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Kent Breeze Corporation

Noise Assessment Report

Kent Breeze Wind Farm and MacLeod Windmill Project

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May 14, 2010

Project Report

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DISTRIBUTION

Teresa Newland – Kent Breeze Corporation

Noise Assessment Report

Table of Contents

List of Tables

List of Appendices

Report Disclaimer

This report has been prepared by Hatch for the sole and exclusive use of Kent Breeze (the "Client") for the purpose of assisting the management of the Client in making decisions with respect to the potential development of the Kent Breeze Wind Farm and Macleod Windmill Project and for attachment to their application for a Renewable Energy Approval from the Ontario Ministry of the Environment (MOE) and may be used for this purpose; but shall not be (a) used for any other purpose, or (b) provided to, relied upon or used by any third party.

Executive Summary

A noise impact assessment on the Kent Breeze Wind Farm and the Macleod Wind Mill projects was carried out to determine compliance with Ontario Ministry of Environment "Noise Guidelines for Wind Farms" (MOE 2008).

These projects represent two planned wind farms adjacent to each other near the town of Thamesville, in the Regional Municipality of Chatham-Kent, Ontario. They are collectively called "Kent Breeze Wind Farms" There are no other planned or approved wind farms within a 5 km radius of the project site.

Information on real and potential receptors was gathered by the IBI Group and forwarded to Hatch along with UTM coordinates for each. Wind turbine locations were laid out for noise compliance and also compliance to the setbacks required by Ontario Regulation 359-09.

Wind turbine noise emissions were adjusted for the site's summer night-time wind shear which is higher than the manufacturers test site. The result of this adjustment meant that only a single sound power level was applicable for all wind speeds required to be examined by the MOE.

The noise study documented in this report concludes that all receptors are compliant with the Noise Guidelines (MOE 2008).

The maximum noise emission for a non-participating receptor at an existing dwelling is 40.0 dB. The maximum noise emission at a future dwelling placed on what is now a vacant lot is 40.0 dB.

1. Introduction

Kent Breeze Corporation has been awarded two Standard Offer contracts by the Ontario Power Authority for the supply of up to 10 MW of wind power each into the local distribution network (27.6 kV). The two projects are known as the Kent Breeze Wind Farm and Macleod Windmill Project and are located adjacent to each other in the Regional Municipality of Chatham-Kent, approximately 10 km from the town of Thamesville, Ontario.

Kent Breeze has filed a "notice of commencement" for the projects under the Environmental Assessment Act and has received a firm offer for wind turbines from General Electric (GE), their 2.5xl model at a hub height of 85-m. (2.5 MW each, 4 machines per project, 8 machines in total).

This Noise Impact Assessment is a study required by the Ontario Ministry of the Environment (MOE) as a prerequisite for the issuance of a Renewable Energy Approval.

2. Project Layout

The project layout presented in this report meets two primary criteria:

- Noise compliance in accordance with "Noise Guidelines for Wind Farms (MOE, October 2008)
- Setback compliance per Ontario Regulation 359-09.

Since the publication of "Noise Guidelines for Wind Farms", the Green Energy Act was implemented and required wind farms to meet certain setback rules. This project chose a minimum setback of 550 m from receptors as permitted by Ontario Regulation 359-09.

The layout also complies with the following:

- Setback from roads, railways – 60 m (blade length + 10 m, see Table 2.1, item i)
- Lot line setback – 85 m (hub height)
- Significant woodlot setback – 120 m.

Table 2.1 Project Layout Requirements Summary

Item	Description	Report Location
a)	Geographic Location of the Project Study Area	Map 1 in Appendix A
b)	Locations of Wind Turbines	Maps 1 to 4 in Appendix A
c)	Location of transformer substation or switching station	Switching station only – Map 5 in Appendix A
d)	Locations of all Receptors	Maps 3 and 4 in Appendix A, and Tables 4.1 and 4.2
e)	Property Boundaries	Maps 1, 3, 4 in Appendix A
f)	Municipal Zoning and Land-Use Plans	All properties on which wind turbines are located are zoned agricultural.
g)	Topographical Features	Maps 2 and 5 in Appendix A
h)	Other Wind Farms	Kent Breeze and Macleod Windmills represent two adjacent proposed wind farms. There are no other approved or planned wind farms within 5 km of the project area.
i)	Renewable Energy Setback Compliance	Compliance with Ontario Regulation 359-09 is shown on Map 4 in Appendix A. The GE2.5xl machines will have an 85-m hub height and 100-m rotor diameter. Blade length = rotor diameter divided by 2 (= 50 m).

3. Noise Sources

3.1 Wind Turbine Generators

3.1.1 Make, Model and Hub Height

GE 2.5xl, 85-m hub height.

3.1.2 Maximum Electrical Output Rating

2500 kW.

3.1.3 Range of Rotational Speeds

5-14 rpm

3.1.4 Mode of Operation

The noise information provided in this application (Appendix B) is for Normal Operating Mode (NO). The GE 2.5xl can operate in "noise reduced" modes. This application is not based on any noise reduced mode of operation.

3.1.5 Sound Power Levels

Refer to Product Acoustic Specifications in Appendix B.

3.1.6 Frequency Spectra in Octave Bands

Refer to Product Acoustic Specifications in Appendix B.

3.1.7 Tonality

Refer to Product Acoustic Specifications in Appendix B. There are no sound emissions defined as tonal by IEC standards.

3.2 Transformer Substation

The project does not have a step-up transformer required to convert power to grid voltage. The wind turbine generators produce power at local distribution system voltage and are connected to the grid at the two switching stations located on Map 5 in Appendix A.

3.3 Adjustment to Wind Turbine Generator Acoustic Emissions for Wind Speed Profile

GE Normal Operation noise emissions form the input data for the calculations of Adjusted Emissions Levels. The adjustment method is detailed in Appendix C.

Two adjustments were made to the manufacturer's noise emissions, one for wind shear (0.42, summer 11p.m. to 7 a.m.) and the other to increase each of the apparent sound power levels by octave band by 0.9 dB to account for the manufacturer's reported uncertainty. The A-weighted sound power level used in modeling is 105.1 dbA re 10^{-12}W for normalized wind speeds ranging from 6 to 10 m/s at 10-m height.

3.3.1 Wind Turbine Acoustic Emissions Summary

Table 3.1 Wind Turbine Acoustic Emissions Summary

Make and Model	GE 2.5 xl									
Electrical Rating (kW)	2500									
Hub Height (m)	85									
Wind Shear Coefficient	0.42									
Octave Band Apparent Sound Power Level LwA (dBA re 1E-12W)										
	Manufacturer's Emissions Levels					**Adjusted Sound Power Levels**				
Wind Speed (m/s)	6	7	8	9	10	6	7	8	9	10
Frequency (Hz)			[1]							
63	-	-	86.8	-	-	86.8	86.8	86.8	86.8	86.8
125	-	-	93.3	-	-	93.3	93.3	93.3	93.3	93.3
250	-	-	99.5	-	-	99.5	99.5	99.5	99.5	99.5
500	-	-	100.1	-	-	100.1	100.1	100.1	100.1	100.1
1000	-	-	98.4	-	-	98.4	98.4	98.4	98.4	98.4
2000	-	-	95.1	-	-	95.1	95.1	95.1	95.1	95.1
4000	-	-	87.3	-	-	87.3	87.3	87.3	87.3	87.3
8000	-	-	70.9	-	-	70.9	70.9	70.9	70.9	70.9
A-weighted	-	-	105.1	-	-	105.1	105.1	105.1	105.1	105.1
[1] The maximum noise emission										

3.4 Noise Sources and Locations

Wind turbine identification and their coordinates are given in Table 3.2. Coordinates are in Universal Transverse Mercator (UTM) NAD83, Zone 17. Refer also to the maps in Appendix A. During project development turbines Kent 2 and MacLeod 2 were deleted from the layout. This is the reason why turbines are not sequentially numbered.

Table 3.2 Noise Sources Identification and UTM Coordinates

Project Name: Kent Breeze Wind Farms and Macleod Windmill Project				
Identifier	**Equipment Make and Model**	**UTM Coordinates**		**Remarks**
		X (Easting)	**Y (Northing)**	
Kent-1	GE 2.5xl	413230	4711135	
Kent-2				Deleted
Kent-3	GE 2.5xl	412788	4709343	
Kent-4	GE 2.5xl	413679	4709641	
Kent-5	GE 2.5xl	414023	4710276	
Macleod-1	GE 2.5xl	414288	4710646	
Macleod-2				Deleted
Macleod-3	GE 2.5xl	415670	4710482	
Macleod-4	GE 2.5xl	415773	4711215	
Macleod-5	GE 2.5xl	415995	4712127	

4. Receptors

The project's receptor list is included in Tables 4.1 and 4.2. Receptor locations were provided by the IBI Group, London, Ontario.

"Potential" receptors refer to receptors on vacant lots. Location of the receptor on these lots was by IBI. All of the vacant lots are very large and there are multiple locations where a dwelling may reasonably be expected to be located. In all cases, the location provides the prospective dwelling builder at least a 100 m x 100 m building envelope on a portion of the vacant land that would reasonably be expected to contain a dwelling and conforms to the municipal zoning bylaws in effect.

There is one "Participating Receptor" (Number 19). It is a house on land controlled by the proponent (Kent Breeze Corporation).

Table 4.1 Point of Reception Locations

Point of Reception ID	Description	UTM Coordinates	
		X	Y
1	Dwelling	416364.46	4711359
2	Dwelling	416390.09	4711380
3	Dwelling	416410.09	4711398
4	Dwelling	416435.09	4711417
5	Dwelling	416726.09	4711689
6	Dwelling	416770.38	4711633
7	Dwelling	416784.09	4711646
8	Dwelling	416655.09	4711531
9	Dwelling	416697.54	4711663
10	Dwelling	415956.09	4712857
11	Dwelling	415744.09	4712662
12	Dwelling	415443.01	4712386
13	Dwelling	415269.09	4712225
14	Dwelling	415194.09	4712261
15	Dwelling	415304.09	4712358
16	Dwelling	415370.09	4712327
17	Dwelling	415310.09	4712525
18	Dwelling	415411.24	4712593
20	Dwelling	413022.09	4710315
21	Dwelling	412613.08	4709948
22	Dwelling	414506.11	4709204
23	Dwelling	414583.11	4709326
24	Dwelling	415162.1	4709529
25	Dwelling	415198.1	4709545
26	Dwelling	415764.08	4709276
27	Dwelling	416351.09	4709566
28	Dwelling	415787.08	4709822
29	Dwelling	416335.09	4710089
30	Dwelling	416718.1	4710349
31	Dwelling	416683.09	4710331
32	Dwelling	416548.09	4710115
33	Dwelling	416854.1	4710451
34	Dwelling	416823.09	4710344
35	Dwelling	416898.1	4710351
36	Dwelling	417001.09	4710581
37	Dwelling	417309.19	4710671
38	Dwelling	417254.09	4710631
39	Dwelling	417279.52	4710651
40	Dwelling	410953.7	4708570
41	Dwelling	410920.8	4708615
42	Dwelling	410902.51	4708653
43	Dwelling	410876.1	4708685
44	Dwelling	410818.01	4708739
45	Dwelling	410479.27	4709127
46	Dwelling	410109.23	4709499
47	Dwelling	409944.24	4711102
48	Dwelling	412031.57	4713014
49	Dwelling	412016.74	4712987
50	Dwelling	412324.8	4711405
51	Dwelling	412133.69	4711252
52	Dwelling	411831.43	4710967
53	Dwelling	411685.86	4710947
54	Dwelling	411567.66	4710710
55	Dwelling	411522.93	4710670
56	Dwelling	411207.93	4710391
57	Dwelling	410935.36	4710176
58	Dwelling	411425.38	4708942
59	Dwelling	411707.9	4709091
60	Dwelling	413270.24	4712257
61	Dwelling	413559.31	4712651
62	Dwelling	413619.98	4712747
63	Dwelling	413791.38	4712840
64	Dwelling	413877.95	4712936
65	Dwelling	413961.16	4712911
66	Dwelling	414070.33	4713084
67	Dwelling	414098.24	4713036
68	Dwelling	414497.63	4713489
69	Dwelling	414692.23	4713445
70	Dwelling	413427.31	4713559
71	Dwelling	413137.87	4713573
72	Dwelling	412814.59	4713568
73	Dwelling	412930.57	4713583
74	Dwelling	412533.61	4713448
75	Dwelling	412269.91	4713216
76	Dwelling	414217.6	4711293
77	Dwelling	414477.68	4711523
78	Dwelling	414521.29	4711663
79	Dwelling	414620.55	4711658
80	Dwelling	414613.56	4711731
81	Dwelling	414919.05	4711867
82	Dwelling	415013.53	4712084
83	Dwelling	415014.63	4712009
84	Dwelling	415220.86	4712128
85	Dwelling	415242.92	4712316
86	Dwelling	416236.21	4713105
87	Dwelling	416221.5	4713368
88	Dwelling	416501.99	4713352
89	Dwelling	416558.97	4713385
90	Dwelling	414854.35	4713457
91	Dwelling	417334.66	4713355
92	Dwelling	417827.06	4713271
93	Dwelling	418001.28	4713188
94	Dwelling	418281.62	4712891
95	Dwelling	418299.74	4712864
96	Dwelling	418319.94	4712840
97	Dwelling	418332.85	4712827
98	Dwelling	418345.21	4712817
99	Dwelling	418367.97	4712788
100	Dwelling	418383.92	4712777
101	Dwelling	418395.93	4712765
102	Dwelling	418421.92	4712733
103	Dwelling	418440.02	4712711
104	Dwelling	418493.6	4712655
105	Dwelling	418641.01	4712445
106	Dwelling	418972.92	4712104
107	Dwelling	419002.88	4712063
108	Dwelling	419186.06	4711913
109	Dwelling	418754.9	4711529
110	Dwelling	418650.4	4711460
111	Dwelling	418609.82	4711434
112	Dwelling	418594.15	4711419
113	Dwelling	418525.01	4711432
114	Dwelling	418503.59	4711311
115	Dwelling	418647.79	4711336
116	Dwelling	418448.45	4711278
117	Dwelling	418337.8	4711323
118	Dwelling	418275.27	4711412
119	Dwelling	418296.78	4711384
120	Dwelling	418306.75	4711374
121	Dwelling	418316.73	4711353
122	Dwelling	418309.42	4711302
123	Dwelling	418260.85	4711270
124	Dwelling	418198.1	4711269
125	Dwelling	418147.76	4711220
126	Dwelling	418236.68	4711157
127	Dwelling	418193.44	4711133
128	Dwelling	418112.5	4711186
129	Dwelling	418064.83	4711180
130	Dwelling	418017.6	4711158
131	Dwelling	417961.49	4711133
132	Dwelling	417933.33	4711117
133	Dwelling	417860.82	4711090
134	Dwelling	417761.26	4711028
135	Dwelling	417784.98	4711041
136	Dwelling	417720.23	4711011
137	Dwelling	417794.52	4710977
138	Dwelling	417656.08	4710994
139	Dwelling	417779.46	4710942
140	Dwelling	417707.4	4710907
141	Dwelling	417670.09	4710878
142	Dwelling	417605.74	4710865
143	Dwelling	417559.35	4710932
144	Dwelling	417534.08	4710923
145	Dwelling	417592.71	4710843
146	Dwelling	417540.59	4710837
147	Dwelling	417470.91	4710785
148	Dwelling	417522.23	4710817
149	Dwelling	417441.89	4710902
150	Dwelling	417127.44	4710646
151	Dwelling	417205.38	4710694
152	Dwelling	418521.68	4710541
153	Dwelling	418180.84	4710426
154	Dwelling	418133.58	4710378
155	Dwelling	418112.12	4710256
156	Dwelling	417966.41	4710149
157	Dwelling	417885.34	4710002
158	Dwelling	416486.76	4708488
159	Dwelling	415999.99	4708121
160	Dwelling	414460.56	4707649
161	Dwelling	412177.69	4707285
162	Dwelling	412180.41	4707229
163	Dwelling	412185.6	4707371
164	Dwelling	411919.87	4707478
165	Dwelling	411942.59	4707495
166	Dwelling	411952.65	4707507
167	Dwelling	411974.91	4707523
168	Dwelling	412045.81	4707557
169	Dwelling	412083.32	4707591
170	Dwelling	412277.72	4707736
171	Dwelling	412312.79	4707778
172	Dwelling	412393.15	4707810
173	Dwelling	412426.69	4707852
174	Dwelling	412578.98	4707957
175	Dwelling	412550.97	4707845
176	Dwelling	413443.47	4708541
177	Dwelling	413678.23	4708700

Point of Reception ID	Description	UTM Coordinates	
		X	Y
178	Dwelling	413747.67	4708750
179	Dwelling	414078.38	4708959
180	Dwelling	414725.19	4709325
181	Dwelling	415249.34	4709446
182	Dwelling	415251.66	4709018
183	Dwelling	413069.65	4708385
184	Dwelling	412390.45	4707922
185	Dwelling	412134.56	4707713
186	Dwelling	412013.79	4707627
187	Dwelling	411992.43	4707604
188	Dwelling	411951.02	4707570
189	Dwelling	411923.21	4707543
190	Dwelling	411850	4707568
191	Dwelling	411856.66	4707556
192	Dwelling	411854.56	4707603
193	Dwelling	411737.31	4707709
194	Dwelling	410677.58	4708893
195	Dwelling	415231.84	4713583
196	Dwelling	415469.47	4713517
197	Dwelling	416810.11	4713353
198	Dwelling	416607.14	4713353
199	Dwelling	417657.51	4712433
200	Dwelling	417580.77	4712353
201	Dwelling	417562.89	4712321
202	Dwelling	417517.97	4712295
203	Dwelling	417541.81	4712203
204	Dwelling	417300.86	4712182
205	Dwelling	417251.26	4712161
206	Dwelling	417211.45	4712152
207	Dwelling	417051.26	4711951
208	Dwelling	417096.39	4711904
209	Dwelling	417034.33	4711858
210	Dwelling	416923.67	4712735
211	Dwelling	414614.68	4709856
212	Dwelling	414642.37	4709804
213	Dwelling	414673.03	4709784
214	Potential Receptor (Vacant Lot)	411269.71	4710577
215	Potential Receptor (Vacant Lot)	412429.21	4712316
216	Potential Receptor (Vacant Lot)	412512.62	4712389
217	Potential Receptor (Vacant Lot)	413674.8	4712612
218	Potential Receptor (Vacant Lot)	413248.32	4712377
219	Potential Receptor (Vacant Lot)	413479.26	4712450
220	Potential Receptor (Vacant Lot)	414345.62	4713223
221	Potential Receptor (Vacant Lot)	415630.3	4713977
222	Potential Receptor (Vacant Lot)	416832.98	4713872
223	Potential Receptor (Vacant Lot)	417003.42	4713877
224	Potential Receptor (Vacant Lot)	417291.48	4713325
225	Potential Receptor (Vacant Lot)	418023.65	4712880
226	Potential Receptor (Vacant Lot)	418018.84	4712688
227	Potential Receptor (Vacant Lot)	417882.01	4711188
228	Potential Receptor (Vacant Lot)	418129.27	4711435
229	Potential Receptor (Vacant Lot)	418215.69	4711527
230	Potential Receptor (Vacant Lot)	415421.48	4707903
231	Potential Receptor (Vacant Lot)	415224.29	4707844
232	Potential Receptor (Vacant Lot)	415043.18	4707776
233	Potential Receptor (Vacant Lot)	414907.08	4707722
234	Potential Receptor (Vacant Lot)	414271.22	4707418
235	Potential Receptor (Vacant Lot)	412223.23	4707796
236	Potential Receptor (Vacant Lot)	411364.4	4708694
237	Potential Receptor (Vacant Lot)	411310.85	4708751
238	Potential Receptor (Vacant Lot)	410748.5	4708831
239	Potential Receptor (Vacant Lot)	410707.1	4709928
240	Potential Receptor (Vacant Lot)	410825.66	4710041
241	Potential Receptor (Vacant Lot)	411010.09	4710229
242	Potential Receptor (Vacant Lot)	411121.12	4710312
243	Potential Receptor (Vacant Lot)	411324.37	4710511
244	Potential Receptor (Vacant Lot)	411544.59	4710841
245	Potential Receptor (Vacant Lot)	411663.85	4710798
246	Potential Receptor (Vacant Lot)	411783.12	4710914
247	Potential Receptor (Vacant Lot)	412996.19	4711989
248	Potential Receptor (Vacant Lot)	412752.56	4711776
249	Potential Receptor (Vacant Lot)	412537.88	4711577
250	Potential Receptor (Vacant Lot)	411962.01	4711211
251	Potential Receptor (Vacant Lot)	411982.46	4711098
252	Potential Receptor (Vacant Lot)	411472.4	4708785
253	Potential Receptor (Vacant Lot)	411558.38	4708857
254	Potential Receptor (Vacant Lot)	411744	4709135
255	Potential Receptor (Vacant Lot)	411988.17	4709250
256	Potential Receptor (Vacant Lot)	412306.8	4707873
257	Potential Receptor (Vacant Lot)	412498.07	4709965
258	Potential Receptor (Vacant Lot)	412911.86	4710228
259	Potential Receptor (Vacant Lot)	414103.3	4711292
260	Potential Receptor (Vacant Lot)	414341.06	4711376
261	Potential Receptor (Vacant Lot)	414567.71	4711568
262	Potential Receptor (Vacant Lot)	415103.04	4712068
263	Potential Receptor (Vacant Lot)	415745.94	4713418
264	Potential Receptor (Vacant Lot)	416454.83	4713293
265	Potential Receptor (Vacant Lot)	417382.5	4712267
266	Potential Receptor (Vacant Lot)	417469.28	4712349
267	Potential Receptor (Vacant Lot)	417618.12	4712152
268	Potential Receptor (Vacant Lot)	416923.65	4711865
269	Potential Receptor (Vacant Lot)	417585.27	4710980
270	Potential Receptor (Vacant Lot)	416981.15	4711797
271	Potential Receptor (Vacant Lot)	416757.87	4711576
272	Potential Receptor (Vacant Lot)	416565.93	4710278
273	Potential Receptor (Vacant Lot)	416128.76	4709981
274	Potential Receptor (Vacant Lot)	416432.66	4710203
275	Potential Receptor (Vacant Lot)	416725.6	4710219
276	Potential Receptor (Vacant Lot)	416416.23	4710000
277	Potential Receptor (Vacant Lot)	417133.53	4710520
278	Potential Receptor (Vacant Lot)	414855.69	4709461
279	Potential Receptor (Vacant Lot)	414943.3	4709340
280	Potential Receptor (Vacant Lot)	414466.92	4709176
281	Potential Receptor (Vacant Lot)	413886.51	4708812
282	Potential Receptor (Vacant Lot)	413796.16	4708757
283	Potential Receptor (Vacant Lot)	414231.47	4709222
284	Potential Receptor (Vacant Lot)	413868.08	4708935
285	Potential Receptor (Vacant Lot)	413739.86	4708836
286	Potential Receptor (Vacant Lot)	413593.54	4708740
287	Potential Receptor (Vacant Lot)	413281.46	4708393
288	Potential Receptor (Vacant Lot)	413096.26	4708405
289	Potential Receptor (Vacant Lot)	412983.04	4708196
290	Potential Receptor (Vacant Lot)	412892.69	4708292
291	Potential Receptor (Vacant Lot)	414737.18	4709893
292	Potential Receptor (Vacant Lot)	415060.06	4710181

Table 4.2 Participating Receptor Locations

Point of Reception ID	Description	UTM Coordinates	
		X	Y
19	Dwelling (Participating)	413972.0	4710708

5. Noise Impact Assessment

5.1 Distance Requirement

Several receptors are within 1500 m of a wind turbine. In addition, noise from the wind turbine is in excess of 102 dBA. Per the requirements of MOE 2008 and Ontario Regulation 359-09, a "detailed noise impact assessment" was carried out for all receptors identified within the project area.

5.2 Impact of Adjacent Planned and Approved Wind Farms

The Kent Breeze Wind Farm and Macleod Windmill project represent two adjacent “planned” wind farms. They are assessed together. There are no other planned or approved wind farms within 5 km of the project area.

5.3 Assessment of Participating Receptors

Noise impact on the one "participating" receptor is calculated and presented in this report.

5.4 Prediction Method

Predictions of the total sound power level at a point of reception were carried out using CADNA-A software (version 4.0.135) which is based on the methods described in standard ISO 9613-2.

A sample calculation for a source to receiver pair is included in Appendix E.

5.5 Adjustment for Special Quality of Sound

Adjustment due to tonal nature of sound is not required based on the data provided by GE (which is based on IEC 61400-14 Declaration of Apparent Sound Power Level and Tonality Values).

5.6 Specific Parameters

5.6.1 Integer Wind Speed Values

Calculations were carried out for integer wind speed of 6 m/s (at 10-m height) for the summer night-time scenario (the Adjusted Emission Levels in Table 3.1). At 6 m/s and higher, each turbine is emitting its maximum noise and therefore the noise emissions for 7 to 10 m/s (at 10-m height) are the same as the 6-m/s case.

5.6.2 Atmospheric Absorption

Atmospheric absorption coefficients used by CADNA-A conform to ISO 9613-2 and are those listed in MOE 2008 Table 2 (which are based on 10°C and 70% relative humidity).

5.6.3 Ground Attenuation

A global value of 0.7 for ground attenuation was used.

6. Results and Compliance

6.1 Presentation of Results

Noise impacts at each "Point of Reception" are provided in Tables 6.1 and 6.2.

A map showing noise contours is included in Appendix D (one map, for the 6-m/s, summer night-time case, applicable for all integer values of wind speeds at 10-m height from 6 to10 m/s).

6.2 Compliance

Compliance to the requirements of MOE 2008, Table 1 (40.0 dBA or less at 6 m/s 10-m height) is met for all points of reception. Maximum noise at an existing dwelling that is non-participating is 40.0 dBA (receptor 211). Maximum noise at a receptor placed on a vacant lot is 40.0 dBA (number 259).

Noise impacts at higher wind speeds (7 to 10 m/s at 10-m height) are the same as the 6 m/s case and are all compliant with MOE 2008.

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
1	Dwelling	4.5	620	Macleod-4	39.8	40.0	43.0	45.0	49.0	51
2	Dwelling	4.5	649	Macleod-4	39.5	40.0	43.0	45.0	49.0	51
3	Dwelling	4.5	673	Macleod-4	39.3	40.0	43.0	45.0	49.0	51
4	Dwelling	4.5	702	Macleod-4	39.0	40.0	43.0	45.0	49.0	51
5	Dwelling	4.5	890	Macleod-5	36.6	40.0	43.0	45.0	49.0	51
6	Dwelling	4.5	957	Macleod-5	36.2	40.0	43.0	45.0	49.0	51
7	Dwelling	4.5	962	Macleod-5	36.1	40.0	43.0	45.0	49.0	51
8	Dwelling	4.5	923	Macleod-5	37.1	40.0	43.0	45.0	49.0	51
9	Dwelling	4.5	879	Macleod-5	36.8	40.0	43.0	45.0	49.0	51
10	Dwelling	4.5	734	Macleod-5	36.6	40.0	43.0	45.0	49.0	51
11	Dwelling	4.5	581	Macleod-5	38.7	40.0	43.0	45.0	49.0	51
12	Dwelling	4.5	580	Macleod-5	39.1	40.0	43.0	45.0	49.0	51
13	Dwelling	4.5	698	Macleod-5	38.1	40.0	43.0	45.0	49.0	51
14	Dwelling	4.5	777	Macleod-5	37.3	40.0	43.0	45.0	49.0	51
15	Dwelling	4.5	695	Macleod-5	37.9	40.0	43.0	45.0	49.0	51
16	Dwelling	4.5	623	Macleod-5	38.7	40.0	43.0	45.0	49.0	51
17	Dwelling	4.5	762	Macleod-5	36.9	40.0	43.0	45.0	49.0	51
18	Dwelling	4.5	721	Macleod-5	37.2	40.0	43.0	45.0	49.0	51
20	Dwelling	4.5	850	Kent-1	39.5	40.0	43.0	45.0	49.0	51
21	Dwelling	4.5	635	Kent-3	39.2	40.0	43.0	45.0	49.0	51
22	Dwelling	4.5	939	Kent-4	37.0	40.0	43.0	45.0	49.0	51
23	Dwelling	4.5	961	Kent-4	37.3	40.0	43.0	45.0	49.0	51
24	Dwelling	4.5	1083	Macleod-3	36.4	40.0	43.0	45.0	49.0	51
25	Dwelling	4.5	1052	Macleod-3	36.4	40.0	43.0	45.0	49.0	51
26	Dwelling	4.5	1213	Macleod-3	33.9	40.0	43.0	45.0	49.0	51
27	Dwelling	4.5	1145	Macleod-3	33.7	40.0	43.0	45.0	49.0	51
28	Dwelling	4.5	676	Macleod-3	38.1	40.0	43.0	45.0	49.0	51
29	Dwelling	4.5	777	Macleod-3	37.0	40.0	43.0	45.0	49.0	51

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
30	Dwelling	4.5	1060	Macleod-3	35.0	40.0	43.0	45.0	49.0	51
31	Dwelling	4.5	1028	Macleod-3	35.2	40.0	43.0	45.0	49.0	51
32	Dwelling	4.5	956	Macleod-3	35.4	40.0	43.0	45.0	49.0	51
33	Dwelling	4.5	1188	Macleod-3	34.3	40.0	43.0	45.0	49.0	51
34	Dwelling	4.5	1165	Macleod-3	34.2	40.0	43.0	45.0	49.0	51
35	Dwelling	4.5	1238	Macleod-3	33.7	40.0	43.0	45.0	49.0	51
36	Dwelling	4.5	1337	Macleod-3	33.5	40.0	43.0	45.0	49.0	51
37	Dwelling	4.5	1634	Macleod-4	31.8	40.0	43.0	45.0	49.0	51
38	Dwelling	4.5	1593	Macleod-3	32.1	40.0	43.0	45.0	49.0	51
39	Dwelling	4.5	1613	Macleod-4	32.0	40.0	43.0	45.0	49.0	51
40	Dwelling	4.5	1992	Kent-3	27.4	40.0	43.0	45.0	49.0	51
41	Dwelling	4.5	2006	Kent-3	27.4	40.0	43.0	45.0	49.0	51
42	Dwelling	4.5	2010	Kent-3	27.4	40.0	43.0	45.0	49.0	51
43	Dwelling	4.5	2024	Kent-3	27.3	40.0	43.0	45.0	49.0	51
44	Dwelling	4.5	2062	Kent-3	27.2	40.0	43.0	45.0	49.0	51
45	Dwelling	4.5	2320	Kent-3	26.2	40.0	43.0	45.0	49.0	51
46	Dwelling	4.5	2685	Kent-3	25.0	40.0	43.0	45.0	49.0	51
47	Dwelling	4.5	3287	Kent-1	24.0	40.0	43.0	45.0	49.0	51
48	Dwelling	4.5	2230	Kent-1	26.2	40.0	43.0	45.0	49.0	51
49	Dwelling	4.5	2215	Kent-1	26.6	40.0	43.0	45.0	49.0	51
50	Dwelling	4.5	948	Kent-1	34.9	40.0	43.0	45.0	49.0	51
51	Dwelling	4.5	1106	Kent-1	33.8	40.0	43.0	45.0	49.0	51
52	Dwelling	4.5	1411	Kent-1	32.3	40.0	43.0	45.0	49.0	51
53	Dwelling	4.5	1558	Kent-1	31.6	40.0	43.0	45.0	49.0	51
54	Dwelling	4.5	1718	Kent-1	31.3	40.0	43.0	45.0	49.0	51
55	Dwelling	4.5	1771	Kent-1	31.1	40.0	43.0	45.0	49.0	51.0
56	Dwelling	4.5	1898	Kent-3	29.8	40.0	43.0	45.0	49.0	51.0
57	Dwelling	4.5	2033	Kent-3	28.7	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
58	Dwelling	4.5	1423	Kent-3	30.8	40.0	43.0	45.0	49.0	51.0
59	Dwelling	4.5	1112	Kent-3	33.0	40.0	43.0	45.0	49.0	51.0
60	Dwelling	4.5	1125	Kent-1	33.8	40.0	43.0	45.0	49.0	51.0
61	Dwelling	4.5	1553	Kent-1	31.8	40.0	43.0	45.0	49.0	51.0
62	Dwelling	4.5	1661	Kent-1	31.4	40.0	43.0	45.0	49.0	51.0
63	Dwelling	4.5	1797	Kent-1	31.1	40.0	43.0	45.0	49.0	51.0
64	Dwelling	4.5	1915	Kent-1	30.8	40.0	43.0	45.0	49.0	51.0
65	Dwelling	4.5	1922	Kent-1	31.0	40.0	43.0	45.0	49.0	51.0
66	Dwelling	4.5	2115	Macleod-5	30.4	40.0	43.0	45.0	49.0	51.0
67	Dwelling	4.5	2069	Macleod-5	30.6	40.0	43.0	45.0	49.0	51.0
68	Dwelling	4.5	1996	Macleod-5	29.4	40.0	43.0	45.0	49.0	51.0
69	Dwelling	4.5	1827	Macleod-5	29.9	40.0	43.0	45.0	49.0	51.0
70	Dwelling	4.5	2434	Kent-1	27.9	40.0	43.0	45.0	49.0	51.0
71	Dwelling	4.5	2442	Kent-1	27.5	40.0	43.0	45.0	49.0	51.0
72	Dwelling	4.5	2470	Kent-1	27.1	40.0	43.0	45.0	49.0	51.0
73	Dwelling	4.5	2468	Kent-1	27.2	40.0	43.0	45.0	49.0	51.0
74	Dwelling	4.5	2417	Kent-1	27.1	40.0	43.0	45.0	49.0	51.0
75	Dwelling	4.5	2293	Kent-1	27.3	40.0	43.0	45.0	49.0	51.0
76	Dwelling	4.5	656	Macleod-1	39.9	40.0	43.0	45.0	49.0	51.0
77	Dwelling	4.5	901	Macleod-1	37.9	40.0	43.0	45.0	49.0	51.0
78	Dwelling	4.5	1047	Macleod-1	37.1	40.0	43.0	45.0	49.0	51.0
79	Dwelling	4.5	1068	Macleod-1	37.2	40.0	43.0	45.0	49.0	51.0
80	Dwelling	4.5	1136	Macleod-1	36.8	40.0	43.0	45.0	49.0	51.0
81	Dwelling	4.5	1071	Macleod-5	37.0	40.0	43.0	45.0	49.0	51.0
82	Dwelling	4.5	946	Macleod-5	36.8	40.0	43.0	45.0	49.0	51.0
83	Dwelling	4.5	951	Macleod-5	37.0	40.0	43.0	45.0	49.0	51.0
84	Dwelling	4.5	739	Macleod-5	38.0	40.0	43.0	45.0	49.0	51.0
85	Dwelling	4.5	741	Macleod-5	37.5	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
86	Dwelling	4.5	1021	Macleod-5	33.5	40.0	43.0	45.0	49.0	51.0
87	Dwelling	4.5	1272	Macleod-5	31.6	40.0	43.0	45.0	49.0	51.0
88	Dwelling	4.5	1344	Macleod-5	31.1	40.0	43.0	45.0	49.0	51.0
89	Dwelling	4.5	1398	Macleod-5	30.7	40.0	43.0	45.0	49.0	51.0
90	Dwelling	4.5	1729	Macleod-5	30.1	40.0	43.0	45.0	49.0	51.0
91	Dwelling	4.5	1849	Macleod-5	28.1	40.0	43.0	45.0	49.0	51.0
92	Dwelling	4.5	2195	Macleod-5	26.4	40.0	43.0	45.0	49.0	51.0
93	Dwelling	4.5	2306	Macleod-5	26.0	40.0	43.0	45.0	49.0	51.0
94	Dwelling	4.5	2450	Macleod-5	25.6	40.0	43.0	45.0	49.0	51.0
95	Dwelling	4.5	2459	Macleod-5	25.5	40.0	43.0	45.0	49.0	51.0
96	Dwelling	4.5	2471	Macleod-5	25.2	40.0	43.0	45.0	49.0	51.0
97	Dwelling	4.5	2480	Macleod-5	25.2	40.0	43.0	45.0	49.0	51.0
98	Dwelling	4.5	2489	Macleod-5	25.2	40.0	43.0	45.0	49.0	51.0
99	Dwelling	4.5	2503	Macleod-5	25.1	40.0	43.0	45.0	49.0	51.0
100	Dwelling	4.5	2516	Macleod-5	25.1	40.0	43.0	45.0	49.0	51.0
101	Dwelling	4.5	2524	Macleod-5	25.1	40.0	43.0	45.0	49.0	51.0
102	Dwelling	4.5	2542	Macleod-5	25.0	40.0	43.0	45.0	49.0	51.0
103	Dwelling	4.5	2554	Macleod-5	25.0	40.0	43.0	45.0	49.0	51.0
104	Dwelling	4.5	2594	Macleod-5	24.9	40.0	43.0	45.0	49.0	51.0
105	Dwelling	4.5	2706	Macleod-5	24.6	40.0	43.0	45.0	49.0	51.0
106	Dwelling	4.5	3019	Macleod-5	23.7	40.0	43.0	45.0	49.0	51.0
107	Dwelling	4.5	3050	Macleod-5	23.6	40.0	43.0	45.0	49.0	51.0
108	Dwelling	4.5	3239	Macleod-5	22.6	40.0	43.0	45.0	49.0	51.0
109	Dwelling	4.5	2864	Macleod-5	25.1	40.0	43.0	45.0	49.0	51.0
110	Dwelling	4.5	2778	Macleod-5	25.5	40.0	43.0	45.0	49.0	51.0
111	Dwelling	4.5	2745	Macleod-5	25.6	40.0	43.0	45.0	49.0	51.0
112	Dwelling	4.5	2734	Macleod-5	25.7	40.0	43.0	45.0	49.0	51.0
113	Dwelling	4.5	2664	Macleod-5	26.0	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
114	Dwelling	4.5	2677	Macleod-5	26.0	40.0	43.0	45.0	49.0	51.0
115	Dwelling	4.5	2808	Macleod-5	25.5	40.0	43.0	45.0	49.0	51.0
116	Dwelling	4.5	2635	Macleod-5	26.3	40.0	43.0	45.0	49.0	51.0
117	Dwelling	4.5	2516	Macleod-5	26.9	40.0	43.0	45.0	49.0	51.0
118	Dwelling	4.5	2429	Macleod-5	27.2	40.0	43.0	45.0	49.0	51.0
119	Dwelling	4.5	2458	Macleod-5	27.1	40.0	43.0	45.0	49.0	51.0
120	Dwelling	4.5	2471	Macleod-5	27.1	40.0	43.0	45.0	49.0	51.0
121	Dwelling	4.5	2487	Macleod-5	27.0	40.0	43.0	45.0	49.0	51.0
122	Dwelling	4.5	2496	Macleod-5	27.0	40.0	43.0	45.0	49.0	51.0
123	Dwelling	4.5	2461	Macleod-5	27.3	40.0	43.0	45.0	49.0	51.0
124	Dwelling	4.5	2403	Macleod-5	27.7	40.0	43.0	45.0	49.0	51.0
125	Dwelling	4.5	2374	Macleod-5	27.9	40.0	43.0	45.0	49.0	51.0
126	Dwelling	4.5	2467	Macleod-4	27.3	40.0	43.0	45.0	49.0	51.0
127	Dwelling	4.5	2425	Macleod-4	27.7	40.0	43.0	45.0	49.0	51.0
128	Dwelling	4.5	2343	Macleod-4	28.1	40.0	43.0	45.0	49.0	51.0
129	Dwelling	4.5	2295	Macleod-4	28.3	40.0	43.0	45.0	49.0	51.0
130	Dwelling	4.5	2248	Macleod-4	28.5	40.0	43.0	45.0	49.0	51.0
131	Dwelling	4.5	2193	Macleod-4	28.7	40.0	43.0	45.0	49.0	51.0
132	Dwelling	4.5	2166	Macleod-4	28.9	40.0	43.0	45.0	49.0	51.0
133	Dwelling	4.5	2095	Macleod-4	29.2	40.0	43.0	45.0	49.0	51.0
134	Dwelling	4.5	2001	Macleod-4	29.7	40.0	43.0	45.0	49.0	51.0
135	Dwelling	4.5	2023	Macleod-4	29.6	40.0	43.0	45.0	49.0	51.0
136	Dwelling	4.5	1961	Macleod-4	29.9	40.0	43.0	45.0	49.0	51.0
137	Dwelling	4.5	2039	Macleod-4	29.5	40.0	43.0	45.0	49.0	51.0
138	Dwelling	4.5	1900	Macleod-4	30.2	40.0	43.0	45.0	49.0	51.0
139	Dwelling	4.5	2028	Macleod-4	29.5	40.0	43.0	45.0	49.0	51.0
140	Dwelling	4.5	1962	Macleod-4	29.9	40.0	43.0	45.0	49.0	51.0
141	Dwelling	4.5	1930	Macleod-4	30.0	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
142	Dwelling	4.5	1870	Macleod-4	30.4	40.0	43.0	45.0	49.0	51.0
143	Dwelling	4.5	1813	Macleod-4	30.6	40.0	43.0	45.0	49.0	51.0
144	Dwelling	4.5	1789	Macleod-4	30.8	40.0	43.0	45.0	49.0	51.0
145	Dwelling	4.5	1861	Macleod-4	30.4	40.0	43.0	45.0	49.0	51.0
146	Dwelling	4.5	1811	Macleod-4	30.7	40.0	43.0	45.0	49.0	51.0
147	Dwelling	4.5	1755	Macleod-4	31.1	40.0	43.0	45.0	49.0	51.0
148	Dwelling	4.5	1798	Macleod-4	30.8	40.0	43.0	45.0	49.0	51.0
149	Dwelling	4.5	1702	Macleod-4	31.3	40.0	43.0	45.0	49.0	51.0
150	Dwelling	4.5	1469	Macleod-3	32.9	40.0	43.0	45.0	49.0	51.0
151	Dwelling	4.5	1529	Macleod-4	32.5	40.0	43.0	45.0	49.0	51.0
152	Dwelling	4.5	2833	Macleod-4	25.9	40.0	43.0	45.0	49.0	51.0
153	Dwelling	4.5	2513	Macleod-3	27.1	40.0	43.0	45.0	49.0	51.0
154	Dwelling	4.5	2467	Macleod-3	27.5	40.0	43.0	45.0	49.0	51.0
155	Dwelling	4.5	2454	Macleod-3	27.4	40.0	43.0	45.0	49.0	51.0
156	Dwelling	4.5	2322	Macleod-3	27.9	40.0	43.0	45.0	49.0	51.0
157	Dwelling	4.5	2269	Macleod-3	28.0	40.0	43.0	45.0	49.0	51.0
158	Dwelling	4.5	2157	Macleod-3	28.0	40.0	43.0	45.0	49.0	51.0
159	Dwelling	4.5	2386	Macleod-3	28.5	40.0	43.0	45.0	49.0	51.0
160	Dwelling	4.5	2141	Kent-4	29.2	40.0	43.0	45.0	49.0	51.0
161	Dwelling	4.5	2148	Kent-3	26.3	40.0	43.0	45.0	49.0	51.0
162	Dwelling	4.5	2201	Kent-3	26.7	40.0	43.0	45.0	49.0	51.0
163	Dwelling	4.5	2063	Kent-3	25.9	40.0	43.0	45.0	49.0	51.0
164	Dwelling	4.5	2058	Kent-3	27.4	40.0	43.0	45.0	49.0	51.0
165	Dwelling	4.5	2034	Kent-3	27.5	40.0	43.0	45.0	49.0	51.0
166	Dwelling	4.5	2019	Kent-3	27.6	40.0	43.0	45.0	49.0	51.0
167	Dwelling	4.5	1995	Kent-3	27.7	40.0	43.0	45.0	49.0	51.0
168	Dwelling	4.5	1936	Kent-3	28.0	40.0	43.0	45.0	49.0	51.0
169	Dwelling	4.5	1890	Kent-3	28.2	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
170	Dwelling	4.5	1688	Kent-3	29.5	40.0	43.0	45.0	49.0	51.0
171	Dwelling	4.5	1638	Kent-3	29.7	40.0	43.0	45.0	49.0	51.0
172	Dwelling	4.5	1585	Kent-3	30.1	40.0	43.0	45.0	49.0	51.0
173	Dwelling	4.5	1536	Kent-3	30.4	40.0	43.0	45.0	49.0	51.0
174	Dwelling	4.5	1404	Kent-3	31.3	40.0	43.0	45.0	49.0	51.0
175	Dwelling	4.5	1518	Kent-3	30.6	40.0	43.0	45.0	49.0	51.0
176	Dwelling	4.5	1038	Kent-3	35.7	40.0	43.0	45.0	49.0	51.0
177	Dwelling	4.5	945	Kent-4	36.5	40.0	43.0	45.0	49.0	51.0
178	Dwelling	4.5	897	Kent-4	36.7	40.0	43.0	45.0	49.0	51.0
179	Dwelling	4.5	794	Kent-4	37.5	40.0	43.0	45.0	49.0	51.0
180	Dwelling	4.5	1096	Kent-4	36.6	40.0	43.0	45.0	49.0	51.0
181	Dwelling	4.5	1122	Macleod-3	35.8	40.0	43.0	45.0	49.0	51.0
182	Dwelling	4.5	1525	Macleod-3	33.6	40.0	43.0	45.0	49.0	51.0
183	Dwelling	4.5	1001	Kent-3	34.8	40.0	43.0	45.0	49.0	51.0
184	Dwelling	4.5	1478	Kent-3	30.7	40.0	43.0	45.0	49.0	51.0
185	Dwelling	4.5	1758	Kent-3	28.9	40.0	43.0	45.0	49.0	51.0
186	Dwelling	4.5	1884	Kent-3	28.2	40.0	43.0	45.0	49.0	51.0
187	Dwelling	4.5	1914	Kent-3	28.1	40.0	43.0	45.0	49.0	51.0
188	Dwelling	4.5	1963	Kent-3	27.8	40.0	43.0	45.0	49.0	51.0
189	Dwelling	4.5	1998	Kent-3	27.6	40.0	43.0	45.0	49.0	51.0
190	Dwelling	4.5	2009	Kent-3	27.6	40.0	43.0	45.0	49.0	51.0
191	Dwelling	4.5	2017	Kent-3	27.5	40.0	43.0	45.0	49.0	51.0
192	Dwelling	4.5	1976	Kent-3	27.7	40.0	43.0	45.0	49.0	51.0
193	Dwelling	4.5	1945	Kent-3	27.8	40.0	43.0	45.0	49.0	51.0
194	Dwelling	4.5	2160	Kent-3	26.8	40.0	43.0	45.0	49.0	51.0
195	Dwelling	4.5	1628	Macleod-5	30.1	40.0	43.0	45.0	49.0	51.0
196	Dwelling	4.5	1474	Macleod-5	30.7	40.0	43.0	45.0	49.0	51.0
197	Dwelling	4.5	1497	Macleod-5	30.1	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
198	Dwelling	4.5	1391	Macleod-5	30.8	40.0	43.0	45.0	49.0	51.0
199	Dwelling	4.5	1732	Macleod-5	29.4	40.0	43.0	45.0	49.0	51.0
200	Dwelling	4.5	1643	Macleod-5	29.9	40.0	43.0	45.0	49.0	51.0
201	Dwelling	4.5	1622	Macleod-5	30.1	40.0	43.0	45.0	49.0	51.0
202	Dwelling	4.5	1574	Macleod-5	30.4	40.0	43.0	45.0	49.0	51.0
203	Dwelling	4.5	1591	Macleod-5	30.4	40.0	43.0	45.0	49.0	51.0
204	Dwelling	4.5	1349	Macleod-5	31.9	40.0	43.0	45.0	49.0	51.0
205	Dwelling	4.5	1299	Macleod-5	32.2	40.0	43.0	45.0	49.0	51.0
206	Dwelling	4.5	1259	Macleod-5	32.5	40.0	43.0	45.0	49.0	51.0
207	Dwelling	4.5	1113	Macleod-5	33.9	40.0	43.0	45.0	49.0	51.0
208	Dwelling	4.5	1166	Macleod-5	33.6	40.0	43.0	45.0	49.0	51.0
209	Dwelling	4.5	1115	Macleod-5	34.1	40.0	43.0	45.0	49.0	51.0
210	Dwelling	4.5	1146	Macleod-5	32.7	40.0	43.0	45.0	49.0	51.0
211	Dwelling	4.5	730	Kent-5	40.0	40.0	43.0	45.0	49.0	51.0
212	Dwelling	4.5	782	Kent-5	39.6	40.0	43.0	45.0	49.0	51.0
213	Dwelling	4.5	819	Kent-5	39.3	40.0	43.0	45.0	49.0	51.0
214	Potential Receptor (Vacant Lot)	4.5	1958	Kent-3	30.0	40.0	43.0	45.0	49.0	51.0
215	Potential Receptor (Vacant Lot)	4.5	1429	Kent-1	31.3	40.0	43.0	45.0	49.0	51.0
216	Potential Receptor (Vacant Lot)	4.5	1447	Kent-1	31.2	40.0	43.0	45.0	49.0	51.0
217	Potential Receptor (Vacant Lot)	4.5	1544	Kent-1	32.0	40.0	43.0	45.0	49.0	51.0
218	Potential Receptor (Vacant Lot)	4.5	1245	Kent-1	33.0	40.0	43.0	45.0	49.0	51.0
219	Potential Receptor (Vacant Lot)	4.5	1340	Kent-1	32.8	40.0	43.0	45.0	49.0	51.0
220	Potential Receptor (Vacant Lot)	4.5	1949	Macleod-5	30.2	40.0	43.0	45.0	49.0	51.0
221	Potential Receptor (Vacant Lot)	4.5	1880	Macleod-5	28.3	40.0	43.0	45.0	49.0	51.0
222	Potential Receptor (Vacant Lot)	4.5	1955	Macleod-5	27.5	40.0	43.0	45.0	49.0	51.0
223	Potential Receptor (Vacant Lot)	4.5	2041	Macleod-5	27.1	40.0	43.0	45.0	49.0	51.0
224	Potential Receptor (Vacant Lot)	4.5	1796	Macleod-5	28.4	40.0	43.0	45.0	49.0	51.0
225	Potential Receptor (Vacant Lot)	4.5	2203	Macleod-5	26.6	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
226	Potential Receptor (Vacant Lot)	4.5	2140	Macleod-5	27.0	40.0	43.0	45.0	49.0	51.0
227	Potential Receptor (Vacant Lot)	4.5	2113	Macleod-4	29.1	40.0	43.0	45.0	49.0	51.0
228	Potential Receptor (Vacant Lot)	4.5	2283	Macleod-5	28.0	40.0	43.0	45.0	49.0	51.0
229	Potential Receptor (Vacant Lot)	4.5	2340	Macleod-5	27.4	40.0	43.0	45.0	49.0	51.0
230	Potential Receptor (Vacant Lot)	4.5	2463	Kent-4	28.7	40.0	43.0	45.0	49.0	51.0
231	Potential Receptor (Vacant Lot)	4.5	2372	Kent-4	28.9	40.0	43.0	45.0	49.0	51.0
232	Potential Receptor (Vacant Lot)	4.5	2312	Kent-4	28.9	40.0	43.0	45.0	49.0	51.0
233	Potential Receptor (Vacant Lot)	4.5	2280	Kent-4	28.9	40.0	43.0	45.0	49.0	51.0
234	Potential Receptor (Vacant Lot)	4.5	2302	Kent-4	28.4	40.0	43.0	45.0	49.0	51.0
235	Potential Receptor (Vacant Lot)	4.5	1649	Kent-3	29.6	40.0	43.0	45.0	49.0	51.0
236	Potential Receptor (Vacant Lot)	4.5	1567	Kent-3	29.8	40.0	43.0	45.0	49.0	51.0
237	Potential Receptor (Vacant Lot)	4.5	1594	Kent-3	29.7	40.0	43.0	45.0	49.0	51.0
238	Potential Receptor (Vacant Lot)	4.5	2105	Kent-3	27.0	40.0	43.0	45.0	49.0	51.0
239	Potential Receptor (Vacant Lot)	4.5	2163	Kent-3	27.6	40.0	43.0	45.0	49.0	51.0
240	Potential Receptor (Vacant Lot)	4.5	2085	Kent-3	28.1	40.0	43.0	45.0	49.0	51.0
241	Potential Receptor (Vacant Lot)	4.5	1988	Kent-3	29.0	40.0	43.0	45.0	49.0	51.0
242	Potential Receptor (Vacant Lot)	4.5	1930	Kent-3	29.4	40.0	43.0	45.0	49.0	51.0
243	Potential Receptor (Vacant Lot)	4.5	1875	Kent-3	30.3	40.0	43.0	45.0	49.0	51.0
244	Potential Receptor (Vacant Lot)	4.5	1713	Kent-1	31.0	40.0	43.0	45.0	49.0	51.0
245	Potential Receptor (Vacant Lot)	4.5	1604	Kent-1	31.7	40.0	43.0	45.0	49.0	51.0
246	Potential Receptor (Vacant Lot)	4.5	1466	Kent-1	32.1	40.0	43.0	45.0	49.0	51.0
247	Potential Receptor (Vacant Lot)	4.5	889	Kent-1	35.4	40.0	43.0	45.0	49.0	51.0
248	Potential Receptor (Vacant Lot)	4.5	804	Kent-1	36.1	40.0	43.0	45.0	49.0	51.0
249	Potential Receptor (Vacant Lot)	4.5	825	Kent-1	35.9	40.0	43.0	45.0	49.0	51.0
250	Potential Receptor (Vacant Lot)	4.5	1273	Kent-1	32.8	40.0	43.0	45.0	49.0	51.0
251	Potential Receptor (Vacant Lot)	4.5	1251	Kent-1	33.1	40.0	43.0	45.0	49.0	51.0
252	Potential Receptor (Vacant Lot)	4.5	1432	Kent-3	30.7	40.0	43.0	45.0	49.0	51.0
253	Potential Receptor (Vacant Lot)	4.5	1325	Kent-3	31.4	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
254	Potential Receptor (Vacant Lot)	4.5	1068	Kent-3	33.4	40.0	43.0	45.0	49.0	51.0
255	Potential Receptor (Vacant Lot)	4.5	809	Kent-3	35.9	40.0	43.0	45.0	49.0	51.0
256	Potential Receptor (Vacant Lot)	4.5	1549	Kent-3	30.2	40.0	43.0	45.0	49.0	51.0
257	Potential Receptor (Vacant Lot)	4.5	692	Kent-3	38.4	40.0	43.0	45.0	49.0	51.0
258	Potential Receptor (Vacant Lot)	4.5	897	Kent-3	39.1	40.0	43.0	45.0	49.0	51.0
259	Potential Receptor (Vacant Lot)	4.5	676	Macleod-1	40.0	40.0	43.0	45.0	49.0	51.0
260	Potential Receptor (Vacant Lot)	4.5	736	Macleod-1	39.0	40.0	43.0	45.0	49.0	51.0
261	Potential Receptor (Vacant Lot)	4.5	966	Macleod-1	37.6	40.0	43.0	45.0	49.0	51.0
262	Potential Receptor (Vacant Lot)	4.5	858	Macleod-5	37.3	40.0	43.0	45.0	49.0	51.0
263	Potential Receptor (Vacant Lot)	4.5	1310	Macleod-5	31.5	40.0	43.0	45.0	49.0	51.0
264	Potential Receptor (Vacant Lot)	4.5	1272	Macleod-5	31.6	40.0	43.0	45.0	49.0	51.0
265	Potential Receptor (Vacant Lot)	4.5	1437	Macleod-5	31.2	40.0	43.0	45.0	49.0	51.0
266	Potential Receptor (Vacant Lot)	4.5	1533	Macleod-5	30.6	40.0	43.0	45.0	49.0	51.0
267	Potential Receptor (Vacant Lot)	4.5	1665	Macleod-5	30.1	40.0	43.0	45.0	49.0	51.0
268	Potential Receptor (Vacant Lot)	4.5	1007	Macleod-5	35.0	40.0	43.0	45.0	49.0	51.0
269	Potential Receptor (Vacant Lot)	4.5	1831	Macleod-4	30.5	40.0	43.0	45.0	49.0	51.0
270	Potential Receptor (Vacant Lot)	4.5	1081	Macleod-5	34.5	40.0	43.0	45.0	49.0	51.0
271	Potential Receptor (Vacant Lot)	4.5	977	Macleod-5	36.2	40.0	43.0	45.0	49.0	51.0
272	Potential Receptor (Vacant Lot)	4.5	923	Macleod-3	35.9	40.0	43.0	45.0	49.0	51.0
273	Potential Receptor (Vacant Lot)	4.5	685	Macleod-3	37.9	40.0	43.0	45.0	49.0	51.0
274	Potential Receptor (Vacant Lot)	4.5	817	Macleod-3	36.7	40.0	43.0	45.0	49.0	51.0
275	Potential Receptor (Vacant Lot)	4.5	1091	Macleod-3	34.5	40.0	43.0	45.0	49.0	51.0
276	Potential Receptor (Vacant Lot)	4.5	893	Macleod-3	35.8	40.0	43.0	45.0	49.0	51.0
277	Potential Receptor (Vacant Lot)	4.5	1467	Macleod-3	32.6	40.0	43.0	45.0	49.0	51.0
278	Potential Receptor (Vacant Lot)	4.5	1168	Kent-5	36.8	40.0	43.0	45.0	49.0	51.0
279	Potential Receptor (Vacant Lot)	4.5	1302	Kent-4	35.9	40.0	43.0	45.0	49.0	51.0
280	Potential Receptor (Vacant Lot)	4.5	919	Kent-4	37.1	40.0	43.0	45.0	49.0	51.0
281	Potential Receptor (Vacant Lot)	4.5	859	Kent-4	36.9	40.0	43.0	45.0	49.0	51.0

Table 6.1 Wind Turbine Noise Impact Summary - Points of Reception - Non-Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to 10 m/s (dBA)	Sound Level Limit (dBA)				
						6 m/s	7 m/s	8 m/s	9 m/s	10 m/s
282	Potential Receptor (Vacant Lot)	4.5	895	Kent-4	36.7	40.0	43.0	45.0	49.0	51.0
283	Potential Receptor (Vacant Lot)	4.5	698	Kent-4	38.8	40.0	43.0	45.0	49.0	51.0
284	Potential Receptor (Vacant Lot)	4.5	735	Kent-4	38.1	40.0	43.0	45.0	49.0	51.0
285	Potential Receptor (Vacant Lot)	4.5	811	Kent-4	37.5	40.0	43.0	45.0	49.0	51.0
286	Potential Receptor (Vacant Lot)	4.5	909	Kent-4	37.0	40.0	43.0	45.0	49.0	51.0
287	Potential Receptor (Vacant Lot)	4.5	1073	Kent-3	34.8	40.0	43.0	45.0	49.0	51.0
288	Potential Receptor (Vacant Lot)	4.5	990	Kent-3	35.0	40.0	43.0	45.0	49.0	51.0
289	Potential Receptor (Vacant Lot)	4.5	1166	Kent-3	33.4	40.0	43.0	45.0	49.0	51.0
290	Potential Receptor (Vacant Lot)	4.5	1060	Kent-3	34.1	40.0	43.0	45.0	49.0	51.0
291	Potential Receptor (Vacant Lot)	4.5	814	Kent-5	39.5	40.0	43.0	45.0	49.0	51.0
292	Potential Receptor (Vacant Lot)	4.5	685	Macleod-3	40.0	40.0	43.0	45.0	49.0	51.0

Table 6.2 Wind Turbine Noise Impact Summary - Participating Receptors

Point of Reception ID	Description	Height (m)	Distance to Nearest Turbine	Nearest Turbine ID	Calculated Sound Level at Selected Wind Speeds 6 to10 m/s (dBA)
19	Dwelling (Participating)	4.5	332	Macleod-1	45.8

7. References

[MOE 2008] Ontario Ministry of Environment, *Noise Guidelines for Wind Farms*, October 2008.

[GE 2009 Sound] GE Energy, Commercial Documentation Wind Turbine Generator Systems GE 2.5xl 60Hz, *Product Acoustic Specifications, Canada Specific, Normal Operation According to IEC61400-11*.

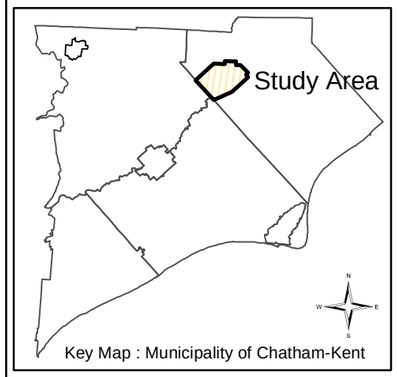
International Organization for Standardization, *ISO 9613-2*, "Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation", December 15, 1996.

Canadian Standards Association / National Standard of Canada, *CAN/CSA-C61400-11-07*, "Wind Turbine Generator Systems - Part 11: Acoustic Noise Measurement Techniques", 2007.

Appendix A

Project Layout Maps

Kent Breeze Wind Farms & Macleod Windmill Project Environmental Assessment



Map 1
Project Areas & Study Area

BASE LINE
BEAR CREEK RD
OAKDALE RD
BRICK RD
FLORENCE RD
ZONE 1 RD
WABASH LINE
SPLINTER LINE
SMOKE LINE
DEW DROP RD
Thamesvill
MASON LINE
HUFFS SD RD
Macleod-5
Macleod-4
Kent-1
Macleod-1
Macleod-3
EVERGREEN LINE
Kent-5
Kent-4
Kent-3
DARRELL LINE
KENT BRIDGE RD
CRAFTS LINE
LONGWOODS RD
PIONEER LINE
MAGNAVILLA LINE
FULLERTON RD
MERRITT LINE
SCANE RD
FYSH LINE

Legend

- Turbine
- Project Area
- Study Area
- Parcel
- Significant Woodlot (As per Official Plan)
- Other Vegitation
- Private Airstrip
- Utility Line
- Railroad

0 0.75 1.5
Kilometres
(11x17 Layout) 1:30,000

April 30, 2010

IBI GROUP

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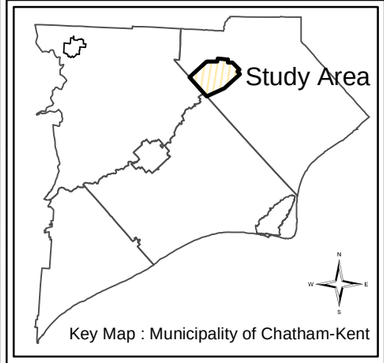
Kent Breeze Wind Farms & Macleod Windmill Project Environmental Assessment



Map 2
Aerial Photo

Legend

- Turbine
- Project Area
- Study Area
- Significant Woodlot (As per Official Plan)
- Other Vegitation

Aerial Photo: Chatham - Kent Ortho 2006

0 0.75 1.5
Kilometres
(11x17 Layout) 1:30,000

April 30, 2010

IBI GROUP

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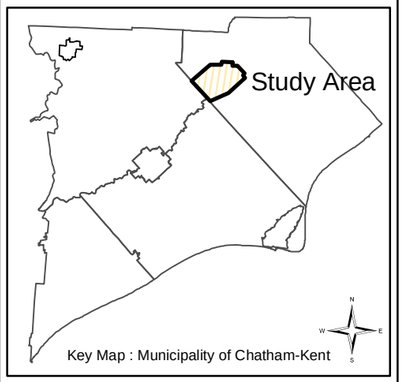
Kent Breeze Wind Farms & Macleod Windmill Project Environmental Assessment



Map 3
Receptor Locations

Legend

- Turbine
- Turbine
- 1.5km Turbine Buffer
- 2km Turbine Buffer
- Points of Reception - Existing Dwelling, Participating
- Points of Reception - Vacant Lot
- Points of Reception - Existing Dwelling, Non Participating
- Project Area
- Study Area
- Parcel
- Private Airstrip
- Significant Woodlot (As per Official Plan)
- Other Vegetation
- Utility Line

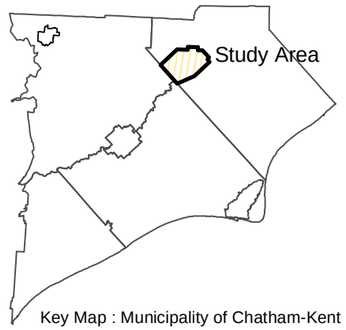
0 0.75 1.5
Kilometres
(11x17 Layout) 1:30,000

April 30, 2010

IBI GROUP

J:\20443\5.8 GIS\Maps\Map Created For Suncore 2010-03-24\PM\kentbreeze_map3-2010-04-13.mxd

Kent Breeze Wind Farms & Macleod Windmill Project Environmental Assessment



Map 4
Renewable Energy Approval Setbacks

Legend

- Turbine
- Removed Turbine
- Points of Reception - Existing Dwelling, Non Participating
- Points of Reception - Vacant Lot
- Points of Reception - Existing Dwelling, Paticipating
- 85m Lot Line Setback
- 60m Road / Railway Setback
- 550m Off Site Receptor Setback
- Building_Envelope
- Significant Woodlot (As per Official Plan)
- Other Vegetation
- 120m Significant Woodlot Setback
- Project Area
- Utility Line
- Contour Line
- Railroad
- Road
- Watercourse

0 495 990

Metres

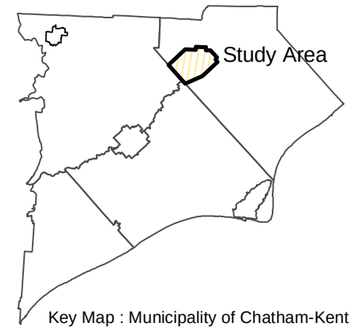
1:15,000 (11 X 17 Layout)

April 30, 2010

IBI GROUP

J:\20443\5.8 GIS\Maps\Map Created For Suncore 2010-03-24\PMKentbreeze_map4-2010-04-13.mxd

Kent Breeze Wind Farms & Macleod Windmill Project Environmental Assessment



Map 5
Project Infrastructure

Legend

- Turbine
- Access Road
- Underground Cable
- Utility Line
- Significant Woodlot (As per Official Plan)
- Other Vegitation
- Contour Line
- Railroad
- Road
- Watercourse

0 495 990
Metres
1:15,000 (11 X 17 Layout)

April 30, 2010

IBI GROUP

J:\204435.8 GIS\Maps\Map Created For Suncore 2010-03-24\PMMkentbreeze_map5-2010-04-13.mxd

Appendix B

Wind Turbine Technical Literature

GE Energy

Commercial Documentation
Wind Turbine Generator Systems
GE 2.5xl - 60 Hz

Product Acoustic Specifications

Canada Specific
Normal Operation according to IEC 61400-11

GE imagination at work

2.5xl Noise information

2 GE 2.5xl Product Normal Operation Apparent Sound Power Level

The **Table 1** provides GE 2.5xl wind turbine equipped with 48.7 m blades (100 m rotor) acoustic specifications relative to wind speed V_{10m}, operating at **Normal Operations** (NO) specifically for Canada, per IEC 61400-11 standard:

Wind speed at V_{10m} [m/s]	$L_{WA,k}$[1] Apparent sound power level [dBA RE. 10^{-12} W]	σ_P product variability [dB]
3	≤ 93	-
4	≤ 96	-
5	≤ 99	-
6	≤ 102	-
7	≤ 104.5	-
8	≤ 105	0
9	≤ 105	-
10	≤ 105	-
11- cut out	≤ 105	-

The **nominal acoustic performances** for GE 2.5xl wind turbine being specified at **95% rated electrical power** per IEC 61400-11 shall be specifically for Canada:

- The **maximum** apparent sound power level **$Lw_{A,K}$ ≤ 105.0dBA** (referenced to 1E-12W) at 95% rated electrical per IEC 61400-11

Tonal noise relative level **$\Delta L_{a,k} < 2$ dB** at 95% rated electrical per IEC 61400-11.

Wind speed at 100m hub height $V_{HH=100}$ [m/s]	Wind speed at 85m hub height $V_{HH=85}$ [m/s]	$L_{WA,k}$* Apparent sound power level [dBA RE. 10^{-12} W]	σ_P product variation [dB]
4.2	4.1	≤ 93	-
5.6	5.5	≤ 96	-
7.0	6.8	≤ 99	-
8.4	8.2	≤ 102	-
9.8	9.6	≤ 104.5	-
11.2	10.9	≤ 105	0
12.6	12.3	≤ 105	-
14.0	13.7	≤ 105	-
15.4	15.1	≤ 105	-

Table 2: Normal operations, GE 2.5xl wind turbine, 48.7 m blades (100 m rotor) apparent sound power level at wind speed V_{HH}

Octave Band Power Spectra (for information only)

		Normalized wind speed V_{10m} [m/s]						
		4	5	6	7	8	9	Uncertainty
Apparent Sound Power Level L_{WA} [dBA re 1E-12W]		**95.7**	**98.6**	**102.1**	**104.1**	**104.2**	**103**	**0.9**
Octave Band Apparent Sound Power Level LwA [dBA re 1E-12W]	**63**	74.7	75.9	79.4	83.3	85.9	84.7	-
	125	83.7	85.7	88.7	92.1	92.4	91.9	-
	250	88.0	90.8	95.1	97.6	98.6	96.6	-
	500	89.1	92.3	97.6	99.8	99.2	97.9	-
	1000	91.0	93.9	96.5	97.6	97.5	96.7	-
	2000	88.2	91.2	92.4	93.8	94.2	93.6	-
	4000	78.6	82.1	82.8	85.8	86.4	85.5	-
	8000	65.9	69.1	69.4	76.0	70.0	72.5	-

Table 3: Normal operations GE 2.5xl measured apparent sound power level and octave band apparent sound power level as a function of normalized wind speed V_{10m}

Appendix C

Adjustment to Wind Turbine Generator Acoustic Emissions for Wind Speed Profile

HATCH™ Calculation Report

Client	Kent Breeze Corporation
Project	Kent Breeze Wind Farm and Macleod Windmill Project
Project No.	H335112

Document Type:	Calculation Report
Document Title:	**Adjusted Noise Emissions For GE 2.5xl**
Document No.	na.

Revision	Signature	Date	Details
Rev: 1	Preparer Reviewer	11-May-10	Issued with Noise Impact Assessment Report
	Preparer Reviewer		

Seal if Required:

LICENSED PROFESSIONAL ENGINEER
R. SKINNER
90333998
May 11/2010
PROVINCE OF ONTARIO

Client Acceptance

By _____ Title _____ Date: _____

Kent Breeze Wind Farm and Macleod Windmill Project

Method For Adjusting GE's Apparent Sound Power Levels Per MOE Requirements

Calculation By: R. Skinner
Checked: J. Moran
Date: May 11, 2010

1. Background

1.1 MOE Noise Guidelines require the Manufacturer's Emissions Levels to be adjusted to reflect summer night-time conditions. The manufacturer in this case is GE, their 2.5xl model, at 85 m hub height. Manufacturer's data [1] is presented two ways:

1. Maximum apparent sound power levels ("A" weighted), by normalized wind velocities (experienced at 10m).
2. Octave band power spectra, 63 to 8000 hz, by normalized wind velocities (10m)

1.2 This calculation walks the reader through the steps used to arrive at "Adjusted Emission Levels" in Table 3.1 of the Noise Assessment Report Adjustment is required for two reasons:

1. The underlying wind shear that formed the basis for the manufacturer noise data is different than the summer night wind shear at this site.
2. Manufacturer's noise emissions by octave band did not include uncertainty, this is added.

[1] Commercial Documentation, Wind Turbine Generator Systems GE2.5xl - 60 Hz, Product Acoustic Specifications, Canada Specific, Normal Operation According to IEC 61400-11

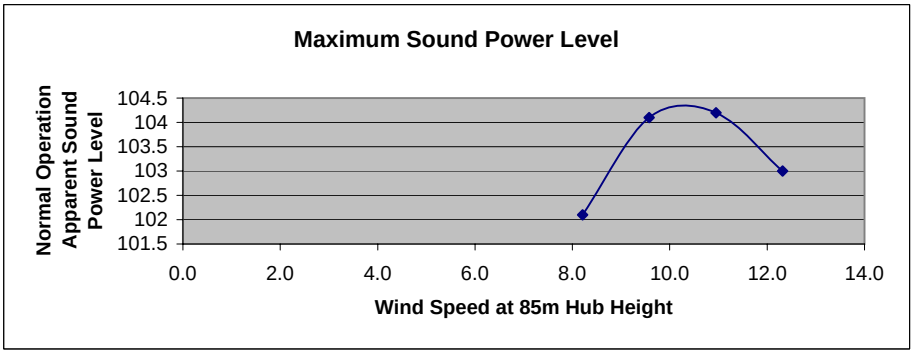
2. Calculations

2.1 Step 1: Obtain the relationship between sound power level and wind speeds at hub height in Manufacturer's Data

2.1.1 Calculate the wind speeds at hub height that correspond to the published noise figures expressed at wind speeds at 10m height. Assume logarithmic profile with a roughness length of 0.03.

Logarithmic Profile defined as:
u/ur = ln(z/z0) / ln(zr/z0)

where	Data and Results (calculated results are in bold)				
u = windspeed at hub height (m/s) (calc)	**8.2**	**9.6**	**10.9**	**12.3**	
ur = windspeed at reference height zr (m/s)	6	7	8	9	
z = hub height (m)	85	85	85	85	
z0 = roughness length (m)	0.03	0.03	0.03	0.03	
GE Apparent Sound Power Level (dBA)	102.1	104.1	104.2	103.0	Derived from Octave Band Spectra Data



2.1.3 Power law relationship is also calculated (for information):

Power law (wind shear calculation):
u/ur = z/zr^alpha

where	Data and Results (calculated results are in bold)			
u = windspeed at hub height (m/s) (calc)	8.2	9.6	10.9	12.3
ur = reference windspeed at height zr (m/s)	6	7	8	9
z = hub height (m)	85	85	85	85
zr = reference height (m)	10	10	10	10
alpha = wind shear coefficient	**0.161**	**0.161**	**0.161**	**0.161**

Kent Breeze Wind Farm and Macleod Windmill Project

Method For Adjusting GE's Apparent Sound Power Levels Per MOE Requirements

Calculation By: R. Skinner
Checked: J. Moran
Date: May 11, 2010

2.2 Step 2 - Calculate wind shear for summer night-time case

Average Velocity For Period:

June 21 to Sept 20, 11pm to 7am data:

	WS_40m	WS_60m	West WS_80m	South WS_80m
Rows with Data (A)	4380	4380	4380	4380
Sum of Rows with Data (B)	15211	19911	22614	22660
Average WindSpeed (B/A)	3.5	4.5	5.2	5.2

where: WS - wind speed
West - west anemometer
South - south anemometer

2.2.1 Wind Data Used

See the attachment to this calculation for information on the wind measurement campaign and a selection of the wind data used. The entire summer wind data set consists of over 13000 rows of data and is not printed with this calcualation.

2.2.2 Curve Data To Use:

Hub Height (m)	40	60	80
Wind Speed (m/s)	3.5	4.5	5.2

2.2.3 Curve Fit:

	Power Law	Log Law
Ref Height, m	80	80
Speed, m/s	5.2	5.2
Alpha or Zo variables:	0.42	7.0
	Alpha	Z0, m

Height m	Power Law Calc'd m/s	Log Law Calc'd m/s	Average For Period m/s	Power Law Error	Log Law Error
10	2.17	0.76			
40	3.89	3.72	3.5	0.39	0.22
60	4.61	4.59	4.6	0.01	-0.01
80	5.20	5.20	5.2	0.00	0.00
85	5.33	5.33			

Note to user: iterate until targets are reached and error minimized

Comment on result - this analysis chose to curve fit the wind shear between 60 and 80 m (minizing the interpolation error at 60m).

2.3 Step 3 Use summer night-time wind shear to calculate wind velocity at hub height and corresponding velocity at 10m height.

Using wind shear calculated above, calculate velocity at 10 m height that would correspond to 10.9 m/s at hub height; this is the wind speed that produces the maximum noise. This is obtained by power law method, below:

Hub height (m)	85	85
Speed, m/s	**10.9**	**11.4**
wind shear	0.42	0.3

Height m	Calc'd m/s	Calc'd m/s
10	**4.44**	**6.00**

At a wind speed of 4.4m/s (10m height), the machine produces its maximum noise.

Kent Breeze Wind Farm and Macleod Windmill Project

Method For Adjusting GE's Apparent Sound Power Levels Per MOE Requirements

Calculation By: R. Skinner
Checked: J. Moran
Date: May 11, 2010

2.3.1 Manufacturer's Noise Emissions Adjusted for Wind Shear

For modeling purposes, use GE's maximum noise emissions for all wind speed at 10m 6m/s or greater with a summer night wind shear of 0.42.

2.4 Step 4 - Revise manufacturer's data by octave band levels to match its maximum apparent sound power levels adjusted for wind shear

To adjust measured emissions to values used for modeling, 0.9 dB was added to each apparent sound power level by frequency band to account for uncertainty. Vendor's highest noise emission occurs at V10 8m/s (in a 0.161 wind shear situation)

Normalized Speed Speed	8 m/s	8 m/s
	LwA	LwA
Frequency (Hz)	NO	NO.adj
63	85.9	86.8
125	92.4	93.3
250	98.6	99.5
500	99.2	100.1
1000	97.5	98.4
2000	94.2	95.1
4000	86.4	87.3
8000	70.0	70.9
Apparent SPL dBA	104.2	105.1

Normalized Wind Speed - at 10m height
LwA - Apparent Sound Power Level (dBA re 1E-12)
SPL - sound power level
NO - normal operations
adj - adjusted to account for uncertainty

GE NO - Normal operations GE2.5xl measured apparent sound power level and octave band apparent sound power level at the stated normalized wind speed (at 10m)

2.4.1 Generate the Wind Turbine Acoustic Emissions Summary (Table 3 of MOE's Noise Guidelines document)

Table C.1 Wind Turbine Acoustic Emissions Summary										
Make and Model:	GE 2.5xl									
Electrical Rating (kW):	2500									
Hub Height (m)	85									
Wind Shear Coefficient	0.42									
	Octave Band Sound Apparent Power Level LwA (dBA re 1E-12W)									
	Manufacturer's Emissions Levels (dBA ref 10^-12)					Adjusted Emissions Levels				
V10 Wind Speed (m/s)	6	7	8	9	10	6	7	8	9	10
Frequency (Hz)			[1]							
63	-	-	86.8	-	-	86.8	86.8	86.8	86.8	86.8
125	-	-	93.3	-	-	93.3	93.3	93.3	93.3	93.3
250	-	-	99.5	-	-	99.5	99.5	99.5	99.5	99.5
500	-	-	100.1	-	-	100.1	100.1	100.1	100.1	100.1
1000	-	-	98.4	-	-	98.4	98.4	98.4	98.4	98.4
2000	-	-	95.1	-	-	95.1	95.1	95.1	95.1	95.1
4000	-	-	87.3	-	-	87.3	87.3	87.3	87.3	87.3
8000	-	-	70.9	-	-	70.9	70.9	70.9	70.9	70.9
Apparent SPL dBA	-	-	105.1	-	-	105.1	105.1	105.1	105.1	105.1
Note										
[1] Only the manufacturer's maximum noise emissions were modeled.										
[2] This table is also Table 3.1 of the main report.										

3. Conclusions and Summary

In a wind shear of .42, the wind turbine experiences winds of 10.9 m/s at hub height when the V10m speed is 4.4m/s. At this hub height velocity the machine produces its maximum noise. Noise impacts at V10 speeds of 6-10m/s, under a summer night wind shear are required to be modeled. The sound power level for the GE 2.5xl machine actually goes down after passing through its maximum at 10.9m/s hub velocity. To be conservative, the sound modeled was the machine's maximum for all wind speed cases (V10m = 6 to 10m/s).

In addition, the manufacturer's octave band power spectra was adjusted upwards by 0.9dB each so that when aggregated into a single A-weighted value, the total is 105.1dBA. The 0.9dB adjustment = the uncertainty in their noise emissions data reported by GE.

To sum up then, two adjustments were made to the manufacturer's noise emissions, one for wind shear, and the other to manufacturer's octave band sound power level data. The A-weighted noise to be modelled is 105.1 dbA for wind speeds >= 6 m/s at 10m height and summer night wind shear of 0.42.

Kent Breeze Wind Farm and Macleod Windmill Project

Wind Measurement Data

Attachment to Calculation: Method For Adjusting GE's Apparent Sound Power Levels Per MOE Requirements

Calculation By: R. Skinner
Checked: J. Moran
Date: May 11, 2010

Note to User - See columns Y-AB for data manipulation to filter for "night" (10pm to 7am).

ZEPHYR NORTH - TN2 PROGRAM SERIES

Kent Breeze Wind Monitoring

Period: 2009 June 21 0:00 to 2009 Sept 20 23:50
Location: DeMeter 80 m WM (DMtr)

Fields in each record are as follows:

1. Year
2. Month
3. Day
4. Hour and minute as hhmm
5. Wind Speed W (m/s) at 40.00 m
6. Std.Dev. Wind Speed W (m/s) at 40.00 m
7. Gust Wind Speed W (m/s) at 40.00 m
8. Wind Speed W (m/s) at 60.00 m
9. Std.Dev. Wind Speed W (m/s) at 60.00 m
10. Gust Wind Speed W (m/s) at 60.00 m
11. Wind Direction (degt) at 60.00 m
12. Std.Dev. Wind Dir. (deg) at 60.00 m
13. Wind Speed W (m/s) at 80.00 m
14. Std.Dev. Wind Speed W (m/s) at 80.00 m
15. Gust Wind Speed W (m/s) at 80.00 m
16. Wind Speed S (m/s) at 80.00 m
17. Std.Dev. Wind Speed S (m/s) at 80.00 m
18. Gust Wind Speed S (m/s) at 80.00 m
19. Wind Direction (degt) at 79.00 m
20. Std.Dev. Wind Dir. (deg) at 79.00 m
21. Air Temperature (C) at 2.00 m
22. Station Pressure (kPa) at 2.00 m

-999 signifies datum is not available

Flags: 0 - datum not available or marked bad
1 - datum good
2 - datum estimated

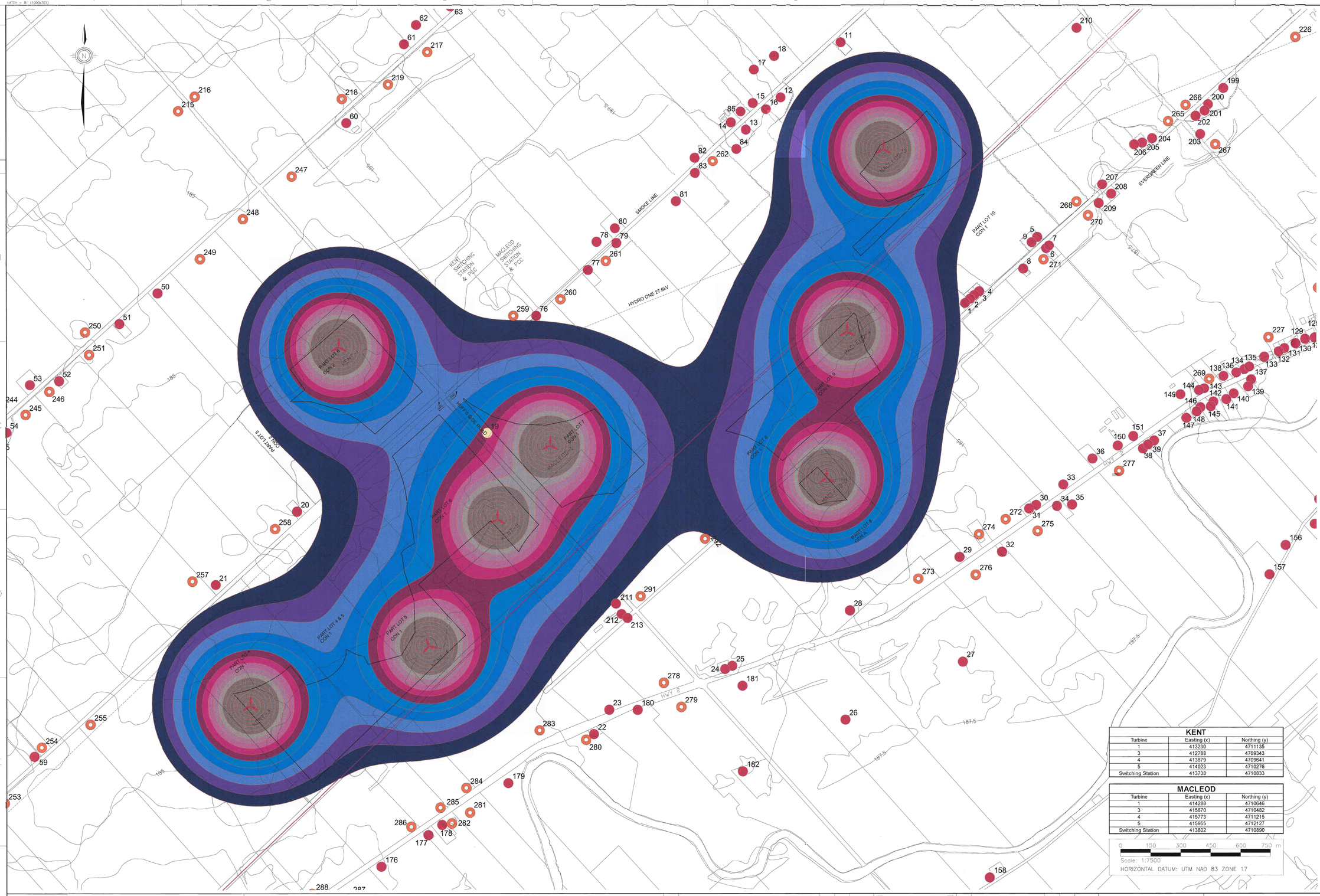
****

Data filtered for "night" (hours 2300 to 700)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Filter, 1=					
Year	Month	Day	Hour	WS_40m	WS_Sdev	Gust_WS_	WS_60m	WS_Sdev	Gust_WS_	WD_60m	WD_Sdev_	WS_80m_\	WS_Sdev	Gust_WS_	WS_80m_S	WS_Sdev	Gust_WS_	WD_79m	WD_Sdev_	Temp	Pres	"night"	WS_40m	WS_60m	WS_80m_\	WS_80m_S	s
2009	6	21	520	3.5	0.613	5.3	3.77	0.535	4.96	339.6	7.6	3.87	0.493	4.93	3.3	0.614	4.57	339.9	5.4	15.5	98.5	1	3.5	3.77	3.87	3.3	
2009	6	21	530	3.27	0.538	4.16	3.73	0.61	5.33	340.3	9	3.97	0.515	5.69	3.41	0.516	4.95	340.8	9.4	15.5	98.5	1	3.27	3.73	3.97	3.41	
2009	6	21	540	3.23	0.729	4.93	3.45	0.757	4.96	359.6	7.6	3.55	0.667	4.93	3	0.588	4.57	355.5	5.1	15.4	98.5	1	3.23	3.45	3.55	3	
2009	6	21	550	2.42	0.472	3.79	2.78	0.535	3.82	5.3	10.3	3.01	0.493	4.17	2.66	0.539	3.8	359.2	9.9	15.5	98.5	1	2.42	2.78	3.01	2.66	
2009	6	21	600	2.68	0.493	4.16	3.07	0.379	3.82	355.8	6.4	3.21	0.319	3.79	2.64	0.473	3.8	354.1	4	15.5	98.5	1	2.68	3.07	3.21	2.64	
2009	6	21	610	3.14	0.38	4.16	3.16	0.332	3.82	351	8.7	3.17	0.306	3.79	2.85	0.415	3.8	342.2	3.6	15.2	98.5	1	3.14	3.16	3.17	2.85	
2009	6	21	620	2.69	0.515	3.79	2.81	0.559	3.82	341.5	6.1	2.81	0.515	3.79	2.42	0.563	3.8	340.3	11.2	15.2	98.5	1	2.69	2.81	2.81	2.42	
2009	6	21	630	2.65	0.515	3.79	3.02	0.431	3.82	352	12.2	3.12	0.38	4.17	2.48	0.494	3.8	342.5	6.4	15.2	98.5	1	2.65	3.02	3.12	2.48	
2009	6	21	640	2.9	0.493	4.16	3.06	0.513	4.19	358.5	8.7	2.96	0.493	4.17	2.54	0.415	3.8	357	6.4	15.3	98.5	1	2.9	3.06	2.96	2.54	
2009	6	21	650	1.78	0.83	3.79	2.1	0.637	3.82	8.9	8.7	2.11	0.612	3.79	2.05	0.516	3.8	4.5	6.7	15.3	98.5	1	1.78	2.1	2.11	2.05	
2009	6	21	700	3.54	0.83	5.3	3.81	0.79	5.33	342.7	9.9	3.76	0.865	5.69	3.27	0.762	4.95	342.7	10.8	15.3	98.6	0	0	0	0	0	
2009	6	21	710	3.69	0.562	4.93	4.11	0.45	5.33	355.3	7.3	4.3	0.433	5.31	3.65	0.614	5.32	352.2	6.4	15.3	98.6	0	0	0	0	0	
2009	6	21	720	3.28	0.761	4.55	3.64	0.61	4.96	352.2	6.7	3.64	0.561	4.93	3.12	0.588	4.57	342.5	5.1	15.6	98.6	0	0	0	0	0	

Appendix D

Noise Contour Drawing



KENT		
Turbine	Easting (x)	Northing (y)
1	413230	4711135
3	412788	4709343
4	413679	4709641
5	414023	4710276
Switching Station	413738	4710833

MACLEOD		
Turbine	Easting (x)	Northing (y)
1	414288	4710546
3	415670	4710482
4	415773	4711215
5	415955	4712127
Switching Station	413802	4710890

0 150 300 450 600 750 m

Scale: 1:7500

HORIZONTAL DATUM: UTM NAD 83 ZONE 17

LEGEND:

40dBA – 40.9dBA	41dBA – 41.9dBA	42dBA – 42.9dBA	43dBA – 43.9dBA	44dBA – 44.9dBA	
45dBA – 45.9dBA	46dBA – 46.9dBA	47dBA – 47.9dBA	48dBA – 48.9dBA	49dBA – 49.9dBA	≥ 50dBA

ID EXISTING DWELLING NOT PARTICIPATING

ID EXISTING DWELLING PARTICIPATING

ID VACANT LOT

WIND TURBINE LOCATION

REFERENCE DRAWINGS

DRAWING NO.	DRAWING TITLE

REVISIONS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	IDENTIFIED VACANT LOT RECEPTORS SEPARATELY		RS	

ISSUE AUTHORIZATION

REV.	ISSUE FOR	AUTH. BY	DATE
B	ISSUED FOR PERMIT	RS	10-05-12
A	ISSUED FOR PERMIT	RS	10-05-06

R. SKINNER 90332269 May 12/2010 PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

HATCH

DESIGNED BY: J. MORAN, DATE: 10-03-25
DRAWN BY: G. COCHRANE, DATE: 10-03-25
CHECKED BY: R. SKINNER, DATE:
DISCP. ENGR.: R. SKINNER, DATE:
PROJ. DES. COORD., DATE:
PROJ. ENGR., DATE:
PROJ. MGR.: R. SKINNER, DATE:
PROJECT NUMBER: 335112

KENT BREEZE CORPORATION

KENT BREEZE WIND FARM AND MACLEOD WINDMILL PROJECT

GE 2.5MW – 85m HUB
ISO-dB MAP FOR WIND SHEAR 0.42
(SUMMER 11PM-7AM) AND 6-10m/s
WIND SPEED AT 10m HEIGHT

SCALE: NONE
DRAWING NO.: H335112-0000-10-014-0004
REVISION: B

DWG. NO. H335112-0000-10-014-0004 REVISION B

CIVIL | ELECTRICAL | MECHANICAL | GEOTECHNICAL | HYDROTECHNICAL | ARCHITECTURAL | OTHER

May 14, 2010 - 12:48pm Login name: Cat554540 Layout: Layout1
Drawing Name: P:\SWCOR\335112\CAD\V\335112-0000-10-014-0004.dwg

Appendix E

Noise Impact Sample Calculation

HATCH™ Calculation Report

Client	Kent Breeze Corporation
Project	Kent Breeze Wind Farms and Macleod Windmill Project
Project No.	H335112

Document Type:	Calculation Report
Document Title:	**Calculated Noise Levels Based on ISO 9613-2**
Document No.	na.

Revision	Signature	Date	Details
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Client Acceptance

By _____ Title _____ Date: _____

Calculation of Sound Pressure Levels from Wind Turbine - Based on ISO 9613-2

KentBreeze Project

Background

As requested by the Ministry of Environment in the Noise Guidelines for Wind Farms in Section 6.7 – Appendices (October 2008), a sample calculation should be included in the Noise Assessment Report. The sample calculation must include at least one detailed calculation for a source to receiver "'pair," preferably addressing the closest wind turbine unit, and it must represent all other "'pairs".

For this project, the receptor No. 12 was chosen for the analysis, along with turbine Macleod 5 (closest pair). The coordinates of both receptor and turbine are given in Table 1 (UTM NAD83, Zone 17). Receptor 12 is not participating in the wind project.

	Easting (m)	Northing (m)	Elevation Above Ground (m)
Turbine Macleod 5	415955	4712127	85
Receptor No. 12	415443	4712386	4.5

The calculations are based on ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – General Method of Calculation. The ground attenuation coefficient was assumed as 0.7, as suggested by the MOE Guidelines (Section 6.4.10 – Specific Parameters). The octave band data (guaranteed Sound Power Levels) for the GE 2.5xl wind turbine were provided by the manufacturer and adjusted for wind shear and noise guarantee. To adjust measured emissions to maximum value used for modelling, 0.8 dB was added to the sound emission of each frequency band.

Calculations

Wind Turbine No.: Macleod 5
Receiver No.: 12

Distance between Source and Receiver:

$$d := 579.5m$$

Wind Turbine Sound Power Levels

Sound Power Level at 63 Hz $L_{wAt\_63} := L_{w\_63} - 26.2 = 86.7$

Sound Power Level at 125 Hz $L_{wAt\_125} := L_{w\_125} - 16.1 = 93.2$

Sound Power Level at 250 Hz $L_{wAt\_250} := L_{w\_250} - 8.6 = 99.4$

Sound Power Level at 500 Hz $L_{wAt\_500} := L_{w\_500} - 3.2 = 100$

Sound Power Level at 1000 Hz $L_{wAt\_1000} := L_{w\_1000} - 0 = 98.3$

Sound Power Level at 2000 Hz $L_{wAt\_2000} := L_{w\_2000} + 1.2 = 95$

Sound Power Level at 4000 Hz $L_{wAt\_4000} := L_{w\_4000} + 1 = 87.2$

Sound Power Level at 8000 Hz $L_{wAt\_8000} := L_{w\_8000} - 1.1 = 70.8$

$Total\_L_{wAt} = 105 \cdot dBA$ A-Weighted Combined Sound Power Level for the Wind Turbine

Sound Pressure Level at the point of reception

Directivity of Source $D := 0$ For source at 85 m above the ground

Attenuation due to geometrical divergence $Att\_div := 20 \cdot \log\left(\frac{d}{1m}\right) + 11$

$Att\_div = 66.3 \cdot dB$

Attenuation due to atmospheric absorption

Attenuation due to atmospheric absorption at 63 Hz $Att\_atm\_63 := 0.1\frac{dB}{km} \cdot d = 0.058$

Attenuation due to atmospheric absorption at 125 Hz $Att\_atm\_125 := 0.4\frac{dB}{km} \cdot d = 0.232$

Attenuation due to atmospheric absorption at 250 Hz $Att\_atm\_250 := 1.0\frac{dB}{km} \cdot d = 0.58$

Attenuation due to atmospheric absorption at 500 Hz $Att\_atm\_500 := 1.9\frac{dB}{km} \cdot d = 1.101$

Attenuation due to atmospheric absorption at 1000 Hz $Att\_atm\_1000 := 3.7\frac{dB}{km} \cdot d = 2.144$

Attenuation due to atmospheric absorption at 2000 Hz $Att\_atm\_2000 := 9.7\frac{dB}{km} \cdot d = 5.621$

Attenuation due to atmospheric absorption at 4000 Hz $Att\_atm\_4000 := 32.8\frac{dB}{km} \cdot d = 19.008$

Attenuation due to atmospheric absorption at 8000 Hz $Att\_atm\_8000 := 117.0\frac{dB}{km} \cdot d = 67.802$

Attenuation due to Ground Absorption

Ground Absorption Coefficient $Ga := 0.7$

Ground Absorption at the Source

Attenuation due to ground absorption at 63 Hz	$Att\_gr\_s\_63 := -1.5dB$
Attenuation due to ground absorption at 125 Hz	$Att\_gr\_s\_125 := -1.5 + Ga \cdot 1.5$
Attenuation due to ground absorption at 250 Hz	$Att\_gr\_s\_250 := -1.5 + Ga \cdot 1.5$
Attenuation due to ground absorption at 500 Hz	$Att\_gr\_s\_500 := -1.5 + Ga \cdot 1.5$
Attenuation due to ground absorption at 1000 Hz	$Att\_gr\_s\_1000 := -1.5 + Ga \cdot 1.5$
Attenuation due to ground absorption at 2000 Hz	$Att\_gr\_s\_2000 := -1.5 \cdot (1 - Ga)$
Attenuation due to ground absorption at 4000 Hz	$Att\_gr\_s\_4000 := -1.5 \cdot (1 - Ga)$
Attenuation due to ground absorption at 8000 Hz	$Att\_gr\_s\_8000 := -1.5 \cdot (1 - Ga)$

Ground Absorption at the Receiver

Attenuation due to ground absorption at 63 Hz	$Att\_gr\_r\_63 := -1.5dB$
Attenuation due to ground absorption at 125 Hz	$Att\_gr\_r\_125 := -1.5 + Ga \cdot 4.688$
Attenuation due to ground absorption at 250 Hz	$Att\_gr\_r\_250 := -1.5 + Ga \cdot 2.890$
Attenuation due to ground absorption at 500 Hz	$Att\_gr\_r\_500 := -1.5 + Ga \cdot 1.501$
Attenuation due to ground absorption at 1000 Hz	$Att\_gr\_r\_1000 := -1.5 + Ga \cdot 1.500$
Attenuation due to ground absorption at 2000 Hz	$Att\_gr\_r\_2000 := -1.5 \cdot (1 - Ga)$
Attenuation due to ground absorption at 4000 Hz	$Att\_gr\_r\_4000 := -1.5 \cdot (1 - Ga)$
Attenuation due to ground absorption at 8000 Hz	$Att\_gr\_r\_8000 := -1.5 \cdot (1 - Ga)$

Ground Absorption In the Middle

Receiver height	$h\_r := 4.5m$
Source height	$h\_s := 85m$

$Factor := 30 \cdot (h\_r + h\_s) = 2685\,m$

Projected distance between Source and Receiver	$dp := 573.9m$

Since dp<Factor, the attenuation in the middle is equal to <u>zero</u> for all frequencies (Table 3)

Total Ground Attenuation for each frequency

Attenuation due to GA at 63 Hz	$Att\_gr\_63 := Att\_gr\_s\_63 + Att\_gr\_r\_63 = -3$
Attenuation due to GA at 125 Hz	$Att\_gr\_125 := Att\_gr\_s\_125 + Att\_gr\_r\_125 = 1.3$
Attenuation due to GA at 250 Hz	$Att\_gr\_250 := Att\_gr\_s\_250 + Att\_gr\_r\_250 = 0.073$

Attenuation due to GA at 500 Hz	$Att\_gr\_500 := Att\_gr\_s\_500 + Att\_gr\_r\_500 = -0.9$
Attenuation due to GA at 1000 Hz	$Att\_gr\_1000 := Att\_gr\_s\_1000 + Att\_gr\_r\_1000 = -0.9$
Attenuation due to GA at 2000 Hz	$Att\_gr\_2000 := Att\_gr\_s\_2000 + Att\_gr\_r\_2000 = -0.9$
Attenuation due to GA at 4000 Hz	$Att\_gr\_4000 := Att\_gr\_s\_4000 + Att\_gr\_r\_4000 = -0.9$
Attenuation due to GA at 8000 Hz	$Att\_gr\_8000 := Att\_gr\_s\_8000 + Att\_gr\_r\_8000 = -0.9$

Total Attenuation for each frequency $Att := Att\_div + Att\_atm + Att\_gr$

Attenuation at 63 Hz	$Att\_63 := Att\_div + Att\_atm\_63 + Att\_gr\_63 = 63.319$
Attenuation at 125 Hz	$Att\_125 := Att\_div + Att\_atm\_125 + Att\_gr\_125 = 67.824$
Attenuation at 250 Hz	$Att\_250 := Att\_div + Att\_atm\_250 + Att\_gr\_250 = 66.914$
Attenuation at 500 Hz	$Att\_500 := Att\_div + Att\_atm\_500 + Att\_gr\_500 = 66.463$
Attenuation at 1000 Hz	$Att\_1000 := Att\_div + Att\_atm\_1000 + Att\_gr\_1000 = 67.505$
Attenuation at 2000 Hz	$Att\_2000 := Att\_div + Att\_atm\_2000 + Att\_gr\_2000 = 70.982$
Attenuation at 4000 Hz	$Att\_4000 := Att\_div + Att\_atm\_4000 + Att\_gr\_4000 = 84.369$
Attenuation at 8000 Hz	$Att\_8000 := Att\_div + Att\_atm\_8000 + Att\_gr\_8000 = 133.163$

A-Weighted Sound Pressure Levels at the POR

Sound Pressure Level at 63 Hz	$L_{pA\_63} := L_{wAt\_63} - Att\_63 = 23.381$
Sound Pressure Level at 125 Hz	$L_{pA\_125} := L_{wAt\_125} - Att\_125 = 25.376$
Sound Pressure Level at 250 Hz	$L_{pA\_250} := L_{wAt\_250} - Att\_250 = 32.486$
Sound Pressure Level at 500 Hz	$L_{pA\_500} := L_{wAt\_500} - Att\_500 = 33.537$
Sound Pressure Level at 1000 Hz	$L_{pA\_1000} := L_{wAt\_1000} - Att\_1000 = 30.795$
Sound Pressure Level at 2000 Hz	$L_{pA\_2000} := L_{wAt\_2000} - Att\_2000 = 24.018$
Sound Pressure Level at 4000 Hz	$L_{pA\_4000} := L_{wAt\_4000} - Att\_4000 = 2.831$
Sound Pressure Level at 8000 Hz	$L_{pA\_8000} := L_{wAt\_8000} - Att\_8000 = -62.363$

$Total\_L_{pA} = 37.8 \cdot dBA$ A-Weighted Sound Pressure Level at the Point of Reception

Conclusions

Based on the calculation procedure provided in ISO 9613-2 and the parameters suggested by the Ministry of Environment in the Noise Guidelines for Wind Farms, Section 6.4.10 (October 2008), the estimated sound pressure level at the point of reception was 37.8 dBA, equal to the prediction of CADNA-A for the same receptor (37.8 dBA).

It is important to note that Receptor 12 receives sound contributions from several sources, and the level shown above (37.8 dBA) corresponds only to the contribution from Turbine Macleod 5. The total sound pressure level at Receptor 12 is 39 dBA.

Both the air and ground attenuation components were included and calculated based on ISO 9613.

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