sources (often represented by habitation sites, fulachta fiadh and middens. Rivers and streams also serve as routeways, defences and ritual sites and boundaries. River beds may also contain archaeological features associated with fording sites, early bridge crossings and milling activities such as mill races. Three water crossings are proposed as part of the construction access road and these are largely located at the junction of townland boundaries as detailed above.

13.3.4.4 Description of the proposed construction access road

No documented constraints are located along the proposed construction access road including National Monuments, Recorded Monuments, NIAHs or RPS. The route was examined and assessed for the presence of previously unknown constraints. The route is described below from east to west.

Plate 13-58 Route of proposed construction access road where it commences at the east, looking west.

Plate 13-59 Proposed construction access road to the rear of agricultural sheds, looking west in low-lying marshy ground.

Plate 13-60 Looking NW towards construction access road in low-lying marshy ground.

Plate 13-61 Construction access road from public road to west looking east towards agricultural sheds and Drumkeeran.

Plate 13-62 Section of third-party lands where some road widening will take place, looking north over Derrycullinan Td.

Plate 13-63 Continuation north of section of road widening at Derrycullinan Td.

Plate 13-64 Section of proposed construction access road along existing road looking NW in Derrycullinan townland.

Plate 13-65 Continuation of construction access road looking SE along existing section of road.

Plate 13-66 Section of existing track in Dereens townland where the proposed construction access road enters scrub and forestry (to right of photo).

Plate 13-67 Proposed water crossing at Drummanacappul / Derrycullinan Td.

Plate 13-68 Continuation south of proposed construction access road through forestry, looking E.

Plate 13-69 Proposed Construction Access road through Tinnybeg Td. Looking NE through forestry.

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Plate 13-70 Proposed construction access road through Tinnybeg Td. Looking NW along existing track.

Plate 13-71 Continuation west of proposed construction access road looking west where it extends into mature forest.

Plate 13-72 Proposed construction access road where it extends through forestry from public road at Bargowla Td.

Plate 13-73 Continuation of proposed construction access track in a southerly direction along public road looking north.

Plate 13-74 Continuation of proposed construction access road along public road (some road widening may be required here).

Plate 13-75 Proposed construction access road along existing road where upgrade works are proposed, looking south

Plate 13-76 Continuation south of proposed construction access road looking north.

Plate 13-77 Continuation of proposed construction access road along existing road where upgrade works are required, looking south

Plate 13-78 Proposed construction access road along existing road where upgrade works are required, looking west

Plate 13-79 Entrance into core wind farm site looking north-west.

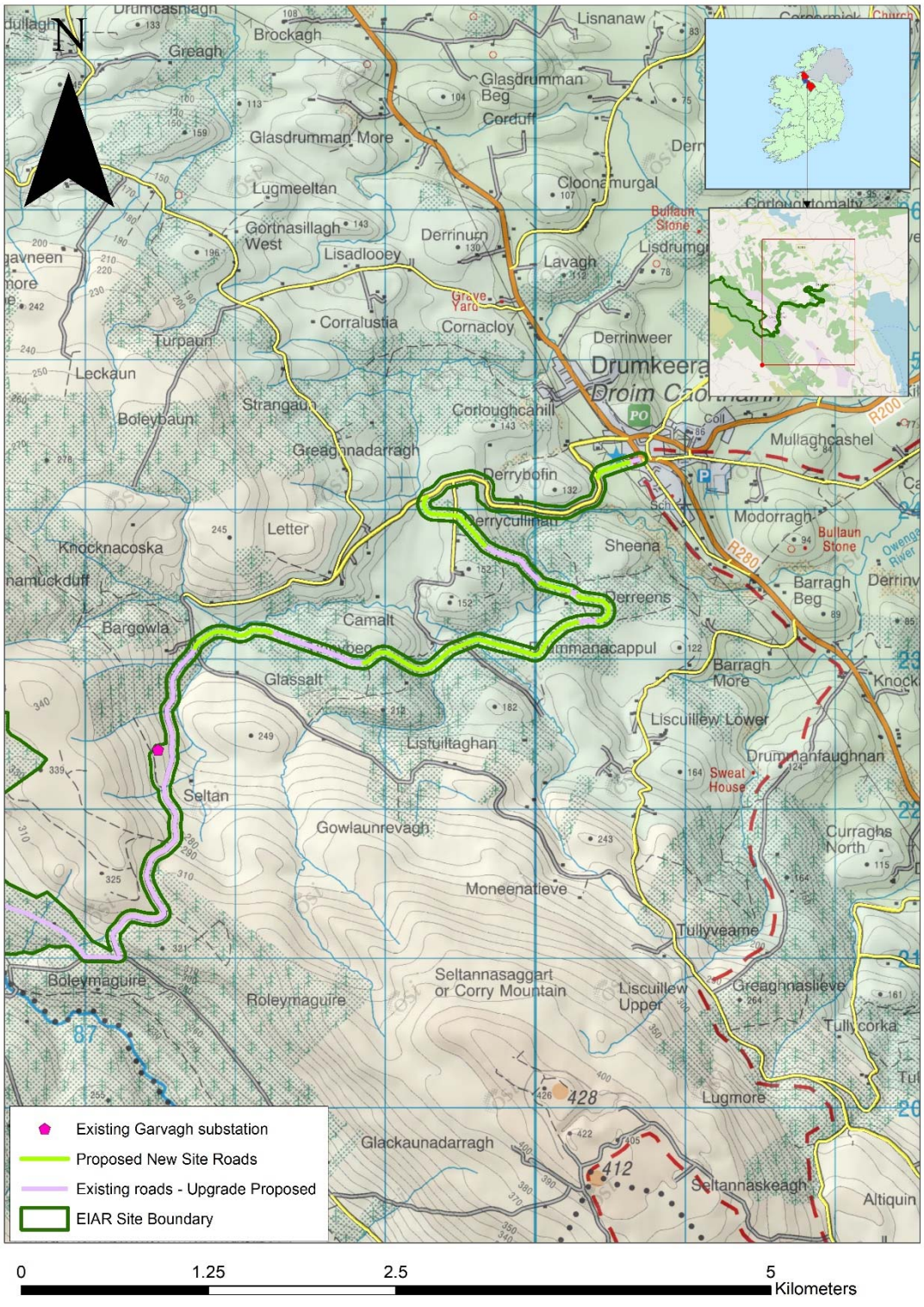


Figure 13-22 Proposed construction access road between R280 Regional road and proposed core wind farm site.

13.4 Likely Significant Effects and Associated Mitigation Measures

13.4.1 Construction Phase Potential Impacts (Indirect)

Indirect effects, in terms of archaeology, architectural and cultural heritage are considered to be those effects which happen away from 'the site'. This includes impacts on visual setting of any cultural heritage asset in the wider landscape. Since these effects are only possible once the proposed turbines are constructed, they are considered operational effects and are therefore discussed in Section 13.4.5 below. No indirect effects were identified which would occur at the construction stage.

13.4.2 Construction Phase Potential Impacts (Direct)

Direct Impact refers to a 'physical impact' on a monument or site. The construction phase of the development consists largely of earthmoving activities such as peat and topsoil removal. The potential impacts on the known and potential archaeological, architectural and cultural heritage of the area are outlined below with the suggested mitigation measures. The impacts are described according to each element of the Proposed Development, turbines, grid connection, delivery route. Where any potential direct impacts do occur they are negated through the use of suitable mitigation measures such as exclusions zones (buffer zones), testing, monitoring, etc.

13.4.2.1 Turbines and Met Mast

13.4.2.1.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

No National Monuments in State Ownership/Guardianship are located within the application site boundary or the footprint of any proposed turbines or met mast therefore no direct impacts on these aspects of the archaeological resource are identified. No recorded monuments are located within the footprint of any proposed turbines or met mast and therefore no construction effects will occur in this regard. Documented built heritage was assessed and included structures listed on the RPS and NIAH. No Protected Structures or NIAH structures are located within the footprint of any proposed turbines or met mast therefore no direct impacts on these aspects of the architectural and cultural heritage resource will occur.

Proposed Mitigation Measures

Since no direct effects to the known cultural heritage resource were identified mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction and erection of the proposed wind turbines and met mast will have no direct effects on National Monuments, Recorded Monuments, Protected Structures or NIAH. The significance of effects is therefore imperceptible.

13.4.2.1.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. There are no instances where a proposed turbine base, hardstand or met mast overlays a townland boundary and therefore there is no impact on any townland boundary.

Proposed Mitigation Measures

Since no direct effects to the townland boundaries as a result of the proposed turbines or met mast will occur mitigation measures are not required.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The construction and erection of the proposed wind turbines or met mast will have no significant direct effects on townland boundaries. The significance of effects is therefore imperceptible.

13.4.2.1.3 *Impact on unrecorded potential sub-surface sites*

The potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the turbine bases and hardstands and the met mast may impact on any new sites, if present.

Pre-Mitigation Impact

Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The construction and erection of the proposed wind turbines and met mast could have a slight impact on sub-surface archaeological features, if present.

13.4.2.2 Proposed New Roads and Amenity facilities

13.4.2.2.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

No National Monuments in State Ownership/Guardianship, Recorded Monuments or Built Heritage structures (RPS/NIAH) are located within the application site boundary or the footprint of any proposed new roads or amenity facilities therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Proposed Mitigation Measures

The construction and erection of the proposed roads and amenity facilities will have no significant direct effects on any known cultural heritage assets.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The construction and erection of the proposed roads and amenity facilities will have no significant direct effects on any known cultural heritage assets. The significance of effects is therefore imperceptible.

13.4.2.2.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. There are a number of instances where the proposed new road footprint overlays townland boundaries within the wind farm EIAR boundary and these include Carrowmore, Boleymaguire, Braudphark, Carrownyclowan, Garvagh Glebe and Garvagh. This will result in a direct impact to the townland boundaries where they survive, albeit it, within the width of the proposed road corridor. The impact without mitigation measures is likely to be slight-moderate since only small sections of the boundaries are proposed to be removed where they survive.

Proposed Mitigation Measures

Preservation by record where relevant during construction stage monitoring at the following areas:

- Proposed new road to T1 where it traverses the Garvagh/Garvagh-Glebe townland boundary
- Proposed New road to T3 where it traverses the Garvagh-Glebe/ Carrownyclowan townland boundary

Residual Impact

Residual Impacts after the mitigation measures have been implemented will be slight-not significant.

Significance of Effects

The significance of Effects will be slight-not significant.

13.4.2.2.3 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

The potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for new roads or amenity facilities may impact on any new sites, if present.

Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The potential significance of effects after the mitigation measures is likely to be slight.

13.4.2.2.4 *Impact on Water Crossings*

Pre-Mitigation Impact

Nine new water crossings are proposed as part of the construction of the new roads for the proposed wind farm. Rivers, streams and their banks have a high level of archaeological potential. Sites adjacent to watercourses have been favoured since prehistoric times for their proximity to food sources (often represented by habitation sites, fulachta fiadh and middens. Rivers and streams also serve as routeways, defences and ritual sites and boundaries. River beds may also contain archaeological features associated with fording sites, early bridge crossings and milling activities such as mill races. The impact without mitigation measures is likely to be slight-moderate since only small sections of the watercourses are proposed to be impacted within the confines of the road corridors.

Proposed Mitigation Measures

A licensed metal detection survey of the watercourses that are proposed to be crossed. The metal detection survey could be undertaken concurrently during the construction stage in advance of any works to the rivers/streams. A report on the results should be submitted to the relevant authorities.

Archaeological monitoring of ground works during construction. A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.

- Proposed new road to T1 where it traverses the Garvagh/Garvagh-Glebe watercourse at ITM E583591, N823655
- Proposed New road to T10 where it crosses the stream to the north of T10 at ITM E584754, N822568

Residual Impact

Residual Impacts after the mitigation measures have been implemented will be slight-not significant.

Significance of Effects

The significance of effects will be Slight - Not Significant

13.4.2.3 Borrow Pits

13.4.2.3.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

One borrow pit areas were assessed as part of the EIAR. No National Monuments in State Ownership/Guardianship, Recorded Monuments or Built Heritage structures (RPS/NIAH) are located within the application site boundary or the footprint of the proposed borrow pits therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Proposed Mitigation Measures

Since no direct effects to the known cultural heritage resource as a result of the proposed borrow pits were identified mitigation measures are not required.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed borrow pits will have no significant direct effects on National Monuments, Recorded Monuments, Protected Structures or NIAH. The significance of effects will be imperceptible.

13.4.2.3.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. There are no instances where a proposed borrow pit will impact on a townland boundary.

Proposed Mitigation Measures

Since no direct effects to townland boundaries as a result of the proposed borrow pits were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed borrow pits will have no significant direct effects on townland boundaries. The significance of effects will be imperceptible.

13.4.2.3.3 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

The potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed borrow pits may impact on any new sites, if present. Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The significance of effects could be slight if sub-surface archaeological features are present within the area of the borrow pits.

13.4.2.3.4 *Impact on Water Crossings*

Pre-Mitigation Impact

There are no instances where a proposed borrow pit will impact on a water crossing. No impacts will occur, therefore.

Proposed Mitigation Measures

Since no direct effects water crossings as a result of the proposed borrow pits were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed borrow pits will have no significant direct effects on water crossings. The significance of effects will be imperceptible.

13.4.2.4 Peat Repository Areas

13.4.2.4.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

Two peat repository areas were assessed as part of the EIAR. No National Monuments in State Ownership/Guardianship, Recorded Monuments or Built Heritage structures (RPS/NIAH) are located within the application site boundary or the footprint of the proposed peat repository areas therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Proposed Mitigation Measures

Since no direct effects to the known cultural heritage resource as a result of the proposed peat repository areas were identified mitigation measures are not required.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed peat repository areas will have no significant direct effects on National Monuments, Recorded Monuments, Protected Structures or NIAH. The significance of effects will be imperceptible.

13.4.2.4.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. There are no instances where a proposed peat repository area will impact on a townland boundary.

Proposed Mitigation Measures

Since no direct effects to townland boundaries as a result of the proposed peat repository areas were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed peat repository areas will have no significant direct effects on townland boundaries. The significance of effects will be imperceptible.

13.4.2.4.3 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

The potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed peat repository areas may impact on any new sites, if present. Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The significance of effects could be slight if sub-surface archaeological features are present within the peat repository areas.

13.4.2.4.4 *Impact on Water Crossings*

Pre-Mitigation Impact

There are no instances where a proposed peat repository areas will impact on a water crossing. No impacts will occur, therefore.

Proposed Mitigation Measures

Since no direct effects to water crossings as a result of the proposed peat repository areas were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed peat repository areas will have no significant direct effects on water crossings. The significance of effects will be imperceptible.

13.4.2.5 Electricity Substation

The electricity substation is located in mature forestry.

13.4.2.5.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

No National Monuments in State Ownership/Guardianship, Recorded Monuments or Built Heritage structures (RPS/NIAH) are located within the application site boundary or the footprint of the proposed substation site therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Proposed Mitigation Measures

Since no direct effects to the known cultural heritage resource as a result of the proposed substation were identified mitigation measures are not required.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed substation will have no significant direct effects on National Monuments, Recorded Monuments, Protected Structures, NIAH. The significance of effects will be imperceptible.

13.4.2.5.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. There are no instances where the proposed substation will impact on a townland boundary.

Proposed Mitigation Measures

Since no direct effects to townland boundaries as a result of the proposed substation were identified mitigation measures are not required.

Residual Impact

No Residual Impacts.

Significance of Effects

The excavation associated with the proposed substation will have no significant direct effects on townland boundaries. The significance of effects will be imperceptible.

13.4.2.5.3 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

Similar to any other aspect of the proposed development which involves ground disturbance, the potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed substation site may impact on any new sites, if present. Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The significance of effects is likely to be Slight.

13.4.2.5.4 *Impact on Water Crossings*

Pre-Mitigation Impact

There are no occurrences where any aspect of the proposed substation site will impact on a water course.

Proposed Mitigation Measures

Since no direct effects to water crossings as a result of the proposed substation were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed substation will have no significant direct effects on water crossings. The significance of effects will be imperceptible.

13.4.2.6 Proposed Temporary Construction Compounds

Two compounds are proposed as part of the development.

13.4.2.6.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

No National Monuments in State Ownership/Guardianship, Recorded Monuments or Built Heritage structures (RPS/NIAH) are located within the application site boundary or the footprint of the proposed compounds therefore no direct impacts on these aspects of the cultural heritage resource will occur.

Proposed Mitigation Measures

Since no direct effects to the known cultural heritage resource as a result of the proposed compounds were identified mitigation measures are not required.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The excavation associated with the proposed temporary construction compounds will have no significant direct effects on National Monuments, Recorded Monuments, Protected Structures, NIAH. The significance of effects will be imperceptible.

13.4.2.6.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. There are no instances where the proposed compounds will impact on a townland boundary.

Proposed Mitigation Measures

Since no direct effects to townland boundaries as a result of the proposed temporary compounds were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The construction of the proposed temporary construction compounds will have no significant direct effects on townland boundaries. The significance of effects will be imperceptible.

13.4.2.6.3 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

Similar to any other aspect of the proposed development which involves ground disturbance, the potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed compounds may impact on any new sites, if present.

Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The construction of the proposed temporary construction compounds could have a slight impact on sub-surface archaeological features, if present.

13.4.2.6.4 *Impact on Water Crossings*

Pre-Mitigation Impact

There are no occurrences where any aspect of the proposed compounds will impact on a water course therefore no impacts will occur.

Proposed Mitigation Measures

No Impacts were identified and therefore mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The construction of the proposed temporary construction compounds will have no significant direct effects on water crossings. The significance of effects will be imperceptible.

13.4.2.7 Underground Grid Connection Cable Route

This route was assessed as part of the EIAR and is addressed in Section 13.3.3 above.

13.4.2.7.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

No National Monuments in State Care or Recorded Monuments are located along the proposed Grid connection cable route. No impacts to the known recorded archaeological resource will occur therefore. The route is located along an existing forest road within the site boundary and thereafter along a public road as far as the existing Garvagh substation. No known structures listed in the statutory list of Protected Structures are located along the proposed grid connection route. Furthermore, no structures listed in the NIAH are located along the route. One structure (19th century house/settlement) is depicted on the 25 inch OS map in the townland of Garvagh Glebe and is situated just to the north of the existing forest road to the east of the proposed substation site. This area is now under forest cover. The house was not located during survey and it is likely that the structure is no longer extant.

Since no direct effects to the known cultural heritage resource as a result of the proposed Grid route option were identified mitigation measures are not required.

Proposed Mitigation Measures

Since no direct effects to any known cultural heritage assets as a result of the proposed grid connection were identified mitigation measures are not required.

Residual Impact

No residual Impacts will occur.

Significance of Effects

The construction of the proposed underground grid connection will have no significant direct effects on any National Monuments, Recorded Monuments, Protected Structures, NIAH.

13.4.2.7.2 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries are addressed in the Section 13.3.1.5 of the EIAR. Since the proposed grid route option is located along existing roads there are no instances where townland boundaries will require removal. No impacts will occur therefore.

Proposed Mitigation Measures

Since no direct effects to any townland boundaries as a result of the proposed grid connection were identified mitigation measures are not required.

Residual Impact

No Residual Impacts will occur.

Significance of Effects

The construction of the proposed underground grid connection will have no significant direct effects on any townland boundaries.

13.4.2.7.3 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

Similar to any other aspect of the proposed development which involves ground disturbance, the potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. The excavation of topsoil /peat for the proposed grid connection route may impact on any new sites, if present.

Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same.
- Archaeological monitoring of ground works during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The construction of the proposed underground grid connection route could have a slight impact on sub-surface archaeological features, if present.

13.4.2.8 Proposed Construction Access Road

13.4.2.8.1 *Impact on National Monuments, Recorded Monuments, Protected Structures, NIAH*

Pre-Mitigation Impact

No National Monuments in State Care, Recorded Monuments, Protected Structures, NIAH are located along the proposed construction access road. No impacts will occur, therefore.

Proposed Mitigation Measures

Since no direct effects to any National Monuments, Recorded Monuments, Protected Structures, NIAH as a result of the proposed access route to the wind farm were identified mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed access road to the wind farm will have no significant direct effects on any National Monuments, Recorded Monuments, Protected Structures, NIAH.

13.4.2.8.2 *Impact on unrecorded potential sub-surface sites*

Pre-Mitigation Impact

Similar to any other aspect of the proposed development which involves ground disturbance, the potential exists for the development area to contain as yet unrecorded sub-surface sites and artefacts. It is possible that such sites may be uncovered either within the peat/topsoil and/or at the level of the underlying natural subsoil. Excavation of topsoil /peat removal which is required at off-road locations along the haul route may impact on any new sites, if present. Mitigation measures are proposed to alleviate any potential negative effects as a result of the groundworks.

Should new sites or features be present within the site (currently not visible on the surface) the impact is likely to be significant negative and permanent (i.e. the excavation by machinery would permanently remove the sites resulting in a significant negative impact).

Proposed Mitigation Measures

- Archaeological monitoring of any geotechnical / engineering trial pits or investigations along the off-road sections of the proposed construction access road and a report detailing the results of same.
- Archaeological monitoring of topsoil/peat removal of **all off-road sections** of the proposed route during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

The sites/features, if detected, during monitoring will be preserved by record (archaeologically excavated) or preserved in-situ (avoidance) and therefore a full record made of same. In this regard, the potential impact after the mitigation measures is likely to be slight.

Significance of Effects

The construction of the proposed construction access route to the wind farm could have a slight impact on sub-surface archaeological features, if present.

13.4.2.8.3 *Impact on water crossings*

Pre-Mitigation Impact

Three of the nine new water crossings are proposed as part of the new construction access road. Rivers, streams and their banks have a high level of archaeological potential. Sites adjacent to watercourses have been favoured since prehistoric times for their proximity to food sources (often represented by habitation sites, fulachta fiadh and middens. Rivers and streams also serve as routeways, defences and ritual sites and boundaries. River beds may also contain archaeological features associated with fording sites, early bridge crossings and milling activities such as mill races. The impact without mitigation measures is likely to be slight-moderate since only small sections of the watercourses are proposed to be impacted within the confines of the road corridors.

Proposed Mitigation Measures

A licensed metal detection survey of the watercourses that are proposed to be crossed will be undertaken. The metal detection survey could be undertaken concurrently during the construction stage monitoring in advance of any works to the rivers/streams. A report on the results should be submitted to the relevant authorities.

Archaeological monitoring of ground works during construction will be undertaken. A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.

Residual Impact

Residual Impacts after the mitigation measures have been implemented will be slight-not significant.

Significance of Effects

The significance of effects will be Slight - Not Significant

13.4.2.8.4 *Impact on Townland Boundaries*

Pre-Mitigation Impact

Townland boundaries along the construction access road are addressed in the Section 13.3.4.2 of the EIAR. There are a number of instances where the proposed new road footprint overlays townland boundaries. This will result in a direct impact to the townland boundaries where they survive, albeit, within the width of the proposed road corridor. The impact without mitigation measures is likely to be slight-moderate since only small sections of the boundaries are proposed to be removed where they survive.

Proposed Mitigation Measures

Preservation by record where relevant during construction stage monitoring at the following areas:

- Barraghmore/Dereens townland boundary
- Dereens / Drummanacappul
- Drummanacappul / Lisfuiltaghan
- Lisfuiltaghan / Tinnybeg
- Tinnybeg / Seltan
- Seltan / Bargowla
- Sheena / Derryboffin
- Letter / Derrycullinan
- Derrycullinan / Drummanacappul

Residual Impact

Residual Impacts after the mitigation measures have been implemented will be slight-not significant.

Significance of Effects

The significance of Effects will be slight-not significant.

13.4.3 Operational Phase Potential Impacts (Indirect)

Indirect impacts are where a feature or site of archaeological, architectural heritage merit or their setting is located in close proximity to a proposed development. Indirect impacts here are mainly concerned with impacts on setting. Impacts on settings of sites may arise when a development is proposed immediately adjacent to a recorded monument or cluster of monuments or any cultural heritage asset. While the Proposed Development may not physically impact on a site, it may alter the setting of a monument or group of monuments. There is no standardised industry-wide approach for assessing the degree of impact to the setting of a monument. Professional judgement and experience are utilised in the assessment of impacts on setting as well as Viewshed Analysis in ArcGIS online.

Potential operational impacts are discussed below according to each element of the proposed development. Those elements of the proposed development which are not capable of impacting on the visual setting of monuments include proposed roads, amenity trails, underground cables etc and those elements which are deemed to be more likely to impact on visual setting which include turbines and substation buildings are discussed below.

13.4.3.1 Impact of Proposed Turbines

13.4.3.1.1 *Impact on National Monuments in State Care*

A review of all National Monuments in State Care was undertaken as part of the assessment in order to ascertain any potential impacts on their setting as a result of the proposed development. No National Monuments are located within the EIAR site boundary and none are located within close proximity, the nearest Monument being located at 8.3km from turbine 2. These are detailed in Table 13-2 above.

Pre-Mitigation Impact

Creevlea Abbey: A site visit to the National Monument shows that the area in the direction of the windfarm (to the south-east) is heavily planted with trees. The distance, together with the intervening tree cover suggests that the impacts on the setting of the National Monument will be 'not significant'.

Gortlowan Motte: A site visit to the roadside adjacent to the National Monument shows that the area in the direction of the windfarm (to the south-east) is planted with trees and numerous boundaries. The distance, together with the intervening vegetation suggests that the impacts on the setting of the National Monument will be 'not significant'.

Castlelore Cashel: A site visit to the National Monument shows that the area in the direction of the windfarm (to the south-east) is planted with trees and numerous boundaries (Plate 13-4). The distance, together with the intervening vegetation suggests that the impacts on the setting of the National Monument will be 'not significant'.

Carrignagat Megalithic tomb: No public access to the megalithic tombs could located. A site visit to the nearest point on the public road suggests that any potential views may be obscured by vegetation. The distance, together with the natural intervening vegetation suggests that the impacts on the setting of the National Monument will be 'not significant'.

Heapstown Cairn: Viewshed analysis from this National Monument shows no visibility in the direction of the proposed turbines. Views from the adjacent public road shows that this large mound of stones is located to the rear of a small farmhouse and is surrounded by trees on all sides. Intervening topography is such that no visibility of the location of the proposed windfarm is possible from this location. The ZTV also suggests that no turbines would be visible from this location. In this regard the impacts on setting will not occur, therefore.

Moytirra Court Tomb: A site visit to the nearest publicly accessible point to the court tomb on the adjacent road shows that views in the direction of the wind farm are possible towards the north-east and therefore some visibility of turbines may occur. The distance, together with the intervening natural vegetation and topography suggests that the impacts on the setting of the National Monument will be 'not significant'.

Proposed Mitigation Measures

It is not possible to mitigate the potential indirect effects of turbines on National Monuments.

Residual Impact

The residual impact is considered to be 'Not Significant'

Significance of Effects

The significance of impacts does not change from the pre-mitigation impacts since it is not possible to mitigate the indirect effects of the turbines in the wider landscape setting. The significance of remains Not Significant.

13.4.3.1.2 *Impact on setting of Recorded Monuments within the EIAR boundary*

Pre-Mitigation Impact

No Recorded Monuments are located within the EIAR site boundary therefore impacts on the immediate setting of recorded monuments will not occur.

Proposed Mitigation Measures

Since no indirect effects on setting to any Recorded Monuments as a result of the proposed turbines were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction and erection of the proposed turbines will have no significant indirect effects on Recorded Monuments within the EIAR site boundary since none are located therein.

13.4.3.1.3 *Impact on Recorded Monuments within 5km*

Pre-Mitigation Impacts

Ninety-five monuments are located within 5km of the nearest proposed turbine and these are detailed above in

Table 13-3. Monuments within 5 kilometres of the proposed turbines are included here for purposes of assessing potential visual impacts in the wider landscape setting. No monuments are located within 1km of the nearest proposed turbines. Only one monument (1%) is located between 1 and 2km of the nearest proposed turbine. Eleven monuments (12%) are located between 2 and 3km with 38 monuments located between 3 and 4km representing 40%. The majority of monuments are located between 4 and 5km representing 47% of the total. The immediate setting of the recorded monuments will not be negatively impacted, therefore. Figure 13-10 demonstrates that the majority of the recorded monuments are located at a remove from the proposed turbines with a notable dearth of monuments within close proximity to the site. The ZTV shows that there will be no visibility from the large cluster of monuments to the south-west of the proposed windfarm. Visibility may be possible from north and north west with limited visibility from the north-east and east.

Potential impact on visual setting of the RMPs within 5km of the proposed development is considered to be slight (An effect which causes changes in the character of the environment which are not high or very high and do not directly impact or affect an archaeological site).

Proposed Mitigation Measures

It is not possible to mitigate the potential indirect effects of turbines on recorded monuments within 5km outside the EIAR site boundary.

Residual Impacts

The residual impact is considered to be 'Slight'

Significance of Effects

The significance of impacts does not change from the pre-mitigation impacts since it is not possible to mitigate the indirect effects of the turbines in the wider landscape setting. The significance of remains Slight.

13.4.3.1.4 *Impact of Turbines on setting of NIAH/RPS structures within the EIAR boundary*

Pre-Mitigation Impact

No built heritage structures which are subject to legal protection are located within the wind farm site boundary or immediately adjacent to same therefore no impacts will occur.

Proposed Mitigation Measures

Since no indirect effects on setting to any NIAH/RPS structure as a result of the proposed turbines were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction and erection of the proposed turbines will have no significant indirect effects on any RPS/NIAH structures.

13.4.3.1.5 *Impact of Turbines on setting of NIAH/RPS structures within 5km of the nearest proposed turbine*

Pre-Mitigation Impact

Seven structures on the NIAH/RPS are located within 5km of the nearest proposed turbine, the majority of which are located on the periphery of the 5km study area boundary. The distance of the proposed turbines from the structures is such that no direct impacts will occur. The setting of the buildings within Drumkeeran village does not extend beyond the urban limits of village itself. The ZTV suggests that 3 turbines may theoretically be visible from Drumkeeran but this is based on a bare landscape model with no vegetation or tree cover. Impacts are considered to be 'Not Significant'.

Proposed Mitigation Measures

It is not possible to mitigate the potential indirect effects of turbines on RPS/NIAH structures within 5km.

Residual Impacts

The residual impact is considered to be 'Not Significant'

Significance of Effects

The significance of impacts does not change from the pre-mitigation impacts since it is not possible to mitigate the indirect effects of the turbines in the wider landscape setting. The significance of remains 'Not Significant'.

13.4.4 Proposed New roads and Amenity Facilities

13.4.4.1.1 *Impacts on setting of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites*

Pre-Mitigation Impact

Proposed new roads and amenity facilities will not have any operational effects (visual impact) on any documented (or otherwise) cultural heritage assets. The nature of the new roads is such that they are not a visually dominant feature capable of any negative effects on setting in the landscape.

Operational Impacts will not occur as a result of new roads

Proposed Mitigation Measures

Since no indirect effects on setting to any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites as a result of the proposed new roads were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed new roads will have no significant indirect effects on any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites.

13.4.4.2 Proposed Borrow Pit and Peat Repository Areas

13.4.4.2.1 *Impacts on setting of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites*

Pre-Mitigation Impact

The borrow pit and peat repository areas, during the operational phase of the Proposed Development, will not impact on the immediate setting of any National Monuments, Recorded Monuments, Protected Structures or NIAH structures or any new constraints identified.

No Impacts will occur therefore.

Proposed Mitigation Measures

Since no indirect effects on setting to any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites as a result of the proposed borrow pit and peat repository were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed borrow pit will have no significant indirect effects on any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites.

13.4.4.3 Electricity Substation

13.4.4.3.1 *Impacts on setting of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites*

Pre-Mitigation Impact

The substation is located within the EIAR site boundary and as no National Monuments, Recorded Monuments, Protected Structures or NIAH structures are located therein, no impacts on setting are anticipated.

No Impacts will occur therefore.

Proposed Mitigation Measures

Since no indirect effects on setting to any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites as a result of the proposed substation were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed substation will have no significant indirect effects on any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites.

13.4.4.4 Temporary Construction Compounds

13.4.4.4.1 *Impacts on setting of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites*

Pre-Mitigation Impact

The proposed temporary compounds are located within the EIAR site boundary and as no National Monuments, Recorded Monuments, Protected Structures or NIAH structures are located therein, no

impacts on setting are anticipated. Furthermore, wider landscape setting will not be impacted by the proposed compounds.

No Impacts will occur therefore.

Proposed Mitigation Measures

Since no indirect effects on setting to any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites as a result of the proposed temporary compounds were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed temporary compounds will have no significant indirect effects on any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites.

13.4.4.5 Underground Grid Connection Cable Route

13.4.4.5.1 *Impacts on setting of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites*

Pre-Mitigation Impact

No National Monuments in State Care or Recorded Monuments are located along the proposed grid connection cable route. No known structures listed in the statutory list of Protected Structures are located along the proposed grid connection route. Furthermore, no structures listed in the NIAH are located along the route. Since the grid connection cable route is sub-surface, no operational effects will occur to any cultural heritage assets.

No Impacts will occur therefore.

Proposed Mitigation Measures

Since no indirect effects on setting to any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites as a result of the proposed Underground Grid Connection Cable Route were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed Underground Grid Connection Cable Route will have no significant indirect effects on any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites.

13.4.4.6 Proposed Access / Transport Delivery Route

13.4.4.6.1 *Impacts of on setting of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites*

Pre-Mitigation Impact

The haul route will be utilised to transport components for the wind farm and materials to and from the windfarm site and therefore it is not anticipated that the temporary use of this delivery route will negatively affect the setting of any cultural heritage asset assessed in this report.

No Impacts will occur therefore.

Proposed Mitigation Measures

Since no indirect effects on setting to any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites as a result of the proposed Access route or Haul route were identified, mitigation measures are not required.

Residual Impact

No residual impacts will occur.

Significance of Effects

The construction of the proposed Access Route / Haul Route will have no significant indirect effects on any of National Monuments, Recorded monuments, NIAH/RPS and Local Cultural heritage sites.

13.4.5 Operational Phase Potential Impacts (Direct)

In terms of archaeology, architecture and cultural heritage, since peat removal and groundworks would be complete, no direct effects will occur at the operational stage.

13.5 Cumulative Impacts

Cumulative impact is defined as 'The addition of many small impacts to create one larger, more significant, impact' (EPA 2002, 33). It is also defined as 'impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project' (EC 1999). Cumulative impacts encompass the combined effects of multiple developments or activities on a range of receptors. In this case the receptors are the archaeological monuments and architectural/cultural heritage sites in the immediate vicinity of the Proposed Development. Cumulative Impacts at the Construction and Operational Stages are considered.

13.5.1 Cumulative Impacts (Direct Impacts)

The addition of other projects to the proposed Croagh windfarm project was considered in order to assess Cumulative Impacts. These included all other windfarms in the vicinity, mainly within 10km of the proposed Croagh windfarm. There will be no direct impacts or direct cumulative impacts as a result of the proposed Croagh wind farm project since all potential direct effects are dealt with through mitigation to alleviate or remove the impact altogether. In this regard no direct cumulative impacts will occur.

13.5.2 Cumulative Impacts (Indirect Impact on Setting)

Cumulative impacts on setting are more likely to occur at the operational stage of the development (i.e. post-construction). In this regard in order to assess overall cumulative effects on archaeology and cultural heritage the proposed project is considered in the context of other developments, in particular other permitted and proposed wind farms as shown in Figure 13-23. This map shows the location of existing, permitted and proposed turbines within 20km of the proposed Croagh wind farm. It also shows that the current potential inter-visibility between monuments will not be impacted by the addition of the Croagh wind turbines to other existing, proposed and permitted turbines.

13.5.2.1 National Monuments

Creevlea Abbey: A site visit to the National Monument shows that the area in the direction of the proposed Croagh wind farm has good screening in the form of vegetation and trees. The distance, together with the intervening tree cover suggests that the impacts on the setting as a result of the Croagh turbines alone will be 'not significant'. Viewshed analysis from the monument suggests that the other permitted, existing and proposed turbines will have some level of visibility. In this regard when the Croagh windfarm is added to the other existing, proposed and permitted projects, the potential to see more turbines from the monument may result in a cumulative impact on setting in the wider landscape.

Gortlowan Motte: A site visit to the roadside adjacent to the National Monument shows that the area in the direction of the Croagh windfarm (to the south-east) is planted with trees and numerous boundaries. The distance, together with the intervening vegetation suggests that the impacts on the setting of the National Monument will be not significant. Viewshed analysis shows that only some of the Croagh and Garvagh/Glebe turbines may potentially be visible from the monument. No cumulative impacts would occur therefore.

Castlelore Cashel: A site visit to the National Monument shows that the area in the direction of the windfarm (to the south-east) is planted with trees and numerous boundaries (Plate 13-4). The distance, together with the intervening vegetation suggests that the impacts on the setting of the National Monument arising from the Croagh windfarm will be 'not significant'. Viewshed analysis from the monument suggests that the other permitted, existing and proposed turbines will have some level of visibility from the cashel. In this regard when the Croagh windfarm is added to the other existing, proposed and permitted projects, the potential to see more turbines from the monument may result in a cumulative impact on setting in the wider landscape.

Carrignagat Megalithic tomb: No public access to the megalithic tombs could located. A site visit to the nearest point on the public road suggests that any potential views may be obscured by vegetation. The distance, together with the natural intervening vegetation suggests that the impacts on the setting of the National Monument will be 'not significant'. Viewshed analysis from the monument suggests that the other permitted, existing and proposed turbines will have some level of visibility from the megalithic tomb. In this regard when the Croagh windfarm is added to the other existing, proposed and permitted projects, the potential to see more turbines from the monument may result in a cumulative impact on setting in the wider landscape.

Heapstown Cairn: Viewshed analysis from this National Monument shows no visibility in the direction of the proposed turbines. Views from the adjacent public road shows that this large mound of stones is located to the rear of a small farmhouse and is surrounded by trees on all sides. Intervening topography is such that no visibility of the location of the proposed windfarm is possible from this location. The ZTV also suggests that no turbines would be visible from this location. In this regard the impacts on setting will not occur therefore. The viewshed analysis carried out from the monument also shows that no other proposed, existing or permitted turbines are visible from this location. In this regard no cumulative impacts will occur.

Moytirra Court Tomb: A site visit to the nearest publicly accessible point to the court tomb on the adjacent road shows that views in the direction of the wind farm are possible towards the north-east and therefore some visibility of turbines may occur. The distance, together with the intervening natural vegetation and topography suggests that the impacts on the setting of the National Monument will be 'not significant'. Viewshed from Moytirra Court tomb shows that some permitted, proposed and existing turbines would have some visibility from the monument, mainly those to the south of the Croagh windfarm. In this regard when the Croagh windfarm is added to the other existing, proposed and permitted projects, the potential to see more turbines from the monument may result in a cumulative impact on setting in the wider landscape.

The Viewshed model and ZTVs are based on bare landscape without vegetation, tree cover, boundaries which in reality provide screening in the landscape. The above cumulative impacts are based on theoretical models and site visits and are therefore a worst-case scenario.

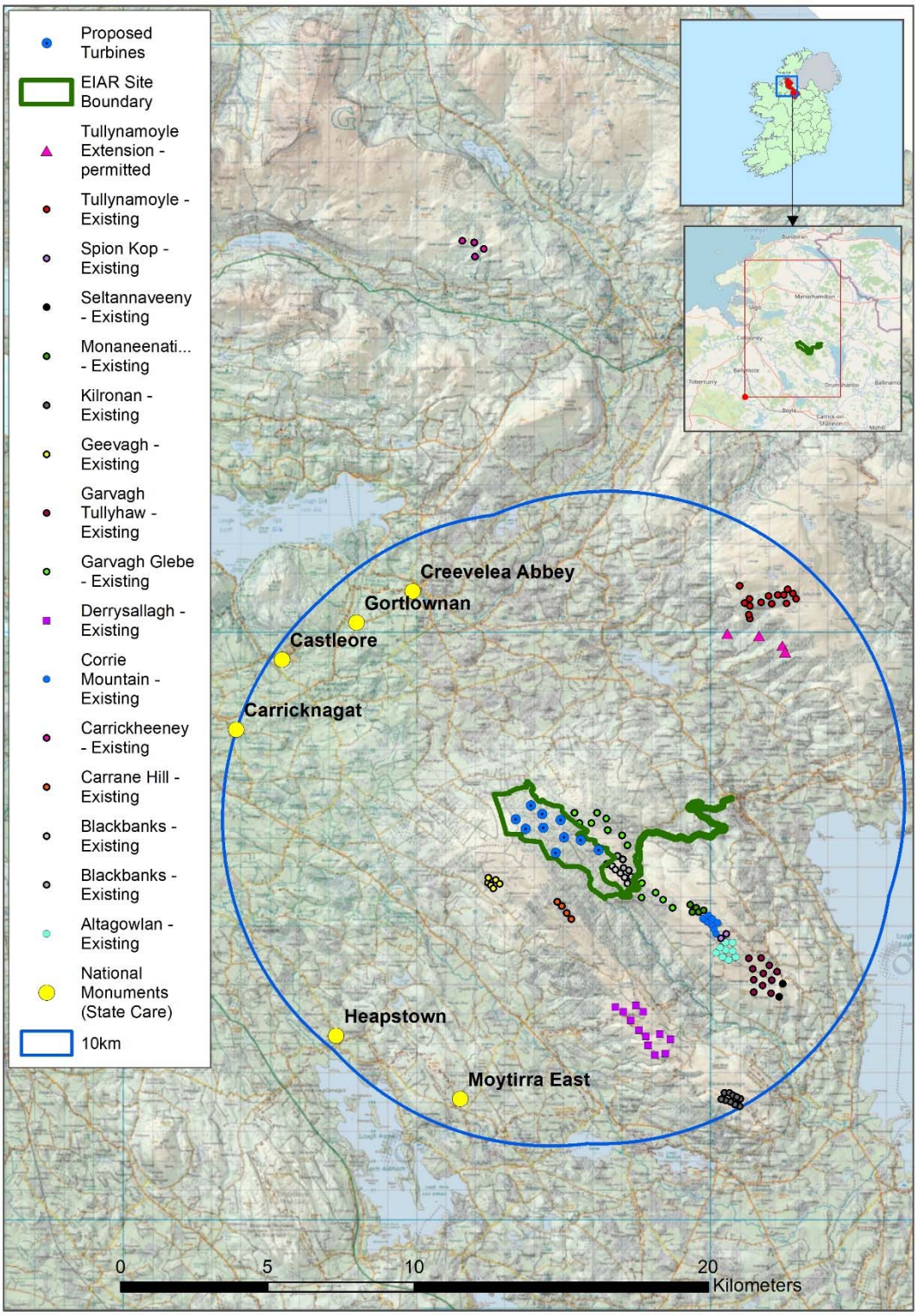


Figure 13-23 Additional projects considered when assessing cumulative impacts

13.5.3 Cultural Heritage Assets within 5km of the proposed Croagh turbines

The indirect effects on setting of RMPs and other cultural heritage sites within 5km of the proposed development has been addressed in this chapter of the EIAR. The ZTV shows that the area to the south-west of the proposed Croagh windfarm which contains a large cluster of recorded monuments will have no views towards any proposed turbines. This view will continue regardless of the addition of any other projects, therefore from this perspective, no cumulative impacts will occur. The ZTV shows that visibility of 9-10 Croagh turbines from the area of the RMPs and any other cultural heritage sites to the north and north-west is possible.

When the Croagh turbines are added to the other permitted, proposed and existing turbines, more turbines may be visible from various monuments within 5km of the windfarm. The ability to see an increased number of turbines will result in a cumulative impact on setting in the wider landscape. No significant cumulative impacts will occur however.

13.6 Decommissioning Phase

There will be no significant potential impacts on the archaeological, architectural and cultural heritage environment during the decommissioning of the development. Any potential direct impacts will already have been resolved through mitigation measures and the established access tracks will be used for the removal of the built features of the wind farm.

14. MATERIAL ASSETS

Material Assets are defined in the '*Advice Notes for Preparing Environmental Impact Statements'* (EPA, Draft 2015) as "*resources that are valued and that are intrinsic to specific places" and in the* 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, Draft 2017) *'*as "*built services and infrastructure. Traffic is included because in effect traffic consumes roads infrastructure*.' They may be either of human or natural origin. The cultural assets of Archaeology and Cultural Heritage are addressed in Chapter 13 of this Environmental Impact Assessment Report (EIAR). Economic assets of natural heritage include non-renewable resources such as minerals or soils, and renewable resources such as wind and water. These assets are addressed in Chapter 8: Land, Soils and Geology, Chapter 9: Hydrology and Hydrogeology, and Chapter 10: Air and Climate. Tourism and amenity resources, which are also considered material assets, are addressed in Chapter 5: Population and Human Health.

This chapter of the EIAR addresses the likely significant effects of the proposed development on transportation infrastructure (Section 14.1 Traffic and Transport) and on Telecommunications and Aviation (Section 14.2), which are economic assets of human origin. This chapter of the EIAR has been prepared in accordance with the requirements of the EIA legislation and guidance outlined in Chapter 1: Introduction.

14.1 Traffic and Transport

14.1.1 Introduction

14.1.1.1 Background and Objectives

The purpose of this section is to assess the effects, on roads and traffic, of the traffic movements that will be generated during the construction, operational and decommissioning phases of the proposed Croagh Wind Farm development.

For developments of this nature, the construction phase is the critical period with respect to the traffic effects experienced on the surrounding road network, in terms of both the additional traffic volumes that will be generated on the road network, and the geometric requirements of the abnormally large loads associated with the delivery of wind turbine components. The requirements of the additional traffic and abnormal sized loads generated during the construction stage were assessed on both the external road network and at the junctions of the proposed road that will provide access to the site.

It should be noted that abnormal weight loads are not a feature of the turbine delivery vehicles, they are abnormal in size only. All construction and delivery vehicles for the proposed development will be subject to the standard axle weight requirements set out under Road Traffic (Construction and Use of Vehicles) Regulations 2003 (S.I. No. 5 of 2003)and therefore the loadings from construction traffic will not exceed the relevant standards. Notwithstanding the need to use some specialist vehicles to facilitate turbine delivery, it should be noted that the number of load-bearing axles for any specialist vehicles carrying large loads are designed to ensure that the load on any one axle does not exceed acceptable load bearing statutory limits. Therefore, the structural integrity of the national and regional road network used during the construction of the proposed development is adequate to provide for these accepted loads.

The magnitude of the increase in traffic volumes experienced on the surrounding network is identified during the various construction stages of the proposed development. Traffic management measures are also provided in Sections 14.1.7 and 14.1.10.6 aimed at minimising the traffic impact on the local highway network. Refer also to Appendix 14-2 for the Outline Traffic Management Plan (TMP).

14.1.1.2 Statement of Authority

This section of the EIAR has been prepared by Alan Lipscombe of Alan Lipscombe Traffic and Transport Consultants Ltd. Alan is a competent expert in traffic and transport assessments. In 2007 Alan set up a traffic and transportation consultancy providing advice for a range of clients in the private and public sectors. Prior to this Alan was a founding member of Colin Buchanan's Galway office having moved there as the senior transportation engineer for the Galway Land Use and Transportation Study. Since the completion of that study in 1999, Alan has worked throughout the West of Ireland on a range of projects including: major development schemes, the Galway City Outer Bypass, Limerick Planning Land-Use and Transportation Study, Limerick Southern Ring Road Phase II, cost benefit analyses (COBA) and various studies for the NUI Galway. Before moving to Galway in 1997, Alan was involved in a wide variety of traffic and transport studies for CBP throughout the UK, Malta and Indonesia. He has particular expertise in the assessment of development related traffic, including many wind farm developments including the following; Ardderoo, Derryadd, Derrinlough, Knocknamork, Shehy More, Cloncreen, Derrykillew, Coole, Ballyhorgan, Cahermurphy, Lettergull, Barnadivane, Cleanrath and Knocknalough .

Alan has a BEng (hons) Degree in Transportation Engineering (Napier University, Edinburgh, 1989), is a member of Engineers Ireland and of the Institute of Highways and Transportation and is a TII accredited Road Safety Audit Team Member.

14.1.1.3 Guidance and Legislation

This section has been completed in accordance with the guidance set out in Chapter 1 of this EIAR. The assessment uses standard terminology to describe the likely significant effects associated with the proposed development. Further information on the classification of effects used in this assessment is presented in Section 1.8 of this EIAR.

14.1.1.4 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as outlined in Sections 2.6 and 2.7of Chapter 2 of the EIAR, and summarised below.

Transport Infrastructure Ireland

Transport Infrastructure Ireland (TII) responded to Scoping on the 23rd January 2019 in which it provided a list of recommendations to be followed when preparing the EIAR. All relevant TII guidelines and policies have been taken into account in the preparation of this assessment, including the following;

- PE-PDV-02045, Transport Assessment Guidelines, Transport Infrastructure Ireland, May 2014
- PE-PAG-02017, Project Appraisal Guidelines, Unit 5.3, Travel Demand Projections, Transport Infrastructure Ireland, May 2019
- DN-GEO-03060, Geometric Design of junctions, Transport Infrastructure Ireland, April 2017
- TII Automatic Traffic Count Data, N4, N16 2019,

Sligo and Leitrim County Councils

Turbine delivery and potential routes were discussed with both Leitrim and Sligo County Council during pre-planning meetings. No issues were raised by either local authority during the consultation process.

14.1.1.5 Methodology and Section Structure

The traffic and transport assessment takes cognisance of guidance for such assessments set out by Transport Infrastructure Ireland (TII), in the document PE-PDV-02045 '*Traffic and Transport Assessment Guidelines'*, (TII, 2014). The geometric requirements of the turbine delivery vehicles were assessed using Autocad and Autotrack.

The Traffic and Transport Section of this chapter is set out as follows:

- A review of the existing and future transport infrastructure in the vicinity of the proposed development, including an assessment of 2019 traffic flows and traffic forecasts during an assumed construction year of 2024 (Sections 14.1.2 - Receiving Environment and 14.1.3 – Existing Traffic Volumes).
- A description of the nature of the proposed development and the traffic volumes that it will generate during the different construction stages and when it is operational (Section 14.1.4 – Proposed Development and Traffic Generation).
- A description of the abnormally sized large loads and vehicles that will require access to the site (Section 14.1.5 – Construction Traffic Design Vehicles).
- A review of the effects of development generated traffic on links and junctions during construction and when the facility is operational (Section 14.1.6 –Traffic effects during construction and during operation).
- Identification of traffic management for large deliveries during construction (Section 14.1.7 – Traffic Management for Large Deliveries).
- A geometric assessment of the route and its capacity to accommodate the abnormal-sized loads associated with the development (Section 14.1.8 – Route Assessment).
- An assessment of the provision for sustainable modes of travel (in this case primarily with respect to the transport of construction staff) (Section 14.1.9 – Provision for Sustainable Modes of Travel).

The description of likely significant effects on the public road network is provided in Section 14.1.10.

14.1.2 Receiving Environment

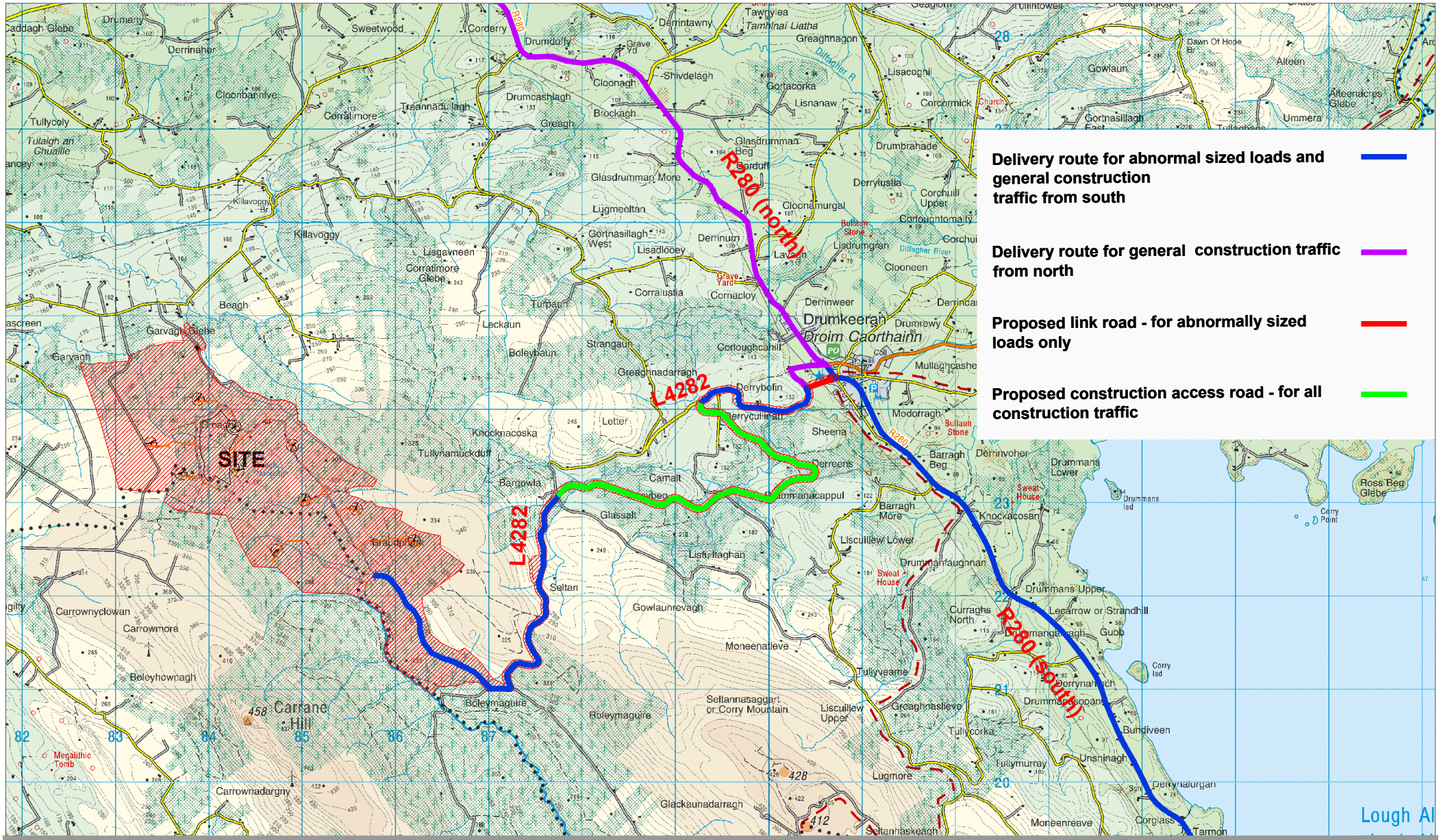
14.1.2.1 Site Location

The Proposed Development, known as Crough Wind Farm, is located in both Co. Leitrim and Co. Sligo, in the townlands listed in Table 1-1 of Chapter 1: Introduction.

The closest settlement to the EIAR site boundary is Drumkeeran, Co Leitrim, which is located adjacent to the eastern extremity of the study area. Other settlements in the area include Dromahair, Co Leitrim (c. 7.3km northwest), Drumshambo, Co. Leitrim (c. 14.3km southeast) and Ballyfarnan, Co. Roscommon (c. 7.2km south). The site location is shown on Figure 1-1 of the EIAR.

14.1.2.2 Proposed Abnormal Size Load Delivery Route

A detailed assessment of the transport route for the abnormally large vehicles was made from a point at which the route turns left off the R280 Regional Road at the southern side of Drumkeeran onto a new link road built for the purpose of providing access to the proposed site for abnormally sized vehicles. The route is shown in Figure 14-1 and is discussed in detail in Section 14.1.8. The delivery route for the abnormal loads will be assessed further afield, from the port of arrival to the R280 south of Drumkeeran, by the delivery company prior to construction. The likely delivery route from the port of Dublin is set out in Section 4.4.2.



NOTES:

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Base mapping provided by MKO

Figure 14.1 Site location and delivery route

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	NTS
PROJECT NO: 7410	DATE: 30.06.20	DRAWN BY:	AL

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TRAFFIC & TRANSPORT CONSULTANTS

The route assessment includes locations 1 to 13 on the access route shown on Figure 14-2a, including the left turn on the R280 approaching Drumkeeran (location 1) followed by the turnoff from the R280 in Drumkeeran village into an existing farmyard where the route passes through an existing shed that will be partially demolished. A new link road approximately 260 metres in length will be constructed through the farmyard to link the R280 to the existing L-4282 at Derryboffin (locations 2 and 3). The route then travels west on the L-4282 for approximately 1.5 kms before turning left onto the proposed construction access road at Derrycullinan (location 5). The proposed construction access road is approximately 4.6 kms long and comprises sections of upgraded forestry road and sections of new road and links back into the L-4282 by means of a new junction at Bargowla (location 6). From there the route follows the L-4282 south for approximately 2.5 kms before heading northwest for approximately 2 kms (locations 7 to 12) to the main site access junction (location 13).

It is noted that the proposed link road passing through the farmyard linking the R280 in the village of Drumkeeran with the L-4282 will be used solely for the purposed of the delivery of abnormally sized loads to the site. All of these deliveries will be made using Garda Siochana escorts and local transient traffic management measures put in place by the haulage company. The link road will be closed at all other times.

14.1.2.3 Proposed Construction Traffic Haul Route

From Drumkeeran the delivery route for general construction traffic, including deliveries and site staff, will be as described previously for abnormally sized loads, with the exception that from Drumkeeran access will be gained from the existing L-4282 at its junction with the R280 and R200, as shown in Figures 14-1 and 14-2a.

From further afield the delivery route for general heavy goods vehicle (HGV) construction traffic may vary depending on the location of the suppliers used for concrete and other materials required to construct the proposed development. Based on the location of suppliers in the vicinity of the Proposed Development, it is estimated that the following proportion of concrete and general construction traffic will travel on the following links;

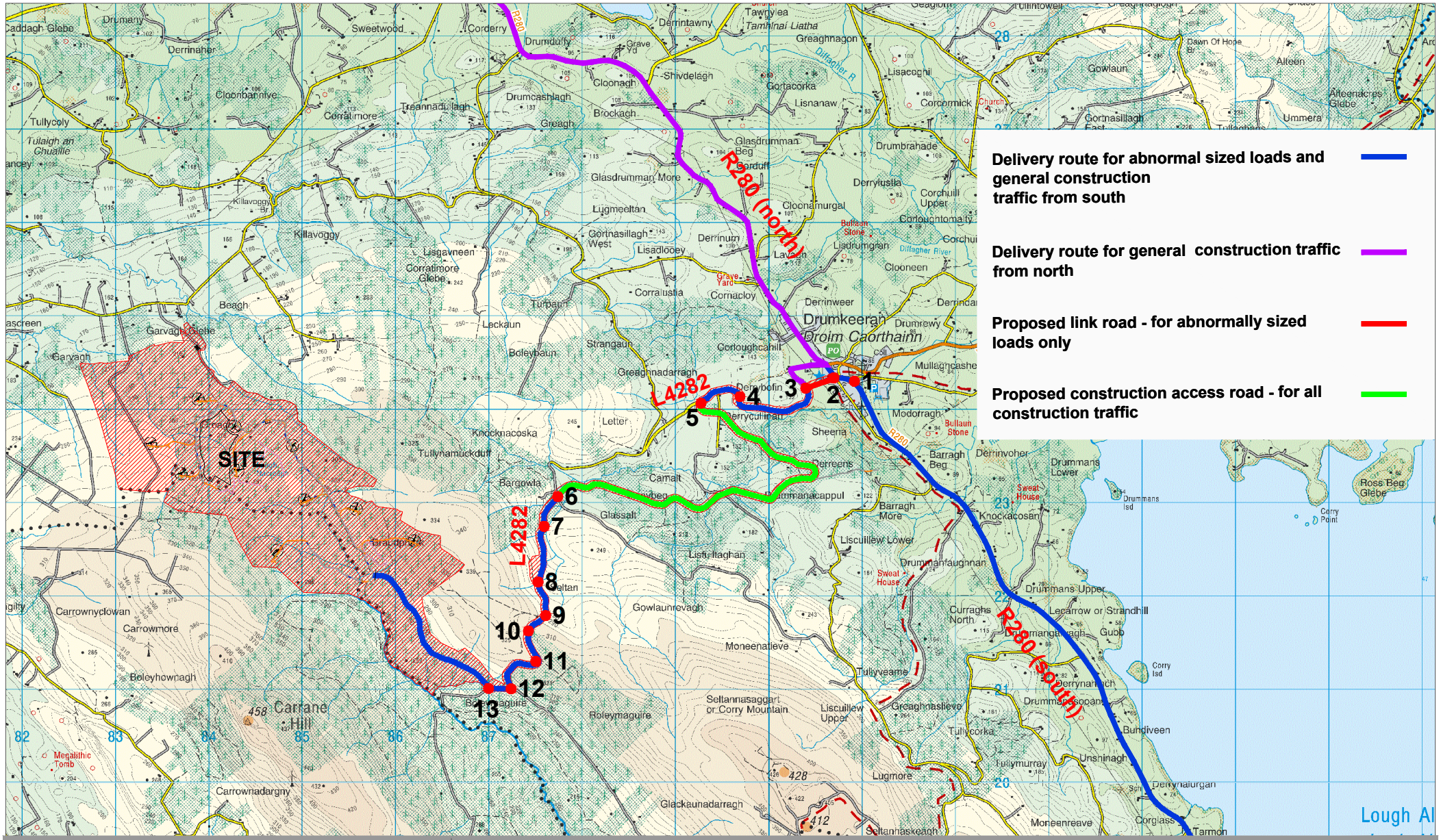
Concrete

- It is not confirmed at this stage where the concrete required for the turbine foundations will be transported from. A worst case scenario based on all traffic approaching the site from the north via the N16 and/or R280 followed by the existing L-4282 and proposed construction access road to the site, or all from the south via the N4 and/or R280, followed by the new proposed construction access road, was therefore tested.

General construction materials

- Similarly, it is not confirmed at this stage where the stone and general construction materials will be transported from. Again a worst case scenario based on all traffic approaching the site from the north via the N16 and/or R280 followed by the existing L-4282 and construction access road to the site, or all from the south via the N4 and/or R280, followed by the L-4282 and new proposed construction access road was tested,

It is noted that while the N16 to the north and the N4 to the south are included in the assessment in order to test a worst case scenario, it is likely in reality that the concrete and stone required during construction, which accounts for over 60% of all deliveries made to the site, will originate from suppliers closer to the proposed site and will therefore not impact on these roads.



NOTES:

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Base mapping provided by MKO

Figure 14.2a Route assessment location plan

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	NTS
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

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TRAFFIC & TRANSPORT CONSULTANTS

All wind turbine deliveries (abnormally sized loads and other components delivered using standard HGVs)

- All will travel to the site from the south via the N4 and R280 followed by the L-4282 and new proposed access road.

The construction of the proposed link road and the construction access road ensures that all wind turbine loads and all other materials delivered to the site will not require to travel on the section of the L-4282 between locations 5 and 6 on which existing residences are situated.

The assessment presented in this section of the EIAR is based on these conservative scenarios.

14.1.2.4 Site Entrance

There is one site entrance proposed for the construction stage of the development in order to transport turbine components, materials and equipment to the site, and it is via the western section of the L-4282 and the existing forestry road that currently accesses the site located in the townland of Boleymaguire at location 13. It is noted that the existing L-4282 provides for up to 100 two-way HGV's for the purpose of tree felling, agriculture and general construction, as observed during a traffic survey discussed subsequently in this Section.

In addition to the proposed new link road and construction access road, upgrade works will be required along the existing L-4282, in the townland of Seltan, in order to accommodate access and egress of turbine delivery and construction vehicles. Following the construction phase of the proposed development, the boundary between the proposed construction access road and the R280 to the east and the L-4282 to the west will be reinstated by erecting fencing. It is noted, however, that they may need to be reopened temporarily during the lifetime of the development should replacement blades or other abnormal loads be required to be delivered to the site.

During the operational stage, access to the amenity carpark will be via the L-8282 local road and existing forestry track that currently provides access to the site from the north, and is separate from the construction delivery routes proposed. The route will not require any upgrade to accommodate amenity traffic. Further information on the proposed amenity elements associated with the proposed development is outlined in Chapter 4 of this EIAR.

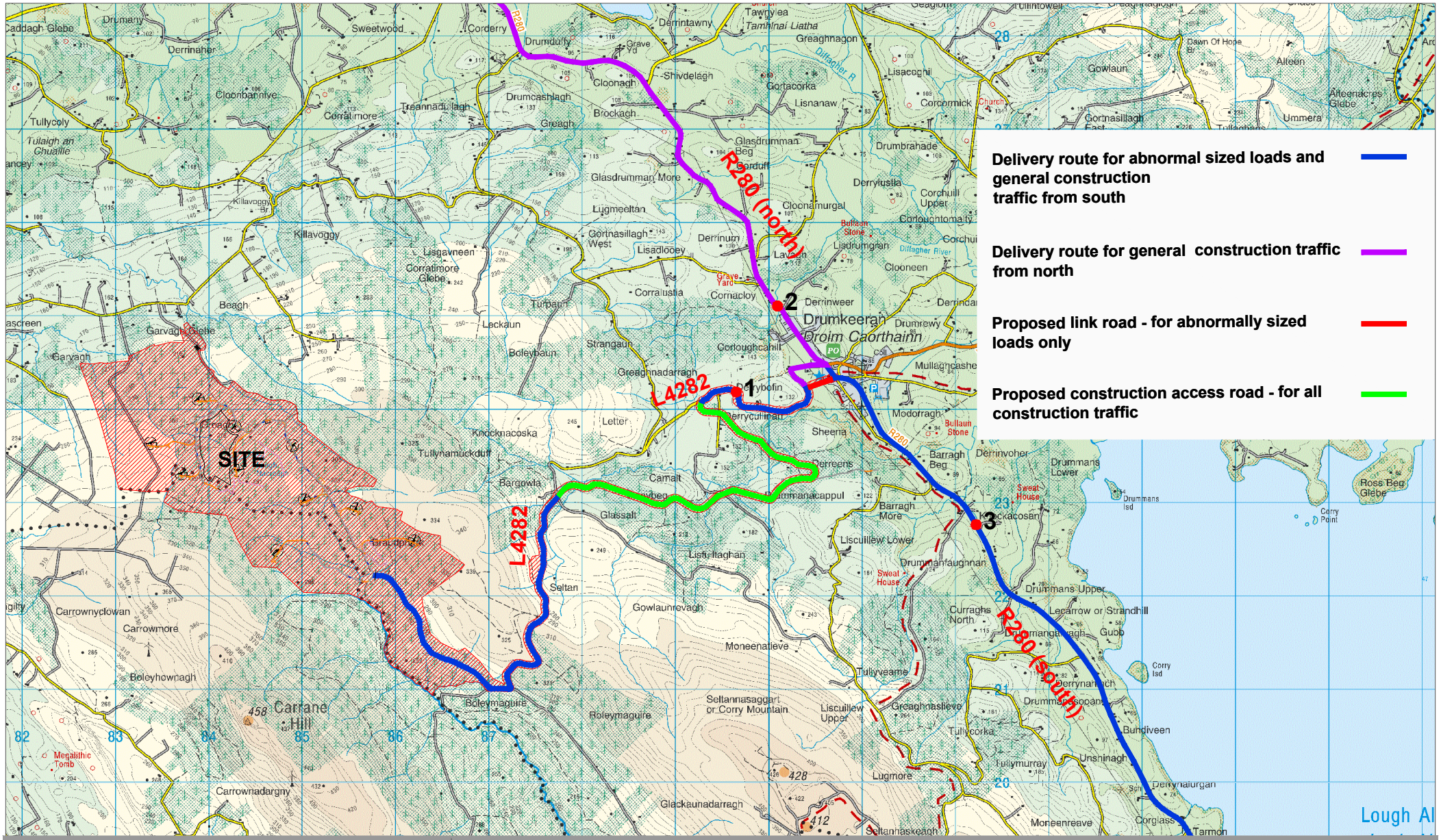
14.1.3 Existing Traffic Volumes

It should be noted that traffic volumes are discussed in terms of vehicles and passenger car units, or PCUs, where each vehicle is expressed in terms of its demand on the network relative to the equivalent number of cars or light goods vehicles (LGV). For example, an articulated HGV was given a factor of 2.4 passenger car units (as per TII Project Appraisal Guidelines for National Roads Unit 5.2), while one of the extended loaders required to transport the wind turbine equipment was assigned a value of 10 PCUs.

14.1.3.1 Background Traffic Flows

The link count locations included in the assessment are shown in Figure 14-2b.

Continuous traffic counters are maintained by TII on the N4 to the east of Carrick-on-Shannon and on the N16 to the west of Belcoo. Traffic data from these sites, together with all day classified counts undertaken at locations in close proximity to the proposed development site, on the R280, at the location of the proposed access junction south of Drumkeeran (also applied to the R280 north of the village), and on the L-4282, to the west of Drumkeeran, were used to provide background traffic volumes on the local public road network. The classified counts were undertaken by Traffinomics Ltd on Wednesday 25th September 2019.



NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Base mapping provided by MKO

Figure 14.2b Link count locations

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coillte	SCALE:	NTS
PROJECT NO: 7410	DATE: 26.06.20	DRAWN BY:	AL

ALAN LIPSCOMBE
TRAFFIC & TRANSPORT CONSULTANTS

Base year 2019 traffic volumes for the link locations shown in Figures 14-2b range from 7,546 vehicles per day on the N4 to the east of Carrick-on-Shannon to 2,781 vehicles on the N16 west of Belcoo and 1,879 vehicles on the R280 south of Drumkeeran, down to 156 vehicles per day on the L-4282 west of Drumkeeran.

Table 14-1 Observed all day flows, year 2019 (2-way vehicles)

Link	2019
1 L-4282	156
2 R280 north	1,879
3 R280 south	1,879
4 N4 east of Carrick-on-Shannon	7,546
5 N16 west of Belcoo	2,781

14.1.3.2 Future Background Traffic Volumes

This section describes the process adopted to produce background traffic forecasts for an assumed construction year of 2024.

Revised guidelines for forecasting annual growth in traffic volumes were produced by TII in May 2019, as set out by county in the 'Project Appraisal Guidelines for National Roads (Unit 5.3)'. The annual growth rates for light vehicles for Co. Leitrim, and factors for the years relevant to this study, are shown in Table 14-2 and Table 14-3. Traffic volumes are forecast to increase during the period from 2019 (the observed traffic count year) to 2024 (the assumed construction year) by 3.0%, assuming a medium growth scenario. All day traffic flows, for the years 2019 and 2024, on the study area network are compared in Table 14-4.

It should be noted that while the assumed construction year of 2024 may vary slightly, this will not alter the forecast outcomes and effects presented in this section of the EIAR. This is due to the annual growth rate for background traffic being just 0.6% (as shown in Table 14-2) and the traffic volumes generated by the Proposed Development will remain unchanged regardless of construction year, as presented subsequently in Section 14.1.4.

Table 14-2 TII Traffic Growth Annual Factors and Indices for County Leitrim

Year	Lights – Annual Factor			Lights (Cars and LGVs) – Cumulative Index		
	Low	Medium	High	Low	Medium	High
2019	1.0044	1.006	1.009	1.000	1.000	1.000
2020	1.0044	1.006	1.009	1.004	1.006	1.009
2021	1.0044	1.006	1.009	1.009	1.012	1.018
2022	1.0044	1.006	1.009	1.013	1.018	1.027
2023	1.0044	1.006	1.009	1.018	1.024	1.036
2024	1.0044	1.006	1.009	1.022	1.030	1.046

Source: TII Project Appraisal Guidelines – Unit 5.3, May 2019

Table 14-3 TII traffic growth rates by growth scenario

Period	New Factors		
	Low	Medium	High
2019 – 2024	1.022	1.030	1.046

Table 14-4 Average all day flows by location and year (2-way vehicles)

Link	2019	2024
1 L-4282	156	161
2 R280 north	1,879	1,935
3 R280 south	1,879	1,935
4 N4 east of Carrick-on-Shannon	7,546	7,772
5 N16 west of Belcoo	2,781	2,864

The TII traffic count data recorded on the N4 and N16, and the classified counts undertaken on the R280 and L-4282 were also used to determine the existing percentage of HGVs on the study area network. The observed percentage of HGVs was observed to vary from 5.1% on the R280 approaching Drumkeeran from the south, 6.3% on the N4, up to 25.0% on the L-4282 to the west of the village. Traffic volumes forecast on the study network for the year 2024 are shown by vehicle type in Table 14-5.

Table 14-5 All day flows, percentage HGVs and flows by vehicle type, year 2024

Link	All day flow (vehs)	% HGV's	Vehicles		PCUs		
			HGVs	Cars / lgvs	HGVs	Cars / lgvs	Total
1 L-4282	161	25.0%	40	121	96	121	217
2 R280 north	1,935	5.1%	99	1,837	237	1,837	2,074
3 R280 south	1,935	5.1%	99	1,837	237	1,837	2,074
4 N4 east of Carrick-on-Shannon	7,772	6.3%	490	7,283	1,175	7,283	8,458
5 N16 west of Belcoo	2,864	5.8%	166	2,698	399	2,698	3,097

14.1.4 Proposed Development and Traffic Generation

14.1.4.1 Development Trip Generation – During Construction

The assessment of the effects of traffic generated during the construction of the proposed development is considered in two stages.

- Stage 1 – Site preparation and groundworks, construction of turbine foundations, cabling, met mast foundations, substation construction, construction of compound and tree felling, and,
- Stage 2 – Turbine component delivery and construction.

For the purpose of the traffic impact assessment, projections based on typical wind farm construction projects regarding the length of the construction phases and work periods etc. must be made to inform the assessment. These projections allow for a worst-case scenario assessment but should not be inferred as prescriptive limitations to the construction phase. There are numerous variables which can affect a construction project programme such as weather for example. The construction phase of the proposed development will be carried out in accordance with the CEMP, which is submitted as Appendix 4.3 of this EIAR.

The construction phase of the proposed development is expected to last approximately 12 months (1 year). While this could increase to 18 months, 12 months was assumed for the purpose of this assessment in order to test the worst-case scenario.

14.1.4.1.1 *Stage 1 – Site Preparation and Ground Works*

For assessment purposes a standard 255 working days per annum was adopted for the 12 month construction period for the site preparation and ground works stage with the total numbers of deliveries made to the site during that period shown in Table 14-6.

During this construction phase, there will be two distinct types of days with respect to trip generation. A total of 10 days will be used to pour the 10 concrete wind turbine foundations. Foundations will likely be poured one per day, with an estimated 75 concrete loads required for each turbine foundation delivered to the site over a 12-hour period. This will result in just over 6 HGV trips to and from the site

per hour. On the remaining 245 working days for this stage, other general materials will be delivered to the site.

During all of Stage 1, based on trip rates typical of wind farm projects, it is estimated that 3,218 two-way trips will be made to the site by trucks and large articulated HGVs, as set out in Table 14-6, with the daily effect on the local road network shown in Table 14-7 and 14-8. The figures show that on the 10 days that concrete will be delivered to the site an additional 360 two-way PCUs will be added to the network (comprising 75 two-way HGV trips or 150 movements, with 2.4 PCUs per movement), as shown in Table 14-7. Similarly, on the 245 days when other materials will be delivered to the site, traffic volumes on the local network are forecast to increase by an average 48 two-way PCUs, as set out in Table 14-8.

Table 14-6 Stage 1 – Site preparation and groundworks – total movements

Material	Total no. Truck Loads	Truck type
Concrete	750	Trucks
Concrete blinding and steel	110	Large artic
Plant / fencing / compound set-up	24	Large artic
Forestry felling	540	Large artic
Crushed rock and stone	1,364	Large artic
Ducting / cabling	294	Large artic
Grid cable laying	25	Large artic
Cranes	11	Large artic
Substation components	79	Large artic
Refuelling / maintenance / misc	22	Large artic
Total	**3,218**	

Table 14-7 Stage 1 – Concrete foundation pouring – total movements and volumes per delivery day

Material	Total Truck Loads	Truck type	PCU Value	Total PCUs	PCU Movements /day*	2- way PCUs/day
Concrete	750	Truck	2.4	1,800	180.0	360.0
* Estimation based on 10 concrete pouring days						

Table 14-8 Stage 1 – Site preparation and groundworks – total movements and volumes per delivery day

Material	Total Truck Loads	Truck type	PCU Value	Total PCUs	PCU Movements /day*	2- way PCUs/day
Concrete blinding and steel	110	Large artic	2.4	263	1.1	2.1
Plant / fencing / compound set-up	24	Large artic	2.4	57	0.2	0.5
Forestry felling	540	Large artic	2.4	1,296	5.3	10.6
Crushed rock and stone	1,364	Large artic	2.4	3,273	13.4	26.7
Ducting / cabling	294	Large artic	2.4	706	2.9	5.8
Grid cable laying	25	Large artic	2.4	60	0.2	0.5
Cranes	11	Large artic	2.4	26	0.1	0.2
Substation components	79	Large artic	2.4	190	0.8	1.5
Refuelling / maintenance / waste collection / misc.	22	Large artic	2.4	52	0.2	0.4
Total	2,468			5,923	24.2	48.4
* Estimation based on ground work period of 245 working days						

14.1.4.1.2 *Stage 2 – Turbine Construction*

During the turbine construction stage, including delivery and assembly, some deliveries to the site will be made by abnormally large vehicles, referred to in this section as extended artics, transporting the component parts of the turbines (nacelles, blades and towers). There will also be deliveries made by normal large HGVs, transporting cables, tools and smaller component parts. The types of load and associated numbers of trips made to the site during the turbine construction period are shown in Table 14-9, which summarises that a total of 90 trips will be made to and from the site by extended artics, with a further 40 trips made by conventional large articulated HGVs.

Table 14-9 Stage 2 – Wind turbine plant – total movements

Material	Units	Quantity per Unit	Total Quantity	Quantity per Truck	Total Truck Loads	Truck type
Nacelle	10	1	10	1	10	Extended Artic
Blades	10	3	30	1	30	Extended Artic
Towers	10	5	50	1	50	Extended Artic
Sub total					***90***	
Transformer	10	1	10	1	10	Large Artic
Drive train and blade hub	10	1	10	1	10	Large Artic
Base and other deliveries	10	2	20	1	20	Large Artic
Sub total					***40***	
Total					**130**	

For the purpose of this assessment a delivery period based on previous constructed wind farm sites already constructed, is provided although this may be subject to change. It is assumed that the turbine delivery element will progress at the rate of 5 extended artic trips made by convoy to the site on 2 days per week, resulting in this stage taking approximately 18 days/nights spread over a 10-week period. On a further two days per week, lasting for approximately 11 weeks, the remaining equipment required during this phase will be delivered to the site. The additional traffic movements for these 2 types of days are summarised in Table 14-10 and Table 14-11. In Table 14-10, a PCU equivalent value of 10 was allocated to each extended artic movement, resulting in an additional 100 PCUs on the study network on these 2 days per week, while an additional 14.4 PCUs are forecast to be on the network on two other days per week, as shown in Table 14-11, during the turbine construction phase.

Table 14-10 Stage 2 – Wind turbine plant, extended artics – total movements and volumes per delivery day

Material	Units	Truck Type	PCU Value	Total PCUs	2-way PCUs/ day
Nacelle	1	Extended Artic	10	10.0	20.0
Blades	3	Extended Artic	10	30.0	60.0
Towers	5	Extended Artic	10	50.0	100.0

Material	Units	Truck Type	PCU Value	Total PCUs	2-way PCUs/ day
Total per turbine	9			90.0	180.0
Total per delivery day	5			50.0	100.0
* Based on 5 abnormal sized loads being delivered per day on 2 days per week (total 90 loads will take 18 nights spread over 9 weeks)					

Table 14-11 Stage 2 - Wind turbine plant, normal artic HGVs - total movements and volumes per delivery day

Material	Quantity per Unit	PCU Value	2-way PCUs / day
Transformer	1	2.4	4.8
Drive train and blade hub	1	2.4	4.8
Base & other deliveries	1	2.4	4.8
Total	3		14.4
* based on equipment for 2 turbines being moved per week spread over 2 days			

14.1.4.1.3 *Construction Employee Traffic*

It is estimated that a maximum of 80 staff members will be employed on the site at any one time during the site preparation and groundworks stage of construction, reducing to a maximum of 40staff at any one time during the turbine construction stage. If a worst case is assumed that all staff will travel to / from the site by car, at an average of 2 persons per car, then a total of 80 PCU movements (each trip is two way) will be added to the network during the groundworks stage of the development, reducing to 40 pcu trips during the turbine construction stage.

14.1.4.2 Development Trip Generation – During Operation

It is assumed that the wind farm will be unmanned once operational and will be remotely monitored. Traffic associated with the operational phase of the wind farm will be from the wind farm developers, Eirgrid personnel visiting the substation, and maintenance personnel who will visit individual turbines.

It is estimated that the traffic volumes that will be generated by the development once it is operational will be minimal. The site will be unmanned but will generate maintenance trips, with approximately two maintenance staff travelling to site at any one time. The impact on the network of these trips during the operational stage is discussed in Section 14.1.6.

Once operational the site will also be open to visitors for amenity purposes, with those travelling by car using the carpark provided and accessed via the existing local road network to the north of the site. Based on visitors to existing wind farm sites it is forecast that up to 40 car trips per day will be generated by this use.

14.1.5 Construction Traffic Design Vehicles

14.1.5.1 Construction Traffic Vehicle Types

The delivery of turbine components including blades, tower sections and nacelles is a specialist operation due to the oversized loads involved. The blades are the longest turbine component and in the case of the Proposed Development blades up to 70m long have been considered for the purpose of this assessment.

The actual turbine to be installed on the site will be the subject of a competitive tender process, and could include turbines not amongst those originally considered as part of this assessment because they are not yet available on the market. The worst case scenario of a blade length of 70m has been assessed regardless of the make or model of the turbine eventually selected for installation on site. Aa confirmatory delivery assessment and program will be carried out by the turbine delivery company to ensure the findings of this assessment remain valid for whatever model of turbine is selected.

For the purpose of the assessment set out in this EIAR, it is assumed that the blades, which are the largest turbine components, will be transported using a standard extended arctic. As this method involves transporting the blade in a horizontal position it represents the worst case in terms of the geometric requirements on the road network. It is noted, however, that during the delivery phase consideration will be given to using alternative transportation technologies, including the use of scissor lift adaptors which raise the rear of the blade over existing obstructions, and in extreme cases, the use of blade lift adaptors that can transport blades at an angle to both lift the rear of the blade and shorten the wheelbase of the transporter.

The key dimensions of the vehicles tested are as follows:

Transport of Blades – Super Wing Carrier with blade

Total length	76.0 m
Length of blade	70.0 m
Inner radius	28.0 m

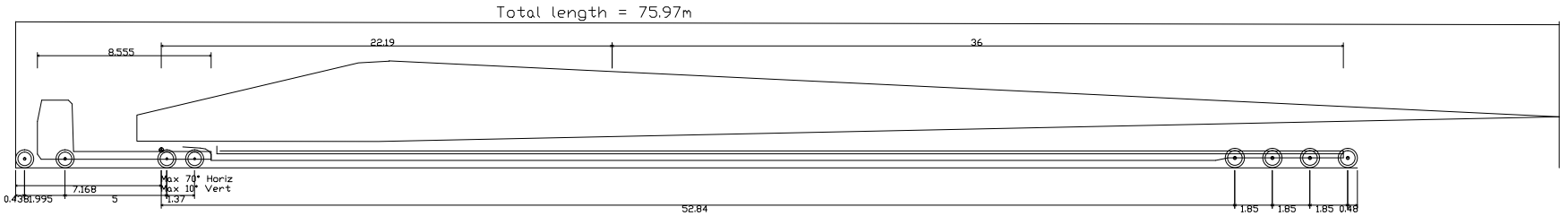
Transport of Tower – Using low-bed or drop deck trailers

Total length (with load)	49.6 m
Length of load	30.0 m
Inner radius	25.0 m

The critical vehicles in terms of size and turning geometry requirements, and used in the detailed route assessment discussed in Section 14.1.8 are the blade and tower transporters. The geometry of the design vehicles are included as Figures 14-4 and 14-5.

The vehicles used to transport the nacelles will be shorter in length compared to the blade and tower transporters.

All other vehicles requiring access to the site will be standard HGVs and will be significantly smaller than the design test vehicles.



70.0 m blade	
Overall Length	75.97m
Overall Width	2.550m
Overall Body Height	4.800m
Min Body Ground Clearance	0.375m
Track Width	2.500m
Lock to Lock Time	6.00s
Wall to Wall Turning Radius	9.800m

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14.4 Design blade extended artic profile (70m blade)

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coilte	SCALE:	NTS
PROJECT NO: 7410	DATE: 03.04.20	DRAWN BY:	AL

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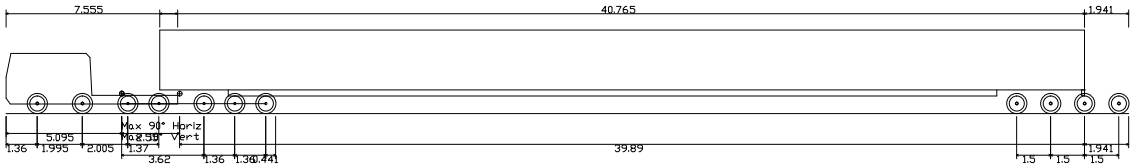

Tower (Final)	
Overall Length	49.476m
Overall Width	2.550m
Overall Body Height	3.695m
Min Body Ground Clearance	0.427m
Max Track Width	2.520m
Lock to Lock Time	6.00s
Wall to Wall Turning Radius	9.800m

NOTES:

PLANNING DRAWING ONLY - NOT FOR CONSTRUCTION PURPOSES

Figure 14.5 Design tower extended artic profile (70m blade)

PROJECT:	Croagh Wind Farm, County Leitrim		
CLIENT:	Coilte	SCALE:	NTS
PROJECT NO: 7410	DATE: 03.04.20	DRAWN BY:	AL

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14.1.6 Traffic Effects During Construction and During Operation

14.1.6.1 Traffic Effect During Construction and During Operation

As detailed below, transportation of large turbine components will be carried out at night when traffic is at its lightest and in consultation with the relevant Roads Authority and An Garda Síochána with deliveries accompanied by Garda escort.

Effect on Link Flows – During Construction

Background traffic volumes, as established previously and set out in Table 14-5, and development generated traffic volumes are shown for the typical construction day scenarios discussed in Section 14.1.4 are set out in Table 14-12 to 14-15, with the traffic effects summarised in Table 14-16 to 14-19. The actual figures presented in the tables, may vary slightly, however they are considered to represent a robust worst case assessment of the likely effects.

In terms of daily traffic flows the potential effects may be summarised as follows:

During Stage 1 – Concrete Pouring

For these 10 days an additional 440 PCUs will travel on the study network.

There are 2 potential options for deliveries of concrete, from suppliers to the north of Drumkeeran, and those to the south.

If solely delivered from the north - On these days, the percentage increase in traffic volumes experienced on the study network will be between 14% on the N16 west of Belcoo, to 21% on the R280 north of Drumkeeran, to more than a 3 fold increase (203%) on the existing L-4282 just to the west of Drumkeeran.

If solely delivered from the south the percentage increase in traffic volumes experienced will be between 5% on the N4 east of Carrick-on Shannon, to 21% on the R280 south of Drumkeeran and a 3 fold increase (203%) on the existing L-4282 just to the west of Drumkeeran.

During Stage 1 - Site Preparation and Groundworks

On average an additional 128 PCUs will travel on the local highway network for each of the 245 days.

If solely delivered from the north - the percentage increase in traffic volumes experienced on the study network will range from 4% on the N16 west of Belcoo, to 6% on the R280 north of Drumkeeran, to a 59% increase on the existing L-4282 just to the west of Drumkeeran.

If solely delivered from the south - the percentage increase in traffic volumes experienced will be between 2% on the N4 east of Carrick-on Shannon, to 6% on the R280 south of Drumkeeran and a 59% increase on the existing L-4282 just to the west of Drumkeeran.

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During Stage 2 - Turbine Construction Stage – Delivery of large equipment using extended articulated vehicles

As stated previously, all of the deliveries for this stage will approach the site from the south and will utilise the proposed link road through the farmyard linking the R280 with the L4282 at the southern end of Drumkeeran. Only construction staff trips will therefore use the existing section of the L-4282 just to the west of Drumkeeranduring this stage.

The additional 140 PCUs (made up of cars and large extended artics) will travel on the study network for 18 days. On the days this impact occurs, volumes will increase by 2% on the N4 to the east of Carrick-on-Shannon, and by 7% on the R280 just south of Drumkeeran. While there will be limited impact on the L-4282 just to the west of Drumkeeran during this delivery phase due to construction staff trips, the section between the link road and the proposed construction access road (between locations 3 and 5 indicated in Figure 14-2a) will provide for the abnormally sized loads, resulting in a 65% increase in traffic volumes.

The most significant traffic impact may be experienced during these delivery periods primarily due to the slow speeds, size and geometric requirements of these vehicles. The provision of traffic management measures, including ensuring that these deliveries are made at night as is proposed, (as set out in Sections 14.1.7 and 14.1.10.6 and included in the CEMP), will be required to minimise the impact of development traffic on the study network on these days.

During Stage 2 - Turbine Construction Stage – Other deliveries using conventional articulated HGVs

For 10 days on the delivery route 55 additional PCUs (made up of cars and standard articulated HGV movements to the site and back) will travel on the study network. On these days, the percentage increase on the study network will be between 1% on the N4, to 3% on the R280 approaching Drumkeeran and 25% on the L-4282 towards the site.

Table 14-12 Effects of development traffic during concrete pouring

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 L-4282	121	96	217	80	360	440	201	456	697
2 R280 north	1,837	237	2,074	80	360	440	1,917	597	2,514
3 R280 south	1,837	237	2,074	80	360	440	1,917	597	2,514
4 N4 east of Carrick-on-Shannon	7,283	1,175	8,458	80	360	440	7,363	1,535	8,898
5 N16 west of Belcoo	2,698	399	3,097	80	360	440	2,778	759	3,537

Table 14-13 Development traffic during site preparation and groundworks

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 L-4282	121	96	217	80	48	128	201	144	345
2 R280 north	1,837	237	2,074	80	48	128	1,917	285	2,202
3 R280 south	1,837	237	2,074	80	48	128	1,917	285	2,202
4 N4 east of Carrick-on-Shannon	7,283	1,175	8,458	80	48	128	7,363	1,223	8,586
5 N16 west of Belcoo	2,698	399	3,097	80	48	128	2,778	447	3,225

Table 14-14 Development traffic during turbine construction - extended artics (large turbine components)

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 L-4282	121	96	217	40	100	140	161	196	357
2 R280 north	1,837	237	2,074	40	100	140	1,877	337	2,214
3 R280 south	1,837	237	2,074	40	100	140	1,877	337	2,214
4 N4 east of Carrick-on-Shannon	7,283	1,175	8,458	40	100	140	7,323	1,275	8,598
5 N16 west of Belcoo	2,698	399	3,097	40	100	140	2,738	499	3,237

Table 14-15 Effect of development traffic during turbine construction – other deliveries (small turbine components)

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
	Car	HGV	Total	Car	HGV	Total	Car	HGV	Total
1 L-4282	121	96	217	40	15	55	161	111	272
2 R280 north	1,837	237	2,074	40	15	55	1,877	252	2,129
3 R280 south	1,837	237	2,074	40	15	55	1,917	252	2,129

Link	Background PCUs			Development PCUs			Total PCUs (Background + Development)		
4 N4 east of Carrick-on-Shannon	7,283	1,175	8,458	40	15	55	7,323	1,190	8,513
5 N16 west of Belcoo	2,698	399	3,097	40	15	55	2,738	414	3,152

Table 14-16 Summary effect of development traffic during concrete pouring

Link	Background	Development	Total	% increase	Estimated No. of days
1 L-4282	217	440	657	202.8%	Up to 10
2 R280 north	2,074	440	2,514	21.2%	Up to 10
3 R280 south	2,074	440	2,514	21.2%	Up to 10
4 N4 east of Carrick-on-Shannon	8,458	440	8,898	5.2%	Up to 10
5 N16 west of Belcoo	3,097	440	3,537	14.2%	Up to 10

Table 14-17 Summary effect of development traffic during site preparation and ground works

Link	Background	Development	Total	% increase	Estimated No. of days
1 L-4282	217	128	345	59.0%	Up to 245
2 R280 north	2,074	128	2,202	6.2%	Up to 245
3 R280 south	2,074	128	2,202	6.2%	Up to 245
4 N4 east of Carrick-on-Shannon	8,458	128	8,586	1.5%	Up to 245
5 N16 west of Belcoo	3,097	128	3,225	4.1%	Up to 245

Table 14-18 Summary effect of development traffic during turbine construction – extended artics (large turbine components)

Link	Background	Development	Total	% increase	Estimated No. of days
1 L-4282	217	140	357	64.5%	18
2 R280 north	NA	NA	NA	NA	NA

Link	Background	Development	Total	% increase	Estimated No. of days
3 R280 south	2,074	140	2,214	6.8%	18
4 N4 east of Carrick-on-Shannon	8,458	140	8,598	1.7%	18
5 N16 west of Belcoo	NA	NA	NA	NA	NA

Table 14-19 Summary effect of development traffic during turbine construction – other deliveries (small turbine components)

Link	Background	Development	Total	% increase	Estimated No. of days
1 L-4282	217	55	272	25.4%	10
2 R280 north	NA	NA	NA	NA	NA
3 R280 south	2,074	55	2,129	2.7%	10
4 N4 east of Carrick-on-Shannon	8,458	55	8,513	0.7%	10
5 N16 west of Belcoo	NA	NA	NA	NA	NA

An assessment of the impact on link capacities in the study area was undertaken for the various construction stages as set out in Table 14-20, Table 14-21, and Table 14-22. The capacity for each link in the study area is shown in Table 1420. The capacities range from a daily flow of 11,600 vehicles on the N4 down to 2,200 on the L-4282, and are based on road widths and capacities set out in the TII Standards document DN-GEO-03031 Road Link Design, Table 6/1.

Background, or do nothing traffic flows, are compared to flows forecast for the various construction delivery stages in Table 14-21 with the percentage capacity reached for each link and stage shown in Table 14-22. Based on this assessment the following points are noted;

- On the external network the N4 to the east of Carrick-on-Shannon is the busiest road with the link capacity forecast to operate at 73% for the do-nothing scenario, increasing to a maximum of 77% during the 10 days that the concrete foundations will be poured.
- All other roads leading to the site are forecast to operate well within link capacity for all scenarios.

Table 14-20 Carriageway widths, link type and link capacity

Link	Width (m)	Link type	Link capacity
1 L-4282	approx.5.0m	Local road	2,200
2 R280 north	6.0	Type 3 single	5,000
3 R280 south	6.0	Type 3 single	5,000
4 N4 east of Carrick-on-Shannon	7.0	Type 1 single	11,600
5 N16 west of Belcoo	7.0	Type 2 single	8,600

Table 14-21 Link capacity and summary of link flows by construction delivery stage

Link	Link capacity	Construction delivery stage				
		Background traffic	Concrete pour	Other site works	Turbine plant	Turbine equipment
1 L-4282	2,200	217	657	345	NA	NA
2 R280 north	5,000	2,074	2,514	2,202	NA	NA
3 R280 south	5,000	2,074	2,514	2,202	2,214	2,129
4 N4 east of Carrick-on-Shannon	11,600	8,458	8,898	8,586	8,598	8,513
5 N16 west of Belcoo	8,600	3,097	3,537	3,225	NA	NA

Table 14-22 Link capacity and % of link capacity by construction delivery stage

Link	Link capacity	Construction delivery stage				
		Background traffic	Concrete pour	Other site works	Turbine plant	Turbine equipment
1 L-4282	5,000	10%	30%	16%	16%	12%
2 R280 north	5,000	41%	50%	44%	44%	43%
3 R280 south	5,000	41%	50%	44%	44%	43%
4 N4 east of Carrick-on-Shannon	11,600	73%	77%	74%	74%	73%
5 N16 west of Belcoo	8,600	36%	41%	38%	38%	37%

Substation Construction

It is estimated that an additional 398 HGV trips will be generated to and from the site during the construction of the substation, associated compound and grid connection works. The construction of the substation will take place at the same time as the site preparation and groundworks stage, as set out in Table 14-6 and Table 14-7, with traffic effects included in the assessment for that construction period.

Access Road

All materials (stone and gravel) required to construct the internal access road are included in Tables 14-6 and 14-8 and are included in the assessment presented in Section 14.1.6.1.

Effect on Link Flows – During Operation

Once the wind farm is operational it is estimated that approximately two operation and maintenance staff will access the site at any particular time in order to carry out operational maintenance, with a similar number of vehicle trips. It is considered that the traffic impact during this phase will be imperceptible.

Effect on Junctions – During Construction

Guidance relating to the requirement to undertake a detailed junction capacity assessment at junctions in the proximity of a proposed development is set out in Document PE-PDV-02045 Traffic and Transport Assessment Guidelines, TII, May 2014. The guidance states that a capacity assessment should be undertaken where the proposed development results in an increase in traffic volumes of 10% or greater, in situations where the network is not currently congested. . As the traffic volumes on the L4282 are forecast to increase by greater than this threshold during the construction of the Proposed Development, a detailed capacity assessment was undertaken for the existing R280 / L-4282 junction in Drumkeeran. As the impact on the R280 is below this threshold it is considered that no further junctions were required to be the subject of a detailed capacity assessment.

The capacity of the R280 / L4282 junction was assessed using the industry standard junction simulation software PICADY, which permits the capacity of any junction to be assessed with respect to existing or forecast traffic movements and volumes for a given period. The capacity for each movement possible at the junction being assessed is determined from geometric data input into the program with the output used in the assessment as follows:

- Queue – This is the average queue forecast for each movement and is useful to ensure that queues will not interfere with adjacent junctions.
- Degree of Saturation or Ratio of Flow to Capacity (% Sat or RFC) – As suggested, this offers a measure of the amount of available capacity being utilised for each movement. Ideally each movement should operate at a level of no greater than 85% of capacity.
- Delay – Output in minutes, this gives an indication of the forecast average delay during the time period modelled for each movement.

Scenarios Modelled

While other junctions and links on the network will experience an increase in traffic volumes passing through them, as discussed previously and as set out in Table 14-16 to 14-20 above, the worst-case effect will be experienced during peak hours when, during peak construction periods, up to 80 workers (40 cars) will pass through it. It is noted that deliveries of materials to the site will take place during the day after the workers have arrived on site, and before they leave at the end of the day, and will therefore not occur at the same time.

R280 / Access Road Junction Capacity Test Results

The AM and PM peak hour traffic flows through the R280 / L-4282 junction were calculated from the link flows and are shown for the year 2024 in Figure 14-3a, with background traffic flows for the assumed construction year of 2024 shown in Figure 14-3b. Traffic flows generated by the proposed development during the AM and PM peak hours are shown in Figure 14-3c while the year 2024 traffic flows with development generated traffic are shown in Figure 14-3d.

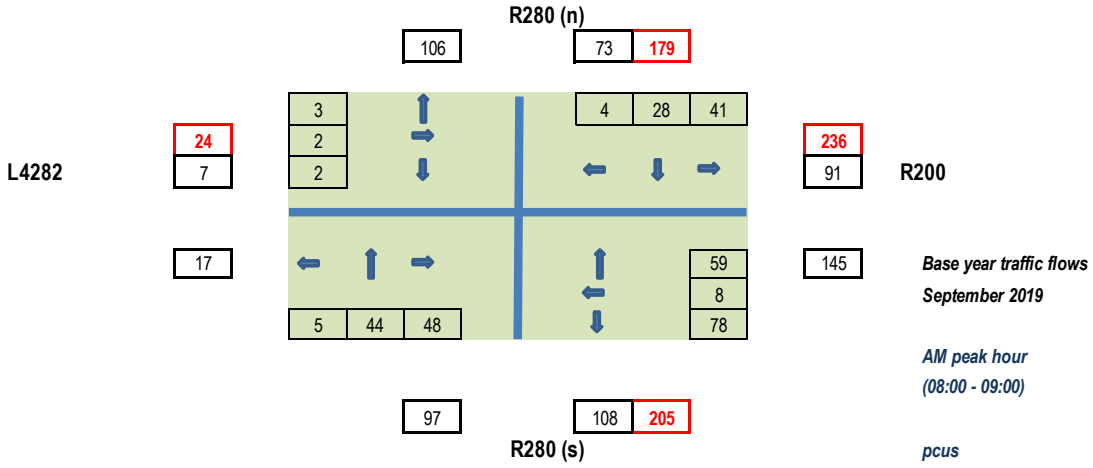
The results of the capacity assessment, as set out in Tables 14-23 and 14-24, show that additional car trips passing through the junction will be accommodated by the existing junction with a maximum ratio of flow to capacity (RFC) forecast to increase from 33.0% from the do nothing scenario to 37.1% with the Proposed Development construction traffic in place during the AM peak hour, with a similar increase from32.7% to 33.0% during the PM peak hour. Of the movements effected the most by the Proposed Development, the right turn from the R280 onto the L-4282 is forecast to increase from 0.9% to 3.9% during the AM peak hour and the exit from the L-4282 onto the R280 from 1.5% to 11.2% during the PM peak hour. All of these movements are forecast to operate well within the acceptable limit of 85%.

Table 14-23 Junction capacity test results, R280 / L4282 junction, , without and with construction staff, year 2024, AM peak

Period	Location	Without construction traffic			With construction traffic		
AM		RFC	Queue (vehicles)	Delay (minutes)	RFC	Queue (vehicles)	Delay (minutes)
	From R200	33.6%	0.50	0.18	37.1%	0.58	0.20
	From L4282	1.7%	0.02	0.13	1.7%	0.02	0.13
	Right turn into R200	11.1%	0.14	0.12	11.2%	0.15	0.12
	Right turn into L4282	0.9%	0.01	0.12	3.9%	0.04	0.13

Table 14-24 Junction capacity test results, R280 / L4282 junction, , without and with construction staff, year 2024, PM peak

Period	Location	Without construction traffic			With construction traffic		
PM		RFC	Queue (vehicles)	Delay (minutes)	RFC	Queue (vehicles)	Delay (minutes)
	From R200	32.7%	0.48	0.19	33.0%	0.49	0.19
	From L4282	1.5%	0.01	0.13	11.2%	0.13	0.15
	Right turn into R200	13.2%	0.16	0.13	13.4%	0.17	0.13



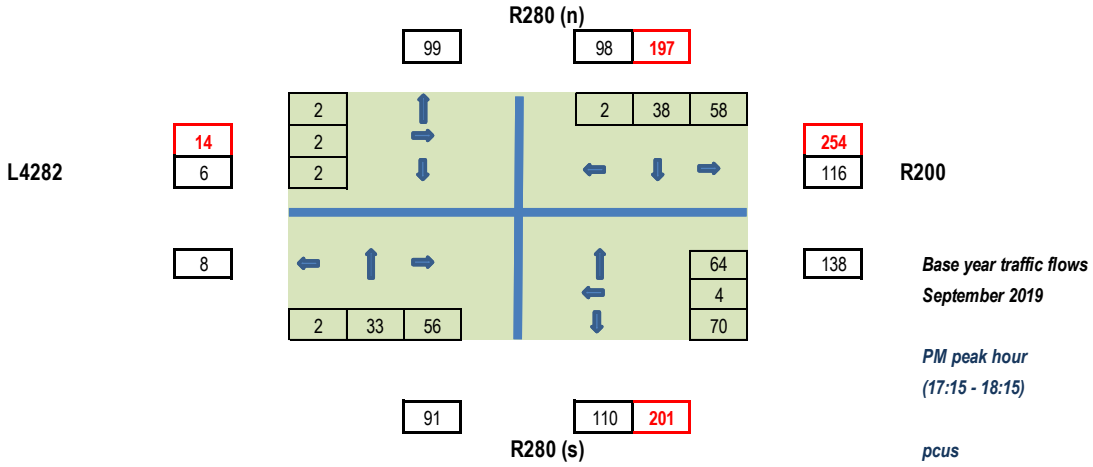


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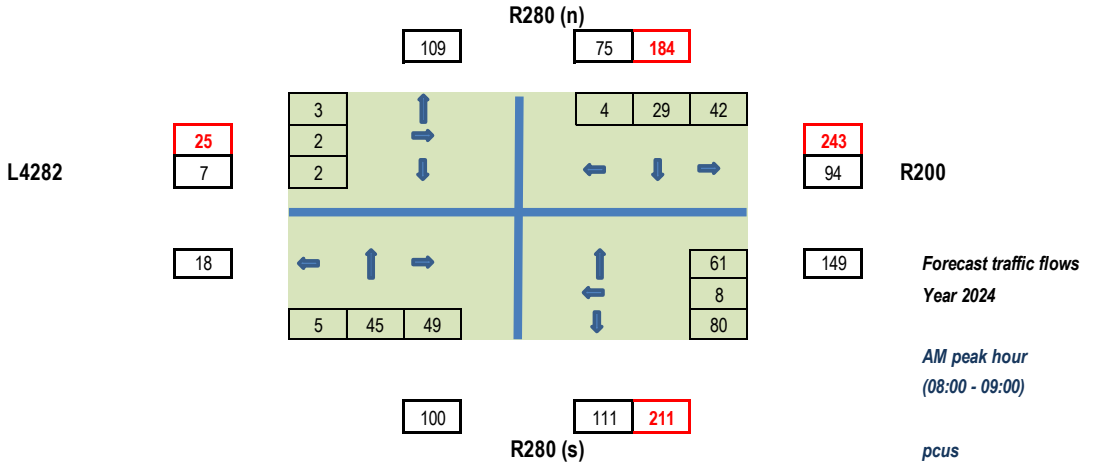
Figure 14.3a Base year traffic flows, AM & PM peak hours, R280 / L4282 junction year 2019 - pcus



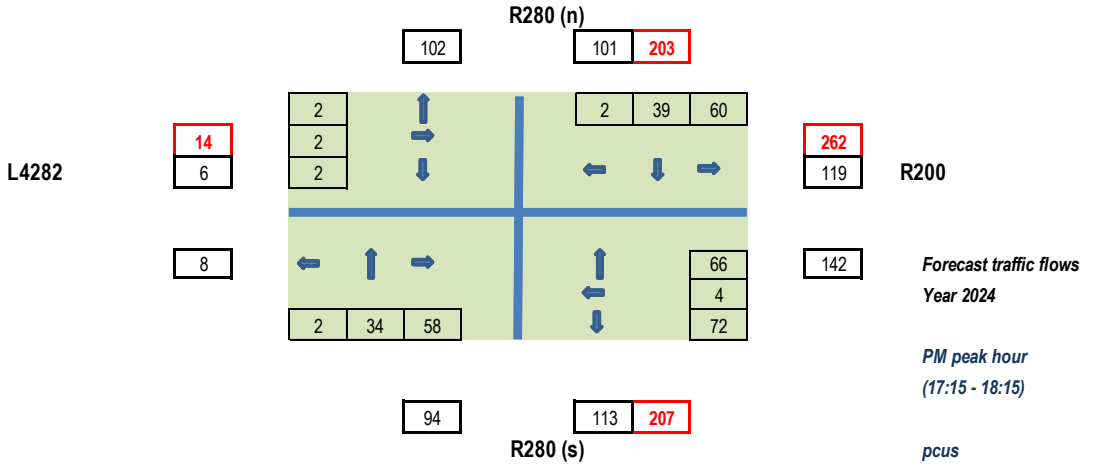


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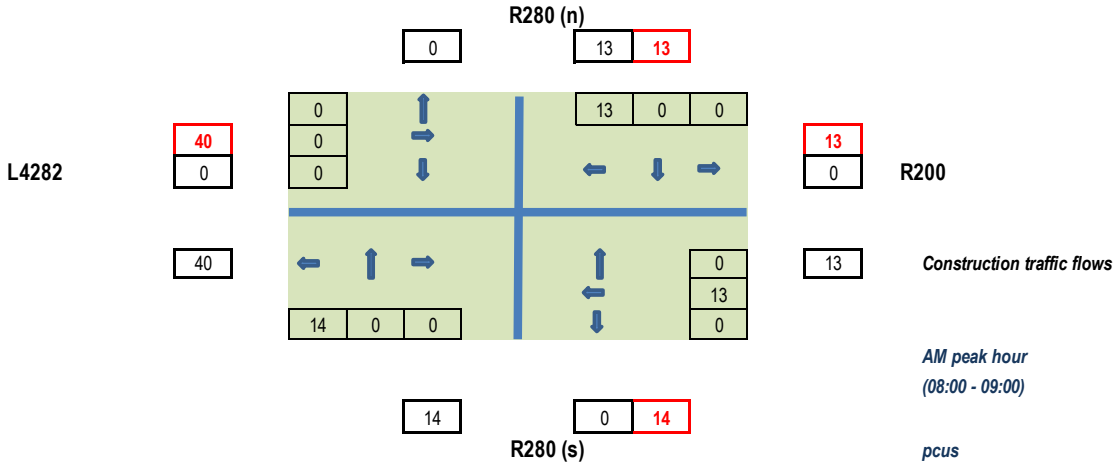
Figure 14.3b Construction year background traffic flows, AM & PM peak hours, R280 / L4282 junction, year 2024 - pcus



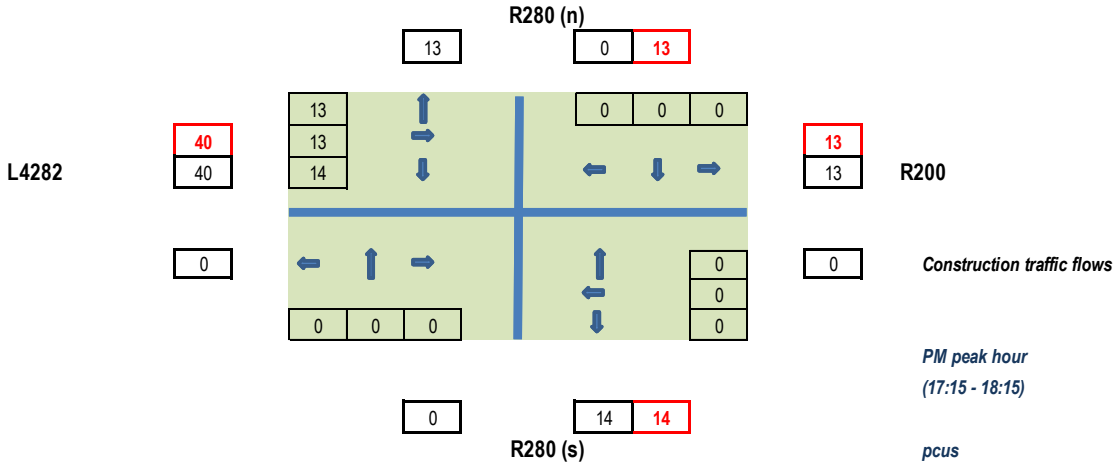


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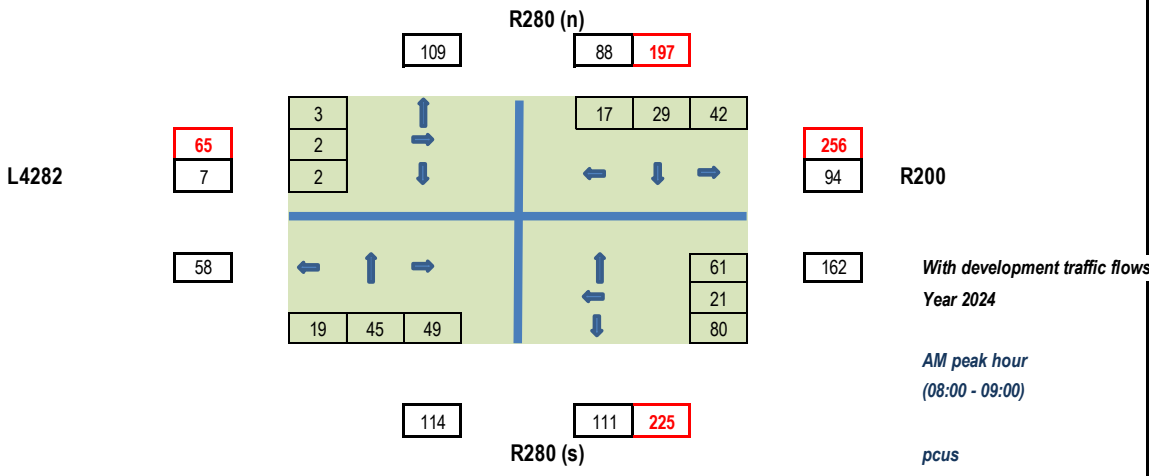
Figure 14.3c Construction traffic flows, AM & PM peak hours, R280 / L4282 junction - pcus



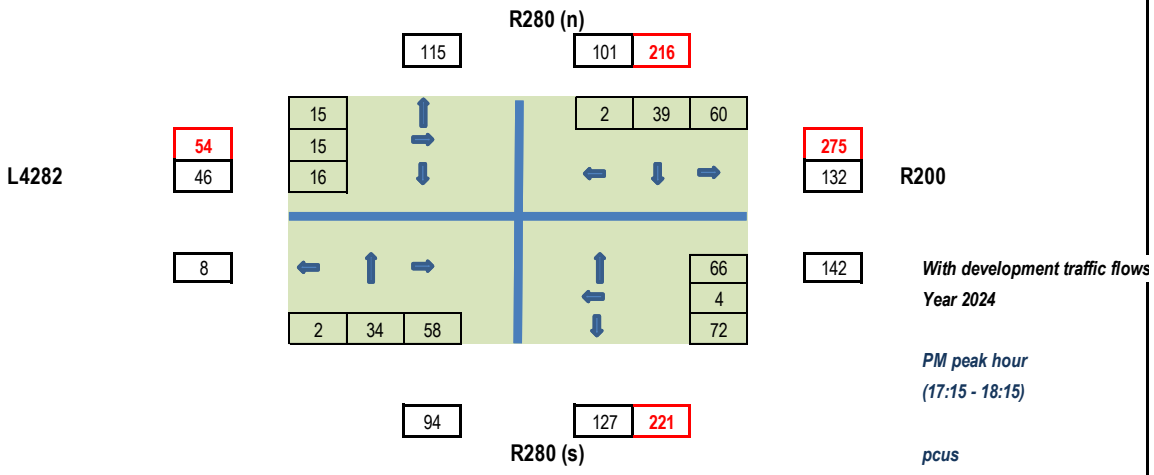


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Figure 14.3d With construction traffic flows, AM & PM peak hours, R280 / L4282 junction, year 2024 - pcus

Period	Location	Without construction traffic			With construction traffic		
	Right turn into L4282	0.4%	0.00	0.12	0.4%	0.00	0.12

Effect on Junctions – During Operation

As discussed in Section 14.1.6 it is forecast that once operational, the development will generate approximately 2 trips per day for maintenance purposes. It is therefore concluded that the development will not have a significant effect on the local network once constructed.

Effect on Network of Grid Connection

The grid connection to the Proposed Development will be via the existing 110KV Garvagh substation with the cable layed on approximately 4.7 kms of the improved L4282 leading to the site. With the exception of the transportation of the materials required to construct the cable link, which has been taken into account elsewhere in this section, the construction of the cable link will have no additional impact on traffic on the external road network.

14.1.7 Traffic Management of Large Deliveries

The greatest effect on the road network will likely be experienced on the approximately 18 days during which the 5 large loads comprising the tower sections, the blades and the nacelles are delivered to the site.

Traffic management measures are included in Section 14.1.10.6 and include the following:

- Identification of a delivery schedule,
- Details of the alterations required to the infrastructure identified in Section 141.8 of this report and any other minor alteration identified,
- A dry run of the route using vehicles with similar dimensions.

The transport of large components is challenging and can only be done following extensive route selection, route proofing and consultation with An Garda Síochána and the various local authorities. Turbine components are often transported at night when traffic is lightest and this is done in consultation with the roads authorities / An Garda Síochána and special permits are generally required.

In some cases, temporary accommodation works are required along the turbine delivery route (TDR) such as hedge or tree cutting, temporary relocation of powerlines/poles, lampposts, signage and minor road verge works. Any updates to the road will be carried out in advance of turbine deliveries and following consultation and agreement with the appropriate local authorities.

It is not anticipated that any sections of the local road network will be closed, although there may be delays to local traffic at various locations if the deliveries are made during daylight hours. During these periods, it may be appropriate to operate local diversions for through traffic. It is noted that it is proposed that all deliveries of abnormally sized loads will be made during night time hours, as is the norm for such deliveries.

14.1.8 Route Assessment

A route assessment was undertaken covering the proposed delivery route for the abnormal loads, with the route and assessment locations shown in Figure 14-2a. The route assessment discussed in this section commences at the proposed access junction off the R280 with all locations along the route

referred to in this section highlighted in Figure 14-2a. For these locations, preliminary road and junction /alignments, based on site surveys, were supplied by the project team. A swept path analysis was then undertaken using Autotrack in order to establish the locations where the wind turbine transport vehicles will be accommodated, and the locations where some form of remedial measure, such as local widening, may be required.

The assessment presents the preliminary design of the proposed junctions at the eastern and western ends of the proposed access road (with the R280 at the eastern end and the L-4282 at the western end), and the autotrack assessments for the appropriate vehicle types relevant to each.

The locations discussed are as follows;

- Location 1 – Bend on R280,
- Location 2 - Access Junction A – Link Road / R280,
- Location 3 - Access Junction B – Link Road / L-4282,
- Location 4 – Bends on L-4282,
- Location 5 - Access Junction C – Construction Access Road / L-4282,
- Location 6 - Access Junction D – Construction Access Road / L-4282,
- Locations 7 to 12 on L-4282.
- Location 13 - Access Junction E – Site Access / L-4282.

The following text summarises the findings of the swept path analysis for Locations 1 to 13. All figures referred to in this section are included as Appendix 14-1.

Location 1 – Bend on R280

The autotrack assessment undertaken for the bend on the R280 on the northbound approach to Drumkeeran, indicated as location 1 in Figure 14-2a, is shown in Figures 14-6 and 14-7. The figures show that the existing road will accommodate the abnormally sized vehicles required to transport the turbine blades and towers to the site.

Location 2 – Access Junction A – Link Road / R280

The access proposed at this location will provide for the abnormally sized turbine vehicles only, with all traffic movements made into and out of the link road to / from the R280 made with a Garda escort and temporary traffic management measures. The autotrack assessment shown in Figures 14-8 and 14-9 show the areas that will require to be cleared, and which are available, for the duration of the delivery of the large turbine plant.

Location 3 – Access Junction B – Link Road / L-4282

Similar to Access Junction A, the junction between the proposed link road and the L-4282 will provide for the abnormally sized turbine vehicles only, with all traffic movements made into and out of the link road to / from the L-4282 made with a Garda escort and temporary traffic management measures. The autotrack assessment shown in Figures 14-10 and 14-11 show the areas that will require to be cleared, and are available, for the duration of the delivery of the large turbine plant.

Location 4 – Bends on L-4282

The autotrack assessment undertaken at this location is shown in Figures 14-12 and 14-13. The figures show the extent of local road widening works required to accommodate the abnormally sized vehicles at this location.

Location 5 - Access Junction C – Construction Access Road / L-4282 access road junction

The temporary works required to accommodate the wind farm turbine vehicles, together with the junction layout proposed for the general site works and construction stages, are shown for the Access Junction C in Figures 14-14 to 14-17. The proposed junction layout is designed in accordance with TII guidelines (TII DN-GEO-03060) and the proposed junction markings are as prescribed in the Traffic Signs Manual (Figure 7.35 of manual).

In accordance with Table 26 of Leitrim County Development Plan 2015 – 2021, for a design speed of 60 km/h visibility splays of 2.4 x 70 metres are shown to the west and east along the L-4282 in Figure 14-14. Figures 14-15 to and 14-17 demonstrate that the junction layout proposed for the delivery stage will accommodate all wind farm transport vehicles.

Location 6 - Access Junction D – Construction Access Road / L-4282

Access junction D links the western end of the proposed construction access roads with the L-4282.

The proposed layout for Access Junction D as set out in Figure 14-18, complies with current design standards, and the 2.4m x 70m visibility splays shown are in accordance with the Leitrim County Development Plan 2015 – 2021, for a design speed of 60km/h. Figures 14-19 to 14-21 show that the proposed junction geometry will accommodate the largest wind farm turbine transporter vehicles.

Locations 7 to 12 on L-4282

The autotrack assessment undertaken at pinch points, shown as locations 7 to 12 in Figure 14-2a, on the L-4282 and the access road leading to the proposed wind farm site, are shown in Figures 14-22 to 14-33.

The figures show locations where road widening works will be required along the route to accommodate the abnormally sized vehicles required to transport the turbine blades and towers to the site.

Locations 13 – Access Junction E – Site Access on L-4282

Access junction E provides access to the site from the L-4282 for all vehicle types.

The proposed layout for Access Junction E, together with 2.4m x 70m visibility splays are shown in Figure 14-34, while Figures 14-35 to 14-37 show that the proposed junction geometry will accommodate all vehicle types requiring access to the site.

14.1.9 Provision for Sustainable Modes of Travel

14.1.9.1 Walking and Cycling

The provision for these modes is not relevant during the construction stage of the development and travel distances will likely exclude any employees walking or cycling to work.

14.1.9.2 Public Transport

There are no public transport services that currently pass the site although mini-buses may be considered for transporting construction staff to and from the site in order to minimise traffic generation and parking demand on site.

14.1.10 Likely and Significant Effects and Associated Mitigation Measures

14.1.10.1 "Do Nothing" Scenario

If the proposed wind farm does not proceed, there will be no additional traffic generated or accommodation works carried out on the local road network and therefore no direct or indirect effects on roads and traffic.

14.1.10.2 Construction Phase

During the 10 days when the concrete foundations are poured the effect on the surrounding road network will be negative, resulting in an increase in traffic levels ranging from 5% on the N4 to a 3 fold increase (203%) on the L-4282 leading to the site. It is noted that the high percentage increase forecast for the L-4282 is due to the low volume of background traffic. The direct effect will be temporary, and will be slight.

During the remaining 245 days for the site preparation and ground works when deliveries to the site will take place, the effect on the surrounding road network will be negative, resulting in an increase in traffic levels ranging from 2% on the N4, to an increase of 59% on the L-4282 approaching the site. On these days, the direct effect will be temporary and will be slight.

During the 10 days of the turbine construction stage when general materials are delivered to the site, the delivery of construction materials will result in a negative impact on the surrounding road network, increasing traffic levels, ranging from 1% on the N4, to an increase of 3 on the R280 and 3% on the L-4282 leading to the site. The direct effect during this period will be temporary and will be slight.

During the 18 days when the various component parts of the wind turbine plant are delivered to the site using extended articulated HGVs, the effect of the additional traffic on these days will be moderate due to the size of vehicles involved, resulting in increased traffic volumes of between 2.0% on the N4 to 7% on the R280, and 65% on the L-4282 leading to the site, but will be temporary. The direct effect will be reduced to slight if the delivery of the large plant is done at night, as is proposed.

It was determined that all links in the study area and the junction between the R280 and the L-4282 will operate within operational capacity for all days within the construction period.

14.1.10.3 Operational Phase

During the operational phase the direct effect on the surrounding local highway network will be neutral and long term given that there will be approximately two maintenance staff travelling to site at any one time, resulting in typically two visits to the site on any one day made by a car or light goods vehicle.

Should the proposed wind farm be consented and developed, the recreational and amenity proposals set out in Chapter 4 will be implemented which means that there will be some levels of traffic accessing the site for amenity use during the operational stage. This traffic will access the site via the R280 and existing L-8281 where the proposed amenity car park is located. The volumes are likely to be small (up to a maximum of 40 car trips per day) based on information from other similar wind farm developments. Given the capacity of the local highway network there is no significant effects anticipated on roads and traffic.

14.1.10.4 Decommissioning Phase

The design life of the wind farm is 30 years. When the site is decommissioned, cranes will disassemble each turbine tower and all equipment.

All turbine infrastructure including turbine components will be separated and removed off-site for re-use, recycling and waste disposal.

It is proposed that turbine foundations and hardstanding areas will be left in place and covered with soil/topsoil. It is proposed to leave the access roads, visitor car park and walkways in situ at the decommissioning stage . It is considered that leaving the turbine foundations, access tracks and hardstanding areas in situ will cause less environmental damage than removing and recycling them.

The effects on the network during decommissioning will be less significant compared to those during the construction phase as presented in this section of the EIAR as the volume of materials transported to and from the site will be significantly less.

14.1.10.5 Cumulative Effects

A detailed assessment of all developments at varying stages in the planning process (from pre-planning to operational), is set out in Section 2.5 of this EIAR, with an assessment of the potential cumulative traffic effects with the proposed subject wind farm assessed on the following criteria;

- Project status (proposed to operational)
- Degree of overlap with the Proposed Development delivery highway network (low to high)
- Traffic volumes (low to high)

Cumulative impacts of significance will only occur with other wind farms that have yet to be constructed as the traffic generation for existing operational wind farms is very low.

There are 3 proposed developments that could potentially result in cumulative traffic impacts with the proposed Croagh Wind Farm. The first is a permitted extension to the existing Tullynamoyle Wind Farm, comprising an additional 4 turbines, located approximately 8.5kms to the northeast. The second is the permitted decommissioning of 2 existing wind turbines with and the replacement of one larger turbine at the existing Spion Kop wind farm development, located approximately 3.5kms to the south east of the Proposed development. The third is a proposed battery array development proposed off the R280 adjacent to the Corderry Substation, located approximately 4km to the north of Drumkeeran.

As parts of the delivery routes for general construction traffic are common to the 3 development described above and the Proposed Development (R280), in the event that the construction of the Proposed Development coincides with any of these developments, then traffic related cumulative impacts would be negative, temporary and slight given the distance between the sites. The construction phase of the Proposed Development will be scheduled in order that cumulative impacts will be avoided with these developments.

It is noted that all general forestry activity will be curtailed on the site during the construction of the proposed development.

Reference was also made in the preparation of this assessment to other planning applications as set out in Chapter 2.

14.1.10.6 Mitigation Measures

This section summarises the mitigation measures to minimise the effects of the Proposed Development during both the construction operational and decommissioning stages.

Mitigation by Design

Mitigation by design measures includes the following;

- Selection of the most appropriate delivery route to transport the wind turbine components, requiring the minimum remedial works to accommodate the vehicles as set out in Section 14.1.8.
- Construction of improvements to the local highway network at locations identified in Section 14.1.8.

Mitigation Measures During the Construction Stage

The successful completion of this development will require significant coordination and planning and it is therefore recommended that the following 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 wind farm.

Delivery of abnormal sized loads

The following are the main points to note for these deliveries which will take place after peak evening traffic:

- 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.
- The deliveries will be made in consultation with the Local Authority and An Garda Síochána.
- It is estimated that 90 abnormal sized loads will be delivered to the site, comprising 18 convoys of 5, undertaken over 18 separate nights.
- These nights will be spread out over an approximate period of 9 weeks and will be agreed in advance with the relevant authorities
- 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 5 vehicles.
- There will also be two escort vehicles provided by the haulage company for each convoy.

Other traffic management measures

A **Traffic Management Plan (TMP)** is provided specifying details relating to traffic management and as Appendix 14-2 this EIAR. Prior to the commencement of the construction phase of the proposed development a detailed Traffic Management Plan will be prepared by the Contractor for agreement with the local authority and An Garda Síochána. The TMP includes recommendations for 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 Councils 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 Councils 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 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 4.3.
- **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.

Mitigation Measures During Operational Stage

Due to the very low volumes of traffic forecast to be generated during this stage no mitigation measures are required.

Mitigation Measures During Decommissioning Stage

When the proposed development is decommissioned after the 30 years of operation, a decommissioning plan will be prepared for agreement with the local authority, as described in Section 4.11 of Chapter 4. This plan will include a material recycling / disposal plan and traffic management plan and other similar mitigation measures to those implemented during the construction phase. In

terms of traffic effects the decommissioning stage will generally mirror the constructions stage although the effects will be significantly reduced as the volumes of materials removed from the site will be less.

14.1.10.7 Residual Impacts

Construction Stage

During the 12-month construction stage of the Proposed Development, it is forecast that the additional traffic that will appear on the delivery route indicated in Figure 14-2a will have a slight, negative and temporary impact on existing road users, which will be minimised with the implementation of the mitigation measures included in the proposed traffic management plan.

Operational Stage

As the traffic impact of the proposed development will be imperceptible during the operational stage, there will be no residual impacts during this stage.

Decommissioning Stage

As stated above, in the event that the wind farm is decommissioned a decommissioning plan will be prepared and implemented in order to minimise the residual impacts during this stage.

14.2 Telecommunications and Aviation

14.2.1 Introduction

This section of the EIAR assesses the likely significant effects of the proposed wind farm on telecommunications and aviation. Section 14.2.3 describes the way in which wind turbines can potentially interfere with telecommunications signals or aviation activities. Section 14.2.4 presents details on how such effects will be avoided, with the likely significant effects assessed (and mitigation measures proposed) in Section 14.2.5.

14.2.1.1 Statement of Authority

This section of the EIAR has been prepared by Eoin McCarthy (B.Sc. Env.), Environmental Scientist with MKO. Eoin has over 8 years' experience in the preparation of EIARs for wind energy developments, including the assessment of likely significant effects on material assets. He has coordinated the scoping and consultation exercise with telecommunications operators and aviation authorities for numerous wind energy developments and prepared the relevant sections of the EIARs.

14.2.2 Methodology and Guidance

This section of the assessment focuses particularly on the scoping and consultation exercise conducted with telecommunications operators and aviation authorities. Scoping was carried out in line with the above EPA guidelines, and the '*Best Practice Guidelines for the Irish Wind Energy Industry*' (Irish Wind Energy Association, 2012), which provides a recommended list of telecommunications operators for consultation.

A full description of the scoping and consultation exercise is provided in Section 2.7 of Chapter 2 of this EIAR. Consultation with the telecommunications operators and aviation bodies informed the constraints mapping process, which in turn informed the layout of the proposed development, as described in Chapter 3 of the EIAR.

The assessment of likely significant effects on material assets uses the standard methodology and classification of impacts as presented in Section 1.8.1 of Chapter 1 of this EIAR. The full project description, including proposed turbine locations and elevations, is provided in Chapter 4.

14.2.3 Background

14.2.3.1 Broadcast Communications

Wind turbines, like all large structures, have the potential to interfere with broadcast signals, by acting as a physical barrier or causing a degree of scattering to microwave links. The most significant effect at a domestic level relates to a possible flicker effect caused by the moving rotor, affecting, for example, radio signals. The most significant potential effect occurs where the wind farm is directly in line with the transmitter radio path.

14.2.3.2 Domestic Receivers

Depending on local topography, a domestic receiver may receive broadcast signals from more than one location. The strength of the signals varies with distance from the transmitter, and the receiver's antenna is generally always directed towards the most local, and usually strongest, broadcasting station.

There are two types of potential electromagnetic interference to domestic receivers, depending on the location of the receiver in relation to a wind farm. 'Shadowed' houses are located directly behind a wind farm, relative to the location from where the signal is being received. In this case, the main signal passes through the wind farm and the rotating blades can create a degree of signal scattering. In the case of viewers located beside the wind farm (relative to the broadcast signal direction), the effects are likely to be due to periodic reflections from the blade, giving rise to a delayed signal.

In both cases, i.e. shadowed houses located behind the wind farm and those located to the side of it, the effects of electromagnetic interference may depend to some degree on the wind direction, since the plane of rotation of the rotor will affect both the line-of-sight blockage to viewers located behind the wind farm and the degree of reflection to receivers located to the side.

14.2.3.3 Other Signal Types

Wind turbines have the potential to affect other signal types used for communication and navigational systems, for example tower-to-tower microwave communication links, and airborne and ground radar systems. Interference with radar systems occurs when wind turbines are located close to an airport or directly in line with the instrument landing approach. The nearest such operational airport to the Proposed Development site is Sligo Airport, located approximately 26 kilometres northwest of the site.. Ireland West Internnational Airport Knock is located approximately 45km southwest of the site. Both airports are are outside the range at which issues would be expected.

Potential effects on broadcast communications are generally easily dealt with by detailed micro-siting of turbines in order to avoid alignment with signal paths or by the use of repeater relay links out of line with the wind farm.

14.2.4 Preventing Electromagnetic Interference

14.2.4.1 National Guidelines

The '*Wind Energy Development Guidelines for Planning Authorities'* (Department of the Environment, Heritage and Local Government, 2006) state that developers are advised to contact individual local and national broadcasters and mobile phone operators to inform them of proposals to develop wind farms.

This consultation has been carried out by MKO as part of the assessment of the proposed development as summarised below; full details are provided in Section 2.5 in Chapter 2 of this EIAR.

The guidelines also state that potential interference with broadcast commincations can be overcome by the installation of deflectors or repeators where required.

14.2.4.2 Scoping and Consultation

As part of the EIAR scoping and consultation exercise, MKO contacted the relevant national and regional broadcasters, fixed and mobile telephone operators, aviation authorities and other relevant consultees. Consultation was also carried out with ComReg in order to identify any other additional licensed operators in the vicinity of the proposed site to be contacted, who may not have been on the list of main operators.

The responses received from the telecommunications and aviation consultees are summarised below in Table 12-25.

Table 14-25 Telecommunications and Aviation Scoping Responses

Consultee	Response	Potential for Interference Following Consultation Exercise
Airspeed	No response received to date	No
Broadcasting Authority of Ireland	No response received to date	No
BT Communications Ireland	Received 15th August 2018	No
ComReg (Commission for Communications Regulation)	Received 15th August 2018	No
Department of Defence	Received 6th February 2019	No
Eir	Received 9th November 2018	Yes – see below
ESB Telecoms	Received 20th September 2018	No
Irish Aviation Authority	Received 3rd January 2019	No
Imagine Group	Received 15th August 2018	No
Ripplecom	Received 16th August 2018	No
RTE Transmission Network (2rn)	Received 20th August 2018	Yes - see below
Tetra Ireland Communications (emergency services)	Received 22nd August 2018	No
Towercom	Received 22nd August 2018	No
Three Ireland Ltd	Received 16th August 2018	Yes – see below
Virgin Media	Received 16th August 2018	No

Consultee	Response	Potential for Interference Following Consultation Exercise
Vodafone Ireland	Received 16th August 2018	No

The scoping responses from the telecommunications and aviation consultees are described below. Relevant copies of scoping responses are provided in Appendix 2-1.

14.2.4.2.1 Broadcasters

RTÉ Transmission Network (operating as 2rn), stated that that there is a risk of disruption to television reception for viewers to the south of the site. To mitigate against interference on viewers' television sets and/or broadcast radio receivers, RTÉ have recommended that a protocol agreement, between 2rn and the developer, be put in place for the wind farm development. The Protocol Document will ensure that the appropriate mitigation is carried out, by the wind farm developer, in the event of any unanticipated broadcast interference arising to RTÉ television or radio reception as a result of the proposed wind farm.

14.2.4.2.2 Other Operators

Of the scoping responses received from telephone, broadband and other telecommunications operators, those who highlighted an initial potential interference risk are addressed below. The final proposed turbine layout does not overlap with any of the telecoms links or clearance zones requested by operators. The remaining consultees who responded to scoping, operate links either outside the proposed development site, and therefore are not subject to any interference risk, or do not operate any links in the area.

Eir

Eir replied to a scoping request from MKO on the 9th November 2018, noting that they had one link in the area of the proposed development and requested that a clearance of 100 metres was to be maintained between the turbines and the Eir link.

It should also be noted that all turbine locations are located in excess of 500 metres from the Eir link and therefore no impact is expected.

Three

Three replied to a scoping request from MKO on the 16th August 2018, noting that they had one link in the area of the proposed development.

It should also be noted that all turbine locations are located in excess of 500 metres from the Three link and therefore no impact is expected.

14.2.4.2.3 Aviation

As noted in Table 14- above, scoping responses were received from the following aviation consultees:

- Department of Defence
- Irish Aviation Authority

Pertinent information has been summarised below, however the scoping responses should be referenced to for further detail:

Department of Defence

In February 2019, a scoping response was received from the Department of Defence (DoD) which set out lighting requirements for turbines, as follows:

1. *Single turbines or turbines delineating corners of a wind farm should be illuminated by high intensity obstacle strobe lights (Red).*
2. *Obstruction lighting elsewhere in a wind farm will be of a pattern that will allow the hazard be identified and avoided by aircraft in flight.*
3. *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 850 nanometres (NM) of wavelength. Light intensity to be of similar value to that emitted in the visible spectrum of light.*

Irish Aviation Authority

In January 2019, a scoping response was received from the Irish Aviation Authority (IAA). The requirements of the IAA include the following:

1. *Agree an aeronautical obstacle warning light scheme for the wind farm development.*
2. *Provide as-constructed coordinates in WGS84 format together with ground and tip height elevations at each wind turbine location.*
3. *Notify the Authority of intention to commence crane operations with a minimum of 30 days prior notification of their erection.*

14.2.5 Likely Significant Effects and Associated Mitigation Measures

14.2.5.1 'Do-Nothing' Scenario

If the proposed development were not to proceed, there would be no change to existing telecommunications and aviation operations in the area.

14.2.5.2 Construction Phase

The potential for electromagnetic interference from wind turbines occurs only during the operational phase of the development. There are no electromagnetic interference impacts associated with the construction phase of the proposed development, and therefore no mitigation required.

14.2.5.3 Operational Phase

14.2.5.3.1 *Telecommunications*

Pre-Mitigation Impact

Consultation regarding the potential for electromagnetic interference from the proposed development was carried out with the relevant national and regional broadcasters, fixed line and mobile telephone operators and other operators, which confirmed that no turbines are proposed within the areas requested to be left clear of turbines.

Mitigation Measures

As there is no potential for electromagnetic interference from the proposed development on telecommuncations, there are no mitigation mesaures proposed.

Residual Impact

The proposed development will have no residual impact on the telecommunications signals of any other operator, due to distance from or absence of any links in the area.

Significance of Effects

There will be no significant effect on telecommunications from the proposed development.

14.2.5.3.2 *Aviation*

Pre-Mitigation Impact

The scoping response of the DoD and IAA has requested that standard lighting requirements be used at the proposed wind farm, in line with Air Corps policy on tall structures.

Mitigation Measures

The scoping response from the DoD and IAA set out lighting requirements for turbines as detailed above. These requirements will be complied with and form part of the proposed development.The coordinates and elevations for built turbines will be supplied to the IAA, as is standard practice for wind farm developments.

Residual Impact

The proposed development will have no residual impact on aviation as all lighting requirements will be met by the applicant.

Significance of Effects

There will be no significant effect on aviation operations due to the proposed development.

14.2.5.4 Decommissioning Phase

As stated in Section 14.2.5.2 above, the potential for electromagnetic interference from wind turbines occurs only during the operational phase of the development. There are no electromagnetic interference impacts associated with the construction or decommissioning phases of the proposed development, and therefore no mitigation required.

14.2.5.5 Cumulative Effect

Chapter 2, Section 2.8 of this EIAR describes the methodology used in compiling the list of projects considered in the assessment of cumulative effects, and provides a description of each project, including current status. Although there are seven existing wind farms within 5 kilometres of the proposed Croagh Wind Farm turbines, there will be no cumulative impacts relating to the proposed development and surrounding projects in relation to Telecommunications or Aviation.

During the development of any large project that holds the potential to effect telecoms or Aviation, the Developer is responsible for engaging with all relevant Telecoms Operators and Aviation Authorities to ensure that the proposals will not interfere with television or radio signals by acting as a physical barrier. In the event of any potential impact, the Developer for each individual project is responsible for ensuring that the necessary mitigation measures are in place. Therefore, as each project is designed and built to avoid impacts arising, a cumulative impact cannot arise.

15. INTERACTION OF EFFECTS

15.1 Introduction

The preceding Chapters 5 to 14 of this EIAR identify the potential significant environmental effects that may occur in terms of Population and Human Health, Biodiversity (Flora and Fauna) Ornithology (Birds), Land, Soils and Geology, Water (Hydrology and Hydrogeology), Air and Climate, Noise and Vibration, Landscape and Visual, Cultural Heritage (Archaeological, Architectural and Cultural Heritage) and Material Assets (Roads and Traffic, Telecommunications and Aviation), as a result of the proposed development as described in Chapter 4 of this EIAR. However, for any development with the potential for significant environmental effects there is also the potential for interaction between these potential significant effects. The result of interactive effects may exacerbate the magnitude of the effects or improve them, or have a neutral effect.

A matrix is presented in Table 15-1 below to identify potential interactions of impacts between the various aspects of the environment already assessed in this EIAR. The matrix highlights the potential for the occurrence of positive, neutral or negative effects during both the construction (C) and operational (O) phases. It is considered that the potential effects during the decommissioning phase will be similar to the construction phase effects but of a lesser magnitude. The matrix is symmetric, with each environmental component addressed in the chapters of this EIAR being placed on both axes of a matrix, and therefore, each potential interaction is identified twice.

Table 15-1 Interaction Matrix: Potential for Interacting Impacts

	Phase	Population and Human Health	Biodiversity, Flora and Fauna	Ornithology	Land, Soils and Geology	Water	Air and Climate	Noise and Vibration	Landscape and Visual	Cultural Heritage	Material Assets
Population and Human Health	C										
	O										
Biodiversity, Flora and Fauna	C										
	O										
Ornithology, Birds	C										
	O										
Land, Soils and Geology	C										
	O										
Water	C										
	O										
Air and Climate	C										
	O										
Noise and Vibration	C										
	O										
Landscape and Visual	C										
	O										
Cultural Heritage	C										
	O										
Material Assets	C										
	O										

Legend: **No Interacting Effect:** **Positive Effect:** **Neutral Effect:** **Negative Effect:**

The potential for interaction of impacts has been assessed, throughout this EIAR, as part of the Impact Assessment process. While the work on all parts of the Environmental Impact Assessment Report (EIAR) was not carried out by MKO, the entire project and all the work of all sub-consultants was managed and coordinated by the company. This EIAR was edited and collated by MKO as an integrated report of findings from the impact assessment process, by all relevant experts, and impacts that potentially interact have been assessed in detail in the individual chapters of the EIAR above and summarised in Section 15.2 below.

Where any potential negative impacts have been identified during the assessment process, these impacts have been avoided or reduced by by design and the proposed mitigation measures, as presented throughout the EIAR and highlighted in Section 15.2 below.

15.1.1 Statement of Authority

This chapter of the EIAR was completed by Eoin McCarthy and Michael Watson. Eoin is a Senior Environmental Scientist with MKO with over 8 years of experience in private consultancy and has been involved in the preparation of EIARs for over twenty wind energy projects. Eoin holds B.Sc. (Hons) in Environmental Science from NUI, Galway. Michael Watson is Project Director and head of the Environment Team in MKO. Michael has over 18 years' experience in the environmental sector. Following the completion of his Master's Degree in Environmental Resource Management, Geography, from National University of Ireland, Maynooth he worked for the Geological Survey of Ireland.

15.2 Impact Interactions

15.2.1 Population and Human Health

Population and Human Health, Air and Climate, Noise

As identified in Chapter 5 of this EIAR, the construction phase has the potential to create a short-term, negative effect on human health due to the nuisance caused by construction plant and vehicle noise emissions, should the mitigation measures outlined in Chapter 11 not be implemented.

During the operational phase the proposed development has the potential to generate noise but as identified in Chapter 11, the potential effects on population and human health are not siginificant.

During the operational phase, the energy generated by the proposed development will offset energy and the associated emission of greenhouse gases from electricity-generating stations dependent on fossil fuels, thereby having a positive effect on climate (i.e. slowing the rate of global warming). In doing so, there will be reduced effects from climate change on human health over the 'do-nothing' scenario and continuing reliance on generating energy using fossil fuels.

Population and Human Health, Land, Soils and Geology, Air and Climate

The excavation and movement of peat and spoil during the construction phase of the proposed development has the potential to create dust emissions which, consequently, have the potential to have a temporary, slight, negative effect on local air quality and human health. Mitigation measures to reduce dust emissions generated during the construction phase of the proposed development are presented in Chapter 10.

Population and Human Health and Water

As described in Chapter 9 of this EIAR, the construction phase of the proposed development has the potential to give rise to some water pollution as a result of site activities, and any water pollution could have a potential significant negative effect on the health of other users of that water within the same

catchment. Mitigation measures are presented in Chapter 9 to minimise the potential of any such issues occurring.

Population and Human Health, and Material Assets

Chapter 14 of this EIAR discusses how the construction phase of the project will give rise to traffic movements of abnormal loads and increased traffic volumes on the local road network and, therefore, is likely to create some short-term inconvenience for other road users.. A Traffic Management Plan will be in place to minimise all disruption insofar as possible, as outlined in the Section 14.1 of this EIAR and included as appendix 14.2.

Population and Human Health, and Landscape and Visual

The construction phase of the proposed development will see the temporary introduction of construction machinery and the erection of wind turbines into a natural, but already modified landscape. The erection of the turbines in particular will change the existing landscape. Whether the long-term change in landscape created by the erection of the turbines is deemed to be positive or negative is a subjective matter. What appears to be a positive visual effect to one viewer could be deemed to be a negative effect by another viewer. The landscape and visual impact assessment of the proposed development, included as Chapter 12 of this EIAR, concludes that, from 22 viewpoints assessed, the visual effect will be moderate from seven location and ranges from not significant to slight at the remaining locations. Therefore, it is considered that the overall visual impact of the proposed development will not be significant.

15.2.2 Biodiversity

Biodiversity and Land, Soils and Geology

The removal of forestry, peat and spoil, during construction of the proposed development, is likely to result in some disturbance of flora and fauna in the areas surrounding the proposed works area thereby, potentially causing a long term, slight, negative effect on flora and fauna. Excavated peat and spoil will be used for the restoration of the proposed borrow pit, permanently placed within one of the peat and spoil repositories or used for landscaping.

Biodiversity and Water

Site activities during the construction phase have the potential to give rise to some water pollution, and consequential indirect effects (such as disturbance and deterioration of habitat quality) on flora and fauna that use that water within the same catchment. The site activities during the construction phase, and continuing on for the operational phase, will give rise to additional localised drainage, which has the potential to have a significant, long term, negative effect on flora and their associated habitats should the appropriate measures not be implemented. These potential impacts have been assessed in Chapter 6 and Chapter 9 of this EIAR, and the relevant measures outlined in these chapters will be in place to avoid any water pollution and subsequent effect on flora and fauna.

Biodiversity and Air and Climate

During the construction phase of the proposed development, increased vehicular and dust emissions within and around the site have the potential to be a nuisance to flora and fauna, thereby having a temporary, slight, negative effect. The mitigation measures outlined in Chapter 10 of the EIAR will ensure that the potential for negative effects is reduced or eliminated.

During the operational phase, the proposed development will help offset carbon emissions from fossil fuel based electricity generation plants, which will help contribute to a slower increase in the rate of

global warming and a reduction in air pollution, consequently, could in combination with other renewable energy projects, have a long term, significant positive effect on flora and fauna.

Biodiversity and Noise and Vibration

Site activity during the construction phase could give rise to noise that could be a nuisance for fauna, thereby having a temporary, slight, negative effect. Best practice mitigation measures are included in Chapter 6 and Chapter 11 to minimise the potential negative effect of noise generated during the construction phase on ornithology.

Biodiversity and Landscape

The removal of some vegetation within the development footprint and surrounding areas is likely to result in a change to the visual landscape during the construction phase, which will become part of the normal landscape of the wider area for the duration of the operational phase. The visual effect of this change is considered to be long-term, localised and slight.

15.2.3 Ornithology

Ornithology and Land, Soils and Geology

The removal of forestry, peat and spoil, during construction of the proposed development, is likely to result in some disturbance of flora and fauna, including birds, in the areas surrounding the proposed works area thereby, potentially causing an indirect long term, slight, negative effect on birds.

Ornithology and Water

Site activities during the construction phase have the potential to give rise to some water pollution, and consequential indirect effects on birds and their prey species (such as disturbance and deterioration of habitat quality) that use that water within the same catchment. The site activities during the construction phase, and continuing on for the operational phase, are likely to give rise to additional localised drainage, which has the potential to have a significant, negative effect on the habitats of particular bird species and subsequently a long, term, negative effect on ornithology should the measures outlined in Chapter 9 of this EIAR not be implemented.

Ornithology and Air and Climate

During the construction phase of the proposed development, increased vehicular and dust emissions within and around the site have the potential to be a nuisance for birds, thereby having a temporary, slight, negative effect. The mitigation measures outlined in Chapter 10 of the EIAR will ensure that the potential for negative effects is reduced or eliminated.

During the operational phase, the proposed development will help offset carbon emissions from fossil fuel based electricity generation plants, which will help contribute to a slower increase in the rate of global warming and, consequently, could in combination with other renewable energy projects, contribute to preventing the loss of bird species from Ireland as a result of climate change.

Ornithology and Noise and Vibration

Site activity during the construction phase could give rise to noise that could be a nuisance for birds that use the site, therefore, causing a temporary, slight, negative effect on ornithology. Best practice mitigation measures are included in Chapter 7 and Chapter 11 to minimise the potential negative effect of noise generated during the construction phase on ornithology.

15.2.4 Land, Soils and Geology

Land, Soils and Geology and Water

As identified in Chapter 9 of this EIAR, the movement and removal of peat and spoil during the construction phase has the potential to have a significant, negative effect on water quality through potentially silt-laden runoff from the proposed works areas. Mitigation measures to ensure there are no significant, negative effects on water quality are presented in Chapter 9.

Land, Soils and Geology and Archaeological, Architectural and Cultural Heritage

The removal of peat and spoil during the construction phase has the potential to have a permanent, significant, negative effect on previously unrecorded sub-surface archaeological site and artefacts. Mitigation measures outlined in Chapter 13 will reduce the potential for negative effects on unrecorded sites and artefacts during excavations.

Land, Soils and Geology and Landscape and Visual

The removal of peat and spoil and the subsequent replacement with crushed stone for the construction of site roads and hardstanding areas within the proposed development site has the potential to alter the local landscape. The visual effect of this change is expected to be long term, localised in nature and slight.

15.2.5 Air and Climate

Air and Climate and Material Assets

The movement of construction vehicles both within and to and from the site has the potential to give rise to dust nuisance effects during the construction phase. This is assessed further in Chapter 10 of this EIAR, and mitigation measures are presented to minimise any potential effects.

15.2.6 Landscape and Visual

Landscape and Visual and Cultural Heritage

As described in Chapter 13 of this EIAR, the proposed development has the potential to change the landscape setting of recorded sites and monuments in the wider area. However, it is concluded in Chapter 13 that any potential, indirect, visual effect of the proposed development on national and recorded monuments would not be significant.

15.3 Mitigation and Residual Impacts

Where any potential interactive negative impacts have been identified in the above, a full suite of appropriate mitigation measures has already been included in the relevant sections (Chapters 5-14) of the EIAR. The implementation of these mitigation measures will reduce or remove the potential for these effects. Information on potential residual impacts and the significance of effects, is also presented in each relevant chapter.

16. SCHEDULE OF MITIGATION

16.1 Introduction

All mitigation measures relating to the pre-commencement, construction and operational phases of the Proposed Development are set out in the relevant chapters of the EIAR submitted as part of the planning permission application.

It is intended that the CEMP will be updated where required prior to the commencement of the development, to include all mitigations measures, conditions and or alterations to the EIAR and application documents should they emerge during the course of the planning process and would be submitted to the Planning Authority for written approval.

All mitigation measures which will be implemented during the pre-commencement, construction and operational phases of the project are outlined in Table 16-1. The mitigation measures have been grouped together according to their environmental field/topic and are presented under the following headings:

- Construction Management
- Drainage Design and Management
- Peat, subsoils and bedrock
- Population and Human Health
- Biodiversity
- Ornithology
- Noise
- Air Quality/Dust
- Traffic
- Cultural Heritage

The mitigation proposals in the below format provides an easy to audit list that can be reviewed and reported on during the future phases of the project. The proposal for site inspections and environmental audits are set out in the Construction and Environmental Management Plan (CEMP) which is included as Appendix 4-4 of this EIAR. 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.

16.2 EIAR Mitigation and Monitoring Measures

Table 16-1 Schedule of Mitigation Croagh Wind Farm

EIAR Mitigation Measure (MM) Number	Reference Heading	Location	Mitigation Measure
Pre-Commencement Phase			
MM1	Environmental Management	EIAR Chapter 4	The Contractor will be responsible for implementing the mitigation measures specified throughout the EIAR and compiled in the Audit Report which is included in the CEMP. The Contractor will also be responsible for ensuring that all construction staff understand the importance of implementing the mitigation measures. The implementation of the mitigation measures will be overseen by the environmental clerk of works or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary.
MM2	Environmental Management	EIAR Chapter 4	The Environmental Clerk of Works will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office.
MM3	Environmental Management	EIAR Chapter 4	A Site Environmental Clerk of Works will oversee the site works and implementation of the Construction Environmental Management Plan (CEMP), and provide on-site advice on the mitigation measures necessary as necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the Site Environmental Clerk of Works for the

			Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by parties where required prior to commencement of construction, and may be further adjusted as required during the course of the project.
MM4	Environmental Management	EIAR Chapter 4	An Ecological Clerk of Works (ECoW) or Project Ecologist will be appointed. Duties will include: › 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 site. › 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 where required with regular updates in relation to construction progress.
MM5	Site Drainage Plan	EIAR Chapter 4	› The Project Hydrologist/Design Engineer will assist in preparing a site drainage plan before construction commences.
MM6	Preparative Site Drainage Management,	EIAR Chapter 4	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 EIS/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	Biodiversity	EIAR Chapter 6	Pre-construction surveys for Badger and Otter will be undertaken prior to the commencement of works
MM8	Biodiversity	EIAR Chapter 6	On a precautionary basis, prior to the commencement of any site works, a badger sett disturbance licence will be sought from the National Parks and Wildlife Service.

MM9	Biodiversity	EIAR Chapter 6 and Chapter 4	A detailed drainage maintenance plan for the proposed development is provided in Chapter 4 of this EIAR. This plan provides details of how water quality will be protected during the construction of the proposed development
MM10	Biodiversity	EIAR Chapter 6	The implementation of the Biodiversity Management has been provided which will ensure that any Upland blanket bog habitat that is lost to facilitate the proposed infrastructure will be replaced within the site The proposed development has the potential to result in enhancement of the surrounding areas through habitat rehabilitation management which is outlined in the Biodiversity Management Plan.
MM11	Ornithology	EIAR Chapter 7	A breeding bird survey will be undertaken between April and July. Monitoring will be undertaken by a suitably qualified ornithologist. The survey will include a thorough walkover survey to a 500m radius of the development footprint and/or all works areas, where access allows. If breeding activity of birds of high conservation concern is identified, the nest site will be located, and earmarked for monitoring at the beginning of the first breeding season of the construction phase. If it is found to be active during the construction phase no works shall be undertaken within a 500m buffer (Forestry Commission Scotland 2006; Ruddock & Whitfield 2007) in line with best practise. No works shall be permitted within the buffer until it can be demonstrated that the nest is no longer occupied.
MM12	Traffic Management Plan, Delivery Programme, pre-commencement road works	EIAR Chapter 14	A **Traffic Management Plan (TMP)** is provided specifying details relating to traffic management and as Appendix 14-2 this EIAR. Prior to the commencement of the construction phase of the proposed development a final Traffic Management Plan, incorporating all the mitigation measures set out in the TMP will be prepared by the Contractor for agreement with the local authority and An Garda Síochána. The TMP includes recommendations for 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 Councils 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 authorities 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 verify and record the 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 Councils 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 Councils 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, › Additional measures - Various additional measures will be put in place 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 4.3. › Re-instatement works - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.
MM13	Information to Local Residents	EIAR Chapter 14	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. The Coillte CLO, in place since June 2018 will also be liaising wityh all local residents and near neighbours.
Construction Phase			
Construction Management			
MM14	Health and Safety	EIAR Chapter 5	During construction of the Proposed Development, all staff will be made aware of and adhere to: › Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005); › Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007), as amended; › Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. 291 of 2013), as amended; and

			› Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006). This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan which will include measures to exclude members of the public from certain areas of the site during construction.
MM15	Health and Safety	EIAR Chapter 4	Stock-proof fencing will be erected around the borrow pit and peat and spoil repositories if deemed necessary to prevent uncontrolled access to this area. Appropriate health and safety signage will also be erected on this fencing and at locations around the site
MM16	Health and Safety	EIAR Chapter 5	The scale and scope of the project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'. The PSDP appointed for the construction stage shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to): › Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project; › Where possible, eliminate the hazards or reduce the risks; › Communicate necessary control measures, design assumptions or remaining risks to the PSCS so they can be dealt with in the Safety and Health Plan; › Ensure that the work of designers is coordinated to ensure safety; › Organise co-operation between designers; › Prepare a written Safety and Health Plan; › Prepare a safety file for the completed structure and give it to the client; and › Notify the Authority and the client of non-compliance with any written directions issued.

MM17	Health and Safety	EIAR Chapter 5	The PSCS appointed for the construction stage shall be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to): › Development of the Safety and Health Plan for the construction stage with updating where required as work progresses; › Compile and develop safety file information › Reporting of accidents / incidents; › Weekly site meeting with PSCS; › Coordinate arrangements for checking the implementation of safe working procedures. Ensure that the following are being carried out: › Induction of all site staff including any new staff enlisted for the project from time to time; › Toolbox talks as necessary; › Maintenance of a file which lists personnel on site, their name, nationality, current Safe Pass number, current Construction Skills Certification Scheme (CSCS) card (where relevant) and induction date; › Report on site activities to include but not limited to information on accidents and incidents, disciplinary action taken and PPE compliance; › Monitor the compliance of contractors and others and take corrective action where necessary; and › Notify the Authority and the client of non-compliance with any written directions issued.
MM18	Refuelling,	EIAR Section 4, 6, 8, 9	On-site refuelling will be carried out using a mobile double skinned, bunded 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 jeep 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. Refuelling operations will be carried out only by designated trained and competent operatives under a Permit to Refuel process. Mobile anti-

			pollution measures such as drip trays and fuel absorbent mats will be used during all refuelling operations
MM19	Reinstatement	EIAR Chapter 4	Some overburden material will be stored temporarily adjacent to the works areas for reinstatement when the main construction activities are completed. Soil will be backfilled outside the drainage channels along track-sides and vegetated sods replaced over the surface, bedded-in, regraded, etc., to re-constitute a stable and settled ground surface on which the natural vegetation can recover and will be resistant to erosion.
MM20	Plant and Equipment Inspections	EIAR Chapter 8.	A programme for the regular inspection of plant and equipment for leaks and fitness for purpose will be developed at the outset of the construction phase.
MM21	Environmental Management- Invasive Species	EIAR Chapter 6	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 Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes. › Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist. › Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licencing. › The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area. › All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works. › 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 species such as Knotweed. All clean down must be undertaken in areas with no potential to result in the spread of invasive species. › When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal. › 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. › Any soils or subsoils contaminated with invasive species will sent for disposal to an authorized waste facility under licence from NPWS. 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) and Irish Water (2016) Information and Guidance Document on Japanese Knotweed.
Drainage Design and Management			
MM22	Clear Felling of Coniferous Plantation	EIAR Chapter 9	A self-imposed buffer zone of 50 metres will be maintained for all streams. The large distance between most of the proposed felling areas (which are outside the 50m buffer) and sensitive aquatic zones means that potential poor-quality runoff from felling areas will be adequately managed and attenuated prior to even reaching the aquatic buffer zone and primary drainage routes. The following mitigation measures will be employed during tree felling. Additional measures are indicated for felling inside the 50m buffer zone. Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods (from the guidance listed above) which are set out as follows:

			› Machine combinations (i.e. hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; › Trees will be cut manually inside the 50m buffer and using machinery to extract whole trees only; › Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicle through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works; › Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour; › Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas. Where possible, all new silt traps will be constructed on even ground and not on sloping ground; › In areas particularly sensitive to erosion or where felling inside the 50 metre buffer is required, it will be necessary to install double or triple sediment traps. › Double silt fencing will also be put down slope of felling areas which are located inside the 50 metre buffer zone; › All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone; › Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain

			alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled; › Brash mats will be used 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. Where there is risk of severe erosion occurring, extraction should be suspended during periods of high rainfall; › Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites; › Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off; › Checking and maintenance of roads and culverts will be on-going through the felling operation; › No crossing of streams by machinery will be permitted and only travel perpendicular to and away from stream will be allowed; › Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, qualified personnel will be used where refuelling is required; › A permit to refuel system will be adopted at the site; and, › Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.
MM23	Silt Traps	EIAR Chapter 9	Silt traps will be strategically placed down-gradient within forestry drains near streams. The main purpose of the silt traps and drain blocking is to slow water flow, increase residence time, and allow settling of silt in a controlled manner.
MM24	Drain Inspection and Maintenance	EIAR Chapter 9	The following items shall be carried out during pre-felling inspections and after:

			› Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines; › Inspection of all areas reported as having unusual ground conditions; › Inspection of main drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches shall be identified. Ideally the pre-felling inspection shall be carried out during rainfall; › Following tree felling all main drains shall be inspected to ensure that they are functioning; › Extraction tracks nears drains need to be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground; › Culverts on drains exiting the site will be unblocked; and, › All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.
MM25	Surface Water Quality Monitoring	EIAR Chapter 9	Sampling will be completed before, during (if the operation is conducted over a protracted time) and after the felling activity. The 'before' sampling should be conducted within 4 weeks of the felling activity, preferably in medium to high water flow conditions. The "during" sampling will be undertaken once a week or after rainfall events. The 'after' sampling will comprise as many samplings as necessary to demonstrate that water quality has returned to pre-activity status (i.e. where an impact has been shown). The felling surface water monitoring data will also be compared with the EIAR baseline water quality sampling data. Criteria for the selection of water sampling points include the following: › Avoid man-made ditches and drains, or watercourses that do not have year-round flows, i.e. avoid ephemeral ditches, drains or watercourses; › Select sampling points upstream and downstream of the forestry activities; › It is advantageous if the upstream location is outside/above the forest in order to evaluate the impact of land-uses other than forestry;

			› Where possible, downstream locations should be selected: one immediately below the forestry activity, the second at exit from the forest, and the third some distance from the second (this allows demonstration of no impact through dilution effect or contamination by other land-uses where impact increases at third downstream location relative to second downstream location); and, › The above sampling strategy will be undertaken for all on-site sub-catchments streams where tree felling is proposed. › Daily surface water monitoring forms will be utilised at every works site near watercourses. These will be taken daily and kept on site for record and inspection.
MM26	Earthworks	EIAR Chapter 9	› Avoid working during heavy rainfall and for up to 24 hours after heavy events to ensure drainage systems are not overloaded. › Apart from interceptor drains, which will convey clean runoff water to the downstream drainage system, there will be no direct discharge (without treatment for sediment reduction, and attenuation for flow management) of runoff from the proposed wind farm drainage into the existing site drainage network. This will reduce the potential for any increased risk of downstream flooding or sediment transport/erosion; › Silt traps will be placed in the existing drains upstream of any streams where construction works / tree felling is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; › During the construction phase of the wind farm, runoff from individual turbine hardstanding areas will be not discharged into the existing drain network but discharged locally at each turbine location through stilling ponds and buffered outfalls onto vegetated surfaces; › Buffered outfalls which will be numerous over the site will promote percolation of drainage waters across vegetation and close to the point at which the additional runoff is generated, rather than direct discharge to the existing drains of the site; and, › Drains running parallel to the existing roads that requiring widening will be upgraded, widening will be targeted to the opposite side of the road. Velocity and silt control measures such as check dams, sand bags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction

			works. Regular buffered outfalls will also be added to these drains to protect downstream surface waters.
MM27	Check dams	EIAR Chapter 9	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. 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 as per the drainage design.
MM28	Level Spreaders	EIAR Chapter 9	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.
MM29	Vegetation filters	EIAR Chapter 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.
MM30	Settlement ponds	EIAR Chapter 9	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 as per the drainage design.
MM31	Silt Fences	EIAR Chapter 9	Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to water courses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be placed within drains down-gradient of all construction areas inside the hydrological buffer zones.
MM32	Water Treatment Train	EIAR Chapter 9	A water treatment train such as a “Siltbuster” if required. If the discharge water from construction areas fails to be of a high quality during the daily inspections then a filtration treatment system (such

			as a 'Siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This will apply for all of the construction phase.
MM33	Silt Bags	EIAR Chapter 9	Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, the majority of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats Sediment entrapment mats, consisting of coir or jute matting, will be placed at the silt bag location to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure.

MM34	Potential Release of Hydrocarbons	EIAR Chapter 9	› All plant will be inspected and certified to ensure they are leak free and in good working order prior to use on site; › On-site re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer or truck will be re-filled off site and will be towed/driven around the site to where machinery are located. The 4x4 jeep/fuel truck 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 and only designated trained and competent operatives will be authorised to refuel plant on site under a Permit to refuel process. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations; › Fuels stored on site will be minimised. Any storage areas will be located within the temporary construction compounds and be bunded appropriately for the fuel storage volume for the time period of the construction; › The electrical control building 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; › An emergency plan for the construction phase to deal with accidental spillages will be contained within the Construction Environmental Management Plan. Spill kits will be available to deal with accidental spillages.
MM35	Release of Cement-Based Products	EIAR Chapter 9	› 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. › the use of pre-cast elements for culverts and concrete works will beprioritised. › Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined cement washout ponds. › Weather forecasting will be used to plan dry days for pouring concrete.

			› The pour site will be kept free of standing water and plastic covers will be ready in case of sudden rainfall event.
MM36	Morphological Changes to Surface Water Courses & Drainage Patterns	EIAR Chapter 9	› All proposed new stream crossings will be bottomless culverts or clear span structures and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing location; › Where the proposed underground cabling route follows an existing road or road proposed for upgrade, the cable will pass over or below the culvert within the access road; › Any guidance / mitigation measures required by the OPW or the Inland Fisheries Ireland during consultation/consenting process (such as Section 50 Applications as defined below) will be incorporated into the design of the proposed crossings; › As a further precaution, near stream construction work, will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", i.e., May to September inclusive. This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI); › During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas; and, › All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

MM37	Plant and equipment inspections	EIAR Chapter 8	Site plant will 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 the Construction Environmental Management Plan. Spill kits will be available to deal with accidental spillages.
MM38	Wastewater Disposal	EIAR Chapter 4	Temporary port-a-loo toilets located within a staff portacabin will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by an appropriately consented waste collector to wastewater treatment plants.
MM39	Concrete Deliveries and Management	EIAR Chapter 4	No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products will be used and where possible, pre-cast elements for culverts and concrete works will be used.
MM40	Concrete Deliveries and Management	EIAR Chapter 4	No washing out of any plant used in concrete transport or concreting operations will be allowed on-site.
MM41	Concrete Deliveries and Management	EIAR Chapter 4	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. Chute cleaning water is to be directed into a dedicated lined washout area. This lined area will be removed from site once the construction phase is complete.
MM42	Concrete Deliveries and Management	EIAR Chapter 4	Weather forecasting will be used 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
MM43	Concrete Deliveries and Management	EIAR Chapter 4	The use of pre-cast elements for culverts and concrete works will beprioritised.

Peat, Subsoils and Bedrock			
MM44	Topsoil/Peat and Subsoil Excavation	EIAR Chapter 8	› Placement of turbines and associated infrastructure in areas with shallow peat during the design phase; › Use of the existing road network to reduce peat excavation and borrow pit volumes; › Use of floating roads (where acceptable to do so) to reduce peat excavation volumes; › The peat and subsoil which will be removed during the construction phase will be localised to the Proposed Development infrastructure; › No turbines or related infrastructure will be constructed near or on any designated sites such as NHAs or SACs; › A minimal volume of peat and subsoil will be removed to allow for infrastructural work to take place in comparison to the total volume present on the site due to optimisation of the layout by mitigation by design; › The bedrock at the site is classified as "Medium" importance; and, › The peat deposits and mineral soil at the site is classified as "Low" importance as the blanket bog is already degraded by forestry works and drainage.
MM45	Peat Instability and Failure	EIAR Chapter 8	› Appointment of experienced and competent contractors; › The site will 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 as detailed in the peat stability assessment report; › 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.
MM46	Contamination of Soil by Leakages and Spillages and	EIAR Chapter 8	› Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling will occur at a controlled fuelling station;

	Alteration of Peat/Soil Geochemistry		› On site re-fuelling will be undertaken using a double skinned bowser with spill kits on the ready for accidental leakages or spillages; › On site re-fuelling will be undertaken by suitably trained personnel only under a permit to refuel system; › Fuels stored on site will be minimised. Storage areas located at the temporary compounds where required will be bunded appropriately for the fuel storage volume for the time period of the construction 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 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; › The plant used during construction will be regularly inspected for leaks and fitness for purpose; › All waste tar material arising from the chipping and resurfacing of the public road portion of the temporary construction access road will be removed off-site and taken to licenced waste facility; › An emergency plan for the construction phase to deal with accidental spillages is contained within the Construction and Environmental Management Plan (Appendix 4-4 of this EIAR). Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.
MM47	Erosion of Exposed Subsoils and Peat During Construction of Infrastructure	EIAR Chapter 8	› Peat removed from turbine locations and access roads will be used for landscaping, placed alongside designated access roads, used to reinstate the 1 no. proposed borrow pits or placed in 2 no. repositories. Where possible, the acrotelm shall be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat within the borrow pits. Re-seeding and spreading/planting of heather and moss cuttings will also be carried out in these areas. These measures will prevent erosion of stored peat in the long term. A full Peat and Spoil Management Plan for the development is included as Appendix 4-2. › Any excess temporary mounded peat in storage for long periods will be sealed using the back of an excavator bucket. This will prevent erosion of soil. Silt fences

			will be installed around stockpiles to limit movement of entrained sediment in surface water runoff. The use of bunds around earthworks and mounds will prevent egress of water from the works. › In order to minimize erosion of mineral subsoils stripping of peat will not take place during extremely wet periods as defined in the Chapter 9 of this EIAR (to prevent increased silt rich runoff). Temporary drainage systems will be required to limit runoff impacts during the construction phase. › During tree felling, brash mats will be used 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 will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.
Biodiversity			
MM48	Potential Effects on Rivers and Streams, Open Waterbodies and Sensitive Aquatic Faunal Species	EIAR Chapter and Chapter 9	› A detailed drainage maintenance plan for the proposed development is provided in Section 4.7.11 of this EIAR. This plan provides details of how water quality will be protected during the construction of the proposed development. In addition to this, specific mitigation is provided in relation to water quality in Chapter 9 of this EIAR. In addition, the Construction Environmental Management Plan (CEMP) that is provided as Appendix 4-4 of the EIAR, provides the details of exactly how the measures will be implemented during construction. › In relation to watercourse crossings, Inland Fisheries Ireland (IFI) will be consulted a minimum of four weeks in advance of the installation of clear-span bridges .
MM49	Potential Effects on Peatlands and Associated Habitats	EIAR Chapter 6	› The proposed development has been deliberately designed to minimise loss of Upland blanket bog (PB2). Where the development footprint does occur on this habitat at Turbine 1, the proposed development provides for the replacement of peatland habitat through the restoration of forestry (WD4) back to peatland, located adjacent to Turbine 7. This is fully described in the site-specific Biodiversity Management Plan (BMP), provided in Appendix 6-5 of the EIAR. The BMP aims to ensure that there will be no net loss of peatland habitat

			associated with the proposed development. This has been further developed by the inclusion of an additional peatland enhancement area comprising of degraded Upland blanket bog (PB2) located to the north of Turbine 7. It is proposed to undertake enhancement of this area of peatland through drain blocking and the removal of encroaching conifers (establishing as a result of natural seed dispersal). The location and extent of the habitat replacement and enhancement areas located adjacent to T7 are mapped in the Biodiversity Management Plan, Appendix 6-5 of the EIAR
MM50	Fauna	EIAR Chapter 6	› An exclusion zone will be put in place along the section of haul road during the construction phase to ensure works are not undertaken within 30 metres of a known badger sett on site (known to be approx. 40 metres from the proposed footprint). › No works should be undertaken within 150m of any holts at which breeding females or cubs are present. › No wheeled or tracked vehicles (of any kind) should be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance should also not take place within 15m of such holts, except under licence (TII, 20061). › All of the above works will be undertaken or supervised by an appropriately qualified ecologist.
MM51	Bats	EIAR Chapter 6	› Construction best practice will be employed to minimise general noise and disturbance potential. 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).
MM52	Invasive Species	EIAR Chapter 6	› All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere.

[1] *NRA, 2006. Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes. Dublin: Transport Infrastructure Ireland. Available at: www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Otters-prior-to-the-Construction-of-National-Road-Schemes.pdf*

			› Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally. › Stands of Knotweed will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. A minimum buffer of seven metres will be applied to avoid disturbance of lateral Knotweed rhizomes. › Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist. › Should removal of Knotweed off site be required this will be done so under the supervision of an ecologist in line with NPWS licencing. › The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area. › All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works. › 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 species such as Knotweed. All clean down must be undertaken in areas with no potential to result in the spread of invasive species. › When working at locations in proximity to natural watercourses, a suitable barrier will be erected between the watercourse and the stand of invasive species. This will assist in preventing the spread of any invasive species into the watercourse during their removal. › 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. › Any soils or subsoils contaminated with invasive species will sent for disposal to an authorized waste facility under licence from NPWS. › 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) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed.*
Ornithology			
MM53	Ornithology	EIAR Chapter 7	Taking a precautionary approach, it is proposed that construction works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm.
MM54	Ornithology	EIAR Chapter 7	› Following from the pre-commencement surveys, if a nest site of a high conservation species is found to be active during the construction phase no works shall be undertaken within a 500m buffer (Forestry Commission Scotland 2006; Ruddock & Whitfield 2007) in line with best practise. No works shall be permitted within the buffer until it can be demonstrated that the nest is no longer occupied. › The removal of woody vegetation will be undertaken in accordance with Section 40 of the Wildlife Act 1976 as amended. › During the construction phase, noise limits, noise control measures, hours of operation (i.e. dusk and dawn is high faunal activity time) and selection of plant items will be considered in relation to disturbance of birds. › Plant and machinery will be turned off when not in use. › All plant and equipment for use will comply with the Construction Plant and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001 (S.I. No. 632 of 2001) other relevant legislation. › An Ecological Clerk of Works (ECoW) will be appointed and will operate for the duration of construction works. Duties will include: o Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided. o Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development site. o Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise. o 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.
Noise & Vibration			
MM55	BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Noise*	EIAR Chapter 5 and Chapter 11	The proposed development is predicted to comply with the identified criteria for the construction phase. While no specific mitigation measures are required to achieve construction noise criteria, best practice mitigation measures below will be complied with. › limiting the hours during which site activities likely to create high levels of noise or vibration are permitted; › establishing channels of communication between the contractor/developer, Local Authorities and residents; › appointing a site representative responsible for matters relating to noise and vibration; › monitoring typical levels of noise and vibration during critical periods and at sensitive locations; keeping site access roads even to mitigate the potential for vibration from lorries; › selection of plant with low inherent potential for generation of noise and/ or vibration; › placing of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints, and; › regular maintenance and servicing of plant items. › No plant used on site will be permitted 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 outside of general construction hours will be surrounded by an acoustic enclosure or portable screen. › During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Section 11.3.2.1.1 . using methods outlined in British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise. › The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 7:00hrs and 19:00hrs weekdays and between 7:00hrs and 14:00hrs on Saturdays. However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (i.e. concrete pours, rotor/tower deliveries) it will be necessary on occasion to work outside of these hours.
MM56	*BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration*	EIAR Chapter 5 and Chapter 11	Specific to blasting the following mitigation measures will be employed to control the impact during blasts › Trial blasts may be undertaken to obtain scaled distance analysis; › Ensuring appropriate burden to avoid over or under confinement of the charge; › Accurate setting out and drilling; › Appropriate charging; › Appropriate stemming with appropriate material such as sized gravel or stone chipping; › Delay detonation to ensure small maximum instantaneous charges; › Decked charges and in-hole delays; › Blast monitoring to enable adjustment of subsequent charges; › Good blast design to maximise efficiency and reduce vibration; › Avoid using exposed detonating cord on the surface.
MM57	*BS 5228-1:2009+A1:2014 Code of practice for noise and vibration*	EIAR Chapter 5	Where rock breaking is employed in relation to the proposed borrow pit location, the following are examples of measures that will be employed, where necessary, to mitigate noise emissions from these activities:

	control on construction and open sites – Noise; Vibration		› Fit suitably designed muffler or sound reduction equipment to the rock breaking tool to reduce noise without impairing machine efficiency. › Ensure all leaks in air lines are sealed. › Use a dampened bit to eliminate ringing. › Erect acoustic screen between compressor or generator and noise sensitive area. When possible, line of sight between top of machine and reception point needs to be obscured. › Enclose breaker or rock drill in portable or fixed acoustic enclosure with suitable ventilation.
MM58	*BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise; Vibration*	EIAR Chapter 5 and Chapter 11	Where blasting is employed in relation to the proposed borrow pit location, the following are examples of measures that will be employed, where necessary, to mitigate noise emissions from these activities: › Restriction of hours within which blasting can be conducted (e.g. 09:00 – 18:00hrs). › Notification to nearby residents before blasting starts (e.g. 24-hour written notification). › The firing of blasts at similar times to reduce the 'startle' effect. › On-going circulars informing people of the progress of the works. › The implementation of an onsite documented complaints procedure. › The use of independent monitoring by external bodies for verification of results. › Trial blasts in less sensitive areas to assist in blast designs and identify potential zones of influence.
Air Quality/Dust			
MM59	Dust Emissions	EIAR Chapter10	› In periods of extended dry weather, dust suppression may be necessary along haul roads, site roads, substation and construction compounds and around the borrow pit area 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, borrow pit and site compounds 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 which may have the potential to generate dust will be undertaken with tarpaulin cover or similar, where necessary. › The transport of dry excavated material from the on-site borrow pit which may have potential to generate dust will be avoided. If necessary, excavated material will be dampened prior to transport from the borrow pits.
MM60	Exhaust Emissions	EIAR Chapter 10	› All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise. › All machinery will be switched off when not in use. › The majority of aggregate materials for the construction of the proposed development will be obtained from the borrow pit on site. This will significantly reduce the number of delivery vehicles accessing the site, thereby reducing the amount of emissions associated with vehicle movements.
MM61	Greenhouse Gas Emissions	EIAR Chapter 10	› All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise. › Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority. › Aggregate materials for the construction of site access tracks and all associated infrastructure will all be locally sourced, where possible, which will further reduce potential emissions.

Traffic			
MM62	Traffic Management Co-Ordinator	EIAR Chapter 14	A competent Traffic Management Coordinator 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.
MM63	Liaison with the relevant local authority	EIAR Chapter 14	Liaison with the relevant local authority including the roads section of local authorities that the delivery routes traverse and An Garda Siochána, during the delivery phase.
MM64	Travel Plans for Construction Workers	EIAR Chapter 14	The construction company will be required to provide a travel plan for construction staff, which will include the identification of a routes to / from the site and identification of an area for parking.
MM65	Temporary traffic signs	EIAR Chapter 14	As part of the traffic management measures temporary traffic signs will be put in place at all key junctions, including the access junction on the N15. All measures will be in accordance with the "Traffic Signs Manual, Chapter 8 – Temporary Traffic Measures and Signs for Road Works" (DoT now DoTT&S) and "Guidance for the Control and Management of Traffic at Roadworks" (DoTT&S). A member of construction staff (flagman) will be present at key junctions during peak delivery times.
MM66	Delivery of abnormal sized loads	EIAR Chapter 14	The following are the main points to note for these deliveries which will take place after peak evening traffic: › 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. › The deliveries will be made in consultation with the Local Authority and An Garda Síochána. › It is estimated that 90 abnormal sized loads will be delivered to the site, comprising 18 convoys of 5, undertaken over 18 separate nights. › These nights will be spread out over an approximate period of 9 weeks and will be agreed in advance with the relevant authorities › In order to manage each of the travelling convoys, for each convoy there will be two Garda escort vehicles that will stop traffic at the front and rear of the convoy of 5 vehicles.

			➢ There will also be two escort vehicles provided by the haulage company for each convoy ➢ 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.
MM67	Telecommunications	EIAR Chapter 14	The Department of Defense and Irish Aviation Authority (IAA) set out lighting requirements for turbines. These requirements will be complied with and form part of the proposed development. The coordinates and elevations for built turbines will be supplied to the IAA, as is standard practice for wind farm developments.
Cultural Heritage			
MM68	Impact of excavation works on unrecorded potential sub-surface sites	EIAR Chapter 13	➢ Archaeological monitoring (under licence from the National Monuments Service) of any further geotechnical / engineering trial pits or investigations and a report detailing the results of same. ➢ Archaeological monitoring of ground works during construction works. The National Monuments Service will be informed of such findings to discuss how best to proceed. If archaeological finds, features or deposits are uncovered during archaeological monitoring, 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).Once the project is completed, a report on the results of the monitoring will be compiled and submitted to the relevant authorities. ➢ Preservation of Townland boundaries by record where relevant during construction stage monitoring at the following areas: o Proposed new road to T1 where it traverses the Garvagh/Garvagh-Glebe townland boundary

			○ Proposed New road to T3 where it traverses the Garvagh-Glebe/ Carrownyclowan townland boundary › A licensed metal detection survey of the watercourses that are proposed to be crossed. The metal detection survey will be undertaken concurrently during the construction stage in advance of any works to the rivers/streams. A report on the results should be submitted to the relevant authorities. › Archaeological monitoring of any geotechnical / engineering trial pits or investigations and a report detailing the results of same. › Archaeological monitoring of any geotechnical / engineering trial pits or investigations along the off-road sections of the proposed construction access road and a report detailing the results of same. › Archaeological monitoring of topsoil/peat removal of all off-road sections of the proposed route during construction. A report on the results of the monitoring shall be compiled and submitted to the relevant authorities on completion of the project.
MM69	Felling Licence	EIAR Chapter 4	› Felling will be carried out under the terms of a licence application to the Forest Service, as per the Forest Service's policy on granting felling licenses for wind farm developments
MM70	Clear felling of Coniferous Plantation	EIAR Chapter 4	› Works will be overseen by an ECoW as described above. › The extent of all necessary tree felling will be identified and demarcated with markings on the ground in advance of any felling commencing. › All roads and culverts will be inspected prior to any machinery being brought on site to commence the felling operation. No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings. › Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt traps will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled

			once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed. No direct discharge of such drains to watercourses will occur from within felling areas. › New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities. › All silt traps will be sited outside of buffer zones and have no direct outflow into the aquatic zone. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of away from all aquatic zones. › All new collector drains will taper out before entering the aquatic buffer zone to ensures the discharging water gently fans out over the buffer zone before entering the aquatic zone. › Machine combinations will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; › Mechanised operations will be suspended during and immediately after heavy rainfall. › Where brash is required to form brash mats, it is to be laid out at harvesting stage to prevent soil disturbance by machine movement. › Unused Brash may be moved within the site to facilitate the creation of mats in more demanding locations. › Felling of trees will be pointed directionally away from watercourses. › Felling will be planned to minimise the number of machine passes in any one area. › Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible. › Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone. Straw bales and check dams to be emplaced on the down gradient side of timber storage sites. › Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when harvesting operations have been completed but removing of natural debris deflectors will be avoided

Operational Phase			
Health and Safety			
MM71	Health & Safety	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. Signs will be erected at suitable locations such as, amenity access points and carparks, setting out the conditions of public access under the relevant legislation and providing normal hours (and out of hours) contact details. Staff associated with the project will conduct frequent visits, which will include inspections to establish whether any signs have been defaced, removed or are becoming hidden by vegetation or foliage, with prompt action taken as necessary. Signs will also be erected at suitable locations across the site as required for the ease and safety of operation of the wind farm. These signs include: › Buried cable route markers at 30m (maximum) intervals and change of cable route direction; › Directions to relevant turbines at junctions; › "No access to Unauthorised Personnel" at appropriate locations; › Speed limits signs at site entrance and junctions; › "Warning these Premises are alarmed" at appropriate locations; › "Danger HV" at appropriate locations; › "Warning – Keep clear of structures during electrical storms, high winds or ice conditions" at site entrance; › "No unauthorised vehicles beyond this point" at specific site entrances; and › Other operational signage required as per site-specific hazards.
MM72	Health & Safety	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.

			The components of a wind turbine are designed to last up to 30 years and are equipped with a number of safety devices to ensure safe operation during their lifetime. During the operation of the wind farm regular maintenance of the turbines will be carried out by the turbine manufacturer or appointed service company. A project or task specific Health and Safety Plan will be developed for these works in accordance with the site's health and safety requirements.
Biodiversity			
MM73	Bats	EIAR Chapter 6	In order 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. Details of this mitigation and how it is calculated is provided in Appendix 6-2. In addition to this, ongoing monitoring of bat activity will be undertaken for at least 3 years' post construction of the wind farm. This will provide data and information on the actual recorded impact of the wind turbines on the local bat populations. Full details of the proposed monitoring programme are provided in Appendix 6.2 and include measurement of bat activity, weather conditions and any correlation between the two. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions. If, following monitoring, there are significant effects recorded, a range of measures are proposed to ensure that any such effects are fully mitigated. These measures include blade feathering, curtailment of turbines during certain conditions and increase of buffers surrounding the turbines. Any or all of the above measures may be employed following actual monitoring of the impact of the operating turbines on bats to ensure that no potential for significant effects on bat species remains.
Traffic Management			
MM74	Roads	EIAR Chapter 14	**A Post Construction Condition Survey** – Where required by the local authority, 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

Population and Human Health			
MM75	Shadow Flicker	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. 1. *Recording the weather conditions at the time of the site visit, including wind speeds and direction (i.e. blue sky, intermittent clouds, overcast, moderate breeze, light breeze, still etc.).* 2. *Recording the house number, time and duration of site visit and the observation point GPS coordinates.* 3. *Recording the nature of the sensitive receptor, its orientation, windows, landscaping in the vicinity, any elements of the built environment in the vicinity, vegetation.* 4. *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: 1. *Installation of appropriate window blinds in the affected rooms of the residence;* 2. *Planting of screening vegetation;* 3. *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 will be fitted with shadow flicker control units to allow the turbines to be controlled to prevent the occurrence of shadow flicker at properties surrounding the wind farm.

Ornithology			
MM76	Bird monitoring programmes	EIAR Chapter 7	A detailed post-construction Bird Monitoring Programme has been prepared for the operational phase of the Proposed Development, please refer to Appendix 7-7 for further details. The programme of works will monitor parameters associated with collision, displacement/barrier effects and habituation and these surveys will be scheduled to coincide with Years 1, 2, 3, 5, 10 & 15 of the life-time of the wind farm. Monitoring measures are broadly based on guidelines issued by the Scottish Natural Heritage (SNH, 2009). The following individual components are proposed for monitoring years: › Monthly flight activity surveys: vantage point surveys › Distribution and abundance surveys: breeding wader to a 500m radius of the development area, breeding hen harrier surveys and winter hen harrier roost surveys to a 2km radius of the development area. › Targeted bird collision surveys (corpse searches) will be undertaken with training dogs. The surveys will include detection and scavenger trials, to correct for these two biases and ensure the resulting data is robust.
Drainage Management Plan			
MM77	Progressive Replacement of Natural Surface with Lower Permeability Surfaces	EIAR Chapter 9	› Interceptor drains will be installed 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/road side drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling; › On steep sections of access road transverse drains ('grips') will be constructed in the surface layer of the road to divert any runoff off the road into swales/road side drains; › Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock;

			› Settlement ponds, emplaced downstream of road swale sections and at turbine locations, 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; and, › Settlement ponds will be designed in consideration of the greenfield runoff rate.
Noise & Vibration			
MM78	Turbine Programming	EIAR Chapter 11	› The predicted operational noise levels of the proposed development will be within the relevant best practice noise criteria curves for wind farms at all but one noise sensitive location. Therefore, on a very limited basis, curtailment of turbine operation in certain wind speeds and directions will be required to achieve the noise criteria Modern wind turbines can be programmed to run in reduced modes of operation (or low noise modes) in order to achieve the calculated 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. › Low Frequency Noise: In the unlikely event of low frequency noise, a detailed investigation will be undertaken following guidance outlined in Appendix VI of the EPA document entitled Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA, 2016). › Amplitude Modulation (AM): In the unlikely event of AM, an independent Acoustic Consultant will assess the level of AM in accordance with the methods outlined in the Institute of Acoustics (IoA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) namely, A Method for Rating Amplitude Modulation in Wind Turbine Noise (August 2016) or subsequent revisions (August 2016).
MM79	Noise Monitoring	EIAR Chapter 11	Commissioning noise surveys will be undertaken to ensure compliance with any noise conditions applied to the development. In the unlikely instance that an exceedance of these noise criteria is identified, the assessment guidance outlined in the IoA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014) should be followed and relevant corrective actions will be taken. For example, implementation of noise operational modes resulting in curtailment of

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			turbine operation can be implemented for specific turbines in specific wind conditions to ensure predicted noise levels are within the relevant noise criterion curves/planning conditions. Such curtailment can be applied using the wind farm SCADA system without undue effect on the wind farm operations. For post-commissioning of the proposed turbine units, the noise monitoring be repeated with consideration of the guidance outlined in the IoA GPG and Supplementary Guidance Note 5.
Decomissioning Phase			
MM80	Ornithology	EIAR Chapter 7	The following measures are proposed for the decommissioning phase: › During the decommissioning phase, disturbance limitation measures will be as per the construction phase, e.g. commencing works outside the bird nesting season (1st of March to 31st of August inclusive). › Plant machinery will be turned off when not in use. › All plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (SI 359/1996).