

Appendix 12-3- Noise Modelling Assumptions and Inputs



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

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

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

Noise Calculations have been conducted using a source height corresponding to the hub height of the turbines, a receiver height of 4m and an assumed ground factor of G=0.5.

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

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

where d = distance from the source

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

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

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

Barrier Attenuation The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO9613 model have been shown to be significantly greater than that measured in practice under down wind conditions.

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

Table A12-1 Atmospheric Attenuation Assumed for Noise Calculations (dB per km)

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

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

Name	Easting	Northing	Name	Easting	Northing
P1968	608964	761979	P1350	604567	767745
P1966	608935	761997	P1346	607297	767766
P1964	608900	762016	P1343	604618	767814
P1958	608861	762161	P1341	607277	767838
P1956	608832	762255	P1339	602368	767846
P1933	607497	762902	P1337	602339	767866
P1931	607972	762940	P1327	604602	767952
P1930	608197	762952	P1319	604788	768019
P1929	608105	762955	P1314	604498	768088
P1927	607498	762978	P1309	604465	768179
P1925	608014	762989	P1306	604451	768209
P1923	608760	762992	P1304	604438	768245
P1924	608725	762992	P1301	604420	768273
P1917	607371	763034	P1294	604336	768325
P1915	608643	763045	P1291	604372	768348
P1912	611451	763056	P1284	604377	768399
P1906	608843	763071	P1278	604329	768459
P1907	608785	763071	P1272	604373	768493
P1902	607242	763084	P1261	604371	768546
P1885	611449	763159	P1206	603095	768659
P1855	605142	763290	P1182	603138	768715
P1845	610145	763335	P1173	604353	768748
P1844	605219	763338	P1163	607226	768773
P1841	605101	763343	P1149	604316	768827
P1832	606904	763427	P1133	604252	768860
P1817	611228	763489	P1121	604526	768885
P1808	611339	763515	P1017	603675	769013
P1804	605016	763581	P0986	603482	769060
P1764	606709	763674	P0922	602226	769122
P1751	606660	763730	P0916	602206	769125
P1745	611180	763757	P0912	602092	769131
P1734	606623	763816	P0906	602170	769133
P1728	606602	763862	P0891	601913	769147
P1713	606531	763921	P0886	606355	769151
P1697	611357	763955	P0884	601889	769152
P1701	606529	763950	P0880	601866	769156

Name	Easting	Northing	Name	Easting	Northing
P1686	611878	763974	P0871	601844	769164
P1680	611872	763982	P0867	601819	769168
P1622	611716	764073	P0862	602197	769172
P1604	611878	764171	P0852	606201	769179
P1605	611081	764171	P0853	602143	769179
P1602	611022	764191	P0854	601798	769179
P1600	611002	764204	P0850	602249	769182
P1596	610985	764233	P0836	602119	769187
P1595	610958	764244	P0837	601775	769187
P1594	610937	764272	P0832	602274	769195
P1593	610915	764300	P0828	601752	769198
P1592	610919	764329	P0829	601688	769198
P1589	606179	764360	P0824	606344	769208
P1587	610888	764377	P0821	602298	769213
P1575	606012	764432	P0804	606369	769223
P1573	606010	764439	P0805	601700	769223
P1571	606008	764446	P0791	602320	769229
P1570	606006	764453	P0785	602343	769239
P1569	606001	764462	P0784	601801	769241
P1568	606125	764470	P0778	606277	769254
P1567	605999	764471	P0768	603158	769273
P1566	606119	764479	P0760	601673	769281
P1564	606109	764492	P0759	601509	769286
P1562	606102	764499	P0758	601631	769287
P1563	605970	764499	P0750	603135	769300
P1560	606018	764504	P0751	602399	769300
P1559	606021	764509	P0748	602409	769305
P1558	606093	764512	P0747	602337	769309
P1557	606024	764516	P0735	601603	769379
P1556	606087	764518	P0734	601882	769380
P1554	606029	764524	P0730	603083	769385
P1553	606077	764529	P0731	602995	769385
P1552	606033	764530	P0732	601920	769385
P1550	606036	764535	P0725	601949	769392
P1548	606070	764537	P0726	601648	769392
P1546	606050	764554	P0715	602032	769409
P1545	606059	764555	P0704	602734	769426
P1542	606008	764585	P0693	601829	769444
P1538	610833	764637	P0685	602981	769452
P1539	604979	764634	P0665	606785	769499
P1537	605026	764641	P0589	605379	769600
P1536	610819	764665	P0573	601723	769617
P1534	605149	764690	P0555	601711	769649
P1533	611941	764718	P0525	605374	769691
P1530	611921	764762	P0524	606677	769693
P1529	611952	764775	P0519	607876	769702
P1528	611891	765043	P0517	607881	769708
P1527	606647	765048	P0509	607887	769717

Name	Easting	Northing	Name	Easting	Northing
P1526	606683	765074	P0505	607061	769720
P1525	611834	765087	P0502	607892	769723
P1524	607038	765230	P0501	601676	769725
P1521	607136	765279	P0494	607899	769732
P1520	611488	765290	P0491	607902	769739
P1519	607170	765312	P0486	607909	769748
P1518	611521	765325	P0474	607913	769755
P1517	607203	765333	P0462	607920	769763
P1516	607151	765339	P0457	607866	769768
P1515	607251	765349	P0456	607924	769770
P1514	611601	765436	P0451	607859	769772
P1513	611673	765458	P0452	607788	769772
P1512	609095	765472	P0448	607794	769776
P1511	611652	765493	P0447	607851	769778
P1510	605051	765514	P0442	607929	769782
P1509	611649	765540	P0438	607844	769783
P1508	607581	765551	P0432	607834	769788
P1507	604884	765554	P0433	607798	769788
P1506	604943	765597	P0430	607825	769789
P1503	611612	765661	P0429	607929	769790
P1505	604868	765654	P0427	607885	769794
P1504	607742	765661	P0426	607801	769795
P1502	607798	765686	P0424	607880	769799
P1501	608879	765691	P0425	607817	769799
P1500	607886	765712	P0421	607925	769803
P1499	608905	765745	P0422	607811	769803
P1498	604732	765758	P0416	607871	769806
P1497	608885	765772	P0410	607920	769810
P1494	611587	765852	P0409	607866	769812
P1495	608762	765850	P0408	607912	769817
P1492	603596	765858	P0407	607907	769821
P1489	603618	765914	P0405	607859	769822
P1488	603888	765928	P0404	607301	769825
P1487	611481	765960	P0402	607855	769828
P1486	608709	765974	P0399	607898	769829
P1483	611483	766015	P0390	607948	769840
P1484	604447	766010	P0389	607940	769841
P1481	610308	766064	P0386	607958	769843
P1480	608618	766120	P0381	607966	769844
P1479	603667	766142	P0382	607852	769844
P1478	611325	766159	P0377	607930	769845
P1477	603885	766190	P0370	607923	769850
P1475	603868	766227	P0369	607851	769852
P1474	603790	766233	P0368	607975	769853
P1471	608477	766364	P0364	607915	769855
P1470	608599	766393	P0359	607980	769856
P1466	610204	766436	P0354	607987	769864
P1465	610243	766473	P0355	607856	769864

Name	Easting	Northing	Name	Easting	Northing
P1463	610051	766591	P0350	607990	769871
P1461	610859	766621	P0351	607859	769871
P1462	603497	766610	P0345	607999	769879
P1460	610937	766638	P0344	607870	769881
P1459	608620	766639	P0342	608005	769884
P1458	607706	766685	P0340	607877	769885
P1457	604321	766686	P0339	607889	769891
P1456	604949	766688	P0338	607896	769892
P1455	604349	766715	P0327	607907	769901
P1453	608660	766730	P0322	607912	769906
P1454	607731	766730	P0321	608042	769909
P1452	604362	766733	P0319	607919	769914
P1451	607671	766760	P0318	607986	769915
P1450	603442	766770	P0320	602918	769910
P1449	604377	766771	P0317	607977	769920
P1448	603416	766792	P0315	607970	769924
P1447	604237	766793	P0314	608012	769926
P1445	604406	766800	P0312	607962	769929
P1443	603387	766815	P0311	607956	769933
P1442	603235	766818	P0309	608030	769937
P1441	604215	766825	P0310	607584	769937
P1438	610042	766834	P0307	608025	769946
P1440	604431	766827	P0305	608020	769951
P1439	603480	766832	P0298	607953	770005
P1436	604581	766839	P0296	608026	770016
P1435	610605	766858	P0294	602965	770018
P1434	604463	766871	P0293	607964	770025
P1433	604532	766892	P0291	601514	770034
P1432	604178	766893	P0287	608002	770045
P1431	603394	766904	P0288	607950	770045
P1428	608851	766916	P0284	607976	770063
P1429	604138	766912	P0265	606522	770099
P1427	604441	766918	P0259	601546	770116
P1426	603367	766931	P0251	607753	770155
P1425	604323	766933	P0245	602904	770195
P1424	604287	766939	P0244	607852	770202
P1423	603338	766960	P0242	607858	770214
P1422	603299	766990	P0232	605359	770329
P1421	607502	766997	P0215	601560	770412
P1419	604212	767015	P0211	602904	770424
P1417	607485	767034	P0204	602767	770602
P1416	607477	767057	P0182	605236	771235
P1414	607529	767066	P0181	605299	771237
P1413	604661	767075	P0180	605407	771250
P1411	607464	767096	P0178	605446	771254
P1410	610429	767173	P0177	605489	771255
P1407	603073	767333	P0175	605286	771295
P1405	610316	767359	P0174	605337	771299

Name	Easting	Northing	Name	Easting	Northing
P1406	604724	767356	P0173	605405	771309
P1403	609852	767414	P0172	605170	771336
P1402	602768	767437	P0170	605813	771401
P1400	602635	767455	P0168	605186	771416
P1399	604703	767467	P0166	605817	771442
P1398	602763	767479	P0164	605824	771455
P1396	609254	767514	P0159	605160	771540
P1394	607344	767521	P0127	604729	771954
P1395	602674	767520	P0125	604618	771973
P1393	602548	767538	P0115	605146	772129
P1388	602530	767573	P0111	605086	772139
P1383	602604	767584	P0091	605564	772177
P1375	604702	767631	P0074	605331	772217
P1371	607324	767636	P0039	606195	772303
P1372	602547	767636	P0028	602133	772601
P1368	602490	767661	P0025	605910	772721
P1357	602462	767708	P0022	603934	772861
P1355	607306	767721	P0020	602845	772918
P1353	607377	767729	P0019	602748	773221
P1352	602427	767742	--	--	--

Table A12-3 presents the turbine sound power noise emission values used the assessment of the typical candidate turbine at the proposed development.

Table A12-3 *LWA Levels Used for Prediction Model – Vestas V162 107.5 m Hub Height*

Wind Speed (m/s at 10m Standardised Height)	Octave Bank Centre Frequency (Hz)								dB LWA
	63	125	250	500	1000	2000	4000	8000	
3	75.2	82.7	87.3	89.1	88.0	84.1	77.3	67.7	94.0
4	75.9	83.6	88.2	89.9	88.8	84.6	77.6	67.5	94.8
5	80.3	87.9	92.5	94.2	93.1	88.9	81.9	71.9	99.1
6	84.6	92.1	96.7	98.4	97.3	93.2	86.3	76.3	103.3
7	85.9	93.4	98.0	99.7	98.6	94.5	87.6	77.7	104.6
8	86.2	93.6	98.1	99.9	98.8	94.8	88.0	78.3	104.8
9	86.2	93.6	98.2	100.1	99.0	95.2	88.6	79.1	105.0
10	86.3	93.8	98.5	100.4	99.5	95.9	89.4	80.2	105.4
≥11	86.0	93.6	98.4	100.5	99.7	96.2	89.9	80.8	105.5

The following tables present the turbine coordinates for the proposed development.

Table A12-4 Turbine Location Coordinates for Proposed Development

Turbine Ref.	Co-ordinates (ITM)	
	X	Y
T01	604,227.3	769,638.5
T02	603,783.9	769,930.4
T03	603,631.1	770,709.8
T04	603,272.8	771,269.1
T05	603,935.1	771,598.2
T06	604,401.2	770,969.8
T07	604,567.4	770,386.8
T08	605,467.2	768,511.6
T09	605,987.8	768,296.2
T10	606,512.6	768,082.3
T11	606,428.3	766,264.2
T12	606,826.0	766,063.7
T13	606,674.6	767,005.1
T14	605,796.1	765,861.0
T15	605,927.9	765,412.5
T16	608,183.5	764,439.0
T17	607,954.4	764,866.5
T18	608,541.3	764,121.6
T19	609,012.7	763,846.1
T20	609,820.3	764,154.7
T21	609,286.0	764,676.2
T22	609,854.3	765,243.8