APPENDIX 12-3

NOISE MODELLING PARAMETERS

APPENDIX 12-3. NOISE MODELLING PARAMETERS

Prediction calculations for turbine noise have been conducted in accordance with ISO 9613: *Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation*, 1996. Guidance in terms of the calculation settings has been obtained from the *Institute of Acoustics (IOA) Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (2013) (IOA GPG) and its associated supplementary guidance notes. The following are the main aspects that have been considered in terms of the noise predictions presented in this instance.

Ground Effect:

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

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

Noise predictions have been carried out using a source height corresponding to the hub height of the proposed turbines, a receiver height of 4m and a ground effect factor of G=0.5.

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:

$$A_{geo} = 20\log(d) - 11 \text{ dB}$$

where d = distance from the source

A wind turbine may be considered as a point source beyond a distance corresponding to one rotor diameter.

Atmospheric 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.

In accordance with the guidance set out in the IOA GPG for calculations, a temperature of 10°C and a relative humidity of 70% have been used, which give relativity low levels of atmosphere attenuation and corresponding worst case noise predictions.

Topographic Screening

In the IOA GPG, section 4.3.11 the following is stated: "*Topographic screening effects of the terrain (ISO 9613-2, Equation 12) should be limited to a reduction of no more than 2 dB, and then only if there is no direct line of sight between the highest point on the turbine rotor*

and the receiver location." The modelling software takes account of these limitations on the degree of screening from terrain. The "valley correction" from section 4.3.9 of the IOA GPG is also applied where relevant.

The atmospheric attenuation outlined in Table A12-1 were used for all calculations in accordance with the guidance outlined in the IOA GPG. No meteorological corrections were applied to all calculations.

Table A12-1 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

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 12.4.5.1 of the EIAR incorporates the setting outlined in this appendix.

Table A12-2 Coordinates (ITM) for Noise Sensitive Locations (NSLs)

ID	ITM X	ITM Y
H001	507,591	556,533
H002	512,575	558,153
H003	512,700	558,530
H004	510,409	559,003
H005	507,882	556,595
H006	510,577	559,091
H007	510,316	558,973
H008	510,806	557,553
H009	508,037	556,587
H010	507,994	556,607
H011	510,368	556,529
H012	509,005	556,059
H013	509,229	556,133
H014	510,926	557,408
H015	508,269	556,562
H016	510,884	556,384
H017	507,408	556,640
H018	512,189	559,937
H019	509,329	556,214
H020	508,161	556,692
H021	508,984	554,368
H022	511,636	559,768
H023	508,202	556,704

ID	ITM X	ITM Y
H024	511,622	557,153
H025	511,555	557,167
H026	509,577	554,339
H027	510,918	559,429
H028	509,366	554,354
H029	511,972	557,112
H030	510,981	559,534
H031	509,370	556,302
H032	509,867	554,282
H033	508,337	556,701
H034	511,836	559,975
H035	513,066	558,537
H036	510,931	556,526
H037	509,067	554,288
H038	508,753	554,274
H039	510,708	559,383
H040	508,661	554,279
H041	509,400	554,295
H042	509,994	554,249
H043	509,135	554,275
H044	512,582	560,024
H045	511,163	556,332
H046	509,938	554,227
H047	508,793	554,224
H048	510,126	556,821
H049	509,908	556,766
H050	510,115	556,826
H051	511,348	559,869
H052	507,542	556,920
H053	506,953	554,327
H054	507,020	554,319
H055	508,459	556,742
H056	509,889	554,160
H057	509,948	554,162
H058	509,409	554,169
H059	509,660	554,122
H060	508,562	556,775
H061	510,056	554,078
H062	508,565	554,094
H063	507,687	557,091
H064	508,513	554,101
H065	506,905	554,158
H066	507,547	554,225
H067	512,535	560,272
H068	512,510	560,280
H069	510,054	554,012

ID	ITM X	ITM Y
H070	509,588	557,802
H071	510,048	553,996
H072	512,560	560,305
H073	506,884	556,790
H074	509,562	557,807
H075	508,198	554,103
H076	507,156	554,087
H077	509,850	557,016
H078	508,361	554,053
H079	512,317	560,430
H080	509,532	557,712
H081	508,032	554,066
H082	508,001	554,069
H083	506,529	554,118
H084	510,030	553,879
H085	509,748	557,076
H086	506,558	554,081
H087	507,807	554,114
H088	506,919	553,981
H089	510,131	553,864
H090	513,273	560,028
H091	507,562	557,298
H092	507,438	557,282
H093	507,944	557,326
H094	506,914	557,033
H095	508,141	557,315
H096	506,180	556,580
H097	505,735	556,012
H098	506,148	556,556
H099	506,485	556,774
H100	506,120	556,546
H101	506,026	554,351
H102	507,162	557,223
H103	506,084	556,524
H104	509,955	553,764
H105	510,112	553,786
H106	505,797	554,624
H107	507,926	557,375
H108	508,101	553,920
H109	509,400	559,056
H110	506,006	556,468
H111	511,999	556,530
H112	507,433	557,379
H113	513,246	560,226
H114	511,615	560,503
H115	505,774	554,554

ID	ITM X	ITM Y
H116	509,557	557,168
H117	505,819	556,342
H118	505,935	554,322
H119	509,400	557,087
H120	509,420	559,233
H121	509,460	557,145
H122	509,608	557,228
H123	505,515	555,072
H124	505,780	556,346
H125	509,354	557,098
H126	510,262	553,696
H127	506,585	556,961
H128	508,435	557,386
H129	505,719	554,447
H130	510,060	559,908
H131	505,650	556,288
H132	509,107	557,047
H133	510,419	553,671
H134	505,644	556,311
H135	513,673	558,156
H136	511,356	560,537
H137	506,264	553,905
H138	510,018	559,925
H139	510,634	553,751
H140	505,597	556,270
H141	505,910	556,684
H142	505,606	556,331
H143	510,679	553,743
H144	509,014	558,094
H145	505,352	555,787
H146	508,965	558,213
H147	506,292	553,800
H148	506,168	553,865
H149	505,541	556,314
H150	505,790	556,659
H151	510,632	553,650
H152	508,948	558,566
H153	506,152	553,851
H154	506,965	553,591
H155	511,170	560,591
H156	505,477	556,248
H157	505,383	556,052
H158	508,147	557,665
H159	508,140	557,685
H160	509,080	557,608
H161	508,127	557,674

ID	ITM X	ITM Y
H162	507,215	557,620
H163	506,773	557,413
H164	508,171	557,690
H165	505,229	555,417
H166	506,752	557,409
H167	507,427	557,700
H168	506,717	557,391
H169	506,782	553,555
H170	506,076	556,986
H171	509,698	559,925
H172	510,529	560,344
H173	508,877	558,122
H174	510,469	560,308
H175	506,687	557,403
H176	505,220	555,714
H177	508,851	558,389
H178	509,009	557,573
H179	509,756	560,003
H180	508,914	558,913
H181	505,221	554,968
H182	506,633	557,397
H183	506,205	553,687
H184	508,850	558,716
H185	508,322	557,737
H186	506,857	557,566
H187	509,496	559,864
H188	508,838	558,789
H189	509,228	559,612
H190	506,194	553,645
H191	508,820	557,916
H192	508,367	557,774
H193	508,754	558,509
H194	514,008	558,160
H195	506,697	557,542
H196	510,781	560,643
H197	505,971	553,731
H198	506,718	557,589
H199	509,304	559,816
H200	505,270	556,357
H201	510,081	560,312
H202	506,464	557,440
H203	505,238	556,352
H204	505,012	555,616
H205	508,423	557,885
H206	510,931	553,476
H207	504,975	555,534

ID	ITM X	ITM Y
H208	508,846	559,308
H209	505,820	553,694
H210	504,976	555,144
H211	509,029	559,633
H212	508,734	559,084
H213	507,663	558,018
H214	505,753	553,689
H215	505,813	553,623
H216	507,756	558,066
H217	506,543	553,116
H218	511,494	553,799
H219	507,842	558,125
H220	505,677	553,637
H221	505,731	553,580
H222	508,880	552,987
H223	509,449	553,075
H224	505,436	553,730
H225	505,741	553,470
H226	505,487	553,672
H227	508,682	552,921
H228	505,387	553,753
H229	508,475	552,931
H230	508,098	558,231
H231	510,951	553,169
H232	505,389	553,730
H233	510,686	553,037
H234	508,286	552,935
H235	509,425	552,878
H236	506,415	553,070
H237	509,381	552,873
H238	508,179	558,271
H239	506,751	552,993
H240	504,915	554,291
H241	509,291	552,865
H242	508,078	558,307
H243	508,282	558,457
H244	508,035	552,951
H245	509,275	552,809
H246	508,244	558,382
H247	509,318	552,807
H248	507,950	552,916
H249	511,027	553,038
H250	508,227	558,649
H251	506,076	553,069
H252	505,657	553,301
H253	509,424	552,739

ID	ITM X	ITM Y
H254	507,653	552,880
H255	507,320	552,825
H256	505,985	553,061
H257	507,543	552,834
H258	507,631	552,850
H259	507,780	552,870
H260	507,707	552,866
H261	509,226	552,688
H262	511,809	553,541
H263	507,218	552,762
H264	507,385	552,774
H265	507,306	552,728
H266	507,249	552,720
H267	507,421	552,728
H268	511,960	553,616
H269	507,131	552,675
H270	505,871	552,947
H271	507,271	552,658
H272	507,101	552,639
H273	512,245	553,813
H274	507,214	552,620
H275	507,054	552,601
H276	507,167	552,586
H277	512,182	553,675
H278	511,894	553,361
H279	511,608	553,066

Table A12-3 presents the proposed turbines locations in Irish Transverse Mercator coordinates system.

Table A12-3 Turbine Coordinates in Irish Transverse Mercator

Turbine ID	ITM X	ITM Y
T01	512,234	559,029
T02	511,718	558,777
T03	511,969	558,466
T04	510,753	558,366
T05	511,153	558,170
T06	511,548	557,969
T07	510,300	555,783
T08	509,807	555,268
T09	509,359	555,344
T10	508,872	555,280
T11	508,449	555,395
T12	508,113	555,660
T13	507,799	555,873
T14	507,383	555,284