

Proposed Gathabawn Wind Farm

Environmental Impact Assessment Report

Chapter 10: Noise & Vibration



September 2026

Table of Contents

CHAPTER 10 NOISE & VIBRATION	10-4
EIAR 10.1 INTRODUCTION	10-4
EIAR 10.1.1 Competent Experts	10-4
EIAR 10.1.2 Sources of Information	10-4
EIAR 10.1.3 Methodology Used.....	10-5
EIAR 10.1.4 Statement on Certainty and Sufficiency of Information Provided	10-5
EIAR 10.1.5 Development being Considered	10-6
EIAR 10.2 SENSITIVE ASPECTS	10-7
EIAR 10.2.1 Overview of Noise & Vibration in the Local Environment	10-7
EIAR 10.2.2 Zone of Influence/Study Areas.....	10-7
EIAR 10.3 BASELINE ENVIRONMENT	10-10
EIAR 10.3.1 Context and Characteristics	10-10
EIAR 10.3.2 Local Facilities and Areas of High Amenity	10-14
EIAR 10.3.3 Local Walkers and Outdoor Workers.....	10-14
EIAR 10.3.4 Existing Sources of Impacts.....	10-17
EIAR 10.3.5 Importance, Sensitivity and Vulnerability to Change	10-17
EIAR 10.3.6 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)	10-17
EIAR 10.4 IMPACT OF THE PROPOSED DEVELOPMENT.....	10-18
EIAR 10.4.1 Criteria and Methodology.....	10-18
EIAR 10.4.2 Source-Pathway-Receptor	10-18
EIAR 10.4.3 Evaluation of Noise & Vibration Effects.....	10-19
EIAR 10.4.4 Construction Stage- Noise & Vibration Impacts (will not be significant).....	10-20
EIAR 10.4.5 Noise and Vibration from decommissioning works and activities.....	10-31
EIAR 10.4.6 OPERATIONAL PHASE IMPACTS	10-32
EIAR 10.4.7 Cumulative Effect of the Whole Project	10-54
EIAR 10.4.8 Environmental Protection Measures and Monitoring for Non-Significant Effects.....	10-55
EIAR 10.5 CUMULATIVE EFFECTS WITH OTHER PROJECTS.....	10-57
EIAR 10.5.1 Evaluation of Cumulative Impacts with Other Projects.....	10-57
EIAR 10.6 SUMMARY CONCLUSION	10-73
EIAR 10.7 Glossary, List of Abbreviations.....	10-74
EIAR 10.8 Reference List for Noise & Vibration	10-76
EIAR 10.9 List of Figures	10-78
EIAR 10.10 List of Appendices	10-78

List of Figures 10-79

List of Figures

Figure No.	Figure Title	Location
Figure 10.1	Determining the Study Area for Operational Noise	Section 10.2.2.3 and Section 10.5.1.2.3 and End of Chapter 10
Figure 10.2	Noise Sensitive Locations	Section 10.3.3 and End of Chapter 10
Figure 10.3	Noise Monitoring Locations	Section 10.3.1.1 and End of Chapter 10
Figure 10.4	Noise Prediction Model Results (Noise Contour Map)	Section 10.4.6.1.5 and End of Chapter 10
Figure 10.5	Substation and nearby NSLs	Section 10.4.4.4.1 and End of Chapter 10
Figure 10.6	Construction Phase Noise Sources	Section 10.4.4 and End of Chapter 10
Figure 10.7.1	Other Projects Scoped-In to the Noise & Vibration Cumulative Evaluations	End of Chapter 10
Figure 10.7.1	Other Projects Scoped-In to the Noise & Vibration Cumulative Evaluations	End of Chapter 10

List of Appendices

Appendix No.	Appendix Title	Location
Appendix 10.1	Methodology for the evaluation of Noise – Construction Phase	End of Chapter 10
Appendix 10.2	Methodology for the evaluation of Noise– Operational Phase	End of Chapter 10
Appendix 10.3	Methodology for the evaluation of Vibration	End of Chapter 10
Appendix 10.4	Background Noise Measurements	End of Chapter 10
Appendix 10.5	Calibration Certificates	End of Chapter 10
Appendix 10.6	Construction Phase Noise Sources	End of Chapter 10

CHAPTER 10 NOISE & VIBRATION

EIAR 10.1 INTRODUCTION

This Chapter 10 (Noise & Vibration) comprises the detailed assessment undertaken of the potential noise and vibration impact on local residential amenity, from the proposed Gathabawn Wind Farm development.

This assessment covers noise, vibration and special characteristics – infrasound and amplitude modulation. Impact assessments have been prepared for the construction and decommissioning phases and for the operational phase for all houses within the noise study area – called noise sensitive locations (NSLs) in this report.

EIAR 10.1.1 Competent Experts

This Noise and Vibration evaluation has been prepared by the following staff of AWN Consulting Ltd:

Mike Simms (Principal Acoustic Consultant) holds a BE and MEngSc in Mechanical Engineering and is a member of the Institute of Acoustics (MIOA) and of the Institution of Engineering and Technology (MIET). Mike has worked in the field of acoustics for over 20 years. He has extensive experience in all aspects of environmental surveying, noise modelling and impact assessment for various sectors including, wind energy, industrial, commercial, and residential.

Miguel Cartuyvels (Acoustic Consultant) holds a BEng (Hons) in Industrial Engineering and is an associate member (AMIOA) of the Institute of Acoustics. Miguel has worked in the field of acoustics since 2021, where he has contributed to numerous projects related to environmental surveying, noise modelling, and impact assessment for various sectors, including wind energy, industrial, commercial, and residential.

EIAR 10.1.2 Sources of Information

In order to gather information on the baseline environment and for the impact evaluation, the following sources were considered:

Table 10-1: Sources of Baseline Information for Noise and Vibration

Consultation Sources
No feedback was received from consultees with regard to Land or Land Use. See Chapter 3: Consultation for further details.
Desktop Sources
Reviewing or aerial images of the study area and other online sources of information (e.g., Google Earth and OSI Maps)
Review of Kilkenny County Council Planning Files for new houses permitted in the Study Area
• Review of peer-reviewed studies on noise and vibration • Review of Lisdowney Wind Farm planning conditions
Fieldwork
• Background noise measurements (carried out in 2022)

EIAR 10.1.3 Methodology Used

The evaluation of Noise and Vibration has been carried out in accordance with the following guidelines and codes of practice:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022), and with the following:
- British Standard Institute (BSI) British Standard (BS) 5228-1:2009 +A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228-1) (BSI 2014a);
- Department of the Environment, Heritage, and Local Government (DEHLG) Wind Energy Development Guidelines (hereafter referred to as WEDG (DEHLG, 2006);
- Department of Trade, and Industry (UK) Energy Technology Support Unit (ETSU) ETSU-R-97 The Assessment and Rating of Noise from Wind Farms (hereafter referred to as ETSU-R-97) (ETSU, 1996);
- Department for Energy Security and Net Zero (DESNZ) Assessment and Rating of Wind Turbine Noise (hereafter referred to as ARWTN) (DESNZ, 2026);
- Institute of Acoustics (IOA) A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (hereafter referred to as IOA GPG) (IOA, 2013);
- Transport Infrastructure Ireland (TII) (previously National Roads Authority (NRA)) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (hereafter referred to as the TII Noise Guidelines 2014) (NRA 2014);
- United Kingdom Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as DMRB Noise and Vibration) (UKHA 2020);
- International Organization for Standardization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General Method of Calculation (hereafter referred to as ISO 9613:1996-2) (ISO 1996).
- International Organization for Standardization (ISO) 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors (hereafter referred to as ISO 9613:2024-2) (ISO 2024).

This methodology has been used to evaluate potential impacts and determine appropriate mitigation measures. The methodologies can be found in full in the following methodologies:

Appendix 10.1: Methodology for the evaluation of Noise – Construction Phase,
 Appendix 10.2: Methodology for the evaluation of Noise – Operational Phase, and
 Appendix 10.3: Methodology for the evaluation of Vibration

EIAR 10.1.4 Statement on Certainty and Sufficiency of Information Provided

A clear documentary trail is provided throughout this chapter and chapter appendices to the competency of data and methods used and the rationale for selection of same. The information used to compile this chapter is collated from reports and documents generated by local authorities and statutory agencies, with remit in the regulatory field, including the Environmental Protection Agency, Institute of Acoustics, British Standards Institute and the World Health Organisation. All documentation used is referenced at the end of the chapter.

In respect of Noise & Vibration, no material limitations or difficulties were encountered during the course of the studies carried out to inform the assessment of impacts of the Gathabawn Wind Farm Project.

EIAR 10.1.5 Development being Considered

The subject development – the **Proposed Gathabawn Windfarm**, comprises 12 wind turbines and all associated foundations and hard-standing areas in respect of each turbine, 2 control buildings, 7.7km of access roads, 1 met mast and 1 LiDAR unit for measuring meteorological conditions, underground cabling between the turbines and control buildings, 7 site entrances, newly created Biodiversity Areas and all ancillary associated and facilitating works and activities. 7 turbines and 1 control building are proposed in the Ballylehaun Area, and 5 turbines and 1 control building are proposed in the Ballyring Area.

The overall whole Gathabawn Windfarm Project also includes a connection to the national electricity grid, which is not part of the currently proposed development. While the ultimate grid connection point is subject to a separate process with Eirgrid, a candidate route has been identified to the closest node at Eirgrid Ballyragget Substation. This **Candidate Gathabawn Grid Connection** comprises a new substation in Parksgrove (Parksgrove Substation) and three distinct underground cable (UGC) sections: Ballylehaun-Ballyring UGC, Ballyring-Parksgrove UGC, and Parksgrove-Moatpark UGC.

To facilitate the evaluation of the whole project, this candidate grid connection is included in the baseline descriptions and considered within the impact evaluations detailed below.

EIAR 10.2 SENSITIVE ASPECTS

EIAR 10.2.1 Overview of Noise & Vibration in the Local Environment

In general terms the proposed development is located in a predominantly rural area and away from major urban areas or centres of population. The surrounding landscape comprises agricultural grassland and to a lesser extent, commercial forestry plantations.

The existing noise sources comprise natural and man-made noise sources. Natural noise sources include mainly wind-borne noise and birdsong. Man-made noise sources include farm machinery and milking parlours when in operation, and traffic on the local road network. The existing Lisdowney Wind Farm also contribute to the existing ambient noise environment. There are few sources of vibration in the local environment.

EIAR 10.2.2 Zone of Influence/Study Areas

EIAR 10.2.2.1 Construction Noise Study Area

This section defines the study area for the assessment of construction and decommissioning noise and vibration, based on the potential for effects at nearby NSLs.

Based on a review of typical construction plant noise levels derived from BS 5228-1, including high noise-generating activities such as rock breaking, which at 300 m is more than 10 dB below the lowest noise threshold, a study area of 300 m has been defined as the **Construction Study Area** and applied for general construction activities and decommissioning occurring within the Proposed Gathabawn Windfarm site and along the Candidate Gathabawn Grid Connection. Taking account of the '10 dB rule' described in Section EIAR 10.2.2.3, it is unlikely that a cumulative impact can occur beyond 300 m.

The Construction Study Area represents the combined spatial extent of all construction activities. However, in practice, each discrete construction activity is assessed based on a 300 m buffer from the location of the works, reflecting the distance over which significant effects may arise.

For linear and short-duration activities associated with the Facilitating Works along the Turbine Delivery Route and concentrated traffic along Construction Haul Routes, a reduced study area of 200 m has been adopted and is defined as the Traffic Study Area. This reflects the highest noise threshold as indicated in [Appendix 10.1 Methodology for Construction Noise](#) – Traffic and transient nature of these works, whereby noise levels are only elevated for short periods at any given NSL.

Construction activities where the nearest NSLs are located beyond these defined distances are unlikely to result in significant noise effects, having regard to BS 5228 threshold criteria and the attenuation of noise with distance.

EIAR 10.2.2.2 Operational Noise Study Area Extent

The area or zone of influence around the proposed Gathabawn Wind Farm within sensitive aspects of the environment could be affected by the Project is called the Study Area herein. The Study Areas for the Noise and Vibration evaluation are set out in below and illustrated on [Figure 10.1: Determining the Study Area for Operational Noise](#).

It is considered appropriate to define a noise sensitive location (NSL); In this context, it is considered prudent to adopt the definition supplied by the Environmental Protection Agency (EPA) which states the following in NG4 Appendix I:

Noise Sensitive Location (NSL) – any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Table 10-2: Study Area of the Project in relation to Noise & Vibration

Sensitive Aspect	Zone of Influence/Study Area	Justification for the Study Area extent
Residents or People at Noise Sensitive Locations (NSLs) Or people at local schools, churches, village parks and local walking routes	2km from turbines	As detailed in Section 10.2.2.3 below, a 2km study area covers a larger area than the cumulative 30 dB L_{A90} contour around the proposed Gathabawn Wind Farm, therefore the distance of 2km represents a conservative extent for the study area. This 2km study area also extends around the main construction works which will occur at the Wind Farm site. The 2km study area is illustrated on Figure 10.1: Determining the Study Area for Noise for Operational Noise.
	L58141, L1803, L1804, , L1806, L18062, L1807, L1808	In relation to the materials haulage routes – these roads will be subject to concentrated material haulage - this study area incorporates the nearest houses to these noise sources.

EIAR 10.2.2.3 Rationale for Study Area Extent

The Institute of Acoustics document *Good Practice Guide To The Application Of ETSU-R-97 For The Assessment And Rating Of Wind Turbine Noise* states, in Section 2.2 in relation to the extent of the study area:

The 'study area' for background noise surveys (and noise assessment) should, as a minimum, be the area within which noise levels from the proposed, consented and existing wind turbine(s) may exceed 35 dB L_{A90} at up to 10 m/s wind speed. (Note: unless stated, in this document the wind speed reference for noise data is the 10 metre standardised wind speed, derived from the wind speed at turbine hub height as explained in Section 2.6).

It is noted that for the proposed wind turbines, their maximum sound power level is reached at 9 m/s standardised wind speed, thus the noise contours for 9 m/s standardised wind speed are the same.

The cumulative wind farms which were considered in the study area extends to 5 km, though in terms of environmental noise, this extends well beyond the range of potential cumulative impacts.

The only existing wind farm within 5km is Lisdowney Wind Farm, an operational development of four turbines, the closest of which is c. 1.25km to the north of the proposed Gathabawn wind turbines.

Figure 10.1 below shows the cumulative 35 dB L_{A90} contours for the proposed of Gathabawn wind turbines and the operational Lisdowney wind turbines. The NSLs included in the noise assessment presented in this EIAR include all those within the cumulative 35 dB L_{A90} contour.

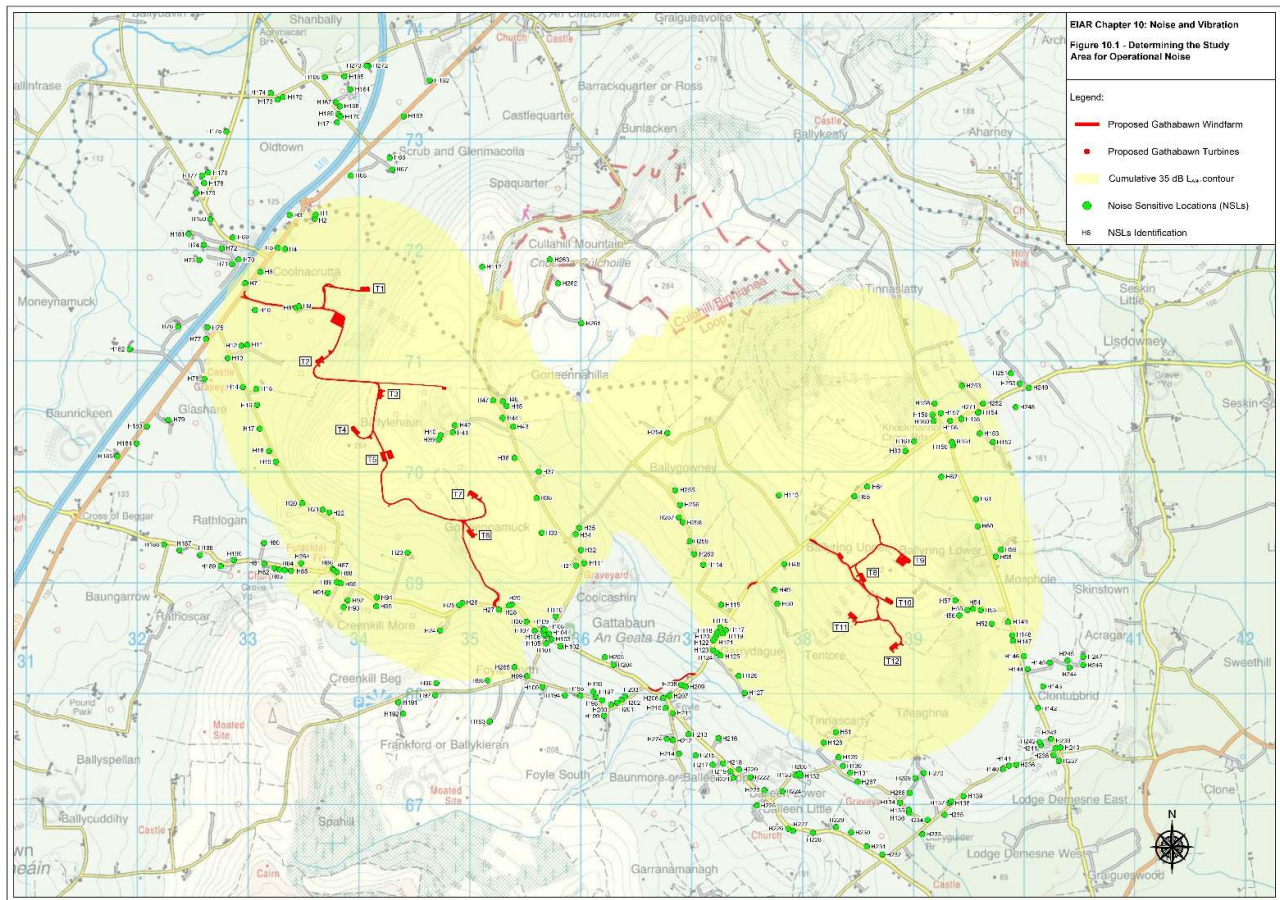


Figure 10-1: Determining the Study Area for Operational Noise – cumulative 35 dB L₉₀ contour

Two additional potential windfarms within 5km of the Proposed Gathabawn Windfarm turbines are also noted – Seskin Wind Farm (currently under appeal, ACP) which lies partially within 5km, and Killoshulan on the nearby Spahill/Clomantagh Hill (preplanning).

EIAR 10.3 BASELINE ENVIRONMENT

The context and characteristics of the baseline environment, and the trends and evolution thereof, in relation to *Local Residents* are described in the subsections below.

The result of fieldwork and desktop surveys are summarised in the sections below, illustrated on the mapping listed below, with the detailed data included in the Appendices listed:

EIAR Figures (included at the end of this Chapter):

Figure 10.2 Noise Sensitive Locations

Figure 10.3 Noise Monitoring Locations

EIAR 10.3.1 Context and Characteristics

EIAR 10.3.1.1 Noise Sensitive Locations – Local Residences

A site survey and research of the Kilkenny County Council and Laois County Council (for planning permissions), along with a search of the EirCode Finder online facility and review of aerial photography was carried by Ecopower Developments in May 2026, with a follow up search of planning applications in September 2026 to ascertain whether any new houses or other sensitive properties had been applied for in the intervening period. All dwellings within 2 km of a Gathabawn wind turbine have been included in the noise prediction modelling software and a result generated. These can be seen on [Figure 10.1](#).

There are 274 No. noise-sensitive locations (NSLs) within the noise study area of the proposed turbines. Distance ranges are summarised below:

- 65 No. NSLs are within 1km of a proposed turbine
- 104 No. NSLs between 1km and 1.5km of a proposed turbine
- 105 No. NSLs between 1.5km and 2km of a proposed turbine

See Table below showing the distance from the nearest turbine to all NSLs. Mapping of these NSLs in relation to the proposed turbines follows the table.

Table 10-3: Local Residences within 2km of the Proposed Gathabawn Windfarm turbines

** House is also within 300m of the Candidate Gathabawn Grid Connection*

House ID	EirCode	Distance to nearest turbine (m)	House ID	EirCode	Distance to nearest turbine (m)	House ID	EirCode	Distance to nearest turbine (m)
H01	R32 VH9Y	807	H93	E41 H012	1333	H185	E41 CY61	1998
H02	R32 DE92	783	H94	E41 P527	1033	H186	E41 RX38	1999
H03	R32 XW81	959	H95	E41 N924	1080	H187	E41 K188	1912
H04	R32 EY81	824	H96	E41 EW29	1363	H188	E41 H009	1793
H05	R32 X0W0	886	H97	E41 C583	1474	H189	E41 K1W6	1725
H06	R32 P5D2	948	H98	E41 F1W8	1303	H190	E41 XF53	1605
H07	R32 P5D3	950	H99	E41 VH58	1347	H191	E41 KN36	1642
H08	E41 F851	511	H100	E41 TP65	1492	H192	E41 TK82	1720
H09	E41 F851	515	H101	E41 ND23	1163	H193	E41 NP66	1673
H10	E41 HN26	721	H102	E41 P864	1259	H194	E41 C1W7	1652
H11	-	644	H103	E41 PR62	1162	H195	E41 A033	1727
H12	E41 YX22	694	H104	E41 XN47	1108	H196	E41 H6V2	1765
H13	E41 E226	804	H105	E41 HP82	1100	H197	E41 A309	1871
H14	E41 C8W5	711	H106	E41 H958	1085	H198	E41 HE03	1878
H15	E41 DD70	604	H107	E41 NT68	1011	H199	E41 X094	1998
H16	E41 P7N0	674	H108	E41 V020	1051	H200	E41 T802	1958
H17	E41 T180	802	H109	E41 YX38	1051	H201	E41 X925	1978

House ID	EirCode	Distance to nearest turbine (m)	House ID	EirCode	Distance to nearest turbine (m)	House ID	EirCode	Distance to nearest turbine (m)
H18	E41 XF96	780	H110	E41 Y680	1031	H202	E41 XE62	1987
H19	E41 RP86	756	H111*	E41 W621	1024	H203	E41 T665	1984
H20	E41 P304	817	H112	R32 V6K6	1047	H204	E41 C827	1711
H21	E41 P9R2	716	H113*	E41 C6H3	1021	H205	E41 V8N7	1606
H22	E41 YH63	685	H114	E41 FT52	1419	H206	E41 XT61	1847
H23	E41 R6K5 / E41 W2F7	611	H115	E41 H599	1199	H207	E41 W718	1789
H24	E41 VP94	899	H116	E41 FW95	1199	H208	E41 A440	1649
H25	E41 NH97	630	H117	E41 A580	1151	H209	E41 V577	1619
H26	E41 YE94	608	H118	E41 XA07	1230	H210	E41 D789	1862
H27	E41 XC03	697	H119	E41 HE94	1180	H211	E41 VW74	1825
H28	E41 WD59	697	H120	E41 CK07	1241	H212	E41 T258	1944
H29	E41 Y578	702	H121	E41 K590	1253	H213	E41 P208	1799
H30	E41 PW90	904	H122	E41 W778	1272	H214	E41 N2D0	1970
H31*	E41 H970	959	H123	E41 DP68	1289	H215	E41 V3W8	1863
H32*	E41 C6N4	976	H124	E41 NW60	1260	H216	E41 Y032	1606
H33*	-	615	H125	E41 PW71	1234	H217	E41 PC65	1808
H34*	E41 X030	920	H126	E41 XE17	1142	H218	E41 E430	1735
H35*	E41 F6X6	955	H127	E41 CF97	1170	H219	E41 D516	1744
H36*	E41 R923	604	H128	R95 WV90	1038	H220	E41 E9X3	1684
H37*	E41 T3H5	650	H129	R95 K2PA	1082	H221	E41 HT02	1774
H38*	E41 XY19	509	H130	R95 EY97	1138	H222	R95 W2V6	1680
H39	E41 FY96	523	H131	R95 P953	1173	H223	R95 P270	1707
H40	E41 E1W5	554	H132	R95 E3Y1	1403	H224	R95 RK64	1611
H41	E41 C635	559	H133	R95 NDY2	1423	H225	R95 YH33	1857
H42	E41 V009	617	H134	R95 E36V	1386	H226	R95 FP95	1865
H43*	E41 N9K6	709	H135	R95 YK59	1456	H227	R95 PK29	1859
H44*	E41 W623	732	H136	R95 EY71	1486	H228	R95 WK03	1798
H45*	E41 E7C6	844	H137	R95 K6X2	1482	H229	R95 A433	1677
H46*	E41 YC63	870	H138	R95 W2Y2	1474	H230	R95 DX21	1690
H47*	E41 A7P0	854	H139	R95 CYV6	1479	H231	R95 EK25	1793
H48*	E41 YN30	694	H140	R95 A008	1481	H232	R95 R240	1853
H49	E41 YH70	762	H141	R95 T3Y9	1496	H233	R95 X406	1693
H50	E41 KD26	701	H142	R95 Y8X0	1431	H234	R95 KT52	1574
H51	R95 V2K1	898	H143	R95 HP49	1414	H235	R95 KPR8	1571
H52	R95 XV34	919	H144	R95 P224	1247	H236	R95 V8N7	1539
H53	R95 KFN4	778	H145	R95 EW86	1436	H237	R95 W8D4	1821
H54	R95 V240	715	H146	R95 C2F3	1202	H238	R95 NP78	1751
H55	R95 K8WE	681	H147	R95 HXR9	1105	H239	R95 TX40	1733
H56	R95 YYW0	617	H148	R95 YD77	1105	H240	R95 W9W8	1768
H57	R95 DYP5	542	H149	R95 YY83	1043	H241	R95 W603	1605
H58	R95 V3WF	780	H150	R95 C1P3	1117	H242	R95 R8FT	1581
H59	R95 Y899	831	H151	R95 C9R2	1141	H243	R95 T8F5	1658
H60	R95 AH22	691	H152	R95 FX31	1313	H244	R95 WF54	1619
H61	R95 PRP4	822	H153	R95 W215	1317	H245	R95 KC58	1597
H62	R95 E6D5	815	H154	R95 H7FE	1484	H246	R95 KH59	1742
H63	R95 V8VC	997	H155	R95 EY27	1370	H247	R95 HF53	1736
H64	E41 PR83	775	H156	R95 HE92	1321	H248	R95 XW53	1690
H65	E41 EY95	703	H157	R95 ANP2	1366	H249	R95 F3CH	1900
H66	R32 YK28	1185	H158	R95 X038	1443	H250	R95 CK61	1889
H67	R32 R9C5	1085	H159	R95 YY04	1339	H251	R95 RW82	1927
H68	R32 FF64	1019	H160	R95 VH34	1287	H252	R95 XE93	1572

House ID	EirCode	Distance to nearest turbine (m)	House ID	EirCode	Distance to nearest turbine (m)	House ID	EirCode	Distance to nearest turbine (m)
H69	-	1297	H161	R95 X4HY	1082	H253	R95 C860	1652
H70	R32 W9K1	1153	H162	R32 X4A8	1950	H254*	E41 RV00	1859
H71	R32 Y6W6	1159	H163	R32 DH00	1576	H255	E41 V205	1832
H72	R32 YD52	1328	H164	R32 P620	1792	H256	E41 EH26	1739
H73	R32 F9D7	1394	H165	R32 NX29	1914	H257	E41 XV30	1714
H74	R32 YX81	1458	H166	R32 T9RR	1935	H258	E41 CD86	1667
H75	E41 NN96	1030	H167	R32 R1H5	1694	H259	E41 DT22	1566
H76	E41 DE48	1290	H168	R32 RC67	1653	H260	E41 EF98	1509
H77	E41 XC57	1020	H169	R32 Y5W7	1584	H261	R32 V226	1826
H78	E41 A322	1028	H170	R32 K2C2	1559	H262	R32 E6P3	1714
H79	E41 HX62	1445	H171	R32 A9P7	1513	H263	R32 R7F6	1660
H80	E41 W738	1311	H172	R32 VE02	1881	H264	E41 A6Y8	1193
H81	E41 F642	1430	H173	R32 YP95	1879	H265	E41 T2N3	1233
H82	E41 AK53	1392	H174	R32 N765	1960	H266	R95 W63R	1390
H83	E41 K065	1367	H175	R32 KVY9	1897	H267	R95 P9KW	1232
H84	E41 DY90	1340	H176	R32 E4P9	1775	H268	R95 PD90	1308
H85	E41 E6P0	1305	H177	R32 N6P1	1802	H269	R95 WN80	1183
H86	E41 NP92	1084	H178	R32 F8D9	1750	H270	R95 EK58	1156
H87	E41 CK00	1092	H179	R32 T8KP	1767	H271	R95 NX9R	1484
H88	E41 H261	1096	H180	R32 Y5TE	1547	H272	R32 DK09	1999
H89	E41 T186	1179	H181	R32 XA61	1624	H273	R32 DXA9	1998
H90	E41 HY65	1177	H182	E41 TC63	1691	H274	E41 C7N0	1986
H91	E41 KT18	1299	H183	E41 P276	1645			
H92	E41 VW11	1274	H184	E41 XR84	1791			

* House is also within 500m of the Candidate Gathabawn Grid Connection

Note: House H23 has two Eircodes, both linked to the same building, and is treated as one house, H23, herein.

Table 10-4: Local Residences within 300m of the Candidate Gathabawn Grid Connection

UGC: Underground Cables: Ballylehaun-Ballyring UGC/Ballyring-Parksgrove UGC/Parksgrove-Moatpark UGC

PS: Parksgrove Substation

House ID	EirCode	Distance to nearest UGC (m)	House ID	EirCode	Distance to nearest UGC (m)	House ID	EirCode	Distance to nearest UGC (m)
H31	E41 H970	231	H276	R95 N8Y4	75	H294	R95 K5X5	119 (UGC) 355 (PS)
H32	E41 C6N4	136	H277	R95 X6X0	148	H295	R95 FA3H	80 (UGC) 328 (PS)
H33	-	144	H278	R95 E5R7	49	H296	R95 X884	289
H34	E41 X030	19	H279	R95 R1X6	83	H297	R95 F6HW	265
H35	E41 F6X6	20	H280	R95 VW80	115	H298	R95 D6P5	129 (UGC) 394 (PS)
H36	E41 R923	32	H281	R95 E8N9	181	H299	R95 N1F1	94 (UGC) 359 (PS)
H37	E41 T3H5	96	H282	R95 AX64	217	H300	R95 C7P2	51 (UGC) 313 (PS)
H38	E41 XY19	37	H283	R95 V226	289	H301	R95 RKW4	346 (UGC) 315 (PS)
H43	E41 N9K6	33	H284	R95 K184	250	H302	R95 PE09	240
H44	E41 W623	27	H285	R95 H018	247	H303	R95 NH68	243
H45	E41 E7C6	48	H286	R95 NDH5	193	H304	R95 R2T7	107

House ID	EirCode	Distance to nearest UGC (m)	House ID	EirCode	Distance to nearest UGC (m)	House ID	EirCode	Distance to nearest UGC (m)
H46	E41 YC63	42	H287	R95 FC84	299	H305	R95 D9V2	38
H47	E41 A7P0	24	H288	R95 VW30	116	H306	R95 C3H3	13
H48	E41 YN30	204	H289	-	43	H307	R95 A0CR	54
H111	E41 W621	244	H290	R95 A727	276	H308	R95 W5C9	134
H113	E41 C6H3	103	H291	R95 D9W7	253 (UGC) 440 (PS)	H309	R95 A338	159
H254	E41 RV00	38	H292	R95 X0H4	117 (UGC) 436 (PS)	H310	R95 P7TK	184
H275	R95 TN96	165	H293	R95 X440	87 (UGC) 421 (PS)			

EIAR 10.3.2 Local Facilities and Areas of High Amenity

There are no community facilities within the study area, i.e. within 2km of the Gathabawn turbines.

Areas of High Amenity would include the following:

- Gathabawn Loop Walk;
- Millenium Park near NSL ref H104, and
- Spa Hill viewing near NSL ref H191.

EIAR 10.3.3 Local Walkers and Outdoor Workers

In terms of other amenity areas, the local forest road network is using for walking and biking; although these areas are sensitive to noise due to people using them, their use is temporary or transient and therefore any potential impacts from noise would not be significant.

In relation to people working outside, such as farm workers, they are likely to be affected more by noise from farm machinery operating near them rather than noise from the proposed development and are not considered further herein.

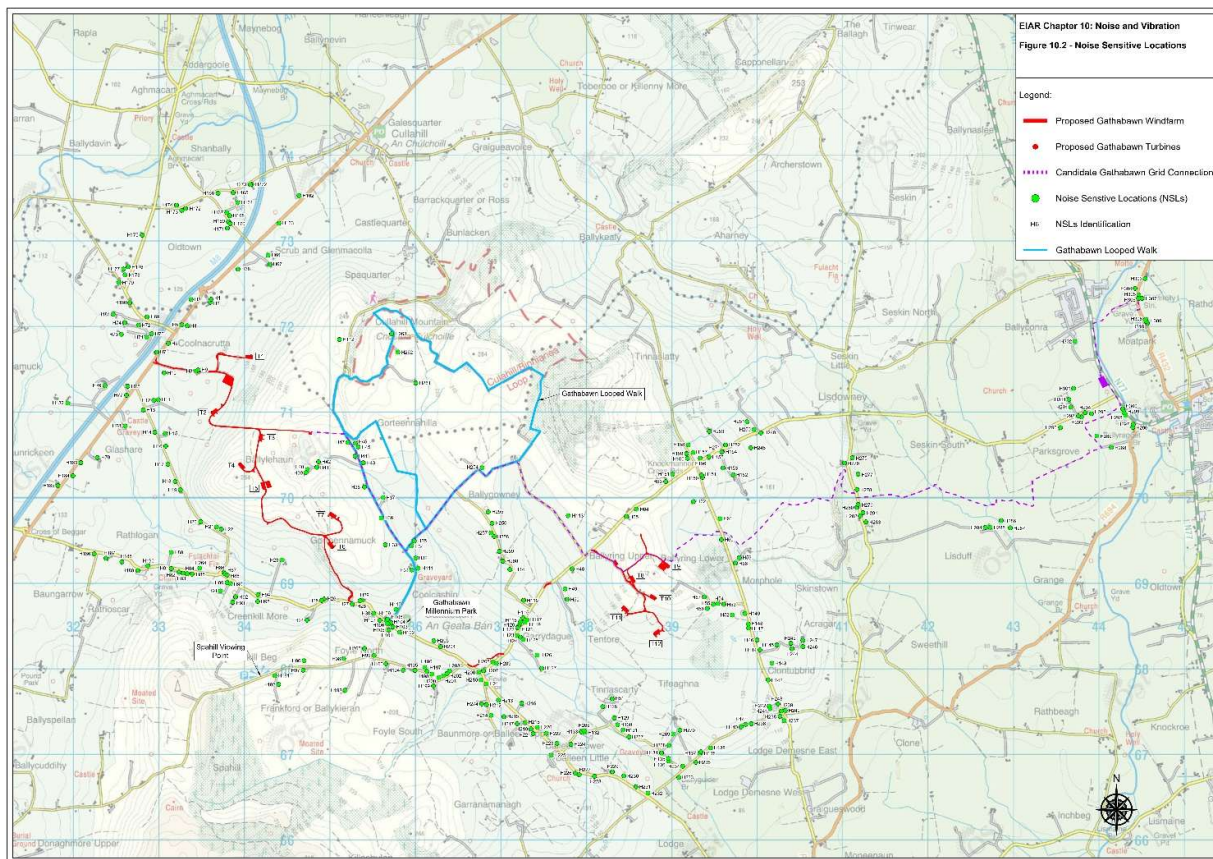


Figure 10-2: Location of Noise Sensitive Locations (NSL) in relation to Gathabawn Turbines

EIAR 10.3.3.1 Baseline Noise Measurements

To inform this assessment, baseline noise levels have been measured at eight representative NSLs surrounding the proposed development site. Details of the Background Noise Measurements are detailed in [Appendix 10.4: Background Noise Measurements](#).

The noise monitoring locations were identified by preparing a preliminary noise model contour at an early stage of the assessment. Locations were selected generally on proximity to the proposed wind turbines. The selection of the noise monitoring locations was informed by a site visit and supplemented by reviewing aerial images of the study area and other online sources of information (e.g., Google Earth and OSI Maps). The selected locations for the noise monitoring are outlined in the table below and depicted on the map in [Figure 10.3](#).

Table 10-5 Noise Measurement Co-ordinates (ITM)

Name	Distance to nearest Gathabawn Turbine	Easting	Northing
NML1-H057	508 m to T09	639,299	668,905
NML2-H064	776 m to T09	638,502	669,891
NML3-H040	541 m to T05	634,676	670,340
NML4-H038	529 m to T08	635,364	670,169
NML5-H008	519 m to T02	633,377	671,526
NML6-H023	531 m to T06	634,458	669,328
NML7-H027	715 m to T06	635,233	668,785
NML8	583 m to T11	637,829	668,545

Site visits by survey personnel were carried out during the morning and afternoon time; during these visits, primary noise sources contributing to noise build-up were noted. In respect of night-time periods, when noise due to traffic on local roads, agricultural activities and other sources tend to reduce - there was no indication of any significant local night-time sources of noise at any location.

No significant sources of vibration were noted at any of the survey locations.

Table 10-6 presents a summary of the various derived $L_{A90,10\text{min}}$ noise levels for each of the monitoring locations for daytime periods and night time periods. These levels have been derived using regression analysis carried out on the data sets in line with best practice guidance contained in the Institute of Acoustics *Good Practice Guide Supplementary Guidance No. 2: Data Processing & Derivation of ETSU-R-97 Background Curves*.

Table 10-6 Derived Levels of $L_{A90,10\text{-min}}$ for Various Wind Speeds

House	Period	Derived $L_{A90, 10\text{-min}}$ Levels (dB) at Various Standardised 10m Height Wind Speeds						
		3	4	5	6	7	8	9
NML1-H057	Day	24.8	25.8	27.2	28.9	31.0	33.5	36.5
	Night	19.3	19.9	21.2	23.2	25.8	28.9	32.4
NML2-H064	Day	24.9	28.0	29.6	33.0	36.8	39.9	41.1
	Night	19.6	23.4	27.6	31.8	35.7	39.0	41.4
NML3-H040	Day	24.3	25.5	27.5	29.6	32.8	37.0	41.8
	Night	19.0	20.2	20.4	22.4	27.1	33.1	39.1
NML4-H038	Day	24.7	26.2	27.5	28.9	30.7	33.1	36.3
	Night	19.9	21.1	22.7	24.5	26.8	29.5	32.7
NML5-H008	Day	39.7	40.4	40.7	40.8	41.1	41.8	43.1
	Night	31.5	30.9	31.1	32.2	34.0	36.3	39.1
NML6-H023	Day	29.5	31.7	33.9	36.2	38.6	41.0	43.7

House	Period	Derived LA90, 10-min Levels (dB) at Various Standardised 10m Height Wind Speeds						
		3	4	5	6	7	8	9
NML7-H027	Night	22.4	24.5	26.9	29.7	32.7	36.0	39.3
	Day	24.7	25.8	27.3	28.6	30.5	33.5	36.7
NML8	Night	21.0	21.9	23.3	25.1	27.4	30.2	33.6
	Day	22.7	24.8	27.2	28.2	31.0	35.1	39.3
	Night	17.8	19.3	21.6	24.4	27.7	31.3	35.1

The background noise measurements show that the area surrounding the Wind Farm is typical of rural settings.

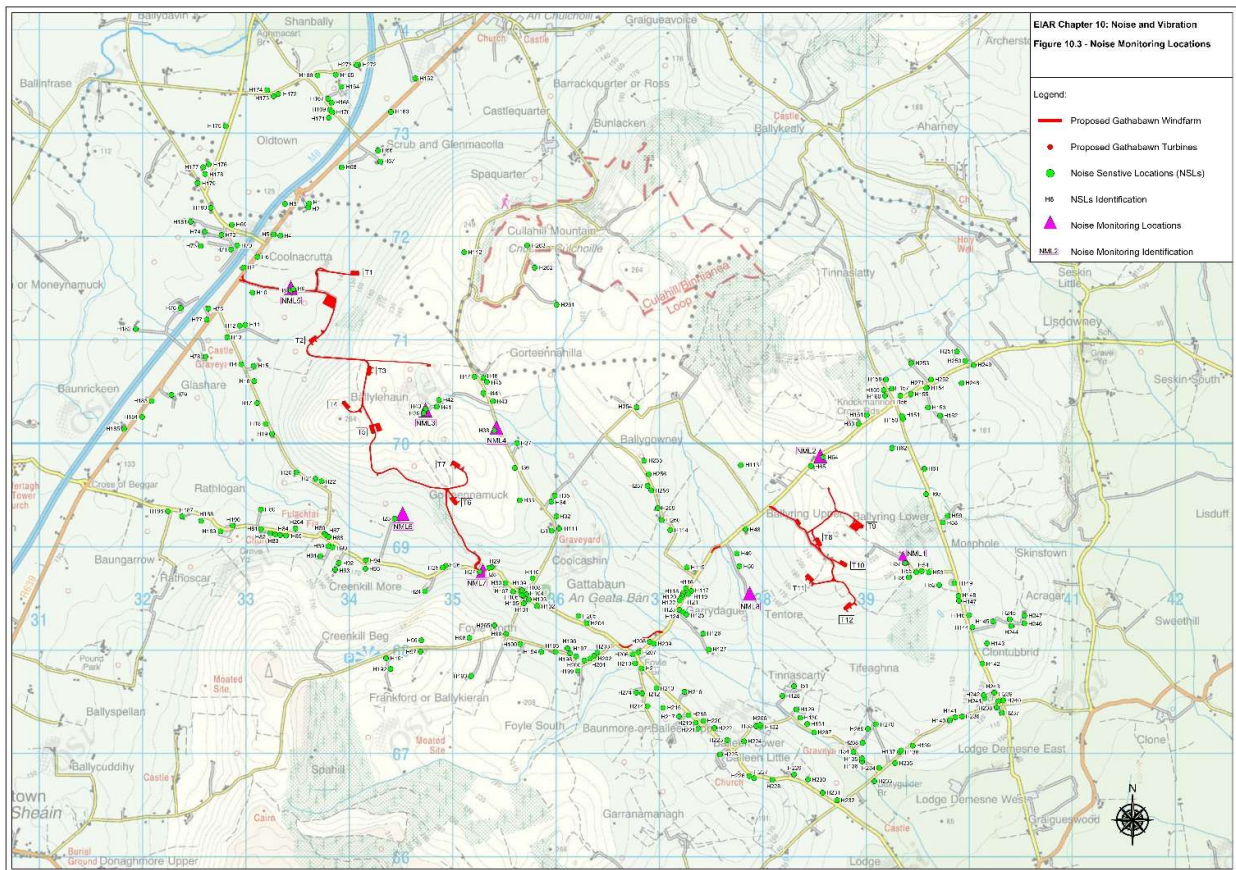


Figure 10-3: Noise Monitoring Locations

EIAR 10.3.4 Existing Sources of Impacts

The occurrence of existing pollution or environmental damage in the areas on or around the location of the Project have also been considered. The existing noise sources comprise natural and man-made noise sources. Natural noise sources include mainly wind-borne noise and birdsong.

Man-made noise sources of noise in the area around the Wind Farm site include farm machinery when in operation, traffic on the local road network and the operational Lisdowney Wind Farm and Wind Farm Substation. There are few sources of vibration in the local environment.

The influence of noise from Lisdowney turbines has been taken into account in the derivation of baseline noise levels, in accordance with the IOA GPG. Further details are presented in [Appendix 10-4 Background Noise Measurements](#).

EIAR 10.3.5 Importance, Sensitivity and Vulnerability to Change**EIAR 10.3.5.1 Importance**

The low number of residential properties is common in rural areas of Ireland, as is their distribution with the majority of properties centred around small rural villages and towns and in ribbon style development along the local road networks. The area has no statutory or other designations regarding noise or vibration, however it is noted that residential amenity will be protected from intrusive noise from the Gathabawn Wind Farm by noise limits, derived from the WEDG 2006, imposed as conditions of planning.

EIAR 10.3.5.2 Sensitivity and Vulnerability to Change

Local residents are sensitive to noise as a distraction or disturbance preventing enjoyment of their property or local outdoor amenity during the day. At night, noise that is too loud can lead to sleep disturbance. Local residents can be very sensitive to any new permanent source of noise introduced to their environment, depending on the level and characteristics of the noise that is audible.

It is noted that the noise criteria derived from the WEDG 2006 are designed to protect amenity at residential noise-sensitive locations.

EIAR 10.3.6 Evolution of the Baseline Environment (the 'Do-Nothing' scenario)

There has been a trend of renewable energy development in the area, with Lisdowney Wind Farm and Lisdowney Substation becoming operational in 2015. The addition of further wind energy development, will mean additional noise sources in the area and an increase in ambient noise levels albeit within the bounds of the noise limits as imposed by conditions of planning.

In the absence of this proposed development proceeding, the baseline levels will increase in line with the trends identified above.

EIAR 10.4 IMPACT OF THE PROPOSED DEVELOPMENT

This Section comprises an evaluation of the impacts of the Proposal on the receiving environment.

EIAR 10.4.1 Criteria and Methodology

The criteria used for evaluating the impact of operational noise in this report is based on guidance in relation to acceptable levels of noise from wind farms as contained in the document *Wind Energy Development Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government in 2006. These guidelines are in turn based on detailed recommendations set out in the Department of Trade and Industry (UK) Energy Technology Support Unit (ETSU) publication *The Assessment and Rating of Noise from Wind Farms* (1996), which has been superseded by the Department for Energy Security and Net Zero (DESNZ) publication *Assessment and Rating of Wind Turbine Noise* (DESNZ, 2026). The ARWTN document has been used to supplement the guidance contained within the WEDGs, where appropriate and necessary. See [Appendix 10.1 Methodology for the evaluation of Noise – Operational Phase](#).

The criteria used for evaluating the impact of construction and decommissioning phase noise in this report is based on BS 5228-1:2009 +A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise and Part 2: Vibration (BSI, 2014) guidance as set out in [Appendix 10.2 Methodology for the evaluation of Noise – Construction Phase](#) and [Appendix 10.3: Methodology for the evaluation of Vibration](#).

EIAR 10.4.2 Source-Pathway-Receptor

The following sources of impacts, pathways for impacts to the identified receptors (sensitive aspects) are listed below:

EIAR 10.4.2.1 Sources of Impact

<u>Construction Stage</u>	<u>Operational Stage</u>	<u>Decommissioning Stage</u>
Use and movement of plant and heavy machinery	Operational turbines	Use and movement of plant and heavy machinery
Excavation of soils and rock at construction works areas	Operational substation.	Movement and placement of soils at turbine reinstatement areas
Rockbreaking and excavation at borrow pits		Disassembly works at turbines;
Construction of hardstanding areas		Vehicular traffic
Delivery vehicles and traffic		

EIAR 10.4.2.2 Pathways

- Air
- Ground

EIAR 10.4.2.3 Receptors

- Local residents
- Local community at community facilities and local amenities

EIAR 10.4.3 Evaluation of Noise & Vibration Effects

A summary of the findings of the evaluation of noise and vibration from the Whole Gathabawn Windfarm Project, and particularly the Proposed Gathabawn Windfarm turbines is presented in the table below. The relevant phases of the development are the construction, operational and decommissioning phases which are denoted by C, O and D respectively.

The evaluations follow this summary table

Table 10-7: List of Noise & Vibration effects evaluated in detail

NOISE AND VIBRATION	EIAR Section
<u>Operational Phase:</u>	
Operational Noise from the Proposed Gathabawn Turbines	EIAR 17.4.3.1
Consideration of Low Frequency Sound, Tonality & Amplitude Modulation	EIAR 17.4.3.2

All of the remaining Noise or Vibration effects of the Gathabawn Windfarm Project have no likelihood of causing significant adverse effects to local residents or local community receptors. A short evaluation of these effects is provided in [Section 10.4.XX](#), with a list of these impacts provided in the table below. The relevant phases of the development are the construction, operational and decommissioning phases which are denoted by C, O and D respectively

Impact	Phase	Impact Significance	Relevant Section
Noise from Construction Works	C	Not Significant	Section 10.4.4.1
Noise from the construction of Wind Farm Site Roads and Internal Cabling	C	Not Significant	Section 10.4.4.2
Noise from the Facilitating Works along the Turbine Delivery Route	C	Not Significant	Section 10.4.4.3
Noise from construction of the Biodiversity Areas	C	Not Significant	Section 10.4.4.4
Noise from Construction Traffic	C	Not Significant	Section 10.4.4.5
Vibration from Construction Works	C	Imperceptible	Section 10.4.6.2
Noise from construction of the Candidate Grid Connection	C	Not Significant	Section 10.4.6.6
Noise from the construction of the Ballyhaun-Ballyring Cable Link	C	Not Significant	Section 10.4.6.3
Noise from the operational Wind Farm Substation	O	Not Significant	Section 10.4.6.3
Vibration Emissions during the Operational Phase	O	Imperceptible	Section 10.4.6.4
Noise from decommissioning works and activities	D	Not Significant	Section 10.4.6.7
Vibration from decommissioning works	D	Imperceptible	Section 10.4.6.8

EIAR 10.4.4 Construction Stage- Noise & Vibration Impacts (will not be significant)

Construction noise prediction calculations have been conducted using the methodology outlined in [Appendix 10.1 Methodology for the evaluation of Noise – Construction Phase](#). The noise levels referred to in this section are indicative only and are intended to demonstrate that it will be possible for the contractor to comply with current best practice guidance.

The predicted “worst case” levels are expected to occur for only short periods of time - most of the time, construction noise levels will be lower than these levels in the vicinity of the proposed development.

Detailed information of these construction activities is included in [Chapter 5: Description of the Development](#).

In general, as illustrated on [Figure 10.6: Construction Phase Noise Sources](#) (over), the distances between the construction activities associated with the Proposed Gathabawn Windfarm or Candidate Grid Connection works and the nearest Noise Sensitive Locations (NSLs) are such that it is not expected that there will be significant noise and vibration impacts at NSLs. Elements of the proposed construction activity which are greater than 300m (200 m for linear works), from Noise Sensitive Locations (NSLs) will not exceed the threshold limits at NSLs, and are considered not to have potential for significant noise and vibration impacts.

The following elements of the Whole Project are located within 300m (or 200m for linear works) from NSLs during their construction, and therefore have the potential for associated noise and vibration impacts:

Table 10-8: Wind farm works within 300m of NSLs (or 200m for linear works)

Windfarm Works within 300m (or 200m - linear works)	NSLs within 300m/200m
Facilitating works FW1 and Road Widening Works on the L58141 (FW2). Hedgerow planting behind newly widened road boundary.	H07, H08, within 200m H71 and H70 – within 300m
Road Widening Works and Facilitating Works (FW2) and FW3, FW4, FW5. Windfarm Site Roads, Cabling and Ballylehaun Temporary Compound.	H08, H09
Windfarm Site Roads & Facilitating Works FW7 beside the L1803	H25, H26, H27, H28, H29
Facilitating Works FW8 beside the L1804 and L1806	H206, H207, J208, H209 and H210
Facilitating Works FW9 beside the L1806	H49

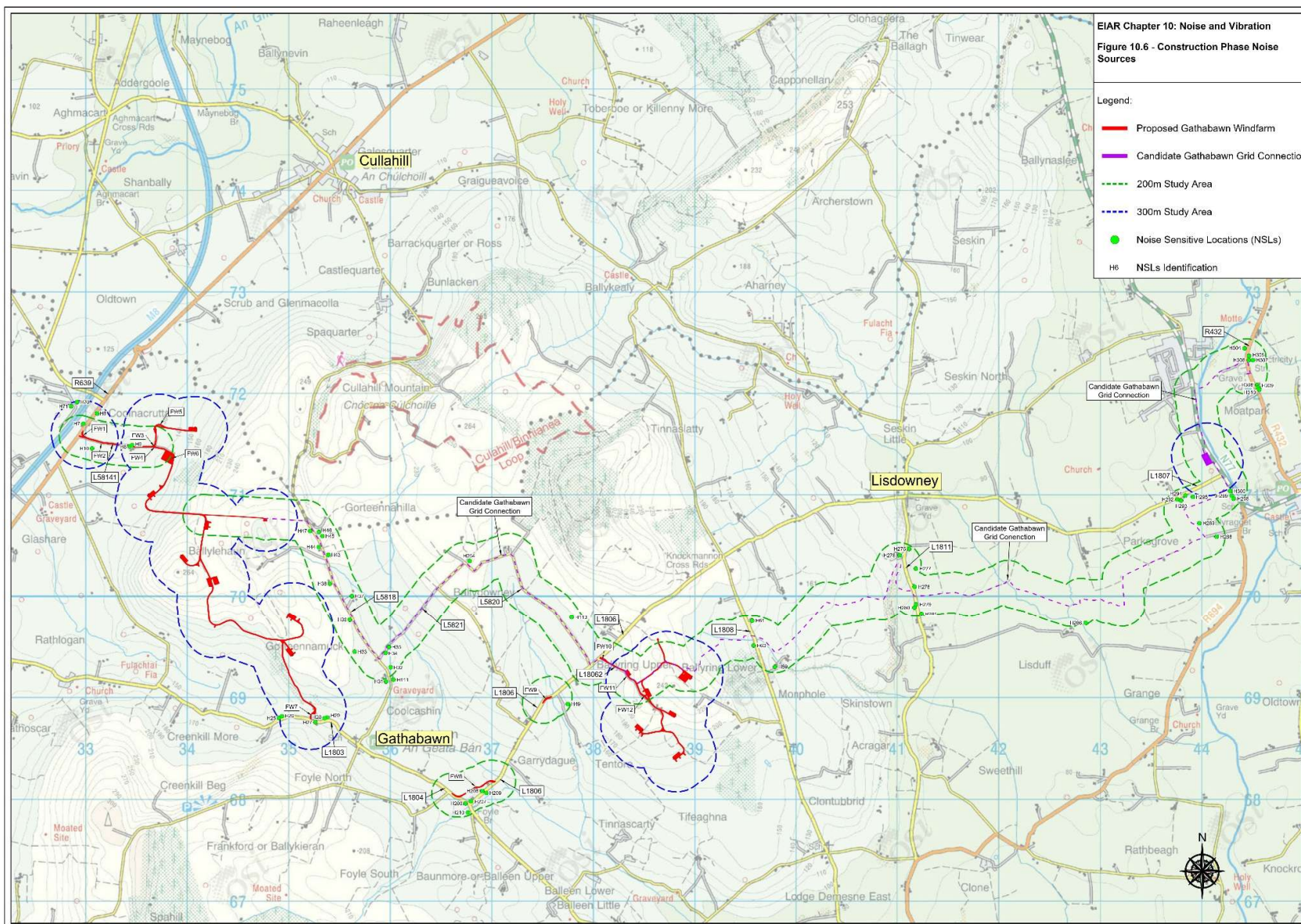
These NSLs can be found on [Figure 10.6: Construction Phase Noise Sources](#) below.

Table 10-9: Candidate Grid Connection works within 300m of NSLs (or 200m for linear works)

Grid Works within 300m (or 200m if the works are linear in nature)	NSLs within 200m
Trenching/Road Resurfacing along the Ballylehaun-Ballyring UGC	H47, H46, H45, H44, H43, H38, H37, H36, H33, H31, H111, H35, H35, H254, H113
Trenching/Road Resurfacing along the Ballyring-Parksgrove UGC	H60, H61, H59, H276, H275, H278, H279, H280, H281, H286, H288, H289, H292, H293, H294, H295, H298, H299, H300
Excavations, earthworks, surfacing at Parksgrove Substation	No houses within 300m
Trenching/Road Resurfacing along the Parksgrove-Moatpark UGC	H304, H305, H306, H307, H308, H309, H310

These NSLs can be found on [Figure 10.7: Construction Phase Noise Sources](#) below.

The following sections present an assessment of those elements of the Project identified in the tables above, which have the potential for associated noise and vibration impacts during their construction. All other stages and elements are considered not to have potential for significant noise and vibration impacts at NSLs.



EIAR 10.4.4.1 Noise from the construction of Wind Farm Site Roads and Internal Cabling

It is proposed to construct new roads and to upgrade existing internal roads to access the various parts of the development. The Internal Cabling between the turbines and control buildings will be installed into the internal site roads using an excavator. These are considered Linear Works therefore the construction noise threshold of 70 dB $L_{Aeq,1hr}$ applies, in accordance with the methodology in [Appendix 10.1](#).

It should be noted that construction activities will be carried out during normal daytime working hours (i.e., weekdays 0800 – 1800hrs and Saturdays 0800 – 13:00hrs). However, to ensure that optimal use is made of good weather periods or at critical periods within the programme (e.g., concrete pours) or to accommodate delivery of large turbine component along public routes it could be necessary on occasion to work outside of these hours. Any such out of hours working will be agreed in advance with Kilkenny County Council.

Table 10-10 outlines the typical construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 10-10: Indicative Noise Levels from Construction Plant at Various Distances from Wind Farm Site Roads and Internal Cabling Works

Item (BS 5228-1 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,1hr}$)	Predicted Noise Level (dB $L_{Aeq,1hr}$) at distance (m)		
			10 m	25 m	50 m
HGV Movement (C.2.34)	Removing spoil and transporting fill and other materials	80	78	66	59
Tracked Excavator (C.4.63)	Excavation / filling	77	75	63	56
Dumper Truck (C.4.4)	Excavation / filling	76	74	62	55
Road Roller (C.5.19)	Road surfacing	80	78	66	59
Total			81	69	62

NSLs located closer than 25 m to the works may experience construction noise levels above 70 dB $L_{Aeq,1hr}$. However, due to the progressive nature of the construction methodology, it is anticipated that works will remain in close proximity to the nearest NSLs only for a limited duration. The predicted noise levels shown in Table 10-10 are expected to occur for less than two days in a worst-case scenario, with works typically progressing at a rate of 100 metres per day along the route. At distances of 25 m and beyond, predicted noise levels are below the construction noise criterion of 70 dB $L_{Aeq,1hr}$ for linear works and no significant noise effects are predicted.

Review of Table 10.12 and the Wind Farm site road layout on [Figure 10.6](#) has identified that 6 NSLs are within 300m/200m of windfarm road construction works, these houses are also within 200m of facilitating works. The separation distance of these NSLs from the closest works is outlined below:

H0008	8m	H0027	29m
H0009	11m	H0028	105m
H0026	278m	H0029	125m

All other NSL locations are at greater distances (more than 300m from the nearest section of Windfarm Site Road/Windfarm Cabling or Facilitating Works at either the Ballylehaun Area or the Ballyring Area), with the majority at significantly greater distances. Based on the guidance in [Appendix 10.1](#), the likely noise impacts are considered not significant, and no specific mitigation measures are required.

EIAR 10.4.4.2 Noise from the Facilitating Works along the Turbine Delivery Route

Temporary works are proposed to facilitate the transport of the large components to the turbine locations; the locations of these temporary works are described in EIAR 5.3.9 and identified on [Figure 10.6](#).

Table 10-11 outlines the typical construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 10-11: Indicative Noise Levels from Construction Plant at Various Distances from Facilitating Works

Item (BS 5228-1 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB L _{Aeq,1hr})	Predicted Noise Level (dB L _{Aeq,1hr}) at distance (m)		
			25 m	35 m	75 m
HGV Movement (C.2.34)	Removing spoil and transporting fill and other materials	80	66	62	54
Tracked Excavator (C.4.63)	Excavation / filling	77	63	59	51
Dumper Truck (C.4.4)	Excavation / filling	76	62	58	50
Road Roller (C.5.19)	Road surfacing	80	66	62	54
Total			71	67	59

A number of specific temporary works areas are located at distances of 25 to 75 m from NSLs:

- FW1 at the turnoff from the Regional Road R639, which is located approx. 200m from H007;
- FW2 road widening works on the L58141, which is located approx. 60m from H10, and passes alongside H8 and H9;
- FW7 at site entrance No 3 along L1803, which is located at approximately 25m from H027, and
- FW8 provide access from the L1804 to the L1806 local roads, where locations H206, H207, H208, and H209 are at distances of 35 to 75 m from the proposed works.

At H027, there predicted construction noise level of 71 dB L_{Aeq,1hr} is in excess of the construction noise criterion of 65 dB L_{Aeq,1hr} for general construction. Similarly, at NSLs at distance of the order of 35 m the predicted construction noise level

However, these works will be limited in duration and completed with 6 days. Based on the guidance in [Appendix 10.1](#), the likely noise impacts are considered not significant, and no specific mitigation measures are required.

At H206, H207, H208 and H209, the predicted noise levels are within the construction noise criteria of 65 dB L_{Aeq,1hr} and therefore the likely noise impacts are considered not significant, and no specific mitigation measures are required.

EIAR 10.4.4.3 Noise from the construction of Biodiversity Areas – Protection, Creation, Enhancement

It is proposed to provide a Biodiversity Net Gain at the windfarm site through the protection, enhancement and creation of habitats for the benefit of local flora and fauna. The proposed Biodiversity Area at Ballylehaun to the west of the proposed turbine T4 is closest to NSLs, where NSL ref H019 is at a distance of 290 m.

The works consist of planting hedgerows improving existing hedgerows, post driving and planting native trees. Due to the nature of the works, no significant noise effects are expected at the nearest NSL, and no mitigation measures are required.

EIAR 10.4.4.4 Noise from the construction Candidate Grid Connection for Gathabawn Wind Farm

The Candidate Gathabawn Grid Connection comprises the construction of a new substation compound at Parksgrove, and the construction of Underground Cabling between the Windfarm Control Buildings and this new substation, and then a further section of underground cabling from Parksgrove Substation to the Eirgrid Ballyragget Substation at Moatpark. The Ballylehaun-Ballyring UGC are located in the public road, whereas the Ballyring-Parksgrove UGC is a cross country in agricultural fields with limited road crossings. The Parksgrove-Moatpark UGC is routed across fields and along the public road. Further details are presented in EIAR 5.4.

The construction of the Parksgrove Substation is considered to have a zone of influence of 300m, whereas the construction of the Underground Cabling is considered to be linear works with an associated Zol of 200m.

There are no NSLs within 300m of Parksgrove Substation.

EIAR 10.4.4.4.1 Noise from the Proposed Parksgrove Substation works

There is one NSL within 300m of the Parksgrove Substation compound works area - at a distance of 290 to the west, as shown in **Figure 10.5** below, which is approximately 320 m to the closest point of the substation.

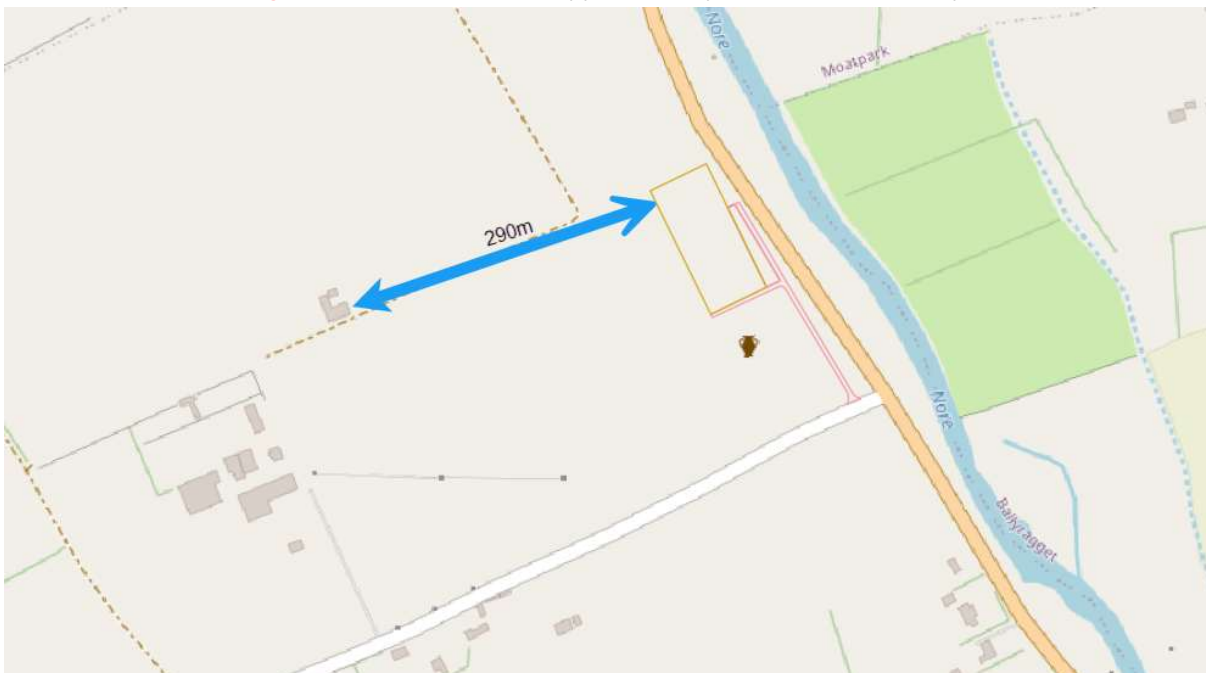


Figure 10-5: Nearest NSL to Parksgrove Substation (Candidate Grid Connection works)

Several noise sources that would be expected on the substation construction site have been identified and predictions of the potential noise emissions have been calculated at this NSL Table 10-12 outlines the

expected construction noise levels associated with the proposed works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 10-12: Indicative Noise Levels from Construction Plant at Various Distances from Substation

Item (BS 5228-1 Ref.)	Activity/Notes	Plant Noise level at 10m Distance (dB $L_{Aeq,1hr}$)	Predicted Noise Level (dB $L_{Aeq,1hr}$) at distance (m)
			25 m
HGV Movement (C.2.34)	Removing spoil and transporting fill and other materials	80	39
Tracked Excavator (C.4.63)	Excavation / filling	77	36
Excavator Mounted Rock Breaker (C9.12)	Rock Breaking.	85	44
General Construction (Various)	All general activities plus deliveries of materials and plan	84	43
Concrete Mixer Truck and Concrete Pump (C.4.28)	Concrete preparation and delivery	75	34
Dumper Truck (C.4.4)	Moving materials	76	35
Dewatering Pumps (D.7.70)	If required.	80	39
Vibrating Rollers (C.5.24)	Surfacing	84	43
Total			50

At 290 m from the works the predicted noise levels from construction activities are in the range of 35 to 44 dB $L_{Aeq,1hr}$, with a total 'worst-case' cumulative construction level of the order of 50 dB $L_{Aeq,1hr}$. In all instances the predicted noise levels at the nearest NSLs are below the adopted significance threshold outlined in Table 11.1 (Category A – 65 dB $L_{Aeq,T}$ during daytime periods). This assessment is considered representative of worst-case construction noise levels at NSLs.

There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the thresholds outlined in [Appendix 10.1](#) and this finding is valid should all items of plant operate simultaneously. The likely noise impacts are considered not significant and no specific mitigation measures are required.

EIAR 10.4.4.4.2 Noise from Underground Cabling works (linear works)

Ta outlines the expected construction noise levels associated with the proposed Underground Cabling works for this element of the construction. Calculations have assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period. Note the plant items and activities are indicative and based on conservative assumption to be representative of a reasonable worst case.

Table 10-13: Indicative Noise Levels from Construction Plant at Various Distances from UGC Works

Item (BS 5228-1 Ref.)	Plant Noise level at 10m Distance (dB L _{Aeq,1hr})	Predicted Noise Level (dB L _{Aeq,1hr}) at distance (m)			
		10 m	15 m	25 m	30 m
Tracked Excavator (C.2.7)	70	68	64	56	54
Vibrating Rollers (C.2.40)	73	71	67	59	57
Wheeled Loader (C.2.8)	68	66	62	54	52
Cumulative Predicted Construction Noise Level (No Rock Breaking)		74	70	62	60
Excavator Mounted Rock Breaker (C9.12)a	85	78	74	66	64
Cumulative Predicted Construction Noise Level (with Rock Breaking)		79	75	67	65

^a Assumed 20% on time for rock breaking

^b Only one tracked excavator considered in cumulative calcs. Rock breaking & Vibration rolling occurring simultaneously

For standard grid connection works, any NSL set back at 15 m or more from Underground Cabling works is predicted to experience noise levels within the linear construction noise limit of 70 dB L_{Aeq,1hr} as set out in Section [Appendix 10.1](#).

The associated construction works will occur for short durations at varying distances from Noise Sensitive Locations (NSLs). Review of the grid connection route has identified that the nearest NSLs to the proposed underground cable route, along local roads, are located at approximately 10 m from the nearest point.

NSLs located closer than 15 m to the works may experience construction noise levels slightly above 70 dB L_{Aeq,1hr}. However, due to the progressive nature of the construction methodology, it is anticipated that works will remain in close proximity to the nearest NSLs only for a limited duration. The predicted noise levels shown in Ta are expected to occur for less than two days in a worst-case scenario, with works typically progressing at a rate of 80-100 metres per day along the route.

Based on the guidance in [Appendix 10.1](#), the likely noise impacts are considered not significant, and no specific mitigation measures are required.

EIAR 10.4.4.4.3 Noise from the construction of the jointing chambers

There are 11 number joint bay pits proposed along the grid connection route it is expected that excavations for these pits will require an element of rock breaking. Where rock breaking is required at joint bay pits, any NSL set back 25 metres or more from the proposed works is predicted to remain within the linear construction noise limit of 70 dB L_{Aeq,1hr} as set out in [Appendix 10.1](#). NSLs at less than 25m from a joint bay location may experience construction noise levels above 70 dB L_{Aeq,1hr}. Nevertheless, it is anticipated that rock breaking will only occur at each location for less than 2-3 days.

In line with the guidance in [Appendix 10.1](#), the likely noise impacts are considered not significant, and no specific mitigation measures are required.

EIAR 10.4.4.4.4 Noise from the Eirgrid Ballyragget Substation works

The works at the Eirgrid Ballyragget Substation consist of cable trenches, installation of ducting and additional electrical plant. Taking into account the predicted noise levels presented in Table 10-12 and that the nearest NSL are at distances of over 100 m from the works, the likely noise impacts are considered not significant and no specific mitigation measures are required.

EIAR 10.4.4.4.5 Noise from construction of Watercourse Crossings

Works along the Ballyring-Parksgrove UGC route include a river crossing using standard methods at the Lismayne river, which is situated at approximately 50m from NSL H060. Taking this distance into account along with the predicted noise levels presented in Table 10-13, the likely noise impacts are considered not significant and no specific mitigation measures are required. The water crossing at the River Nore is discussed in the next section.

EIAR 10.4.4.4.6 Noise from Horizontal Directional Drilling Works –N77, and watercourses W2 & W6

Works along the Parksgrove-Moatpark UGC include two locations where horizontal directional drilling will be used:

- The crossing of under the N77 national road, where the nearest noise-sensitive location is
- The crossing of under the River Nore.

Table 10-14 outlines the typical construction noise levels associated with the proposed works for this element of the construction and the predicted noise levels to the nearest NSL at each location. Calculations have again assumed an on-time of 66% for each item of plant i.e., that the item is operational for 8 hours over a 12-hour assessment period.

Table 10-14: Indicative Noise Levels from Construction Plant at Various Distances from Facilitating Works

Item (BS 5228-1 Ref.) Activity/Notes	Plant Noise level at 10m Distance (dB LAeq,1hr)	Predicted Noise Level (dB LAeq,1hr) at distance (m)		
Tracked Excavator (C.4.17)	71	47	41	37
Directional drill (Vermeer D40x55 or similar)	76	52	46	42
Total		53	47	43

There is no item of plant that would be expected to give rise to noise levels that would be considered out of the ordinary or in exceedance of the thresholds outlined in Appendix 10.1. The likely noise impacts are considered not significant and no specific mitigation measures are required.

EIAR 10.4.4.5 Summary of Noise from Construction Works

In summary, there will be noise emissions from various construction works areas. Noise emissions from construction works will be variable and not constant.

In summary, it is evaluated that the potential worst-case effects at the nearest noise sensitive location assessed for each activity, are described as negative, not significant and short-term.

EIAR 10.4.4.6 Noise from Construction Traffic

This section of the report has been prepared in order to review potential noise impacts associated with construction traffic on the local road network. Chapter 16 of this EIAR presents an assessment of traffic and transportation and reference has been made to this chapter to inform the following discussion.

Based on information in [Appendix 16.1: Traffic and Transport Assessment](#), changes in traffic noise levels associated with the additional traffic for each of the construction situations listed above have been calculated. In the Traffic and Transport Assessment, two potential construction years are analysed, 2027 and 2037.

The potential noise impact of HGV movements along these roads is assessed through consideration of the cumulative noise level associated with a series of individual events.

The noise level associated with an event of short duration, such as a vehicle drive-by, may be expressed in terms of its Sound Exposure Level (SEL) (L_{Ax}). The SEL can be used to calculate the contribution of an event or series of events to the overall noise level in a given period. The appropriate formula is as follows.

$$L_{Aeq,T} = L_{Ax} + 10\log_{10}(N) - 10\log_{10}(T) - 10\log_{10}(r_2/r_1) - S \text{ dB}$$

Where:

- $L_{Aeq,T}$ is the equivalent continuous sound level over the time period T (s);
- L_{Ax} is the “A-weighted” Sound Exposure Level of the event under consideration (dB);
- N is the number of events over the course of time period T.
- r_2 is the distance from the edge of the entrance road to the facade of nearest property
- r_1 is the distance from vehicle to the point of original measurement
- S is the attenuation due to screening

The mean value of Sound Exposure Level for a HGV at low speeds is of the order of 85 dB L_{Ax} at a distance of 5m from the edge of the road. For a car or LGV, value is 67 dB L_{Ax} . This figure is based on a series of measurements conducted under controlled conditions. Based on the conservative assumption that all construction traffic is HGVs, the predicted noise levels at 5m from the edge of the routes are considered over an 12-hour period.

On local roads, L-1806, L-1807 and L-5818, an increase in traffic noise of 10 dB(A) corresponds to a major impact and would indicate an initial significance rating of ‘significant’. However, in line with the methodology in [Appendix 10.1](#), it is noted that the overall predicted noise levels from construction traffic of are below the construction noise threshold value of 65 dB $L_{Aeq,12hr}$. Therefore, the noise effect of construction traffic is considered not significant.

Table 10-15: Estimated Changes to Traffic Noise Levels due to Construction – AM Peak

Local Road ID	Traffic Noise Level without development, dB $L_{Aeq,1hr}$	Traffic Noise Level with development, dB $L_{Aeq,1hr}$	Change, dB $L_{Aeq,1hr}$	Significance of Effect
R639 (2027)	63.2	65.1	+1.9	Not Significant
R639 (2037)	63.6	65.4	+1.8	Not Significant
L-1806 (2027)	50.7	58.7	+8.0	< 65 dB(A), Not Significant
L-1806 (2037)	50.8	58.7	+7.9	< 65 dB(A), Not Significant
L-1807 (2027)	52.3	64.4	+12.1	< 65 dB(A), Not Significant
L-1807 (2037)	52.4	64.4	+12.0	< 65 dB(A), Not Significant
L-1804 (2027)	51.4	58.8	+7.4	< 65 dB(A), Not Significant
L-1804 (2037)	51.5	58.8	+7.3	< 65 dB(A), Not Significant
L-5818 (2027)	--	58.0	--	< 65 dB(A), Not Significant

Local Road ID	Traffic Noise Level without development, dB LAeq,1hr	Traffic Noise Level with development, dB LAeq,1hr	Change, dB LAeq,1hr	Significance of Effect
L-5818 (2037)	--	58.0	--	< 65 dB(A), Not Significant
L-5820 (2027)	--	58.0	--	< 65 dB(A), Not Significant
L-5820 (2037)	--	58.0	--	< 65 dB(A), Not Significant

Table 10-16: Estimated Changes to Traffic Noise Levels due to Construction

Local Road ID	Traffic Noise Level without development, dB LAeq,1hr	Traffic Noise Level with development, dB LAeq,1hr	Change, dB LAeq,1hr	Significance of Effect
R639 (2027)	63.8	65.5	+1.7	Not Significant
R639 (2037)	64.1	65.7	+1.6	Not Significant
L-1806 (2027)	50.6	58.7	+8.1	< 65 dB(A), Not Significant
L-1806 (2037)	50.7	58.7	+8.0	< 65 dB(A), Not Significant
L-1807 (2027)	51.8	64.4	+12.6	< 65 dB(A), Not Significant
L-1807 (2037)	51.9	64.4	+12.5	< 65 dB(A), Not Significant
L-1804 (2027)	51.3	58.8	+7.5	< 65 dB(A), Not Significant
L-1804 (2037)	51.4	58.8	+7.4	< 65 dB(A), Not Significant
L-5818 (2027)	--	58.0	--	< 65 dB(A), Not Significant
L-5818 (2037)	--	58.0	--	< 65 dB(A), Not Significant
L-5820 (2027)	--	58.0	--	< 65 dB(A), Not Significant
L-5820 (2037)	--	58.0	--	< 65 dB(A), Not Significant

Significance of the Pre-Mitigation Impact: With respect to the EPA's criteria for description of effects, the potential worst-case construction traffic noise impact at the nearest NSLs are described **negative, not significant and short-term**.

EIAR 10.4.4.7 Vibration from Construction Works

Imperceptible impact. Assessment of effects from vibration during the construction phase was conducted using the methodology outlined in [Appendix 10.3: Methodology for the evaluation of Vibration](#). Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to this development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228-2 recommends that, for a soundly constructed residential properties and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e., non-structural) damage should be taken as a peak particle velocity (PPV) of 15mm/s for transient vibration at frequencies below 15Hz and 20mm/s at frequencies above than 15Hz. Below these vibration magnitudes minor damage is unlikely, although the standard notes that where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

The Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) publication Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (NRA, 2014) also contains information on the permissible construction vibration levels during the construction phase as shown in Table 10-17.

Table 10-17: Allowable Vibration at Sensitive Properties (NRA, 2014)

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Following review of the guidance documents set out above, the TII values in Table 10-17 are considered appropriate for this assessment as they provide more stringent vibration criteria.

Evaluation of vibration emissions during construction works

It is recommended that vibration from construction activities be limited to the values set out in Table 10-17 above.

It should be noted that these limits are not absolute but provide guidance as to magnitudes of vibration that are very unlikely to cause cosmetic damage. Magnitudes of vibration slightly greater than those in the table are normally unlikely to cause cosmetic damage, but construction work creating such magnitudes should proceed with caution. Where there is existing damage these limits may need to be reduced by up to 50%.

As stated in the previous section, noise monitoring locations were selected generally on proximity to the proposed wind turbines. The selection of the noise monitoring locations was informed by a site visit and supplemented by reviewing aerial images of the study area and other online sources of information (e.g., Google Earth and OSI Maps). No significant sources of vibration were noted at any of the survey locations.

Also, it is not expected that blasting or piling will be required; in any case, based on the large distances between the Wind Farm site construction works boundary within which any piling would take place and the nearest NSLs, no significant impact will be experienced if limited piling or blasting was required.

EIAR 10.4.4.7.1 General Construction Vibration

Due to the distance of the proposed works boundary from noise sensitive locations (NSLs), and that no blasting or piling is anticipated, the vibration level at the nearest NSL will be below the allowable TII values and therefore vibration effects at NSLs are not expected. Construction vibration effects on NSLs is assessed as neutral, imperceptible and short-term.

EIAR 10.4.4.7.2 Vibration from Borrow Pits

Due to the distance of the nearest NSL to the Borrow Pits (438m to the nearest NSL) and the duration of any potential impact on any single dwelling, significant vibration effects are not expected. Borrow Pit activity vibration effects on NSLs is assessed as neutral, imperceptible and short-term.

EIAR 10.4.5 Noise and Vibration from decommissioning works and activities

EIAR 10.4.5.1 Noise from Decommissioning Works

Not Significant. Although similar works and equipment will be used to the construction phase, decommissioning phase will be lower overall, while lower noise levels to those calculated for the construction phase would be expected. In any case, based on the construction noise levels (see EIAR 10.4.4), the predicted noise levels are expected to be below the appropriate criteria at all NSLs for the decommissioning phase. Therefore, the potential noise effects at nearest noise sensitive locations is considered to be negative, not significant and temporary.

EIAR 10.4.5.2 Vibration from decommissioning works

Imperceptible impact. There are no expected significant sources of vibration associated with the decommissioning phase and effect remains are predicted to be neutral and temporary and therefore not significant.

EIAR 10.4.6 OPERATIONAL PHASE IMPACTS**EIAR 10.4.6.1 Operational Noise from Proposed Gathabawn Turbines****EIAR 10.4.6.1.1 Irish and International Noise Limit Criteria and Guidance**

The operational noise assessment documented in this chapter (Section 10.4.5.1.4 below) is based on guidance in relation to acceptable levels of noise from wind farms as contained in the document *Wind Energy Development Guidelines for Planning Authorities* published by the Department of the Environment, Heritage and Local Government in 2006. These guidelines are in turn based on detailed recommendations set out in the Department of Trade and Industry (UK) Energy Technology Support Unit (ETSU) publication *The Assessment and Rating of Noise from Wind Farms* (1996), which has been superseded by the Department for Energy Security and Net Zero (DESNZ) publication *Assessment and Rating of Wind Turbine Noise* (DESNZ, 2026). The ARWTN document has been used to supplement the guidance contained within the WEDGs, where appropriate and necessary.

EIAR 10.4.6.1.1.1 Wind Energy Development Guidelines for Planning Authorities

Section 5.6 of the *Wind Energy Development Guidelines for Planning Authorities* (WEDGs) published by the Department of the Environment, Heritage and Local Government (2006) addresses noise and outlines the appropriate noise criteria in relation to wind farm developments.

The following extracts from this document should be considered:

“An appropriate balance must be achieved between power generation and noise impact.”

While this comment is noted it should be stated that the Guidelines give no specific advice in relation to what constitutes an ‘appropriate balance’. In the absence of this, guidance will be taken from alternative and appropriate publications.

“In the case of wind energy development, a noise sensitive location includes any occupied house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational importance. Noise limits should apply only to those areas frequently used for relaxation of activities for which a quiet environment is highly desirable. Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.”

As can be seen from the description of noise sensitive locations in Section 10.3 Baseline Environment and the calculations presented later in this chapter the various issues identified in this extract have been incorporated into our assessment.

“In general, a lower fixed limit of 45dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.”

This represents the commonly adopted daytime noise criterion curve in relation to wind farm developments. However, an important caveat should be noted as detailed in the following extract.

“However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30dB(A), it is recommended that the daytime level of the $L_{A90, 10min}$ of the wind energy development be limited to an absolute level within the range of 35 – 40dB(A).”

In relation to night time periods the following guidance is given:

“A fixed limit of 43dB(A) will protect sleep inside properties during the night.”

This limit is defined in terms of the $L_{A90,10min}$ parameter. This represents the commonly adopted night-time noise criterion curve in relation to wind farm developments.

In summary, the Wind Energy Development Guidelines outlines the following guidance to identify appropriate wind turbine noise criteria curves at noise sensitive locations:

- An appropriate absolute limit level in the range of 35 – 40 dB L_{A90} for quiet daytime environments with background noise levels of less than 30 dB $L_{A90,10min}$;
- 45 dB $L_{A90,10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), for daytime environments with background noise levels of not less than 30 dB $L_{A90,10min}$ and;
- 43 dB $L_{A90,10min}$ for night time periods.

While the caveat of an increase of 5dB(A) above background for night-time operation is not explicit within the current guidance it is commonly applied in noise assessments prepared and is detailed in numerous examples of planning conditions issued by local authorities and An Bord Pleanála.

EIAR 10.4.6.1.1.2 The Assessment and Rating of Noise from Wind Farms – ETSU-R-97

The core of the noise guidance contained within the Wind Energy Development Guidelines is based on the 1996 ETSU publication *The Assessment and Rating of Noise from Wind Farms* (ETSU-R-97).

ETSU-R-97 advises regulating wind turbine noise by establishing noise limits at the properties most sensitive to noise. The document considers that applying fixed noise limits across all wind speeds is not appropriate for wind turbine projects. Instead, it recommends setting noise limits in relation to the prevailing background noise levels at sensitive locations. A crucial step in assessing noise for wind energy projects involves identifying the existing background noise levels through on-site surveys.

ETSU-R-97 states on page 58, “...noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question...”. Therefore, the noise contribution from all wind turbine development in the area should be included in the assessment.

The ETSU-R-97 guidance allows for a higher level of turbine noise operation at properties that have an involvement in the development, as a higher fixed level of 45 dB L_{A90} and/or a higher level above the prevailing background noise level.

A fixed lower threshold of 45 dB L_{A90} has been applied in the assessment for NSL identified as being involved in the project, for day and night-time periods.

EIAR 10.4.6.1.1.3 Key updates introduced by the Assessment and Rating of Wind Turbine Noise – ARWTN

The Assessment and Rating of Wind Turbine Noise (ARWTN) (2026) replaces ETSU-R-97 and provides updated technical guidance for the assessment and control of operational wind turbine noise. However, as the operational noise assessment for the Proposed Project is based on the methodology set out in the Wind Energy Development Guidelines (WEDG) 2006, the ARWTN document is reviewed here primarily to identify relevant updates and clarifications. The ARWTN retains the fundamental principles of ETSU-R-97, including the assessment of wind turbine noise at noise sensitive receptors, the use of background noise measurements to inform noise limits, and the requirement to consider cumulative noise from all acoustically relevant wind energy developments.

The guidance increases emphasis on the assessment of cumulative operational noise and confirms that the combined contribution from existing, permitted and proposed wind energy developments should be considered where relevant. ARWTN also provides updated procedures for operational compliance

monitoring, including refined methodologies for the assessment of tonal noise and amplitude modulation (AM). These characteristics are intended to be addressed through post-construction compliance monitoring and planning conditions, rather than through the application of penalties at the planning assessment stage unless there is clear evidence that such characteristics are likely to occur.

A notable update within ARWTN is the confirmation that certain acoustical issues do not require specific assessment during the planning process: namely infrasound, ground-borne vibration and low-frequency noise. The guidance confirms that infrasound generated by modern wind turbines is below the threshold of perception at typical receptor distances, that ground-borne vibration levels are significantly below those detectable by humans, and that low-frequency noise is adequately controlled through the standard A-weighted noise assessment criteria and tonal assessment procedures. Consequently, assessment of these characteristics is scoped out of the operational noise assessment for the Proposed Project.

EIAR 10.4.6.1.1.4	Institute of Acoustics Good Practice Guide
-------------------	--

The original ETSU-R-97 concepts underwent a thorough standardisation and modernisation in 2013 with the Institute of Acoustics (IOA) publication of A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IOA GPG) including 6 Supplementary Guidance Notes. These documents bring together the combined experience of acoustic consultants in the UK and Ireland in the application of the assessment methods. Numerous improvements in the accuracy and robustness are described, including the treatment of wind shear and the general adaptation to larger wind turbines. The guidance contained within IOA GPG, and its Supplementary Guidance Notes (SGNs) are considered to represent best practice and have been adopted for this assessment.

EIAR 10.4.6.1.1.5	Future Potential Wind Energy Development Guidance Changes
-------------------	---

In December 2019, the Draft WEDG19 were published for consultation and at the time of writing, the final guidelines have yet to be published. It is important to note that during the public consultation on the 2019 draft WEDGs, several concerns relating to the proposed approach of the 2019 draft WEDGs have been expressed by various parties. Specific concerns expressed by a group of acoustic professionals working in the field are most relevant. The group was made up of acousticians who act for wind farm developers, Councils, Government bodies and residents' groups (all of whom are members of the Institute of Acoustics, IOA). The group contained several of the authors / contributors to ETSU-R-97, ARWTN, the IOA Good Practice Guide (IOA GPG) and the IOA Amplitude Modulation Working Group, which are all referenced extensively in the draft guidelines. Comment on the statement from the party group can be reviewed at:

<https://pub.ioa.org.uk/blogs/wind-energy-development-guidelines-wedg-consultation-irish-department-housing-planning-community>

Wherein it is stated that :

"a number of acousticians working in the field have raised serious concerns over the significant amount of technical errors, ambiguities and inconsistencies in the content of the draft WEDG and these were highlighted during the consultation process by a group of acousticians"

A copy of the group's consultation response in full can be viewed at:

<https://awnconsulting.com/wp-content/uploads/2026/03/WEDG-consultation-joint-response-R0.pdf>

In a written answer to Parliamentary Question on 19 June 2025, the Minister for Housing, Local Government and Heritage stated that the review of the 2006 Wind Energy Development Guidelines is ongoing and that, when finalised, the revised Guidelines "will be issued under section 28 of the Planning and Development Act

2000, as amended or, subject to commencement of the Planning and Development Act 2024, as a National Planning Statement, as appropriate". The Minister further stated that "The current 2006 Wind Energy Development Guidelines remain in force, pending the finalisation of the review." The full written answer is available from the Houses of the Oireachtas: Wind Energy Guidelines, Dáil Éireann Debate, 19 June 2025.

The assessment of wind turbine noise presented in this EIAR is based on the guidance outlined in the 2006 Wind Energy Development Guidelines and has been supplemented with best practice guidance from ARWTN, ESTU-R-97 and the Institute of Acoustics Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IOA GPG). If updated Wind Energy Guidelines are published during the application process for the proposed development it is anticipated that any relevant changes affecting the noise will be addressed through an appropriate planning condition, or where a supplementary assessment is necessary, through provision of additional information.

EIAR 10.4.6.1.1.6	World Health Organization (WHO) Noise Guidelines for the European Region
-------------------	--

The WHO Environmental Noise Guidelines for the European Region (2018) provide guidance on protecting human health from exposure to environmental noise. They set health-based recommendations based on average environmental noise exposure of several sources of environmental noise, including wind turbine noise. Recommendations are rated as either 'strong' or 'conditional'.

A strong recommendation, *"can be adopted as policy in most situations"* whereas a conditional recommendation, *"requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply"*.

The objective of the WHO Environmental Noise Guidelines for the European Region is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

In relation to wind turbine noise, the WHO Guideline Development Group (GDG) state the following:

"For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB L_{den} , as wind turbine noise above this level is associated with adverse health effects.

No recommendation is made for average night noise exposure L_{night} of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.

To reduce health effects, the GDG conditionally recommends that policy-makers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another."

As stated within the same WHO document, the **quality of evidence** used for this research is stated as being '**Low**', the **recommendations are therefore conditional**.

The WHO Environmental Noise Guidelines aim to support the legislation and policy-making process on local, national, and international level, thus shall be considered by Irish policy makers for any future revisions of Irish National Guidelines.

There is potential increased uncertainty due to the parameter used by the WHO for assessment of exposure (i.e., L_{den}), which it is acknowledged may be a poor characterisation of wind turbine noise and may limit the

ability to observe associations between wind turbine noise and health outcomes, as stated below, from within the WHO Environmental Noise Guidelines:

“Even though correlations between noise indicators tend to be high (especially between L_{Aeq} -like indicators) and conversions between indicators do not normally influence the correlations between the noise indicator and a particular health effect, important assumptions remain when exposure to wind turbine noise in L_{den} is converted from original sound pressure level values. The conversion requires, as variable, the statistical distribution of annual wind speed at a particular height, which depends on the type of wind turbine and meteorological conditions at a particular geographical location. Such input variables may not be directly applicable for use in other sites. They are sometimes used without specific validation for a particular area, however, because of practical limitations or lack of data and resources. This can lead to increased uncertainty in the assessment of the relationship between wind turbine noise exposure and health outcomes. Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.”

...Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region.”

It is considered that the conditional WHO recommended average noise exposure level (i.e. 45 dB L_{den}) if applied, as target noise criteria for an existing or proposed wind turbine development in Ireland, should be done with caution. The conditional WHO recommendation for average noise exposure level (i.e., 45 dB L_{den}) may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.

EIAR 10.4.6.1.1.7 Good Practice for Baseline Noise Measurements

The IOA GPG states, that at a minimum continuous baseline noise monitoring should be carried out at the nearest noise sensitive locations for typically a two-week period and should capture a representative sample of wind speeds in the area (i.e., cut in speeds to wind speed of rated sound power of the proposed turbine). Background noise measurements (i.e., $L_{A90,10min}$) should be related to wind speed measurements that are collated at the site of the wind turbine development. Regression analysis is then conducted on the data sets to derive background noise levels at various wind speeds to establish the appropriate day and night time noise criterion curves.

EIAR 10.4.6.1.1.8 Good Practice for Operational Noise Predictions

The noise levels associated with the wind turbines have been calculated in accordance with ISO 9613-2, 1996 including IOA's GPG parameter settings for wind turbine screening limit and wind turbine valley correction settings. A new version of ISO 9613 was published in 2024 that includes a more generic definition of the parameters indicated. However, IOA GPG includes a more conservative approach for terrain screening and are only applicable when using the ISO 9613-2, 1996. Therefore, the noise prediction calculations herein, are made using the more conservative ISO 9613-2, 1996 with the IOA parameters. The IOA is undertaking a review of the GPG to clarify the use of the superseded standard with respect to the newest revision.

ISO 9613 is a noise prediction standard that considers noise attenuation offered, amongst other factors, by distance, ground absorption, directivity, and atmospheric absorption. Noise predictions and contours are typically prepared for various wind speeds, and the predicted levels are compared against the relevant noise criterion curve to demonstrate compliance with the appropriate noise criteria.

Where noise predictions indicate that reductions in noise emissions are required to satisfy any adopted criteria, consideration can be given to detailed downwind analysis and operating turbines in lower noise modes, which is typically offered by modern wind turbine units.

The Institute of Acoustics Good Practice Guide (IOA GPG) states that cumulative noise exceedances should be avoided and where existing or permitted development is at the noise limit, any new turbine noise sources should be designed to be 10 dB below the limit value.

Section 5.1 of the relevant IOA GPG states the following:

“5.1.1 ETSU-R-97 states at page 58, “...absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question...”

Also:

5.1.4 During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.

5.1.5 Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary.”

ElAR 10.4.6.1.2 Noise Modelling software used for the calculations

Operating noise prediction calculations have been conducted using the methodology outlined in [Appendix 10.2 Methodology for the evaluation of Noise – Operational Phase](#).

The software, DGMR iNoise Enterprise, was selected to calculate noise levels in accordance with ISO 9613: *Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation*, (ISO, 1996).

iNoise is a proprietary noise calculation package for computing noise levels and propagation of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated considering a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A-weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- Attenuation due to atmospheric absorption; and
- Meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impacts at distances greater than approximately 400 m).

ElAR 10.4.6.1.3 Gathabawn Turbine Details

The turbine noise assessment has been undertaken considering the sound emissions of the Vestas V136 turbine at the hub heights of 82 m and 102 m, as follows:

- Tip height : 170m (T1, T2, T3, T4, T5, T8, T10, T11, T12) and 150m (T6, T7, T9)
- Hub height : 102m (T1, T2, T3, T4, T5, T8, T10, T11, T12) 82m (T6, T7, T9)

Sound power levels for the Vestas V136 at the two hub heights, referenced to wind speeds at standardised 10 m height (calculated in accordance with the IOAGPG), are presented in Table 10-18.

Table 10-18: Sound Power Levels for Turbines

Wind Speed at 10m Standardised (m/s)	Vestas V136 at hub height of 82 m	Vestas V136 at hub height of 102 m
3	91.4	91.7
4	94.7	95.2
5	99.6	100.2
6	103.3	103.5
7	103.9	103.9
8	103.9	103.9
9	103.9	103.9

EIAR 10.4.6.1.4 Operational Wind Turbine Noise Criteria

With respect to the relevant guidance documents described in Section EIAR 10.4.5.1.1, noise criteria curves have been identified for the proposed development. The noise criteria curves for the NSLs have been derived following a detailed review of the background noise data conducted at the nearest NSLs.

This set of criteria has been derived in line with the intent of the relevant Irish guidance and best practice guidance (as described in Section EIAR 10.4.5.1.1). It is comparable to noise planning conditions applied to similar sites previously granted planning permission by An Bord Pleanála and local planning authorities in Ireland.

The following points were also taken into consideration when setting the noise criteria curves for the NSLs:

- The EPA document 'Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)' proposes a daytime noise criterion of 45 dB(A) in 'areas of low background noise'. Accounting for the difference in the noise parameters, the proposed lower threshold here, this is more than 3 dB more stringent than this level.
- It is reiterated that the 2006 Wind Energy Development Guidelines states that "An appropriate balance must be achieved between power generation and noise impact."
- Based on a review of other national guidance (i.e. EPA NG4) in relation to acceptable noise levels in areas of low background noise it is considered that the criteria adopted as part of this assessment are robust.

Therefore, in summary, it is considered that the operational noise limits, as set out in Table 10-19 below, for the development cumulatively with other permitted Wind Farms in the area are appropriate:

40 dB $L_{A90,10min}$ for daytime in quiet environments with typical background noise of less than 30 dB $L_{A90,10min}$.

45 dB $L_{A90,10min}$ for daytime in environments with typical background noise greater than or equal to 30 dB $L_{A90,10min}$ or a maximum increase of 5 dB(A) above background noise (whichever is the higher); and

43 dB $L_{A90,10min}$ for night-time periods or a maximum increase of 5 dB(A) above background noise (whichever is the higher).

Table 10-19 Proposed Noise Criteria Curves for the Gathabawn Wind Farm

Day and night time noise criteria curves have been determined and are presented in Table 10-20. These are the operational noise criteria that are applicable to this assessment.

House	Period	Derived L _{A90} , 10-min Levels (dB) at Various Standardised 10m Height Wind Speeds						
		3	4	5	6	7	8	9
NML1-H057	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NML2-H064	Day	40.0	40.0	40.0	45.0	45.0	45.0	46.1
	Night	43.0	43.0	43.0	43.0	43.0	44.0	46.4
NML3-H040	Day	40.0	40.0	40.0	40.0	45.0	45.0	46.8
	Night	43.0	43.0	43.0	43.0	43.0	43.0	44.1
NML4-H038	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NML5-H008	Day	45.0	45.4	45.7	45.8	46.1	46.8	48.1
	Night	43.0	43.0	43.0	43.0	43.0	43.0	44.1
NML6-H023	Day	40.0	45.0	45.0	45.0	45.0	46.0	48.7
	Night	43.0	43.0	43.0	43.0	43.0	43.0	44.3
NML7-H027	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0
NML8	Day	40.0	40.0	40.0	40.0	45.0	45.0	45.0
	Night	43.0	43.0	43.0	43.0	43.0	43.0	43.0

Table 10-20 Proposed Noise Criteria Curves for the Gathabawn Wind Farm

The background noise data is utilised to establish suitable noise criteria curves for each of the NSLs where measurements were undertaken. For all other locations, in the absence of specific background noise measured at each NSL, a background noise envelope based on the lowest levels derived from the various survey locations has been employed for the purpose of this assessment. This is a conservative approach to the assessment and is applied separately for daytime and night-time periods. The actual wind turbine noise limits for a given NSL shall be defined relative to the background noise levels at each NSL as discussed in detail in Section EIAR 10.4.6.1.4 in accordance with the Guidelines (DoEHLG, 2006). Finally, in accordance with the guidance discussed in EIAR 10.4.6.1.1.2, criteria of 45 dB L_{A90} for day and night-time periods are applied to NLSs which are financially involved in the project.

EIAR 10.4.6.1.5 Assessment of Operating Wind Turbine Noise – Gathabawn Standalone Results

The predicted noise levels for the Proposed Development have been calculated for all 274 No. noise sensitive locations (NSLs) identified within the noise study area, along with two additional locations St Munchins Church, Millenium Park.

Predicted noise levels have been calculated using the ISO 9613-2 standard which represents worst-case conditions favourable to noise propagation (typically downwind propagation from source to receiver and/or downward refraction under temperature inversions).

A worst case ‘omni-directional’ assessment has been completed; this assumes that all noise sensitive locations are downwind of all turbines at the same time which is not possible because the NSLs surround the site but nevertheless the assessment considers the worst-case scenario.

There is uncertainty associated with the measurement of wind turbine noise. This is sometimes included in the warranted noise levels, sometimes it is not. In accordance with the IOA GPG guidelines: If no data on uncertainty or test reports are available for the turbine then a factor of +2dB should be added. A margin of +2dB has been added to the sound power levels used in the noise model for this assessment, in line with the IOA GPG.

The results of the noise prediction models have been compared against the turbine noise criteria that have been assigned to each of the NSLs in accordance with the criteria set out in the Section 10.4.3.1.4 above.

The predicted noise levels at various wind speeds are in Table 10-21 below; for NSLs, H001, H002 and H003, the comparison compared against the noise criteria curves is shown in full. For brevity, the remaining NSLs show the predicted noise levels. Where exceedances are predicted, the comparison against noise criteria curves is shown in full.

Figure 10.4 (*found after the modelling table*) shows the noise contours for the proposed Gathabawn turbines only, at the wind speed of 9 m/s at standardised 10 m height, this being the wind speed at which the wind turbine reaches its maximum sound power level (See Section EIAR 10.2.3.1.).

Table 10-21 Predicted Noise Levels for all 274 No. NSLs for Gathabawn Wind Farm ALONE

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H001	Predicted Noise Level	23.8	27.4	32.4	35.7	36.1	35.8	35.6
H001	Daytime Criterion	40	40	40	40	45	45	45
H001	Daytime Excess	--	--	--	--	--	--	--
H001	Night-time Criterion	43	43	43	43	43	43	43
H001	Night-time Excess	--	--	--	--	--	--	--
H002	Predicted Noise Level	24.1	27.7	32.6	36.0	36.4	36.1	35.8
H002	Daytime Criterion	40	40	40	40	45	45	45
H002	Daytime Excess	--	--	--	--	--	--	--
H002	Night-time Criterion	43	43	43	43	43	43	43
H002	Night-time Excess	--	--	--	--	--	--	--
H003	Predicted Noise Level	22.7	26.3	31.3	34.6	35.0	34.7	34.4
H003	Daytime Criterion	40	40	40	40	45	45	45
H003	Daytime Excess	--	--	--	--	--	--	--
H003	Night-time Criterion	43	43	43	43	43	43	43
H003	Night-time Excess	--	--	--	--	--	--	--
H004	Predicted Noise Level	24.6	28.2	33.1	36.5	36.8	36.6	36.3
H005	Predicted Noise Level	24.1	27.7	32.6	36.0	36.3	36.1	35.8
H006	Predicted Noise Level	24.3	27.9	32.9	36.2	36.6	36.3	36.1
H007	Predicted Noise Level	24.3	27.9	32.9	36.2	36.6	36.3	36.1
H008	Predicted Noise Level	28.8	32.4	37.3	40.7	41.0	40.8	40.6
H009	Predicted Noise Level	28.9	32.4	37.4	40.8	41.1	40.9	40.7
H010	Predicted Noise Level	25.9	29.5	34.4	37.8	38.2	37.9	37.7
H011	Predicted Noise Level	26.6	30.2	35.2	38.5	38.9	38.6	38.4
H012	Predicted Noise Level	26.0	29.6	34.6	38.0	38.3	38.1	37.8
H013	Predicted Noise Level	25.0	28.6	33.6	36.9	37.3	37.0	36.8
H014	Predicted Noise Level	25.7	29.3	34.3	37.6	38.0	37.7	37.5
H015	Predicted Noise Level	27.1	30.6	35.6	39.0	39.3	39.1	38.9
H016	Predicted Noise Level	26.6	30.2	35.2	38.5	38.9	38.7	38.4
H017	Predicted Noise Level	26.1	29.7	34.7	38.0	38.4	38.1	37.9
H018	Predicted Noise Level	26.0	29.6	34.6	38.0	38.3	38.1	37.8
H019	Predicted Noise Level	26.2	29.8	34.7	38.1	38.4	38.2	38.0
H020	Predicted Noise Level	26.0	29.6	34.5	37.9	38.3	38.0	37.8
H021	Predicted Noise Level	26.7	30.3	35.2	38.6	39.0	38.8	38.6
H022	Predicted Noise Level	26.9	30.5	35.4	38.8	39.2	39.0	38.8
H023	Predicted Noise Level	27.7	31.2	36.0	39.6	40.1	39.9	39.7
H024	Predicted Noise Level	25.7	29.2	34.1	37.7	38.2	38.0	37.7
H025	Predicted Noise Level	26.1	29.6	34.4	38.1	38.6	38.4	38.1
H026	Predicted Noise Level	26.0	29.4	34.3	38.0	38.5	38.3	38.0
H027	Predicted Noise Level	24.9	28.4	33.2	36.9	37.4	37.2	36.9
H028	Predicted Noise Level	24.8	28.3	33.1	36.8	37.3	37.1	36.8
H029	Predicted Noise Level	24.8	28.2	33.1	36.8	37.3	37.0	36.8
H030	Predicted Noise Level	23.0	26.5	31.4	35.0	35.5	35.2	34.9
H031	Predicted Noise Level	22.9	26.4	31.3	34.9	35.4	35.1	34.8

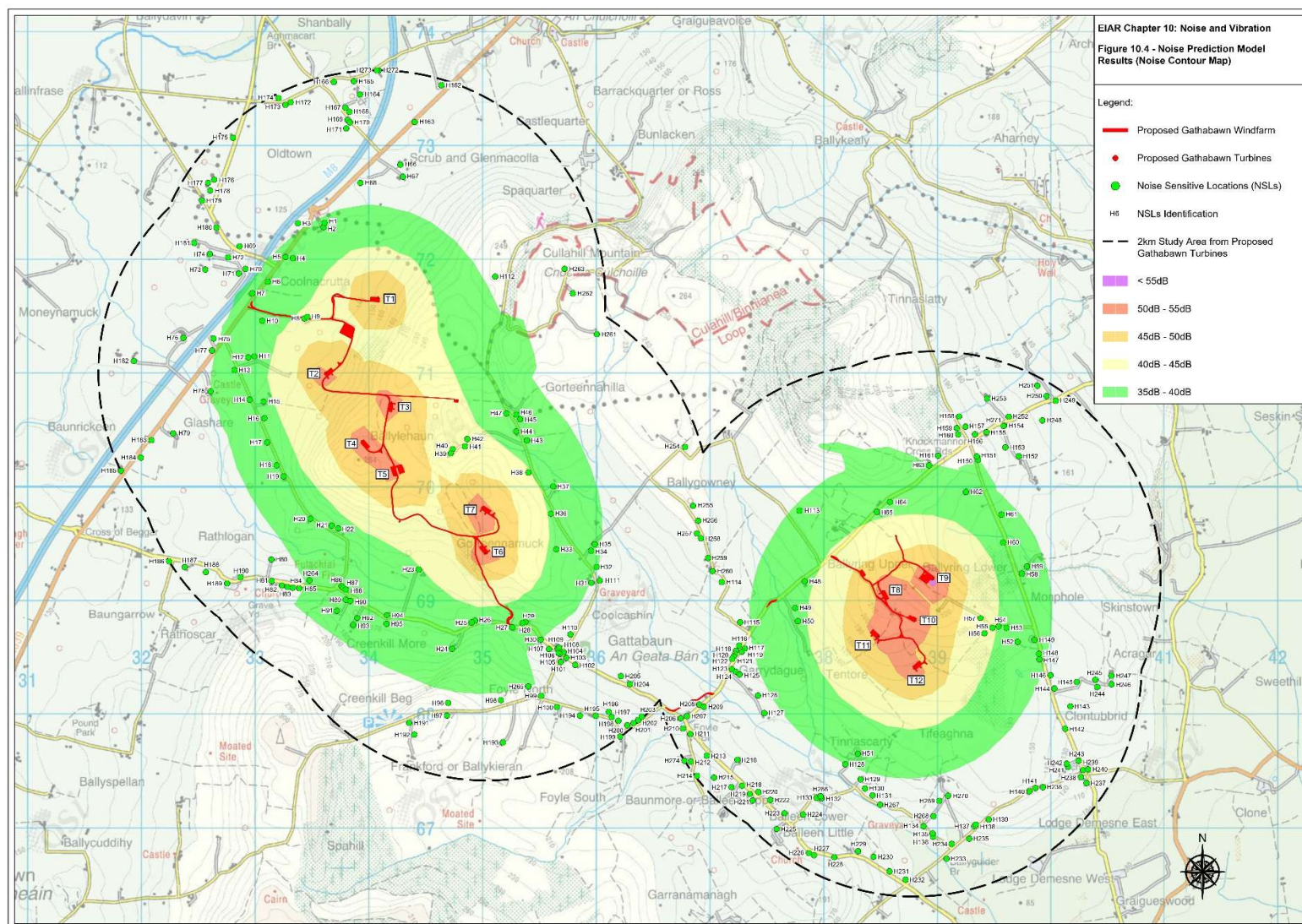
Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H032	Predicted Noise Level	23.1	26.6	31.5	35.1	35.6	35.3	35.0
H033	Predicted Noise Level	26.9	30.4	35.2	38.9	39.4	39.2	39.0
H034	Predicted Noise Level	23.8	27.2	32.1	35.7	36.2	36.0	35.7
H035	Predicted Noise Level	23.4	26.9	31.8	35.4	35.9	35.7	35.4
H036	Predicted Noise Level	27.5	31.0	35.9	39.5	40.0	39.8	39.6
H037	Predicted Noise Level	26.5	29.9	34.8	38.5	39.0	38.7	38.5
H038	Predicted Noise Level	28.2	31.7	36.6	40.2	40.7	40.5	40.3
H039	Predicted Noise Level	30.8	34.3	39.2	42.7	43.1	43.0	42.8
H040	Predicted Noise Level	30.5	34.0	39.0	42.4	42.8	42.7	42.5
H041	Predicted Noise Level	29.8	33.3	38.2	41.7	42.1	41.9	41.7
H042	Predicted Noise Level	29.3	32.8	37.7	41.2	41.6	41.4	41.2
H043	Predicted Noise Level	26.2	29.7	34.6	38.2	38.6	38.4	38.2
H044	Predicted Noise Level	26.4	29.9	34.8	38.3	38.8	38.6	38.3
H045	Predicted Noise Level	25.6	29.1	34.0	37.6	38.0	37.7	37.5
H046	Predicted Noise Level	25.6	29.1	34.0	37.6	38.0	37.7	37.5
H047	Predicted Noise Level	25.9	29.4	34.3	37.8	38.3	38.0	37.8
H048	Predicted Noise Level	27.2	30.7	35.7	39.1	39.4	39.2	39.0
H049	Predicted Noise Level	26.8	30.3	35.3	38.7	39.0	38.8	38.6
H050	Predicted Noise Level	27.1	30.7	35.6	39.0	39.4	39.2	38.9
H051	Predicted Noise Level	24.4	28.0	33.0	36.3	36.7	36.5	36.2
H052	Predicted Noise Level	25.8	29.3	34.3	37.7	38.1	37.9	37.6
H053	Predicted Noise Level	27.0	30.6	35.5	39.0	39.4	39.2	38.9
H054	Predicted Noise Level	27.9	31.4	36.4	39.8	40.2	40.0	39.8
H055	Predicted Noise Level	28.5	32.0	37.0	40.4	40.8	40.6	40.4
H055	Daytime Criterion	40	40	40	40	45	45	45
H055	Daytime Excess	--	--	--	0.4	--	--	--
H055	Night-time Criterion	43	43	43	43	43	43	43
H055	Night-time Excess	--	--	--	--	--	--	--
H056	Predicted Noise Level	29.3	32.8	37.8	41.2	41.6	41.4	41.2
H056	Daytime Criterion	40	40	40	40	45	45	45
H056	Daytime Excess	--	--	--	1.2	--	--	--
H056	Night-time Criterion	43	43	43	43	43	43	43
H057	Predicted Noise Level	30.1	33.6	38.5	42.0	42.4	42.2	42.0
H058	Predicted Noise Level	25.3	28.9	33.8	37.3	37.7	37.5	37.2
H059	Predicted Noise Level	24.7	28.2	33.2	36.7	37.1	36.8	36.6
H060	Predicted Noise Level	25.9	29.4	34.3	37.8	38.3	38.1	37.8
H061	Predicted Noise Level	24.4	27.9	32.8	36.3	36.8	36.5	36.3
H062	Predicted Noise Level	24.6	28.1	33.0	36.5	37.0	36.7	36.5
H063	Predicted Noise Level	23.3	26.8	31.8	35.2	35.7	35.4	35.1
H064	Predicted Noise Level	26.6	30.1	35.0	38.5	38.9	38.7	38.5
H065	Predicted Noise Level	27.2	30.8	35.7	39.2	39.6	39.4	39.1
H066	Predicted Noise Level	19.8	23.4	28.4	31.7	32.1	31.8	31.5
H067	Predicted Noise Level	20.5	24.2	29.1	32.4	32.8	32.5	32.2
H068	Predicted Noise Level	21.5	25.1	30.0	33.4	33.7	33.5	33.2
H069	Predicted Noise Level	21.6	25.3	30.2	33.6	33.9	33.6	33.3
H070	Predicted Noise Level	22.5	26.1	31.0	34.4	34.7	34.5	34.2
H071	Predicted Noise Level	22.3	25.9	30.9	34.2	34.6	34.3	34.0
H072	Predicted Noise Level	21.6	25.2	30.1	33.5	33.8	33.6	33.2
H073	Predicted Noise Level	20.9	24.5	29.5	32.8	33.2	32.9	32.6
H074	Predicted Noise Level	20.6	24.2	29.2	32.5	32.9	32.6	32.2
H075	Predicted Noise Level	22.9	26.5	31.4	34.8	35.1	34.9	34.6
H076	Predicted Noise Level	21.4	25.0	30.0	33.4	33.7	33.4	33.1
H077	Predicted Noise Level	23.0	26.6	31.6	34.9	35.3	35.0	34.7
H078	Predicted Noise Level	23.3	26.9	31.8	35.2	35.6	35.3	35.0

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H079	Predicted Noise Level	20.8	24.4	29.4	32.8	33.1	32.8	32.5
H080	Predicted Noise Level	22.2	25.8	30.8	34.2	34.6	34.3	34.0
H081	Predicted Noise Level	22.6	26.2	31.2	34.6	35.0	34.7	34.4
H082	Predicted Noise Level	22.9	26.5	31.4	34.9	35.3	35.0	34.7
H083	Predicted Noise Level	23.1	26.7	31.6	35.1	35.4	35.2	34.9
H084	Predicted Noise Level	23.3	26.9	31.8	35.3	35.6	35.4	35.1
H085	Predicted Noise Level	23.5	27.1	32.0	35.5	35.9	35.6	35.3
H086	Predicted Noise Level	24.6	28.1	33.0	36.6	37.0	36.8	36.5
H087	Predicted Noise Level	24.6	28.1	33.0	36.6	37.0	36.7	36.4
H088	Predicted Noise Level	24.6	28.2	33.1	36.6	37.0	36.8	36.5
H089	Predicted Noise Level	25.0	28.5	33.4	36.9	37.3	37.1	36.8
H090	Predicted Noise Level	25.1	28.6	33.5	37.0	37.5	37.2	36.9
H091	Predicted Noise Level	24.5	28.1	33.0	36.5	36.9	36.6	36.3
H092	Predicted Noise Level	24.5	28.0	32.9	36.4	36.9	36.6	36.3
H093	Predicted Noise Level	24.0	27.5	32.4	36.0	36.4	36.1	35.8
H094	Predicted Noise Level	25.2	28.7	33.6	37.2	37.7	37.4	37.1
H095	Predicted Noise Level	25.3	28.8	33.7	37.2	37.7	37.4	37.2
H096	Predicted Noise Level	22.5	26.0	30.9	34.5	34.9	34.6	34.3
H097	Predicted Noise Level	21.8	25.3	30.2	33.8	34.2	33.9	33.6
H098	Predicted Noise Level	22.7	26.2	31.1	34.7	35.2	34.9	34.5
H099	Predicted Noise Level	22.4	25.9	30.8	34.4	34.9	34.6	34.2
H100	Predicted Noise Level	21.7	25.2	30.1	33.7	34.2	33.8	33.5
H101	Predicted Noise Level	21.4	24.9	29.8	33.4	33.8	33.5	33.2
H102	Predicted Noise Level	20.9	24.4	29.3	32.9	33.3	33.0	32.7
H103	Predicted Noise Level	21.3	24.8	29.7	33.3	33.8	33.5	33.2
H104	Predicted Noise Level	21.6	25.2	30.0	33.6	34.1	33.8	33.5
H105	Predicted Noise Level	21.7	25.2	30.1	33.7	34.1	33.8	33.5
H106	Predicted Noise Level	21.8	25.3	30.1	33.8	34.2	33.9	33.6
H107	Predicted Noise Level	22.3	25.8	30.7	34.3	34.7	34.5	34.2
H108	Predicted Noise Level	22.0	25.5	30.4	34.0	34.4	34.2	33.8
H109	Predicted Noise Level	22.0	25.5	30.4	34.0	34.4	34.2	33.8
H110	Predicted Noise Level	22.0	25.5	30.4	34.0	34.5	34.2	33.9
H111	Predicted Noise Level	22.5	26.0	30.9	34.5	35.0	34.7	34.4
H112	Predicted Noise Level	22.5	26.1	31.0	34.4	34.8	34.5	34.2
H113	Predicted Noise Level	23.7	27.2	32.2	35.6	36.0	35.7	35.4
H114	Predicted Noise Level	22.8	26.4	31.3	34.7	35.1	34.8	34.5
H115	Predicted Noise Level	22.7	26.3	31.2	34.6	35.0	34.7	34.4
H116	Predicted Noise Level	22.5	26.1	31.0	34.4	34.8	34.5	34.2
H117	Predicted Noise Level	22.8	26.4	31.3	34.7	35.1	34.8	34.5
H118	Predicted Noise Level	22.2	25.8	30.8	34.2	34.5	34.3	33.9
H119	Predicted Noise Level	22.5	26.1	31.1	34.5	34.8	34.6	34.3
H120	Predicted Noise Level	22.1	25.7	30.7	34.1	34.4	34.2	33.8
H121	Predicted Noise Level	22.0	25.6	30.6	34.0	34.3	34.0	33.7
H122	Predicted Noise Level	21.9	25.5	30.4	33.9	34.2	33.9	33.6
H123	Predicted Noise Level	21.7	25.3	30.3	33.7	34.0	33.8	33.4
H124	Predicted Noise Level	21.9	25.5	30.4	33.8	34.2	33.9	33.6
H125	Predicted Noise Level	22.0	25.6	30.6	34.0	34.3	34.0	33.7
H126	Predicted Noise Level	22.5	26.1	31.0	34.4	34.8	34.5	34.2
H127	Predicted Noise Level	22.3	25.9	30.8	34.2	34.6	34.3	34.0
H128	Predicted Noise Level	23.2	26.8	31.7	35.1	35.5	35.2	35.0
H129	Predicted Noise Level	22.6	26.2	31.1	34.5	34.9	34.6	34.3
H130	Predicted Noise Level	22.0	25.7	30.6	34.0	34.4	34.1	33.8
H131	Predicted Noise Level	21.8	25.4	30.4	33.7	34.1	33.8	33.5
H132	Predicted Noise Level	20.5	24.1	29.0	32.4	32.8	32.5	32.2

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H133	Predicted Noise Level	20.4	24.0	28.9	32.4	32.7	32.4	32.1
H134	Predicted Noise Level	19.8	23.4	28.4	31.8	32.1	31.8	31.5
H135	Predicted Noise Level	19.3	23.0	27.9	31.3	31.6	31.3	31.0
H136	Predicted Noise Level	19.1	22.8	27.7	31.1	31.4	31.1	30.8
H137	Predicted Noise Level	19.1	22.7	27.6	31.0	31.4	31.1	30.8
H138	Predicted Noise Level	19.2	22.8	27.7	31.1	31.5	31.2	30.8
H139	Predicted Noise Level	19.1	22.8	27.7	31.1	31.4	31.2	30.8
H140	Predicted Noise Level	19.2	22.8	27.8	31.2	31.5	31.2	30.9
H141	Predicted Noise Level	19.1	22.8	27.7	31.1	31.4	31.2	30.8
H142	Predicted Noise Level	20.1	23.7	28.6	32.0	32.4	32.1	31.8
H143	Predicted Noise Level	20.5	24.1	29.0	32.4	32.8	32.5	32.2
H144	Predicted Noise Level	21.9	25.5	30.4	33.9	34.2	34.0	33.7
H145	Predicted Noise Level	20.7	24.3	29.2	32.6	33.0	32.7	32.4
H146	Predicted Noise Level	22.5	26.1	31.0	34.4	34.8	34.6	34.3
H147	Predicted Noise Level	23.7	27.2	32.2	35.6	36.0	35.7	35.5
H148	Predicted Noise Level	23.8	27.4	32.3	35.8	36.1	35.9	35.6
H149	Predicted Noise Level	24.4	28.0	32.9	36.3	36.7	36.5	36.2
H150	Predicted Noise Level	23.2	26.7	31.6	35.2	35.6	35.4	35.1
H151	Predicted Noise Level	23.0	26.5	31.4	35.0	35.4	35.2	34.9
H152	Predicted Noise Level	20.2	23.8	28.7	32.2	32.6	32.3	32.0
H153	Predicted Noise Level	20.2	23.8	28.7	32.2	32.6	32.3	32.0
H154	Predicted Noise Level	19.1	22.6	27.6	31.0	31.4	31.1	30.8
H155	Predicted Noise Level	19.9	23.5	28.4	31.9	32.3	32.0	31.7
H156	Predicted Noise Level	20.3	23.9	28.8	32.3	32.7	32.4	32.1
H157	Predicted Noise Level	20.0	23.6	28.5	32.0	32.4	32.1	31.8
H158	Predicted Noise Level	19.6	23.2	28.1	31.6	32.0	31.7	31.4
H159	Predicted Noise Level	20.3	23.9	28.8	32.3	32.7	32.4	32.1
H160	Predicted Noise Level	20.7	24.2	29.2	32.7	33.1	32.8	32.5
H161	Predicted Noise Level	22.4	26.0	30.9	34.4	34.8	34.6	34.3
H162	Predicted Noise Level	15.2	18.8	23.7	27.1	27.5	27.1	26.7
H163	Predicted Noise Level	17.2	20.8	25.7	29.1	29.5	29.1	28.8
H164	Predicted Noise Level	16.4	20.0	25.0	28.4	28.7	28.4	28.0
H165	Predicted Noise Level	15.8	19.4	24.4	27.8	28.1	27.7	27.4
H166	Predicted Noise Level	15.7	19.4	24.3	27.7	28.0	27.7	27.3
H167	Predicted Noise Level	17.0	20.6	25.6	28.9	29.3	28.9	28.6
H168	Predicted Noise Level	17.2	20.8	25.8	29.2	29.5	29.2	28.8
H169	Predicted Noise Level	17.6	21.2	26.2	29.6	29.9	29.6	29.2
H170	Predicted Noise Level	17.7	21.4	26.3	29.7	30.0	29.7	29.4
H171	Predicted Noise Level	18.0	21.7	26.6	30.0	30.3	30.0	29.6
H172	Predicted Noise Level	16.6	20.3	25.2	28.6	28.9	28.6	28.2
H173	Predicted Noise Level	16.7	20.3	25.2	28.6	29.0	28.6	28.2
H174	Predicted Noise Level	16.3	19.9	24.9	28.3	28.6	28.2	27.8
H175	Predicted Noise Level	17.0	20.6	25.6	29.0	29.3	28.9	28.6
H176	Predicted Noise Level	18.1	21.7	26.6	30.0	30.4	30.0	29.7
H177	Predicted Noise Level	18.0	21.6	26.6	30.0	30.3	30.0	29.6
H178	Predicted Noise Level	18.3	22.0	26.9	30.3	30.6	30.3	29.9
H179	Predicted Noise Level	18.4	22.1	27.0	30.4	30.7	30.4	30.0
H180	Predicted Noise Level	19.9	23.6	28.5	31.9	32.2	31.9	31.6
H181	Predicted Noise Level	19.6	23.2	28.1	31.5	31.8	31.5	31.2
H182	Predicted Noise Level	19.1	22.7	27.7	31.1	31.4	31.1	30.7
H183	Predicted Noise Level	20.1	23.7	28.6	32.0	32.4	32.0	31.7
H184	Predicted Noise Level	19.4	23.0	28.0	31.3	31.7	31.4	31.0
H185	Predicted Noise Level	18.5	22.1	27.1	30.5	30.8	30.5	30.1
H186	Predicted Noise Level	19.5	23.1	28.0	31.4	31.8	31.5	31.1

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H187	Predicted Noise Level	20.0	23.6	28.5	32.0	32.3	32.0	31.6
H188	Predicted Noise Level	20.1	23.7	28.6	32.1	32.5	32.2	31.8
H189	Predicted Noise Level	21.3	24.9	29.8	33.3	33.6	33.3	33.0
H190	Predicted Noise Level	22.1	25.7	30.6	34.0	34.4	34.1	33.8
H191	Predicted Noise Level	21.2	24.7	29.6	33.2	33.6	33.3	32.9
H192	Predicted Noise Level	20.6	24.2	29.0	32.6	33.0	32.7	32.3
H193	Predicted Noise Level	20.0	23.6	28.4	32.0	32.5	32.2	31.8
H194	Predicted Noise Level	21.2	24.7	29.6	33.2	33.6	33.3	32.9
H195	Predicted Noise Level	21.1	24.6	29.5	33.1	33.5	33.2	32.8
H196	Predicted Noise Level	21.1	24.6	29.5	33.1	33.5	33.2	32.8
H197	Predicted Noise Level	21.0	24.6	29.5	33.0	33.4	33.1	32.7
H198	Predicted Noise Level	20.8	24.4	29.3	32.8	33.2	32.9	32.5
H199	Predicted Noise Level	20.5	24.1	29.0	32.5	32.9	32.6	32.2
H200	Predicted Noise Level	20.8	24.3	29.2	32.8	33.2	32.8	32.4
H201	Predicted Noise Level	20.9	24.4	29.3	32.9	33.3	32.9	32.5
H202	Predicted Noise Level	20.6	24.1	29.0	32.5	32.9	32.6	32.2
H203	Predicted Noise Level	20.2	23.8	28.7	32.2	32.6	32.2	31.8
H204	Predicted Noise Level	19.9	23.4	28.4	31.8	32.2	31.9	31.6
H205	Predicted Noise Level	19.6	23.2	28.1	31.6	32.0	31.7	31.3
H206	Predicted Noise Level	20.2	23.8	28.7	32.2	32.5	32.2	31.8
H207	Predicted Noise Level	19.7	23.3	28.2	31.7	32.1	31.7	31.4
H208	Predicted Noise Level	19.7	23.3	28.3	31.7	32.1	31.8	31.4
H209	Predicted Noise Level	19.8	23.4	28.4	31.8	32.2	31.8	31.5
H210	Predicted Noise Level	20.0	23.6	28.6	32.0	32.4	32.0	31.7
H211	Predicted Noise Level	20.8	24.4	29.3	32.7	33.1	32.8	32.4
H212	Predicted Noise Level	21.0	24.6	29.5	33.0	33.4	33.0	32.6
H213	Predicted Noise Level	21.5	25.1	30.0	33.5	33.8	33.5	33.1
H214	Predicted Noise Level	20.8	24.4	29.3	32.7	33.1	32.8	32.4
H215	Predicted Noise Level	21.2	24.8	29.7	33.1	33.5	33.2	32.8
H216	Predicted Noise Level	21.5	25.1	30.1	33.5	33.8	33.5	33.2
H217	Predicted Noise Level	21.3	24.9	29.9	33.3	33.7	33.3	33.0
H218	Predicted Noise Level	21.6	25.3	30.2	33.6	34.0	33.6	33.3
H219	Predicted Noise Level	21.6	25.2	30.1	33.6	33.9	33.6	33.2
H220	Predicted Noise Level	21.9	25.5	30.4	33.8	34.2	33.9	33.5
H221	Predicted Noise Level	21.4	25.0	30.0	33.4	33.8	33.4	33.1
H222	Predicted Noise Level	21.9	25.5	30.5	33.9	34.2	33.9	33.6
H223	Predicted Noise Level	21.8	25.4	30.3	33.7	34.1	33.8	33.4
H224	Predicted Noise Level	22.1	25.7	30.7	34.1	34.4	34.1	33.8
H225	Predicted Noise Level	20.9	24.5	29.4	32.8	33.2	32.9	32.5
H226	Predicted Noise Level	20.5	24.1	29.0	32.4	32.8	32.5	32.1
H227	Predicted Noise Level	20.5	24.1	29.0	32.4	32.8	32.5	32.1
H228	Predicted Noise Level	20.6	24.2	29.2	32.6	32.9	32.6	32.2
H229	Predicted Noise Level	20.4	24.0	29.0	32.4	32.8	32.4	32.1
H230	Predicted Noise Level	19.0	22.6	27.5	30.9	31.3	31.0	30.6
H231	Predicted Noise Level	17.4	21.0	26.0	29.4	29.7	29.4	29.1
H232	Predicted Noise Level	17.0	20.6	25.6	29.0	29.4	29.0	28.6
H233	Predicted Noise Level	17.8	21.4	26.3	29.7	30.1	29.8	29.4
H234	Predicted Noise Level	18.5	22.1	27.0	30.5	30.8	30.5	30.2
H235	Predicted Noise Level	18.5	22.1	27.1	30.5	30.8	30.5	30.2
H236	Predicted Noise Level	18.9	22.5	27.4	30.8	31.2	30.9	30.6
H237	Predicted Noise Level	17.3	20.9	25.8	29.3	29.6	29.3	29.0
H238	Predicted Noise Level	17.7	21.4	26.3	29.7	30.0	29.7	29.4
H239	Predicted Noise Level	17.9	21.5	26.4	29.8	30.2	29.9	29.5
H240	Predicted Noise Level	17.7	21.3	26.2	29.6	30.0	29.7	29.4

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H241	Predicted Noise Level	18.6	22.3	27.2	30.6	31.0	30.6	30.3
H242	Predicted Noise Level	18.8	22.4	27.4	30.8	31.1	30.8	30.5
H243	Predicted Noise Level	18.4	22.0	26.9	30.4	30.7	30.4	30.1
H244	Predicted Noise Level	19.4	23.0	27.9	31.4	31.7	31.4	31.1
H245	Predicted Noise Level	19.6	23.2	28.2	31.6	32.0	31.7	31.3
H246	Predicted Noise Level	18.7	22.3	27.2	30.6	31.0	30.7	30.4
H247	Predicted Noise Level	18.8	22.4	27.3	30.8	31.1	30.8	30.5
H248	Predicted Noise Level	17.7	21.2	26.2	29.6	30.0	29.7	29.4
H249	Predicted Noise Level	16.4	20.0	24.9	28.4	28.8	28.4	28.1
H250	Predicted Noise Level	16.5	20.1	25.0	28.4	28.8	28.5	28.2
H251	Predicted Noise Level	16.3	19.9	24.8	28.3	28.7	28.4	28.0
H252	Predicted Noise Level	18.5	22.1	27.0	30.5	30.9	30.6	30.2
H253	Predicted Noise Level	18.1	21.7	26.6	30.1	30.5	30.1	29.8
H254	Predicted Noise Level	20.6	24.1	29.0	32.6	33.0	32.6	32.3
H255	Predicted Noise Level	21.7	25.3	30.2	33.7	34.1	33.8	33.4
H256	Predicted Noise Level	21.6	25.2	30.1	33.6	34.0	33.7	33.3
H257	Predicted Noise Level	21.8	25.3	30.2	33.7	34.1	33.8	33.5
H258	Predicted Noise Level	21.8	25.4	30.3	33.8	34.2	33.9	33.6
H259	Predicted Noise Level	22.2	25.8	30.7	34.1	34.5	34.2	33.9
H260	Predicted Noise Level	22.4	26.0	30.9	34.4	34.7	34.4	34.1
H261	Predicted Noise Level	19.7	23.3	28.2	31.7	32.0	31.7	31.4
H262	Predicted Noise Level	19.1	22.7	27.6	31.1	31.5	31.1	30.8
H263	Predicted Noise Level	19.4	23.0	27.9	31.4	31.7	31.4	31.0
H264	Predicted Noise Level	23.4	27.0	31.9	35.4	35.8	35.6	35.2
H265	Predicted Noise Level	23.1	26.6	31.5	35.1	35.5	35.2	34.9
H266	Predicted Noise Level	20.6	24.2	29.1	32.5	32.9	32.6	32.3
H267	Predicted Noise Level	21.2	24.8	29.7	33.1	33.4	33.2	32.9
H268	Predicted Noise Level	20.4	24.0	28.9	32.3	32.7	32.4	32.1
H269	Predicted Noise Level	21.3	24.9	29.9	33.3	33.6	33.3	33.0
H270	Predicted Noise Level	21.5	25.1	30.1	33.5	33.8	33.5	33.2
H271	Predicted Noise Level	19.1	22.6	27.6	31.0	31.4	31.1	30.8
H272	Predicted Noise Level	15.4	19.0	23.9	27.3	27.6	27.3	26.9
H273	Predicted Noise Level	15.4	19.0	23.9	27.3	27.6	27.3	26.9
H274	Predicted Noise Level	20.9	24.5	29.4	32.9	33.2	32.9	32.5
St Munchins Church	Predicted Noise Level	22.1	25.6	30.5	34.1	34.6	34.3	34.0
Millienium Park	Predicted Noise Level	21.4	24.9	29.8	33.4	33.9	33.6	33.3

Figure 10.4 Noise Prediction Model Results (Noise Contour Map) – Gathabawn only

EIAR 10.4.6.1.5.1 Assessment of Effects for Proposed Gathabawn Wind Farm Only
--

Noise levels from the proposed turbines at the remaining NSLs were **within the noise criteria curves at all wind speeds** at all locations except for H055 and H056 for daytime periods. No exceedances of the night-time criteria are found for night-time periods. Therefore, with respect to the EPA's criteria for description of effects, the potential worst-case effects at the majority of noise sensitive locations is considered **negative, not significant and long-term**.

At locations H055 and H056, the potential worst-case effects at the majority of noise sensitive locations are considered **negative, significant and long-term**.

The modelling results should be considered in terms that noise emissions are variable, and that this assessment considers the locations of the greatest potential impact and impacts in the worst-case scenario, in terms of noise emissions, as presented in Section EIAR 10.4.6.1.3.

EIAR 10.4.6.1.5.2 Operating Turbine Noise Monitoring Arrangement

The noise predictions provided above, are based on turbine operating in normal sound power mode with no restrictions on power generation. The findings of the assessment confirmed that the predicted operational noise levels from the Proposed Gathabawn Wind Farm Noise Sensitive Locations (NSLs) will exceed the daytime criteria at two locations. Therefore, mitigation measures are required in respect of operational noise due to the proposed development on its own. The following monitoring plan, identified as OMM04 in **Chapter 20 Mitigation & Monitoring Arrangements**, will be implemented:

WM107: Curtailment Strategy – Noise: A noise curtailment strategy will be developed and implemented to ensure that the operating windfarm complies with the prescribed operational noise criterion. In order to develop this strategy: (i) a pre-construction noise survey will be carried out to establish the background noise levels and to confirm the applicable wind turbine noise criteria at identified Noise Sensitive Locations (NSL) and (ii) following the commissioning of the Project and the commencement of operation of the wind farm, a second noise survey will be carried out at the NSLs to establish compliance with the noise limit conditions applied to the development. This survey will be carried out according to the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014).

Where exceedances are confirmed during surveys, then appropriate sound power operating modes will be activated for specified turbines operating in specified wind conditions as required to reduce noise output when exceedance at a NSL is predicted by the wind turbines computer SCADA software. A third noise survey will be carried following the activation of sound power modes to confirm the effectiveness of the curtailment strategy.

This monitoring arrangement will ensure that operating wind farm noise levels at noise sensitive locations (NSLs) which are prescribed either by planning condition or other required noise criterion, are achieved.

EIAR 10.4.6.1.5.3 Residual Impact (noise from operating turbines)
--

With such mitigation measures in place as outlined in OMM04 above, the predicted noise levels associated with the proposed development will be within best practice noise criteria curves recommended in line with Irish guidance 'Wind Energy Development Guidelines for Planning Authorities', it is considered that **no significant residual effects are associated with the development**. It is concluded that, while noise levels at low wind speeds will increase due to the operation of the turbines, the predicted levels of noise in the local environment will remain low, albeit new sources of noise will be introduced into the soundscape.

The predicted residual operational turbine noise effects at the closest NSLs are considered to be negative, not significant and long-term.

EIAR 10.4.6.2 Consideration of Low Frequency Sound, Tonality & Amplitude Modulation

EIAR 10.4.6.2.1 Special Characteristics – Low Frequency Noise and Infrasound

As stated in the ARWTN and discussed in Section EIAR 10.4.6.1.1.3, low frequency noise and infrasound do not require specific assessment as they are generally below the threshold of perception at typical receptor distances and are not expected to result in any significant effect at the NSLs. Consequently, no assessment criteria for low-frequency noise or infrasound have been adopted as part of this EIAR.

EIAR 10.4.6.2.2 Special Characteristics – Tonality

A tone is the concentration of acoustic energy into a very narrow frequency range, with a noticeable character (such as a “hum” or “whine” for example). The audibility of any tones can be assessed by comparing the narrow band level of such tones with the masking level contained in a band of frequencies around the tone. Several objective methodologies to assess tonal audibility are available, such as that included in ARWTN or that of ISO 1996-2 (2017).

Mechanical noise may emanate from components within the nacelle of a wind turbine. This is a less natural sounding noise which can be characterised in some cases by its tonal content, particularly if resonances in the mechanical noise are not suitably controlled. However, modern turbine designs have evolved to minimise mechanical noise radiation and resonances are normally minimised through design.

Wind farm noise guidelines such as those of ARWTN assume that the wind turbine noise does not normally contain clearly audible tones. It is not possible to predict the occurrence of tonality on a project reliably at the planning stage. The unlikely occurrence of tonality in the wind turbines of the proposed project will be managed through the commitments provided by the Applicant in OMM05 described below.

OMM05	In the event of a complaint which indicates potential occurrence of clearly audible tonality associated with turbine operation, the windfarm operator will employ an independent acoustic consultant to the investigate the audibility of the tones from measured data with a robust, objective method such as that included in ISO 1996-2:2017. If persistent occurrence of clearly audible tonality is identified, then the operator will liaise with the turbine manufacturer to investigate and implement measures to mitigate or minimise the occurrence of tonality as much as is reasonably practicable. This may also involve engineering methods or turbine operational changes for example.
-------	---

EIAR 10.4.6.2.3 Special Characteristics – Amplitude Modulation

In the context of wind turbines, amplitude modulation (AM) is defined in the Institute of Acoustics (IOA) Noise Working Group (Wind Turbine Noise), Amplitude Modulation Working Group (AMWG) document “A Method for Rating Amplitude Modulation in Wind Turbine (IOA, 2016)” as:

“Periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency (BPF) of the turbine rotor(s).”

It is now generally accepted that there are two mechanisms which can cause amplitude modulation:

- ‘Normal’ AM, and;
- ‘Other’ AM (sometimes referred to ‘Excessive’ AM).

In both cases, the result is a regular fluctuation in amplitude at the Blade Passing Frequency (BPF) of the wind turbine blades (the rate at which the blades of the turbine pass a fixed point). For a three-bladed turbine rotating at 20 rpm, this equates to a modulation frequency of 1 Hz.

‘Normal’ AM An observer at ground level close to a wind turbine will be aware of ‘blade swish’ because of the directional characteristics of the noise from the tip of the blade as it rotates towards and then away from the observer. This tends to become less noticeable with increasing distance such that it is often not normally a significant feature at sensitive locations, at least on relatively level sites.

The RenewableUK AM project (RenewableUK, 2013)¹ has coined the term ‘normal’ AM (NAM) for this inherent characteristic of wind turbine noise, which has long been recognised and was discussed in ETSU-R-97 in 1996.

‘Other’ AM In some cases a form of AM is observed at residential distances from a wind turbine (or turbines). The sound is generally heard as a periodic ‘thumping’ or ‘whoomphing’ at relatively low frequencies. On sites where it has been reported, occurrences appear to be occasional, although they can persist for several hours under some conditions, dependent on atmospheric factors, including wind speed and direction. It was proposed in the RenewableUK 2013 study that the fundamental cause of this type of AM is transient stall² conditions occurring as the blades rotate, giving rise to the periodic thumping at the blade passing frequency. Transient stall represents a fundamentally different mechanism from blade swish and can be heard at relatively large distances, primarily downwind of the rotor blade.

The RenewableUK AM project report adopted the term ‘Other AM’ (OAM) for this characteristic. The terms ‘enhanced’ or ‘excess’ AM (EAM) have been used by others, although such definitions do not distinguish between the source mechanisms and presuppose a ‘normal’ level of AM, presumably relating back to blade swish as described in ETSU-R-97.

Frequency of Occurrence of OAM

Research by Salford University commissioned by the Department of Environment Food and Rural Affairs (DEFRA), the UK Department of Business, Enterprise and Regulatory Reform (BERR) and the Department of Communities and Local Government (CLG) investigated the issue of OAM associated with wind turbine noise. The results were reviewed and published in the report ‘Research into Aerodynamic Modulation of Wind Turbine Noise’ (2007). The broad conclusions of this report were that aerodynamic modulation was only considered to be an issue at four, and a possible issue at a further eight, of 133 sites in the UK that were operational at the time of the study and considered within the review. At the four sites where OAM was confirmed as an issue, it was considered that conditions associated with OAM might occur between about 7 and 15% of the time. It also emerged that for three out of the four sites the complaints have subsided, in one case due to the introduction of a turbine control system. **The research has shown that OAM is a rare and unlikely occurrence at operational wind farms.**

It should be noted that OAM is associated with wind turbine operation and there is no method for predicting OAM at any particular location before turbines begin operation due to the general features of a site or the

¹ Summary of Research into Amplitude Modulation of Aerodynamic Noise from Wind Turbines - Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect, Report for Renewable UK, December 2013

² Transient stall is the term used in the Renewable UK report for ‘localised flow separation’.

known attributes of a particular turbine. It should also be noted that it is a rare event associated with a limited number of wind farms. While it can occur, it is the exception rather than the rule.

RenewableUK Research Document (von Hunerbein *et al.* 2013) states the following in relation to matter:

Page 68 Module F “even on those limited sites where it has been reported, its frequency of occurrence appears to be at best infrequent and intermittent.”

Page 6 Module D “It has also been the experience of the project team that, even at those wind farm sites where AM has been reported or identified to be an issue, its occurrence may be relatively infrequent. Thus, the capture of time periods when subjectively significant AM occurs may involve elapsed periods of several weeks or even months.”

Page 61 Module F “There is nothing at the planning stage that can presently be used to indicate a positive likelihood of OAM (Other AM) occurring at any given proposed wind farm site, based either on the site’s general characteristics or on the known characteristics of the wind turbines to be installed.”

Guidance on Amplitude Modulation

It is critical in the discussion of amplitude modulation (AM) to recognise it is an inherent characteristic of wind turbine noise. A distinction must be made between ‘Normal’ AM, which is generated by all wind turbines, generally limited in magnitude and reduces with separation distance, and ‘Other’ or ‘Excessive’ AM, which can be more pronounced and potentially intrusive. As normal AM is assumed to be part of normal wind turbine noise, the noise limits set out in applicable guidelines discussed in this section take this into account and are relatively stringent as a result. Excessive AM, should it occur, may lead to additional impacts at sensitive receptors in some cases. The term AM is commonly used without these descriptions; however, where AM is referenced in this chapter, it should be understood to refer to unacceptable or excessive AM with the potential to result in additional adverse impacts, unless otherwise stated.

Research and guidance in the field of wind turbine noise AM is ongoing with the most notable recent publications discussed here.

The Institute of Acoustics (IOA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) published, A Method for Rating Amplitude Modulation in Wind Turbine Noise (August 2016) (The Reference Method). The document proposes an objective method for measuring and rating AM. The AMWG however does not propose what level of AM is likely to result in adverse community response or propose any limits for controlling AM. The purpose of the AMWG was to use existing research to develop a Reference Methodology for the measurement and rating of AM.

A 2016 report was commissioned by the UK government Wind turbine AM review: Phase 2 report. 3514482A Issue 3. Department of Energy and Climate Change (DECC) prepared by WSP Parsons Brinckerhoff. The objective of this report was to recommend how excessive AM might be controlled through the use of a planning condition. The report recommended the use of a penalty scheme as a potential planning condition for AM to cover periods of complaints due to unacceptable AM. This penalty scheme is based on the AMWG method and other potential AM rating methods were dismissed as not sufficiently robust and was not adopted by the UK or devolved Governments. The report included the following caveat:

“Any condition developed using the elements proposed in this study should be subject to a period of testing and review. The period should cover a number of sites where the condition has been implemented and would be typically in the order of 2-5 years from planning approval being granted.”

It is noted that the WSP report recommended that excessive AM be controlled specifically during period of complaints. The key point is that while excessive amplitude modulation (AM) may occur during the operation of the wind farm, it may not necessarily result in any adverse impacts. As per the discussion on the research

presented previously in this Section, excessive/other AM is considered an atypical phenomenon, and the duration, conditions and specific location or locations at which it presents cannot be predicted in the planning stage. For these reasons, the assessment of AM is typically triggered in response to complaints where the contributing factors aligning to the period of the complaint such as meteorological conditions and turbine operations can be investigated.

ARWTN confirms that the Reference Method is the relevant methodology for quantifying AM and describes the application of a noise level rating to account for the presence of AM in line with that developed in the WSP Parsons Brinckerhoff document. This rating level is only applied in the context of compliance monitoring only. There is no requirement in ARTWN to assess AM at the planning stage.

The International Electrotechnical Commission (IEC) published Technical Specification 61400-11-2 (Edition 1.0, 2024) Wind Energy Generation Systems – Part 11-2: Acoustic noise measurement techniques – Measurement of wind turbine sound characteristics in receptor position, in 2024. This document introduces a standardised methodology for measuring and rating AM at receptor locations. The method broadly aligns with the AMWG approach but includes some minor differences.

To date there is no clear industry and Governmental consensus on how AM should be regulated or managed through the planning and operational stage. In the absence of clear policy in Ireland to control AM from wind turbines, the commitments outlined in the Section 11.7.2.2, where a monitoring protocol in agreement with the local authority. The monitoring protocol should include the use of best-practice robust, precise, enforceable, reasonable and measurable method.

AM from the proposed project will be managed through the commitments provided by the Applicant in WM108:

WM108	Amplitude modulation: In the event of a complaint which indicates potential amplitude modulation (AM) associated with turbine operation, the windfarm operator will employ an independent acoustic consultant to assess the level of AM experienced by the complainant in accordance with the methods outlined in the Institute of Acoustics IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group Final Report: A Method for Rating Amplitude Modulation in Wind Turbine Noise (9 August 2016) or subsequent revisions. The measurement method outlined in the IOA AMWG document, known as the 'Reference Method', will provide a robust and reliable indicator of AM and yield valuable information on the frequency and duration of occurrence, which can be used to evaluate mitigation requirements. The mitigation measures, if required, will consist of the implementation of operational controls on specified turbines, which will curtail or stop the relevant turbines under specific operational conditions, so that OAM is eliminated.
-------	--

EIAR 10.4.6.3 Noise from the operational Control Buildings

Not Significant. Details of the proposed Ballylehaun and Ballyring Control Buildings are described in Chapter 5 of the EIAR (Description of the Development). There are no significant noise or vibration sources associated with the control buildings.

With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest NSLs associated with the operation of the proposed substation is described as neutral, imperceptible and long-term.

EIAR 10.4.6.4 Noise from the operational Parksgrove Substation

Details of the proposed Parksgrove Substation are described in Chapter 5 of the EIAR (Description of the Development). The noise impact at the nearest NSL has been assessed to identify the potential greatest impact associated with the operation of the Parksgrove Substation.

As part of the Proposed Development, the Parksgrove Substation will be operational on a continuous basis. The noise emission level associated with a typical 110kV substation that would support a development of this nature is the order of 93 dB(A) L_w (sound power level).

Noise prediction calculations for the operation of the Parksgrove Substation have been undertaken in accordance with ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors (ISO, 2024). The set of NSLs near the substation are as presented in **Figure 10.5** below. Predicted noise levels are presented in Table 10-25 below.



Figure 10.5 Substation and nearby NSLs

Name	Distance from Parksgrove Substation (m)	Predicted Substation Noise level, dB L_{Aeq}
H291	442m	29
H292	442m	29
H293	429m	29
H294	364m	30
H295	339m	31
H298	413m	29
H299	377m	30
H300	331m	31
H301	316m	32

Table 10-22 Predicted noise levels due to substation

The highest predicted noise level from the operation of the substation at the nearest NSL is 32 dB L_{Aeq} . In selecting a suitable criterion for substations, reference is made to EPA Noise Guidance note NG4 where a noise criterion of 35 dB L_{Aeq} for night-time periods is stipulated.

The highest predicted noise level due to the operation of the substation is below the criteria for night-time noise.

Additionally, due to the separation distance between the turbines and the Parksgrove Substation, there will be no cumulative impact of operational noise because there is no overlap between the noise sensitive locations (NSLs) assessed for operational substation and NSLs assessed for operational turbines. See **Figure 10.2 Location of Noise Sensitive Locations (NSL) in relation to Gathabawn Turbines and Parksgrove Substation (Section EIAR 10.3 above).**

With respect to the EPA's criteria for description of effects, the potential worst-case associated effects at the nearest NSLs associated with the operation of the proposed substation is described as **negative, not significant and long-term**

The operating Parksgrove Substation will be negligible at the nearest NSL and therefore mitigation measures are not required

Residual Impact: In relation to the proposed substation location the associated effect at the closest NSLs is **negative, not significant and long-term.**

EIAR 10.4.6.5 Vibration Emissions during the Operational Phase

Imperceptible impact. Vibration from operational wind turbines is low and will not result in perceptible levels at nearby sensitive receptors nor will the levels of vibration result in any structural damage. Research undertaken by Snow³ found that levels of ground-borne vibration 100 m from the nearest wind turbine were significantly below criteria for 'critical working areas' given by British Standard BS 6472:1992 Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz) and were lower than limits specified for residential premises by an even greater margin. Hence, the level of vibration produced by wind turbines at this distance is low and does not pose a risk to human health.

More recently, the Low Frequency Noise Report⁴ published by the Federal State of Baden-Württemberg simultaneously measured vibration at several locations, ranging from directly at the wind turbine tower to up to 285m distance from an operational Nordex N117 – 2.4 MW wind turbine with a hub height of 140.6m. The report concluded that beyond 300m from the turbine, the vibration levels had reduced such that they could no longer be differentiated from the background vibration levels.

Considering that all NSL are over 300m away, the level of vibration is significantly below any thresholds of perceptibility. Vibration from the turbines is too low to be perceived at neighbouring residential properties. Vibration levels will also be significantly below levels that would result in damage to the nearest buildings.

Therefore, there are no expected sources of vibration associated with the operational phase of the proposed development. As reported in the Special Characteristics section below, in the UK Institute of Acoustics Bulletin (March 2009) compiled by acoustic consultants regularly employed on behalf of wind farm developers and acoustic consultants regularly employed on behalf of community groups campaigning against

³ ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm, prepared by D J Snow

⁴ Low-frequency noise incl. infrasound from wind turbines and other sources', State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in Germany, 2016

wind farm developments (IAO, 2009), the article concludes that “there is no robust evidence that ground-borne vibration from wind farms, generally has adverse effects on wind farm neighbours”.

In that context, it is assessed that operational vibration effects on NSLs will be neutral, imperceptible and short-term and therefore not significant.

EIAR 10.4.7 Cumulative Effect of the Whole Project

In summary, a number of effects to Noise & Vibration as a result of the development of the Proposed Gathabawn Wind Farm of the Candidate Gathabawn Grid Connection have been identified. These adverse effects are predicted to range from Neutral to Not Significant. It has been evaluated that **none of the effects of the Project will be significant.**

There are **no likely Moderate, Significant, Very Significant or Profound adverse noise or vibration impacts** arising from the construction, operation or decommissioning of the Proposed Gathabawn Windfarm or of the Candidate Gathabawn Grid Connection.

Furthermore, when all of the adverse effects of the Proposed Gathabawn Wind Farm on Noise & Vibration are considered collectively, it is evaluated that **the cumulation of the effects of the Project will not result in significant adverse impacts.**

EIAR 10.4.8 Environmental Protection Measures and Monitoring for Non-Significant Effects**EIAR 10.4.8.1 Mitigation Measures for potentially Significant Effects**

Worst-case noise modelling identified that predicted noise levels will be within criteria at all locations. Notwithstanding, as per Section 10.4.5.1.4.3, the following monitoring arrangement will be implemented to ensure compliance with planning conditions at NSLs:

WM107: Curtailment Strategy – Noise: A noise curtailment strategy will be developed and implemented to ensure that the operating windfarm complies with the prescribed operational noise criterion. In order to develop this strategy: (i) a pre-construction noise survey will be carried out to establish the background noise levels and to confirm the applicable wind turbine noise criteria at identified Noise Sensitive Locations (NSL) and (ii) following the commissioning of the Project and the commencement of operation of the wind farm, a second noise survey will be carried out at the NSLs to establish compliance with the noise limit conditions applied to the development. This survey will be carried out according to the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014).

Where exceedances are confirmed during surveys, then appropriate sound power operating modes will be activated for specified turbines operating in specified wind conditions as required to reduce noise output when exceedance at a NSL is predicted by the wind turbines computer SCADA software. A third noise survey will be carried following the activation of sound power modes to confirm the effectiveness of the curtailment strategy.

This mitigation measured will ensure that operating wind farm noise levels at noise sensitive locations (NSLs) which are prescribed either by planning condition or other required noise criterion, are achieved.

EIAR 10.4.8.2 Best Practice Measures for Non-Significant Effects

Best practice measures which form part of standard wind farm construction/operation and will be implemented during the construction/operation/decommissioning of the development to protect the Noise & Vibration environment and avoid/reduce these not significant effects. These best practice measures are presented below and are included in the Environmental Management Plan for the Project.

ID	Mitigation Measure/Monitoring Arrangement
WM131	<u>Fit for Purpose:</u> All plant and machinery which will be used during decommissioning works will be fit for purpose and in good working order prior to mobilisation to works areas.
WM25	<u>Monitoring of construction noise</u> will be carried out at a number of nearby residences during critical periods of the wind farm construction works.
WM73	<u>Work hours:</u> Construction operations shall generally be restricted to between 0700-1900hrs Monday to Friday, and 0800-1300hrs on Saturdays. Site activities which are likely to create high levels of noise or vibration will be limited to these hours of operation, with no noisy operations on Sundays or Public Holidays However, to ensure that optimal use is made of good weather period or at critical periods within the programme, it could be necessary on occasion to work outside of these hours.
WM74	<u>A Community Liaison Officer (CLO)</u> will be appointed. The CLO will liaise with and keep the local community up-to-date with relevant construction work schedules, through the use of letter drops to or direct contact with nearest neighbours. The CLO will be the point of contact for local residents and local landowners for matters relating to noise, dust or traffic. The Environmental Clerk of Works

	will liaise with the CLO and will be the point of contact between the contractor/developer and the Local Authority regarding any matters relating to noise or vibration from the construction works.
WM77	<u>Noise management:</u> The Contractor undertaking the construction of the Gathabawn Windfarm will be obliged to take specific noise abatement measures when deemed necessary to comply with the recommendations of BS5228-1 (BSI 2014a). The Contractor will coordinate with the construction teams for other developments in order to minimise the cumulative noise effects.

EIAR 10.5 CUMULATIVE EFFECTS WITH OTHER PROJECTS

Other existing and permitted projects, and projects advanced in the planning system were examined for their potential to cumulatively affect local residents and community with the Whole Gathabawn Windfarm Project. These projects are referred to as 'Other Projects' herein. The potential for off-site and secondary consequential development is also considered.

A **Cumulative Study Area** is set out below and Other Projects located within this Study Area are identified and examined for in-combination effects.

- Cumulative Operational Noise: 5km area around the Proposed Gathabawn Windfarm, as per Section EIAR 10.2.2.
- Cumulative Construction Noise: The Study area of cumulative noise during the construction phase has conservatively used the same area as the operational study area.

The Other Projects which occur within the Cumulative Study Areas were subject to a cumulative scoping exercise, see Chapter 5 Description of the Development Appendix 5.4. As a result of this scoping exercise, some of these Other Projects were scoped IN for evaluation of cumulative effects, and these projects are listed below.

The Other Projects which have been Scoped-IN to the cumulative evaluations herein are identified in **Figure 10.7.1 and Figure 10.7.2: Other Projects Scoped-In to the Noise & Vibration Cumulative Evaluations** (included at the end of this chapter).

EIAR 10.5.1 Evaluation of Cumulative Impacts with Other Projects

The potential for cumulative effects with Other Projects is evaluated hereunder. The evaluation takes into account existing sources of pollution or damage identified in Section 10.3.4.

EIAR 10.5.1.1 Construction Phase Cumulative Effects

Other Projects Scoped In: Ballynalacken WF Grid Connection, Seskin WF Grid Connection, Briskalagh WF Grid Connection, Littleton WF Grid Connection, Battery Energy Storage developments 1 and 2 in Moatpark, and the potential Killeshulán WF Grid Connection which is in close proximity to Gathabawn wind farm and grid works.

Cumulative Construction Noise & Vibration:

It is not anticipated that there will be any other construction activities that would give rise to significant cumulative impacts during the construction phase. The predicted noise and vibration for the proposed project are not of enough magnitude to cause an increase in the cumulative construction noise emissions that would exceed the threshold for significant impacts at any NSL.

For grid connection and underground cabling construction work the likelihood of any significant cumulative effects are considered low. In the unlikely event that the works associated with the proposed project occurred in proximity to construction and or decommission works at another development any cumulative effects would be expected to be of brief duration and not significant. The contractor will coordinate with the construction teams for other developments in order to minimise the cumulative noise effects.

The potential for any cumulative noise effect from all of the proposed activities occurring simultaneously or with construction activities from other developments is unlikely and not significant.

EIAR 10.5.1.2 Cumulative Operational Noise Evaluation

There is one operational wind farm and two potential windfarms within, or partially within, the 5km cumulative study area:

- the existing Lisdowney Wind Farm which is 1.25km to the north of the Ballyring turbines;
- potential Seskin Windfarm (under appeal with An Coimisiún Pleanála), which is just on the edge of the study area, with two turbines just within 5km of the Gathabawn turbines; and
- potential Killoshulan Wind Farm, which is 2.4km to the south of the Ballylehaun turbines. This wind farm is at pre-planning stage. A layout for the wind farm was available on the projects community website www.killoshulanwindfarm.com.

Due to its proximity (1.25km), the Lisdowney Wind Farm is the principal project to be considered for cumulative noise emissions.

A review of the Seskin turbine locations and EIAR found that the noise study area for Seskin does not overlap any of the NSLs within 2km of the proposed Gathabawn Wind turbines, therefore there is no likelihood of significant noise impacts and Seskin Wind Turbines are screened out of the cumulative noise model.

In respect of the potential Killoshulan wind turbines, it is noted that the turbine coordinates and the turbine make and model have not been finalised and a complete cumulative noise impact assessment cannot be carried out as yet. As will be shown in the following sections, the small number of NSLs with exceedances of the criteria due to the proposed Gathabawn wind turbines are located to the east of the proposed turbines, at some 4km from the potential Killoshulan wind turbines. The environmental assessment of the Killoshulan project, compliance with criteria will have to be demonstrated NSLs much closer to Killoshulan wind turbines. It is therefore not anticipated that noise from Killoshulan wind turbines, when combined with that from Gathabawn and Lisdowney, will lead to any additional significant effects or exceedances of noise criteria at NSLs in this assessment.

The potential for cumulative noise impacts from both the Proposed Gathabawn Windfarm turbines and the existing Lisdowney Wind Farm turbines is examined hereunder.

EIAR 10.5.1.2.1 Lisdowney Turbines

The adjacent Lisdowney Wind Farm Wind Turbines are a Enercon E82 wind turbines, as presented in Table 10-23:

Table 10-23: Lisdowney Wind Farm Turbine Details

Lisdowney turbine	Co-ordinates		Turbine Type	Hub height	Rotor diameter
1	637826	670634	Enercon E82	80	82
2	638226	670627	Enercon E82	80	82
3	638141	670356	Enercon E82	80	82
4	638528	670422	Enercon E82	80	82

The sound power levels used in the noise prediction model are outlined in Table 10-19.

Table 10-24: Lisdowney Enercon E82

Wind speed @10m	Octave Band (Hz)									Total SWL dB(A)	SWL dB(A) +2dB
	63	125	250	500	1000	2000	4000	8000			

3m/s	79.5	85.6	88.6	89.9	91.2	88.1	80.5	68.1	96.3	98.3
4m/s	79.5	85.6	88.6	89.9	91.2	88.1	80.5	68.1	96.3	98.3
6m/s	79.5	85.6	88.6	89.9	91.2	88.1	80.5	68.1	96.3	98.3
6m/s	83.9	90.0	93.0	94.3	95.6	92.5	84.9	72.5	100.7	102.7
7m/s	86.5	92.6	95.6	96.9	98.2	95.1	87.5	75.1	103.3	105.3
>8m/s	87.2	93.3	96.3	97.6	98.9	95.8	88.2	75.8	104.0	106.0

EIAR 10.5.1.2.2 Lisdowney Standalone Results

The predicted results of noise modelling for the Lisdowney Wind Farm operating alone are presented in **Table 10-21** below. These are the predicted results without the contribution of the Gathabawn Wind Farm. The results are presented for locations where predicted sound power levels are greater than 25dB L_{A90} . NSLs in the study are not listed in **Table 10-25** have noise levels below 25 dB L_{A90} and are not affected by Lisdowney wind turbine noise. No exceedances of the criteria are found.

Table 10-25 Predicted Noise Levels greater than for Lisdowney Wind Farm ALONE

Location	Parameter	Predicted Noise Level (dB L_{A90}) – Cumulative						
		3	4	5	6	7	8	9
H048	Predicted Noise Level	26.9	26.9	26.9	29.6	33.9	34.6	34.6
H061	Predicted Noise Level	25.5	25.5	25.5	25.8	32.5	33.2	33.2
H062	Predicted Noise Level	29.1	29.1	29.1	28.2	36.1	36.8	36.8
H063	Predicted Noise Level	34.8	34.8	34.8	31.4	41.8	42.5	42.5
H064	Predicted Noise Level	34.0	34.0	34.0	31.5	41.0	41.6	41.6
H065	Predicted Noise Level	33.1	33.1	33.1	31.4	40.1	40.8	40.8
H113	Predicted Noise Level	31.6	31.6	31.6	32.7	38.6	39.3	39.3
H114	Predicted Noise Level	26.4	26.4	26.4	28.7	33.4	34.1	34.1
H150	Predicted Noise Level	29.1	29.1	29.1	28.5	36.1	36.8	36.8
H151	Predicted Noise Level	29.2	29.2	29.2	28.7	36.2	37.0	37.0
H152	Predicted Noise Level	25.7	25.7	25.7	26.3	32.7	33.4	33.4
H153	Predicted Noise Level	26.8	26.8	26.8	27.2	33.8	34.5	34.5
H154	Predicted Noise Level	26.9	26.9	26.9	27.6	33.9	34.6	34.6
H155	Predicted Noise Level	28.4	28.4	28.4	28.6	35.4	36.1	36.1
H156	Predicted Noise Level	29.6	29.6	29.6	29.3	36.6	37.3	37.3
H157	Predicted Noise Level	30.5	30.5	30.5	30.1	37.5	38.2	38.2
H158	Predicted Noise Level	31.0	31.0	31.0	30.8	38.0	38.6	38.6
H159	Predicted Noise Level	31.5	31.5	31.5	30.7	38.5	39.2	39.2
H160	Predicted Noise Level	31.4	31.4	31.4	30.5	38.4	39.1	39.1
H161	Predicted Noise Level	34.0	34.0	34.0	31.2	41.0	41.7	41.7
H252	Predicted Noise Level	26.4	26.4	26.4	27.4	33.4	34.1	34.1
H253	Predicted Noise Level	27.8	27.8	27.8	28.9	34.8	35.5	35.5
H254	Predicted Noise Level	28.1	28.1	28.1	33.9	35.1	35.8	35.8
H255	Predicted Noise Level	27.8	27.8	27.8	32.0	34.8	35.5	35.5
H256	Predicted Noise Level	27.5	27.5	27.5	31.4	34.5	35.2	35.2
H257	Predicted Noise Level	27.0	27.0	27.0	31.2	34.0	34.7	34.7
H258	Predicted Noise Level	27.0	27.0	27.0	30.5	34.0	34.7	34.7
H259	Predicted Noise Level	26.5	26.5	26.5	30.2	33.5	34.2	34.2
H260	Predicted Noise Level	26.1	26.1	26.1	29.6	33.1	33.8	33.8

EIAR 10.5.1.2.3 Gathabawn and Lisdowney Cumulative Results

The predicted noise levels at various wind speeds are in Table 10-26 below; for NSLs, H001, H002 and H003, the comparison compared against the noise criteria curves is shown in full. For brevity, the remaining NSLs show the predicted noise levels. Where exceedances are predicted, the comparison against noise criteria curves is shown in full.

Figure 10.1 (found after the modelling results table) shows the cumulative noise contours the wind speed of 9 m/s at standardised 10 m height, this being the wind speed at which the wind turbine reaches its maximum sound power level (See Section EIAR 10.2.3.1.).

Table 10-26 Predicted Cumulative Noise Levels for all 274 No. NSLs

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H001	Predicted	23.9	27.4	32.4	35.7	36.1	35.8	35.6
H001	Daytime Criterion	40	40	40	40	45	45	45
H001	Daytime Excess	--	--	--	--	--	--	--
H001	Night-time Criterion	43	43	43	43	43	43	43
H001	Night-time Excess	--	--	--	--	--	--	--
H002	Predicted	24.2	27.7	32.7	36.0	36.4	36.2	35.9
H002	Daytime Criterion	40	40	40	40	45	45	45
H002	Daytime Excess	--	--	--	--	--	--	--
H002	Night-time Criterion	43	43	43	43	43	43	43
H002	Night-time Excess	--	--	--	--	--	--	--
H003	Predicted	22.8	26.3	31.3	34.6	35.0	34.7	34.4
H003	Daytime Criterion	40	40	40	40	45	45	45
H003	Daytime Excess	--	--	--	--	--	--	--
H003	Night-time Criterion	43	43	43	43	43	43	43
H003	Night-time Excess	--	--	--	--	--	--	--
H004	Predicted	24.6	28.2	33.1	36.5	36.8	36.6	36.3
H005	Predicted	24.1	27.7	32.6	36.0	36.3	36.1	35.8
H006	Predicted	24.3	27.9	32.9	36.2	36.6	36.3	36.1
H007	Predicted	24.3	27.9	32.9	36.2	36.6	36.3	36.1
H008	Predicted	28.8	32.4	37.3	40.7	41.0	40.9	40.6
H009	Predicted	28.9	32.5	37.4	40.8	41.1	41.0	40.8
H010	Predicted	25.9	29.5	34.4	37.8	38.2	37.9	37.7
H011	Predicted	26.6	30.2	35.2	38.5	38.9	38.6	38.4
H012	Predicted	26.1	29.7	34.6	38.0	38.3	38.1	37.8
H013	Predicted	25.0	28.6	33.6	36.9	37.3	37.0	36.8
H014	Predicted	25.7	29.3	34.3	37.6	38.0	37.8	37.5
H015	Predicted	27.1	30.7	35.6	39.0	39.3	39.1	38.9
H016	Predicted	26.7	30.2	35.2	38.5	38.9	38.7	38.5
H017	Predicted	26.1	29.7	34.7	38.0	38.4	38.2	37.9
H018	Predicted	26.1	29.7	34.6	38.0	38.3	38.1	37.9
H019	Predicted	26.2	29.8	34.7	38.1	38.4	38.2	38.0
H020	Predicted	26.0	29.6	34.5	37.9	38.3	38.1	37.8
H021	Predicted	26.8	30.3	35.2	38.6	39.0	38.8	38.6
H022	Predicted	27.0	30.5	35.4	38.8	39.2	39.0	38.8
H023	Predicted	27.8	31.2	36.1	39.7	40.2	40.0	39.7
H024	Predicted	26.2	29.4	34.2	37.8	38.4	38.2	37.9
H025	Predicted	26.4	29.7	34.5	38.1	38.6	38.5	38.2
H026	Predicted	26.3	29.6	34.3	38.0	38.6	38.4	38.1
H027	Predicted	25.8	28.8	33.4	37.1	37.7	37.5	37.3
H028	Predicted	25.3	28.5	33.2	36.9	37.5	37.3	37.0
H029	Predicted	25.2	28.4	33.2	36.8	37.4	37.2	37.0
H030	Predicted	24.4	27.2	31.6	35.3	35.9	35.8	35.5
H031	Predicted	25.1	27.5	31.7	35.4	36.1	36.0	35.8
H032	Predicted	25.4	27.8	31.9	35.6	36.4	36.3	36.1
H033	Predicted	27.9	30.8	35.4	39.1	39.7	39.6	39.4
H034	Predicted	25.8	28.3	32.5	36.2	36.9	36.8	36.6
H035	Predicted	25.8	28.1	32.2	35.9	36.7	36.6	36.4
H036	Predicted	28.4	31.4	36.0	39.7	40.3	40.2	40.0
H037	Predicted	27.6	30.5	35.0	38.7	39.3	39.2	38.9
H038	Predicted	28.9	32.0	36.7	40.4	40.9	40.8	40.6
H039	Predicted	31.0	34.4	39.3	42.8	43.2	43.0	42.8
H040	Predicted	30.7	34.1	39.0	42.5	42.9	42.8	42.6
H041	Predicted	30.0	33.4	38.2	41.7	42.2	42.0	41.8
H042	Predicted	29.6	32.9	37.8	41.3	41.7	41.6	41.3
H043	Predicted	27.2	30.2	34.8	38.4	38.9	38.8	38.6
H044	Predicted	27.3	30.3	34.9	38.5	39.1	38.9	38.7
H045	Predicted	26.6	29.6	34.2	37.8	38.3	38.2	37.9

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H046	Predicted	26.6	29.6	34.2	37.8	38.3	38.1	37.9
H047	Predicted	26.8	29.8	34.5	38.0	38.6	38.4	38.1
H048	Predicted	30.0	32.2	36.2	39.8	40.5	40.5	40.4
H049	Predicted	29.0	31.5	35.7	39.2	39.8	39.8	39.6
H050	Predicted	28.9	31.6	35.9	39.4	40.0	39.9	39.7
H051	Predicted	25.4	28.5	33.1	36.5	37.0	36.8	36.6
H052	Predicted	27.1	30.0	34.5	38.0	38.5	38.4	38.2
H053	Predicted	28.4	31.2	35.8	39.2	39.8	39.7	39.5
H054	Predicted	29.1	32.0	36.5	40.0	40.6	40.5	40.3
H055	Predicted	29.6	32.6	37.1	40.6	41.2	41.0	40.9
H055	Daytime Criterion	40	40	40	40	45	45	45
H055	Daytime Excess	--	--	--	0.6	--	--	--
H055	Night-time Criterion	43	43	43	43	43	43	43
H055	Night-time Excess	--	--	--	--	--	--	--
H056	Predicted	30.1	33.2	37.9	41.4	41.9	41.7	41.5
H056	Daytime Criterion	40	40	40	40	45	45	45
H056	Daytime Excess	--	--	--	1.4	--	--	--
H056	Night-time Criterion	43	43	43	43	43	43	43
H057	Predicted	31.0	34.0	38.7	42.2	42.7	42.6	42.4
H058	Predicted	27.1	29.7	34.1	37.6	38.3	38.2	38.0
H059	Predicted	26.7	29.2	33.5	37.1	37.8	37.7	37.5
H060	Predicted	28.2	30.6	34.7	38.4	39.1	39.0	38.8
H061	Predicted	28.0	29.9	33.6	37.2	38.2	38.2	38.0
H062	Predicted	30.4	31.6	34.5	38.3	39.5	39.8	39.6
H063	Predicted	35.1	35.5	36.6	40.7	42.8	43.3	43.3
H063	Daytime Criterion	40	40	40	40	45	45	45
H063	Daytime Excess	--	--	--	0.7	--	--	--
H063	Night-time Criterion	43	43	43	43	43	43	43
H063	Night-time Excess	--	--	--	--	--	0.3	0.3
H064	Predicted	34.7	35.4	37.5	41.4	43.1	43.4	43.4
H064	Daytime Criterion	40	40	40	45	45	45	46.1
H064	Daytime Excess	--	--	--	--	--	--	--
H064	Night-time Criterion	43	43	43	43	43	44	46.4
H064	Night-time Excess	--	--	--	--	0.1	--	--
H065	Predicted	34.1	35.1	37.6	41.4	42.9	43.2	43.1
H066	Predicted	20.2	23.6	28.4	31.8	32.2	32.0	31.6
H067	Predicted	20.9	24.3	29.2	32.5	32.9	32.7	32.4
H068	Predicted	21.7	25.2	30.1	33.4	33.8	33.6	33.3
H069	Predicted	21.6	25.3	30.2	33.6	33.9	33.6	33.3
H070	Predicted	22.5	26.1	31.0	34.4	34.7	34.5	34.2
H071	Predicted	22.3	25.9	30.9	34.2	34.6	34.3	34.0
H072	Predicted	21.6	25.2	30.1	33.5	33.8	33.6	33.2
H073	Predicted	20.9	24.5	29.5	32.8	33.2	32.9	32.6
H074	Predicted	20.6	24.2	29.2	32.5	32.9	32.6	32.2
H075	Predicted	22.9	26.5	31.4	34.8	35.1	34.9	34.6
H076	Predicted	21.4	25.0	30.0	33.4	33.7	33.4	33.1
H077	Predicted	23.0	26.6	31.6	34.9	35.3	35.0	34.7
H078	Predicted	23.3	26.9	31.8	35.2	35.6	35.3	35.0
H079	Predicted	20.8	24.4	29.4	32.8	33.1	32.8	32.5
H080	Predicted	22.3	25.9	30.8	34.2	34.6	34.3	34.0
H081	Predicted	22.8	26.3	31.2	34.6	35.0	34.8	34.4
H082	Predicted	23.1	26.6	31.4	34.9	35.3	35.0	34.7
H083	Predicted	23.2	26.7	31.6	35.1	35.5	35.2	34.9
H084	Predicted	23.4	26.9	31.8	35.3	35.7	35.4	35.1
H085	Predicted	23.8	27.2	32.0	35.5	36.0	35.7	35.4
H086	Predicted	25.0	28.3	33.1	36.6	37.1	36.9	36.6
H087	Predicted	25.0	28.3	33.1	36.6	37.1	36.9	36.6

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H088	Predicted	25.0	28.3	33.1	36.7	37.2	36.9	36.6
H089	Predicted	25.3	28.6	33.4	37.0	37.4	37.2	36.9
H090	Predicted	25.4	28.8	33.6	37.1	37.6	37.3	37.1
H091	Predicted	24.8	28.2	33.0	36.5	37.0	36.7	36.4
H092	Predicted	24.9	28.2	33.0	36.5	37.0	36.8	36.5
H093	Predicted	24.5	27.7	32.5	36.0	36.5	36.3	36.0
H094	Predicted	25.6	28.9	33.6	37.3	37.8	37.6	37.3
H095	Predicted	25.7	29.0	33.7	37.3	37.8	37.6	37.3
H096	Predicted	23.3	26.4	31.0	34.6	35.2	35.0	34.6
H097	Predicted	22.8	25.8	30.4	34.0	34.5	34.3	34.0
H098	Predicted	23.7	26.7	31.3	34.9	35.5	35.3	35.0
H099	Predicted	23.7	26.6	31.0	34.7	35.3	35.1	34.8
H100	Predicted	23.3	26.0	30.4	34.0	34.7	34.5	34.2
H101	Predicted	23.4	25.9	30.1	33.8	34.5	34.4	34.1
H102	Predicted	23.2	25.6	29.7	33.4	34.1	34.0	33.7
H103	Predicted	23.4	25.9	30.1	33.8	34.5	34.4	34.1
H104	Predicted	23.6	26.2	30.4	34.1	34.8	34.6	34.4
H105	Predicted	23.6	26.2	30.4	34.1	34.8	34.6	34.4
H106	Predicted	23.7	26.2	30.5	34.2	34.8	34.7	34.4
H107	Predicted	24.0	26.6	31.0	34.6	35.3	35.1	34.9
H108	Predicted	23.8	26.4	30.7	34.4	35.0	34.9	34.6
H109	Predicted	23.8	26.4	30.7	34.4	35.1	34.9	34.7
H110	Predicted	23.9	26.4	30.7	34.4	35.1	35.0	34.7
H111	Predicted	25.0	27.3	31.4	35.0	35.8	35.8	35.5
H112	Predicted	23.0	26.3	31.1	34.5	34.9	34.7	34.4
H113	Predicted	32.2	32.9	34.9	38.8	40.5	40.8	40.8
H114	Predicted	28.0	29.4	32.5	36.2	37.4	37.5	37.3
H115	Predicted	26.7	28.5	32.1	35.7	36.6	36.7	36.5
H116	Predicted	26.0	28.0	31.7	35.3	36.2	36.2	35.9
H117	Predicted	26.1	28.2	32.0	35.5	36.4	36.4	36.1
H118	Predicted	25.7	27.7	31.4	35.0	35.9	35.9	35.7
H119	Predicted	25.9	27.9	31.7	35.3	36.1	36.1	35.9
H120	Predicted	25.6	27.6	31.4	34.9	35.8	35.8	35.6
H121	Predicted	25.2	27.3	31.2	34.7	35.5	35.5	35.3
H122	Predicted	25.0	27.2	31.0	34.6	35.4	35.4	35.2
H123	Predicted	24.7	26.9	30.8	34.4	35.2	35.1	34.9
H124	Predicted	24.8	27.0	31.0	34.5	35.3	35.2	35.0
H125	Predicted	24.8	27.1	31.1	34.6	35.4	35.3	35.1
H126	Predicted	24.8	27.3	31.5	35.0	35.6	35.6	35.3
H127	Predicted	24.5	27.0	31.2	34.7	35.3	35.2	35.0
H128	Predicted	24.4	27.4	31.9	35.4	35.9	35.7	35.4
H129	Predicted	23.8	26.8	31.3	34.8	35.3	35.1	34.8
H130	Predicted	23.3	26.2	30.8	34.2	34.8	34.6	34.3
H131	Predicted	22.8	25.9	30.5	33.9	34.4	34.2	34.0
H132	Predicted	22.6	25.2	29.4	32.9	33.5	33.4	33.2
H133	Predicted	22.6	25.1	29.3	32.8	33.5	33.3	33.1
H134	Predicted	21.1	24.0	28.6	32.0	32.5	32.4	32.1
H135	Predicted	20.7	23.6	28.1	31.6	32.1	31.9	31.6
H136	Predicted	20.5	23.4	27.9	31.4	31.9	31.7	31.4
H137	Predicted	20.3	23.3	27.8	31.3	31.8	31.6	31.3
H138	Predicted	20.5	23.4	27.9	31.4	31.9	31.7	31.4
H139	Predicted	20.5	23.4	27.9	31.4	31.9	31.7	31.4
H140	Predicted	20.6	23.5	28.0	31.4	32.0	31.8	31.5
H141	Predicted	20.6	23.4	27.9	31.4	31.9	31.8	31.5
H142	Predicted	21.6	24.4	28.9	32.3	32.9	32.7	32.4
H143	Predicted	22.0	24.8	29.2	32.7	33.3	33.1	32.9
H144	Predicted	23.2	26.1	30.6	34.1	34.7	34.5	34.2

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H145	Predicted	23.4	25.7	29.7	33.3	34.0	34.0	33.7
H146	Predicted	24.2	26.9	31.3	34.8	35.4	35.2	35.0
H147	Predicted	25.2	28.0	32.4	35.9	36.5	36.4	36.1
H148	Predicted	25.6	28.2	32.6	36.1	36.7	36.6	36.4
H149	Predicted	26.2	28.8	33.2	36.7	37.3	37.2	37.0
H150	Predicted	30.1	31.1	33.5	37.4	38.9	39.2	39.0
H151	Predicted	30.2	31.1	33.5	37.4	38.9	39.2	39.0
H152	Predicted	26.8	27.8	30.4	34.3	35.6	35.9	35.8
H153	Predicted	27.7	28.6	30.8	34.7	36.2	36.5	36.4
H154	Predicted	27.5	28.2	30.2	34.2	35.8	36.2	36.1
H155	Predicted	29.0	29.6	31.4	35.4	37.1	37.5	37.4
H156	Predicted	30.0	30.6	32.2	36.2	38.0	38.5	38.4
H157	Predicted	30.9	31.3	32.6	36.7	38.7	39.1	39.1
H158	Predicted	31.3	31.6	32.8	36.9	38.9	39.4	39.4
H159	Predicted	31.8	32.2	33.4	37.5	39.5	40.0	40.0
H160	Predicted	31.8	32.2	33.5	37.5	39.5	40.0	40.0
H161	Predicted	34.3	34.6	35.7	39.8	41.9	42.5	42.4
H162	Predicted	16.3	19.4	23.9	27.4	27.8	27.6	27.2
H163	Predicted	17.8	21.1	25.8	29.2	29.6	29.4	29.0
H164	Predicted	16.6	20.1	25.0	28.4	28.8	28.4	28.1
H165	Predicted	16.1	19.6	24.4	27.8	28.2	27.9	27.5
H166	Predicted	15.7	19.4	24.3	27.7	28.0	27.7	27.3
H167	Predicted	17.2	20.7	25.6	29.0	29.3	29.0	28.6
H168	Predicted	17.4	20.9	25.8	29.2	29.5	29.2	28.9
H169	Predicted	17.8	21.3	26.2	29.6	29.9	29.6	29.3
H170	Predicted	17.9	21.4	26.3	29.7	30.1	29.8	29.4
H171	Predicted	18.2	21.7	26.6	30.0	30.4	30.0	29.7
H172	Predicted	16.6	20.3	25.2	28.6	28.9	28.6	28.2
H173	Predicted	16.7	20.3	25.2	28.6	29.0	28.6	28.2
H174	Predicted	16.3	19.9	24.9	28.3	28.6	28.2	27.8
H175	Predicted	17.0	20.6	25.6	29.0	29.3	28.9	28.6
H176	Predicted	18.1	21.7	26.6	30.0	30.4	30.0	29.7
H177	Predicted	18.0	21.6	26.6	30.0	30.3	30.0	29.6
H178	Predicted	18.3	22.0	26.9	30.3	30.6	30.3	29.9
H179	Predicted	18.4	22.1	27.0	30.4	30.7	30.4	30.0
H180	Predicted	19.9	23.6	28.5	31.9	32.2	31.9	31.6
H181	Predicted	19.6	23.2	28.1	31.5	31.8	31.5	31.2
H182	Predicted	19.1	22.7	27.7	31.1	31.4	31.1	30.7
H183	Predicted	20.1	23.7	28.6	32.0	32.4	32.0	31.7
H184	Predicted	19.4	23.0	28.0	31.3	31.7	31.4	31.0
H185	Predicted	18.5	22.1	27.1	30.5	30.8	30.5	30.1
H186	Predicted	19.5	23.1	28.0	31.4	31.8	31.5	31.1
H187	Predicted	20.0	23.6	28.5	32.0	32.3	32.0	31.6
H188	Predicted	20.1	23.7	28.6	32.1	32.5	32.2	31.8
H189	Predicted	21.3	24.9	29.8	33.3	33.6	33.3	33.0
H190	Predicted	22.1	25.7	30.6	34.0	34.4	34.1	33.8
H191	Predicted	22.1	25.2	29.8	33.4	33.9	33.6	33.3
H192	Predicted	21.6	24.6	29.2	32.8	33.3	33.1	32.8
H193	Predicted	21.6	24.3	28.7	32.4	33.0	32.8	32.5
H194	Predicted	23.0	25.6	29.9	33.6	34.2	34.0	33.7
H195	Predicted	23.1	25.6	29.9	33.5	34.2	34.0	33.7
H196	Predicted	23.2	25.7	29.9	33.5	34.2	34.0	33.8
H197	Predicted	23.1	25.6	29.9	33.5	34.2	34.0	33.7
H198	Predicted	23.0	25.5	29.7	33.3	34.0	33.8	33.5
H199	Predicted	22.7	25.2	29.4	33.0	33.7	33.5	33.2
H200	Predicted	23.0	25.5	29.6	33.2	33.9	33.8	33.5
H201	Predicted	23.1	25.6	29.8	33.4	34.0	33.9	33.6

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H202	Predicted	23.0	25.4	29.5	33.1	33.8	33.7	33.4
H203	Predicted	22.9	25.2	29.2	32.8	33.5	33.4	33.1
H204	Predicted	23.0	25.1	29.0	32.6	33.4	33.4	33.1
H205	Predicted	22.9	24.9	28.7	32.4	33.2	33.2	32.9
H206	Predicted	23.2	25.4	29.3	32.9	33.6	33.6	33.3
H207	Predicted	23.1	25.1	28.9	32.5	33.3	33.3	33.0
H208	Predicted	23.1	25.1	28.9	32.5	33.4	33.3	33.1
H209	Predicted	23.2	25.2	29.0	32.6	33.4	33.4	33.1
H210	Predicted	23.0	25.2	29.1	32.7	33.5	33.4	33.1
H211	Predicted	23.4	25.7	29.8	33.3	34.0	33.9	33.6
H212	Predicted	23.2	25.7	29.9	33.5	34.1	34.0	33.7
H213	Predicted	23.6	26.2	30.4	33.9	34.6	34.4	34.1
H214	Predicted	22.9	25.4	29.7	33.2	33.8	33.7	33.4
H215	Predicted	23.2	25.8	30.0	33.6	34.2	34.0	33.8
H216	Predicted	23.7	26.2	30.4	34.0	34.6	34.5	34.2
H217	Predicted	23.3	25.9	30.2	33.7	34.3	34.2	33.9
H218	Predicted	23.6	26.2	30.5	34.0	34.6	34.5	34.2
H219	Predicted	23.4	26.1	30.4	33.9	34.5	34.4	34.1
H220	Predicted	23.7	26.4	30.7	34.2	34.8	34.6	34.4
H221	Predicted	23.3	26.0	30.3	33.8	34.4	34.2	33.9
H222	Predicted	23.6	26.4	30.8	34.2	34.8	34.6	34.4
H223	Predicted	23.5	26.2	30.6	34.1	34.7	34.5	34.2
H224	Predicted	23.7	26.5	30.9	34.4	35.0	34.8	34.5
H225	Predicted	22.7	25.4	29.7	33.2	33.8	33.6	33.3
H226	Predicted	22.2	25.0	29.3	32.8	33.4	33.2	32.9
H227	Predicted	22.2	24.9	29.3	32.8	33.4	33.2	32.9
H228	Predicted	22.3	25.1	29.4	32.9	33.5	33.3	33.0
H229	Predicted	22.2	24.9	29.3	32.8	33.4	33.2	32.9
H230	Predicted	21.0	23.6	27.9	31.4	32.0	31.8	31.6
H231	Predicted	19.9	22.3	26.4	30.0	30.6	30.5	30.2
H232	Predicted	19.3	21.8	26.0	29.5	30.2	30.0	29.7
H233	Predicted	19.3	22.2	26.6	30.1	30.6	30.4	30.1
H234	Predicted	20.0	22.8	27.3	30.8	31.3	31.1	30.8
H235	Predicted	19.7	22.7	27.2	30.7	31.2	31.0	30.7
H236	Predicted	20.4	23.2	27.7	31.1	31.7	31.5	31.2
H237	Predicted	19.1	21.8	26.2	29.6	30.2	30.1	29.8
H238	Predicted	19.5	22.2	26.6	30.1	30.6	30.5	30.2
H239	Predicted	19.6	22.4	26.7	30.2	30.8	30.6	30.3
H240	Predicted	19.5	22.2	26.5	30.0	30.6	30.5	30.2
H241	Predicted	20.3	23.0	27.4	30.9	31.5	31.3	31.0
H242	Predicted	20.4	23.2	27.6	31.1	31.7	31.5	31.2
H243	Predicted	20.1	22.8	27.2	30.7	31.3	31.1	30.8
H244	Predicted	22.5	24.6	28.5	32.1	32.9	32.8	32.6
H245	Predicted	22.7	24.9	28.8	32.3	33.1	33.1	32.8
H246	Predicted	22.0	24.1	27.8	31.4	32.3	32.2	32.0
H247	Predicted	22.2	24.2	28.0	31.6	32.4	32.4	32.2
H248	Predicted	25.0	25.9	28.2	32.1	33.6	33.9	33.8
H249	Predicted	24.8	25.5	27.5	31.4	33.1	33.4	33.3
H250	Predicted	25.2	25.9	27.8	31.7	33.4	33.8	33.7
H251	Predicted	25.5	26.2	27.9	31.9	33.6	34.0	33.9
H252	Predicted	27.1	27.8	29.7	33.6	35.3	35.7	35.6
H253	Predicted	28.2	28.7	30.2	34.3	36.2	36.6	36.5
H254	Predicted	28.8	29.5	31.6	35.5	37.2	37.5	37.4
H255	Predicted	28.7	29.7	32.1	36.0	37.4	37.7	37.6
H256	Predicted	28.5	29.5	32.0	35.9	37.3	37.5	37.4
H257	Predicted	28.1	29.2	31.9	35.7	37.1	37.3	37.1
H258	Predicted	28.2	29.3	32.0	35.8	37.1	37.3	37.2

Location	Parameter	Predicted Noise Level (dB LA90) – Gathabawn Wind Farm ALONE						
		3	4	5	6	7	8	9
H259	Predicted	27.9	29.2	32.1	35.8	37.0	37.2	37.0
H260	Predicted	27.6	29.0	32.1	35.8	37.0	37.1	37.0
H261	Predicted	23.5	25.4	29.0	32.6	33.5	33.5	33.3
H262	Predicted	22.7	24.6	28.4	32.0	32.8	32.8	32.6
H263	Predicted	22.8	24.8	28.6	32.2	33.0	33.0	32.7
H264	Predicted	23.7	27.1	31.9	35.4	35.9	35.6	35.4
H265	Predicted	24.2	27.1	31.6	35.3	35.9	35.7	35.4
H266	Predicted	22.7	25.2	29.5	33.0	33.6	33.5	33.2
H267	Predicted	22.5	25.4	29.9	33.4	33.9	33.7	33.4
H268	Predicted	21.6	24.6	29.1	32.6	33.1	32.9	32.6
H269	Predicted	22.4	25.4	30.0	33.5	34.0	33.8	33.5
H270	Predicted	22.6	25.6	30.2	33.7	34.2	34.0	33.7
H271	Predicted	27.5	28.2	30.2	34.2	35.8	36.2	36.1
H272	Predicted	15.7	19.2	24.0	27.4	27.8	27.4	27.1
H273	Predicted	15.7	19.2	24.0	27.4	27.8	27.4	27.1
H274	Predicted	23.1	25.6	29.8	33.3	34.0	33.8	33.6
St Munchins Church	Predicted	24.0	26.5	30.8	34.5	35.2	35.1	34.8
Millienium Park	Predicted	23.4	25.9	30.1	33.8	34.6	34.4	34.2

See Figure 10-1: Determining the Study Area for Operational Noise

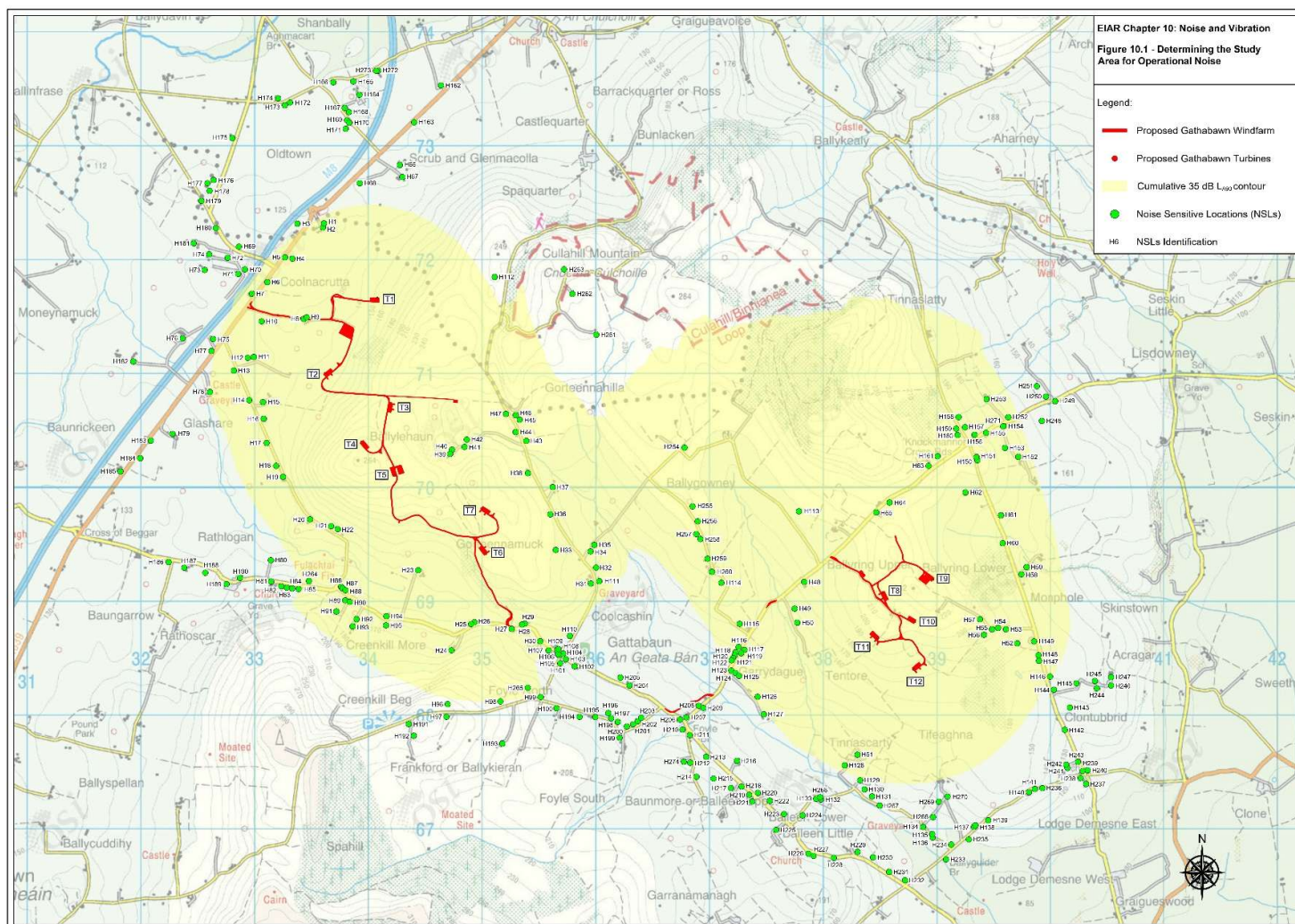
EIAR 10.5.1.2.3.1 Discussion of Cumulative Modelling Results

Exceedances are found at 4 NSLs – H055, H056, H063 and H064. The cumulative noise at all other NSLs were within the noise criteria levels for day-time and noise-time noise.

In relation to the NSLs where noise levels will be within the noise criteria levels, it is considered that no significant effect is associated with the cumulative operation of the proposed development, as the predicted noise levels associated will be within the relevant best-practice noise criteria for wind farms. Therefore, with respect to the EPA's criteria for description of effects, the potential worst-case effects at these noise sensitive locations is considered **negative, not significant and long-term**.

For the four locations where exceedances are noted an additional assessment was carried out.

Figure 10-1: Determining the Study Area for Operational Noise



EIAR 10.5.1.2.3.2 Additional Assessment for H041, H042, H055, H056 and H063

It is predicted that there are exceedances of between 0.1 dB(A) and 1.7 dB(A) at 4 No. NSLs. See Table 10-27 showing predicted exceedance at the 4 No. NSLs with the predicted daytime and night-time noise levels and night-time exceedance values.

Table 10-27 Cumulative Noise Prediction Model for NSLs with exceedances only

Location	Parameter	Predicted Noise Level (dB L _{A90}) for windspeed at standardised 10 m height (m/s)						
		3	4	5	6	7	8	9
H055	Predicted	29.6	32.5	37.1	40.6	41.1	41.0	40.8
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	0.6	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
H056	Predicted	30.1	33.2	37.9	41.4	41.9	41.7	41.5
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	1.4	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	--	--
H063	Predicted	35.1	35.5	36.6	40.7	42.8	43.3	43.3
	Daytime Criterion	40	40	40	40	45	45	45
	Daytime Excess	--	--	--	0.7	--	--	--
	Night-time Criterion	43	43	43	43	43	43	43
	Night-time Excess	--	--	--	--	--	0.3	0.3
H064	Predicted	34.7	35.4	37.5	41.4	43.1	43.4	43.4
	Daytime Criterion	40	40	40	45	45	45	45
	Daytime Excess	--	--	--	--	--	--	--
	Night-time Criterion	43	43	43	43	43	44	46.4
	Night-time Excess	--	--	--	--	0.1	--	--

EIAR 10.5.1.2.3.3 Consideration of Wind Direction and Noise Propagation on 4 No. NSLs where exceedances are predicted

This section discusses additional considerations in respect of the predicted noise levels at the 4 No. NSLs where exceedances are predicted. The methodology for calculation wind turbine noise levels taking into account the effects of wind direction is presented in Appendix A10.2.3.

Table 10-28 and Table 10-29 present the predicted noise exceedances for each wind direction sector at the 4 No. NSLs for daytime and night-time periods respectively. It is noted that the 0.1 exceedance at H064 for night-time periods is not predicted once directional effects are taken into account.

There are therefore 3 No. remaining NSLs where exceedances are found: H055, H056 and H063.

Table 10-28 Cumulative directional Noise Prediction Model for NSLs with exceedances only - Daytime

Location	Direction	Predicted Noise Level (dB L _{A90}) for windspeed at standardised 10 m height (m/s)						
		3	4	5	6	7	8	9
H055	North	--	--	--	--	--	--	--
	Northeast	--	--	--	--	--	--	--
	East	--	--	--	--	--	--	--
	Southeast	--	--	--	--	--	--	--
	South	--	--	--	--	--	--	--
	Southwest	--	--	--	--	--	--	--
	West	--	--	--	+0.6	--	--	--
	Northwest	--	--	--	+0.6	--	--	--
H056	North	--	--	--	--	--	--	--
	Northeast	--	--	--	--	--	--	--
	East	--	--	--	--	--	--	--
	Southeast	--	--	--	--	--	--	--
	South	--	--	--	--	--	--	--
	Southwest	--	--	--	+0.9	--	--	--
	West	--	--	--	+1.4	--	--	--
	Northwest	--	--	--	+1.4	--	--	--
H063	North	--	--	--	--	--	--	--
	Northeast	--	--	--	--	--	--	--
	East	--	--	--	--	--	--	--
	Southeast	--	--	--	--	--	--	--
	South	--	--	--	--	--	--	--
	Southwest	--	--	--	--	--	--	--
	West	--	--	--	+0.5	--	--	--
	Northwest	--	--	--	+0.2	--	--	--

Table 10-29 Cumulative directional Noise Prediction Model for NSLs with exceedances only – Night-time

Location	Direction	Predicted Noise Level (dB L _{A90}) for windspeed at standardised 10 m height (m/s)						
		3	4	5	6	7	8	9
H063	North	--	--	--	--	--	--	--
	Northeast	--	--	--	--	--	--	--
	East	--	--	--	--	--	--	--
	Southeast	--	--	--	--	--	--	--
	South	--	--	--	--	--	--	--
	Southwest	--	--	--	--	--	--	--
	West	--	--	--	--	--	+0.1	+0.1
	Northwest	--	--	--	--	--	--	--
H064	North	--	--	--	--	--	--	--
	Northeast	--	--	--	--	--	--	--
	East	--	--	--	--	--	--	--
	Southeast	--	--	--	--	--	--	--
	South	--	--	--	--	--	--	--
	Southwest	--	--	--	--	--	--	--
	West	--	--	--	--	--	--	--
	Northwest	--	--	--	--	--	--	--

EIAR 10.5.1.2.3.1 Examination of contribution from each windfarm at H063
--

It is noted that H063 is considerably closer to Lisdowney turbines than to the proposed Gathabawn turbines. Noise from each of the windfarms, individually, at H063 is presented in Table 10-24.

Table 10-30 Noise Contributions for each wind farm at H063

Location	Parameter	Predicted Noise Level (dB L _{A90})						
		3	4	5	6	7	8	9
H063	Gathabawn	23.3	26.8	31.7	35.2	35.6	35.4	35.1
	Lisdowney	34.8	34.8	34.8	31.4	41.8	42.5	42.5
	Cumulative	35.1	35.5	36.6	40.7	42.8	43.3	43.2

It is seen that at 8 and 9 m/s, where cumulative exceedances are the night-time criteria are noted, the noise contributions from Gathabawn are 7.1 to 7.4 dB below those for Lisdowney. This also implies that a noise from Gathabawn would have to be reduced by 2 dB in order to achieve a reduction in the overall noise level of 0.5 dB, which is an imperceptible change in noise levels. For this reason, it is not considered necessary to mitigate the noise levels at H063. Further discussion on the practical benefits of applying reduction is presented in the next section.

Mitigation measures will be required in order to address the remaining exceedances at 2 No. NSLs: H055 and H056.

EIAR 10.5.1.2.3.2 Assessment of Effects on 2 No. remaining NSLs showing exceedances

As discussed in *Section EIAR 10.3.1.2.1.7: Good Practice for Operational Noise Predictions*, it noted again that the noise prediction calculations have been made using the ISO 9613-2 standard and relate to conditions favourable to noise propagation (typically downwind propagation from source to receiver and/or downward refraction under temperature inversions) and it is noted that a margin of +2dB has been added to the sound power levels used in the noise model for this assessment to allow for uncertainty, in line with the IOA GPG.

The cumulative exceedances are as follows:

- At H055, potential exceedances of up to 0.6 dB L_{A90} are indicated in southwest and west wind directions, and
- At H056, potential exceedances of up to 1.4 dB L_{A90} are indicated in south, southwest and west wind directions.

Mitigation measures to reduce noise levels to within criteria are discussed hereunder.

EIAR 10.5.1.2.3.3 Operating Turbine Noise Mitigation Measures

The noise predictions provided above, are based on turbine operating in normal sound power mode with no restrictions. The findings of the assessment confirmed that the predicted operational noise levels from the Proposed Gathabawn Windfarm at 272 of the 274 No. Noise Sensitive Locations (NSLs) will not exceed the or night noise criteria.

Modern wind turbines are available with a range of sound power operating modes which can be deployed if required to reduce noise output when exceedance is predicted by the wind turbine's computer SCADA software. Implementation of specified sound power modes resulting in curtailment of the operation of the wind turbine, can be implemented for specified turbines operating in specified wind conditions.

For any turbine curtailment strategy that is developed, consideration must be given to the practical benefits. In this instance the magnitude of the predicted exceedance is considered insignificant, curtailment would yield an imperceptible and unmeasurable change in the total wind turbine noise level at a given NSL. Such curtailment may unnecessarily reduce the electrical power generating capacity of a wind farm, for an imperceptible change to the overall turbine noise levels. When curtailing for exceedance, consideration should be given to the background noise at the specific NSL to avoid unnecessarily curtailing turbine noise when the result would yield an imperceptible change to the overall turbine noise levels. For this reason, it is

not considered necessary to apply mitigation to Gathabawn for the 0.2 dB exceedance at H063, where Lisdowney is the main contributor to wind turbine noise levels.

At the remaining 2 No. of NSLs, slight exceedance is predicted to occur in certain wind direction conditions. Mitigation can be put in place to address these exceedances, if the exceedances are confirmed during commissioning noise surveys.

In this instance, the Vestas 136 turbine is used in the development of mitigation measures. The potential exceedance, if realised, can be mitigated through curtailment of the specific turbines for the relevant wind speed bins and periods. The V136 turbines have been modelled with all turbines operating in normal mode.

Noise Curtailment Strategy: An outline noise curtailment strategy developed to eliminate the incidences of exceedance at the 2 No. NSLs is presented list in Section EIA 10.5.1.2.3.2:

Table 10-31 Indicative Curtailment Matrix for Daytime-time Periods at 6 m/s

Turbine	Mode Number at 6 m/s windspeed at standardised 10m height							
	N	NE	E	SE	S	SW	W	NW
T1	--	--	--	--	--	--	--	--
T2	--	--	--	--	--	--	--	--
T3	--	--	--	--	--	--	--	--
T4	--	--	--	--	--	--	--	--
T5	--	--	--	--	--	--	--	--
T6	--	--	--	--	--	--	--	--
T7	--	--	--	--	--	--	--	--
T8	--	--	--	--	--	--	--	--
T9	--	--	--	--	--	--	SO12	SO12
T10	--	--	--	--	--	SO12	SO12	SO12
T11	--	--	--	--	--	--	--	--
T12	--	--	--	--	--	--	--	--

If required for the final installed turbine type, the curtailment strategy would have to be verified by the manufacturer based on the control and physical limitation of the turbine.

With these mitigation measures in place, the predicted noise levels at 8 and 9m/s for daytime periods are in within the adopted criteria.

Following the implementation of the curtailment strategy (mitigation measure), no exceedance will occur at H055 or H056. Therefore, the residual noise effects at these locations are considered **negative, long-term and not significant**.

The mitigation measures and residual noise levels presented above show that it is possible for the proposed development to operate within the noise criteria.

EIAR 10.5.1.2.3.4	Operational Noise Monitoring & Curtailment Strategy Mitigation Measure
-------------------	--

The above mitigation, identified as WM107 in **Chapter 20 Mitigation & Monitoring Arrangements**, as:

WM107: Curtailment Strategy – Noise: A noise curtailment strategy will be developed and implemented to ensure that the operating windfarm complies with the prescribed operational noise criterion. In order to develop this strategy: (i) a pre-construction noise survey will be carried out to establish the background noise levels and to confirm the applicable wind turbine noise criteria at identified Noise Sensitive Locations (NSL) and (ii) following the commissioning of the Project and the commencement of operation of the wind farm, a second noise survey will be carried out at the NSLs to establish compliance with the noise limit conditions applied to the development. This survey will be carried out according to the IOA GPG and Supplementary Guidance Note 5: Post Completion Measurements (July 2014).

Where exceedances are confirmed during surveys, then appropriate sound power operating modes will be activated for specified turbines operating in specified wind conditions as required to reduce noise output when exceedance at a NSL is predicted by the wind turbines computer SCADA software. A third noise survey will be carried following the activation of sound power modes to confirm the effectiveness of the curtailment strategy. This mitigation measure will ensure that operating Wind Farm noise levels at noise sensitive locations (NSLs) which are prescribed either by planning condition or other required noise criterion, are achieved.

EIAR 10.5.1.2.3.5	Residual Impact (Operational)
-------------------	--------------------------------

The predicted noise levels associated with the proposed development will be within best practice noise criteria curves recommended in line with Irish guidance 'Wind Energy Development Guidelines for Planning Authorities', it is considered that no significant residual effects are associated with the development.

It is concluded that, while noise levels at low wind speeds will increase due to the operation of the turbines, the predicted levels of noise in the local environment will remain low, albeit new sources of noise will be introduced into the soundscape. **The predicted residual operational turbine noise effects at the closest NSLs are considered to be negative, not significant and long-term.**

The above effects should be considered in terms that the effect is variable, and that this assessment considers the locations of the greatest potential impact and impacts in the worst-case scenario.

EIAR 10.6 SUMMARY CONCLUSION

RESIDENTS OR LOCAL PEOPLE AT NOISE SENSITIVE LOCATIONS: The assessment of construction noise and vibration has been conducted in accordance with best practice guidance. Subject to good working practices as recommended in this report, noise and vibration associated with the construction phase of the Gathabawn Windfarm Project is not expected to exceed the recommended limit values, therefore noise and vibration during the construction phase are not expected to cause any significant effects. No significant vibration effects are associated with the operational phase of the Gathabawn Wind Farm.

Based on detailed information on the site layout, the turbine noise emission levels and the turbine height range, worst-case operating turbine noise levels have been predicted at 274 no. Noise Sensitive Locations within the noise study area for a range of operational wind speeds. Following mitigation, the predicted noise levels associated with the proposed operating turbines will be within best practice noise limits recommended in Irish guidance, therefore it is not considered that a significant operation noise effect will be associated with the Gathabawn Wind Farm. If mitigation is required, reduced sound power modes can be deployed using the turbine control software to reduce noise impact at specified locations.

In summary, it is evaluated that the noise and vibration impact of the Gathabawn Wind Farm, both alone and cumulatively with Other Elements of the Whole Project and cumulatively with Other Projects, will be Not Significant in the context of current national guidance.

EIAR 10.7 Glossary, List of Abbreviations**Glossary of Terms**

Term	Definition
A – Weighting	The “A” suffix denotes the fact that the sound levels have been “A-weighted” in order to account for the non-linear nature of human hearing.
Amplitude Modulation	Periodic fluctuations in the level of audible noise from a wind turbine (or wind turbines), the frequency of the fluctuations being related to the blade passing frequency (BPF) of the turbine rotor(s)
Background Noise	The noise level rarely fallen below in any given location over any given time period, often classed according to day time, evening or night time periods. The $L_{A90,10min}$ is the parameter that is used to define the background noise level in this instance. L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.
Gathabawn Wind Farm Project	Gathabawn Wind Farm including 12 No. turbines, turbine foundations and hardstanding areas, Wind Farm Site Roads, Internal Wind Farm Cabling, Wind Farm Control Buildings, Site Entrances, ancillary works at and for the Wind Farm, along with the Internal Cable Link, Parksgrove Substation and ancillary works, and Gathabawn Grid Connection and grid connection works to the Eirgrid Ballyragget Substation.
dB (decibel)	The unit normally employed to measure the magnitude of sound. It is defined as 20 times the logarithm of the ratio between the RMS pressure of the sound field and the reference pressure of 20 micro-pascals (20 μ Pa).
dB(A)	An ‘A-weighted decibel’ – a measure of the overall noise level of sound across the audible frequency range (20 Hz – 20 kHz) with A-frequency weighting (i.e. A – Weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Hub Height Wind Speed	The wind speed at the centre of the turbine rotor.
Hertz (Hz)	The unit of sound frequency in cycles per second.
$L_{Aeq,T}$	This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T). The closer the L_{Aeq} value is to either the L_{AF10} or L_{AF90} value indicates the relative impact of the intermittent sources and their contribution. The relative spread between the values determines the impact of intermittent sources such as traffic on the background.
L_{A90}	Refers to those A-weighted noise levels in the lower 90 percentile of the sampling interval; it is the level which is exceeded for 90% of the measurement period. It will therefore exclude the intermittent features of traffic and is used to estimate a background level. Measured using the “Fast” time weighting.
L_{den}	Refers to the L_{Aeq} noise levels over a whole day, but with a penalty of 10 dB(A) for night-time noise (23:00-07:00) and 5 dB(A) for evening noise (19:00-23:00), also known as the day evening night noise indicator.
Low Frequency Noise	LFN - noise which is dominated by frequency components towards the lower end of the frequency spectrum.

Term	Definition
Noise	Sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
Noise Sensitive Location (NSL)	Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
octave band	A frequency interval, the upper limit of which is twice that of the lower limit. For example, the 1,000Hz octave band contains acoustical energy between 707Hz and 1,414Hz. The centre frequencies used for the designation of octave bands are defined in ISO and ANSI standards.
Pascal (Pa)	Pascal is a unit of pressure and so sound pressures are measured in Pascals.
Sound Power Level (L_W)	The sound power level radiated by a source is defined as: $L_W = 10 \log_{10} \left(\frac{W}{W_0} \right) dB$ where W is the acoustic power of the source in Watts (W) and W₀ is a reference sound power chosen in air to be 10⁻¹² W.
Sound Pressure Level (L_P)	The sound pressure level at a point is defined: $L_P = 20 \log_{10} \left(\frac{P}{P_0} \right) dB$ where P is the sound pressure and P₀ is a reference pressure for propagation of sound in air and has a value of 2x10⁻⁵Pa.
Tonal	Sounds which cover a range of only a few Hz which contains a clearly audible tone i.e. distinguishable, discrete or continuous noise (whine, hiss, screech, or hum etc.) are referred to as being 'tonal'.
10 Minute Average Wind Speed (m/s)	The wind speed measured by an anemometer at a specified height above ground level, averaged over a 10-minute period.
Wind Shear	The increase of wind speed with height above ground.

List of Abbreviations

Abbreviation	Full Term
AM	Amplitude Modulation
CNT	Construction Noise Threshold
EIA	Environmental Impact Assessment
HGV	Heavy Goods Vehicle
IOA	Institute of Acoustics
NSL	Noise Sensitive Location
OAM	Other Amplitude Modulation
SEL	Sound Exposure Level

EIAR 10.8 Reference List for Noise & Vibration

Berglund, B. and Lindvall, T. (1995) *Community Noise*, World Health Organization.

British Standards Institute (1993) *BS 7385-2:1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibrations*.

British Standards Institute (2014a) *BS 5228-1:2009+A1:2014 Code of Practice for noise and vibration control of construction and open sites – Part 1: Noise*.

British Standards Institute (2014b) *BS 5228-2:2009+A:2014 Code of Practice for noise and vibration control from construction and open sites – Part 2: Vibration*.

Environmental Protection Agency (2011) *Guidance Note on Noise Assessment of Wind Turbine Operations at EPA Licenced Sites (NG3)*.

Environmental Protection Agency (2016) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*.

Environmental Protection Agency (2022) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*.

Evans, T., Cooper, J. and Lenchine, V. (2013) *Infrasound levels near Wind Farms and in other environments*, South Australian Environment Protection Agency.

Germany, State Institute for the Environment, Measurements and Nature Conservation (2016) *Low-frequency noise incl. infrasound from wind turbines and other sources*, Karlsruhe: LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg.

Highways England (2020) *Design Manual for Roads and Bridges Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2*, Highways England, Transport Scotland, Welsh Government and Department of Infrastructure.

Houses of the Oireachtas (2025) *Wind Energy Development Guidelines Dáil Éireann Debate, Thursday – 19 June 2025*, available: <https://www.oireachtas.ie/en/debates/question/2025-06-19/308/>.

Institute of Acoustics (2009) 'Prediction and assessment of wind turbine noise', *Acoustics Bulletin March-April 2009*, 34(2).

Institute of Acoustics (2013) *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise*.

Institute of Acoustics (2014) *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise Supplementary Guidance Note 2: Data Processing & Derivation of ETSU-R-97 Background Curves*.

Institute of Acoustics (2016) *A Method for Rating Amplitude Modulation in Wind Turbine Noise*, IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group.

Institute of Acoustics (2024) *Institute of Acoustics Statement in Respect of Wind Farm Noise Assessment*, available: <https://www.ioa.org.uk/sites/default/files/IOA%20Statement%20-%20Wind%20Farm%20Noise%20Assessment%20Dec%202024.pdf>.

International Organization for Standardization (2024) *ISO 9613-2:2024 Acoustics – Attenuation of sound during propagation outdoors Part 2: Engineering method for the prediction of sound pressure levels outdoors*.

Ireland, Department of the Environment, Heritage and Local Government (2006) *Wind Energy Development Guidelines*.

Moorhouse, A. T., Hayes, M., von Hunerbein, S. and Piper, B. (2007) *Research into aerodynamic modulation of wind turbine noise: final report*, Department of Environmental, Food and Rural Affairs, Department of Business, Enterprise and Regulatory Reform, Department of Communities and Local Government.

National Roads Authority (2014) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*.

Snow, D. (1997) *Low frequency noise and vibrations measurements at a modern wind farm*.

United Kingdom, Department of Trade and Industry (1996) *Energy Technology Support Unit ETSU-R-97 The Assessment and Rating of Noise from Wind Farms*.

United Kingdom, Department of Trade and Industry (2006) *The Measurement of Low Frequency Noise at Three UK Wind Farms*.

United Kingdom, Health Protection Agency (2010) *Health Effects of Exposure to Ultrasound and Infrasound – Report of the independent Advisory Group on Non-Ionising Radiation*.

Von Hunerbein, S., King, A., Piper, B. and Cand, M. (2013) *Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect*, RenewableUK.

Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause & Effect

World Health Organization (2018) *Environmental Noise Guidelines for the European Region*.

EIAR 10.9 List of FiguresFIGURES (overleaf)

Figure 10.1	Determining the Study Area for Operational Noise
Figure 10.2	Noise Sensitive Locations
Figure 10.3	Noise Monitoring Locations
Figure 10.4	Noise Prediction Model Results (Noise Contour Map)
Figure 10.5	Substation and nearby NSLs
Figure 10.6	Construction Phase Noise Sources
Figure 10.7.1	Other Projects Scoped-In to the Noise & Vibration Cumulative Evaluations
Figure 10.7.2	Other Projects Scoped-In to the Noise & Vibration Cumulative Evaluations

EIAR 10.10 List of AppendicesAPPENDICES (overleaf)

Appendix 10.1	Methodology for the evaluation of Noise – Construction Phase
Appendix 10.2	Methodology for the evaluation of Noise– Operational Phase
Appendix 10.3	Methodology for the evaluation of Vibration
Appendix 10.4	Background Noise Measurements
Appendix 10.5	Calibration Certificates
Appendix 10.6	Construction Phase Noise Sources

List of Figures

-  Proposed Gathabawn Windfarm
-  Proposed Gathabawn Turbines
-  Cumulative 35 dB L_{A90} contour
-  Noise Sensitive Locations (NSLs)
- H6 NSLs Identification

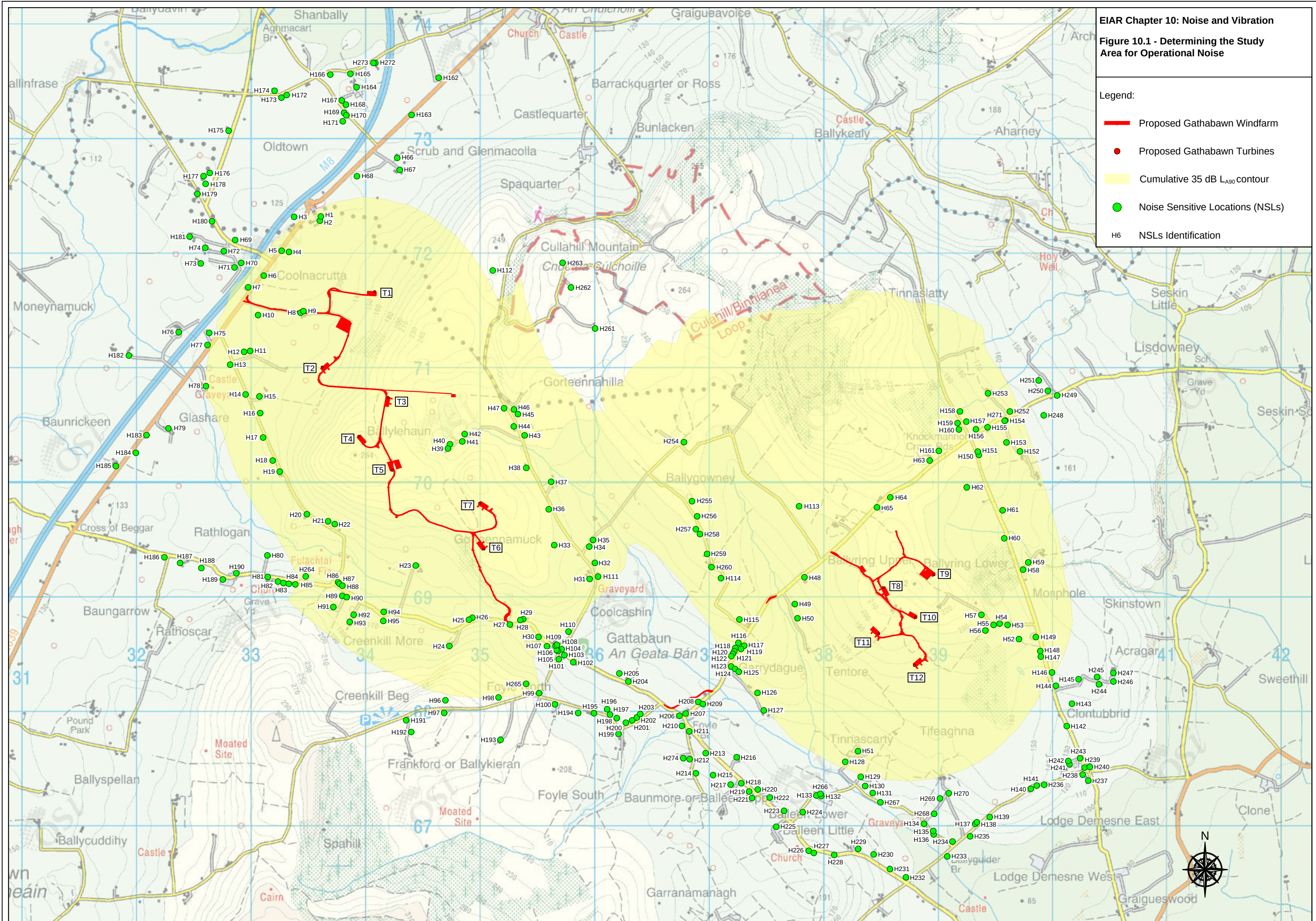


Figure 10.2 - Noise Sensitive Locations

Legend:

- Proposed Gathabawn Windfarm
- Proposed Gathabawn Turbines
- - - Candidate Gathabawn Grid Connection
- Noise Sensitive Locations (NSLs)
- H6 NSLs Identification
- Gathabawn Looped Walk

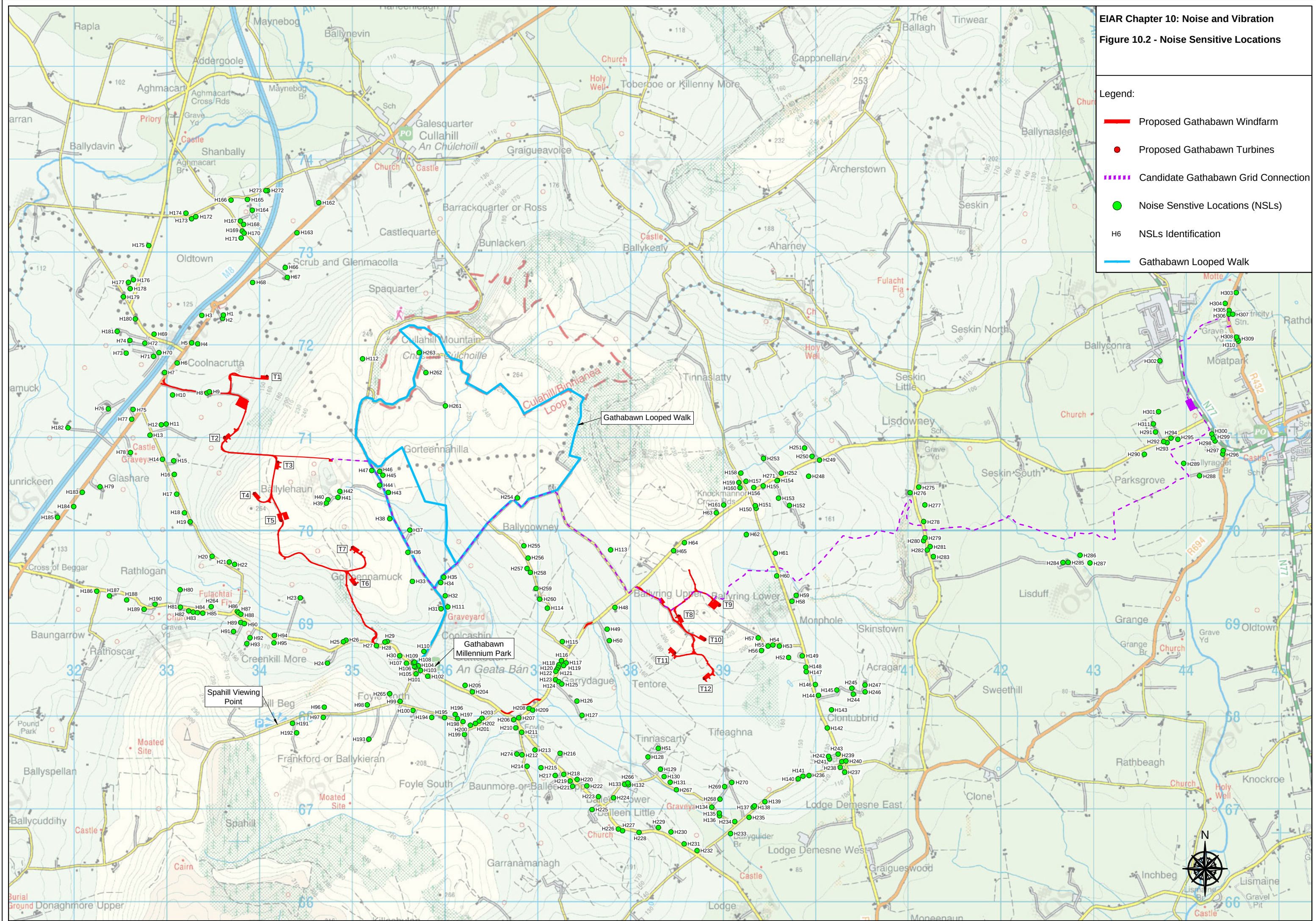


Figure 10.3 - Noise Monitoring Locations

Legend:

- Proposed Gathabawn Windfarm
- Proposed Gathabawn Turbines
- Noise Sensitive Locations (NSLs)
- H6 NSLs Identification
- ▲ Noise Monitoring Locations
- NML2 Noise Monitoring Identification

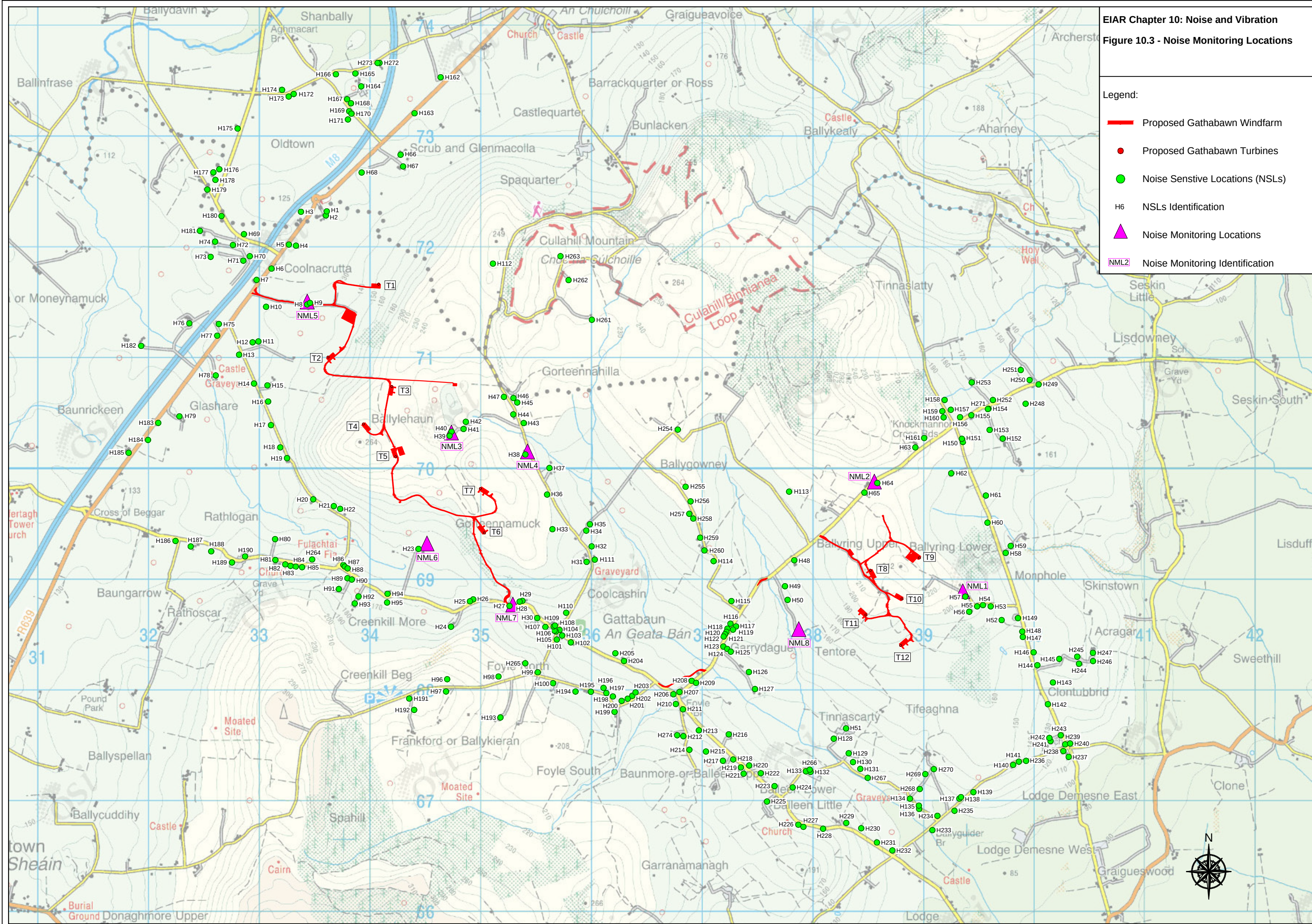
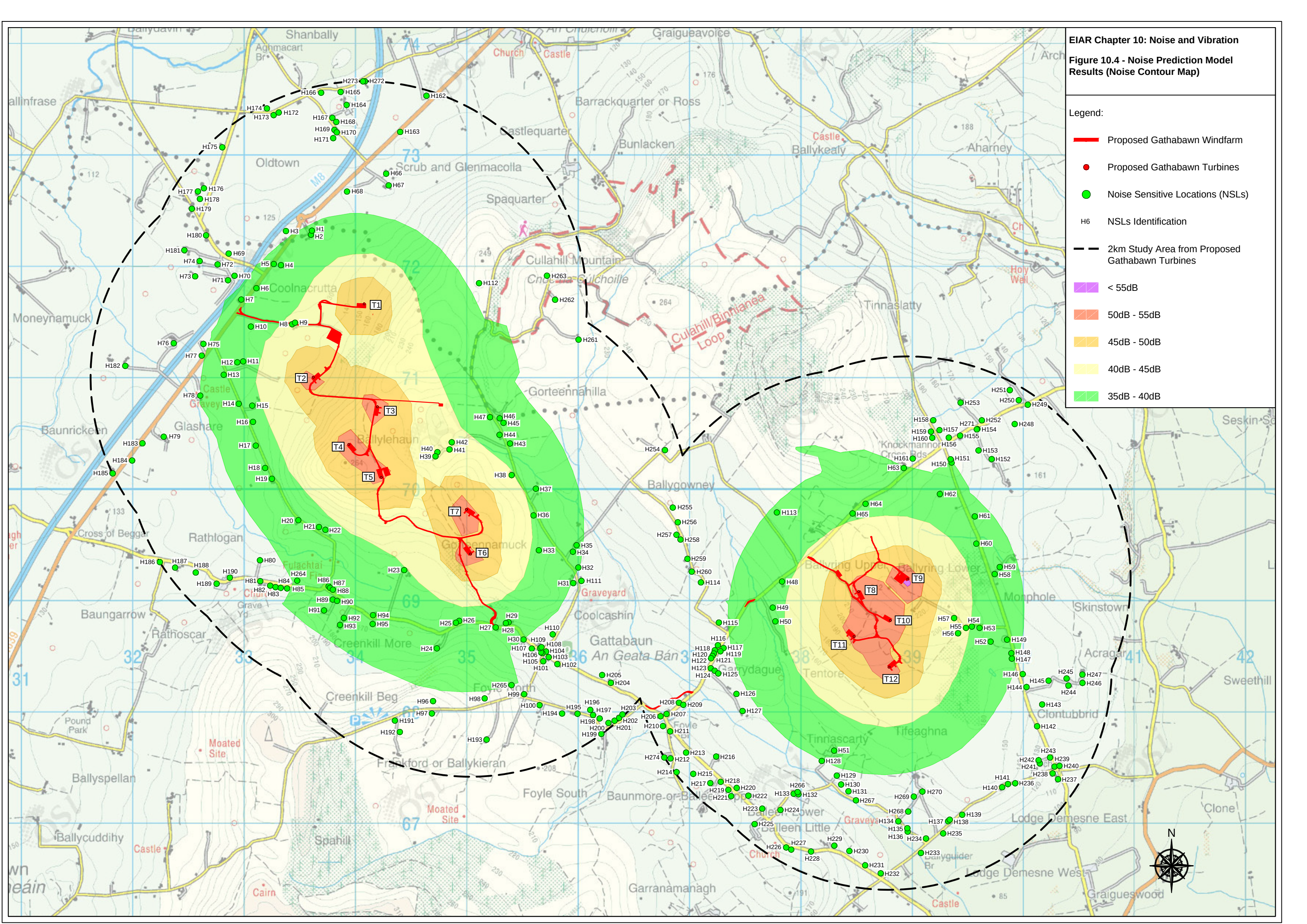


Figure 10.4 - Noise Prediction Model Results (Noise Contour Map)

Legend:

- Proposed Gathabawn Windfarm
- Proposed Gathabawn Turbines
- Noise Sensitive Locations (NSLs)
- NSLs Identification
- 2km Study Area from Proposed Gathabawn Turbines
- < 55dB
- 50dB - 55dB
- 45dB - 50dB
- 40dB - 45dB
- 35dB - 40dB



Ballyconra

Moatpark

R432

Parksgrove Substation

H301

H311

H291

H294

H292

H293

H290

H295

H298

H300

H299

H297

H296

H289

H288

PO

Castle

Parksgrove

Legend:

----- Candidate Gathabawn Grid Connection

■ Parksgrove Substation

● Noise Sensitive Locations (NSLs)

H6 NSLs Identification

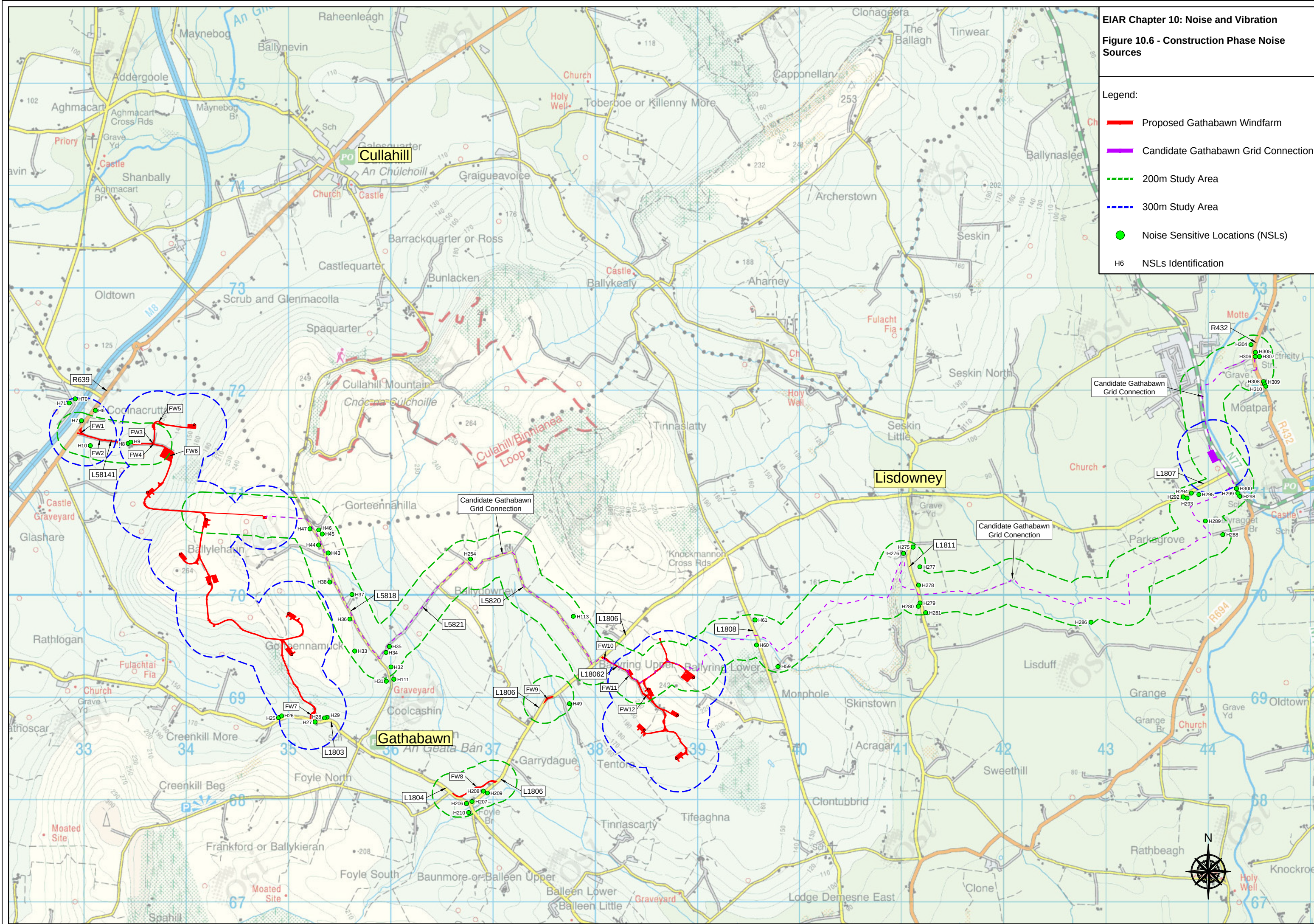


ElAR Chapter 10: Noise and Vibration

Figure 10.6 - Construction Phase Noise Sources

Legend:

- Proposed Gathabawn Windfarm
- Candidate Gathabawn Grid Connection
- 200m Study Area
- 300m Study Area
- Noise Sensitive Locations (NSLs)
- NSLs Identification



Appendix to Chapter 10: Noise and Vibration

Appendix 10.1: Methodology for the evaluation of Noise - Construction Phase

Contents

A10.1	Methodology for the evaluation of Noise – Construction Phase	2
A10.1.1	Guidance Documents	2
A10.1.2	Overview of methodology process	2
A10.1.3	Guidance on Construction Phase Noise	3

A10.1 Methodology for the evaluation of Noise – Construction Phase

A10.1.1 Guidance Documents

The assessment of construction noise impacts for the proposed development have been undertaken with reference to the following guidance documents relating to environmental noise and vibration::

- British Standard Institute (BSI) British Standard (BS) 5228-1:2009 +A1:2014 Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228–1) (BSI, 2014a);
- Transport Infrastructure Ireland (TII) (previously National Roads Authority (NRA)) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (hereafter referred to as the TII Noise Guidelines 2014) (NRA, 2014);
- United Kingdom Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as DMRB Noise and Vibration) (UKHA, 2020);

In addition to specific noise guidance documents outlined above, the Environmental Protection Agency (EPA) *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA, 2022) was considered and consulted in the preparation of this Chapter.

A10.1.2 Overview of methodology process

The assessment methodology undertaken is summarised as follows:

Review of appropriate guidance to identify appropriate noise criteria for both the construction, operational and decommissioning phases.

- Characterise the receiving environment through baseline noise surveys at various Noise Sensitive Locations (NSLs) surrounding the proposed development.
- Undertake predictive calculations to assess the potential impacts associated with the construction/decommissioning phase of the proposed development at NSLs.
- Undertake predictive calculations to assess the potential impacts associated with the operational of the proposed turbines and substation at NSLs.
- Specify mitigation measures to reduce, where necessary, the identified potential outward impacts relating to noise from the proposed development.
- Describe the significance of the residual noise effects associated with the proposed development.

A10.1.2.1 EPA Description of Effects

The significance of effects of the proposed development shall be described in accordance with the EPA guidance document *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (EIAR), (2022). Details of the methodology for describing the significance of the effects are provided in EIAR Chapter 1 – Introduction and Policy Context. The effects associated with the proposed development are described in the relevant sections of this chapter in accordance with the EPA guidance set out in Chapter 1 (Introduction and Policy Context).

A10.1.2.2 Guidance Documents and Assessment Criteria

The following sections review best practice guidance that is commonly adopted in relation to developments such as the one under consideration here.

A10.1.3 Guidance on Construction Phase Noise

There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and may consider noise limits at their discretion.

In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the BS5528-1 (BSI, 2014a).

The approach adopted here calls for the designation of a Noise Sensitive Location (NSL) into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. A threshold noise value is applied to each category. Exceedances (construction noise only) of the threshold value, at the facade of a noise-sensitive location (NSL) during construction, indicates a potential significant noise impact associated with the construction activities. The threshold values recommended by BS5228-1 (BSI, 2014a) are depicted in Table 1.

Assessment category and threshold value period (T)	Threshold value, in $L_{Aeq,T}$ dB		
	Category A ^{Note A}	Category B ^{Note B}	Category C ^{Note C}
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends ^{Note D}	55	60	65
Daytime (07:00 – 19:00hrs) Saturdays (08:00 – 13:00hrs)	65	70	75

Table 1 Example Threshold for Potential Significant Effect at Dwellings

- Note A Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
- Note B Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
- Note C Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
- Note D 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

This assessment method is valid for residential properties.

The following methodology was followed to identify the Threshold values for the Nighttime/Evening time/Daytime for the Noise Sensitive Locations (NSLs) in relation to the proposed windfarm site: For each period (i.e. daytime, evening and nighttime) the ambient noise level at the 3 No. NSLs where the ambient/baseline noise was monitored, was determined and rounded to the nearest 5dB. The resulting values indicate that the ambient noise levels are less than the values in Baseline Noise Level Category A as detailed in Table 1 above. Therefore the Construction Noise Threshold (CNT) values in Category A are the appropriate values in terms of construction noise levels at Noise Sensitive Locations. See Table 2 below.

Period	Baseline Noise Category	Construction Noise Threshold Value $L_{Aeq,1hr}$ (dB)
Night time (23:00 to 07:00hrs)	A	45
Evening (19:00 to 23:00hrs)	A	55
Daytime (07:00 – 19:00) Saturdays (08:00 – 13:00)	A	65

Table 2 Baseline Noise Categories and associated Construction Noise Thresholds (CNTs)

Based on the above, the construction noise threshold value of 65 dB $L_{Aeq,1hr}$ is proposed for the site because the planned hours of work on site during the Daytime on weekdays are between 07:00 hrs and 19:00 hrs.

A10.1.3.1.1 Guidance on Noise from additional traffic on Public Roads during the Construction Phase5

There are no specific guidelines or limits relating to traffic related sources of noise along the local or surrounding roads.

Given that traffic from the development will make use of existing roads already carrying traffic volumes, it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development.

For the assessment of potential noise impacts from construction related traffic along public roads, it is proposed to adopt guidance from Design Manual for Roads and Bridges (DMRB), Highways England, Transport Scotland, The Welsh Government and The Department of Infrastructure 2020.

Table 4, taken from DMRB offers guidance as to the likely short term impact associated with any change in traffic noise level.

Change in Sound Level (dB L _{A10})	Magnitude of Impact	EPA Significance of Effect
Less than 1 dB	Negligible	Imperceptible
1 – 2.9	Minor	Not Significant
3 – 4.9	Moderate	Slight, Moderate
5+	Major	Significant

Table 3 ***Likely Short Term Effects Associated with Change in Traffic Noise Level (Source Design Manual for Roads and Bridges (DMRB), 2020).***

The DMRB guidance will be used to assess the predicted increases in traffic levels on public roads associated with the Proposed Project and comment on the short-term impacts during the construction phase. Where a major or moderate impact is identified due to the change in traffic noise level, reference will be made to the overall predicted noise level from construction traffic in the context of the construction noise criteria outlined in Table 2 above.

A10.1.3.1.2 Guidance on Construction Noise Calculations

A variety of items of plant will be used for the purposes of site preparation, construction, and site works. There will be vehicular movements to and from the site that will make use of existing roads. There is the potential for generation of significant levels of noise from these activities.

Due to the nature of construction activities, it is difficult to calculate the actual magnitude of emissions to the local environment in the absence of a detailed construction programme. The standard best practice approach is to predict typical noise levels at the Noise Sensitive Locations (NSLs) using guidance set out in BS5228-1 (BSI, 2014a). Construction noise predictions have been carried out using guidance set out in BS5228-1 (BSI, 2014a).

The methodology adopted for the assessment of construction noise is to analyse the various elements of the construction phase in isolation. For each element, the typical construction noise sources are assessed along with typical sound pressure levels and spectra from BS5228-1 (BSI, 2014a) at various distances from these works.

A10.1.3.1.3 Interpretation of the Construction Noise Threshold (CNT)

Interpretation of the Construction Noise Threshold (CNT)

In order to assist with interpretation of Construction Noise Thresholds (CNTs), Table 3 includes guidance as to the likely magnitude of impact associated with construction activities, relative to the CNT. This guidance is derived from Table 3.16 of the Design Manual for Roads and Bridges (DMRB): Noise and Vibration and adapted to include the relevant significance effects from the EPA Guidelines (EPA, 2022).

Construction Noise Level	Magnitude of Impact (DMRB)	EPA Significance of Effect
Below or equal Baseline Noise Level	Negligible	Not Significant
Above Baseline and below or equal to CNT	Minor	Slight – Moderate
Above threshold and below or equal to CNT + 5dB	Moderate	Moderate – Significant
Above CNT + 5dB	Major	Significant – Very Significant

Table 4 *Description of the magnitude of impacts. Adapted from Design Manual for Roads and Bridges (DMRB) Table 3.16*

Consideration of Duration When Assessing Effects

Section 3.19 of DMRB states that construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or
- A total number of days exceeding 40 in any 6 consecutive months.

The DMRB guidance will be used to assess the predicted increases in traffic noise levels on public roads associated with the proposed development and comment on the likely short-term impacts during the construction phase (and by extension the decommissioning phase).

A10.1.3.2 Guidance on Decommissioning Phase Noise

The guidance for construction noise assessment described above also applies to the decommissioning phase of the project because the sources of noise emissions are similar for both phases, although the activities and works during decommissioning are much reduced compared to the construction phase.

Appendix to Chapter 10: Noise & Vibration

Appendix 10.2: Methodology for the evaluation of Noise – Operational Phase

Contents

A10.2	Methodology for the evaluation of Noise – Operational Phase.....	2
A10.2.1	Guidance on Operational Phase Noise from Wind Turbines	2
A10.2.2	Noise Modelling software used for the calculations	8
A10.2.3	Consideration of Wind Direction on Noise Propagation	8

A10.2 Methodology for the evaluation of Noise – Operational Phase

A10.2.1 Guidance on Operational Phase Noise from Wind Turbines

The operational noise assessment documented in this chapter is based on guidance in relation to acceptable levels of noise from wind farms as contained in the document *Wind Energy Development Guidelines* for Planning Authorities published by the Department of the Environment, Heritage and Local Government in 2006. These guidelines are in turn based on detailed recommendations set out in the Department of Trade and Industry (UK) Energy Technology Support Unit (ETSU) publication *The Assessment and Rating of Noise from Wind Farms* (1996). The ETSU document has been used to supplement the guidance contained within the *Wind Energy Development Guidelines* publication where necessary.

- Department of the Environment, Heritage, and Local Government (DEHLG) *Wind Energy Development Guidelines* (hereafter referred to as WEDG (DEHLG, 2006);
- Department of Trade, and Industry (UK) Energy Technology Support Unit (ETSU) ETSU-R-97 *The Assessment and Rating of Noise from Wind Farms* (hereafter referred to as ETSU-R-97) (ETSU, 1996);
- Department for Energy Security and Net Zero (DESNZ) *Assessment and Rating of Wind Turbine Noise* (DESNZ, 2026);
- Institute of Acoustics (IOA) *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (hereafter referred to as IOA GPG) (IOA, 2013);
- International Organization for Standardization (ISO) 9613-2:2024 *Acoustics – Attenuation of sound during propagation outdoors - Part 2: Engineering method for the prediction of sound pressure levels outdoors* (hereafter referred to as ISO 9613–2) (ISO 2024).

A10.2.1.1 The Assessment and Rating of Noise from Wind Farms – ETSU-R-97

As stated previously the core of the noise guidance contained within the *Wind Energy Development Guidelines* is based on the 1996 ETSU publication *The Assessment and Rating of Noise from Wind Farms* (ETSU-R-97).

ETSU-R-97 calls for the control of operational wind turbine noise by the application of noise limits at the nearest noise sensitive locations (NSLs). ETSU-R-97 considers that absolute noise limits applied at all wind speeds are not suited to wind turbine developments and recommends that operational noise limits should be set relative to the existing background noise levels at NSLs. A critical aspect of the noise assessment of wind energy proposals relates to the identification of baseline noise levels through on-site baseline noise surveys.

ETSU-R-97 states on page 58, “...absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question...”. Therefore, the noise contribution from all wind turbine development in the area should be included in the assessment.

The ETSU-R-97 guidance allows for a higher level of turbine noise operation at properties that have an involvement in the development, both as a higher fixed level of 45 dB L_{A90} and/or a higher level above the prevailing background noise level.

A10.2.1.2 Wind Energy Development Guidelines for Planning Authorities

Section 5.6 of the Wind Energy Development Guidelines for Planning Authorities published by the Department of the Environment, Heritage and Local Government (2006) addresses noise and outlines the appropriate noise criteria in relation to wind farm developments.

The following extracts from this document should be considered:

“An appropriate balance must be achieved between power generation and noise impact.”

While this comment is noted it should be stated that the Guidelines give no specific advice in relation to what constitutes an ‘appropriate balance’. In the absence of this, guidance will be taken from alternative and appropriate publications.

“In the case of wind energy development, a noise sensitive location includes any occupied house, hostel, health building or place of worship and may include areas of particular scenic quality or special recreational importance. Noise limits should apply only to those areas frequently used for relaxation of activities for which a quiet environment is highly desirable. Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed.”

As can be seen from the calculations presented later in this chapter the various issues identified in this extract have been incorporated into our assessment.

“In general, a lower fixed limit of 45dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.”

This represents the commonly adopted daytime noise criterion curve in relation to wind farm developments. However, an important caveat should be noted as detailed in the following extract.

“However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30dB(A), it is recommended that the daytime level of the $L_{A90, 10min}$ of the wind energy development be limited to an absolute level within the range of 35 – 40dB(A).”

In relation to night time periods the following guidance is given:

“A fixed limit of 43dB(A) will protect sleep inside properties during the night.”

This limit is defined in terms of the $L_{A90, 10min}$ parameter. This represents the commonly adopted night-time noise criterion curve in relation to wind farm developments.

In summary, the Wind Energy Development Guidelines outlines the following guidance to identify appropriate wind turbine noise criteria curves at noise sensitive locations:

- An appropriate absolute limit level in the range of 35 – 40 dB $L_{A90, 10min}$ for quiet daytime environments with background noise levels of less than 30 dB $L_{A90, 10min}$;
- 45 dB $L_{A90, 10min}$ or a maximum increase of 5 dB above background noise (whichever is higher), for daytime environments with background noise levels of not less than 30 dB $L_{A90, 10min}$ and;
- 43 dB $L_{A90, 10min}$ for night time periods.

While the caveat of an increase of 5dB(A) above background for night-time operation is not explicit within the current guidance it is commonly applied in noise assessments prepared and is detailed in numerous examples of planning conditions issued by local authorities and An Bord Pleanála.

A10.2.1.3 Key updates introduced by the Assessment and Rating of Wind Turbine Noise – ARWTN

The Assessment and Rating of Wind Turbine Noise (ARWTN) (2026) replaces ETSU-R-97 and provides updated technical guidance for the assessment and control of operational wind turbine noise. However, as the operational noise assessment for the Proposed Project is based on the methodology set out in the Wind Energy Development Guidelines (WEDG) 2006, the ARWTN document is reviewed here primarily to identify relevant updates and clarifications. The ARWTN retains the fundamental principles of ETSU-R-97, including the assessment of wind turbine noise at noise sensitive receptors, the use of background noise measurements to inform noise limits, and the requirement to consider cumulative noise from all acoustically relevant wind energy developments.

The guidance increases emphasis on the assessment of cumulative operational noise and confirms that the combined contribution from existing, permitted and proposed wind energy developments should be considered where relevant. ARWTN also provides updated procedures for operational compliance monitoring, including refined methodologies for the assessment of tonal noise and amplitude modulation (AM). These characteristics are intended to be addressed through post-construction compliance monitoring and planning conditions, rather than through the application of penalties at the planning assessment stage unless there is clear evidence that such characteristics are likely to occur.

A notable update within ARWTN is the confirmation that certain acoustical issues do not require specific assessment during the planning process: namely infrasound, ground-borne vibration and low-frequency noise. The guidance confirms that infrasound generated by modern wind turbines is below the threshold of perception at typical receptor distances, that ground-borne vibration levels are significantly below those detectable by humans, and that low-frequency noise is adequately controlled through the standard A-weighted noise assessment criteria and tonal assessment procedures. Consequently, assessment of these characteristics is scoped out of the operational noise assessment for the Proposed Project.

A10.2.1.4 Future Potential Wind Energy Development Guidance Changes

In December 2019, the Draft Revised Wind Energy Development Guidelines December 2019 (Draft WEDG) were published for consultation and therefore have yet to be finalised. It is important to note that as part of the public consultation several concerns in relation to the proposed approach to operational noise assessment have been expressed by various parties and it is the opinion of the authors of this assessment that the Draft WEDG document does not outline a best practice approach in terms of the assessment of wind turbine noise. Specific concerns expressed by a cross party group of interested professionals can be reviewed at:

<https://pub.ioa.org.uk/blogs/wind-energy-development-guidelines-wedg-consultation-irish-department-housing-planning-community>

The following statement is of note from the above submission:

“a number of acousticians working in the field have raised serious concerns over the significant amount of technical errors, ambiguities and inconsistencies in the content of the draft WEDG and these were highlighted during the consultation process by a group of acousticians”

Therefore, in line with best practice, the assessment presented in this EIAR is based on the current guidance outlined in the Wind Energy Development Guidelines for Planning Authorities (2006) and has been supplemented with guidance from ETSU-R-97 and the IOA GPG and its Supplementary Guidance Notes (SGNs).

If updated Wind Energy Guidelines are published during the application process for the Proposed Development it is anticipated that any relevant changes affecting the noise will be addressed through an appropriate planning condition, or where a supplementary assessment is necessary, through provision of

additional information. It should be noted, modern wind turbines can be controlled to within permitted operational noise levels should the noise criteria change materially in the new Wind Energy Guidelines.

A10.2.1.5 World Health Organization (WHO) Noise Guidelines for the European Region

The WHO Environmental Noise Guidelines for the European Region (2018) provide guidance on protecting human health from exposure to environmental noise. They set health-based recommendations based on average environmental noise exposure of several sources of environmental noise, including wind turbine noise. Recommendations are rated as either ‘strong’ or ‘conditional’. A strong recommendation, “*can be adopted as policy in most situations*” whereas a conditional recommendation, “*requires a policy-making process with substantial debate and involvement of various stakeholders. There is less certainty of its efficacy owing to lower quality of evidence of a net benefit, opposing values and preferences of individuals and populations affected or the high resource implications of the recommendation, meaning there may be circumstances or settings in which it will not apply*”.

The objective of the WHO Environmental Noise Guidelines for the European Region is to provide recommendations for protecting human health from exposure to environmental noise from transportation, wind farm and leisure sources of noise. The guidelines present recommendations for each noise source type in terms of L_{den} and L_{night} levels above which there is risk of adverse health risks.

In relation to wind turbine noise, the WHO Guideline Development Group (GDG) state the following:

“For average noise exposure, the GDG conditionally recommends reducing noise levels produced by wind turbines below 45 dB L_{den} , as wind turbine noise above this level is associated with adverse health effects.

No recommendation is made for average night noise exposure L_{night} of wind turbines. The quality of evidence of night-time exposure to wind turbine noise is too low to allow a recommendation.

To reduce health effects, the GDG conditionally recommends that policy-makers implement suitable measures to reduce noise exposure from wind turbines in the population exposed to levels above the guideline values for average noise exposure. No evidence is available, however, to facilitate the recommendation of one particular type of intervention over another.”

As stated within the same WHO document, the quality of evidence used for this research is stated as being ‘Low’, the recommendations are therefore conditional.

The WHO Environmental Noise Guidelines aim to support the legislation and policy-making process on local, national, and international level, thus shall be considered by Irish policy makers for any future revisions of Irish National Guidelines.

There is potential increased uncertainty due to the parameter used by the WHO for assessment of exposure (i.e., L_{den}), which it is acknowledged may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes, as stated below, from within the WHO Environmental Noise Guidelines:

“Even though correlations between noise indicators tend to be high (especially between L_{Aeq} -like indicators) and conversions between indicators do not normally influence the correlations between the noise indicator and a particular health effect, important assumptions remain when exposure to wind turbine noise in L_{den} is converted from original sound pressure level values. The conversion requires, as variable, the statistical distribution of annual wind speed at a particular height, which depends on the type of wind turbine and meteorological conditions at a particular geographical location. Such input variables may not be directly applicable for use in other sites. They are sometimes used without specific validation for a particular area, however, because of practical limitations or lack of data and resources.

This can lead to increased uncertainty in the assessment of the relationship between wind turbine noise exposure and health outcomes. Based on all these factors, it may be concluded that the acoustical description of wind turbine noise by means of L_{den} or L_{night} may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.”

...Further work is required to assess fully the benefits and harms of exposure to environmental noise from wind turbines and to clarify whether the potential benefits associated with reducing exposure to environmental noise for individuals living in the vicinity of wind turbines outweigh the impact on the development of renewable energy policies in the WHO European Region.”

It is considered that the conditional WHO recommended average noise exposure level (i.e. 45 dB L_{den}) if applied, as target noise criteria for an existing or proposed wind turbine development in Ireland, should be done with caution. The conditional WHO recommendation for average noise exposure level (i.e., 45 dB L_{den}) may be a poor characterisation of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes.

A10.2.1.6 Institute of Acoustics Good Practice Guide

The original ETSU-R-97 concepts underwent a thorough standardisation and modernisation in 2013 with the Institute of Acoustics (IOA) publication of A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (IOA GPG) including 6 Supplementary Guidance Notes. These documents bring together the combined experience of acoustic consultants in the UK and Ireland in the application of the assessment methods. Numerous improvements in the accuracy and robustness are described the treatment of wind shear and the general adaptation to larger wind turbines. The guidance contained within IOA GPG, and its Supplementary Guidance Notes (SGNs) are considered to represent best practice and have been adopted for this assessment.

A10.2.1.7 Good Practice for Baseline Noise Measurements

The IOA GPG states, that at a minimum continuous baseline noise monitoring should be carried out at the nearest noise sensitive locations for typically a two-week period and should capture a representative sample of wind speeds in the area (i.e., cut in speeds to wind speed of rated sound power of the proposed turbine). Background noise measurements (i.e., $L_{A90,10min}$) should be related to wind speed measurements that are collated at the site of the wind turbine development. Regression analysis is then conducted on the data sets to derive background noise levels at various wind speeds to establish the appropriate day and night time noise criterion curves.

A10.2.1.8 Good Practice for Operational Noise Predictions

Operational noise emissions associated with the wind turbines can be predicted in accordance with ISO 9613: Acoustics – Attenuation of sound outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors (2024). This is a noise prediction standard that considers noise attenuation offered, amongst others, by distance, ground absorption, directivity, and atmospheric absorption. Noise predictions and contours are typically prepared for various wind speeds and the predicted levels are compared against the relevant noise criterion curve to demonstrate compliance with the appropriate noise criteria.

For guidance on the methodology for the background noise survey and operation impact assessment for wind turbine noise, the IOA GPG has been adopted.

Where noise predictions indicate that reductions in noise emissions are required to satisfy any adopted criteria, consideration can be given to detailed downwind analysis and operating turbines in low noise mode, which is typically offered by modern wind turbine units.

The Institute of Acoustics Good Practice Guide (IOA GPG) states that cumulative noise exceedances should be avoided and where existing or permitted development is at the noise limit, any new turbine noise sources should be designed to be 10 dB below the limit value.

Section 5.1 of the relevant IOA GPG states the following:

“5.1.1 ETSU-R-97 states at page 58, “...absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area which contribute to the noise received at the properties in question...”

Also:

5.1.4 During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary.

5.1.5 Equally, in such cases where noise from the proposed wind farm is predicted to be 10 dB greater than that from the existing wind farm (but compliant with ETSU-R-97 in its own right), then a cumulative noise impact assessment would not be necessary.”

A10.2.2 Noise Modelling software used for the calculations

The selected software, DGMR iNoise Enterprise, calculates noise levels in accordance with ISO 9613: *Acoustics – Attenuation of sound outdoors, Part 2: Engineering method for the prediction of sound pressure levels outdoors*, (ISO, 2024).

iNoise is a proprietary noise calculation package for computing noise levels and propagation of noise sources. iNoise calculates noise levels in different ways depending on the selected prediction standard. In general, however, the resultant noise level is calculated considering a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of A-weighted sound power levels (L_{WA});
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver, and
- Attenuation due to atmospheric absorption.

A10.2.3 Consideration of Wind Direction on Noise Propagation

When considering noise impacts of wind turbines, the effects of propagation in different wind directions can be considered. The day to day operations of the proposed windfarm will not result in a worst-case condition of all NSLs being downwind of all turbines at the same time i.e. omni-directional predictions. Therefore, to address this and present a more realistic view, a review of expected noise levels downwind of the turbines has been prepared for various wind directions in accordance with the Institute of Acoustics Good Practice Guidance (IOA GPG).

For any given wind direction, a property can be assigned one of the following classifications in relation to turbine noise propagation:

- Downwind (i.e. $0^\circ \pm 80^\circ$);
- Crosswind (i.e. $90^\circ \pm 10^\circ$ and $270^\circ \pm 10^\circ$);
- Upwind (i.e. $180^\circ \pm 70^\circ$).

Table 1 presents the directivity attenuation factor that has been applied to turbines when considering noise propagation in downwind conditions (full downwind is represented by 0° and full upwind is 180°).

Wind Direction Sector	Degrees ($^\circ$)	Attenuation (dB)
Downwind	280 – 360 & 0 - 80	0
Crosswind	260 – 280 & 80 - 100	2
Upwind	230 - 250	5
	220	5.5
	210	6
	200	6.5
	190	7
	180	7.5

Table 1 Turbine Directivity Attenuation with Consideration of Wind Direction

Appendix to Chapter 10: Noise & Vibration

Appendix 10.3: Methodology for the evaluation of Vibration

Contents

A10.3	Methodology for the evaluation of Vibration.....	2
A10.3.1	Guidance on Construction Phase Vibration	2
A10.3.2	Guidance on Operational Phase Vibration	3

A10.3 Methodology for the evaluation of Vibration

The assessment of impacts for the proposed development have been undertaken with reference to the following guidance documents relating to environmental vibration, which are summarised below:

- BS 5228-2:2009+A:2014 Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as BS 5228–2) (BSI, 2014b);
- BS 7385: 1993 Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (hereafter referred to as BS 7385–2) (BSI, 1993);
- United Kingdom Highways Agency (UKHA) Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration Revision 2 (hereafter referred to as DMRB Noise and Vibration) (UKHA, 2020);
-

In addition to specific vibration guidance documents outlined above, the Environmental Protection Agency (EPA) *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA, 2022) was considered and consulted in the preparation of this Chapter.

The assessment methodology undertaken is summarised as follows:

- Review of appropriate guidance to identify appropriate vibration criteria for both the construction, operational and decommissioning phases.
- Characterise the receiving environment through baseline noise surveys at various Noise Sensitive Locations (NSLs) surrounding the proposed development.
- Undertake predictive calculations to assess the potential impacts associated with the construction/decommissioning phase of the proposed development at NSLs.
- Specify mitigation measures to reduce, where necessary, the identified potential outward impacts relating to vibration from the proposed development.
- Describe the significance of the residual vibration effects associated with the proposed development.

A10.3.1 Guidance on Construction Phase Vibration

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. With respect to this development, the range of relevant criteria used for building protection is expressed in terms of Peak Particle Velocity (PPV) in mm/s.

Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- BS 7385 – Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (BSI, 1993) (BS7385).
- BS 5228-2:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BSI, 2014) (BS5228-2).

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

BS 5228-2 recommends that, for a soundly constructed residential properties and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e., non-structural) damage should be taken as a peak particle velocity (PPV) of 15mm/s for transient vibration at frequencies below 15Hz and 20mm/s at frequencies above than 15Hz. Below these vibration magnitudes minor damage is unlikely, although the standard notes that where there is existing damage these limits may be reduced by up to 50%. In addition,

where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

The Transport Infrastructure Ireland (TII) (formerly National Roads Authority (NRA)) publication Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII, 2014) also contains information on the permissible construction vibration levels during the construction phase as shown in Table 1.

Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
8 mm/s	12.5 mm/s	20 mm/s

Table 1 Allowable Vibration at Sensitive Properties (NRA, 2014)

Following review of the guidance documents set out above, the TII values in Table 1 are considered appropriate for this assessment as they provide more stringent vibration criteria.

A10.3.2 Guidance on Operational Phase Vibration

Vibration generated from the operation of a wind turbine unit will decrease rapidly with distance. Typically, at 100 m from a 1MW turbine unit the level of vibration associated with a turbine is the order of 10^{-5} mm/s.

A report from Germany published by the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in 2016, “low frequency noise incl. infrasound from wind turbines and other sources” conducted vibration measurements study for an operational Nordex N117 – 2.4 MW wind turbine. The report concluded that at distances of less than 300m from the turbine vibration levels had dropped so far that they could no longer be differentiated from the background vibration levels.

The shortest distance from any turbine in the Proposed Development to the nearest Noise Sensitive Location (NSL) is over 500m. At that distance, the level of vibration will be significantly below any thresholds for perceptibility. Therefore, vibration criteria have not been specified for the operational phase of the Proposed Development.

The recent guidance Assessment and Rating of Wind Turbine Noise published by the Department for Energy Security and Net Zero, which replaces the ETSU-R-97 guidance, in Section 1.22 *Ground-borne vibration* states:

The term ground-borne vibration refers to mechanical vibration from the operation of the wind turbine that is directly transferred to and propagates through the ground. Levels of ground-borne vibration from modern upwind turbines are very low and, although ground-borne vibration from wind turbines can be measured at large distances using sensitive equipment, these levels are significantly below the human perception threshold and therefore do not result in adverse effects on human receptors.

There are no other sources likely to give rise to any perceptible vibration at NSLs during the operation of the proposed project. The assessment of operational phase vibration has therefore been scoped out of this assessment.



Trinity
Consultants

 **awnconsulting**

Appendix 10.4: Background Noise Survey

Project Title: Gathabawn Wind Farm, Co Kilkenny

CLIENT

Gathabawn
Windfarm Limited

DOCUMENT REFERENCE

227501.0097NR01

DATE

28 September
2026

DOCUMENT CONTROL SHEET

Document Control Sheet		
Our Reference	227501.0097NR01	
Original Issue Date	27 September 2026	
Client:	Gathabawn Windfarm Limited	
Client Address:	Zetec House, Purcell Inch, Kilkenny	
Revision	Revision Date	Description

Details	Written by	Approved by
Signature		
Name	Mike Simms	Miguel Cartuyvels
Title	Principal Acoustic Consultant	Acoustic Consultant
Date	28 September 2026	

Disclaimer

This report considers the specific instructions and requirements of our client. It is not intended for third-party use or reliance, and no responsibility is accepted for any third party. The provisions in this report apply solely to this project and should not be assumed applicable to other developments without review and modification.



TABLE OF CONTENTS

1. INTRODUCTION	1-2
2. BACKGROUND NOISE SURVEY	2-3
2.1 Measurement Locations	2-3
2.2 Measurement Periods	2-4
2.3 Measurement Procedure	2-5
2.4 Instrumentation.....	2-5
2.5 Rainfall Data	2-5
2.6 Wind Data	2-5
2.6.1 Wind Shear	2-5
2.7 Selection of Measurement Locations and Methodology.....	2-6
2.8 Data Analysis	2-7
2.8.1 Assessment Periods.....	2-7
2.8.2 Atypical Noise Data	2-7
2.9 Derived Background Noise Levels	2-7
APPENDIX A. GLOSSARY OF ACOUSTIC TERMS	A-9
APPENDIX B. INSTALLATION PHOTOGRAPHS	B-10
APPENDIX C. REGRESSION ANALYSIS ON DATA SETS	C-18

LIST OF TABLES

Table 2-1. Coordinates of Noise Monitoring Equipment	2-3
Table 2-2. Measurement periods of Noise Monitoring Equipment	2-4
Table 2-3. Details of Noise Measurement Instrumentation	2-5
Table 2-4. Wind Measurement Location	2-5
Table 2-5. Daytime and Night Periods	2-7
Table 2-6. Derived Background Noise Levels at Assessment Hub Height - Daytime	2-8
Table 2-7. Derived Background Noise Levels at Assessment Hub Height – Night-time	2-8

LIST OF FIGURES

Figure 2-1 - Noise Monitoring Location Selection	2-4
Figure 2-2. Distributions of Wind Speeds and Directions Over the Survey Period	2-6

1. INTRODUCTION

AWN Consulting, a Trinity Consultants Company, were appointed to prepare the noise and vibration EIAR chapter and assessment for the Gathabawn Windfarm, Co. Kilkenny. This report has been prepared to provide details and methodology of the background noise survey undertaken and confirm the derived background noise levels at the various Noise Monitoring Locations (NMLs).

2. BACKGROUND NOISE SURVEY

The noise survey and subsequent data analysis was carried out in accordance with best practice following the guidance contained in the Institute of Acoustics publication *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (May 2013), (IOA GPG).

2.1 Measurement Locations

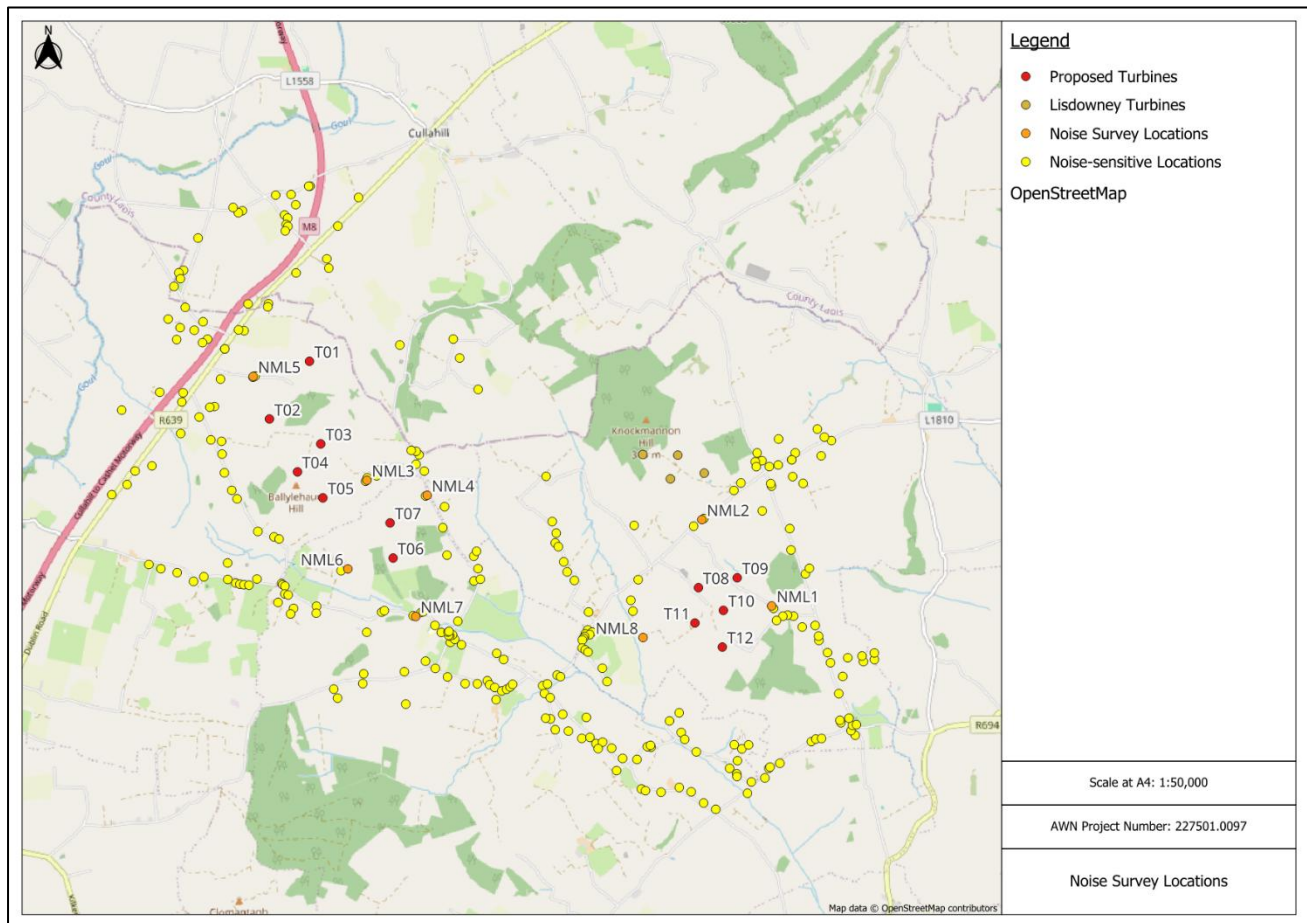
The background noise survey was conducted through installing unattended sound level meters at 8 no. representative locations in the surrounding area. The co-ordinates for selected locations for the noise monitoring locations are outlined in Table 2-1 and identified on a map in Figure 2-1.

Table 2-1. Coordinates of Noise Monitoring Equipment

Location	Coordinates (ITM)	
	Easting	Northing
NML1 (H057)	639,299	668,905
NML2 (H064)	638,502	669,891
NML3 (H040)	634,676	670,340
NML4 (H038)	635,364	670,169
NML5 (H008)	633,377	671,526
NML6 (H023)	634,458	669,328
NML7 (H027)	635,233	668,785
NML8	637,829	668,545

Site visits by survey personnel were carried out during morning and afternoon periods; during these visits, primary noise sources contributing to noise environment were noted as being occasional local traffic noise, birdsongs, wind generated noise and agricultural activity. In respect of night-time periods, when noise due to traffic on local roads, agricultural activities and other sources tend to reduce, there was no indication of any significant local night-time sources of noise at any location. No sources of vibration were noted at any of the survey locations.

Figure 2-1 - Noise Monitoring Location Selection



2.2 Measurement Periods

The periods of noise measurements used in the background noise monitoring assessment are outlined in Table 2-2. The survey was deemed completed when an adequate number of datasets had been measured as recommended in the IOA GPG to determine a suitable representation of the typical background noise.

Table 2-2. Measurement periods of Noise Monitoring Equipment

Location Reference	Survey Period	
	Start Date	End Date
NML1 (H057)	15:00 hrs on 26 Aug 2022	21:20 hrs on 2 Oct 2022
NML2 (H064)	14:20 hrs on 26 Aug 2022	02:50 hrs on 4 Oct 2022
NML3 (H040)	11:10 hrs on 26 Aug 2022	23:10 hrs on 22 Sept 2022
NML4 (H038)	11:50 hrs on 26 Aug 2022	12:20 hrs on 6 Oct 2022
NML5 (H008)	12:20 hrs on 26 Aug 2022	10:10 hrs on 21 Oct 2022
NML6 (H023)	13:40 hrs on 26 Aug 2022	10:20 hrs on 21 Oct 2022
NML7 (H027)	10:30 hrs on 26 Aug 2022	00:30 hrs on 5 Oct 2022
NML8	09:50 hrs on 26 Aug 2022	01:30 hrs on 13 Sep 2022

2.3 Measurement Procedure

Measurements were conducted at all locations over the survey periods outlined in Table 2-2. Data samples for all measurements (noise, rainfall, and wind) were logged continuously at 10-minute interval periods for the duration of the survey. The $L_{Aeq,10min}$ and $L_{A90,10min}$ noise parameters were measured in this instance and the results were saved to the instrument memory for later analysis.

Survey personnel noted potential primary noise sources contributing to noise build-up during the installation and removal of the sound level meters from site.

2.4 Instrumentation

Table 2-3 confirms the details of the noise monitoring instrumentation installed at each location.

Table 2-3. Details of Noise Measurement Instrumentation

Location Reference	Equipment Make and Model	Serial Number
NML1 (H057)	Rion NL-52	186667
NML2 (H064)	Rion NL-52	186670
NML3 (H040)	Rion NL-52	186672
NML4 (H038)	Rion NL-52	186671
NML5 (H008)	Rion NL-52	186668
NML6 (H023)	Rion NL-52	794925
NML7 (H027)	Rion NL-52	164427
NML8	Rion NL-52	186669

Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær type 4231 Sound Level Calibrator where appropriate. Instruments were calibrated on each interim visit and any drift noted. All calibration drifts were less than ± 0.2 dB and within acceptable tolerances outlined in the IOA GPG.

2.5 Rainfall Data

Rainfall was monitored and logged using one Rain Gauge data logger that was installed at Location NML 1 over the duration of the survey.

2.6 Wind Data

Average wind speed and direction was measured in 10-minute intervals at an on-site LIDAR unit and provided to AWN. The coordinates of the unit are provided in Table 2-4. A copy of the LIDAR Installation Report is included in Appendix 10.6 of the EIAR Chapter.

Table 2-4. Wind Measurement Location

Co-ordinates (ITM)	
Easting	Easting
634604	670371

2.6.1 Wind Shear

Wind speeds were measured at 60m and 92 m and above ground level. These wind speeds were then converted to the assessment hub height wind speed of 102 and then corrected to the 'standardised' 10 m

height wind speed in accordance with the IOA GPG. The standardised wind speed at 10 m height is the industry standard for referencing wind speeds with respect to noise from wind turbines.

The standardised is a wind speed measured at a height different than 10 m (generally measured at the turbine hub height) which is expressed to a reference height of 10 m using a roughness length of 0.05 for standardisation purpose in accordance with the IEC 61400-11 standard:

Roughness Length Shear Profile: $U_1 = U_2 \times [\ln(H_1/z) / \ln(H_2/z)]$

Where:

H_1	The height of the wind speed to be calculated (10m)
H_2	The height of the measured or calculated Hub Height wind speed.
U_1	The wind speed to be calculated.
U_2	The measured or calculated Hub Height wind speed.
Z	The roughness length.

Note: A roughness length of 0.05m is used to standardise hub height wind speeds to 10m height in the IEC 61400-11:2003 standard, regardless of what the actual roughness length seen on a site may have been. This 'normalisation' procedure was adopted for comparability between test results for different turbines.

Any reference to wind speed in Chapter 10: Noise & Vibration of the EIAR should be understood to be the standardised 10 m height wind speed unless otherwise stated.

Figure 2-2 presents the distributions of the measured wind speed and wind direction over the survey period.

Figure 2-2. Distributions of Wind Speeds and Directions Over the Survey Period

2.7 Selection of Measurement Locations and Methodology

The purpose of the noise survey is to determine the background noise at representative noise sensitive locations (NSLs) within the receiving environment surrounding the proposed development.

The survey locations were identified with consideration of the potential turbine noise contribution from the proposed Gathabawn Windfarm 2026 assessed using noise prediction modelling and supported by reviewing aerial images and street side images where available on website e.g., Google Earth and Bing Maps.

The assessment methodology in the EIAR will be in accordance with the Institute of Acoustics document A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (2013) hereafter referred to as the IOA GPG.

The following text summaries the guidance from the IOA GPG for the selection of background noise survey locations:

- ▶ The selection of suitable noise monitoring locations for background noise surveys is not straightforward and only general guidance can be given as it is not possible to be prescriptive.
- ▶ Often there are practical constraints on where equipment can be placed, and a considerable degree of experience-based judgement is required when selecting these positions.
- ▶ Any contribution to background noise levels of noise from an existing wind farm must be excluded when assigning background noise and setting noise limits for a new development.
- ▶ No general guidance can therefore be given on the number of measurement locations as this will be site-specific.

A robust assessment of the noise impacts of the wind farm necessitates a detailed survey of the background noise at houses in the vicinity of the wind farm.

2.8 Data Analysis

The following sections present a summary of the statistical analysis carried out on the noise monitoring data to derive the background noise curves at each NML.

2.8.1 Assessment Periods

The results presented in the following sections refer to the noise data collated during 'quiet periods' of the day and night as defined in the IOA GPG. These periods are defined in Table 2-5.

Table 2-5. Daytime and Night Periods

Period Description	Period Definition
Daytime (Amenity Hours)	ETSU-R-97 defines the amenity hours as: 18.00 to 23.00 Monday to Friday. 13.00 to 23.00 on Saturdays; and, 07.00 to 23.00 on Sundays.
Night	ETSU-R-97 defines the night-time hours as 23.00 to 07.00 every day

The data sets have been assessed separately for both daytime and night-time periods as outlined in Table 2-5 and analysed with respect to the methods outlined in the IOA GPG.

2.8.2 Atypical Noise Data

The data sets have been filtered to remove issues such as the dawn chorus and the influence of other atypical noise sources. An example of atypical sources would be short, isolated periods of raised noise levels attributable to local sources, vehicles, agricultural activity, boiler flues, operation of gardening equipment etc. In addition, sample periods affected by rainfall or when rainfall resulted in prolonged periods of atypical noise levels have also been removed from the data sets. This approach is in line with the guidance contained in the IOA GPG.

2.9 Derived Background Noise Levels

The derived background noise levels dB $L_{A90,10min}$ for daytime and nighttime are presented in Table 2-6 and Table 2-7 respectively. These levels have been derived using regression analysis carried out on the data sets measured in line with best practice guidance contained in the IOA GPG and its SGN No. 2 Data Collection. Appendix C presents the regression analysis charts for daytime and night-time periods from each NML.

These background noise levels will be used to determine the appropriate turbine noise limits in accordance with the adopted turbine noise criteria as set out in the Noise and Vibration Chapter for the proposed development.

Table 2-6. Derived Background Noise Levels at Assessment Hub Height - Daytime

Locations	Background Noise Levels dB LA90 at standardised 10m height wind speed m/s for 93 m Hub Height						
	3	4	5	6	7	8	9
NML1 (H057)	24.8	25.8	27.2	28.9	31.0	33.5	36.5
NML2 (H064)	24.9	28.0	29.6	33.0	36.8	39.9	41.1
NML3 (H040)	24.3	25.5	27.5	29.6	32.8	37.0	41.8
NML4 (H038)	24.7	26.2	27.5	28.9	30.7	33.1	36.3
NML5 (H008)	39.7	40.4	40.7	40.8	41.1	41.8	43.1
NML6 (H023)	29.5	31.7	33.9	36.2	38.6	41.0	43.7
NML7 (H027)	24.7	25.8	27.3	28.6	30.5	33.5	36.7
NML8	22.7	24.8	27.2	28.2	31.0	35.1	39.3

Table 2-7. Derived Background Noise Levels at Assessment Hub Height – Night-time

Locations	Background Noise Levels dB LA90 at standardised 10m height wind speed m/s for 93 m Hub Height						
	3	4	5	6	7	8	9
NML1 (H057)	19.3	19.9	21.2	23.2	25.8	28.9	32.4
NML2 (H064)	19.6	23.4	27.6	31.8	35.7	39.0	41.4
NML3 (H040)	19.0	20.2	20.4	22.4	27.1	33.1	39.1
NML4 (H038)	19.9	21.1	22.7	24.5	26.8	29.5	32.7
NML5 (H008)	31.5	30.9	31.1	32.2	34.0	36.3	39.1
NML6 (H023)	22.4	24.5	26.9	29.7	32.7	36.0	39.3
NML7 (H027)	21.0	21.9	23.3	25.1	27.4	30.2	33.6
NML8	17.8	19.3	21.6	24.4	27.7	31.3	35.1

APPENDIX A. GLOSSARY OF ACOUSTIC TERMS

Background noise	The noise level rarely fallen below in any given location over any given time period, often classed according to daytime, evening or night-time periods.
dB	Abbreviation for 'decibel'.
dB(A)	Abbreviation for the decibel level of a sound that has been A-weighted.
Dawn Chorus	Noise due to birds which can occur at sunrise.
Decibel	The unit normally employed to measure the magnitude of sound.
Directivity	The property of a sound source that causes more sound to be radiated in one direction than another.
L_{A90}	The noise level exceeded 90% of the time during a measurement period, often used for the measurement of background noise.
Level	The general term used to describe a sound once it has been converted into decibels.
Sound level meter	An instrument for measuring sound pressure level.

APPENDIX B. INSTALLATION PHOTOGRAPHS

Appendix Figure B-1. NML1 Installation Photograph



Appendix Figure B-2. NML2 Installation Photograph



Appendix Figure B-3. NML3 Installation Photograph



Appendix Figure B-4. NML4 Installation Photograph



Appendix Figure B-5. NML5 Installation Photograph



Appendix Figure B-6. NML6 Installation Photograph



Appendix Figure B-7. NML7 Installation Photograph



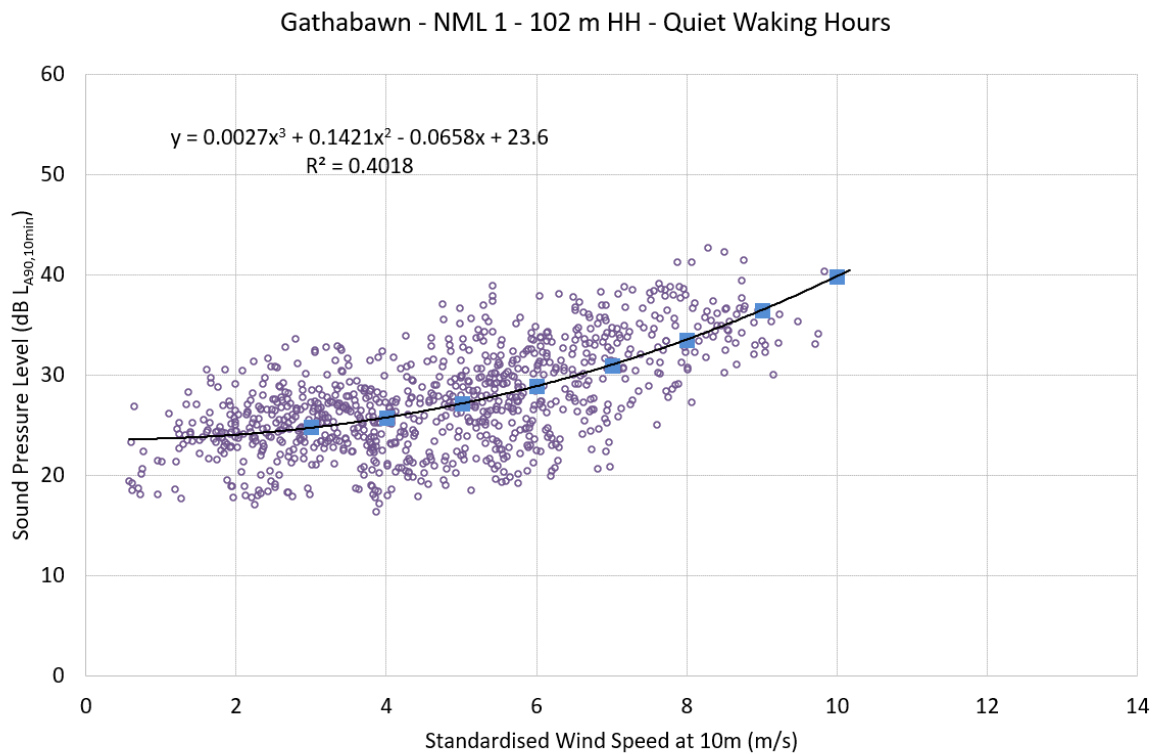
Appendix Figure B-8. NML8 Installation Photograph



APPENDIX C. REGRESSION ANALYSIS ON DATA SETS

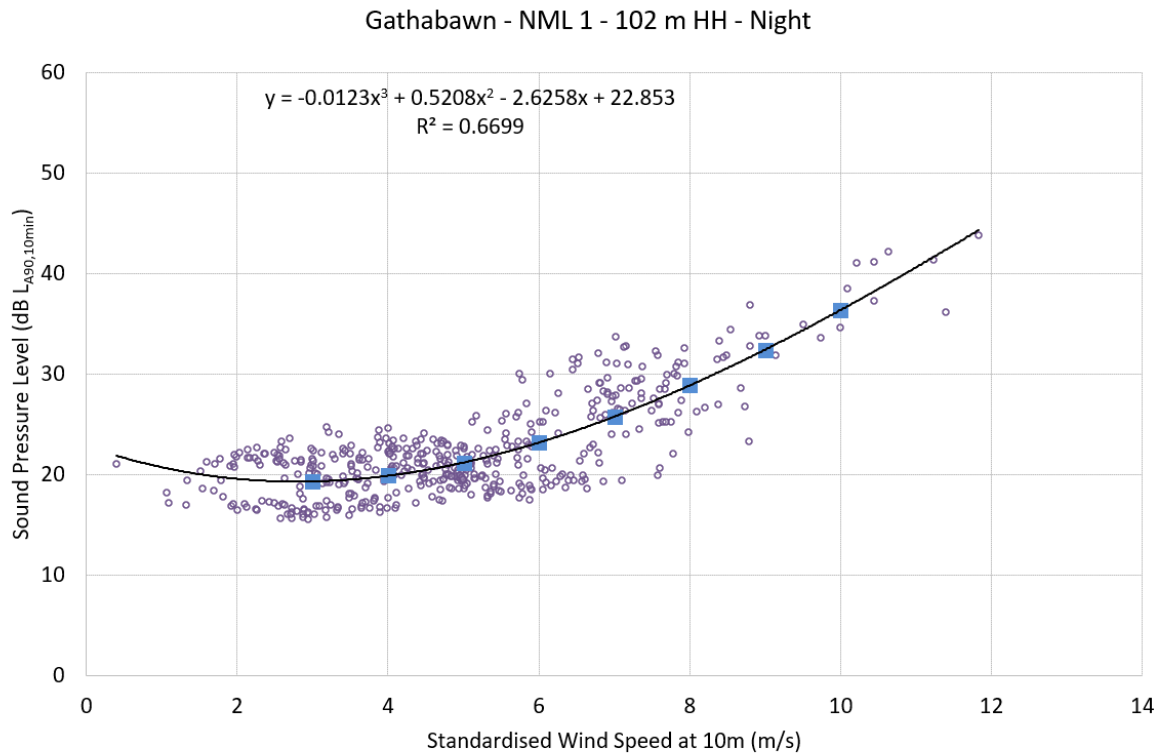
The following graphs present the data sets for each location. Where necessary, the contribution to measured noise levels from existing turbines was addressed by subtracting the calculated noise levels from measured levels, for wind directions sectors where the measurement locations upwind of the existing turbines, as presented in the following table. A logarithmic subtraction is used to derive the background noise levels.

Appendix Figure C-1. NML1 Day



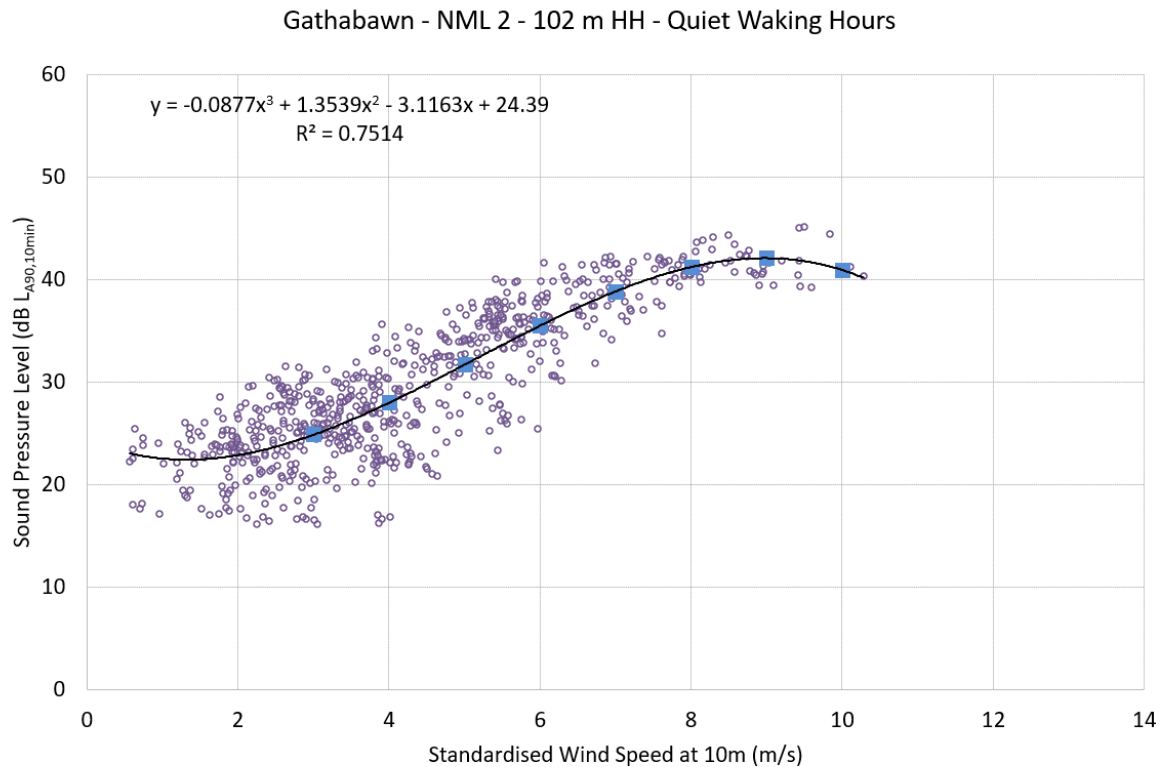
- a. Data in wind direction sectors North and Northwest have been omitted from the analysis to minimise the influence of existing turbines on measured noise levels.

Appendix Figure C-2. NML1 Night



- a. Data in wind direction sectors North and Northwest have been omitted from the analysis to minimise the influence of existing turbines on measured noise levels.

Appendix Figure C-3. NML2 Day

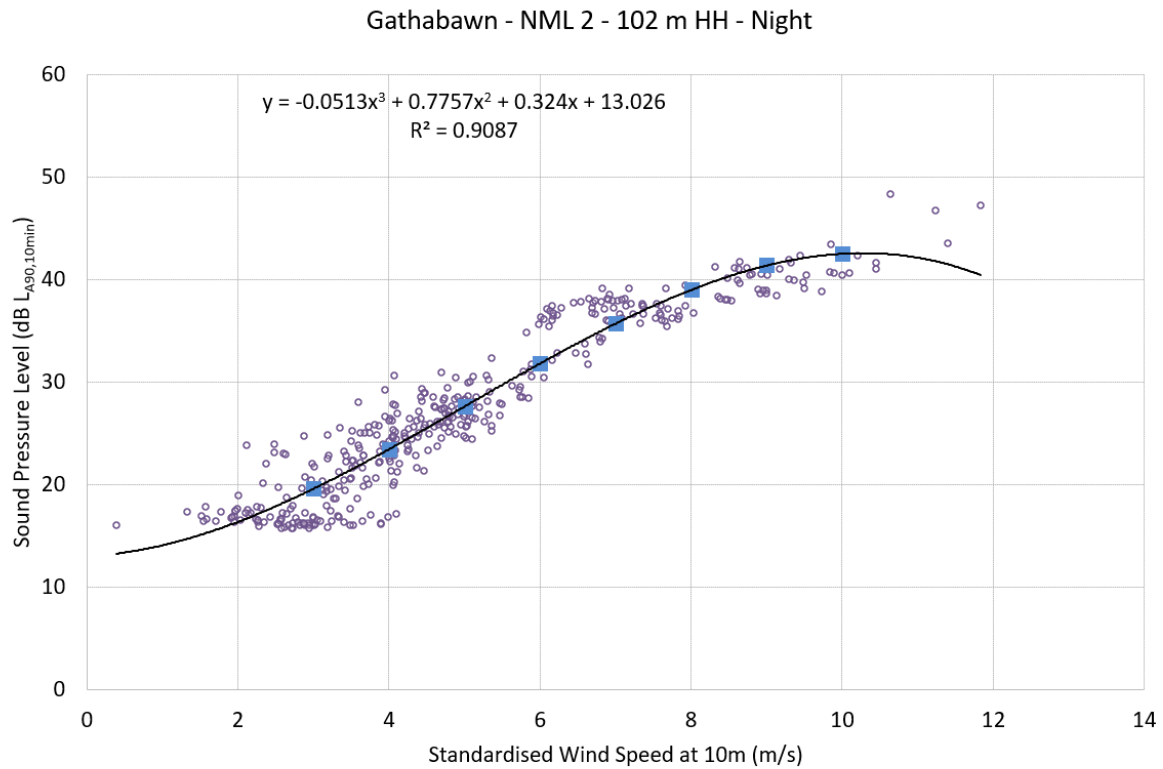


- a. Data in wind direction sectors North and Northwest have been omitted from the analysis to minimise the influence of existing turbines on measured noise levels. Predicted contributions from Lisdowney wind farm have also been subtracted, except for 3 and 4 m/s, where measured noise levels have been used directly.

Appendix Table C-1. NML-2: Derived Background Noise Levels – Daytime

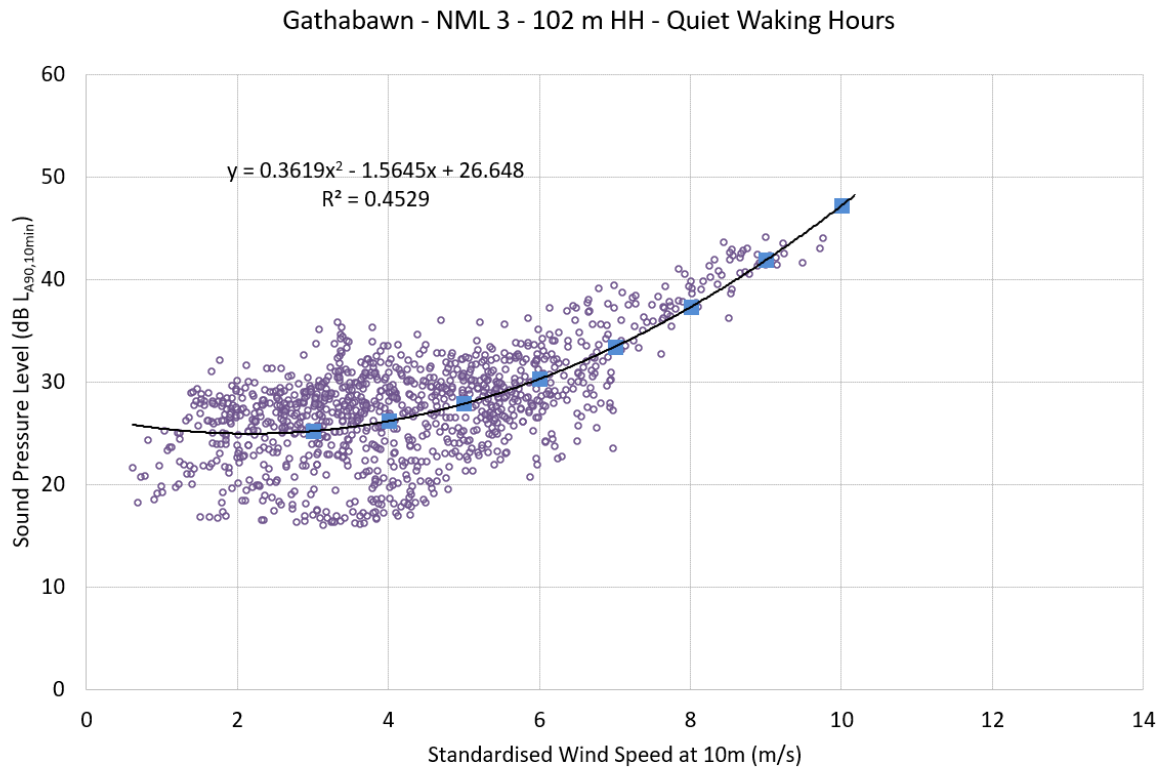
Parameter	Period	Noise Levels dB L_{A90} at standardised 10m height wind speed m/s for 93 m Hub Height						
		3	4	5	6	7	8	9
Measured	Day	24.9	28.0	31.7	35.5	38.8	41.2	42.1
Contribution from Existing (South wind direction)		27.5	27.5	27.5	31.9	34.5	35.2	35.2
Background Noise Level		24.9	28.0	29.6	33.0	36.8	39.9	41.1

Appendix Figure C-4. NML2 Night



- a. Data in wind direction sectors North and Northwest have been omitted from the analysis to minimise the influence of existing turbines on measured noise levels.

Appendix Figure C-5. NML3 Day

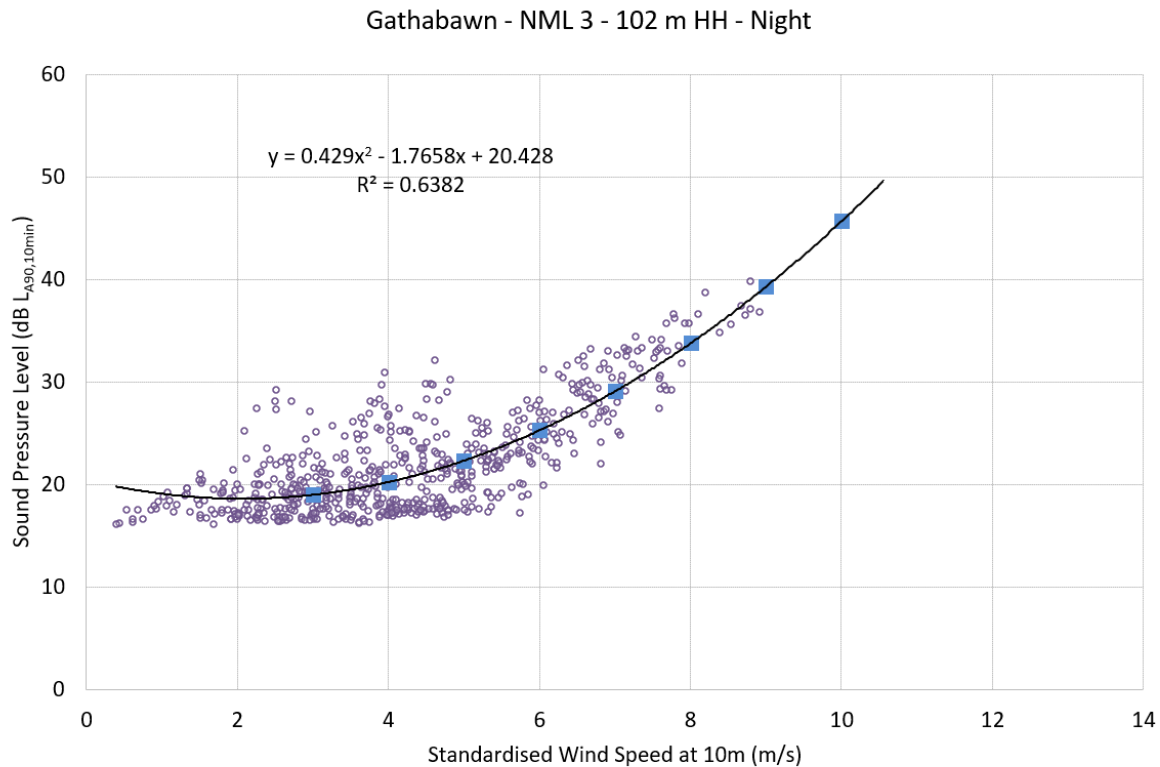


- a. Predicted omni-directional noise levels due to Lisdowney have been subtracted from the measured levels to minimise the influence of existing turbines on measured noise levels.

Appendix Table C-2. NML-3: Derived Background Noise Levels – Daytime

Parameter	Period	Noise Levels dB L_{A90} at standardised 10m height wind speed m/s for 93 m Hub Height						
		3	4	5	6	7	8	9
Measured	Day	25.2	26.2	27.9	30.3	33.4	37.3	41.9
Contribution from Lisdowney		17.8	17.8	17.8	22.2	24.8	25.5	25.5
Background Noise Level		24.3	25.5	27.5	29.6	32.8	37.0	41.8

Appendix Figure C-6. NML3 Night

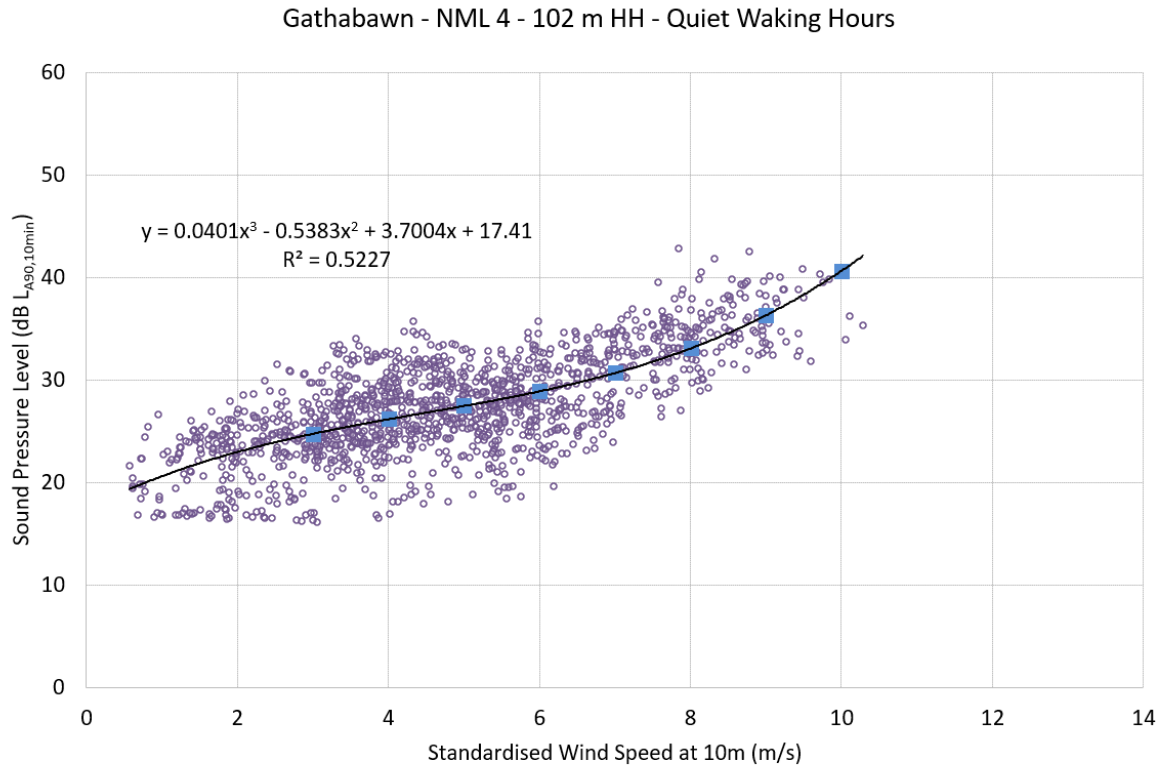


- a. Predicted omni-directional noise levels due to Lisdowney have been subtracted from the measured levels to minimise the influence of existing turbines on measured noise levels, except for 3 and 4 m/s, where the measured values have been used directly.

Appendix Table C-3. NML-3: Derived Background Noise Levels – Night-time

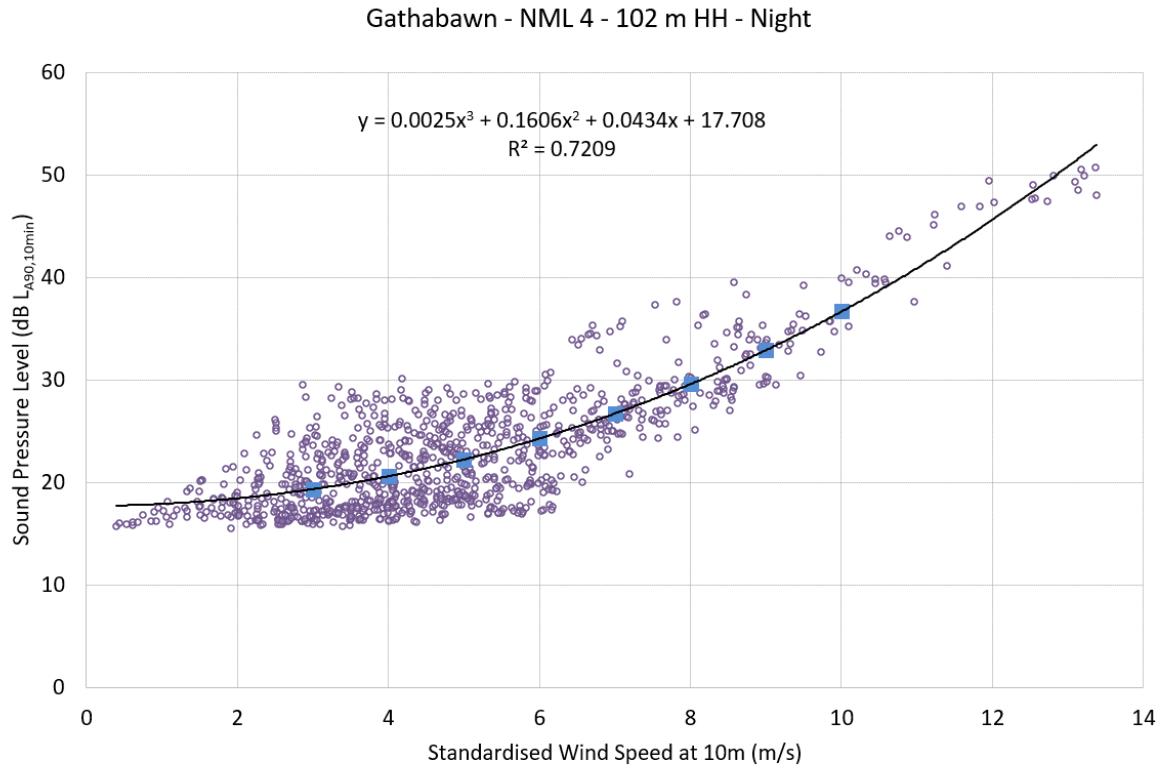
Parameter	Period	Noise Levels dB L_{A90} at standardised 10m height wind speed m/s for 93 m Hub Height						
		3	4	5	6	7	8	9
Measured	Day	19.0	20.2	22.3	25.3	29.1	33.8	39.3
Contribution from Lisdowney		17.8	17.8	17.8	22.2	24.8	25.5	25.5
Background Noise Level		19.0	20.2	20.4	22.4	27.1	33.1	39.1

Appendix Figure C-7. NML4 Day

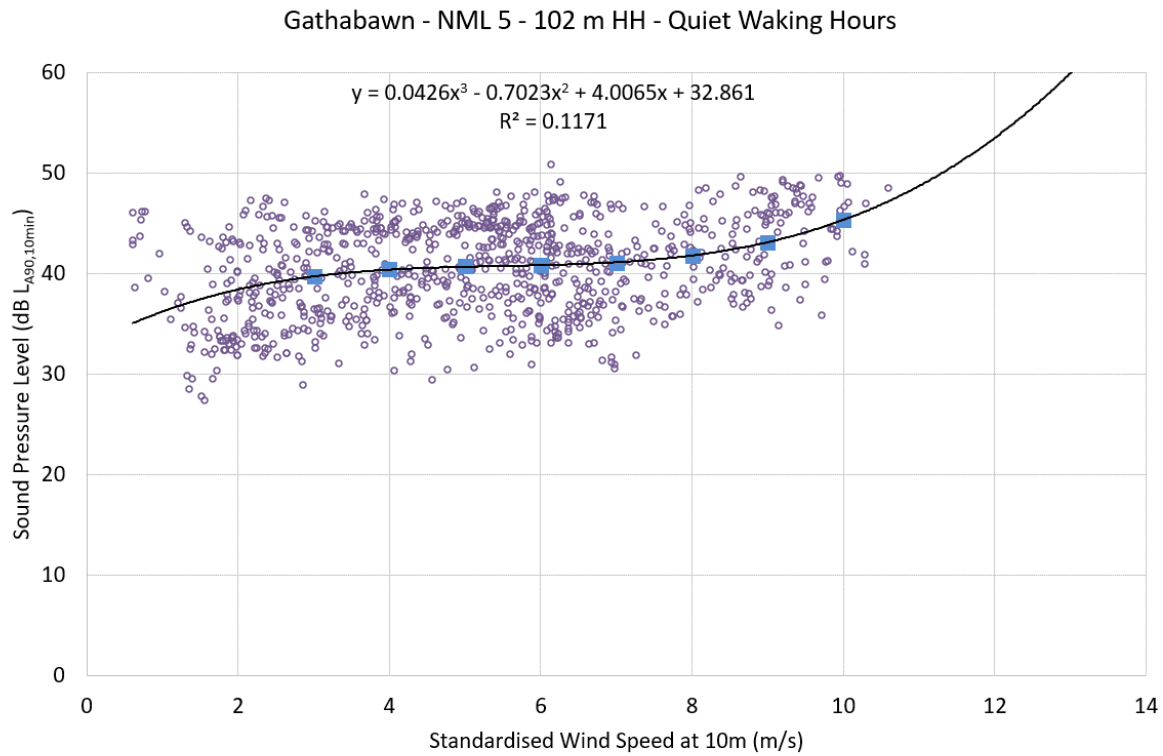


- a. Data in wind direction sectors Northeast and East have been omitted from the analysis to minimise the influence of existing turbines on measured noise levels.

Appendix Figure C-8. NML4 Night

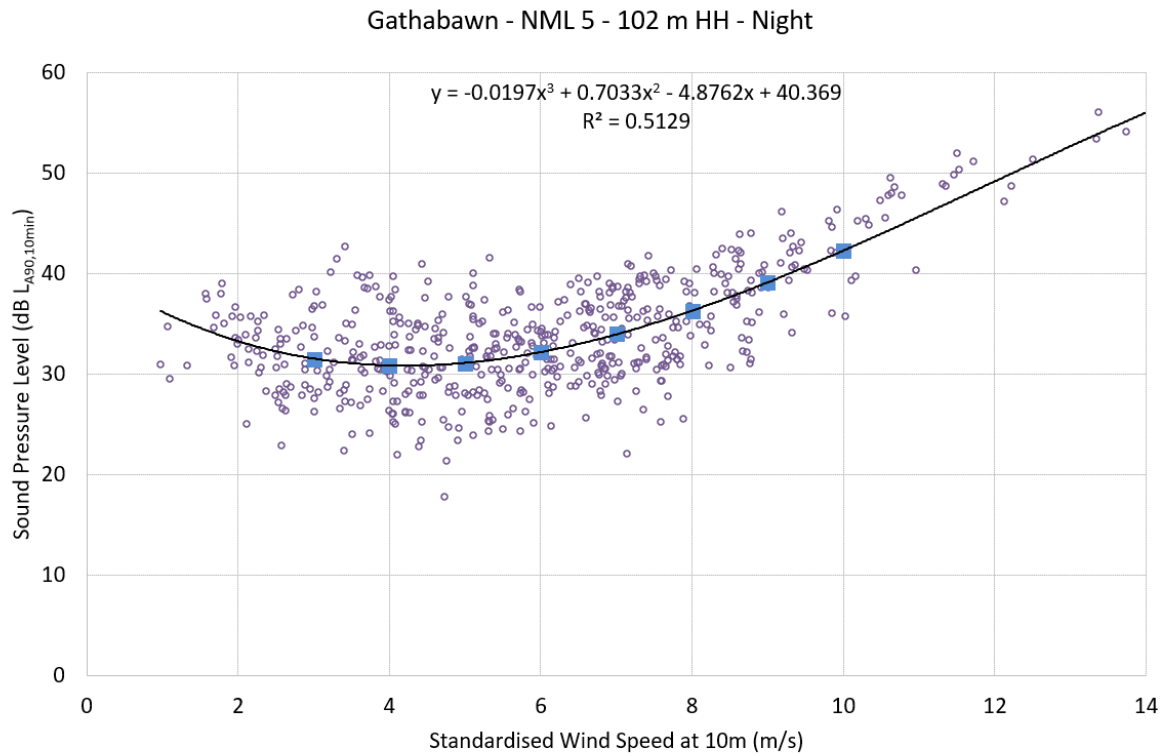


Appendix Figure C-9. NML5 Day



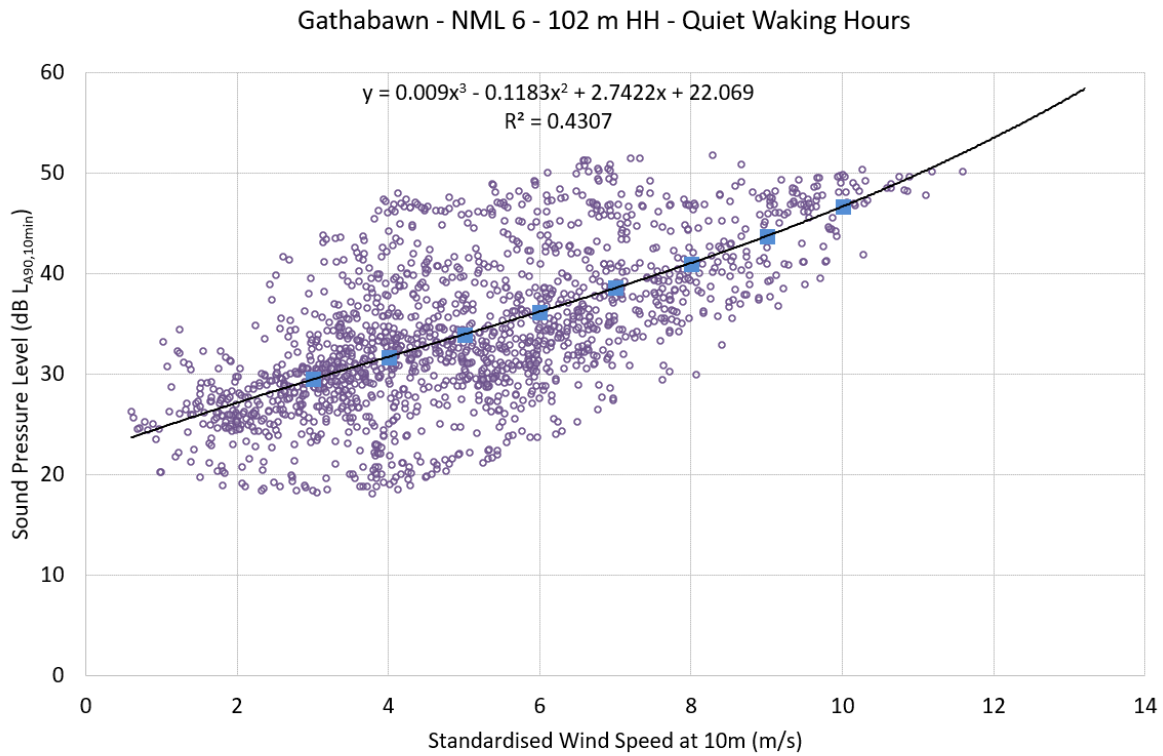
- a. Data in wind direction sectors Northeast, East, South and Southeast only have been used in the analysis to minimise the influence of national road on measured noise levels.

Appendix Figure C-10. NML5 Night

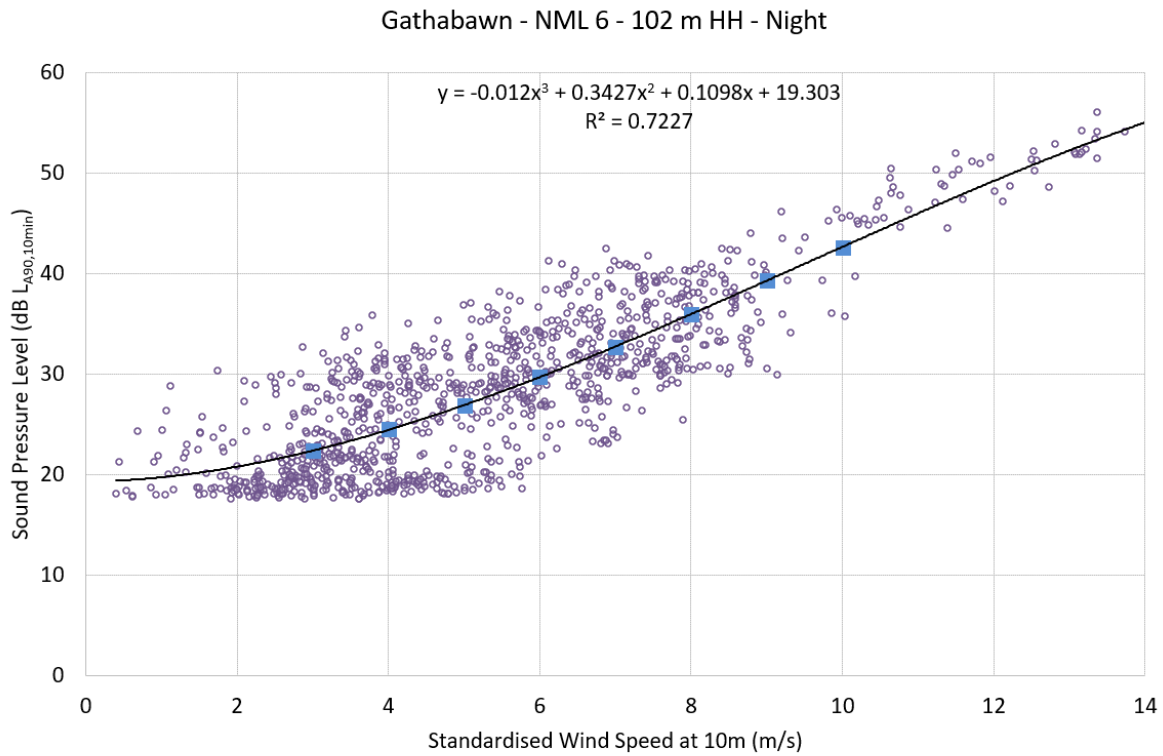


- a. Data in wind direction sectors Northeast, East, South and Southeast only have been used in the analysis to minimise the influence of national road on measured noise levels.

Appendix Figure C-11. NML6 Day

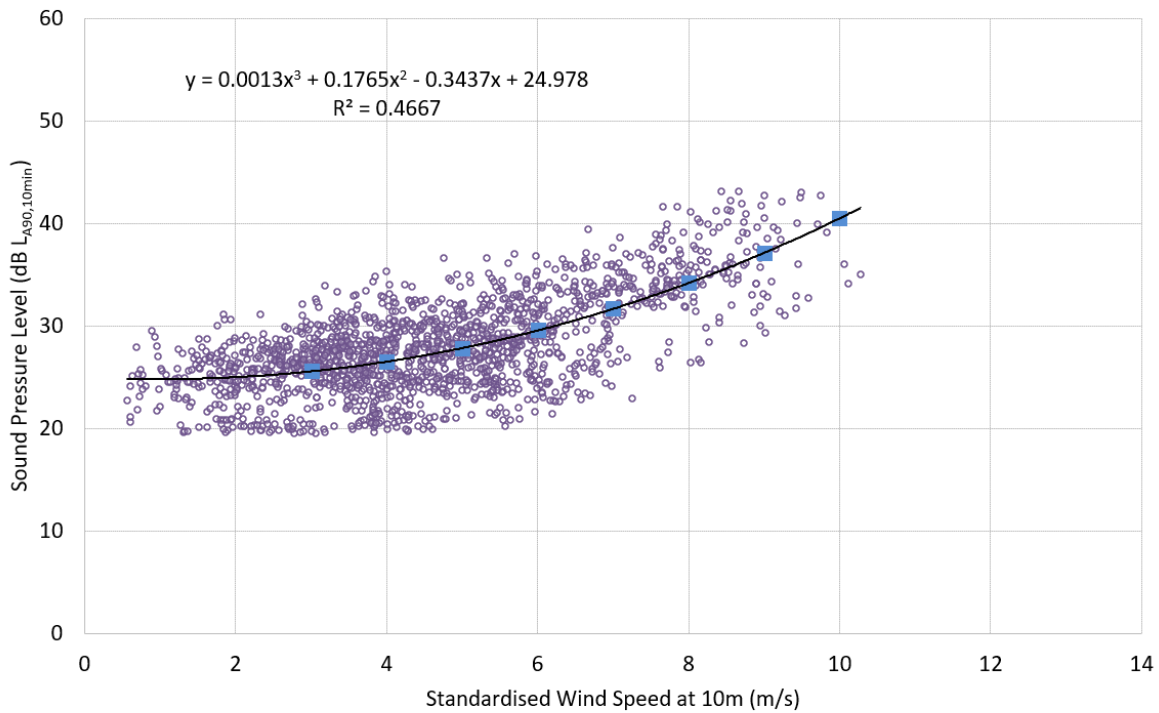


Appendix Figure C-12. NML6 Night



Appendix Figure C-13. NML7 Day

Gathabawn - NML 7 - 102 m HH - Quiet Waking Hours

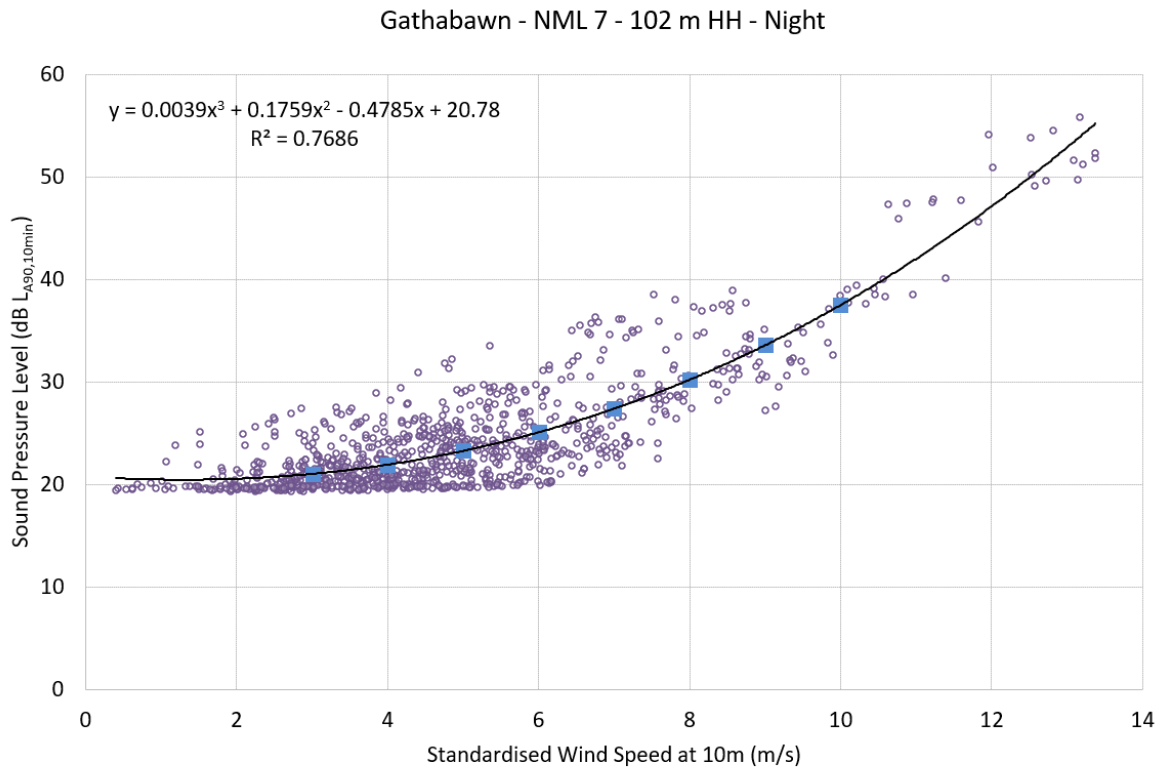


- a. Predicted omni-directional noise levels due to Lisdowney have been subtracted from the measured levels to minimise the influence of existing turbines on measured noise levels.

Appendix Table C-4. NML-7: Derived Background Noise Levels – Daytime

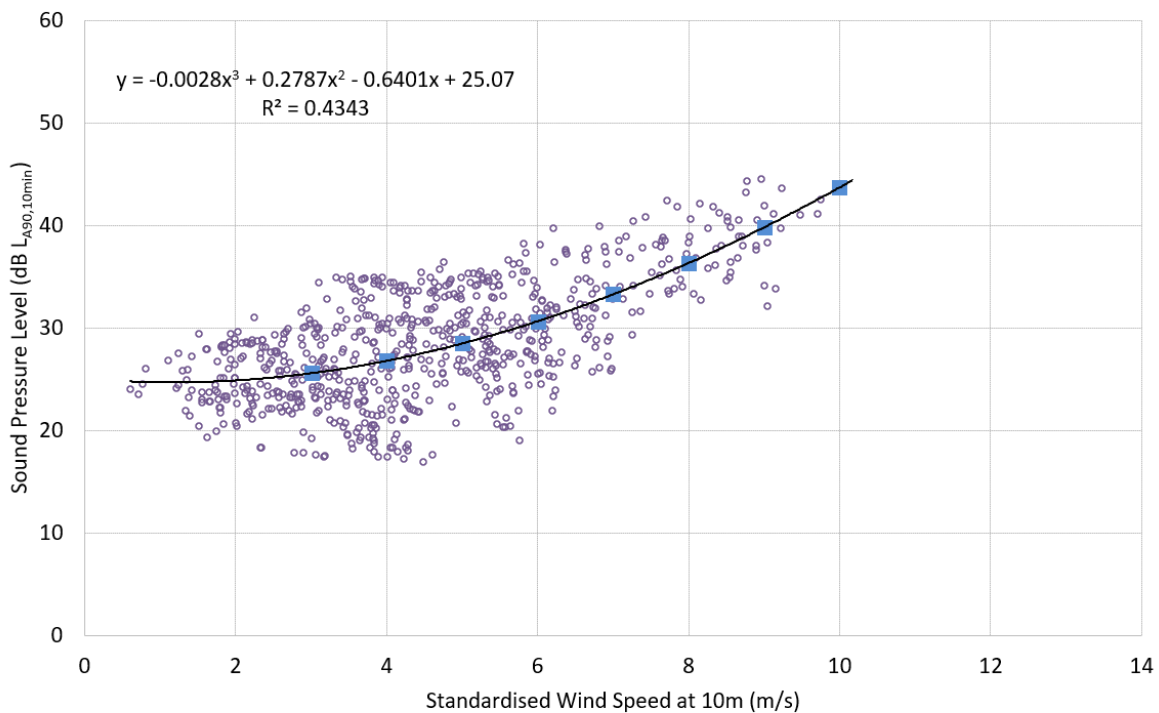
Parameter	Period	Noise Levels dB L_{A90} at standardised 10m height wind speed m/s for 93 m Hub Height						
		3	4	5	6	7	8	9
Measured	Day	25.6	26.5	27.8	29.6	31.7	34.2	37.1
Contribution from Lisdowney		18.5	18.5	18.5	22.9	25.5	26.2	26.2
Background Noise Level		24.7	25.8	27.3	28.6	30.5	33.5	36.7

Appendix Figure C-14. NML7 Night



Appendix Figure C-15. NML8 Day

Gathabawn - NML 8 - 102 m HH - Quiet Waking Hours

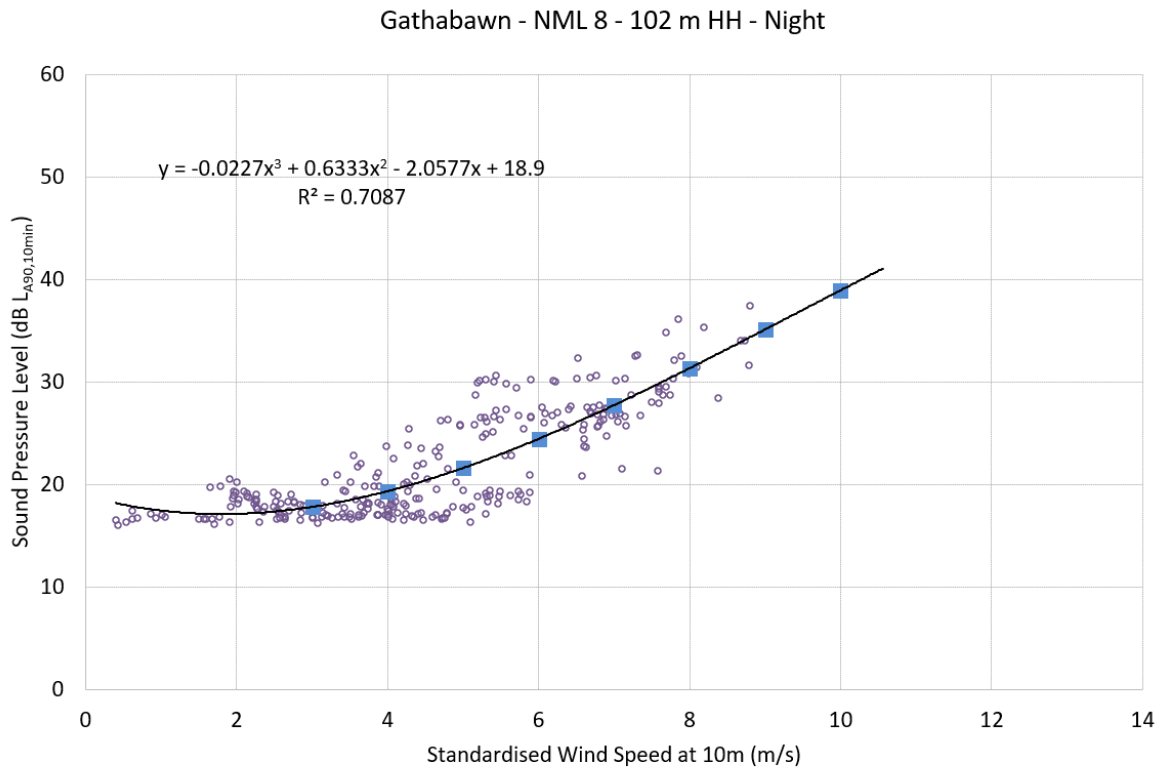


- a. Predicted omni-directional noise levels due to Lisdowney have been subtracted from the measured levels to minimise the influence of existing turbines on measured noise levels.

Appendix Table C-5. NML-7: Derived Background Noise Levels – Daytime

Parameter	Period	Noise Levels dB L_{A90} at standardised 10m height wind speed m/s for 93 m Hub Height						
		3	4	5	6	7	8	9
Measured	Day	25.6	26.8	28.5	30.6	33.3	36.3	39.8
Contribution from Lisdowney		22.5	22.5	22.5	26.9	29.5	30.2	30.2
Background Noise Level		22.7	24.8	27.2	28.2	31.0	35.1	39.3

Appendix Figure C-16. NML8 Night



Appendix to Chapter 10: Noise and Vibration

Appendix 10.5: Calibration Certificates



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 12 May 2022**Certificate Number: UCRT22/1645**

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

Customer

AWN Consulting Ltd

The Tecpro Building

IDA Business and Technology Park

Clonsaugh

Dublin

D17 XD90

Order No.

DOD/22/Cal041

Description

Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	00186667
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	76817
Rion	Microphone	UC-59	21140
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure

TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received

10 May 2022

ANV Job No.

UKAS22/05320

Date Calibrated

12 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate

Dated

04 May 2020

Certificate No.

UCRT20/1386

Laboratory

0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



**CERTIFICATE
OF
CALIBRATION**




0653

Date of Issue: 03 May 2022 **Certificate Number: UCRT22/1596**

Calibrated at & Certificate issued by:
 ANV Measurement Systems
 Beaufort Court
 17 Roebuck Way
 Milton Keynes MK5 8HL
 Telephone 01908 642846 Fax 01908 642814
 E-Mail: info@noise-and-vibration.co.uk
 Web: www.noise-and-vibration.co.uk
 Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory



K. Mistry

Customer	AWN Consulting Limited The Tecpro Building IDA Business and Technology Park Clonshaugh Dublin, D17 XD90 Ireland			
Order No.	DOD/22/Cal040			
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator			
Identification	<i>Manufacturer</i>	<i>Instrument</i>	<i>Type</i>	<i>Serial No. / Version</i>
	Rion	Sound Level Meter	NL-52	00186670
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76820
	Rion	Microphone	UC-59	12816
	Brüel & Kjær	Calibrator	4231	2394086
		Calibrator adaptor type if applicable		UC 0210
Performance Class	1			
Test Procedure	TP 10. SLM 61672-3:2013 <i>Procedures from IEC 61672-3:2013 were used to perform the periodic tests.</i>			
Type Approved to IEC 61672-1:2013	Yes <i>If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013</i>			
Date Received	29 April 2022	ANV Job No.	UKAS22/04300	
Date Calibrated	03 May 2022			

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	<i>Dated</i>	<i>Certificate No.</i>	<i>Laboratory</i>
	05 May 2020	UCRT20/1392	0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 12 May 2022**Certificate Number: UCRT22/1642**

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

Customer

AWN Consulting Ltd

The Tecpro Building

IDA Business and Technology Park

Clonshaugh

Dublin

D17 XD90

Order No.

DOD/22/Cal041

Description

Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	00186672
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	76822
Rion	Microphone	UC-59	12818
Rion	Calibrator	NC-74	34536109
	Calibrator adaptor type if applicable		NC-74-002

Performance Class

1

Test Procedure

TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013

Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received

10 May 2022

ANV Job No.

UKAS22/05320

Date Calibrated

12 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate

Dated

04 May 2020

Certificate No.

UCRT20/1388

Laboratory

0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 16 May 2022

Certificate Number: UCRT22/1656

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

Customer AWN Consulting Ltd
The Tecpro Building
IDA Business and Technology Park
Clonsaugh
Dublin
D17 XD90

Order No. DOD/22/Cal041

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00186671
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76821
	Rion	Microphone	UC-59	16877
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received 10 May 2022

ANV Job No. UKAS22/05320

Date Calibrated 16 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	Dated	Certificate No.	Laboratory
	12 May 2020	UCRT20/1415	0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 03 May 2022**Certificate Number: UCRT22/1600**

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

Customer

AWN Consulting Limited
The Tecpro Building
IDA Business and Technology Park
Clonshaugh
Dublin
D17 XD90
Ireland

Order No.

DOD/22/Cal040

Description

Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	Instrument	Type	Serial No. / Version
Rion	Sound Level Meter	NL-52	00186668
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-25	76701
Rion	Microphone	UC-59	12813
Brüel & Kjær	Calibrator	4231	2460007
	Calibrator adaptor type if applicable		UC 0210

Performance Class

1

Test Procedure

TP 10. SLM 61672-3:2013

*Procedures from IEC 61672-3:2013 were used to perform the periodic tests.***Type Approved to IEC 61672-1:2013**

Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received

29 April 2022

ANV Job No.

UKAS22/04300

Date Calibrated

03 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate*Dated*

07 May 2020

Certificate No.

UCRT20/1405

Laboratory

0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 09 September 2021**Certificate Number: UCRT21/2107**

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.ukWeb: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

Customer AWN Consulting Limited
The Tecpro Building
IDA Business and Technology Park
Clonsaugh
Dublin
D17 XD90

Order No. 2157

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00764925
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	65051
	Rion	Microphone	UC-59	09853
	Brüel & Kjær	Calibrator	4231	3010488
		Calibrator adaptor type if applicable		UC 0210

Performance Class 1

Test Procedure TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received 03 September 2021

ANV Job No. UKAS21/09586

Date Calibrated 09 September 2021

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	Dated	Certificate No.	Laboratory
	10 June 2021	UCRT21/1719	0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 12 May 2022**Certificate Number: UCRT22/1644**

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.uk

Web: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

Customer
AWN Consulting Ltd
The Tecpro Building
IDA Business and Technology Park
Clonshaugh
Dublin
D17 XD90

Order No. DOD/22/Cal041

Description Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00164427
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	54560
	Rion	Microphone	UC-59	09208
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received 10 May 2022

ANV Job No.

UKAS22/05320

Date Calibrated 12 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	Dated	Certificate No.	Laboratory
	05 May 2020	UCRT20/1393	0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.



CERTIFICATE OF CALIBRATION



0653

Date of Issue: 12 May 2022

Calibrated at & Certificate issued by:

ANV Measurement Systems

Beaufort Court

17 Roebuck Way

Milton Keynes MK5 8HL

Telephone 01908 642846 Fax 01908 642814

E-Mail: info@noise-and-vibration.co.ukWeb: www.noise-and-vibration.co.uk

Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Certificate Number: UCRT22/1643

Page	1	of	2	Pages
Approved Signatory				
				
K. Mistry				

Customer AWN Consulting Ltd
 The Tecpro Building
 IDA Business and Technology Park
 Clonshaugh
 Dublin
 D17 XD90

Order No. DOD/22/Cal041**Description** Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification	Manufacturer	Instrument	Type	Serial No. / Version
	Rion	Sound Level Meter	NL-52	00186669
	Rion	Firmware		2.0
	Rion	Pre Amplifier	NH-25	76819
	Rion	Microphone	UC-59	12814
	Rion	Calibrator	NC-74	34536109
		Calibrator adaptor type if applicable		NC-74-002

Performance Class 1**Test Procedure** TP 10. SLM 61672-3:2013*Procedures from IEC 61672-3:2013 were used to perform the periodic tests.***Type Approved to IEC 61672-1:2013** Yes*If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013***Date Received** 10 May 2022**ANV Job No.** UKAS22/05320**Date Calibrated** 12 May 2022

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	Dated	Certificate No.	Laboratory
	04 May 2020	UCRT20/1389	0653

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Appendix to Chapter 10: Noise & Vibration

Appendix 10.6: LiDAR Installation Report

**LiDAR Installation Report****Installation Report**

Prepared by: Peter Brett	Peter Brett Ecopower Ltd Zetec House, Purcellsinch IDA, Business Park, Dublin Road, Kilkenny
Prepared for: AWN Consulting Ltd	

Works Log

Works completed	Date	Reference No.	Document version
LiDAR installation	19/08/2022	Gathabawn WF	1.0

1.Installation

Site location, entrance and access details:

Site manager	Peter Brett
Phone number	086 6026513
Email	peterb@ecopower.ie
Lock code	N/A
Notes	N/A
Latitude / Longitude	52.78324 -7.48715
Elevation (m a.s.l.)	202m

Location Photo:



2. LiDAR Details

Type	Manufacturer/S upplier	Model	Unit ID	Install height (Above Ground Level)	Install date
Ground based Lidar	WindCube	ZX300	1072	200mm	19/08/2022

Measurement ID	Height	Configured height (m)	Installation date
1		23m	19/08/2022
2		38m	19/08/2022
3		39m	19/08/2022
4		49m	19/08/2022
5		60m	19/08/2022
6		79m	19/08/2022
7		92m	19/08/2022
8		104m	19/08/2022
9		129m	19/08/2022
10		149m	19/08/2022
11		169m	19/08/2022