Appendix U

Noise Impact Assessment Report

Tarong West Wind Farm

Noise Impact Assessment

S6000C11A

December 2023

sonus.

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Sonus is a member of the Association of Australian Acoustical Consultants (AAAC).

EXECUTIVE SUMMARY

A noise impact assessment has been made of the proposed Tarong West Wind Farm in accordance with State *code 23: Wind farm development (version 3.0) and State code 23: Wind Farm development - Planning Guidelines (February 2022)* (**State Code 23**).

The noise from the proposed Wind Farm, consisting of 97 turbines with a tip height of up to 249m, has been predicted for all surrounding sensitive land use receptors in the vicinity of the Wind Farm. The predictions have been conducted for the *Vestas V166 4.5MW* wind turbine generator having a nominal hub height of 166m for the candidate turbine. The predictions have been made using the ISO 9613-2 noise propagation model and the inputs recommended by the *May 2013 UK IOA Good Practice Guide* and State Code 23.

The predicted noise levels were compared with the relevant operational noise criteria derived in accordance with State Code 23. Based on the comparison, the noise from the Wind Farm is predicted to satisfy the code assessable noise requirements of State Code 23 for all host-lots and non-host lots.

Although excluded by State Code 23, the noise from the Wind Farm substations and battery energy storage system has been predicted to be more than 10 dB(A) below the WTG criteria and therefore is not expected to cause an adverse impact at the receptors.

The noise assessment conducted demonstrates that the proposed Tarong West Wind Farm satisfies the performance outcomes for acoustic amenity prescribed by State Code 23.

GLOSSARY AND ABBREVIATIONS

Term	Definition
A weighting	Frequency adjustment representing the response of the human ear.
Ambient noise level	Noise level in the absence of the noise from the Wind Farm.
Background noise level	The noise level represented by the L_{A90} in the absence of intermittent noise such as vehicles and wind gusts.
BESS	Battery Energy Storage System
dB	Linear (unweighted) sound pressure or power level in decibels.
dB(A)	A weighted noise or sound pressure or power level in decibels.
Host Lot	Premises located on the Tarong West Wind Farm site.
Non - Host Lot	Premises that do not accommodate any part of the Tarong West Wind Farm development and either adjoin, or are in close proximity to, host lots.
L_{A90}	The A weighted sound pressure level exceeded for 90% of the measurement period.
$L_{A90,10min}$	The L_{A90} sound pressure level measured over a 10 minute period.
L_{Aeq}	The A weighted equivalent continuous noise level – the energy-average of noise levels occurring over a measurement period.
May 2013 UK IOA Good Practice Guide	UK Institute of Acoustics IOA - A Good Practice Guide To The Application Of Etsu-R-97 For The Assessment And Rating Of Wind Turbine Noise
State Code 23	*State code 23: Wind farm development (version 3.0) and State Code 23: Wind Farm development - Planning Guidelines (February 2022)*
Wind Farm	Tarong West Wind Farm
WTG	Wind Turbine Generator

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1 INTRODUCTION

A noise impact assessment has been made of the proposed Tarong West Wind Farm (the **Wind Farm**), in accordance with the *State Code 23: Wind farm development (version 3.0) and State code 23: Wind Farm development - Planning Guidelines (February 2022)* (**State Code 23**).

Noise levels at sensitive land use receptors in the vicinity of the Wind Farm have been predicted using the ISO 9613-2 noise propagation model and the inputs recommended by the *May 2013 UK IOA Good Practice Guide* and State Code 23. The predicted noise levels have been compared with the relevant operational noise criteria, which have been derived from background noise levels measured at selected locations in the vicinity of the Wind Farm.

Relevant receptors in the vicinity of the Wind Farm are identified in Figure 1, which also shows the proposed turbine layout and the 1500m separation distance from Wind Turbine Generators (**WTGs**). Predictions have been made based on the current WTG selection being the *Vestas V166 4.5MW*.

The coordinates of the WTGs and receptors have been provided by RES Australia Pty Ltd and are repeated in Appendices A and B, respectively.

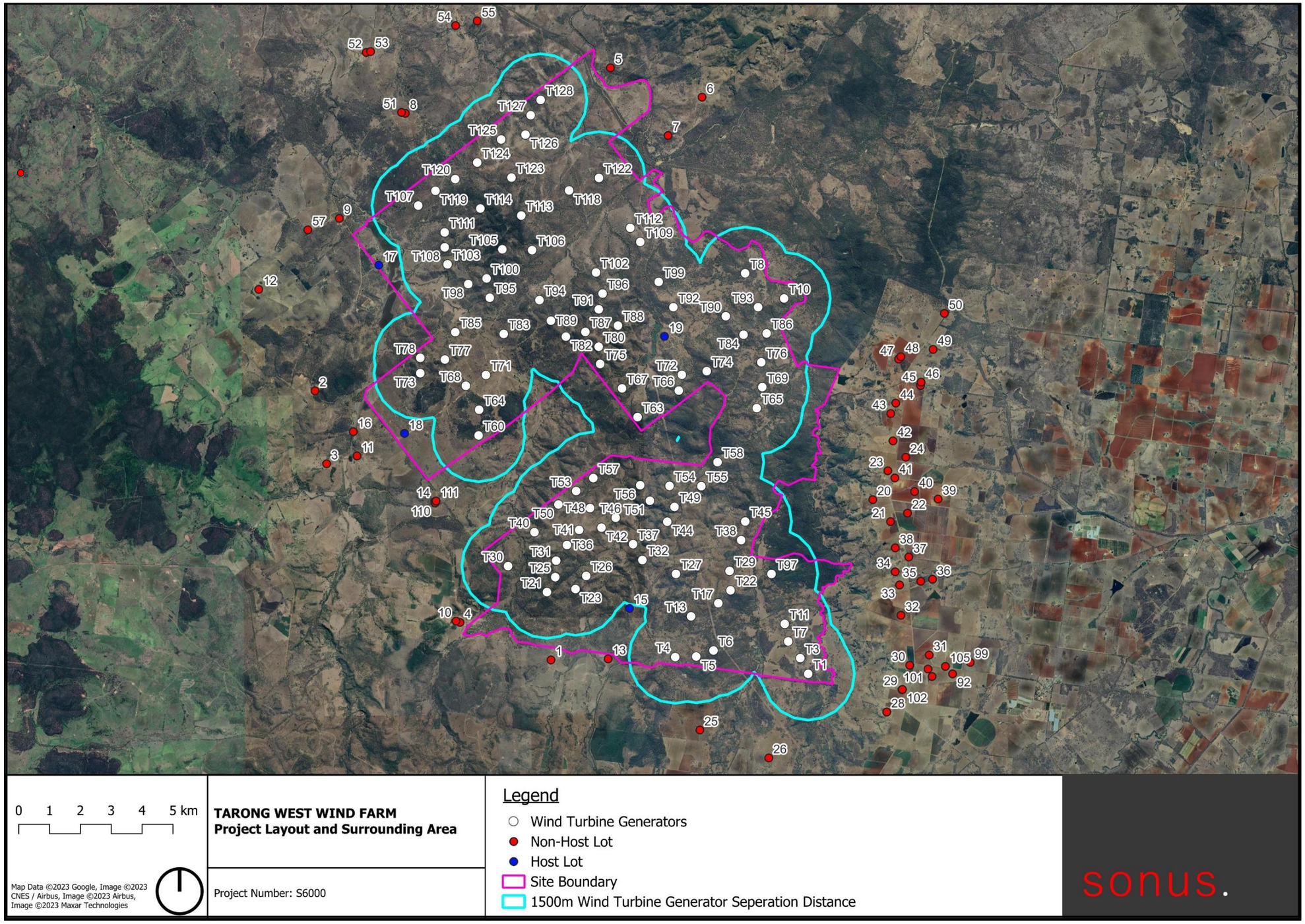

Figure 1: Project Layout and Surrounding Area

2 ENVIRONMENTAL NOISE CRITERIA

State Code 23 provides acoustic criteria to be achieved by the Wind Farm at existing or approved sensitive land uses on host lots and non-host lots to ensure the health and safety of individuals and the community.

For host lots, noise from the Wind Farm must not exceed 45 dB(A) or the background noise level plus 5 dB(A), whichever is greater, during the night period (10pm to 6am).

For non-host lots, noise from the Wind Farm must not exceed 35 dB(A) or the background noise level plus 5 dB(A), whichever is greater, during the night period; and 37 dB(A) or the background noise level plus 5 dB(A), whichever is greater, during the day period (6am to 10pm). Where a deed of release is in place, the noise from the Wind Farm may be increased above these limits, however, must not exceed the agreed maximum noise level limit, or if not available, the limit that would apply if the lot were a host lot.

It is understood that there are currently no non-host lots for which a deed of release has been agreed and therefore no higher noise level criteria apply at this time.

Background noise monitoring was conducted at seven sensitive land uses, which are dwellings on non-host lots. The monitoring was conducted between 2 May and 12 June 2019 at the locations listed in Table 1.

Table 1: Background noise monitoring locations

Location ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
1	350033	7048010
4	347082	7049227
6	354931	7066259
8	345309	7065736
32	361380	7049457
43	361049	7056001
111	346302	7053163

The background noise monitoring was conducted to describe the ambient noise in the area surrounding the Wind Farm during the day and night periods and for a range of wind speeds. The monitoring locations were selected to provide data in all directions from the Wind Farm, such that all sensitive land uses would have at least one representative background noise monitoring location on the same side of the Wind Farm. Details of the measurement methodology and results are described in Sonus report “S6000C7A”, dated December 2023.

Based on the measured background noise levels, wind farm operational noise criteria have been determined for all relevant receptors for integer hub height wind speeds from cut-in (3m/s) to approximate rated power. A hub height of 166m has been used for the analysis. If this hub height were to reduce to 160m, the criteria might increase slightly. That is the criteria would be slightly less onerous.

The most relevant monitoring location for each residence has been determined as the closest monitoring location which is on the same side of the Wind Farm as the residence. The resultant criteria, which are the greater of the relevant base limit or background noise level plus 5 dB(A), are provided in Table 2 and Table 3, for the daytime and night-time periods, respectively.

Table 2: Maximum allowable WTG noise level (L_{Aeq}) (daytime)

Location ID	Representative Logging Location	166m Hub Height Wind Speed (m/s)											
		3	4	5	6	7	8	9	10	11	12	13	14
Non-Host Lots													
1	1	37	38	38	39	39	39	40	40	42	43	46	49
2	111	37	37	37	37	37	37	37	37	39	41	44	47
3	111	37	37	37	37	37	37	37	37	39	41	44	47
4	4	37	37	37	37	37	37	37	37	37	39	42	46
5	6	37	37	37	37	37	37	37	37	37	39	40	43
6	6	37	37	37	37	37	37	37	37	37	39	40	43
7	6	37	37	37	37	37	37	37	37	37	39	40	43
8	8	37	37	37	37	37	37	37	37	38	40	42	45
9	8	37	37	37	37	37	37	37	37	38	40	42	45
10	4	37	37	37	37	37	37	37	37	37	39	42	46
11	111	37	37	37	37	37	37	37	37	39	41	44	47
12	111	37	37	37	37	37	37	37	37	39	41	44	47
13	1	37	38	38	39	39	39	40	40	42	43	46	49
14	111	37	37	37	37	37	37	37	37	39	41	44	47
16	111	37	37	37	37	37	37	37	37	39	41	44	47
20	43	37	37	37	37	37	37	37	38	39	40	42	45
21	32	37	37	37	37	37	37	38	39	40	43	46	50
22	32	37	37	37	37	37	37	38	39	40	43	46	50
23	43	37	37	37	37	37	37	37	38	39	40	42	45
24	43	37	37	37	37	37	37	37	38	39	40	42	45
25	1	37	38	38	39	39	39	40	40	42	43	46	49
26	32	37	37	37	37	37	37	38	39	40	43	46	50
28	32	37	37	37	37	37	37	38	39	40	43	46	50
29	32	37	37	37	37	37	37	38	39	40	43	46	50
30	32	37	37	37	37	37	37	38	39	40	43	46	50
31	32	37	37	37	37	37	37	38	39	40	43	46	50
32	32	37	37	37	37	37	37	38	39	40	43	46	50
33	32	37	37	37	37	37	37	38	39	40	43	46	50

Location ID	Representative Logging Location	166m Hub Height Wind Speed (m/s)											
		3	4	5	6	7	8	9	10	11	12	13	14
34	32	37	37	37	37	37	37	38	39	40	43	46	50
35	32	37	37	37	37	37	37	38	39	40	43	46	50
36	32	37	37	37	37	37	37	38	39	40	43	46	50
37	32	37	37	37	37	37	37	38	39	40	43	46	50
38	32	37	37	37	37	37	37	38	39	40	43	46	50
39	43	37	37	37	37	37	37	37	38	39	40	42	45
40	43	37	37	37	37	37	37	37	38	39	40	42	45
41	43	37	37	37	37	37	37	37	38	39	40	42	45
42	43	37	37	37	37	37	37	37	38	39	40	42	45
43	43	37	37	37	37	37	37	37	38	39	40	42	45
44	43	37	37	37	37	37	37	37	38	39	40	42	45
45	43	37	37	37	37	37	37	37	38	39	40	42	45
46	43	37	37	37	37	37	37	37	38	39	40	42	45
47	43	37	37	37	37	37	37	37	38	39	40	42	45
48	43	37	37	37	37	37	37	37	38	39	40	42	45
49	43	37	37	37	37	37	37	37	38	39	40	42	45
50	43	37	37	37	37	37	37	37	38	39	40	42	45
51	8	37	37	37	37	37	37	37	37	38	40	42	45
52	8	37	37	37	37	37	37	37	37	38	40	42	45
53	8	37	37	37	37	37	37	37	37	38	40	42	45
54	8	37	37	37	37	37	37	37	37	38	40	42	45
55	8	37	37	37	37	37	37	37	37	38	40	42	45
56	8	37	37	37	37	37	37	37	37	38	40	42	45
57	8	37	37	37	37	37	37	37	37	38	40	42	45
100	32	37	37	37	37	37	37	38	39	40	43	46	50
101	32	37	37	37	37	37	37	38	39	40	43	46	50
102	32	37	37	37	37	37	37	38	39	40	43	46	50
105	32	37	37	37	37	37	37	38	39	40	43	46	50
110	111	37	37	37	37	37	37	37	37	39	41	44	47
111	111	37	37	37	37	37	37	37	37	39	41	44	47

It is noted that there are no daytime criteria for host lots (locations 15, 17, 18 & 19).

Table 3: Maximum allowable WTG noise level (L_{Aeq}) (night-time)

Location ID	Representative Logging Location	166m Hub Height Wind Speed (m/s)											
		3	4	5	6	7	8	9	10	11	12	13	14
Host Lots													
15	9	45	45	45	45	45	45	45	45	45	45	45	45
17	1	45	45	45	45	45	45	45	45	45	45	45	45
18	9	45	45	45	45	45	45	45	45	45	45	45	45
19	33	45	45	45	45	45	45	45	45	45	45	45	45
Non-Host Lots													
1	1	35	35	35	35	35	35	35	35	35	36	38	42
2	111	35	35	35	35	35	35	35	35	35	35	36	38
3	111	35	35	35	35	35	35	35	35	35	35	36	38
4	4	35	35	35	35	35	35	35	35	35	35	35	35
5	6	35	35	35	35	35	35	35	35	35	35	35	38
6	6	35	35	35	35	35	35	35	35	35	35	35	38
7	6	35	35	35	35	35	35	35	35	35	35	35	38
8	8	35	35	35	35	35	35	35	35	35	35	36	38
9	8	35	35	35	35	35	35	35	35	35	35	36	38
10	4	35	35	35	35	35	35	35	35	35	35	35	35
11	111	35	35	35	35	35	35	35	35	35	35	36	38
12	111	35	35	35	35	35	35	35	35	35	35	36	38
13	1	35	35	35	35	35	35	35	35	35	36	38	42
14	111	35	35	35	35	35	35	35	35	35	35	36	38
16	111	35	35	35	35	35	35	35	35	35	35	36	38
20	43	35	35	35	35	35	35	35	35	35	35	36	38
21	32	35	35	35	35	35	35	35	35	35	36	38	40
22	32	35	35	35	35	35	35	35	35	35	36	38	40
23	43	35	35	35	35	35	35	35	35	35	35	36	38
24	43	35	35	35	35	35	35	35	35	35	35	36	38
25	1	35	35	35	35	35	35	35	35	35	36	38	42
26	32	35	35	35	35	35	35	35	35	35	36	38	40
28	32	35	35	35	35	35	35	35	35	35	36	38	40
29	32	35	35	35	35	35	35	35	35	35	36	38	40
30	32	35	35	35	35	35	35	35	35	35	36	38	40
31	32	35	35	35	35	35	35	35	35	35	36	38	40
32	32	35	35	35	35	35	35	35	35	35	36	38	40
33	32	35	35	35	35	35	35	35	35	35	36	38	40
34	32	35	35	35	35	35	35	35	35	35	36	38	40
35	32	35	35	35	35	35	35	35	35	35	36	38	40
36	32	35	35	35	35	35	35	35	35	35	36	38	40
37	32	35	35	35	35	35	35	35	35	35	36	38	40
38	32	35	35	35	35	35	35	35	35	35	36	38	40
39	43	35	35	35	35	35	35	35	35	35	35	36	38
40	43	35	35	35	35	35	35	35	35	35	35	36	38
41	43	35	35	35	35	35	35	35	35	35	35	36	38
42	43	35	35	35	35	35	35	35	35	35	35	36	38

Location ID	Representative Logging Location	166m Hub Height Wind Speed (m/s)											
		3	4	5	6	7	8	9	10	11	12	13	14
43	43	35	35	35	35	35	35	35	35	35	35	36	38
44	43	35	35	35	35	35	35	35	35	35	35	36	38
45	43	35	35	35	35	35	35	35	35	35	35	36	38
46	43	35	35	35	35	35	35	35	35	35	35	36	38
47	43	35	35	35	35	35	35	35	35	35	35	36	38
48	43	35	35	35	35	35	35	35	35	35	35	36	38
49	43	35	35	35	35	35	35	35	35	35	35	36	38
50	43	35	35	35	35	35	35	35	35	35	35	36	38
51	8	35	35	35	35	35	35	35	35	35	35	36	38
52	8	35	35	35	35	35	35	35	35	35	35	36	38
53	8	35	35	35	35	35	35	35	35	35	35	36	38
54	8	35	35	35	35	35	35	35	35	35	35	36	38
55	8	35	35	35	35	35	35	35	35	35	35	36	38
56	8	35	35	35	35	35	35	35	35	35	35	36	38
57	8	35	35	35	35	35	35	35	35	35	35	36	38
100	32	35	35	35	35	35	35	35	35	35	36	38	40
101	32	35	35	35	35	35	35	35	35	35	36	38	40
102	32	35	35	35	35	35	35	35	35	35	36	38	40
105	32	35	35	35	35	35	35	35	35	35	36	38	40
110	111	35	35	35	35	35	35	35	35	35	35	36	38
111	111	35	35	35	35	35	35	35	35	35	35	36	38

3 NOISE MODEL

3.1 ISO 9613-2 Noise Propagation Model

WTG noise levels have been predicted using the noise propagation model, *ISO 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors* (**ISO 9613-2**). ISO 9613-2 provides a methodology for predicting noise levels at sensitive land use receptors under meteorological conditions favourable to noise propagation. It is known as a downwind model, based on the conservative assumption of a receptor being downwind (resulting in the highest noise level) of all turbines simultaneously. The noise prediction model inputs are in accordance with the *May 2013 UK IOA Good Practice Guide* and State Code 23, including:

- *Warranted* sound power level data;
- 10°C temperature;
- 70% relative humidity;
- 50% acoustically hard ground and 50% acoustically soft ground;
- barrier attenuation of no greater than 2 dB(A);
- 4m receiver height; and,
- application of a 3 dB(A) correction where a "concave" ground profile exists as defined by the *May 2013 UK IOA Good Practice Guide*.

The noise model uses topographical ground contours provided by RES Australia Pty Ltd and a hub height of 166m above ground level, being the current candidate WTG hub height (Vestas V166)[1]. Vestas V166 has been selected as a candidate WTG for noise modelling purposes and the final turbine selection will need to comply with the noise limits permissible under State Code 23.

3.2 Sound Power Levels

As this project is in the planning phase, a final WTG model has not yet been selected or procured. Therefore, predictions have been made based on the turbine currently under consideration, being the *Vestas V166 4.5MW*.

One-third octave band sound power levels for the proposed WTG have been provided by *Vestas* for each integer hub height wind speed from cut-in to rated power. It is understood that these levels will be guaranteed should the WTGs be selected. Table 4 summarises the sound power level data which has been used for predictions.

[1] It is noted that for other hub heights which would fall within the 249m tip height envelope, the noise level would not increase above that predicted in this assessment.

Table 4: One Third Octave Band Sound Power Levels for Vestas V166 4.5MW WTG, dB(A)

Wind Speed	1/3 Octave Band Centre Frequency																							Overall
	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	
3 m/s	67.2	70.5	73.4	75.7	77.5	78.8	79.7	80.6	81.1	81.7	81.9	81.8	81.4	80.7	79.6	78.1	76.4	74.3	71.8	69	65.9	62.4	58.7	54.5	91.8
4 m/s	66.7	70.3	73.4	75.9	77.9	79.3	80.3	81.3	81.9	82.5	82.8	82.7	82.3	81.5	80.3	78.8	76.9	74.6	72	69	65.7	62	58	53.5	92.5
5 m/s	69.3	73.2	76.5	79.2	81.3	83	84.1	84.7	85.3	85.5	85.8	85.7	85.2	84.3	83.1	81.5	79.6	77.3	74.6	71.5	68.1	64.3	60.2	55.6	95.6
6 m/s	72.4	76.4	79.9	82.9	85.2	87	88.2	89	89.2	89.4	89.3	89.1	88.6	87.7	86.5	84.9	82.9	80.5	77.8	74.7	71.2	67.3	63.1	58.5	99.3
7 m/s	76	80.1	83.6	86.5	88.8	90.6	91.8	92.5	92.8	93	92.8	92.6	92.1	91.2	89.9	88.2	86.2	83.8	81	77.9	74.4	70.5	66.2	61.6	102.8
8 m/s	78.4	82.6	86.2	89.3	91.9	93.8	95.2	96	96.3	96.2	96	95.4	94.9	93.9	92.6	90.9	88.9	86.5	83.7	80.5	77	73.1	68.8	64.1	105.9
9 m/s	79.7	83.8	87.3	90.4	92.9	94.8	96.1	96.9	97.2	97	96.8	96.3	95.7	94.8	93.5	91.8	89.8	87.4	84.6	81.5	78	74.1	69.8	65.2	106.8
10 m/s	80.1	84.1	87.6	90.6	93	94.9	96.2	96.9	97.2	97	96.8	96.2	95.6	94.7	93.5	91.8	89.8	87.5	84.8	81.8	78.3	74.6	70.4	66	106.8
11 m/s	80.3	84.2	87.7	90.6	93	94.9	96.1	96.9	97.2	97	96.7	96.2	95.6	94.7	93.5	91.9	89.9	87.6	85	82	78.6	74.9	70.8	66.4	106.8
12 m/s	80.2	84.1	87.6	90.6	93	94.8	96.1	96.9	97.1	97	96.8	96.2	95.7	94.8	93.6	92	90	87.7	85.1	82.1	78.7	75	71	66.6	106.8
13 m/s	79.9	83.9	87.4	90.4	92.9	94.7	96.1	96.8	97.1	97	96.8	96.2	95.7	94.9	93.6	92	90.1	87.8	85.2	82.2	78.8	75.1	71	66.6	106.8

3.3 Predicted WTG Operational Noise

The predicted WTG noise levels at each sensitive land use receptor for each integer wind speed are provided in Table 5. Predicted noise contours for the operational wind speed with the highest predicted noise level (11m/s) are presented in Figure 2.

Table 5: Predicted noise levels (L_{Aeq}) from Vestas V166 4.5MW WTG

Location ID	Noise Level [dB(A)] for each 166m Hub Height Wind Speed (m/s)										
	3	4	5	6	7	8	9	10	11	12	13
Host Lots											
15	24	25	28	32	35	39	40	40	40	40	40
17	20	21	24	28	31	35	35	36	36	36	35
18	20	20	24	27	31	34	35	35	35	35	35
19	26	27	30	34	37	40	41	41	41	41	41
Non-Host Lots											
1	19	19	23	27	30	33	34	34	34	34	34
2	17	17	21	24	28	31	32	32	32	32	32
3	14	14	18	21	25	28	29	29	29	29	29
4	17	18	21	25	28	32	32	33	33	33	32
5	16	17	20	24	27	31	32	32	32	32	31
6	16	16	19	23	27	30	31	31	31	31	31
7	18	18	22	26	29	32	33	33	33	33	33
8	18	18	21	25	29	32	33	33	33	33	33
9	17	17	21	24	28	31	32	32	32	32	32
10	17	18	21	25	28	31	32	32	32	32	32
11	15	16	19	23	26	29	30	30	30	30	30
12	13	13	17	20	24	27	28	28	28	28	28
13	19	20	23	27	30	34	35	35	35	35	35
14	19	20	23	27	31	34	35	35	35	35	35
16	16	16	19	23	27	30	31	31	31	31	31
20	17	17	20	24	28	31	32	32	32	32	32
21	16	16	19	23	27	30	31	31	31	31	31
22	14	14	17	21	25	28	29	29	29	29	29
23	16	17	20	24	27	30	31	31	31	31	31
24	14	14	18	21	25	28	29	29	29	29	29
25	18	18	21	25	29	32	33	33	33	33	33
26	15	16	19	23	27	30	31	31	31	31	31
28	15	16	19	23	26	29	30	30	30	30	30
29	15	15	19	22	26	29	30	30	30	30	30
30	14	15	18	22	25	28	29	29	29	29	29
31	13	13	16	20	24	27	28	28	28	28	28
32	15	15	18	22	26	29	30	30	30	30	30
33	15	15	18	22	26	29	30	30	30	30	30
34	15	15	19	23	26	29	30	30	30	30	30
35	13	14	17	21	24	27	28	28	28	28	28
36	12	13	16	20	23	27	28	28	28	28	28

Location ID	Noise Level [dB(A)] for each 166m Hub Height Wind Speed (m/s)										
	3	4	5	6	7	8	9	10	11	12	13
37	14	15	18	22	25	28	29	29	29	29	29
38	15	15	19	22	26	29	30	30	30	30	30
39	12	12	16	19	23	26	27	27	27	27	27
40	13	13	17	20	24	27	28	28	28	28	28
41	15	15	19	22	26	29	30	30	30	30	30
42	16	16	19	23	27	30	31	31	31	31	31
43	16	16	20	23	27	30	31	31	31	31	31
44	15	16	19	23	26	29	30	30	30	30	30
45	13	14	17	21	24	27	28	28	29	28	28
46	13	14	17	21	24	27	28	29	29	28	28
47	15	15	19	22	26	29	30	30	30	30	30
48	15	15	18	22	26	29	30	30	30	30	30
49	13	13	16	20	24	27	28	28	28	28	28
50	12	12	15	19	23	26	27	27	27	27	27
51	17	18	21	25	29	32	33	33	33	33	33
52	12	13	16	20	23	26	27	27	27	27	27
53	12	13	16	20	23	27	28	28	28	28	28
54	14	14	18	21	25	28	29	29	29	29	29
55	14	15	18	22	25	29	30	30	30	30	29
56	11	12	15	19	22	25	26	26	26	26	26
57	15	15	18	22	26	29	30	30	30	30	30
100	12	13	16	20	23	26	27	27	27	27	27
101	13	13	16	20	24	27	28	28	28	28	28
102	15	15	18	22	26	29	30	30	30	30	30
105	12	12	15	19	22	26	27	27	27	27	27
110	19	20	23	27	30	34	35	35	35	35	35
111	20	20	23	27	31	34	35	35	35	35	35

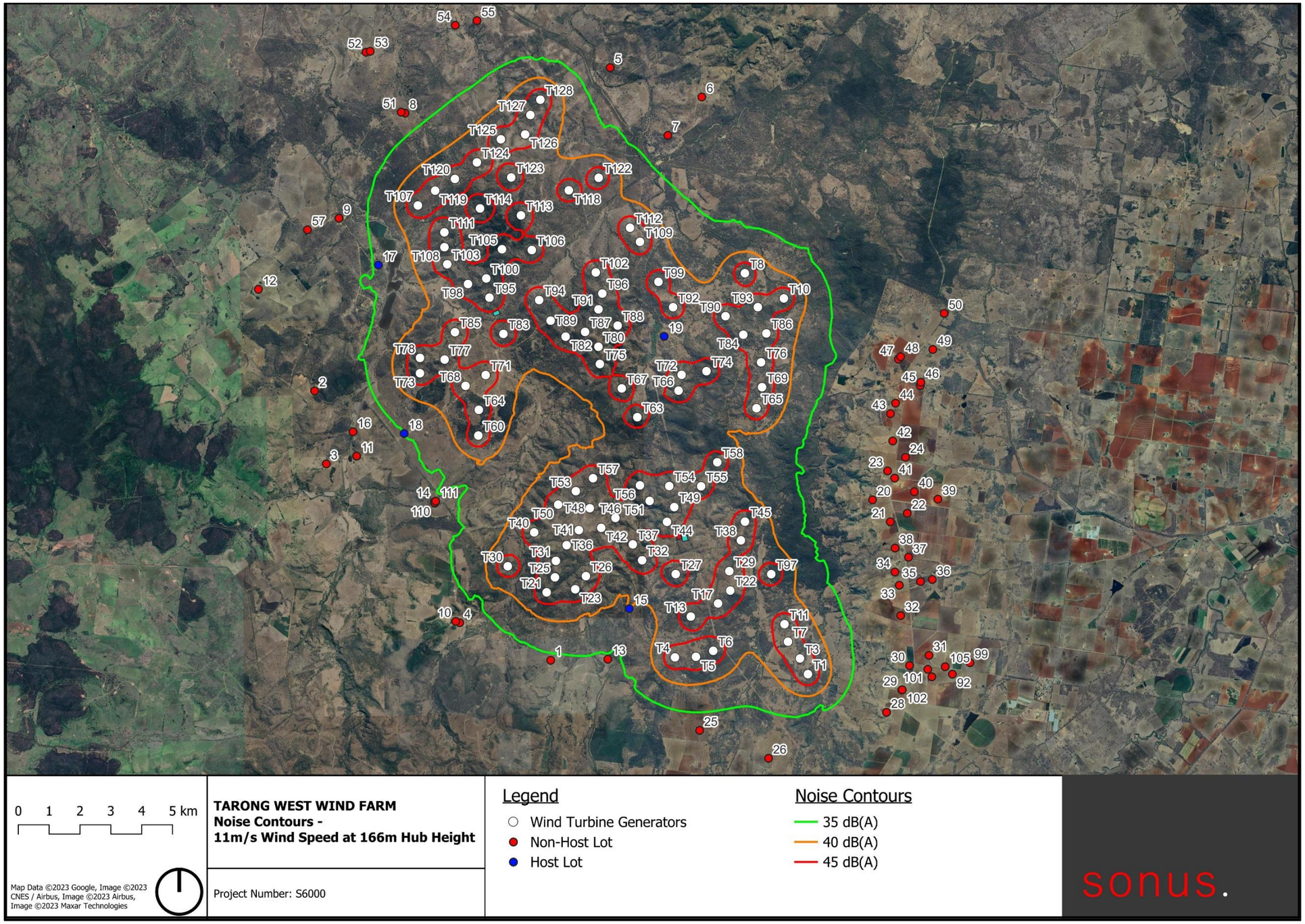

Figure 2: Noise level contour from Vestas V166 4.5MW WTGs at 11m/s

The results above indicate that the highest predicted noise levels at the receptors are as follows:

- 35 dB(A) at non-host lots without a deed of release (lowest criterion 35 dB(A) at night, 37 dB(A) during the day).
- 41 dB(A) at host lots (lowest criterion 45 dB(A) during the night only).

The noise assessment conducted demonstrates that the proposed Tarong West Wind Farm satisfies the performance outcomes for acoustic amenity prescribed by State Code 23.

3.4 Substation & Battery Energy Storage System Noise

Noise from the on-site substations and battery energy storage system (**BESS**) associated with the Wind Farm is not included in the noise assessment in accordance with State Code 23. Notwithstanding, a prediction has been made to determine the potential noise impact of the on-site substations and BESS on the surrounding sensitive land uses.

There are currently three (3) locations under consideration for the on-site substations although only two will be constructed. Notwithstanding, predictions have been made of the noise level at nearby residences from the concurrent operation of all locations under consideration. The assessment is therefore conservative and noise levels will be lower than provided in this report.

The noise predictions have been based on two 180 MVA rated transformer units, located at each of the three possible on-site substations, with approximate coordinates as shown in Table 6;

Table 6: On-site Substation Locations [2]

On-site Substation	Approximate Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
1	354719	3059825
2	348273	7059256
3	354381	7051962

A sound power level of 98 dB(A) for each of the transformers has been derived from the Australian/New Zealand Standard *AS/NZS 60076.10:2009 Power transformers – Part 10: Determination of sound levels.*

[2] RES Australia Pty Ltd file: "InfrastructureAreas_PAUSilf138_97T_20230721"

In addition, the predictions include the noise from a single BESS at approximately 354188 Easting and 7052025 Northing. The predictions have been based on the following noise sources and the manufacturer sound power level data shown in Table 7;

Table 7: BESS Sound Power Levels

BESS Item	Quantity	Representative Unit	Sound Power Level (each)
Power Conversion System	40	Freemaq PCSK	98 dB(A)
Distribution Transformer (3.5MVA)	40	Derived from AS/NZ 60076.10:2009	74 dB(A)
Container HVAC	18 off 5kW units per container (40 containers)	Daikin RZAV50CV1	68 dB(A)

Given the significant separation distance between the proposed substation locations, BESS and the closest sensitive land use receptor (i.e., approximately 1.3km away to the closest host lot and 4.5km to the closest non-host lot), the highest noise level at any sensitive land use receptor (host or non-host) is predicted to be less than 25 dB(A).

Based on the above, the noise will be more than 10 dB(A) below the Wind Farm criteria and therefore is not expected to cause an adverse impact at the receptors.

4 CONCLUSION

A noise impact assessment has been made of the proposed Tarong West Wind Farm in accordance with the State *code 23: Wind farm development (version 3.0) and State code 23: Wind Farm development - Planning Guidelines (February 2022)* (**State Code 23**).

The noise from the proposed Wind Farm, consisting of 97 turbines with a tip height of up to 249m, has been predicted for all surrounding sensitive land use receptors in the vicinity of the Wind Farm. The predictions have been made using the ISO 9613-2 noise propagation model and the inputs recommended by the *May 2013 UK IOA Good Practice Guide* and State Code 23.

The predicted noise levels were compared with the relevant operational noise criteria derived in accordance with State Code 23. Based on the comparison, the noise from the Wind Farm is predicted to satisfy the code assessable noise requirements of State Code 23 for all host-lots and non-host lots.

Although excluded by State Code 23, the noise from the Wind Farm substations and battery energy storage system has been predicted to be more than 10 dB(A) below the WTG criteria and therefore is not expected to cause an adverse impact at the receptors.

The noise assessment conducted demonstrates that the proposed Tarong West Wind Farm satisfies the performance outcomes for acoustic amenity prescribed by State Code 23.

APPENDIX A: COORDINATES OF WIND TURBINE GENERATORS

(RES Australia Pty Ltd file: "PAUSilf138")

Turbine ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
T1	358373	7047561
T3	358115	7048069
T4	354061	7048104
T5	354742	7048122
T6	355302	7048317
T7	357725	7048612
T8	356329	7060549
T10	357592	7059734
T11	357613	7049179
T13	354575	7049425
T17	355459	7049850
T21	349902	7050210
T22	355855	7050269
T23	350828	7050310
T25	350170	7050696
T26	351175	7050736
T27	354086	7050802
T29	355824	7050897
T30	348641	7051055
T31	350201	7051230
T32	352997	7051251
T36	350550	7051738
T37	352695	7051765
T38	356200	7051895
T40	349497	7052152
T41	350946	7052228
T42	351670	7052301
T44	353803	7052493
T45	356332	7052501
T46	352131	7052622
T48	351301	7052937
T49	354039	7052973
T50	350275	7053052
T51	353241	7053173
T53	350848	7053489
T54	353876	7053653
T55	354909	7053646
T56	352926	7053676
T57	351405	7053908

Turbine ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
T58	355433	7054425
T60	347686	7055290
T63	352841	7055886
T64	347701	7056123
T65	356704	7056175
T66	354177	7056747
T67	352337	7056817
T68	347272	7056901
T69	356885	7056858
T71	347924	7057250
T72	354277	7057258
T73	345794	7057309
T74	355083	7057375
T75	351627	7057609
T76	356853	7057663
T77	346592	7057753
T78	345795	7057807
T80	351580	7058168
T82	350517	7058495
T83	348500	7058583
T84	356277	7058557
T85	346929	7058639
T86	357025	7058599
T87	351147	7058647
T88	352204	7058852
T89	350030	7059013
T90	355701	7059156
T91	351582	7059381
T92	354001	7059449
T93	356749	7059450
T94	349658	7059680
T95	348047	7059757
T96	351707	7059891
T97	357184	7050800
T98	347350	7060199
T99	353525	7060270
T100	347944	7060380
T102	351493	7060575
T103	346679	7060840

Turbine ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
T105	348454	7061325
T106	349420	7061300
T107	345727	7062745
T108	346587	7061391
T109	352928	7061566
T111	346585	7061874
T112	352605	7062022
T113	349070	7062423
T114	347742	7062649
T118	350619	7063236

Turbine ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
T119	346286	7063224
T120	346927	7063604
T122	351589	7063641
T123	348752	7063653
T124	347640	7064140
T125	348418	7064889
T126	349204	7065046
T127	349375	7065675
T128	349697	7066171

APPENDIX B: COORDINATES OF RECEPTORS

(RES Australia Pty Ltd file: DAUSilf001_20200117_5km)

Location ID	Coordinates (GDA 94 MGA Zone 55)	
	Easting	Northing
Host Lots		
15	352581	7049680
17	344450	7060814
18	345283	7055357
19	353713	7058504
Non-host Lots		
1	350033	7048010
2	342380	7056737
3	342758	7054371
4	347082	7049227
5	351960	7067211
6	354931	7066259
7	353829	7065016
8	345309	7065736
9	343168	7062331
10	346952	7049270
11	343741	7054626
12	340556	7060027
13	351884	7048043
14	346268	7053150
16	343622	7055412
20	360468	7053207
21	361043	7052496
22	361593	7052771
23	360955	7054145
24	361537	7054584
25	354861	7045738
26	357095	7044834
28	360921	7046323
29	361415	7047048
30	361666	7047837
31	362298	7048170
32	361380	7049457

Location ID	Coordinates (GDA 94 MGA Zone 55)	
	Easting	Northing
33	361337	7050441
Non-host Lots		
34	361194	7050869
35	362022	7050561
36	362405	7050628
37	361634	7051348
38	361197	7051645
39	362586	7053229
40	361823	7053471
41	361184	7053912
42	361123	7055114
43	361049	7056001
44	361214	7056338
45	362016	7056910
46	362034	7057017
47	361305	7057765
48	361379	7057845
49	362424	7058080
50	362790	7059247
51	345185	7065765
52	344044	7067709
53	344181	7067739
54	346939	7068582
55	347641	7068732
56	346466	7069964
57	342147	7061956
100	362390	7047474
101	362258	7047717
102	361429	7047054
105	362824	7047800
110	346273	7053106
111	346302	7053163