

Bat Activity at Oaklands Hill Wind Energy Facility

Autumn 2011

Report to Suzlon Energy Australia.

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EXECUTIVE SUMMARY

Bat presence and activity was surveyed at the Oaklands Hill Wind Energy Facility using ultrasonic bat detectors over 10 consecutive nights from 11 to 20 March 2011. A total of 9,730 calls were recorded from eight bat species, including 96 calls recorded near the top of the anemometry mast. Bat activity (recorded from ground-based detectors) ranged from 0 to 982 calls / detector-night, with an overall mean (\pm standard error) of 160.57 ± 22.91 calls / detector-night ($n = 60$). Bat activity varied significantly between species with *Chalinolobus morio* and *Chalinolobus gouldii* the most common species recorded, respectively averaging 70.08 ± 17.53 and 57.27 ± 8.56 calls / detector-night. *Miniopterus schreibersii* was not recorded during the survey.

Overall bat activity near the top of the anemometry mast was significantly lower than near the base. 96 calls from three species were recorded from the top of the mast compared to 257 calls from 7 species near the base. *Tadarida australis* was the most common species recorded near the top of the anemometry mast and is therefore considered to be at greatest risk of blade strike. *Chalinolobus gouldii* was also recorded flying near the top of the anemometry mast but at relatively low levels of activity. However, as this species was one of the most common species recorded at the wind farm, its risk of blade strike is also considered to be relatively high.

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1.0 INTRODUCTION

In accordance with the Bat and Avifauna Management Plan (Wood 2011), monitoring of bat presence and activity is required to be undertaken in autumn and spring prior to commissioning of the Oaklands Hill wind energy facility. The aim of this monitoring program was to firstly determine the bat species present, particularly the presence of the EPBC listed Southern Bent-wing Bat *Miniopterus schreibersii bassanii*, and examine their relative activity on the wind farm site, and secondly to identify which species were most likely to be impacted by the wind farm. The following report documents the relative activity of bat species at the Oaklands Hill wind energy facility during autumn 2011.

2.0 METHODS

2.1 Oaklands Hill Wind Farm

The Oaklands Hill Wind Farm consists of 32 wind turbines and is located approximately 8 km south of Glenthompson in south-west Victoria. The wind farm is located on three privately owned properties on the east and west of Glenthompson-Caramut Road and covers an area of approximately 2,320 ha. All properties within the wind farm boundary are used primarily for agricultural purposes, particularly grazing by domestic stock.

2.2 Bat activity

Bat activity was examined using ultrasonic bat detectors (Anabat®, Titley Electronics Pty Ltd). These instruments record the echolocation calls of bats which can be later analysed with software (AnalogW) to determine the species of origin by comparing calls to a reference library of calls. Bat calls are recorded on a digital flashcard (128 Mb) as individual files for each pass of the bat. Bat detectors can detect bats flying up to 30 m away although the range of detection is influenced by the species and orientation of the bat, as well as weather conditions, particularly wind strength, humidity and precipitation. All bat detectors were connected to an external 12V, 7.2Ah lead acid battery and placed in waterproof housing, which was secured to the ground using an elastic strap pegged down with four 250 mm tent pegs. The division ratio and sensitivity of all bat detectors were set to 16 and 6 respectively.

Bat detectors were also used to sample the air space within the rotor swept area of the generator blades to identify species that fly at the rotor height of the turbines. This was achieved by hoisting a microphone on an extension cable toward the top of an anemometry mast to a height of approximately 30 m which was a similar altitude to that of the lower blade-swept area of turbines. The microphone cable was tied with cable ties to a nylon rope that looped through a D-ring near the top of the mast to the ground where it was anchored to two metal star-pickets. These pickets were positioned approximately 25 m from the base of the mast and spaced approximately 4 m apart to avoid any potential noise disturbance from the ropes tapping against each other or against the mast during strong winds. The microphone was contained within a curved PVC tube (50 mm diameter) which protected it from rain and directed the face of the microphone away from the mast and in an upward direction.

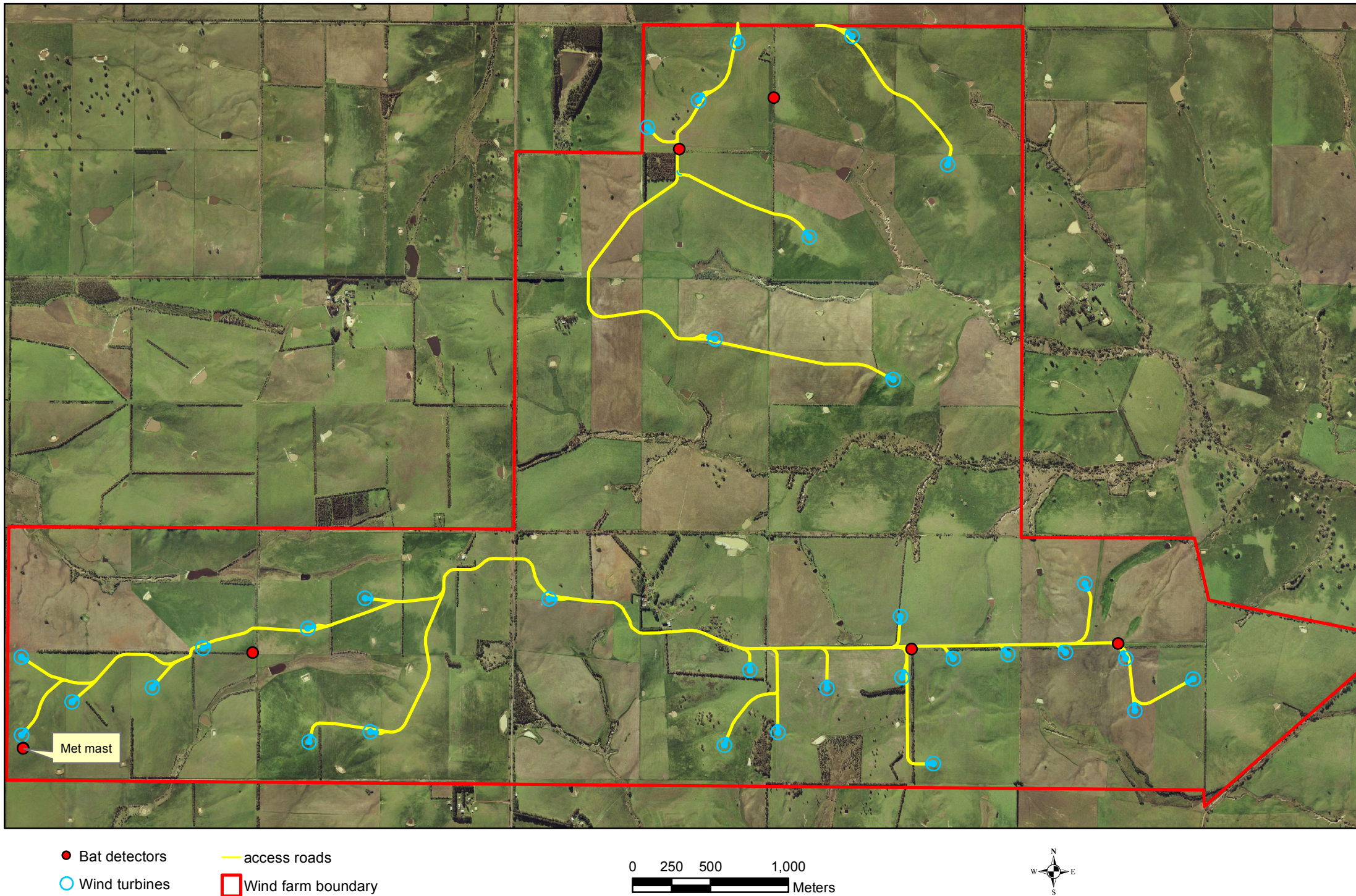
Bat activity was surveyed at the Oaklands Hill Wind Farm from 7:00 pm to 7:00 am (EST) over 10 consecutive nights from 11 – 20 March 2011. Seven bat detectors were set-out at the wind farm site; six ground based and one at the top of an anemometry mast. The locations of all bat detectors are shown in Figure 1. At completion of the survey, data were downloaded from each flashcard.

2.3 Data analysis

Bat calls downloaded from the flashcards were analysed with AnalookW software to identify, where possible, the species of bat for each sequence of bat calls recorded by comparison to a reference library of bat calls. Some of the data could not be positively identified to species level, due to poor call quality or insufficient call sequence, but were assigned to a group of species that share similar call characteristics.

Bat activity at the wind farm was quantified in terms of the total number of bat calls, the mean number of calls per detector-night, and the mean number of calls recorded for each species per detector-night. Chi-square tests were used to examine differences in the activity of each species. Comparisons of bat activity between the top and base of anemometry towers were analysed using the paired sample t-test to examine any differences in bat activity at the different altitudes.

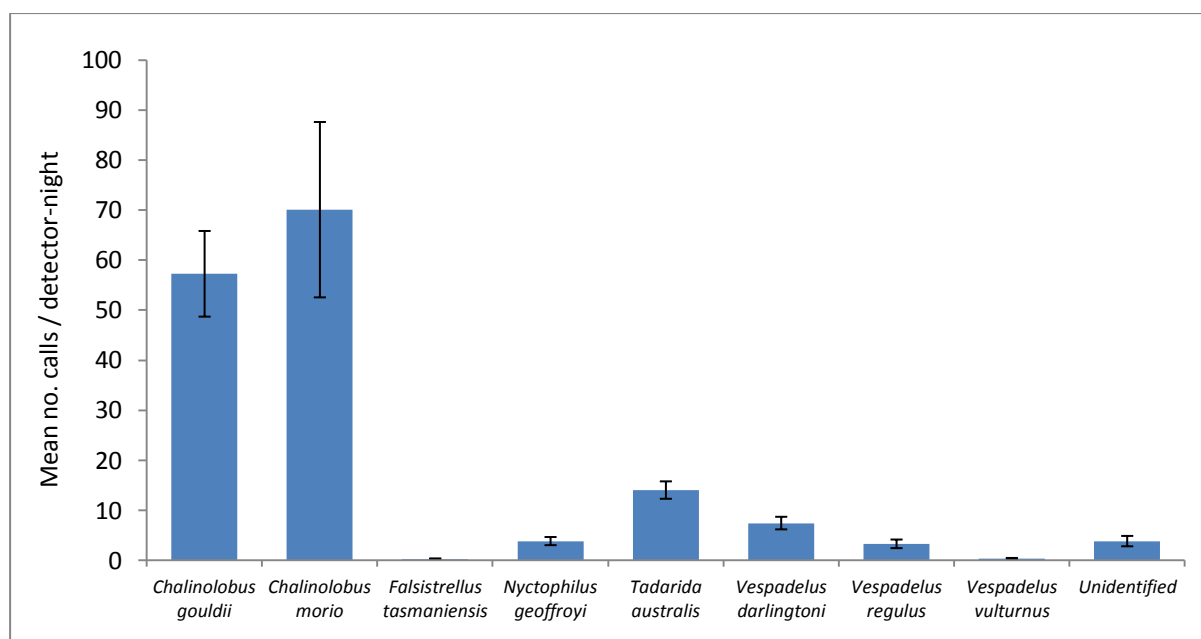
Figure 1. Locations of bat detectors at the Oaklands Hill Wind Farm



3.0 RESULTS

A total of 9,634 calls were recorded from eight bat species at the Oaklands Hill Wind Energy Facility site. 96 additional calls were recorded near the top of the anemometry tower. Bat activity (recorded from ground-based detectors) ranged from 0 to 982 calls / detector-night, with an overall mean (\pm standard error) of 160.57 ± 22.91 / detector-night ($n = 60$). 234 bat calls could not be identified to species level due to poor call quality or insufficient call sequence but were assigned to groups of species that share similar call characteristics. These were typically from either *Vespadelus darlingtoni*, *V.regulus* or *V. vulturnus*. The number of bat calls recorded from each species on each night at each location on the wind farm site is shown in Appendix 1. Bat activity varied significantly between species ($\chi^2 = 20315.911$, d.f. = 8, $p < 0.001$) with *Chalinolobus morio* and *Chalinolobus gouldii* the most common species recorded, respectively averaging 70.08 ± 17.53 and 57.27 ± 8.56 calls / detector-night. *Tadarida australis* and *Vespadelus darlingtoni* were recorded at moderate levels of activity whilst other species were recorded at relatively low levels of activity (Figure 2).

Figure 2. Relative activity of bat species at the Oaklands Hill Wind Farm.



Overall bat activity near the top of the anemometry mast was significantly lower than near the base ($t = -4.364$, d.f. = 9, $p = 0.002$). 96 calls from three species (*Tadarida australis*, *Chalinolobus gouldii* and *Vespadelus darlingtoni*) were recorded from the top of the tower compared to 257 calls from 7 species near the base. *Tadarida australis* accounted for 78% of

all calls recorded near the top of the anemometry mast. Of those species recorded near the top of the mast, their activity was lower near the top of the mast than near the base.

4.0 CONCLUSION

A total of 9,634 calls were recorded from eight bat species at the Oaklands Hill Wind Energy Facility. 96 additional calls were recorded from three species near the top of the anemometry mast. Bat activity (recorded from ground-based detectors) ranged from 0 to 982 calls / detector-night, with an overall mean of 160.57 ± 22.91 calls / detector-night ($n = 60$). Bat activity varied significantly between species with *Chalinolobus morio* and *Chalinolobus gouldii* the most common species recorded.

This survey did not record the presence of *Miniopterus schreibersii* at the wind farm, nor was this species recorded in a preliminary bat survey during November 2006 (Venosta 2007). It is possible that this species may use the site during periods of migration for example, but this would be expected to be infrequent. The Oaklands Hill Wind Farm is therefore unlikely to adversely impact the population of *Miniopterus schreibersii* in south west Victoria.

Overall bat activity near the top of the anemometry mast was significantly lower than near the base. *Tadarida australis* was the most common species recorded near the top of the anemometry mast, accounting for 78% of all calls recorded. *Chalinolobus gouldii* and *Vespadelus darlingtoni* were also recorded near the top of the anemometry mast but at relatively lower levels of activity. The activity of all three species was lower near the top of the mast than near the base. This suggests that whilst these species are at risk from blade strike, their risk is reduced by flying mostly below the wind-swept area of the blades. Although there appears to be a low risk of blade strike to bats, considering the relatively low proportion of activity spent flying at altitudes within the wind-swept area of blades, both *Tadarida australis* and *Chalinolobus gouldii* appear at greatest risk of blade strike due to their flight altitudes and relative abundance on the site.

Bat activity is influenced by a number of factors, including bat abundance, forage availability, weather conditions, floristic and structural attributes of vegetation and proximity to roost sites and fresh water. The highly variable nature of bat activity, as determined by the number and frequency of their calls, necessitates a large sample of bat detector-nights to provide an accurate assessment of bat activity. An additional survey to be undertaken in spring 2011 will

provide a more comprehensive assessment of bat species presence and activity at the Oaklands Hill Wind Farm.

5.0 REFERENCES

Venosta M. (2007). *Bird Utilisation, Brolga and Bat studies at the Oaklands Hill Wind Farm site, Glenthompson, Victoria*. Biosis Research Pty Ltd.

Wood M. (2011). *Oaklands Hill Wind Energy Facility - Bat and Avifauna Management Plan*. Australian Ecological Research Services Pty Ltd.

6.0 APPENDICES

Appendix 1. Number of bat calls recorded from each species at each location on the Oaklands Hill wind farm.

| Location | Date | Species or species group | | | | | | | | | | Total calls | |
|------------------------------------|--------------|--------------------------|-----|----|-----|-----|-----|----|----|-------|----------|-------------|----|
| | | Cg | Cm | Ft | Ng | Ta | Vd | Vr | Vv | Vr/Vv | Vd/Vr/Vv | | |
| Oaklands Hill Wind Energy Facility | Top of Mast | 11/03/2011 | 7 | - | - | - | 15 | 1 | - | - | - | - | 23 |
| | | 12/03/2011 | 5 | - | - | - | 11 | - | - | - | - | - | 16 |
| | | 13/03/2011 | 2 | - | - | - | 23 | 1 | - | - | - | - | 26 |
| | | 14/03/2011 | 1 | - | - | - | 7 | - | - | - | - | - | 8 |
| | | 15/03/2011 | 2 | - | - | - | 16 | 1 | - | - | - | - | 19 |
| | | 16/03/2011 | 1 | - | - | - | 3 | - | - | - | - | - | 4 |
| | | 17/03/2011 | - | - | - | - | - | - | - | - | - | - | 0 |
| | | 18/03/2011 | - | - | - | - | - | - | - | - | - | - | 0 |
| | | 19/03/2011 | - | - | - | - | - | - | - | - | - | - | 0 |
| | | 20/03/2011 | - | - | - | - | - | - | - | - | - | - | 0 |
| | Total calls | 18 | 0 | 0 | 0 | 75 | 3 | 0 | 0 | 0 | 0 | 96 | |
| | Base of Mast | 11/03/2011 | 13 | - | - | - | 29 | - | 3 | 1 | - | - | 46 |
| | | 12/03/2011 | 4 | - | 1 | - | 19 | - | 2 | 1 | - | - | 27 |
| | | 13/03/2011 | 6 | - | 1 | - | 26 | 2 | - | - | - | - | 35 |
| | | 14/03/2011 | 6 | 1 | - | - | 11 | 1 | - | - | - | - | 19 |
| | | 15/03/2011 | 5 | - | - | - | 20 | 1 | 1 | - | - | - | 27 |
| | | 16/03/2011 | 1 | - | - | - | 4 | - | - | - | - | - | 5 |
| | | 17/03/2011 | 7 | - | - | - | 2 | - | - | - | - | - | 9 |
| | | 18/03/2011 | 2 | - | - | - | 16 | 1 | - | - | - | - | 19 |
| | | 19/03/2011 | 9 | 1 | - | - | 23 | 2 | - | - | 1 | 1 | 37 |
| 20/03/2011 | | 5 | - | - | - | 27 | - | - | - | 1 | - | 33 | |
| Total calls | 58 | 2 | 2 | 0 | 177 | 7 | 6 | 2 | 2 | 1 | 257 | | |
| OHWF#1 | 11/03/2011 | 114 | 42 | 1 | 9 | 30 | 8 | 11 | 2 | 8 | 8 | 233 | |
| | 12/03/2011 | 63 | 50 | - | 9 | 7 | 8 | 7 | 5 | 3 | 5 | 157 | |
| | 13/03/2011 | 19 | 35 | - | - | 12 | 4 | 1 | - | - | - | 71 | |
| | 14/03/2011 | 21 | 23 | - | 2 | 12 | 4 | - | - | 1 | - | 63 | |
| | 15/03/2011 | 30 | 21 | - | 1 | 11 | 1 | - | - | - | - | 64 | |
| | 16/03/2011 | 5 | 4 | - | - | 2 | - | - | - | - | 1 | 12 | |
| | 17/03/2011 | 20 | 9 | - | 1 | 2 | 2 | 1 | - | - | - | 35 | |
| | 18/03/2011 | 15 | 7 | - | - | 7 | 1 | 1 | - | - | - | 31 | |
| | 19/03/2011 | 31 | 4 | - | 2 | 11 | 3 | - | - | - | - | 51 | |
| | 20/03/2011 | 43 | 7 | - | 1 | 23 | 1 | 2 | - | - | 2 | 79 | |
| Total calls | 361 | 202 | 1 | 25 | 117 | 32 | 23 | 7 | 12 | 16 | 796 | | |
| OHWF#2 | 11/03/2011 | 108 | 71 | - | 12 | 46 | 39 | 9 | - | - | 2 | 287 | |
| | 12/03/2011 | 76 | 101 | - | 14 | 13 | 33 | 16 | 1 | 9 | 7 | 270 | |
| | 13/03/2011 | 83 | 71 | - | 5 | 1 | 12 | 39 | 3 | 7 | 2 | 223 | |
| | 14/03/2011 | 80 | 110 | - | 3 | 14 | 11 | 13 | - | 8 | 5 | 244 | |
| | 15/03/2011 | 115 | 72 | - | 6 | 12 | 19 | 22 | 1 | 5 | 1 | 253 | |
| | 16/03/2011 | 50 | 44 | - | 1 | 1 | 2 | - | - | 3 | - | 101 | |
| | 17/03/2011 | 53 | 97 | - | 1 | 2 | 4 | 1 | - | 1 | - | 159 | |
| | 18/03/2011 | 31 | 108 | - | 2 | 8 | 5 | 1 | - | - | 1 | 156 | |
| | 19/03/2011 | 130 | 65 | - | 2 | 21 | 6 | 3 | - | 1 | - | 228 | |
| | 20/03/2011 | 132 | 35 | - | 4 | 35 | 9 | 6 | 1 | 12 | - | 234 | |
| Total calls | 858 | 774 | 0 | 50 | 153 | 140 | 110 | 6 | 46 | 18 | 2155 | | |

| Location | Date | Species or species group | | | | | | | | | | Total calls | |
|------------------------------------|-------------|--------------------------|------|-----|-----|-----|-----|----|----|-------|------------|-------------|-----|
| | | Cg | Cm | Ft | Ng | Ta | Vd | Vr | Vv | Vr/Vv | Vd/Vr/Vv | | |
| Oaklands Hill Wind Energy Facility | OHWF#3 | 11/03/2011 | 44 | 39 | - | 3 | 14 | 10 | 8 | - | 3 | 4 | 125 |
| | | 12/03/2011 | 23 | 31 | - | 2 | 8 | 3 | 3 | - | 3 | - | 73 |
| | | 13/03/2011 | 26 | 10 | - | 4 | 3 | 1 | 5 | - | 1 | 3 | 53 |
| | | 14/03/2011 | 72 | 20 | - | 3 | 6 | 8 | 3 | - | 3 | 1 | 116 |
| | | 15/03/2011 | 83 | 12 | - | 2 | 8 | - | - | - | - | - | 105 |
| | | 16/03/2011 | 24 | 16 | - | 1 | 2 | - | - | - | - | 1 | 44 |
| | | 17/03/2011 | 24 | 8 | - | 1 | 2 | 1 | - | - | - | - | 36 |
| | | 18/03/2011 | 46 | 4 | - | - | 29 | - | - | - | - | - | 79 |
| | | 19/03/2011 | 68 | 12 | - | - | 16 | 14 | - | - | 1 | - | 111 |
| | | 20/03/2011 | 18 | 5 | - | 5 | 14 | 5 | - | - | - | 1 | 48 |
| | Total calls | 428 | 157 | 0 | 21 | 102 | 42 | 19 | 0 | 11 | 10 | 790 | |
| | OHWF#4 | 11/03/2011 | 162 | 113 | - | 37 | 83 | 33 | 12 | 2 | 6 | 15 | 463 |
| | | 12/03/2011 | 120 | 86 | - | 24 | 14 | 31 | 15 | 1 | 36 | 16 | 343 |
| | | 13/03/2011 | 103 | 155 | - | 4 | 2 | 11 | 3 | 1 | 6 | 5 | 290 |
| | | 14/03/2011 | 123 | 231 | 3 | 13 | 17 | 13 | - | 2 | 9 | 4 | 415 |
| | | 15/03/2011 | 369 | 312 | 1 | 5 | 11 | 22 | 1 | - | 5 | 8 | 734 |
| | | 16/03/2011 | 105 | 381 | - | 5 | 1 | 2 | - | - | - | - | 494 |
| | | 17/03/2011 | 276 | 532 | - | 5 | 7 | 8 | - | - | - | 2 | 830 |
| | | 18/03/2011 | 134 | 803 | - | 5 | 22 | 17 | - | - | - | 1 | 982 |
| | | 19/03/2011 | 65 | 136 | - | 6 | 25 | 20 | - | - | - | 1 | 253 |
| | | 20/03/2011 | 87 | 104 | 1 | 8 | 29 | 9 | - | - | - | 1 | 239 |
| | Total calls | 1544 | 2853 | 5 | 112 | 211 | 166 | 31 | 6 | 62 | 53 | 5043 | |
| | OHWF#5 | 11/03/2011 | 37 | 29 | 6 | 3 | 14 | 8 | 1 | - | - | 4 | 102 |
| | | 12/03/2011 | 58 | 80 | - | 14 | 3 | 34 | 6 | - | 1 | 2 | 198 |
| | | 13/03/2011 | 9 | 16 | - | 1 | 9 | 3 | 1 | - | - | - | 39 |
| | | 14/03/2011 | 5 | 15 | - | 1 | 4 | 2 | - | - | - | - | 27 |
| | | 15/03/2011 | 16 | 19 | - | 2 | 18 | 6 | - | - | - | - | 61 |
| | | 16/03/2011 | 1 | 10 | - | - | 1 | - | - | - | - | 1 | 13 |
| | | 17/03/2011 | 8 | 19 | - | - | 4 | - | - | - | - | - | 31 |
| | | 18/03/2011 | 11 | 17 | - | - | 3 | 2 | - | - | - | - | 33 |
| 19/03/2011 | | 18 | 7 | 1 | - | 16 | 4 | - | - | - | - | 46 | |
| 20/03/2011 | | 24 | 5 | - | 1 | 10 | 2 | - | - | - | 1 | 43 | |
| Total calls | 187 | 217 | 7 | 22 | 82 | 61 | 8 | 0 | 1 | 8 | 593 | | |

Cg = *Chalinolobus gouldii*, Cm = *Chalinolobus morio*, Ft = *Falsistrellus tasmaniensis*, Ng = *Nyctophilus geoffroyi*,
Ta = *Tadarida australis*, Vd = *Vespadelus darlingtoni*, Vr = *Vespadelus regulus*, Vv = *Vespadelus vulturnus*.