APPENDIX 11.4 - NOISE PREDICTION CALCULATION METHODOLOGY, INPUTS AND ASSUMPTIONS

Prediction calculations for turbine noise have been conducted in accordance with ISO 9613-2:2024: *Acoustics — Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors* (ISO 9613-2). Guidance in terms of the calculation settings has been obtained from the Institute of Acoustics (IOA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IOA GPG) and its associated supplementary guidance notes. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

This appendix provides supplementary information to the EIAR chapter in relation to calculation inputs and assumptions relevant to the noise predictions presented in Chapter 11 of the EIAR.

Ground Effect: Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depend on source height receiver height propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable defined as G, which varies between 0.0 for hard ground (including paving, ice concrete) and 1.0 for soft ground (includes ground covered by grass trees or other vegetation)

Turbine noise calculations have been conducted using a source height corresponding to the hub height of the turbines, a receiver height of 4m and a ground factor of G=0.5.

Other calculations for fixed plant have been conducted using an appropriate ground factor of 1.0 to account for the actual ground conditions between the source and receiver. The nominal receiver height of 4m has been applied to all NSL. The nearest NSL H083 (Landowner property) is a single storey dwelling and therefore a calculation height of 2m has been applied to this NSL.

Geometrical Divergence: This term relates to the spherical spreading in the free-field from a point sound source resulting in an attenuation depending on distance according to the following equation:

$$A_{geo} = 20 \times \log(d) + 11$$

where d = distance from the source

Atmospheric Adsorption: Sound propagation through the atmosphere is attenuated by the conversion of the sound energy into heat. This attenuation is dependent on the temperature and relative humidity of the air through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies.

The atmospheric attenuation outlined in Table 1 were used for all calculations in accordance with the guidance outlined in the IOA GPG. No meteorological corrections were applied to all calculations.

Table 1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

Temp (°C)	% Humidity	Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
10	70	0.12	0.41	1.04	1.92	3.66	9.70	33.06	118.4

The same temperature and relative humidity settings were used in the calculation of noise from fixed plant items (BESS and Substation).

Propagation Effects

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. For calculation of wind turbine noise, barrier and ground corrections have been applied in accordance with of ISO 9613-2 Annex D Calculation of sound pressure levels caused by wind turbines, sections D.3 and D.4

The noise prediction calculations have been undertaken using OSI ground topography data to account for propagation effects. The noise prediction software, iNoise, described in Section 11.4.5.1 of the EIAR incorporates the setting outlined in this appendix.

Table 2 list detail of the receptors used in the noise model and considered in the assessment.

Table 2 Coordinates (ITM) for Noise Sensitive Locations (NSLs)

NSL Ref.	Co – Ordinates (ITM)		NSL Ref.	Co – Ordinates (ITM)	
	Easting	Northing		Easting	Northing
H001	606649	698902	H154	606677	698710
H002	605252	700708	H155	601196	700565
H003	606680	698778	H156	601810	698986
H004	603051	701827	H157	603538	701582
H005	602379	698649	H158	606679	698744
H006	606582	697983	H159	606094	698858
H007	606527	699002	H160	605560	697144
H008	601756	699097	H161	606670	698834
H009	605176	700626	H162	606036	697933
H010[3]	603041	698628	H163	604989	694605
H011	606158	698771	H164	604775	694956
H012	606631	698948	H165	601185	700457
H013	601128	700390	H166	603989	695114
H014	603228	701251	H167	601188	699968
H015	603326	695518	H168	604319	694250
H016	604960	694557	H169	604714	694474
H017	605740	696773	H170	601388	699766
H018	604924	693821	H171	601963	700994
H019	606804	698311	H172	604164	702657
H020	607046	697441	H173	605622	698581
H021	603897	702070	H174	601470	700785
H022	607214	696430	H175	601816	701317
H023	603634	702356	H176	606688	698272
H024	603073	700992	H177	605351	701012
H025	605840	700796	H178	605862	696940
H026	605156	695456	H179	606942	697656
H027	605808	700813	H180	603868	696156
H028	605294	694460	H181	601710	701290
H029	604868	694881	H183	603375	701326
H030	601587	701108	H184	602173	701449
H031	601669	699312	H185	604859	694953
H032	602366	701506	H186	603134	697072
H033	602520	696107	H187	602078	695941
H034	606047	697135	H188	602727	697851
H035	601138	698847	H189	607236	696314
H036	606656	696055	H190	602416	701550
H037	605889	696999	H191	605746	698741
H038	603502	701536	H192	602489	700347
H039	603362	696763	H193	600729	699903
H041	604669	694927	H194	604353	695027
H042	601796	700138	H195	601242	700562
H043	602211	700016	H196	605879	694293
H044	601888	701293	H197	601829	701373
H045	606763	695876	H198	600943	700275
H046	605042	694742	H199	604772	694322
H047	604141	695804	H200	604684	694987

NSL Ref.	Co – Ordinates (ITM)		NSL Ref.	Co – Ordinates (ITM)	
	Easting	Northing		Easting	Northing
H048	605238	700664	H201	601202	699944
H049	604824	693974	H202	602878	697421
H050	601649	701233	H203	604318	695113
H051	604070	694734	H204	604631	694756
H052	600903	700308	H205	605128	700408
H053	602834	697527	H206	601832	701283
H054	605005	694785	H208	606330	698904
H056	601740	701387	H209	601042	698076
H057	602912	700809	H210	601319	699799
H058	604121	701623	H211	604568	693950
H059	603880	702701	H212	606558	698038
H060	601105	698034	H213	607245	696351
H061	603407	701477	H215	601389	701069
H062	606643	698927	H216	605736	696659
H063	603822	695296	H217	603230	695650
H064	603761	701977	H218	603177	697008
H065	605783	698805	H219	603228	701114
H066	604810	694921	H221	602342	698518
H067	601626	699435	H222	605909	694233
H068	601771	699074	H223	600526	699714
H069	602871	695875	H224	603791	702346
H070	603111	702375	H225	603589	701036
H071	601044	698187	H226	606554	697407
H072	604933	694301	H227	607074	696331
H073	605285	698420	H228	605746	700850
H074	603434	695356	H229	604205	701982
H075	605069	694671	H230	604664	694399
H076	606577	698068	H231	603904	702413
H077	601417	699097	H232	602387	701519
H078	601115	700361	H233	603824	702038
H079	605989	698816	H236	601963	700578
H080	601822	699049	H237	601254	698614
H081	601554	697093	H238	605175	695482
H083[3]	602787	700200	H239	603520	701559
H084	605130	695071	H240	606800	697855
H085	606648	698123	H241	602974	701862
H086	601142	700895	H242	600516	699658
H087	602324	698558	H243	603255	701146
H088	601750	701353	H244	603750	695992
H089	601999	698633	H245	604892	693913
H090	601568	699673	H246	602710	698252
H091	605406	698404	H248	604164	701581
H092	600512	699690	H249	605559	698859
H093	601378	698856	H250	602860	697495
H094	600495	699643	H251	600864	700344
H095	602723	700564	H252	605650	700951
H096	604919	694270	H253	602787	700667
H097	601422	701059	H254	605882	696859

NSL Ref.	Co – Ordinates (ITM)		NSL Ref.	Co – Ordinates (ITM)	
	Easting	Northing		Easting	Northing
H098	605316	695574	H255	605227	700915
H099	605273	700919	H256	603793	702008
H100	601843	697526	H257	605802	694162
H101	602206	698647	H258	601933	700595
H102	605257	694497	H259	605238	694533
H103	605000	694503	H260	604721	694978
H104	604948	694824	H261	605768	696807
H105	606220	697490	H262	606612	698969
H106	606627	698498	H263	602720	695830
H107	605464	694429	H264	605092	694539
H108	605849	698872	H265	606431	698888
H109	603105	697327	H266	605286	694488
H110	604678	694958	H267	601361	699792
H111	604986	694814	H268	602459	701555
H112	601808	701313	H270	603156	697042
H113	602104	701636	H271	602308	698126
H114	604915	693860	H272	606029	697105
H115	602000	701433	H273	604879	693952
H116[3]	603328	696917	H274	601696	699551
H117[3]	604896	694864	H275	601480	699706
H118	606766	698262	H276	601785	701311
H119	604854	694902	H277	605670	701325
H120	604625	694696	H278	603023	695683
H121	605776	700980	H279	603301	701323
H122	602507	701557	H280	602295	698433
H123	603481	701461	H281	601205	698375
H124	606590	698090	H282	603915	695202
H125	606634	698800	H283	605486	701103
H126	602020	696236	H284	603105	701018
H127	602732	695948	H286	603238	695588
H129	602671	696112	H287	603157	702486
H130	604494	694100	H288	605678	698754
H131	605422	694444	H289[3]	603903	696862
H132	604184	695118	H292	604724	695526
H133	603694	695183	H293	602058	701453
H134	605332	694431	H294[2]	603834	696367
H135	603660	695476	H296	604236	695925
H136	602577	698287	H297	603439	696465
H137	603284	701274	H298	601361	701433
H138	603634	695267	H299	602107	695966
H139	603042	697051	H300	603128	701955
H140	602747	697815	H301[2]	606627	698163
H141	602239	700043	H302	605075	700340
H142	600660	700167	H303	605863	700840
H143	605619	698616	H304	605694	698873
H144	604916	694848	H306[1]	605332	695616
H145	601639	701219	H307	605240	694608
H146	602183	699987	H309[1]	604480	695458

NSL Ref.	Co – Ordinates (ITM)		NSL Ref.	Co – Ordinates (ITM)	
	Easting	Northing		Easting	Northing
H147	605863	700840	H312	603330	696918
H148	606870	698401	H313[1]	602758	697977
H149	603351	701259	H314	603211	701211
H150	601416	699743	H315	604401	702373
H151	604313	695619	H316[1]	605713	696682
H152	605895	700212	H317[1]	605708	696586
H153	604887	694944	--	--	--

[1] Derelict Property – does not meet definition for NSL classification under WEDGs.

[2] Commercial Property

[3] Landowner Property

Table 3 to Table 7 present the turbine sound power noise emission values used for the various wind farms development in the noise prediction model. An uncertainty of 2 dB has been applied to all wind turbines sound power levels.

Table 3 LwA Levels Used for Prediction Model – Nordex N163[1] 98.5 m Hub Height

Wind Speed (m/s at 10m Standardised Height)	Octave Bank Centre Frequency (Hz)								dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
3	77.0	84.6	86.7	87.9	89.7	90.4	84.8	70.4	95.8
4	78.3	85.9	88.0	89.2	91.0	91.7	86.1	71.7	97.1
5	82.9	90.5	92.6	93.8	95.6	96.3	90.7	76.3	101.7
6	87.3	94.9	97.0	98.2	100.0	100.7	95.1	80.7	106.1
7	88.6	96.2	98.3	99.5	101.3	102.0	96.4	82.0	107.4
8	88.6	96.2	98.3	99.5	101.3	102.0	96.4	82.0	107.4
≥9	88.6	96.2	98.3	99.5	101.3	102.0	96.4	82.0	107.4

Table 4 LwA Levels Used for Prediction Model – Vestas V150[2] 105 m Hub Height

Wind Speed (m/s at 10m Standardised Height)	Octave Bank Centre Frequency (Hz)								dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
3	86.9	88.3	86.9	84.5	86.9	85.5	81.8	65.5	94.7
4	83.7	89.7	89.2	87.7	89.9	89.2	82.2	68.4	96.6
5	84.9	93.5	94.5	93.1	95.0	94.7	87.3	73.5	101.5
6	87.8	95.9	96.0	96.1	97.8	97.5	91.0	77.2	104.1
7	88.6	96.1	96.6	96.8	98.8	98.5	92.7	78.5	104.9
8	88.7	95.6	96.5	97.0	98.9	98.6	92.9	79.6	104.9
≥9	88.4	94.8	95.8	96.8	99.1	99.0	93.4	81.9	104.9

[1] 20250307_F008_277_A17_R11_EN BBTO MultipleModes

[2] 20241120_0079-5099_V04_R04_EN BB SO TO

Table 5 LwA Levels Used for Prediction Model – Nordex N149[3] 105 m Hub Height

Wind Speed (m/s at 10m Standardised Height)	Octave Bank Centre Frequency (Hz)								dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
3	77.1	83.7	86.6	87.6	88	86.2	80.5	71.3	94
4	78.3	84.9	87.8	88.8	89.2	87.4	81.7	72.5	95.2
5	81.1	87.7	91.4	93.5	94.8	92.9	83.3	75.4	99.8
6	85.5	92.1	95.8	97.9	99.2	97.3	87.7	79.8	104.2
7	87	93.5	97.2	99.3	100.6	98.8	89.2	81.3	105.6
8	87.3	93.5	97.2	99.8	100.5	98	90.4	82.4	105.6
≥9	87.3	93.5	97.2	99.8	100.5	98.0	90.4	82.4	105.6

The installed turbine at Lacka/Skehanagh Wind Farm is a V52-850 kW. Noise emission data for this turbine has been taken the AWN database.

Table 6 L_{WA} Levels Used for Prediction Model – Lacka/Skehanagh Wind Farm

Wind Speed (m/s at 10m Standardised Height)	Octave Bank Centre Frequency (Hz)								dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
4	72.2	79.2	85.9	91.5	91.2	87.3	80.9	70.7	95.9
5	73.0	80.0	86.7	92.3	92.0	88.1	81.7	71.5	96.7
6	77.3	84.3	91.0	96.6	96.3	92.4	86.0	75.8	101.0
7	80.1	87.1	93.8	99.4	99.1	95.2	88.8	78.6	103.8
8	80.6	87.6	94.3	99.9	99.6	95.7	89.3	79.1	104.3
≥9	80.7	87.7	94.4	100.0	99.7	95.8	89.4	79.2	104.4

The details and noise emissions of the turbines in the for the proposed Carrig Renewables Wind Farm have been take from the Noise and Vibration chapter in the *Carrig Renewables Wind Farm Environmental Impact Assessment Report -EIAR – 2023.08.25 – 211016.*

Table 7 L_{WA} Levels Used for Prediction Model – Carrig Wind Farm 110.5 m Hub

Wind Speed (m/s at 10m Standardised Height)	Octave Bank Centre Frequency (Hz)								dB L_{WA}
	63	125	250	500	1000	2000	4000	8000	
4	78.3	84.9	87.8	88.8	89.2	87.4	81.7	72.5	95.2
5	81.1	87.7	91.4	93.5	94.8	92.9	83.3	75.4	99.8
6	85.5	92.1	95.8	97.9	99.2	97.3	87.7	79.8	104.2
7	87.0	93.5	97.2	99.3	100.6	98.8	89.2	81.3	105.6
8	87.3	93.5	97.2	99.8	100.5	98.0	90.4	82.4	105.6
≥9	87.3	93.5	97.2	99.8	100.5	98	90.4	82.4	105.6

Table 8 Turbine Location Coordinates for Lacka/Skehanagh Wind Farm

Turbine Ref.	Co-ordinates (ITM)

[3] 20250917_F008_275_A17_R08_EN BBTO MultipleModes

	X	Y
L01	601487	697670
L02	601489	697902
L03	601498	698131
L04	601312	696627
L05	601250	696419
L06	600970	696534
L07	600998	696742
L08	601034	696941

Table 9 Turbine Location Coordinates for Carrig Wind Farm

Turbine Ref.	Co-ordinates (ITM)	
	X	Y
C01	599443	701335
C02	599430	701949
C03	599012	701725
C04	598906	701230
C05	598324	701442
C06	598800	702139
C07	598339	701872