




**EPBC 2018/8289 Kaban Green Power Hub - 2024  
Annual Compliance Report**  
6 August 2024

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind  
Farm Trust

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# Document Management

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	E2M Scope of Works	1
1.2	Kaban Green Power Hub Status	1
1.3	Compliance Assessment Methods	1
<b>2</b>	<b>E2M Compliance Assessment Results</b>	<b>3</b>
2.1	EPBC Conditions Compliance	3
2.2	Performance Criteria Assessment	3
2.3	New Environmental Risks	4
<b>3</b>	<b>Conclusion and Recommendations</b>	<b>22</b>

# List of Tables

Table 1: Compliance Scoring	1
Table 2: Summary of Compliance Results	3
Table 3: EPBC Conditions	5

# Appendices

Appendix 1	Vegetation, Fauna, and Offset Area Management Plan Assessment of Effectiveness
Appendix 2	ACR period 2023-2024: Post-commissioning Bird and Bat Utilisation Surveys
Appendix 3	BBAMP -Turbine Risk Profiles
Appendix 4	BBAMP: Annual Mortality Assessment & Trigger Assessment
Appendix 5	Annual Relative Abundance Reports for Greater Gliders and Magnificent Brood Frogs
Appendix 6	Rehabilitation and Weeds Reports
Appendix 7	MBF Microhabitat and Disturbance Intercept Survey Reports





## Declaration of accuracy

In making this declaration, I am aware that Sections 490 and 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) make it an offence in certain circumstances to knowingly provide false or misleading information or documents. The offence is punishable on conviction by imprisonment or a fine, or both. I declare that all the information and documentation supporting this compliance report is true and correct in every particular. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

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**Signed**



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**Date**

8/8/2024

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**Full Name**

Tony Ng

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**Position**

Director

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**Organisation**

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust  
ACN 637 687 622



# 1 Introduction

## 1.1 E2M Scope of Works

E2M has prepared the third annual compliance report on behalf of Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust, ACN 637 687 622, for the Kaban Green Power Hub (the Project). This annual compliance report has been prepared in accordance with the requirements outlined in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) conditions of approval (EPBC 2018/8289). The objective of this report is to determine if the Project has achieved compliance with all relevant conditions.

The scope of works included reviewing the Project conditions of the latest approval (EPBC 2018/8289) and assessing compliance by reviewing documentation provided by Neoen Australia during the twelve-month period ending on 19 May 2024. The latest version of the approval was decided on 10 August 2022.

## 1.2 Kaban Green Power Hub Status

The Kaban Green Power Hub approved action is to construct and operate a wind farm with up to 29 turbines and associated infrastructure south west of Cairns, in Kaban, far north Queensland. A total of twenty-eight turbines were installed for this Project.

Commission/ing means the first date in which is the first date in which a turbine is installed, and occurred in August 2022.

Turbines 1 to 17 were energised and operational by January 2023. An additional ten turbines were operational by 20 May 2023, with the last (Turbine 18) becoming operational August 2023.

At the end of this reporting period (19 May 2024), the Project was operational with all 28 turbines energised. During this reporting period the following activities took place:

- Transportation and installation of the remainder of all turbine components; and
- Energisation of final 11 turbines.

## 1.3 Compliance Assessment Methods

For each condition of the approval, a decision was made to determine if the condition was 'Open', 'Closed' or 'Not Applicable'. If the condition is 'Open' the compliance was rated as per the rationale outlined in Table 1.

**Table 1: Compliance Scoring**

Rating	Abbreviation	Rationale
Compliant	C	Demonstrated compliance with Condition
Non-compliant	NC	Not compliant with Condition
Not Applicable	N/A	Condition not activated at the time of the compliance assessment or Condition not applicable.

The scope of works was subject to several limitations, including:





- The findings of this report represent E2M's opinion based on the information made available for review and assessment, which is assumed to be true and correct. Information provided was not independently verified.
- The scope of assessment was limited to review of:
  - the documents, images, registers provided by the Principal Contractor responsible for construction and operational activities (Vestas Australia Wind Technologies Pty Ltd)
  - documentation provided by Neoen
  - information collected during site visits by E2M that were required as part of ongoing monitoring works
- Sampling or laboratory analysis were not conducted as part of this compliance assessment.



## 2 E2M Compliance Assessment Results

### 2.1 EPBC Conditions Compliance

Assessment of the Project against the conditions of approval (EPBC 2018/8289) was conducted. As outlined in Table 2, compliance was assessed for a total of 42 conditions. Of these, a total of 18 were not applicable as the stage of the project had not yet activated response to conditions or the condition has previously been met.

The results of the compliance assessment are included in Table 3, with supporting information provided in Appendix 1 to Appendix 7.

**Table 2: Summary of Compliance Results**

Total Conditions	Total Non-applicable conditions	Total Applicable Conditions	# Compliant	# Non-compliant	% Compliant
42	20	22	21	1	99.95%

### 2.2 Performance Criteria Assessment

An assessment of effectiveness of the performance criteria within the Project Vegetation Management Plan, Fauna Management Plan, Bird and Bat Adaptive Management Plan, and Offset Area Management plan is required by the EPBC Conditions of Approval. These assessments are included in Appendix 1. The assessments determined that the mitigation measures have been effective in avoiding and minimising impacts of the Project upon Matters of National Environmental Significance (MNES). The following key findings for this period were noted, namely:

- Fauna Management Plan mitigation and management measures were considered appropriate and the wildlife interaction register identifies that no fauna interactions were observed during this reporting period. No new risks were identified and no changes are recommended to the Fauna Management Plan
- Introduction of new declared and priority weed species were identified within the Project. These are being managed in accordance with the Vegetation Management Plan, which has been identified as benefitting from minor updates.
- A magnificent brood frog abundance monitoring trigger event occurred during the compliance period, which was reported to the Department. No changes were required to the Fauna Management Plan as a result of this trigger event
- Rehabilitation Monitoring identified areas requiring remedial actions and improvements. Work programs were established and commissioned for the wet season commencing November 2024
- Post commissioning, there has been one additional observation of migratory birds or threatened bats within 350 metres of wind turbines. The necessary changes to turbine risk profiling were made; and
- The annual mortality estimate (Sept 2022 - Aug 2023) recorded a trigger event within the Bird and Bat Adaptive Management Plan. This trigger was reported to the department upon becoming aware and cause of trigger is currently under investigation, outside the period of this compliance report.





## 2.3 New Environmental Risks

As required by the Department's Annual Compliance Report Guidelines (2014), new environmental risks require consideration. The following new, and continued, risks have been identified:

- Risk of fire to MBF highlights the risks and importance of controlled burns and the need to implement additional controls around MBF habitat prior to performing annual burns
- Ongoing presence of feral dogs
- An increase in cane toad breeding habitat within the construction footprint was recorded, however no obvious increase in cane toad populations within magnificent brood frog breeding habitat has been recorded
- Introduction of new declared and priority weed species were identified within the Project area. Management actions were identified and initiated as per the Vegetation Management Plan.
- Risk of failure of rehabilitation. Rehabilitation monitoring identified areas requiring remedial action and improvement. Work programs established and commissioned for the commencement of the 2024 wet season; and
- Changed water flow and water shed into two magnificent brood frog habitat was identified and remedial action is scheduled for the 2024 dry-season.



Table 3: EPBC Conditions

Condition No.	Condition	Active	Compliance	Evidence
Maximum clearing limits				
1	To minimise impacts on <b>EPBC Act listed threatened species and communities</b> , the approval holder must not clear more than 129 hectares (ha) of habitat for <b>EPBC Act listed threatened species and communities</b> within the <b>project area</b> , including no more than: a) 95.2 ha of <b>Prostanthera</b> habitat. b) 3 ha of <b>Magnificent Brood Frog</b> habitat. c) 61.2 ha of <b>Greater Glider</b> habitat. d) 100 ha of <b>Northern Quoll</b> habitat, including no more than 5.6 ha of <b>Northern Quoll denning</b> habitat.	Open	C	No additional disturbance has occurred within this period. As per the 2023 Annual Compliance Report, disturbance limits were not exceeded with shapefiles/spatial assessment provided by Vestas, 23 May 2022. Refer to Annual Compliance Report 2023 - Appendix 2 for map series depicting the total project footprint clearing and areas of habitat cleared.
EPBC Act listed threatened and migratory species management				
2	The approval holder must implement the <b>Vegetation Management Plan</b> and <b>Fauna Management Plan</b> for the duration of this approval.	Open	C	The requirements of the Vegetation Management Plan and Fauna Management Plan were implemented throughout 2023/2024 and maintained throughout this reporting period. A Construction Environmental Management Plan was developed and implemented for the construction phase (ceased in August 2023), which incorporated VMP and FMP requirements. A review of the VMP and FMP mitigation and management measures against site practices was conducted and determined that the measures are being effectively implemented.
3	The approval holder must report against each performance criterion specified in the <b>Vegetation Management Plan (VMP)</b> and <b>Fauna Management Plan (FMP)</b> and provide an evaluation of the effectiveness of the measures	Open	C	Refer to Appendix 1 for a report against each performance criterion included within the FMP and VMP as well as an assessment of effectiveness of these measures.





Condition No.	Condition	Active	Compliance	Evidence
	implemented to avoid and mitigate impacts of the action on <b>EPBC Act listed threatened species and communities</b> and <b>EPBC Act listed migratory species</b> in each annual compliance report required under condition 35.			
4	To minimise impacts on <i>Prostanthera clotteniana</i> , the approval holder must undertake <b>pre-clearance surveys</b> of all potential <b>Prostanthera habitat</b> . The approval holder must prevent any direct or indirect impacts to any <i>Prostanthera clotteniana</i> individual.	Closed	N/A	All pre-clearance surveys were conducted prior to this reporting period.
<b>Turbine strike monitoring and management</b>				
5	The approval holder must submit a Bird and Bat Adaptive Management Plan (BBAMP) for the <b>Minister's</b> approval prior to <b>commissioning</b> . The approval holder must not commence <b>operation</b> of the wind farm unless the <b>Minister</b> has approved the BBAMP in writing. The approval holder must implement the approved BBAMP throughout <b>operation</b> .	Open	C	The BBAMP was approved in writing prior to operation of the wind farm, as reported in the 2023 Annual Compliance Report. The approved BBAMP was implemented for operations for the duration of the reporting period.
5A	The BBAMP must build on the <b>Bird and Bat Management Plan</b> to propose and justify methods and procedures which ensure that the action does not cause significant mortality by turbine strike on any <b>EPBC Act listed bird or bat species</b> within the life of the action by ensuring that the effects of wind turbines are managed, monitored and limited such that <b>impacts to EPBC Act listed bird and bat species</b> are reliably detected, quantified, reported and responded to.	Open	C	Monitoring requirements within the BBAMP have been implemented during the audit period, including monthly carcass searches and bird and bat utilisation surveys. The results of these monitoring events have been utilised to determine if methods and procedures included within the BBAMP are managing and limiting impacts to EPBC Act listed bird and bat species.  One additional migratory species was recorded during the reporting period and the risk profiles updated accordingly. No additional amendments were required to the BBAMP.
<b>Opportunity for Improvement</b>				



Condition No.	Condition	Active	Compliance	Evidence
				Reporting timeframes of Annual Mortality Assessment assessed under the BBAMP were subject to delay as statistical models were generated and refined to an acceptable reporting level. As such, potential trigger exceedances were identified up to 12 months following end of analysed data period. This is sought to be improved to ensure ongoing compliance with this condition.
6	To inform the risk <b>profile</b> of each turbine, the approval holder must undertake bird and bat utilisation surveys, including: a) Prior to <b>commissioning</b> , the approval holder must undertake pre commissioning bird and bat utilisation surveys over a period of at least 24 months, including at least one survey undertaken at or adjacent to each proposed wind turbine location in each of at least one wet season and one dry season in succession.	Closed	N/A	Compliance with this condition was demonstrated in the 2023 Annual Compliance Report. No Further Assessment required.
	b) Commencing within 3 months after <b>commissioning</b> , the approval holder must undertake post-commissioning bird and bat utilisation surveys over a period of at least 24 months, including at least one survey at or adjacent to each wind turbine in each of at least two wet seasons and two dry seasons in succession.	Open	NC	<p>As reported in the 2023 Annual Compliance Report, commissioning occurred August 2022, and a survey was conducted in March 2023. While there was some delay between commissioning and the first post-commissioning survey, the Department were informed. Constraints, such as electrical storms, significant rain events, and peak construction activity made performing BBUS unsafe and impractical.</p> <p>The Bird and Bat Utilisation Surveys relevant to this reporting period are included in Appendix 2.</p> <p>Post commissioning surveys conducted so far, include:</p> <ul style="list-style-type: none"> <li>• March 23 - Wet season</li> <li>• September 23 - Dry season</li> </ul>



Condition No.	Condition	Active	Compliance	Evidence
				<ul style="list-style-type: none"> <li>February 24 - Wet season.</li> </ul> <p>The final dry season BBUS is scheduled and commissioned for October 24.</p>
7	At least one survey in each 12 month period of bird and bat utilisation surveys required under condition 6 must be conducted within the <b>migratory period</b> of each <b>EPBC Act listed migratory species</b> .	Open	C	The surveys were conducted in March 2023, September 2023 and February 2024 These months are suitable for detection of all EPBC Act listed migratory species, see Appendix D of BBUS reports.
8	The approval holder must report on the results of the bird and bat utilisation surveys required under condition 6 in each annual compliance <b>report</b> required under condition 35 until all bird and bat utilisation surveys have been reported on.	Open	C	Refer to reports for post-commissioning surveys (Appendix 2) under Condition 6b. Pre-commissioning survey reports were reported in previous Annual Compliance Reports as per Condition 6a.
9	All bird and bat utilisation surveys must be conducted by a <b>suitably qualified ecologist</b> .	Open	C	Refer to report included within Appendix 2. Surveys were conducted by: Dean Jones, Principal ecologist with over 25 years experience. A Class bird bander. Chays Ogston, Senior ecologist and R Class bird bander with 12 years experience. Wise Lum - Bsc: Zoology, local ecologist & bird recovery carer, 8 years experience.
10	Prior to commissioning, the approval holder must assign a risk profile to each turbine within the project area using the results of the pre commissioning bird and bat utilisation surveys required under condition 6(a).	Closed	N/A	Compliance with this condition was demonstrated in previous annual compliance reporting periods. No further assessment required.
11	If, during bird and bat utilisation surveys required under condition 6 or during any other monitoring or incidental observation during operation, one or more individual of an <b>EPBC Act listed bird or bat species</b> is detected within the	Open	C	Principal contractor environmental register. No EPBC listed bird or bat species were detected during incidental observations. During the March 24 monthly carcass search surveys, black-faced monarchs were recorded at WTG21 and WTG 24.



Condition No.	Condition	Active	Compliance	Evidence
	vicinity of a <b>low-risk turbine</b> , the approval holder must assign that turbine to be a <b>high-risk turbine</b> within five <b>business days</b> of the detection			These ‘Low-risk’ turbines were assigned as ‘High-risk’ turbines. Data will be present in the September BBUS report in September 2024, and included in the following compliance report.
12	During <b>operation</b> , the approval holder must include a list of the <b>risk profiles</b> of each turbine within the <b>project area</b> in each annual <b>compliance report</b> required under condition 35.	Open	C	Risk profiles were provided and updated as required, after any significant findings during incidental and monthly carcass search activities. Refer to Appendix 3.
13	During <b>operation</b> , the approval holder must undertake turbine strike monitoring in accordance with the <b>Bird and Bat Management Plan</b> at monitoring sites identified in the <b>Bird and Bat Management Plan</b> and at all <b>high-risk turbines</b> identified as required under conditions 10 and 11.	Open	C	Monthly carcass surveys were conducted. The surveys for one month were missed (December 23) due to safety concerns and extreme weather events. An additional survey to compensate for missing the December 23 survey will be completed in September 24.
14	The approval holder must annually evaluate the effectiveness of the measures implemented to avoid and mitigate impacts of turbine collision on EPBC Act listed bird and bat species and report on that evaluation, and performance against the impact triggers, in each annual compliance report required under condition 35.	Open	C	<p>Annual mortality assessments are performed after a 12 month monitoring period. The report was completed for a period of September 2022 to August 2023. Initial report was received in February 2024, however improved statistical methods for calculating annual mortality, were under development and revision of report provided in July 24. The revised mortality report can be viewed in Appendix 4.</p> <p>Trigger assessment are detailed in the Annual Mortality Assessment report, see Appendix 4.</p> <p><b>Opportunity for Improvement</b> See previous Improvement Opportunity regarding improved reporting timeframes for Annual Mortality Assessments.</p>
15	If an <b>impact trigger</b> is reached or exceeded, the approval holder must implement the adaptive management procedure described in the Bird and Bat Management Plan. The approval holder must, on each occasion that an <b>impact trigger</b> is	Open	C	<p>There was one potential impact trigger within the conditions of the BBAMP.</p> <p>See E2M assessment against trigger values within the Annual Mortality Assessment, Appendix 4.</p>





Condition No.	Condition	Active	Compliance	Evidence
	reached or exceeded, report on the steps taken and outcomes of implementing the adaptive management procedure, including details of the mitigation measures that have been or will be implemented and an assessment of their likely effectiveness in the first annual <b>compliance report</b> required under condition 35 following an <b>impact trigger</b> being reached or exceeded.			<p>The Department was notified of a potential trigger event (July 24, 2024) recorded regarding Bird and Bat Management Plan impact triggers following the Annual Mortality Assessment.</p> <p>The events of the trigger occurred during this compliance period, however discovered, and reported outside of this compliance period. At the time of publishing this report, the trigger verification and investigation are still underway and will be reported against approval conditions in the following compliance report.</p>
16	<p>Within 20 <b>business days</b> of an <b>impact trigger</b> being reached or exceeded, if application of the adaptive management procedure required under condition 15 identifies, in respect of any wind turbine or number of wind turbines, that additional mitigation measures are required but no alternative mitigation measures can or will be implemented; and</p> <p>a) If the additional mitigation measures are required in respect of the Ghost Bat or Spectacled Flying-fox, the approval holder must cease to operate any wind turbine that contributed to reaching or exceeding an <b>impact trigger</b> between sunset and sunrise each day; and/or</p> <p>b) If the additional mitigation measures are required in respect of any nocturnal <b>EPBC Act listed migratory species</b>, the approval holder must cease to operate any wind turbine that contributed to reaching or exceeding an <b>impact trigger</b> between sunset and sunrise each day during the <b>migratory period</b> of any <b>EPBC Act</b></p>	Closed	N/A	As above. Potential Trigger identified and reported outside of compliance reporting period. Following compliance report will report on compliance against Conditions 16.



Condition No.	Condition	Active	Compliance	Evidence
	<p><b>listed migratory species</b> for which an <b>impact trigger</b> has been reached or exceeded; and/or</p> <p>c) If the additional mitigation measures are required in respect of any diurnal <b>EPBC Act listed migratory species</b>, the approval holder must cease to operate any wind turbine that contributed to reaching or exceeding an <b>impact trigger</b> between sunrise and sunset each day during the <b>migratory period</b> of any <b>EPBC Act listed migratory species</b> for which an <b>impact trigger</b> has been reached or exceeded; and/or</p> <p>d) If the additional mitigation measures are required in respect of any cathemeral <b>EPBC Act listed migratory species</b> or any <b>EPBC Act listed migratory species</b> for which diel activity is unknown, the approval holder must cease to operate any wind turbine that contributed to reaching or exceeding an <b>impact trigger</b> the <b>migratory period</b> of any <b>EPBC Act listed migratory species</b> for which an <b>impact trigger</b> has been reached or exceeded.</p>			
17	Any request by the approval holder to cease or reduce the curtailment required under condition 16 must demonstrate how the ceasing or reducing of the curtailment will not result in any additional <b>impact</b> on <b>EPBC Act listed bird and bat species</b> .	N/A	N/A	This condition was not triggered during this compliance reporting period.
<b>Environmental offsets</b>				
18	To compensate for the <b>clearance</b> of <b>Magnificent Brood Frog habitat</b> and <b>Greater Glider habitat</b> as specified in condition 1(b)-(c), the approval holder must legally secure all environmental offsets proposed in the <b>Offset Area Management Plan (OAMP)</b> within 18 months of the	Closed	N/A	Condition criteria was assessed in the 2023 Annual Compliance Report and no further assessment is required.



Condition No.	Condition	Active	Compliance	Evidence
	<b>commencement of the action.</b> The <b>Offset Area Management Plan</b> must be attached to the legal mechanism used to <b>legally secure</b> the offset areas.			
19	The approval holder must notify the Department within five <b>business days</b> of the legal security mechanism for each offset area being executed.	Closed	N/A	Condition criteria was assessed in the 2023 Annual Compliance Report and no further assessment is required.
20	The legal mechanism used to <b>legally secure</b> the offset areas must remain in force for at least the duration of this approval.	Open	C	Offsets remain in force.
21	To ensure that the offsets required under condition 18 provide a conservation gain in accordance with the <b>EPBC Act Environmental Offsets Policy</b> , the <b>completion criteria</b> must be achieved within 20 years of the <b>commencement of the action</b> and then be maintained or improved for the duration of the approval.	N/A	N/A	<p>This condition has not been activated. The following management activities occurred during this audit period:</p> <ul style="list-style-type: none"> <li>• Weed monitoring and treatment; and</li> <li>• Controlled ecological burns (last conducted August/September 2023).</li> </ul>
22	To ensure that the offsets required under condition 18 provide ongoing habitat for the Magnificent Brood Frog and Greater Glider, the key habitat features identified in the <b>Offset Area Management Plan</b> must be maintained or improved for the duration of the approval.	Open	C	The Offset Area Management Plan was finalised on the 10/05/2021, and mandates 2 yearly frequency of habitat quality assessments. Habitat quality assessment survey was performed in March 2023, and not required to occur during this reporting period.
23	To ensure that the completion criteria will be achieved, performance against performance targets must be reported in each annual compliance report required under condition 35.	Open	C	Refer to Appendix 1 for a report against each performance criterion included within the OAMP as an assessment of effectiveness of these measures.
24	If a <b>performance target</b> is not met at the completion of each five year period, the approval holder must, on each occasion that a <b>performance target</b> is not met, report on the corrective action/s that will be implemented and	N/A	N/A	Not required until May 2026.



Condition No.	Condition	Active	Compliance	Evidence
	an assessment of their likely effectiveness in the first annual compliance <b>report</b> required under condition 35 following a <b>performance target</b> not being met and all subsequent <b>compliance reports</b> required under condition 35 for the life of the approval.			
25	If any of the <b>completion criteria</b> are not met within 20 years of the <b>commencement of the action</b> , the approval holder must, within 10 <b>business days</b> of the 20 <sup>th</sup> anniversary of the <b>commencement of the action</b> , notify the <b>Department</b> of the <b>completion criteria</b> that have not been met. Within 6 months of the 20th anniversary of the <b>commencement of the action</b> , if the approval holder has not met all of the <b>completion criteria</b> , the approval holder must submit a supplementary Offset Area Management Plan that details the additional and/or revised management measures that will be implemented and/or alternative offset or offsets that will be provided to compensate for the failed offset and submit it to the <b>Department</b> to be approved in writing by the <b>Minister</b> . If approved in writing by the <b>Minister</b> , the approval holder must implement the approved supplementary Offset Area Management Plan.	N/A	N/A	Not required until May 2042.
26	At least 12 months and no more than 24 months following <b>commissioning</b> , the approval holder must submit a Residual Impacts Report which details the actual residual <b>impact</b> of the action on Magnificent <b>Brood Frog habitat</b> and <b>Greater Glider habitat</b> to the Department. The Residual Impacts Report must be informed by a	N/A	N/A	The project was commissioned August 2022. This requires completion by August 2024, outside of the period of this report.



Condition No.	Condition	Active	Compliance	Evidence
	scientifically robust program of monitoring that has been endorsed by an <b>independent suitably qualified amphibian expert</b> and conducted by a <b>suitably qualified ecologist</b> . The Residual Impacts Report must be prepared by an <b>independent suitably qualified ecologist</b> .			
27	If the actual residual <b>impact</b> of the action on <b>Magnificent Brood Frog habitat</b> or <b>Greater Glider habitat</b> is greater than the <b>impact</b> of the action on <b>Magnificent Brood Frog habitat</b> or <b>Greater Glider habitat</b> already offset, the approval holder must provide an environmental offset to compensate for the additional residual <b>impact</b> consistent with the <b>EPBC Act Environmental Offsets Policy</b> . The approval holder must, within 60 <b>business days</b> of submitting the Residual Impacts Report required under condition 26, submit a supplementary Offset Area Management Plan to the <b>Department</b> to be approved in writing by the <b>Minister</b> . If approved in writing by the <b>Minister</b> , the approval holder must implement the approved supplementary <b>Offset Area Management Plan</b> .	N/A	N/A	N/A
28	The supplementary Offset Area Management Plan, whether submitted under the requirements of condition 23 or condition 25, must include: a) Details to demonstrate how the offset compensates for the residual <b>impact</b> on <b>Magnificent Brood Frog habitat</b> and <b>Greater Glider habitat</b> in accordance with the principles of the <b>EPBC Act Environmental Offsets Policy</b> ;	N/A	N/A	N/A



Condition No.	Condition	Active	Compliance	Evidence
	<p>b) A description of the offset, including location, size, condition, environmental values present and surrounding land uses;</p> <p>c) Baseline data and other supporting evidence that documents the presence of each <b>listed threatened species</b> and the quality of each <b>listed threatened species</b> habitat within the offset area;</p> <p>d) An assessment of <b>site habitat quality</b> using a method agreed to in writing by the <b>Department</b>;</p> <p>e) Details of how the offset area will provide connectivity with other habitats and biodiversity corridors and/or will contribute to a larger strategic offset for each <b>listed threatened species</b>;</p> <p>f) Maps and <b>shapefiles</b> to clearly define the location and boundaries of the offset area, accompanied by <b>offset attributes</b>;</p> <p>g) Specific offset completion criteria derived from the <b>site habitat quality</b> to demonstrate the improvement in the quality of each <b>listed threatened species</b> habitat in the offset area over the duration of this approval;</p> <p>h) Details of the management actions, and timeframes for implementation, to be carried out to meet the offset completion criteria;</p> <p>i) Interim performance targets that set targets at appropriate intervals for progress towards achieving the offset completion criteria;</p> <p>j) Details of the nature, timing and frequency of monitoring to inform progress against achieving the interim performance targets (the frequency of monitoring must be</p>			



Condition No.	Condition	Active	Compliance	Evidence
	<p>sufficient to track progress towards each set of interim performance targets, and sufficient to determine whether the offset area is likely to achieve those interim performance targets in adequate time to implement all necessary corrective actions);</p> <p>k) Proposed timing for the submission of monitoring reports which provide evidence demonstrating whether the interim performance targets have been achieved;</p> <p>l) Timing for the implementation of corrective actions if monitoring activities indicate the interim performance targets will not or have not been achieved;</p> <p>m) Evidence of how the management actions and corrective actions take into account relevant <b>approved conservation advices</b> and are consistent with relevant <b>recovery plans</b> and <b>threat abatement plans</b>; and</p> <p>n) Details of the legal mechanism for <b>legally securing</b> the offset area, such that legal security remains in force over the offset area for at least the duration of this approval.</p>			
Notification of date of commencement of the action				
29	<p>The approval holder must notify the Department in writing of the date of <b>commencement of the action</b> and the date of <b>commissioning</b> within 10 <b>business days</b> after the date of <b>commencement of the action</b>. The approval holder must notify the <b>Department</b> in writing of the date of <b>commissioning</b> within 10 <b>business days</b> after the date of <b>commissioning</b>.</p>	Closed	N/A	Condition criteria was assessed in the 2023 Annual Compliance Report and no further assessment is required.





Condition No.	Condition	Active	Compliance	Evidence
30	If the <b>commencement of the action</b> does not occur within 5 years from the date of this approval, then the approval holder must not <b>commence the action</b> without the prior written agreement of the <b>Minister</b> .	N/A	N/A	The action has commenced.
Compliance records				
31	The approval holder must maintain accurate and complete <b>compliance records</b> .	Open	C	All compliance records have been maintained and stored across Neoen and responsible Contractor's systems.
32	If the Department makes a request in writing, the approval holder must provide electronic copies of <b>compliance records</b> to the <b>Department</b> within the timeframe specified in the request.  Note: <b>Compliance records</b> may be subject to audit by the <b>Department</b> or an independent auditor in accordance with section 458 of the <b>EPBC Act</b> , and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the <b>Department's</b> website or through the general media.	N/A	N/A	No requests for compliance records were made during this compliance period.
Preparation and publication of plans				
33	The approval holder must: a) submit <b>plans</b> electronically to the <b>Department</b> ; b) publish each <b>plan</b> on the website within 20 <b>business days</b> of the date of this approval, unless otherwise agreed to in writing by the <b>Minister</b> or, if a <b>plan</b> requires the approval of the <b>Minister</b> , within 20 <b>business days</b> of the date of the <b>Minister</b> approving the <b>plan</b> ;	Open	C	All plans have been submitted to the Department.  All plans have been submitted electronically.  Sensitive data has been redacted.  Plans are available on the website: <a href="https://kabangreenpowerhub.com.au/documents/">https://kabangreenpowerhub.com.au/documents/</a>



Condition No.	Condition	Active	Compliance	Evidence
	c) exclude or redact <b>sensitive ecological data</b> from <b>plans</b> published on the website or provided to a member of the public; and d) keep <b>plans</b> published on the <b>website</b> until the end date of this approval.			
34	The approval holder must ensure that any <b>monitoring data</b> (including <b>sensitive ecological data</b> ), surveys, maps, and other spatial and metadata required under a <b>plan</b> and conditions of this approval, is prepared in accordance with the <b>Department's Guidelines for biological survey and mapped data</b> (2018) and submitted electronically to the <b>Department</b> in accordance with the requirements of the <b>plan</b> and conditions.	Open	C	Monitoring reports prepared during this reporting period have been submitted to the Department as required and included as an Appendix of this Annual Compliance Report (Refer to Appendix 2, 5-7).
Annual compliance reporting				
35	The approval holder must prepare a compliance <b>report</b> for each 12-month period following the date of <b>commencement of the action</b> , or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must: a) publish each <b>compliance report</b> on the <b>website</b> within 60 <b>business days</b> following the relevant 12-month period; b) notify the <b>Department</b> by email that a <b>compliance report</b> has been published on the <b>website</b> and provide the weblink for the <b>compliance report</b> within five <b>business days</b> of the date of publication; c) keep all <b>compliance reports</b> publicly available on the <b>website</b> until this approval expires;	Open	C	Previous report documentation are available on the Kaban Green Power Hub website and publicly available at the time of this audit.  The publicly available reports include redacted sensitive ecological data, with full compliance report provided to department on 10 August 2023.  This report will be supplied to the department and published on the Kaban Green Power Hub website prior to the sixty business days following 19 <sup>th</sup> of May annual period.



Condition No.	Condition	Active	Compliance	Evidence
	<p>d) exclude or redact <b>sensitive ecological data</b> from <b>compliance reports</b> published on the website; and</p> <p>e) where any <b>sensitive ecological data</b> has been excluded from the version published, submit the full <b>compliance report</b> to the <b>Department</b> within five <b>business days</b> of publication.</p> <p><b>Note: Compliance reports</b> may be published on the <b>Department's</b> website.</p>			
Reporting non-compliance				
36	<p>The approval holder must notify the <b>Department</b> in writing of any: <b>incident</b>; non-compliance with the conditions; or non-compliance with the commitments made in <b>plans</b>. The notification must be given as soon as practicable, and no later than two <b>business days</b> after becoming aware of the <b>incident</b> or non-compliance. The notification must specify:</p> <p>a) any condition which is or may be in breach;</p> <p>b) a short description of the <b>incident</b> and/or non-compliance; and</p> <p>c) the location (including co-ordinates), date, and time of the <b>incident</b> and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.</p>	Open	C	<p>Details of incident notification: Neoen recorded two incidents within the reporting period.</p> <p>1. A controlled burn impacted known MBF populations. The Department was notified on 13 February 24 with the follow-up investigation completed and report submitted to the Department on 23 February 24.</p> <p>2. The Department was notified of a potential trigger event (July 24, 2024) recorded, regarding Bird and Bat Management Plan impact triggers following the Annual Mortality Assessment, Appendix 4.</p> <p>The events of the trigger occurred during this compliance period, however discovered, and reported outside of this compliance period. At the time of publishing this report, the trigger verification and investigation are still underway and will be reported against approval conditions in the following compliance report.</p>



Condition No.	Condition	Active	Compliance	Evidence
				<p>The Department was notified of a potential trigger event following the Annual Mortality Assessment Report. The data analysed for the report fell within this compliance period September 2022 to August 2023 however the approval holder only became aware following this reporting period and reported the potential trigger to the Department on July 24, 2024. Opportunities for Improvement have been included in this compliance report however this event will be evaluated against conditions in the following reporting period due to notification occurring outside of this period.</p>
37	<p>The approval holder must provide to the Department the details of any <b>incident</b> or non-compliance with the conditions or commitments made in <b>plans</b> as soon as practicable and no later than 10 <b>business days</b> after becoming aware of the <b>incident</b> or non-compliance, specifying:</p> <ul style="list-style-type: none"> <li>a) any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;</li> <li>b) the potential impacts of the <b>incident</b> or non-compliance; and</li> <li>c) the method and timing of any remedial action that will be undertaken by the approval holder</li> </ul>	Open	C	<p>A controlled burn impacted known MBF populations. The Department was notified on 13 February 24 with the follow-up investigation completed and report submitted to the Department on 23 February 24, within the required 10 business days.</p> <p>The department was notified of this exceedance. New management strategies have been recommended and will be incorporated into the FMP to mitigate the impacts of controlled burns to MBF populations.</p> <p>A reduced carcass search area for monthly carcass searches was notified to the department on 27 September 23. Reduced search area is due to risk of snake bites and exposure to unexploded ordnance to dogs and handlers within areas of long grass typically located outside of the disturbance footprint. While there was a reduction in search area per site, there was an increase in the number of search sites from 15 to 24 sites of a total of 28 turbine sitings.</p>

#### Independent audit



Condition No.	Condition	Active	Compliance	Evidence
38	The approval holder must ensure that independent <b>audits</b> of compliance with the conditions are conducted as requested in writing by the Minister.	N/A	N/A	No audits have been requested.
39	For each <b>independent audit</b> , the approval holder must: a) provide the name and qualifications of the independent auditor and the draft audit criteria to the <b>Department</b> ; b) only commence the <b>independent audit</b> once the audit criteria have been approved in writing by the <b>Department</b> ; and c) submit an audit report to the <b>Department</b> within the timeframe specified in the approved audit criteria.	N/A	N/A	N/A
40	The approval holder must publish the audit report on the <b>website</b> within 10 <b>business days</b> of receiving the <b>Department's</b> approval of the audit report and keep the audit report published on the <b>website</b> until the end date of this approval.	N/A	N/A	N/A
Completion of the action				
41	Within 30 days after the <b>completion of the action</b> , the approval holder must notify the <b>Department</b> in writing and provide <b>completion data</b> .	N/A	N/A	N/A



### 3 Conclusion and Recommendations

E2M has prepared this Annual Compliance Report for the Kaban Green Power Hub (the Project), in accordance with the requirements outlined in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) conditions of approval (EPBC 2018/8289). The compliance assessment was conducted based on information provided by the Proponent and the Construction contractor, along with information captured by E2M as part of compliance monitoring activities.

The annual compliance report determined that a total of 20 conditions out of 42 were not applicable, due to the stage of the Project. 21 of the active 22 conditions were determined to be compliant, Condition 6b was found to be non-complaint. Actions taken were communicated with the Department at the time and no further actions are required following the final Dry Season survey occurring.

One Opportunity for Improvement was identified in the compliance report for Conditions 5A and 14:

- Reporting timeframes of Annual Mortality Assessment assessed under the BBAMP were subject to delay as statistical models were generated and refined to an acceptable reporting level. As such, potential trigger exceedances were identified up to 12 months following end of analysed data period. This is sought to be improved to ensure ongoing compliance to reliable and timely notification of potential trigger exceedances.

An assessment of the effectiveness of performance criteria for the Vegetation Management Plan, Fauna Management Plan, Bird and Bat Adaptive Management Plan and Offset Area Management Plan was conducted to determine if mitigation measures have been effective in avoiding and minimising impacts of the Project upon Matters of National Environmental Significance. No changes were required to the management plans.

It was noted that one incident occurred within the annual period, namely:

- the potential impact of fire on the relative abundance of the magnificent brood frog.

This incident was notified and investigated in accordance with the Project conditions.

The following recommendations have been made following this report:

- The inclusion of additional control measures to prevent fire damage within magnificent brood frog habitat. Control measures to include, but should not be limited to:
  - Providing up-to-date, site MBF records and maps, to fire consultants prior to performing annual burns
  - Ensure clear communication between approval holder, environmental consultants familiar with the site and fire consultants, to discuss pre-fire management strategies for any MBF sites, located within the proposed annual burn schedule
  - When performing burns, have people on the ground directly monitoring and controlling fires, around MBF habitat.
- Development of a weed treatment plan to reduce priority weed infestations to serve in conjunction with VMP to increase targeted direct for reduction of specific priority weed presence.
- Ensure rehabilitation measures adjacent to magnificent brood frog habitat are performed to improve ground cover.
- Commence works to return pre-construction waterflow levels into magnificent brood frog habitat.









## Appendix 1    Vegetation, Fauna, and Offset Area Management Plan Assessment of Effectiveness

**Table A1: Assessment of Effectiveness of Vegetation Management Plan Performance Criteria**

Performance Criteria	Comment	Review of Effectiveness
Micro-siting does not result in additional disturbance to threatened flora or communities above what is approved.	There has been no additional disturbance to threatened flora or communities as a result of micro-siting.	VMP mitigation and management measures have been effective to date.
No exceedance of approved clearing limits.	Exceedance of approved clearing limits has not occurred.	VMP mitigation and management measures have been effective to date.
No introduction or spread of priority weed species within the site and successful removal of priority weed species within the disturbance footprint.	The VMP is being implemented to prevent the introduction and spread of priority weed species. Post construction weed surveys have been conducted and treatment for control conducted.	VMP mitigation and management measures have been effective to date. While new species were recorded, weed infestations have been identified and treatment program in place. A weed management plan is recommended.
No loss or decline in threatened flora population sizes resulting from indirect impacts associated with construction and operation.	The Project has implemented suitable controls to manage indirect impacts, including erosion and sediment control measures and dust suppression measures. The Project Integrated GIS into heavy plant used for clearing activities to ensure disturbance footprint is not exceeded.	Threatened Flora Monitoring was not required during this reporting period. Refer to previous Annual Compliance Report.



Performance Criteria	Comment	Review of Effectiveness
Progressive stabilisation of disturbed areas and rehabilitation of the disturbance footprint following construction.	<p>The VMP requires progressive stabilisation, which is underway.</p> <p>Temporary rehabilitation for soil stabilisation was utilised during wet season construction activities. Soil binders have also been used to minimise erosion and sedimentation. Within these areas, top-soil has been re-instated and final rehabilitation is now complete.</p> <p>Installations for final designs of erosion and sediment controls have been completed including large rock-filled sediment traps with jute matting, rock checks, culverts and rock lining of roadside drainage.</p>	<p>VMP mitigation and management measures have been effective to date.</p> <p>Monitoring recorded areas of erosion and some rehabilitation deficiencies (Refer to Appendix 6). Remedial works for erosion and rehabilitation have been commissioned early in the coming wet season.</p>



**Table A2: Assessment of Effectiveness of Fauna Management Plan Performance Criteria**

Performance Criteria	Comment	Review of Effectiveness
Micro-siting does not result in additional disturbance to magnificent brood frog and greater glider habitat above what is approved	There has been no additional disturbance to threatened fauna habitat as a result of micro-siting.	FMP mitigation and management measures have been effective to date.
Post-construction: No injury to native fauna	<p>No fauna interactions were observed during this period.</p> <p>Any incidental bird and bat carcass finds were reported and registered under the provisions of the Bird and Bat Adaptive Management Plan</p>	FMP mitigation and management measures have been effective to date
No exceedance of approved clearing limits	Exceedance of approved clearing limits has not occurred.	FMP mitigation and management measures have been effective to date.



Performance Criteria	Comment	Review of Effectiveness
An Erosion and Sediment Control Plan (ESCP) is prepared and implemented to limit potential impacts on threatened fauna, specifically magnificent brood frog	An ESCP was developed and implemented.	<p>As previously reported to the Department, there was some evidence of sedimentation entering waterways inhabited by magnificent brood frog. ESC controls were reviewed as a result. Additional control measures were installed to reduce concentrated waterflows and sedimentation at the construction/MBF habitat interface.</p> <p>Remedial activities to return waterflows in MBF habitat to pre-construction levels, have been commissioned to start this dry-season at 2 two of the impact sites identified within annual MBF relative abundance reports, disturbance intercept and microhabitat assessment reports , Appendix 5.</p>
Disturbance is limited to the disturbance footprint	There has been no clearing outside the disturbance footprint.	FMP mitigation and management measures have been effective to date.



Performance Criteria	Comment	Review of Effectiveness
No loss or decline in threatened fauna population sizes resulting from indirect impacts associated with construction and operation	<p>Annual monitoring of the magnificent brood frog was conducted as required by the FMP. Greater glider monitoring was also conducted. Annual monitoring reports were prepared for these surveys, Appendix 5.</p> <p>No loss or decline of the greater glider was identified. There was a decrease in magnificent brood frog relative abundance for all control and treatment sites impacted by controlled and uncontrolled fires. A full investigation and report was submitted to the Department in February 2024.</p>	<p>FMP mitigation and management measures have been effective to date for the greater glider.</p> <p>Recommendations to directly manage and limit control fires around MBF habitat were provided within the annual MBF monitoring report.</p>
No increase in hydrocarbon abundance within magnificent brood frog habitat	No vehicle events involving hydrocarbon spillages were recorded. There was no signs of hydrocarbons or residues noted during the microhabitat assessment of MBF habitat, Appendix 7.	FMP mitigation and management measures have been effective to date.
No increase in sedimentation of magnificent brood frog habitat	An ESCP was developed and implemented. Regular monitoring of magnificent brood frog habitat has also occurred to determine effectiveness of the FMP in limiting sedimentation within magnificent brood frog habitat.	<p>As previously reported to the Department, there was some evidence of minor sedimentation entering waterways inhabited by magnificent brood frog. ESC controls were reviewed as a result. Control measures have been installed to reduce concentrated waterflows and sedimentation at the construction/MBF habitat interface.</p> <p>Additional remedial activities to return waterflows to pre-</p>



Performance Criteria	Comment	Review of Effectiveness
		construction levels, commissioned to start during the 2024 dry season.





**Table A3: Assessment of Effectiveness with Offset Area Management Plan Performance Criteria**

Performance Criteria	Comment	Review of Effectiveness
No clearing occurs within the offset area	No clearing observed within the offset area during routine monitoring. All clearing associated with the Project has been outside of offset areas.	OAMP management measures have been effective to date.
Magnificent brood frog abundance remains stable or increases within the offset area	Annual MBF relative abundance monitoring was conducted. Some reduction in MBF relative abundance was noted at sites impacted by fire. Refer to Appendix 5.	Additional OAMP management recommendations have been noted in the annual relative abundance report to reduce impact of fires.
Greater glider abundance remains stable or increases within the offset area	Annual greater glider relative abundance monitoring was conducted. Refer to Appendix 5.	OAMP management measures have been effective to date.
No new weeds are introduced to the offset area	A weed survey was conducted in November 21 to establish a baseline for future comparison. No new weed populations have been introduced into offset areas. Controlled burns commenced in offset areas in September 22 and continued weed treatment carried out during June 23. Further weed treatment occurred in January 24. Reports have been prepared for these activities.	OAMP management measures have been effective to date.
Existing weed invasion within the offset area decreases	A weed survey was conducted in November 21 and weed treatment carried out between December 21, April 22, September 22 and June 23. There has been a further, significant reduction in weeds within the areas treated in Jan 24.	OAMP management measures have been effective to date. Declared and priority weed populations have been reduced significantly.



Performance Criteria	Comment	Review of Effectiveness
Greater glider friendly cattle fencing is erected and maintained	Fencing is required 12 months post securing offsets. Fencing contracts have been engaged and all fence lines inspected and repaired. All top barbed-wire strands replaced with barbless wire in all greater glider habitat.	OAMP management measures completed and have been effective to date.
Offset area Habitat Quality score improves by a minimum of 1 point within 10 years	Ongoing. Habitat quality assessments were performed in March 23. Scores have shown slight improvements, but offset management is still the very early stages of development. See Appendix 7.	Ongoing monitoring will be conducted to determine the effectiveness of offset activities.
Fuel loads are managed to limit potential of high intensity bush fires	The first ecological burn was performed in September 22. Further ecological burn took place in August/September 23 as per the LFMP. Controlled burns are scheduled for coming 2024 burn season.	Ongoing monitoring will be conducted to determine the effectiveness of offset activities.





## Appendix 2 ACR period 2023-2024: Post-commissioning Bird and Bat Utilisation Surveys




# **Kaban Green Power Hub: Post-commissioning Bird and Bat Utilisation 2023 Dry Season Monitoring Report**

Survey September 2023

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind  
Farm Trust

Level 21, 570 George Street, Sydney NSW 2000

# Document Management

Rev.	Issue Date	Description	Author (s)	Approved	Signature
A	13/12/2023	For Review	M. Raymond/E. Meyer	Dean Jones	

Document Reference: X:\JOBS\~2021\QEJ21046\DELIVERABLES\FY24\4. BBUS - Post Commissioning\1. Dry Season 2023\2023\_Dry\_Season\_BBUS\_Rev0.docx

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# Contents

<b>Definitions</b>	<b>v</b>
<b>Abbreviations</b>	<b>v</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Project background	1
1.2 Scope and objectives	1
<b>2 Methods</b>	<b>3</b>
2.1 Desktop assessment	3
2.2 Field survey	3
2.3 Collision risk assessment and ‘High Risk’ allocation	11
<b>3 Results</b>	<b>12</b>
3.1 Desktop results	12
3.2 Field results	13
3.3 Turbine collision risk assessment	24
<b>4 Conclusion</b>	<b>32</b>
<b>5 Recommendations</b>	<b>34</b>
<b>6 References</b>	<b>36</b>

# List of Tables

Table 1: Survey locations	4
Table 2: Fixed-point bird count survey schedule	7
Table 3: Fixed-point bird count survey summary	8
Table 4: Echolocation detector survey schedule	9
Table 5: Megabat nocturnal survey schedule	10
Table 6 : Known and likely to occur bird and bat species	12
Table 7: Species call records by turbine number / location (WTG01 - WTG14)	14
Table 8: Species call records by turbine number / location (WTG15 - WTG28)	16
Table 9: Bird species recorded at highest frequencies across fixed point surveys	19
Table 10: Most widely distributed birds across the Site	19
Table 11 Number of birds recorded per height class	21
Table 12: Species recorded within or above RSA	23
Table 13: Total bird species recorded during each BBUS.	24
Table 14: Turbine collision assessment for known and likely occurring threatened and migratory species	25
Table 15: Incidental finds of migratory/threatened bird and bat species during operational phase.	29
Table 16: Turbine risk profiles	30



## List of Figures

Figure 1: Project Location	2
Figure 2. Weather observations recorded nearby to Site during the survey period.	4
Figure 3: Bird species accumulation curve	18
Figure 4. Observed bird heights for all point surveys, during the dry season 2023 BBUS.	23
Figure 5: Turbine risk profiles	31

## Appendices

Appendix A Species list
Appendix B Fixed-point survey results
Appendix C Bat call analysis
Appendix D Migratory species predicted time of occurrence within Site





## Definitions

Term	Definition
The Project	The Kaban Green Power Hub
The survey	Post-commissioning 2023 Dry Season Bird and Bat Utilisation Survey (BBUS)
Rotor Sweep Area (RSA)	The maximum height and width range in which bird and bat species may be susceptible to turbine strike.
Suitable habitat	A species' preferred environment required to sustain a viable population. Suitable habitat may include breeding, foraging and shelter resources.
Site	The areas of Lot 1 on RP735194, Lot 33 on CWL374, Lot 35 on CWL391, Lot 2 on RP735194 and Lot 34 on CWL374 which contain proposed turbines.
Threatened species	Extinct (EX), extinct in the wild (XW), critically endangered (CE), endangered (E), vulnerable (V) or conservation dependent (CD) under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> or extinct in the wild (PE), Endangered, Vulnerable or Near Threatened (EVNT) under the <i>Nature Conservation Act 1992</i> .

## Abbreviations

Term	Definition
BBUS	Bird and Bat Utilisation Survey
DAWE	Commonwealth Government Department of Agriculture, Water and the Environment
DES	Department of Environment and Science
E2M	E2M Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
NC Act	<i>Nature Conservation Act 1992</i>
Kaban Wind Farm	Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust
RSA	Rotor Sweep Area
sp.	Singular species. For example, <i>Eucalyptus</i> sp. refers to a single species of <i>Eucalyptus</i>
spp.	Multiple species. For example, <i>Eucalyptus</i> spp. refers to multiple species of <i>Eucalyptus</i>
WTG	Wind turbine generator



# 1 Introduction

## 1.1 Project background

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust (Kaban Wind Farm) are now at the commissioning stage of the Kaban Green Power Hub wind farm (the Project) in north Queensland. The wind farm is located near the township of Tumoulin, Queensland, within the Tablelands Regional Council Local Government Area. The wind farm contains 28 wind turbine generators (WTGs) located across the following land parcels, herein collectively referred to as the 'Site' (refer to Figure 1):

- Lot 1 on Plan RP735194
- Lot 2 on Plan RP735194
- Lot 33 on Plan CWL374
- Lot 34 on Plan CWL374 and a section of local road reserve.
- Lot 35 on Plan CWL391

## 1.2 Scope and objectives

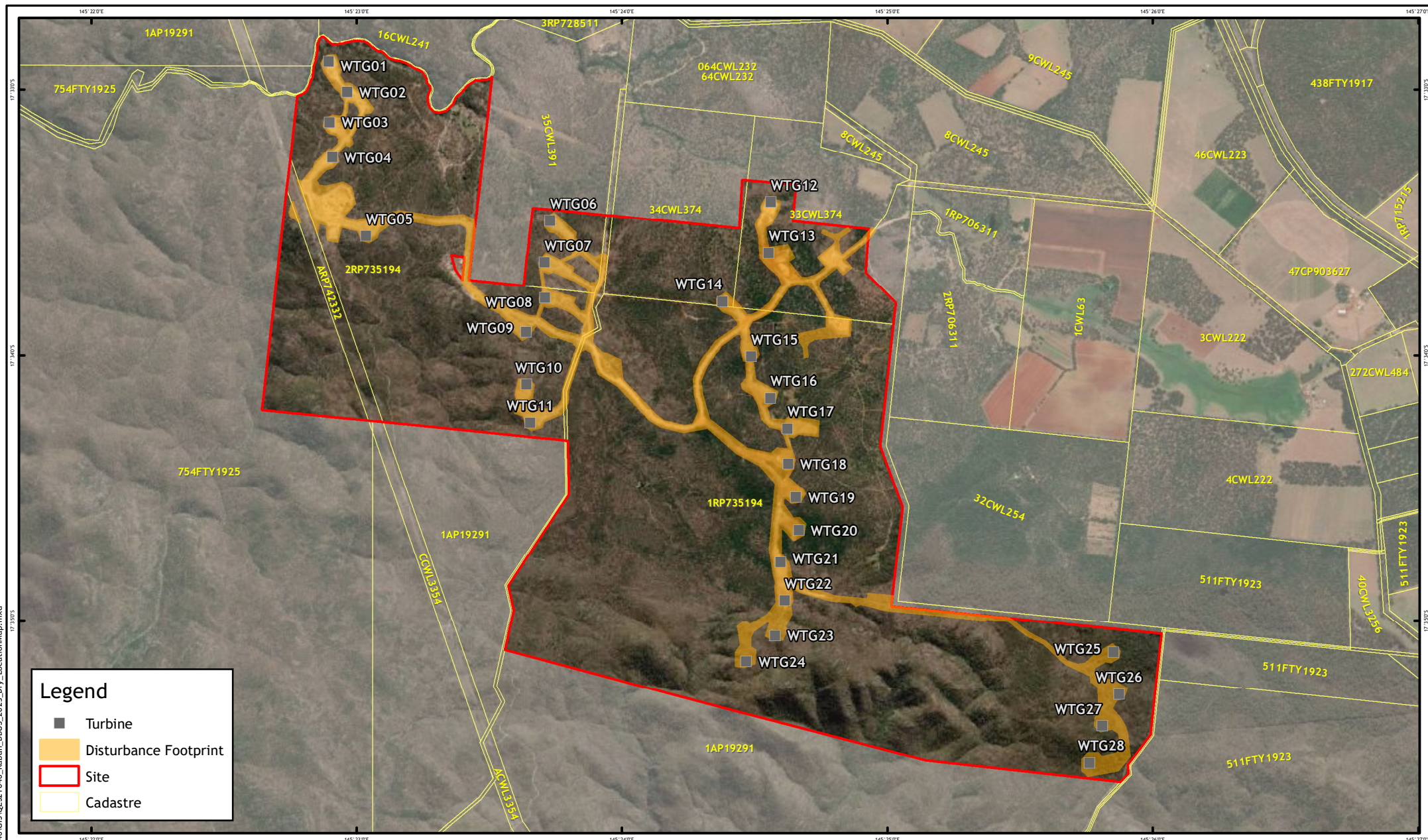
Kaban Wind Farm engaged E2M Consulting Pty Ltd (E2M) to undertake a post-commissioning 2023 Dry Season Bird and Bat Utilisation Survey (BBUS) (herein referred to as 'the survey') at the Kaban Green Power Hub. The survey was undertaken to meet the requirements of Conditions 5A, 6, 7, 9, and 11 of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) Variation of Conditions attached to approval EPBC 2018/8289 received from the (former) Department of Agriculture, Water and the Environment (DAWE) on 10 August 2022.

Specifically, the survey aimed to assess bird and bat utilisation during the 2023 dry season with the following objectives:

- Gathering dry season bird and bat utilisation survey data
- Ascertaining the risk of WTG interference/interaction with threatened and migratory bird and bat species
- Ensure survey timing is seasonally appropriate and is completed within the migratory periods of each EPBC Act listed migratory species defined within the approval; and
- Determining a 'risk profile' for each WTG based on the results of the survey.

This survey and others will provide essential information to help develop the Bird and Bat Adaptive Management Plan as per Conditions 5 and 10 of the Approval.







## 2 Methods

### 2.1 Desktop assessment

Prior to construction, a desktop assessment was undertaken to identify potentially occurring species within the Site. This included review of previous ecological reports for the Site, including:

- Kaban Green Power Hub: Pre-commissioning Bird and Bat Utilisation 2022 Wet Season Monitoring Report (E2M Pty Ltd, 2022)
- Kaban Green Power Hub: Pre-commissioning Bird and Bat Utilisation 2022 Wet Season Monitoring Report (E2M Pty Ltd, 2021)
- Kaban Green Power Hub: Bird and Bat Utilisation Survey, Pre-commissioning 2020 Dry Season (E2M Pty Ltd, 2020)
- Kaban Green Power Hub: RFI - Ecological Assessment Report (E2M, 2019b)
- Kaban Green Power Hub: Ecological Gap Analysis (E2M, 2019a)
- Kaban Green Power Hub: Bird and Bat Adaptive Management Plan (E2M, 2020)
- Kaban Green Power Hub: Fauna Technical Report (AECOM, 2017); and
- Kaban Green Power Hub: Bird and Bat Pre-construction Utilisation Survey (Brett Lane & Associates Pty Ltd, 2017).

### 2.2 Field survey

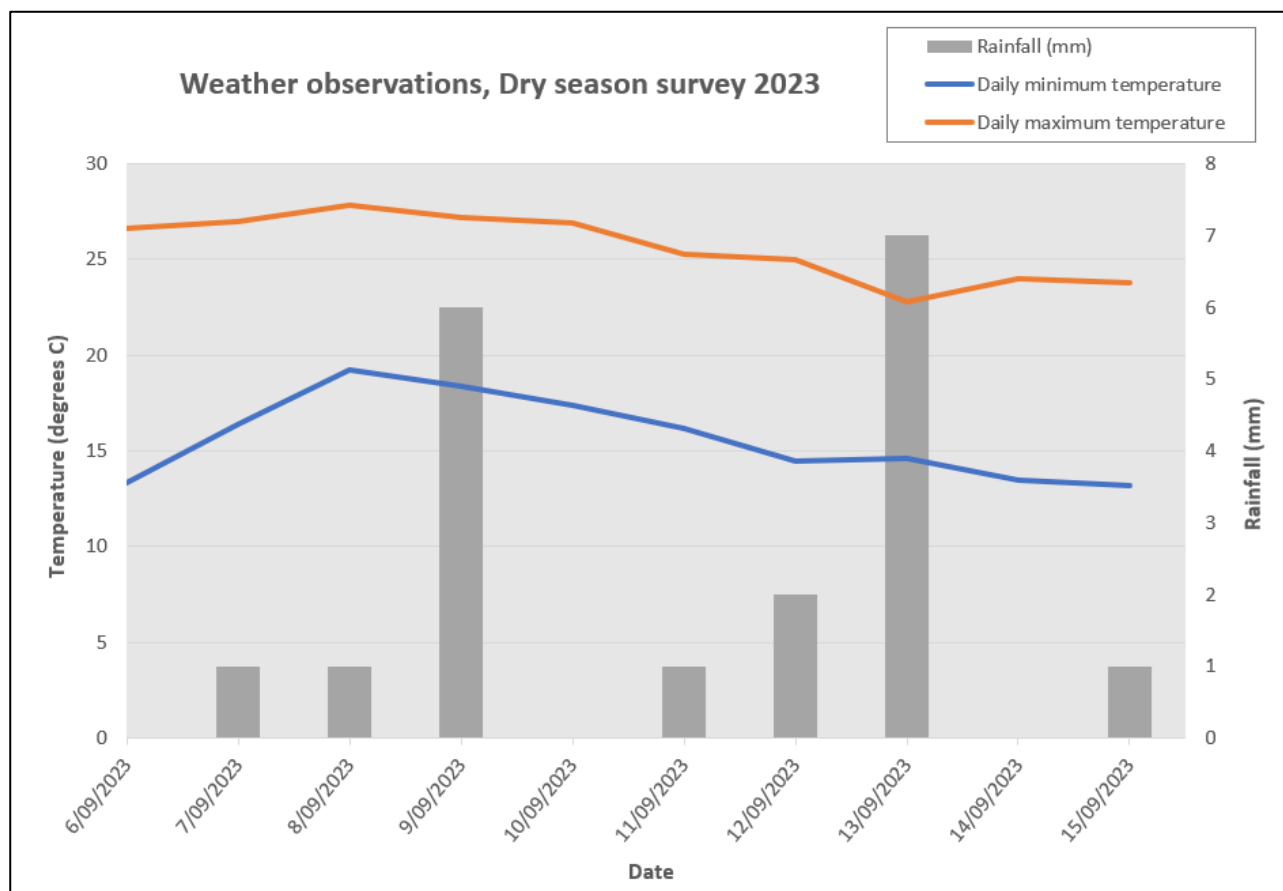
#### 2.2.1 Survey timing and conditions

The field survey was undertaken by two suitably qualified ecologists, Dean Jones and Wise Lum, between 6 and 13 September 2023.

Weather conditions in the region during the survey were mild with average daily temperatures in the mid-twenties and frequent periods of drizzle. During the survey period, daily rainfall totals at the closest Bureau of Meteorology weather station (031200) ranged from 1 to 7 mm. Moderate easterly winds with gusts of up to 20 km/hr were recorded at the closest Weather Underground station (IQLDATHE4), Figure 2.



Figure 2. Weather observations recorded nearby to Site during the survey period.



## 2.2.2 Survey locations

Utilisation surveys were conducted at all 28 WTGs (WTG01 - WTG28). The coordinates and habitat descriptions for each survey location are detailed in Table 1, with their location presented in Figure 1.

Table 1: Survey locations

WTG number / location	Ground-truthed Regional Ecosystem / habitat description	Coordinates
WTG01	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.54821-145.381571
WTG02	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.550126-145.38274
WTG03	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.552032-145.38164
WTG04	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.55423-145.381818



WTG number / location	Ground-truthed Regional Ecosystem / habitat description	Coordinates
WTG05	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.559162, 145.383913
WTG06	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.558235, 145.395489
WTG07	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.560835, 145.395136
WTG08	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.563049, 145.395164
WTG09	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.565181, 145.393968
WTG10	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.568497, 145.393995
WTG11	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.570903, 145.394247
WTG12	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.557055, 145.409347
WTG13	Non-remnant / Non remnant vegetation, including artificial wetlands (dams)	-17.560235, 145.409206
WTG15	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.563257, 145.406316
WTG16	Remnant 7.8.8b / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.566732, 145.408132
WTG17	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.569326, 145.409315
WTG18	Non-remnant / Non remnant vegetation, including artificial wetlands (dams)	-17.571277, 145.410381
WTG19	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.573464, 145.410428
WTG20	Remnant 7.12.27a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.575547, 145.410928
WTG21	Remnant 7.12.27a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.577627, 145.411108
WTG22	Remnant 7.12.27a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.579659, 145.40995
WTG23	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.582056, 145.41024
WTG24	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.584229, 145.409627



WTG number / location	Ground-truthed Regional Ecosystem / habitat description	Coordinates
WTG25	Remnant 9.12.30a / <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.585886, 145.407813
WTG26	Remnant 7.12.27c / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.585312, 145.430873
WTG27	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.587917, 145.431218
WTG28	Remnant 7.12.30a / <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.589915, 145.430164



## 2.2.3 Bird utilisation survey

### 2.2.3.1 Fixed-point bird counts

Fixed-point bird counts were used to determine bird utilisation at each survey location. This involved an ecologist recording the presence and abundance of all bird species observed (heard and/or seen) within a 350 m radius of the survey point during a 20-minute survey period. Information collected during each survey included:

- Bird species
- Number of birds
- Observation type (seen or heard)
- Bird behaviour (flying or perched)
- Birds observed within the rotor sweep area (RSA)
- Height<sup>1</sup> at which bird was first observed, recorded in the following height categories:
  - Below RSA:
    - 0-10 m
    - 10-20 m
    - 20-30 m
    - 30-40 m
  - 40-50 m
  - 50-60 m
  - 60-80 m
  - RSA Height (80 - 255 m); and
  - Above RSA (>255 m).

Additionally, for threatened species and bird groups at greatest risk of WTG interaction (i.e. raptors and waterbirds) the maximum and minimum heights at which the birds were observed were recorded.

**Note:** Due to inability to determine number of individuals and height based on call alone, only positively observed and identified individuals were included when assessing bird habitat/flight height utilisation. However, heard species were used when determining species presence and occurrence across the Site.

### 2.2.3.2 Survey schedule

To identify variations in bird utilisation across different periods of the day, each survey location was assessed a minimum of 6 times throughout three different periods of the day (morning, mid-day and afternoon). Two surveys at each turbine were conducted during the morning, mid-day and afternoon sessions. A total of 170 surveys were conducted. Table 2 lists the date and time each WTG location was surveyed during the field survey and Table 3 summarises when surveys were conducted for each WTG location (Fixed-point bird count survey summary)

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<sup>1</sup> Heights were estimated using landscape features such as trees and referencing against the WTG structure components.





### 2.2.3.3 Incidental observations

Whilst traversing the Site, incidental observations of threatened species, bird groups at greatest risk of WTG interaction (i.e., raptors and waterfowl) and species not previously recorded during fixed-point bird counts were also recorded.



**Table 2: Fixed-point bird count survey schedule**

Survey period	Start time	Date							
		6/09/2023	7/09/2023	8/09/2023	9/09/2023	10/09/2023	11/09/2023	12/09/2023	13/09/2023
Morning	7:00 AM	WTG 18	WTG 06, 16	WTG 12, 24	WTG 24, 01	WTG 01	-	-	-
	7:30 AM	WTG 19, 25	WTG 07, 15, 14	WTG 13, 23, 14	WTG 28, 02	WTG 11	-	-	-
	8:00 AM	WTG 27	WTG 08, 13	WTG 22, 15, 21	WTG 03, 26	WTG 04, 05	-	-	-
	8:30 AM	WTG 20, 28	WTG 09, 12	WTG 16, 20	WTG 08, 27, 25	WTG 03, 09, 02	-	-	-
	9:00 AM	WTG 21, 26	WTG 10, 05	WTG 17, 19	WTG 07	WTG 01, 10	-	-	-
	9:30 AM	WTG 22, 24	WTG 11, 04	WTG 06, 18	-	-	-	-	-
	10:00 AM	WTG 23, 17	-	-	-	-	-	-	-
Mid-day	10:30 AM	WTG 15, 28	WTG 12, 13, 03, 02	WTG 10, 01, 11, 02	WTG 28, 19, 27, 18	WTG 09, 04, 11	-	-	-
	11:00 AM	WTG 14, 27	WTG 14, 01	WTG 09, 03	WTG 26, 17	WTG 10, 05	-	-	-
	11:30 AM	WTG 26, 13	WTG 15	WTG 05, 04	WTG 25, 16	WTG 08, 06	-	-	-
	12:00 PM	WTG 25, 12	WTG 16, 19	WTG 08	WTG 20, 15	WTG 07	-	-	-
	12:30 PM	WTG 24, 21	WTG 17, 20, 21, 18	WTG 08, 23, 06	-	-	-	-	-
	1:00 PM	WTG 23, 22	WTG 22	WTG 24	-	-	-	-	-
	1:30 PM	-	-	-	-	-	-	-	-
Afternoon	2:00 PM	WTG 06, 07, 01, 02	WTG 24, 28, 27, 23	WTG 10, 16, 11, 15	-	-	-	-	-
	2:30 PM	WTG 08, 03	WTG 26, 19	WTG 14, 09	-	-	WTG 20	-	WTG 04
	3:00 PM	WTG 09, 04, 05	WTG 25, 20, 21	WTG 13, 05	-	-	WTG 21, 22	WTG 18	WTG 03
	3:30 PM	WTG 10	WTG 22, 13	WTG 12, 08, 06, 07	-	-	WTG 23	WTG 15, 16, 28	WTG 01, 02, 12
	4:00 PM	-	-	-	-	-	WTG 24	WTG 27, 17	WTG 18, 11, 19
	4:30 PM	-	-	-	-	-	-	WTG 26	WTG 17
	5:00 PM	-	-	-	-	-	-	WTG 25	-
	5:30 PM	-	-	-	-	-	-	-	-

**Note:** Survey times are rounded to the nearest half hour.



**Table 3: Fixed-point bird count survey summary**

Turbine number / location	Survey period			Total number of surveys
	Morning	Mid-day	Afternoon	
WTG01	2	2	2	6
WTG02	2	2	2	6
WTG03	2	2	2	6
WTG04	2	2	2	6
WTG05	2	2	2	6
WTG06	2	2	2	6
WTG07	2	2	2	6
WTG08	2	2	2	6
WTG09	2	2	2	6
WTG10	2	2	2	6
WTG11	2	2	2	6
WTG12	2	2	2	6
WTG13	2	2	2	6
WTG14	2	2	2	6
WTG15	2	3	2	7
WTG16	2	2	2	6
WTG17	2	2	2	6
WTG18	2	2	2	6
WTG19	2	2	2	6
WTG20	2	2	2	6
WTG21	2	2	2	6
WTG22	2	2	2	6
WTG23	2	2	2	6
WTG24	3	2	2	7
WTG25	2	2	2	6
WTG26	2	2	2	6
WTG27	2	2	2	6
WTG28	2	2	2	6



## 2.2.4 Bat utilisation survey

### 2.2.4.1 Passive echolocation detection

Bat utilisation was determined through deployment of automated bat detection devices (Anabat Swift Detectors), that record species-specific echolocation call signatures of nearby microchiropteran bats (microbats). Detectors were fitted with an upward-facing, omnidirectional microphone and deployed approximately 2 m above the ground at each of the WTG survey sites and programmed to operate from dusk to dawn over two nights, yielding a total survey effort of 56 recorder-nights across the Site (see Table 4).

Following the field survey, all recordings were sent to a suitably qualified specialist (Greg Ford of Balance! Environmental) for analysis. Where possible, calls were identified to species level; however, where overlap exists between species' calls, calls were identified as belonging to a species complex (Balance! Environmental, 2022). The full report is included in Appendix C.

**Table 4: Echolocation detector survey schedule**

Turbine number / location	Date set	Date retrieved	Survey nights
WTG01	11/09/2023	13/09/2023	2
WTG02	11/09/2023	13/09/2023	2
WTG03	11/09/2023	13/09/2023	2
WTG04	11/09/2023	13/09/2023	2
WTG05	11/09/2023	13/09/2023	2
WTG06	11/09/2023	13/09/2023	2
WTG07	11/09/2023	13/09/2023	2
WTG08	11/09/2023	13/09/2023	2
WTG09	11/09/2023	13/09/2023	2
WTG10	11/09/2023	13/09/2023	2
WTG11	11/09/2023	13/09/2023	2
WTG12	11/09/2023	13/09/2023	2
WTG13	11/09/2023	13/09/2023	2
WTG14	11/09/2023	13/09/2023	2
WTG15	12/09/2023	14/09/2023	2
WTG16	12/09/2023	14/09/2023	2
WTG17	12/09/2023	14/09/2023	2
WTG18	12/09/2023	14/09/2023	2
WTG19	12/09/2023	14/09/2023	2
WTG20	12/09/2023	14/09/2023	2



Turbine number / location	Date set	Date retrieved	Survey nights
WTG21	12/09/2023	14/09/2023	2
WTG22	12/09/2023	14/09/2023	2
WTG23	12/09/2023	14/09/2023	2
WTG24	12/09/2023	14/09/2023	2
WTG25	12/09/2023	14/09/2023	2
WTG26	12/09/2023	14/09/2023	2
WTG27	12/09/2023	14/09/2023	2
WTG28	12/09/2023	14/09/2023	2

#### 2.2.4.2 Megabat (flying-fox) nocturnal surveys

Two, 20-minute fixed-point surveys for megachiropteran bat (flying-fox) species were conducted at each WTG survey site, yielding a total of 56 surveys. Megachiropteran bat surveys commenced at dusk, when flying-fox species become active and leave their roost sites to forage. Observers conducting surveys recorded any observations of flying-fox, noting species and numbers. The surveys were completed over four nights with the sessions organised to capture an early evening and later survey period, between 6:30 and 9:30 pm. The megachiropteran bat survey timetable can be viewed in Table 5.

**Table 5: Megabat nocturnal survey schedule**

Start time	Date			
	11/09/2023	12/09/2023	13/09/2023	14/09/2023
18.30	WTG01 WTG14	WTG15 WTG28	WTG08 WTG07	WTG19 WTG22
19.00	WTG02 WTG13	WTG16 WTG27	WTG09 WTG06	WTG20 WTG23
19.30	WTG03 WTG12	WTG17 WTG26	WTG10 WTG05	WTG21 WTG25
20.00	WTG04 WTG11	WTG21 WTG25	WTG11 WTG04	WTG24 WTG26
20.30	WTG05 WTG10	WTG20 WTG24	WTG14 WTG03	WTG18 WTG27
21.00	WTG06 WTG08	WTG19 WTG23	WTG13 WTG02	WTG17 WTG28
21.30	WTG09 WTG07	WTG18 WTG22	WTG12 WTG01	WTG16 WTG15

**Note:** Survey times are rounded to the nearest half hour.



### 2.2.4.3 Incidental observations

Incidental observations of any megachiropteran bats (flying-foxes) or threatened microbats<sup>2</sup> throughout the Site were also recorded, along with information on behaviour (i.e. roosting or flying), height observed and number of individuals observed.

### 2.2.5 Survey limitations

- **Bird abundance:** Birds observed during a survey were included in counts only if observers were confident the same individual hadn't been counted earlier during the same survey event based on appearance (e.g., differences in plumage), behaviour (including movement/direction of travel when sighted), temporal overlap/separation of observations. Repeat observations of the same bird were not recorded unless the individual was observed within the RSA.
- **Microbats:** Data from bat echolocation detectors does not allow for the assessment of bat numbers, only relative activity (based on the number of calls detected per unit time). Data from bat detectors cannot be used to determine the flight height of bats recorded either. Due to the limited reach of bat detector microphones, the echolocation calls of microbats active within the RSA are unlikely to be captured on detectors deployed near ground level.
- **Megabats:** The presence/abundance of flying-foxes during surveys is likely dependent on the availability/abundance of flowering canopy trees on Site, with flying-foxes more likely occur on site when canopy trees are in flower. During the current survey period, flowering eucalypt and grevilleas were present at just 6 out of the 28 WTG sites surveyed and, as such, the paucity of flying-foxes during surveys may be attributed to the scarcity of flowering canopy trees.

## 2.3 Collision risk assessment and 'High Risk' allocation

Prior to construction, a desktop collision risk assessment was performed to identify threatened and migratory bird species potentially at risk of interacting with WTGs on Site (see table 6 in 'Results' section).

Together with the result of the BBUS utilisation survey, the results of the desktop collision risk assessment were used to develop a 'risk profile' for each WTG. As per Condition 10 of the EPBC Act approval, WTGs have been assigned a 'low' or 'high' risk rating, as detailed below.

- **Low-risk:** A WTG that has not had an EPBC Act and/or *Nature Conservation Act* (NC Act) listed threatened or migratory bird or bat species detected within a 350 m radius; and
- **High-risk:** A WTG that has had an EPBC Act and/or NC Act listed threatened or migratory bird or bat species detected within a 350 m radius.

The purpose of determining WTG risk profiles is to guide WTG monitoring during the operational phase of the Project, with all high-risk WTG requiring ongoing monitoring.

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<sup>2</sup> While most microbats cannot be identified by flight alone, the threatened ghost bat (*Macroderma gigas*) can be readily identified due to its size, colour and flight pattern.



## 3 Results

### 3.1 Desktop results

Desktop assessment results identified eight bird species and two bat species that are listed as threatened or migratory under either the EPBC Act and/or NC Act as likely or known to occur within the Site.

**Table 6 : Known and likely to occur bird and bat species**

Fauna species	EPBC Act status <sup>1</sup>	NC Act status <sup>1</sup>	Likelihood of occurrence
<b>Birds</b>			
<b>fork-tailed swift</b> ( <i>Apus pacificus</i> )	M	SLC	<b>Likely to occur:</b> The species has previously been recorded within 12 km of the Site and is likely to utilise the airspace above the Site for foraging.
<b>Latham's snipe</b> ( <i>Gallinago hardwickii</i> )	M	SLC	<b>Likely to occur:</b> Suitable habitat occurs within the Site and the species has been previously recorded within 10km of the Site
<b>masked owl - northern</b> ( <i>Tyto novaehollandiae kimberli</i> )	V	V	<b>Likely to occur:</b> Suitable habitat occurs within the Site and the species has been previously recorded within 5km of the Site.
<b>oriental cuckoo</b> ( <i>Cuculus optatus</i> )	M	SLC	<b>Likely to occur:</b> Suitable habitat occurs within the Site and the species has been previously recorded within 12km of the Site
<b>black-faced monarch</b> ( <i>Monarcha melanopsis</i> )	M	LC	<b>Likely to occur:</b> Suitable habitat occurs within the Site and the species has been previously recorded within 12km of the Site
<b>satin flycatcher</b> ( <i>Myiagra cyanoleuca</i> )	M	LC	<b>Likely to occur:</b> Suitable habitat occurs within the Site and the species has been previously recorded within 12km of the Site
<b>rufous fantail</b> ( <i>Rhipidura rufifrons</i> )	M	LC	<b>Likely to occur:</b> Suitable habitat occurs within the Site and the species has been previously recorded within 12km of the Site
<b>white-throated needletail</b> ( <i>Hirundapus caudacutus</i> )	V/M <sup>2</sup>	V <sup>2</sup>	<b>Likely to occur:</b> The species has previously been recorded within 2.5 km of the Site and is likely to utilise airspace above the Site for foraging.
<b>Bats</b>			
<b>ghost bat</b> <i>Macroderma gigas</i>	V	E	<b>Known to occur:</b> A single individual has been recorded previously within the Site.



Fauna species	EPBC Act status <sup>1</sup>	NC Act status <sup>1</sup>	Likelihood of occurrence
<b>spectacled flying-fox</b> <i>Pteropus conspicillatus</i>	V <sup>3</sup>	V <sup>3</sup>	<b>Known to occur:</b> Three individuals have been recorded previously within the Site.

<sup>1</sup> E = Endangered, V = Vulnerable, M = Migratory, SLC = Special Least Concern, LC = Least Concern

<sup>2</sup> Species is listed as Vulnerable under the EPBC Act as of the 4<sup>th</sup> July 2019, and NC Act as of 19<sup>th</sup> September 2019. However, assessment is based on the species status when the Project's EPBC Act referral was submitted. As such, the species has been assessed as a migratory species (EPBC Act) and SLC (NC Act).

<sup>3</sup> Species is listed as Endangered under the EPBC Act as of the 22<sup>nd</sup> February 2019, and NC Act as of 19<sup>th</sup> September 2019. However, assessment is based on the species status when the Project's EPBC Act referral was submitted. As such, the species has been assessed as Vulnerable (EPBC Act/ NC Act).

## 3.2 Field results

### 3.2.1 Bat utilisation

#### 3.2.1.1 Microbats

The microbat utilisation survey identified a total of 4,198 individual bat calls, from at least 14 distinct taxa and up to 18 species. About 75% of calls (3156) recorded during the current surveys were positively identified (Appendix C), (Balance! Environmental, 2022).

The frequency of calls and number of resolved species varied greatly between turbine locations. WTG 10 had one call and one species whereas WTG 25 had 631 calls from 9 species. The highest number of confirmed microbat species was recorded at WTG's 7, 14 and 16, with 12 species recorded at each of these sites (Appendix C).

Overall, the most frequently detected microbat species during surveys was *Miniopterus australis*, comprising up to 41% of calls recorded (i.e., 1,307 calls). The most widely distributed species - recorded across 25 out of 28 WTG sites - were *Scotorepens greyii* and *Miniopterus orianae oceanensis*.

There were no threatened microbat species recorded at any WTG sites.

#### 3.2.1.2 Megabats: Flying-foxes

No flying-foxes were recorded during any of the 42 nocturnal fixed-point surveys (totalling 860 minutes of survey) conducted on Site, nor were there any incidental observations of flying-fox species during the current survey period.





**Table 7: Species call records by turbine number / location (WTG01 - WTG14)**

Species	Turbine number / location													
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10	WTG11	WTG12	WTG13	WTG14
<b>Positively identified calls</b>														
eastern bentwing bat ( <i>Miniopterus orianae oceanensis</i> )	15	34	4	86	77	21	35	10	1		10	71	5	62
eastern forest bat ( <i>Vespadelus pumilus</i> )														1
eastern freetail bat ( <i>Ozimops ridei</i> )	5	13	8	7	13	3	10	3						14
eastern horseshoe bat ( <i>Rhinolophus megaphyllus</i> )	1	4		1					2					1
Gould's wattled bat ( <i>Chalinolobus gouldii</i> )	4	1	1	12	2	3	42	2			1	5		1
greater broad-nosed bat ( <i>Scoteanax rueppellii</i> )						2	1							4
hoary wattled bat ( <i>Chalinolobus nigrogriseus</i> )			1	4		3	3						2	3
little bentwing bat ( <i>Miniopterus australis</i> )	54	47	66	73	240	15	36	16	10		11	1		36
little broad-nosed bat ( <i>Scotorepens greyii</i> )	1	4	2	4	2	1	2		2		6	1	2	3
greater northern freetail bat ( <i>Chaerephon jobensis</i> )	3		1	1			1	2						2
Troughton's sheath-tail bat ( <i>Taphozous troughtoni</i> )			1	1			2							



Species	Turbine number / location													
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10	WTG11	WTG12	WTG13	WTG14
white-striped freetail bat ( <i>Austronomus australis</i> )	4	5	1	10	7		9	5						2
yellow-bellied sheath-tail-bat ( <i>Saccolaimus flaviventris</i> )	4			7	3	1	4	3						1
<i>Nyctophilus spp</i>	10	2	2	3		1	1			1		6	1	
Unresolved calls														
<i>C. gouldii</i> or <i>O. ridei</i>							1							
<i>C. nigrogriseus</i> or <i>S. greyii</i>		1		21	2	9	12				1	3	4	12
<i>M. australis</i> or <i>V. pumilus</i>	1				3									
<i>M. o. oceanensis</i> or <i>Pipistrellus adamsi</i>	2	4	3	1	2				1		1			
<i>O. ridei</i> or <i>S. rueppellii</i>						1								1
<i>P. adamsi</i> or <i>Vespadelus troughtoni</i>			1		28									
<i>S. greyii</i> or <i>S. sanborni</i>														
<i>S. rueppellii</i> or <i>S. orion</i>														
Turbine Site Total	104	115	91	231	379	60	159	41	16	1	30	87	14	143



**Table 8: Species call records by turbine number / location (WTG15 - WTG28)**

Species	Turbine number / location													
	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
<b>Positively identified calls</b>														
eastern bentwing bat ( <i>Miniopterus orianae oceanensis</i> )	8	31	42		8	3	8	63		57	134	50	4	26
eastern forest bat ( <i>Vespadelus pumilus</i> )														
eastern freetail bat ( <i>Ozimops ridei</i> )		29	13	5	91	4	1	3		1	36			
eastern horseshoe bat ( <i>Rhinolophus megaphyllus</i> )		1			1	1					1			
Gould's wattled bat ( <i>Chalinolobus gouldii</i> )		1	1	55	2		3							
greater broad-nosed bat ( <i>Scoteanax rueppellii</i> )	4		22	4	30									
hoary wattled bat ( <i>Chalinolobus nigrogriseus</i> )	1	5	9		2	6	3	2	1	1	20			2
little bentwing bat ( <i>Miniopterus australis</i> )		34	107	1	31	10	23	32		6	410	10	7	31
little broad-nosed bat ( <i>Scotorepens greyii</i> )	5	3	4	2	47	117	3	7		8	4	8	4	5
greater northern freetail-bat ( <i>Chaerephon jobensis</i> )		9	1	1	1						1			
Troughton's sheath-tail bat ( <i>Taphozous troughtoni</i> )					1								2	1
white-striped freetail bat ( <i>Austronomus australis</i> )		6	4		1	2	1		1		3	1	2	14



Species	Turbine number / location													
	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
yellow-bellied sheath-tail bat ( <i>Saccolaimus flaviventris</i> )		14	1	1	1	2	1			3				
<i>Nyctophilus</i> spp.	2	6								1	5			
<b>Unresolved calls</b>														
<i>C. gouldii</i> or <i>O. ridei</i>				45				1	1					
<i>C. nigrogriseus</i> or <i>S. greyii</i>		179	24	47	231	254	23	8	2	3	16	1		37
<i>M. australis</i> or <i>V. pumilus</i>								1			1			1
<i>M. o. oceanensis</i> or <i>Pipistrellus adamsi</i>					1	3		18		1		2		
<i>O. ridei</i> or <i>S. rueppellii</i>		2		2										
<i>P. adamsi</i> or <i>Vespadelus troughtoni</i>			1							1				1
<i>S. greyii</i> or <i>S. sanborni</i>			2				1							
<i>S. rueppellii</i> or <i>S. orion</i>		1		16										
<b>Turbine location total</b>	16	343	214	205	418	402	67	135	5	82	631	72	19	118

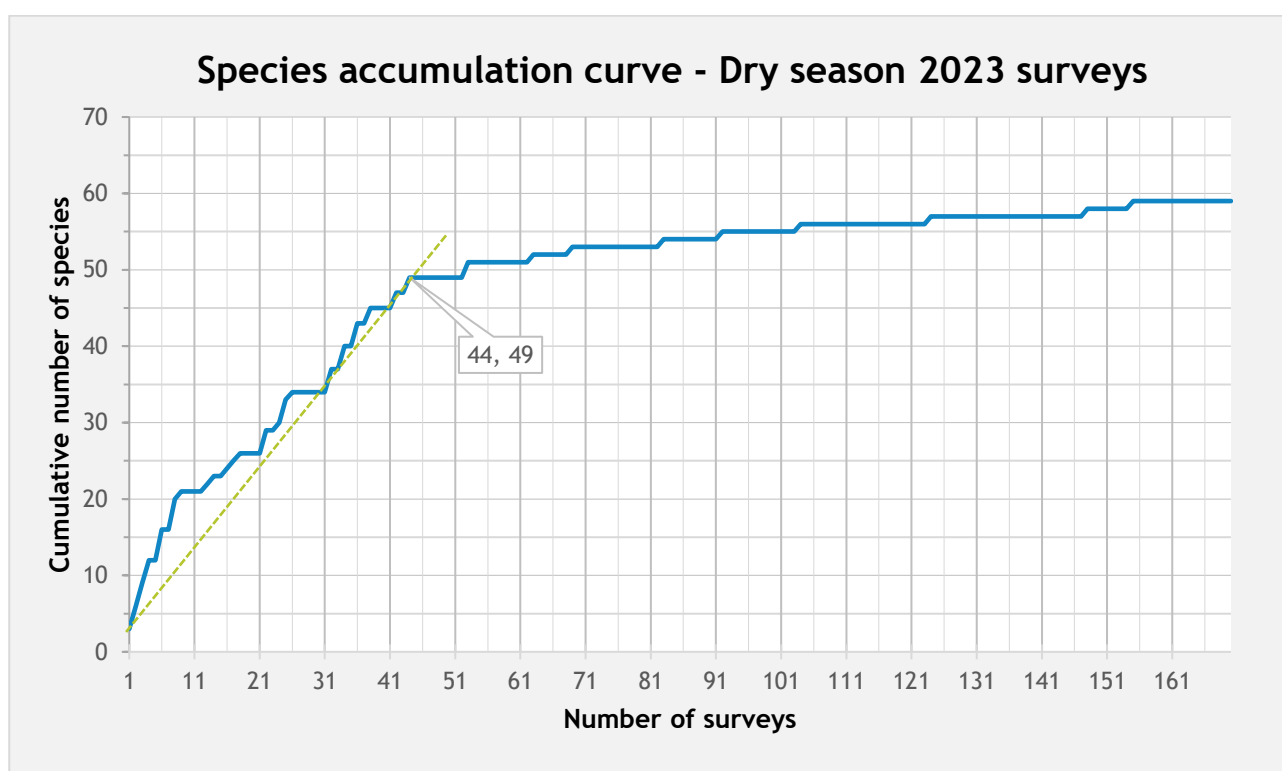


### 3.2.2 Bird utilisation

#### 3.2.2.1 Survey effort

Survey effort during the current survey period is considered adequate to determine the majority of bird species occurring within the Site, with the species accumulation curve in Figure 3 showing that 89% of bird species (49 of 55 species) were observed by survey number 44.

Figure 3: Bird species accumulation curve



#### 3.2.2.2 Bird diversity, abundance and distribution

##### 3.2.2.2.1 Bird Diversity

A total of 57 bird species were observed during the field survey, 55 of which observed during fixed-point surveys, with another 2 species recorded incidentally while traversing the Site (Appendix A). This is a marked increase from the 37 species recorded in the 2022 dry-season survey.

##### 3.2.2.2.2 Bird Abundance

Of the 55 species observed during fixed-point surveys, 8 species were recorded at more than 10% of surveys (Table 9).



**Table 9: Bird species recorded at highest frequencies across fixed point surveys**

Common name	Scientific name	Number of surveys recorded	Percent of surveys recorded
spotted pardalote	<i>Pardalotus punctatus</i>	105	61
yellow-faced honeyeater	<i>Lichenostomus chrysops</i>	98	57
noisy friarbird	<i>Philemon corniculatus</i>	59	35
brown honeyeater	<i>Lichmera indistincta</i>	50	29
scarlet honeyeater	<i>Myzomela sanguinolenta</i>	46	27
striated pardalote	<i>Pardalotus striatus</i>	35	20
white-throated honeyeater	<i>Melithreptus albobularis</i>	35	20
noisy miner	<i>Manorina melanocephala</i>	33	19
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	29	17
grey fantail	<i>Rhipidura albiscapa</i>	25	15
grey butcherbird	<i>Cracticus torquatus</i>	21	12
red-backed fairy-wren	<i>Malurus melanocephalus</i>	20	12
scaly-breasted lorikeet	<i>Trichoglossus moluccanus</i>	20	12
rufous whistler	<i>Pachycephala rufiventris</i>	18	11

### 3.2.2.2.3 Bird species distribution throughout site

There were 11 bird species recorded at over 50% of WTG sites. The yellow-faced honeyeater was the most widely distributed species, observed at 27 of the 28 (96%) WTG sites. The ten most widely distributed bird species on Site during the 2023 dry season survey period are listed in Table 10.

**Table 10: Most widely distributed birds across the Site**

Common name	Scientific name	Observations at different turbine locations	Percent of total turbine locations
yellow-faced honeyeater	<i>Lichenostomus chrysops</i>	27	96
spotted pardalote	<i>Pardalotus punctatus</i>	26	93
noisy friarbird	<i>Philemon corniculatus</i>	24	86
brown honeyeater	<i>Lichmera indistincta</i>	20	71
scarlet honeyeater	<i>Myzomela sanguinolenta</i>	20	71
striated pardalote	<i>Pardalotus striatus</i>	20	71



Common name	Scientific name	Observations at different turbine locations	Percent of total turbine locations
white-throated honeyeater	<i>Melithreptus albogularis</i>	19	68
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	18	64
grey fantail	<i>Rhipidura albiscapa</i>	16	57
grey butcherbird	<i>Cracticus torquatus</i>	16	57

#### 3.2.2.2.4 Threatened and migratory species

There were no migratory or threatened species recorded during fixed-point surveys.

#### 3.2.2.3 Flight heights

Approximately 99% of bird observations during surveys were of birds foraging or flying below the RSA height (Table 11). Only five species observed flying within the RSA or above. These were the black-faced cuckoo shrike, brolga, nankeen kestrel, sarus crane and the wedge-tailed eagle.



Figure 4. Observed bird heights for all point surveys, during the dry season 2023 BBUS.

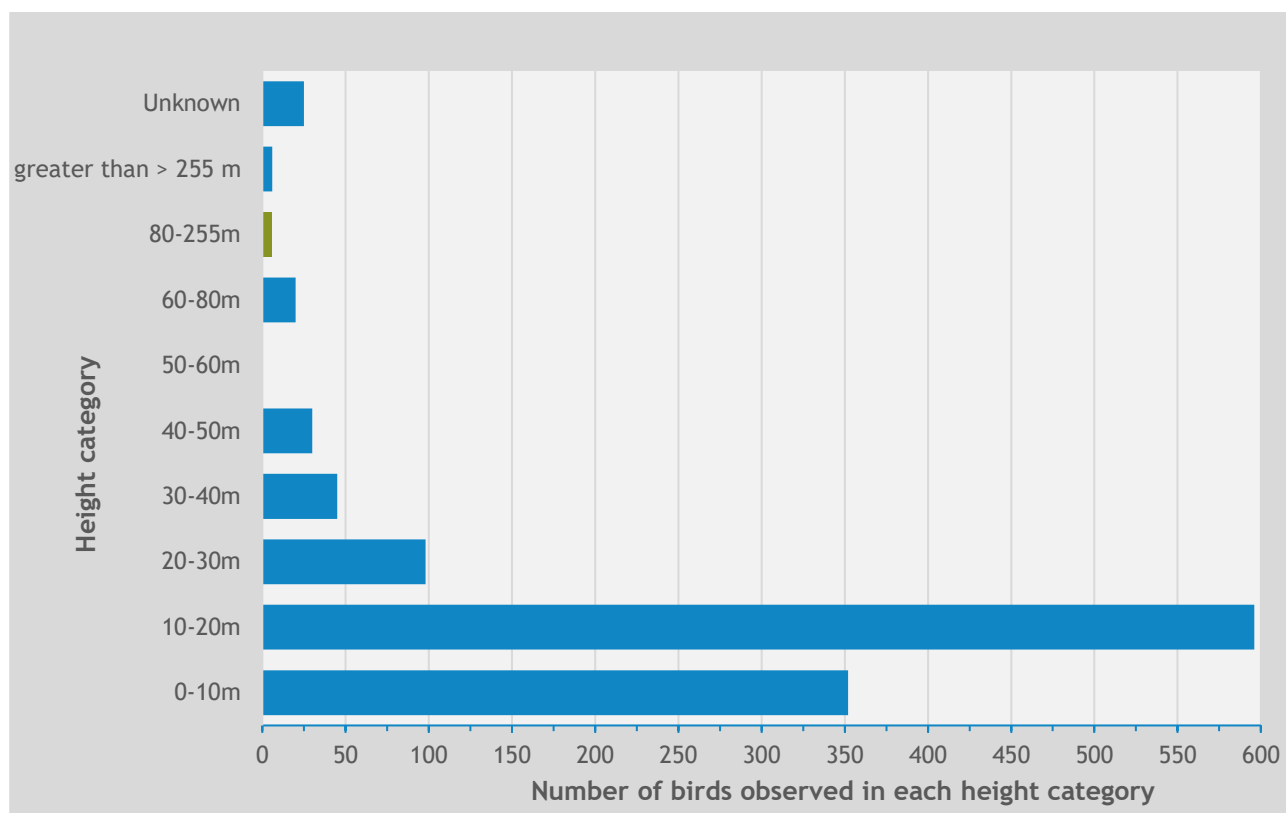


Table 12 provides details of observations of birds flying within and above the RSA.

A full summary of the number and height of birds recorded during the survey/field work is provided in Table 11.

Table 11 Number of birds recorded per height class

Flight Height	Number of observations	Percent of total observations
0-10m	352	29.9
10-20m	597	50.6
20-30m	98	8.3
30-40m	45	3.8
40-50m	30	2.5
50-60m	0	0.0
60-80m	20	1.7
80-255m (RSA)	6	0.5
>255m	6	0.5
Unknown	25	2.1





Flight Height	Number of observations	Percent of total observations
TOTAL	1204	100



Figure 4. Observed bird heights for all point surveys, during the dry season 2023 BBUS.

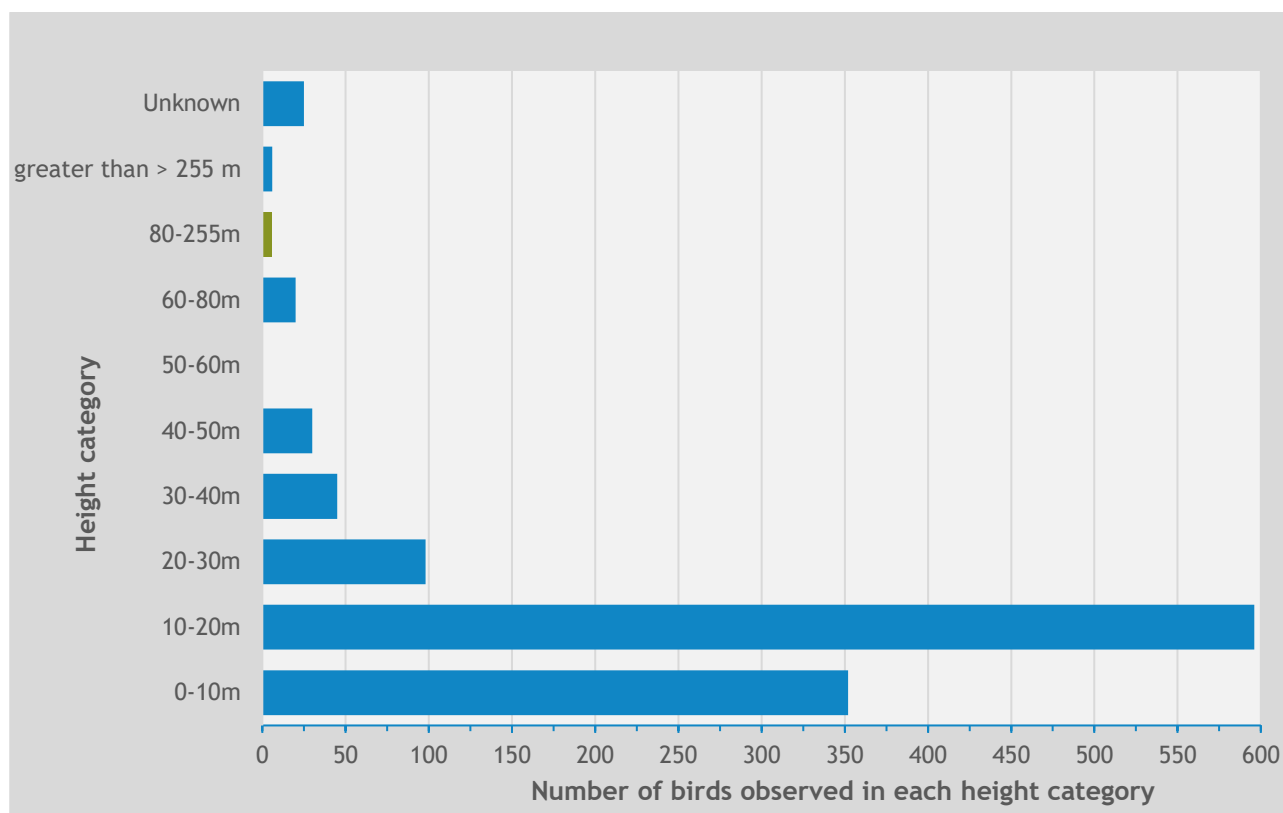


Table 12: Species recorded within or above RSA

Common name	Scientific name	# of Survey Periods Observed	Number of birds observed	# birds within RSA	# birds above RSA
black-faced cuckoo-shrike	<i>Coracina novaehollandiae</i>	4	6	1	0
brolga	<i>Grus rubicunda</i>	1	3	3	0
nankeen kestrel	<i>Falco cenchroides</i>	1	1	1	0
sarus crane	<i>Grus antigone</i>	1	3	0	3
wedge-tailed eagle	<i>Aquila audax</i>	2	4	1	3

### 3.2.2.4 Historical Observations

BBUS investigations undertaken since 2020 include:

1. September 2020, Dry Season
2. October 2021, Dry Season



3. March 2022, Wet Season
4. March 2023, Wet Season
5. September 2023, Dry Season

The number of bird species recorded during fixed point surveys for each BBUS is detailed in Table 13. As shown in this table, the number of bird species recorded during the 2023 dry season survey is substantially higher than all previous BBUSs except for the 2020 dry season survey.

**Table 13: Total bird species recorded during each BBUS.**

BBUS	2020	2021	2022	2023	2023
	Dry Season	Dry Season	Wet Season	Wet Season	Dry Season
# of Species	58	38	49	39	57

## 3.3 Turbine collision risk assessment

### 3.3.1 Bird Survey

#### 3.3.1.1 Threatened species

No threatened bird species were observed during 2023 dry season survey.

#### 3.3.1.2 Migratory species

No migratory bird species were recorded within Site during the 171 fixed-point surveys conducted during the 2023 dry season survey.

### 3.3.2 Bat Survey

#### 3.3.2.1 Threatened microbats

The only threatened microbat species assessed as likely or known to occur on Site is the ghost bat (*Macroderma gigas*). There has only been one observation of this bat species on Site during an earlier survey, however it has not been detected on any subsequent surveys. The infrequent occurrence of this bat and its flight behaviour make it a ‘low risk’ species in terms of turbine collision risk (see Table 14).

No other threatened microbats are considered likely to occur within the Site (Table 14).

#### 3.3.2.2 Threatened megabats

While no threatened flying-fox species were recorded during the survey, the spectacled flying-fox (*Pteropus conspicillatus*) has been previously recorded during surveys and has been detected during incidental carcass searches (Table 15). No other threatened flying foxes are considered likely to occur within the Site (Table 6 ).



Table 14: Turbine collision assessment for known and likely occurring threatened and migratory species

Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
Threatened species					
<b>masked owl</b> ( <i>Tyto novaehollandiae kimberli</i> )	V	V	<p>The species is known to occur in riparian forest, rainforest, open forest and Melaleuca swamps and the edges of mangroves, as well as along margins of sugar cane fields (DAWE, 2021).</p> <p>While the species has previously recorded within 10km of the Site, records of the species across the Atherton Tablelands are scattered, infrequent and at low densities, reducing the risk of collision.</p>	<p>The species holds permanent large home ranges and hunts primarily on the ground or within the canopy, taking small mammals (Curtis &amp; Dennis 2012, DAWE, 2021). It typically glides from perches in trees to prey (Brett Lane &amp; Associates Pty Ltd, 2017). These flight behaviours make the species unlikely to occur within the RSA, and therefore have a low risk of turbine collision.</p>	<p><b>Low risk:</b></p> <p>While the species is considered likely to occur within the Site, the species flight behaviour makes it a low risk of collision.</p>
<b>red goshawk</b> ( <i>Erythroriorchis radiatus</i> )	V	V	<p>The species is known to have a large home range covering between 50 and 220 square kilometres. The species prefers a mix of vegetation types including tall open forest, woodland, lightly treed savannah and the edge of rainforest (DES 2021).</p> <p>While the species has previously recorded within 10km of the Site, records of the species across the Atherton Tablelands are scattered, infrequent and at low densities, reducing the risk of collision.</p>	<p>Typical flight behaviour is to perch and hunt in the canopy but it is known to undertake fast agile flights 10-50m above the tree canopy and soar 200-300 m above its territory (Brett Lane &amp; Associates Pty Ltd, 2017). These flight behaviours make the species at risk of turbine collision.</p>	<p><b>Low risk:</b></p> <p>While the species flight behaviour makes it susceptible to turbine collision, the large home range and low number of occurrences of the species in the Project region makes it a low risk of collision.</p>



Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
Migratory species					
fork-tailed swift ( <i>Apus pacificus</i> )	M	SLC	<p>In Australia, this species mostly occurs over inland plains but sometimes above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh (DAWE, 2021). They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (DAWE, 2021). The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (DAWE, 2021).</p> <p>The species has been previously recorded within 10km of the Site and is predicted to intermittently forage within the airspace above the Site.</p>	<p>The fork-tailed swift is an aerial forager spending large periods of within RSA heights foraging on insect prey (Higgins, 1999).</p>	<p><b>High risk:</b></p> <p>The species flight behaviour makes it highly susceptible to collision, however the occurrence and abundance of individuals occurring within the Site is likely to be highly variable, with the proportion of likely impacted individuals considered to be negligible compared to the total population size.</p>
Latham’s snipe ( <i>Gallinago hardwickii</i> )	M	SLC	<p>Latham’s snipe is a non-breeding visitor to south-eastern Australia and is a passage migrant through northern Australia (DAWE, 2021). In Australia, Latham’s snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (DAWE, 2021).</p> <p>Historical records show the species has previously recorded within the Site.</p>	<p>While the species primarily forages on the ground, it is possible that the species may occur within the RSA height during migration and dispersal. However, the species is unlikely to frequent the Site in large numbers given the lack of extensive wetland habitat.</p>	<p><b>Moderate risk:</b></p> <p>The species may occur within the RSA during migration and dispersal. However, it is only likely to occur infrequently and in low numbers due to the lack of extensive wetland habitat within the Site.</p>



Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
<b>oriental cuckoo</b> ( <i>Cuculus optatus</i> )	M	SLC	<p>In Australia this species is found in monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides, mangroves and islands (Pizzey &amp; Knight, 2007). Important habitat for this species is identified as monsoonal rainforest, vine thickets, wet sclerophyll forest or open <i>Casuarina</i>, <i>Acacia</i> or <i>Eucalyptus</i> woodlands.</p> <p>The species has been previously recorded within 12km of the Site and may utilise the Site for foraging when present in Australia (November to May).</p>	The species is primarily restricted to the canopy layer where it forages on a variety of small invertebrates (Brett Lane & Associates Pty Ltd, 2017). These flight behaviours means the species is unlikely to frequently occur at RSA height.	<p><b>Low risk:</b></p> <p>While the species is considered likely to occur within the Site, the species flight behaviour makes it a low risk of collision.</p>
<b>white-throated needletail</b> ( <i>Hirundapus caudacutus</i> )	M	SLC	<p>In Australia, the white-throated needletail is almost exclusively aerial (DAWE, 2021). Because they are aerial, it is suggested that conventional habitat descriptions are inapplicable (DAWE, 2021). However, DAWE (2021) identifies the species is most commonly recorded over wooded areas, including open forest, rainforest, heathland, plantations, the edge of paddocks and less often over treeless areas such as grassland or swamps (DAWE, 2021).</p> <p>The species was recorded on two separate occasions during the 2021 survey, including one observation of 13 individuals at turbine WTG08 and one observation of three individuals at turbine WTG19.</p>	The white-throated needletail is an aerial forager spending large periods of within RSA heights foraging on insect prey (Higgins, 1999).	<p><b>High risk:</b></p> <p>The species flight behaviour makes it highly susceptible to collision, however the occurrence and abundance of individuals occurring within the Site is likely to be highly variable, with the proportion of likely impacted individuals considered to be negligible compared to the total population size.</p>



Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
Microbats					
ghost bat ( <i>Macroderma gigas</i> )	V	E	<p>In Queensland the species occurs along the central and northern coast, from Rockhampton to Cape York (DES 2021). The species occurs in a wide range of habitats from rainforest, monsoon and vine scrub, to open woodlands in arid areas. These habitats are used for foraging while roost habitat is more specific and includes undisturbed caves or mineshafts which have several openings (DES 2021).</p> <p>A single individual has been recorded within the Site during previous surveys.</p>	<p>The species roosts in caves or undisturbed mineshafts, of which non are known to occur within the Site. Foraging typically occurs within 2km of the roost and consist of flying within the lower half of the canopy, between 1-8m. This behaviour makes it unlikely the species would occur within the RSA.</p>	<p><b>Low risk:</b></p> <p>While the species is known to occur within the Site, the species flight behaviour makes it a low risk of collision.</p>
Flying-foxes					
spectacled flying-fox ( <i>Pteropus conspicillatus</i> )	V	V	<p>The species is known to occur in north-eastern Queensland, between Ingham and Cooktown, and between the McIlwraith and Iron Ranges of Cape York (DAWE, 2021). Spectacled flying foxes have long been considered to be primarily frugivorous and dependent on rainforest for foraging resources (DERM 2010). However, recent research suggests that this is not the case with satellite telemetry studies showing some individuals spend a significant proportion of the time in non-rainforest habitats. Many of these records were obtained from locations tens of kilometres from rainforest and included a range of wet and dry Eucalyptus, and Melaleuca vegetation types (DERM 2010).</p> <p>The species has been recorded within the Site on multiple occasions, though only ever in low numbers (1-2 individuals). The nearest known roost is approximately 25km from the Site.</p>	<p>While the species forages primarily within the canopy, the species would be susceptible to turbine collision during dispersal. However, given the Site is 25km from the nearest known roost it is considered unlikely that the Site would be utilised frequently and by large numbers of individuals.</p>	<p><b>Moderate risk:</b></p> <p>The species flight behaviour makes it a high risk of turbine collision, however, the distance to the nearest roosts makes it unlikely that the site would be utilised frequently and by large numbers of individuals.</p>

<sup>1</sup>: E = Endangered, M = Migratory, SLC = Special Least Concern, V = Vulnerable



### 3.3.3 Post-Operation: Incidental Bird and Bat Observations

The first turbine was energised in late September 2022. Since operation, there have been several records of possible turbine collision deaths, of migratory birds and spectacled flying-foxes. The records of these observations are detailed in Table 15.

**Table 15: Incidental finds of migratory/threatened bird and bat species during operational phase.**

Common Name	Species Name	Date Found	# Individuals Found	Found at Turbine Number/s
Migratory Birds				
Fork-tailed swift	<i>Apus pacificus</i>	January 2023	2	2 & 11
White-throated needletail	<i>Hirundapus caudacutus</i>	March 2023	1	Between 16 & 17
Rufous fantail <sup>3</sup>	<i>Rhipidura rufifrons</i>	March 2023	1	Between 16 & 17
Black-faced Monarch <sup>3</sup>	<i>Monarcha melanopsis</i>	February 23	1	4
Flying-foxes				
Spectacled flying-fox	<i>Pteropus conspicillatus</i>	January 2023	1	16
		February 2023	1	1

<sup>3</sup> While these migratory birds are unlikely to be found onsite, they are potentially using the airspace above the windfarm for migration.





### 3.3.4 Turbine risk profiles

As per Condition 10 of the EPBC Act approval (DCCEEW, 2022), individual WTGs were assessed as ‘high’ or ‘low’ risk as detailed in Section 2.3. Of the 28 WTGs on Site, 14 turbines have been assigned high-risk, based on records of threatened and migratory species observed during scheduled BBUS<sup>B</sup> or through incidental finds as listed in Table 15. All observations have been included for the determination of turbine risk profiles (see Table 16). All ‘high risk’ turbines have been added to the carcass monitoring program bringing a total turbines for monitoring to 24 (see Table 16).

**Table 16: Turbine risk profiles**

WTG	Risk profile	Carcass Monitoring	WTG	Risk profile	Carcass Monitoring
1	High <sup>A</sup>	YES	15	High <sup>A</sup>	YES
2	High <sup>A</sup>	YES	16	High <sup>A</sup>	YES
3	Low	YES <sup>D</sup>	17	High <sup>A</sup>	YES
4	High <sup>A</sup>	YES	18	High <sup>B</sup>	YES
5	Low	YES <sup>D</sup>	19	High <sup>B</sup>	YES
6	Low	YES <sup>D</sup>	20	High <sup>B</sup>	YES
7	High <sup>B</sup>	YES	21	Low	YES <sup>D</sup>
8	High <sup>B</sup>	YES	22	Low	NO
9	High <sup>B</sup>	YES	23	Low	NO
10	Low	YES <sup>D</sup>	24	Low	YES <sup>D</sup>
11	High <sup>A</sup>	YES	25	Low	YES <sup>D</sup>
12	Low	YES <sup>D</sup>	26	Low	NO
13	High <sup>C</sup>	YES	27	Low	NO
14	Low	YES <sup>D</sup>	28	Low	YES <sup>D</sup>

<sup>A</sup> Carcass found at this location during incidental searches since WTGs became operational. Please refer to Table 15 for details.

<sup>B</sup> White-throated needletail observed within 350m of turbines during the 2021 dry season BBUS.

<sup>C</sup> A spectacled flying-fox observation recorded in the 2020 dry season BBUS.

<sup>D</sup> ‘Low risk’ turbines but were delegated for carcass monitoring prior to operation.





## 4 Conclusion

Kaban Wind Farm engaged E2M to undertake the 2023 post-commissioning Dry Season BBUS at the Kaban Green Power Hub. This survey was undertaken to meet the requirements of Conditions 5A, 6, 7, 9, and 11 of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) Variation of Conditions attached to approval EPBC 2018/8289 received from the Department of Agriculture, Water and the Environment (DAWE) on 10 August 2022.

Specifically, the survey aimed to assess bird and bat utilisation during the dry season with the objectives of determining:

- turbine collision risk of potentially occurring threatened and migratory bird and bat species; and
- a ‘risk profile’ for each turbine based on the results of the bird and bat utilisation.

Key findings from the current assessment are summarised below.

- Bird utilisation:
  - No threatened bird species or migratory bird species were observed during the 2023 dry season survey.
  - A total of 57 bird species were recorded across the Site during this survey, including 55 observed during fixed-point surveys.
  - The total bird species observed during this survey is similar to pre-construction observations with 57 and 58 species observed respectively.
  - Bird species were primarily limited to typical woodland species, with spotted pardalote and yellow-faced honeyeater being the two most frequently recorded species.
  - Approximately 99.5% of birds observed occurred below the RSA height, with five observations, from four species recorded at or above the RSA height.
  - Previous BBUS surveys have identified the white-throated needletail utilising the airspace at rotor sweep height.
  - Incidental observation of migratory bird carcasses, post operation, have identified that the white-throated needletail, fork-tailed swift, rufous fantail and the black-faced monarch are potentially using the airspace within the windfarm.
- Bat utilisation:
  - No threatened bat species were recorded during the survey
  - Fourteen resolved calls from at least 14 and up to 18 different species were recorded across the Site
  - The species most frequently recorded calling during surveys was *Miniopterus australis*
  - Previous surveys identified two threatened bat species on Site: the spectacled flying-fox and the ghost bat on Site. To date, both these species have been detected on Site only once.
  - The ghost bat is considered to have a low risk of turbine collision based on its flight behaviour.
  - No other threatened bat species were considered likely to occur.
  - The spectacled flying-fox was considered to have a moderate risk of turbine collision, with high risk flight behaviours but a low frequency of occurrence on Site.





- Incidental observations of threatened and migratory bird/bat species since the commencement of operations
  - Carcasses of four migratory bird species (black-faced monarch, rufous fantail, white-throated needletail and fork-tailed swift) and spectacled flying-fox have been observed within 350 metres of turbines (WTGs) 1, 2, 4, 11, 15, 16 and 17. These WTGs have therefore been assessed as ‘high’ risk.
- High risk turbines
  - Based on the results of BBUSs conducted to date, fourteen (14) WTGS are considered as ‘high risk’ (as detailed in Table 16).
  - All ‘high risk’ WTGs have been included in the carcass monitoring schedule.
- Carcass Monitoring
  - With the addition of ‘high risk’ turbines there are a total of 24 turbines designated for monthly carcass monitoring for the provision of annual bird and bat mortality assessment.



## 5 Recommendations

A key objective of BBUSs is to identify 'high risk' WTGs for ongoing assessment of bird and bat mortality rates via monthly carcass surveys. The results of which will be used to calculate annual mortalities and thereby help identify potential trigger events for migratory birds and threatened bat species. However, under the current design construct, the nominal number of 15 WTG's sites has increased to 24 sites, with the addition of new 'high risk' sites. Therefore, the monthly carcass search effort changes with every addition of 'high risk' WTG's. With this current design it difficult to establish mortality trends and/or patterns if new sites are added from month to month. It is recommended that once the first annual mortality assessment has been completed, that the current design be reviewed and adjusted, if necessary, to a design that allows for consistent monitoring effort from month to month. The new design is to be approved by qualified statisticians familiar in this field.





## 6 References

- AECOM. (2017). *Kaban Green Power Hub—Fauna Technical Report*.
- Balance! Environmental. (2022). *Microbat Call Identification Report—Kaban Wind Farm*.
- Brett Lane & Associates Pty Ltd. (2017). *Neoen Kaban Wind Farm—Bird and Bat Pre-construction Utilisation Survey*.
- Curtis, L. K., & Dennis, A. J. (2012). *Queensland's threatened animals* (K. R. McDonald, P. M. Kyne, & S. J. S. Debus, Eds.). CSIRO Publishing.
- DCCEEW. (2022). *Kaban Green Power Hub, Kaban, Queensland (EPBC 2018/8289), Variation of Conditions Attached to Approval*. Department of Climate Change, Energy, the Environment and Water.
- Department of Agriculture, Water and the Environment. (2021). *Species Profile and Threats Database*.  
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- Department of Environment and Resource Management. (2010). *National recovery plan for the spectacled flying fox Pteropus conspicillatus*. Department Sustainability, Environment, Water, Population and Communities, Canberra.
- Department of Environment and Science (DES). (2021). *Threatened species profile*.  
<https://environment.des.qld.gov.au/wildlife/threatened-species/>
- E2M. (2019a). *Kaban Green Power Hub - Ecological Gap Analysis*.
- E2M. (2019b). *Kaban Green Power Hub RFI - Ecological Assessment Report*.
- E2M. (2020). *Kaban Green Power Hub - Bird and Bat Adaptive Management Plan*.
- E2M Pty Ltd. (2020). *Kaban Green Power Hub Pre-Commissioning Bird and Bat Utilisation 2020 Dry Season Monitoring Report*.
- E2M Pty Ltd. (2022). *Kaban Green Power Hub: Pre-commissioning Bird and Bat Utilisation 2022 Wet Season Monitoring Report*.
- Higgins, P. J. (1999). *Handbook of Australian, New Zealand and Antarctic Birds* (J. N. Davies & K. Y. Dabbagh, Eds.; Vol. 4). Oxford University Press.
- Pizzey, G., & Knight, F. (2007). *The field guide to the birds of Australia*. Harper Collins Publishers.





## Appendix A Species list



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
<b>Birds</b>							
Australasian pipit	<i>Canthus novaeseelandiae</i>	✓					
Australian Bustard	<i>Ardeotis australis</i>	✓					
Australian king-parrot	<i>Alisterus scapularis</i>		✓				
Australian magpie	<i>Cracticus tibicen</i>	✓	✓	✓	✓	✓	✓
Australian owlet-nightjar	<i>Aegotheles cristatus</i>				✓		
Australian pelican	<i>Pelecanus conspicillatus</i>		✓				
Australian raven							✓
Australian wood duck	<i>Chenonetta jubata</i>		✓				
banded honeyeater	<i>Certhionyx pectoralis</i>	✓	✓				
barking owl	<i>Ninox connivens</i>			✓			
bar-shouldered dove	<i>Geopelia humeralis</i>		✓				
barn owl	<i>Tyto alba</i>	✓					✓
black-breasted buzzard	<i>Hamirostra melanosternon</i>	✓					
black butcherbird	<i>Cracticus quoyi</i>	✓					
black kite	<i>Milvus migrans</i>		✓	✓			
black-chinned honeyeater	<i>Melithreptus gularis</i>		✓				
black-faced cuckoo-shrike	<i>Coracina novaehollandiae</i>	✓	✓	✓	✓	✓	✓
black-faced monarch	<i>Monarcha melanopsis</i>		✓				
blue-faced honeyeater	<i>Entomyzon cyanotis</i>		✓				
blue-winged kookaburra	<i>Dacelo leachii</i>	✓	✓	✓			
brolga	<i>Grus rubicunda</i>	✓	✓	✓			✓



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
brown cuckoo dove	<i>Macropygia amboinensis</i>	✓					
brown falcon	<i>Falco berigora</i>	✓	✓			✓	
brown goshawk	<i>Accipiter fasciatus</i>			✓		✓	✓
brown honeyeater	<i>Lichmera indistincta</i>		✓	✓	✓	✓	✓
brown quail	<i>Coturnix ypsilophora</i>		✓	✓	✓		✓
Brown treecreeper	<i>Climacteris picumnus</i>						✓
brush cuckoo	<i>Cacomantis variolosus</i>				✓		
buff-rumped thornbill	<i>Acanthiza reguloides</i>		✓	✓	✓	✓	✓
bush stone-curlew	<i>Burhinus grallarius</i>	✓	✓	✓	✓	✓	✓
cicadabird	<i>Coracina tenuirostris</i>	✓		✓	✓		
collared sparrowhawk	<i>Accipiter cirrocephalus</i>		✓				
common bronzewing	<i>Phaps chalcoptera</i>		✓				✓
common myna	<i>Acridotheres tristis</i>	✓					
crested pigeon	<i>Ocyphaps lophotes</i>	✓					
dollarbird	<i>Eurystomus orientalis</i>	✓					
eastern spinebill	<i>Acanthorhynchus tenuirostris</i>	✓					✓
eastern whipbird	<i>Psophodes olivaceus</i>		✓	✓			
eastern yellow robin	<i>Eopsaltria australis</i>	✓	✓	✓			✓
fantail cuckoo	<i>Rhipidura rufifrons</i>						✓
forest kingfisher	<i>Todiramphus macleayii</i>	✓	✓	✓			✓
fuscous honeyeater	<i>Lichenostomus fuscus</i>				✓		
golden whistler	<i>Pachycephala pectoralis</i>	✓					
great cormorant	<i>Phalacrocorax carbo</i>				✓		
grey butcherbird	<i>Cracticus torquatus</i>	✓	✓	✓	✓		✓
grey fantail	<i>Rhipidura albiscapa</i>	✓	✓	✓	✓	✓	✓
grey shrike-thrush	<i>Colluricincla harmonica</i>	✓	✓	✓	✓	✓	✓
hardhead	<i>Aythya australis</i>	✓	✓				



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
Horsfield's bronze-cuckoo	<i>Chrysococcyx basalis</i>		✓				
jacky winter	<i>Microeca fascians</i>	✓	✓				
laughing kookaburra	<i>Dacelo novaeguineae</i>	✓	✓	✓	✓	✓	✓
leaden flycatcher	<i>Myiagra rubecula</i>			✓	✓	✓	✓
Lewin's honeyeater	<i>Meliphaga lewinii</i>	✓	✓			✓	✓
little bronze-cuckoo	<i>Chrysococcyx minutillus</i>			✓			✓
little friarbird	<i>Philemon citreogularis</i>		✓	✓			✓
little kingfisher	<i>Alcedo pusilla</i>	✓					
little lorikeet	<i>Parvipsitta pusilla</i>		✓	✓	✓		✓
little pied cormorant	<i>Microcarbo melanoleucos</i>	✓	✓				
magpie-lark	<i>Grallina cyanoleuca</i>	✓	✓		✓	✓	✓
masked lapwing	<i>Vanellus miles</i>	✓					
mistletoebird	<i>Dicaeum hirundinaceum</i>		✓	✓	✓		✓
nankeen kestrel	<i>Falco cenchroides</i>	✓		✓	✓		✓
noisy friarbird	<i>Philemon corniculatus</i>	✓	✓	✓	✓	✓	✓
noisy miner	<i>Manorina melanocephala</i>	✓	✓	✓	✓	✓	✓
olive-backed oriole	<i>Oriolus sagittatus</i>	✓	✓		✓		
Pacific black duck	<i>Anas superciliosa</i>	✓	✓		✓		
pale-headed rosella	<i>Platycercus adscitus</i>	✓	✓	✓	✓	✓	✓
pallid cuckoo	<i>Cacomantis pallidus</i>	✓					
peaceful dove	<i>Geopelia striata</i>	✓	✓	✓	✓	✓	✓
pheasant coucal	<i>Centropus phasianinus</i>	✓	✓	✓	✓	✓	✓
pied butcherbird	<i>Cracticus nigrogularis</i>	✓	✓	✓	✓		✓
pied currawong	<i>Strepera graculina</i>	✓	✓	✓	✓	✓	✓
purple swampphen	<i>Porphyrio porphyrio</i>	✓					
rainbow bee-eater	<i>Merops ornatus</i>	✓	✓	✓	✓	✓	✓
rainbow lorikeet	<i>Trichoglossus haematodus moluccanus</i>	✓	✓	✓	✓	✓	✓



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
red-backed button-quail	<i>Turnix maculosus</i>		✓		✓		
red-backed fairy-wren	<i>Malurus melanocephalus</i>	✓	✓	✓	✓	✓	✓
red-browed finch	<i>Neochmia temporalis</i>	✓	✓	✓		✓	
red-tailed black-cockatoo	<i>Calyptorhynchus banksii</i>	✓	✓	✓			✓
rufous whistler	<i>Pachycephala rufiventris</i>		✓	✓	✓	✓	✓
sacred kingfisher	<i>Todiramphus sanctus</i>	✓	✓				
sarus crane	<i>Antigone antigone</i>			✓			✓
scaly-breasted lorikeet	<i>Trichoglossus chlorolepidotus</i>	✓	✓	✓	✓	✓	✓
scarlet honeyeater	<i>Myzomela sanguinolenta</i>	✓	✓	✓	✓		✓
shining bronze-cuckoo							✓
southern boobook	<i>Ninox novaeseelandiae</i>			✓			
spangled drongo	<i>Dicrurus bracteatus</i>		✓	✓	✓		
spotted pardalote	<i>Pardalotus punctatus</i>	✓	✓	✓	✓	✓	✓
squatter pigeon (northern subspecies)	<i>Geophaps scripta peninsulae</i>	✓	✓	✓	✓	✓	✓
striated pardalote	<i>Pardalotus striatus</i>	✓	✓	✓	✓	✓	✓
sulphur-crested cockatoo	<i>Cacatua galerita</i>	✓					
tawny frogmouth	<i>Podargus strigoides</i>	✓		✓		✓	
Torresian crow	<i>Corvus orru</i>	✓	✓	✓		✓	
varied sittella	<i>Daphoenositta chrysoptera</i>	✓		✓	✓	✓	✓
varied triller	<i>Lalage leucomela</i>	✓					
wedge-tailed eagle	<i>Aquila audax</i>	✓	✓	✓	✓	✓	✓
weebill	<i>Smicrornis brevirostris</i>	✓	✓	✓	✓	✓	✓
whistling kite	<i>Haliastur sphenurus</i>		✓	✓	✓		



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	✓	✓	✓	✓	✓	✓
white-browed scrubwren	<i>Sericornis frontalis</i>	✓		✓			
white-cheeked honeyeater	<i>Philidonyris niger</i>						✓
white-faced heron	<i>Egretta novaehollandiae</i>		✓	✓			
white-naped honeyeater	<i>Melithreptus lunatus</i>	✓					
white-necked heron	<i>Ardea pacifica</i>		✓				
white-throated gerygone	<i>Gerygone olivacea</i>		✓	✓	✓		✓
white-throated honeyeater	<i>Melithreptus albugularis</i>		✓	✓	✓	✓	✓
white-throated needletail	<i>Hirundapus caudacutus</i>			✓			
white-throated nightjar	<i>Eurostopodus mystacalis</i>				✓		✓
white-throated treecreeper	<i>Cormobates leucophaea</i>		✓			✓	
white-winged triller	<i>Lalage sueurii</i>	✓					
willie wagtail	<i>Rhipidura leucophrys</i>	✓	✓		✓	✓	✓
yellow thornbill	<i>Acanthiza nana</i>					✓	
yellow-faced honeyeater	<i>Caligavis chrysops</i>	✓	✓	✓	✓	✓	✓
<b>Microbats</b>							
bare-rumped sheath-tail bat	<i>Saccolaimus saccolaimus</i>					✓	
eastern bentwing bat	<i>Miniopterus orianae oceanensis</i>	✓	✓	✓	✓	✓	
eastern cave bat	<i>Vespadelus trougtoni</i>				✓	✓	
eastern forest bat	<i>Vespadelus pumilus</i>					✓	
eastern freetail bat	<i>Ozimops ridei</i>	✓	✓	✓	✓	✓	
eastern horseshoe bat	<i>Rhinolophus megaphyllus</i>	✓	✓	✓	✓	✓	



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
eastern bentwing bat	<i>Miniopterus orianae oceanensis</i>						✓
eastern forest bat	<i>Vespadelus pumilus</i>						✓
eastern freetail bat	<i>Ozimops ridei</i>						✓
eastern horseshoe bat	<i>Rhinolophus megaphyllus</i>						✓
forest pipistrelle	<i>Pipistrellus adamsi</i>					✓	
ghost bat	<i>Pteropus conspicillatus</i>	✓					
Gould's wattled bat	<i>Chalinolobus gouldii</i>	✓	✓	✓	✓	✓	✓
greater broad-nosed bat	<i>Scoteanax rueppellii</i>			✓	✓	✓	✓
hoary wattled bat	<i>Chalinolobus nigrogriseus</i>	✓	✓	✓	✓	✓	✓
inland broad-nosed bat	<i>Scotorepens balstoni</i>				✓		
little bentwing bat	<i>Miniopterus australis</i>	✓	✓	✓	✓	✓	✓
little broad-nosed bat	<i>Scotorepens greyii</i>				✓	✓	✓
northern broad-nosed bat	<i>Scotorepens sanborni</i>				✓		
greater northern freetail bat	<i>Chaerephon jobensis</i>		✓	✓	✓	✓	✓
northern free-tailed bat	<i>Ozimops lumsdenae</i>			✓	✓		
south-eastern broad-nosed bat	<i>Scotorepens orion</i>				✓		
Troughton's sheath-tail bat	<i>Taphozous troughtoni</i>				✓	✓	✓
white-striped freetail bat	<i>Austronomus australis</i>	✓	✓	✓	✓	✓	✓
yellow-bellied sheath-tail-bat	<i>Saccolaimus flaviventris</i>		✓	✓	✓	✓	✓
-	<i>Austronomus australis / Chaerephon jobensis</i>				✓	✓	
-	<i>Chalinolobus gouldii / Ozimops ridei</i>			✓		✓	



Common name	Scientific name	BLA 2018	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry
-	<i>Chalinolobus gouldii</i> / <i>Scotorepens balstoni</i>				✓		
-	<i>Chalinolobus nigrogriseus</i> / <i>Scotorepens greyii</i>				✓	✓	✓
-	<i>Chalinolobus nigrogriseus</i> / <i>Scotorepens</i> spp.		✓	✓		✓	
-	<i>Miniopterus australis</i> / <i>Vespadelus pumilus</i>				✓		✓
-	<i>M. o. oceanensis</i> / <i>P. adamsi</i>					✓	
-	<i>Nyctophilus</i> sp.		✓	✓			
-	<i>Nyctophilus</i> sp. / <i>Myotis macropus</i>	✓	✓		✓		
-	<i>Ozimops lumsdenae</i> / <i>Taphozous troughtoni</i>				✓		
-	<i>Ozimops ridei</i> and <i>Chalinolobus nigrogriseus</i>			✓			✓
-	<i>Ozimops ridei</i> / <i>Scoteanax rueppellii</i>				✓		
	<i>P. adamsi</i> or <i>Vespadelus troughtoni</i>						✓
-	<i>Scotorepens greyii</i> / <i>Scotorepens sanborni</i>	✓	✓	✓	✓	✓	✓
	<i>S. sanborni</i> / <i>M. o. oceanensis</i>					✓	
-	<i>Scotorepens orion</i> / <i>Scoteanax rueppellii</i>	✓					
	<i>S. rueppellii</i> or <i>S. orion</i>						✓
-	<i>V. pumilus</i> / <i>M. australis</i>					✓	
-	<i>Vespadelus troughtoni</i> / <i>Chalinolobus morio</i>		✓				
<b>Flying-foxes</b>							
spectacled flying-fox	<i>Pteropus conspicillatus</i>	✓					





## Appendix B Fixed-point survey results



SPECIES	Turbine									
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10
Australian magpie	1	1		2	4	6	1	1		
black-faced cuckoo-shrike	1		3	1		1				
brown falcon				1						
grey fantail		1			1			1		
grey shrike-thrush								1	1	
laughing kookaburra						1			1	
leaden flycatcher									1	
noisy friarbird	1				1					
noisy miner		6		6		10	2			
pale-headed rosella	1	1	1			6	1		1	
peaceful dove	3				4	8			4	
pied currawong			1							
rainbow bee-eater									3	
rainbow lorikeet						1				
red-backed fairy-wren	6					5	1		3	
red-browed finch						3				
rufous whistler		1						3		



scaly-breasted lorikeet	4									
spotted pardalote	3		1	1						
squatter pigeon (northern subspecies)		1		2	9	2				
striated pardalote	1					1			2	
Torresian crow						1				
wedge-tailed eagle									2	
weebill		3		1				3		
white-bellied cuckoo-shrike				1						
white-throated honeyeater	1	1	2	2		4	2	8		
willie wagtail					1					
yellow-faced honeyeater	3	2			1			4	3	
<b>Grand Total</b>	<b>17</b>	<b>18</b>	<b>12</b>	<b>13</b>	<b>17</b>	<b>52</b>	<b>13</b>	<b>8</b>	<b>29</b>	<b>7</b>



Species	Turbine									
	WTG11	WTG12	WTG13	WTG14	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20
Australian magpie			3		2					
black-faced cuckoo-shrike					1		1			
buff-rumped thornbill	4							1		
grey fantail							1			4
laughing kookaburra		1	2	1	2					2
Lewin's honeyeater									1	1
magpie-lark								2		
noisy friarbird										2
noisy miner			1	1	1		3		3	2
pale-headed rosella	2		10				2			3
peaceful dove		4		2		3	1			
pied currawong	1									3
rainbow lorikeet							3			
red-backed fairy-wren		1	4	10	1	5	10	4	3	2
rufous whistler							1	2		
scaly-breasted lorikeet		1	2							
spotted pardalote			1		1		1			
striated pardalote	1									
varied sittella				8			6			
wedge-tailed eagle	2						2			
weebill			1	3						
white-throated honeyeater	5	2		8	2	1	3	4	5	2
white-throated treecreeper							1		1	



willie wagtail				3	4					
yellow-faced honeyeater	2			1		2	1	3		6
<b>Grand Total</b>	<b>17</b>	<b>9</b>	<b>24</b>	<b>37</b>	<b>14</b>	<b>11</b>	<b>36</b>	<b>16</b>	<b>13</b>	<b>27</b>

	Turbine							
Species	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
Australian magpie				2				1
black-faced cuckoo-shrike				3				
brown goshawk								1
brown honeyeater	1				2			
buff-rumped thornbill		5						
grey fantail	1	2			5	1		1
grey shrike-thrush								1
laughing kookaburra		2			2		7	
leaden flycatcher					1			
noisy friarbird			1		2	1	5	1
noisy miner								6
pale-headed rosella		4	1	8				4
peaceful dove		2				3	2	
pheasant coucal						1		
pied currawong					2			1
rainbow bee-eater				3				
red-backed fairy-wren		6	7		5	2		
rufous whistler				2	3	2	1	



scaly-breasted lorikeet	5							
spotted pardalote	1	2	3	1	2	2		
striated pardalote	2			1		2		
wedge-tailed eagle	2							
white-bellied cuckoo-shrike	1							
white-throated honeyeater	1	3	2	5	2	8	7	
yellow thornbill	2							
yellow-faced honeyeater	4	1	1	1	1	4	3	
<b>Grand Total</b>	<b>5</b>	<b>31</b>	<b>12</b>	<b>23</b>	<b>31</b>	<b>20</b>	<b>30</b>	<b>30</b>





## Appendix C Bat call analysis



## Microbat Call Identification Report

<b>Prepared for ("Client"):</b>	E2M Pty Ltd
<b>Survey location/project name:</b>	Kaban Wind Farm, NE Qld
<b>Survey dates:</b>	6-13 September 2023
<b>Client project reference:</b>	
<b>Job no.:</b>	E2M-2306
<b>Report date:</b>	13 November 2023

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## Methods

### Data received

*Balance! Environmental* received 20,684 full-spectrum ultrasonic acoustic files (WAV files), recorded at 28 sites using Anabat Swift detectors (Titley Scientific, Brisbane). The detectors were deployed between 6<sup>th</sup> and 13<sup>th</sup> September 2023, with each site sampled for two consecutive nights with a single detector.

### Bat-call analysis

Analyses were performed in several steps with *Anabat Insight* (Version 2.0.8; Titley Scientific).

1. All WAV files were processed with a generic noise filter to exclude files containing only non-bat noise.
2. Files that passed the filter (i.e., contained bat calls) were then processed as follows:
  - a. All WAV files were processed through a Decision Tree Analysis to group and label files according to the average zero-crossing metrics of calls within each file. Separation was based primarily on the characteristic frequency (Fc) metric, but metrics such as pulse duration (Dur), slope of characteristic section (Sc) and time between pulses (TBC) were included to further refine calls recognition by the Decision Tree.
  - b. Species present within each Decision Tree group were then confirmed using a combination of further species-specific metric-based filters and manual review of the call spectrograms. Due to the large number of files included in the analysis, the species confirmation process continued only until all potential constituent species within each group were identified for each site. The remaining calls in each group retained a multi-species label and appear within the “unresolved” calls section of the results tables.
  - c. For each site, at least 100 (if available) of the WAV files that passed the noise filter were reviewed to search for Ghost Bat (*Macroderma gigas*) calls in the spectrograms. The species’ calls are not often recorded and tend to be lost in the ZC conversion process. It is also difficult to detect *M. gigas* calls using the ZC-metric-based filters

Manual species confirmation was based on comparing visual properties of call spectrograms and derived metrics with those of reference calls from northern Queensland and/or with published call descriptions (e.g., Armstrong *et al.* 2021, McKenzie *et al.* 2018, Milne 2004, Reinhold *et al.* 2001,). The likelihood of species’ occurrence on site was confirmed by referring to published distributional information (e.g., Australasian Bat Society 2021, (Churchill 2008; Baker & Gynther 2023).

### Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Armstrong *et al.* (2020).



## Results & Discussion

The noise-filtering process excluded 16,524 WAV files from further analysis. A total of 4198 individual bat calls were identified within the remaining 4160 WAV files.

Some 75% (3156) of the calls were positively identified to 14 distinct taxa, including:

- *Rhinolophus megaphyllus*
- *Chalinolobus gouldii*
- *Chalinolobus nigrogriseus*
- *Nyctophilus* sp. (could be any or all of *N. bifax*, *N. geoffroyi*, *N. gouldi*)
- *Scoteanax rueppellii*
- *Scotorepens greyii*
- *Vespadelus pumilus*
- *Miniopterus australis*
- *Miniopterus orianae oceanensis*
- *Austronomus australis*
- *Chaerephon jobensis*
- *Ozimops ridei*
- *Saccolaimus flaviventris*
- *Taphozous troughtoni*

The other 1042 “unresolved” calls included 890 that belonged to either *C. nigrogriseus* or *S. greyii*. Another 61 unresolved calls were allocated to three other groups representing species that were also reliably identified from more definitive calls.

Four unresolved groups represented at least one and up to four additional species that were not otherwise identified in the September 2023 dataset. Three of those species – *Pipistrellus adamsi*, *Scotorepens sanborni* and *Vespadelus troughtoni* – were identified in the March-April survey data (see Balance Environmental report dated 27/6/2023). The fourth unresolved species – *Scotorepens orion* – was not previously identified; however, the few calls from the September survey could simply be variant calls from *Scoteanax rueppellii*.

**Appendix 1** lists the species detected at each survey location and the number of calls attributed to each species. Sample call sonograms for each identified species are presented in **Appendix 2**.

## References

- Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera. Australasian Bat Society. Version 2020-06-09.  
URL: <http://ausbats.org.au/species-list/4593775065>
- Armstrong, K.N., Broken-Brow, J., Hoyer, G., Ford, G., Thomas, M. and Corben, C. (2021). Effective identification of sheath-tailed bats of Australian forests and woodlands. *Australian Journal of Zoology* **68**(6), 346-363. <https://doi.org/10.1071/ZO20044>.
- Australasian Bat Society (2021). *BatMap*. <http://ausbats.org.au/batmap>; accessed 7/9/2021.
- Baker, A. and Gynther, I. (ed.) (2023). *Strahan's Mammals of Australia*. 4th edition; New Holland; Sydney.
- Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.
- McKenzie, N.L., Bullen, R.D., Cowan, M.A. and Milne, D.J. (2018). Echolocation and distribution of *Saccolaimus saccolaimus* in north-western Australia. *Records of the Western Australian Museum* **33**, 135-144. DOI: 10.18195/issn.0312-3162.33(33 2).2018.135-144
- Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.
- Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.

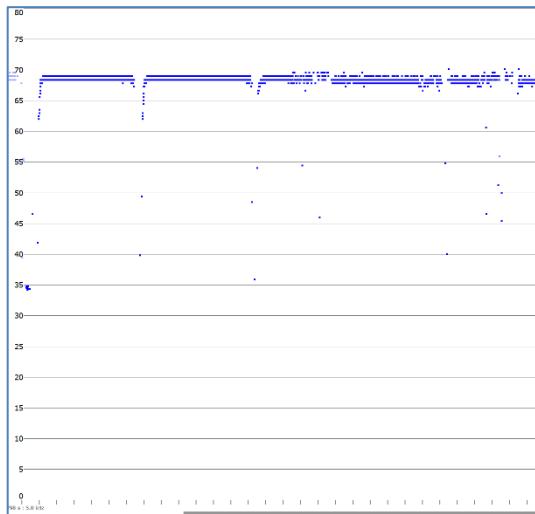
**Appendix 1** Microbat species recorded during the Kaban wind farm survey, September 2023; Sites WTG01-WTG14.  
Number of calls identified per species and unresolved species group per site.

Site WTG-:	01	02	03	04	05	06	07	08	09	10	11	12	13	14
<b>Positively identified calls</b>														
<i>Rhinolophus megaphyllus</i>	1	4		1					2					1
<i>Chalinolobus gouldii</i>	4	1	1	12	2	3	42	2			1	5		1
<i>Chalinolobus nigrogriseus</i>			1	4		3	3						2	3
<i>Nyctophilus sp.</i>	10	2	2	3		1	1			1		6	1	
<i>Scoteanax rueppellii</i>						2	1							4
<i>Scotorepens greyii</i>	1	4	2	4	2	1	2		2		6	1	2	3
<i>Vespadelus pumilus</i>														1
<i>Miniopterus australis</i>	54	47	66	73	240	15	36	16	10		11	1		36
<i>Miniopterus orianae oceanensis</i>	15	34	4	86	77	21	35	10	1		10	71	5	62
<i>Austronomus australis</i>	4	5	1	10	7		9	5						2
<i>Chaerephon jobensis</i>	3		1	1			1	2						2
<i>Ozimops ridei</i>	5	13	8	7	13	3	10	3						14
<i>Saccolaimus flaviventris</i>	4			7	3	1	4	3						1
<i>Taphozous troughtoni</i>			1	1			2							
<b>Unresolved calls</b>														
<i>C. gouldii</i> or <i>O. ridei</i>							1							
<i>C. nigrogriseus</i> or <i>S. greyii</i>		1		21	2	9	12				1	3	4	12
<i>M. australis</i> or <i>V. pumilus</i>	1				3									
<i>M. o. oceanensis</i> or <i>Pipistrellus adamsi</i>	2	4	3	1	2				1		1			
<i>O. ridei</i> or <i>S. rueppellii</i>						1								1
<i>P. adamsi</i> or <i>Vespadelus troughtoni</i>			1		28									
<i>S. greyii</i> or <i>S. sanborni</i>														
<i>S. rueppellii</i> or <i>S. orion</i>														
Site Total	104	115	91	231	379	60	159	41	16	1	30	87	14	143

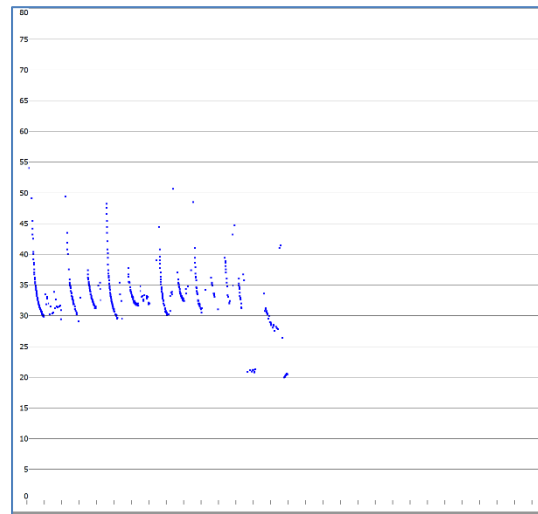
**Appendix 1** Microbat species recorded during the Kaban wind farm survey, September 2023; Sites WTG15-WTG28  
Number of calls identified per species and unresolved species group per site.

Site WTG-:	15	16	17	18	19	20	21	22	23	24	25	26	27	28
<b>Positively identified calls</b>														
<i>Rhinolophus megaphyllus</i>		1			1	1					1			
<i>Chalinolobus gouldii</i>		1	1	55	2		3							
<i>Chalinolobus nigrogriseus</i>	1	5	9		2	6	3	2	1	1	20			2
<i>Nyctophilus sp.</i>	2	6								1	5			
<i>Scoteanax rueppellii</i>		22	4	30										
<i>Scotorepens greyii</i>	5	3	4	2	47	117	3	7		8	4	8	4	5
<i>Vespadelus pumilus</i>			1											
<i>Miniopterus australis</i>		34	107	1	31	10	23	32		6	410	10	7	31
<i>Miniopterus orianae oceanensis</i>	8	31	42		8	3	8	63		57	134	50	4	26
<i>Austronomus australis</i>		6	4		1	2	1		1		3	1	2	14
<i>Chaerephon jobensis</i>		9	1	1	1						1			
<i>Ozimops ridei</i>		29	13	5	91	4	1	3		1	36			
<i>Saccolaimus flaviventris</i>		14	1	1	1	2	1			3				
<i>Taphozous troughoni</i>					1								2	1
<b>Unresolved calls</b>														
<i>C. gouldii</i> or <i>O. ridei</i>				45				1	1					
<i>C. nigrogriseus</i> or <i>S. greyii</i>		179	24	47	231	254	23	8	2	3	16	1		37
<i>M. australis</i> or <i>V. pumilus</i>								1			1			1
<i>M. o. oceanensis</i> or <i>Pipistrellus adamsi</i>					1	3		18		1		2		
<i>O. ridei</i> or <i>S. rueppellii</i>		2		2										
<i>P. adamsi</i> or <i>Vespadelus troughoni</i>			1							1				1
<i>S. greyii</i> or <i>S. sanborni</i>			2				1							
<i>S. rueppellii</i> or <i>S. orion</i>		1		16										
Site Total	16	343	214	205	418	402	67	135	5	82	631	72	19	118

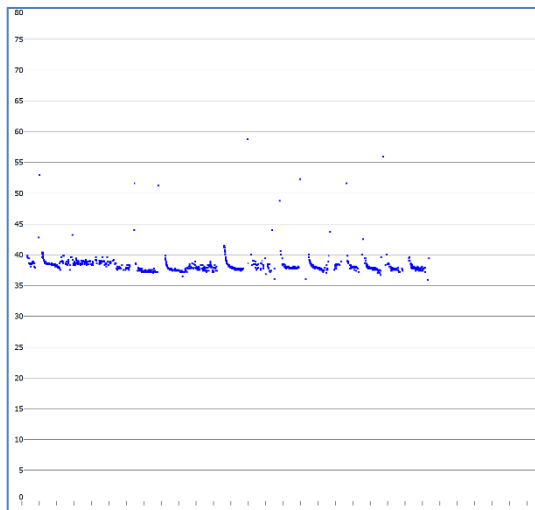
**Appendix 2** Representative call sequences from the Kaban wind farm survey, September 2023.  
x-axis = 10 ms per tick-mark; time between pulses removed ("compressed")



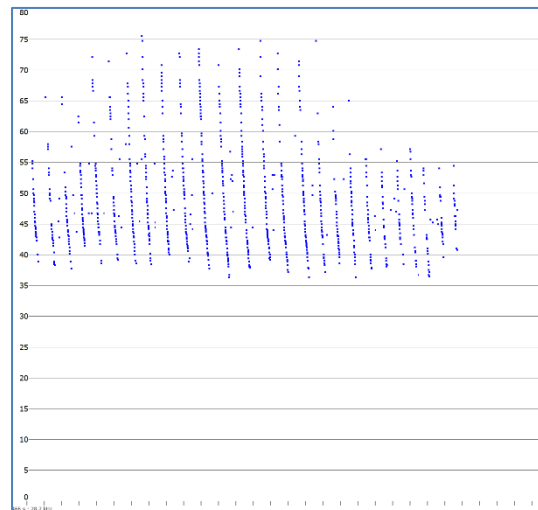
*Rhinolophus megaphyllus*



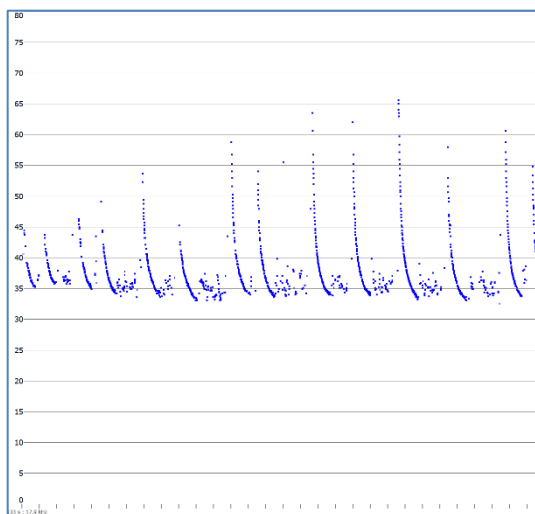
*Chalinolobus gouldii*



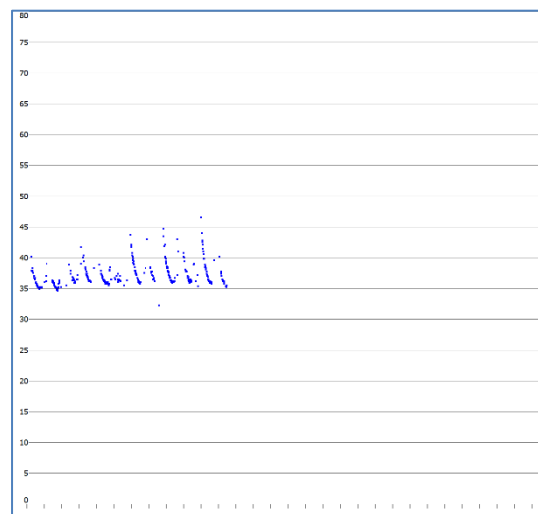
*Chalinolobus nigrogriseus*



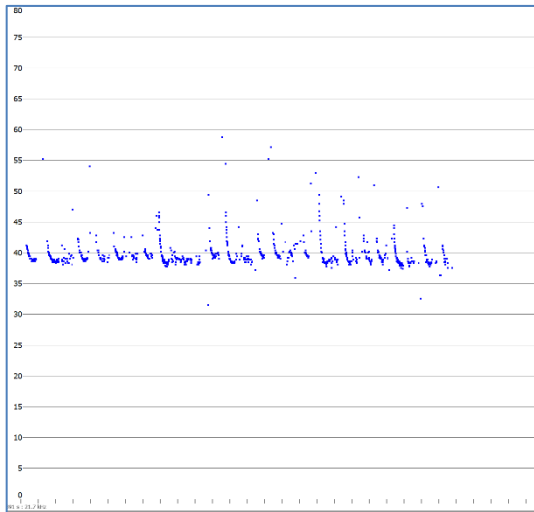
*Nyctophilus* sp.



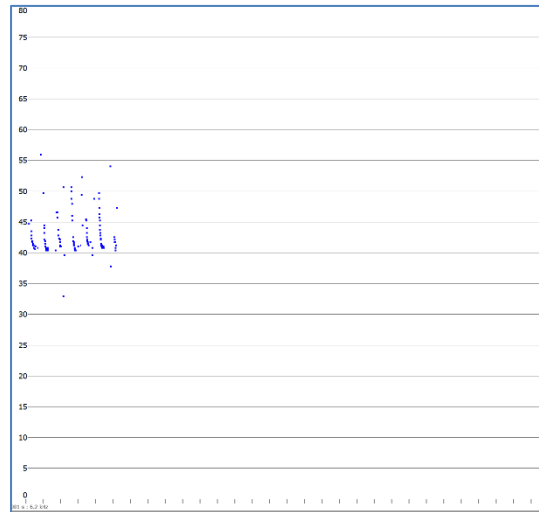
*Scoteanax rueppellii*



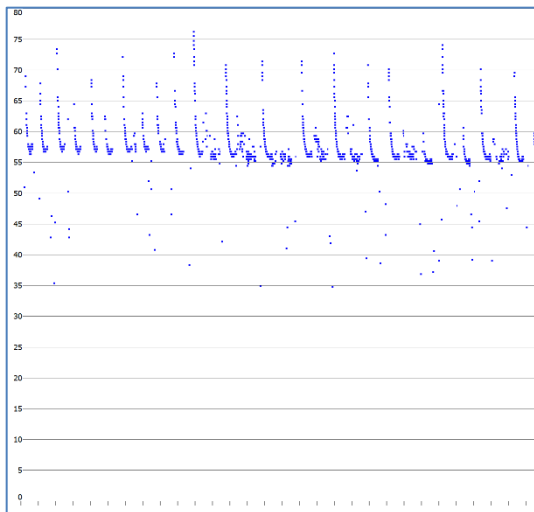
*S. rueppellii* or *Scotorepens orion*



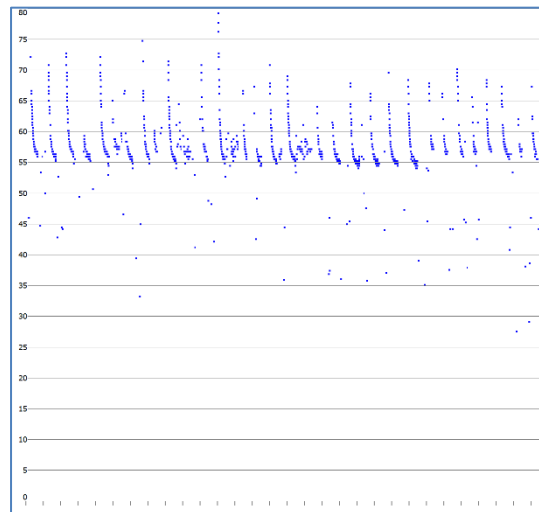
*Scotorepens greyii*



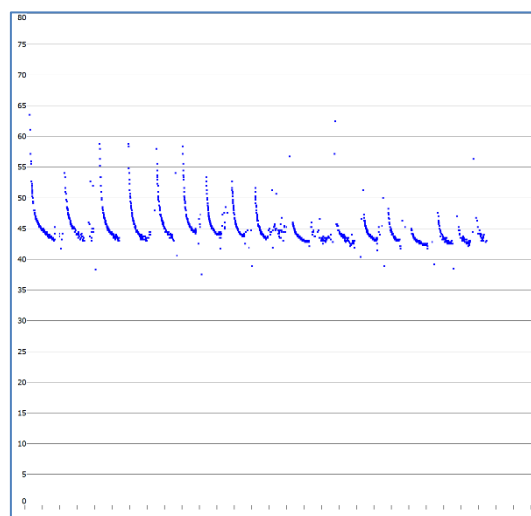
*S. greyii* or *S. sanborni*



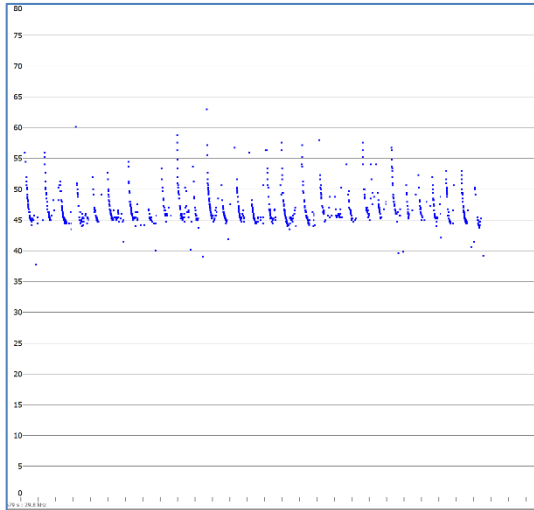
*Vespadelus pumilus*



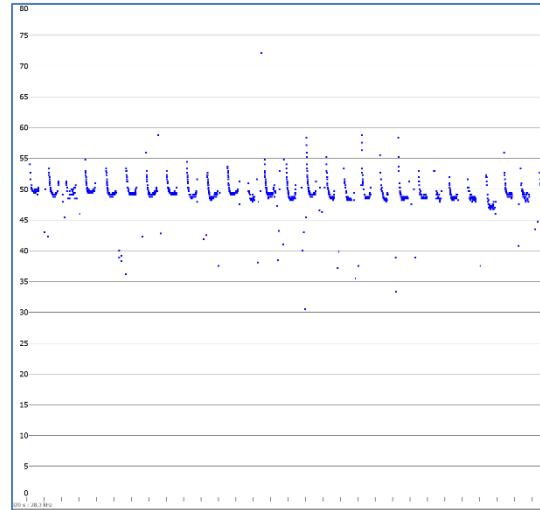
*Miniopterus australis*



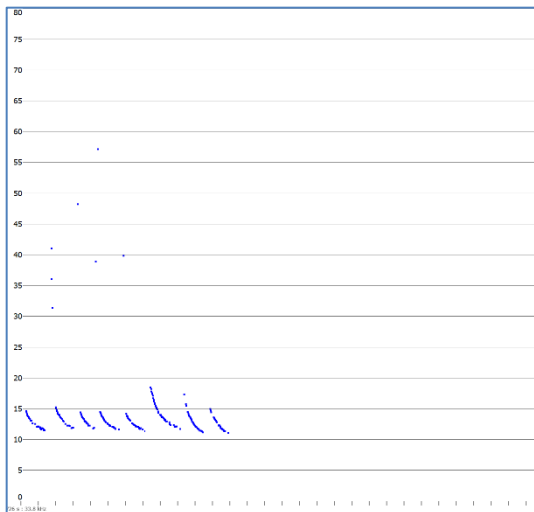
*Miniopterus orianae oceanensis*



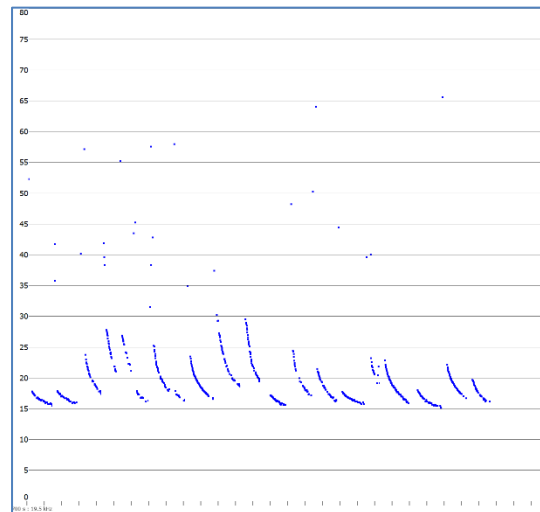
Probably *Pipistrellus adamsi*



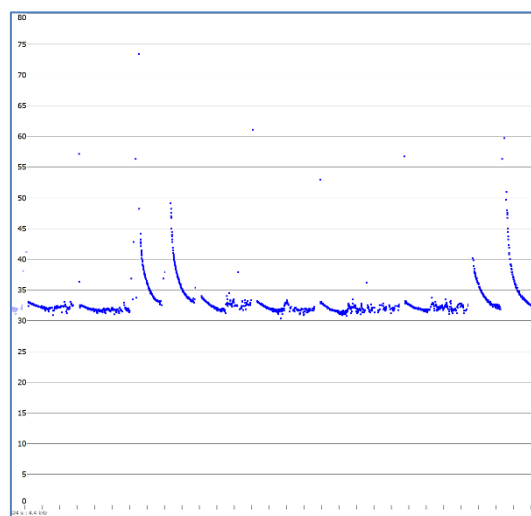
Probably *Vespadelus trougtoni*



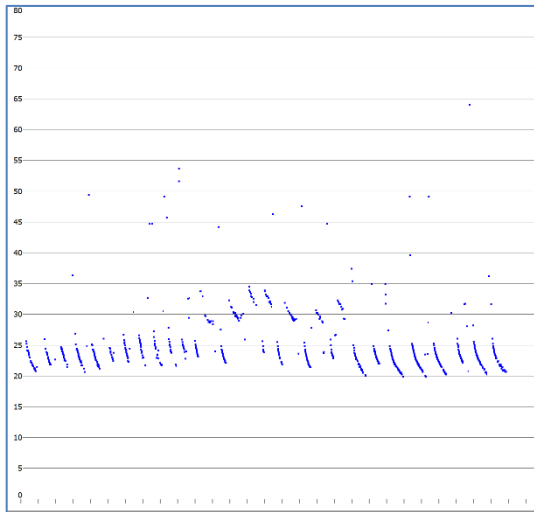
*Austronomus australis*



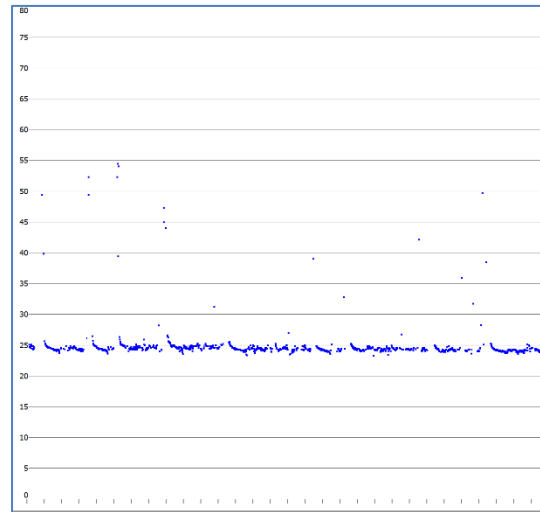
*Chaerephon jobensis*



*Ozimops ridei*



*Saccolaimus flaviventris*



*Taphozous troughoni*





## Appendix D Migratory species predicted time of occurrence within Site

Species	Wet Season						Dry Season					
	November	December	January	February	March	April	May	June	July	August	September	October
Fork-tailed swift ( <i>Apus pacificus</i> )												
Latham's snipe ( <i>Gallinago hardwickii</i> )												
oriental cuckoo ( <i>Cuculus optatus</i> )												
rufous fantail ( <i>Rhipidura rufifrons</i> )												
satin flycatcher ( <i>Myiagra cyanoleuca</i> )												
white-throated needletail ( <i>Hirundapus caudacutus</i> )												



= Optimum survey timing

#### Data Sources:

- Species Profile and Threats Database (DAWE 2020)
- The Field Guide to the Birds of Australia (Pizzey & Knight 2007)
- Handbook of Australian, New Zealand and Antarctic Birds (Higgins 1999)




# **Kaban Green Power Hub Post-commissioning Bird and Bat Utilisation Monitoring Report**

**February 2024 Wet Season**

**Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust**

**Level 21, 570 George Street, Sydney NSW 2000**

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Rev.	Issue Date	Description	Author (s)	Internal Review	Approved	Signature
0	19/06/2024	Issued for Use	E. Amsters	Ed Meyer	Dean Jones	

Document Reference: ...\\JOBS\\-2021\\QEJ21046\\DELIVERABLES\\FY24\\4. BBUS - Post Commissioning\\2. Wet Season 2024\\Rev0\\KABAN\_Feb2024\_Wet\_Season\_BBUS\_Rev0.pdf

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# Contents

<b>Definitions</b>	<b>v</b>
<b>Abbreviations</b>	<b>v</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Project background	1
1.2 Scope and objectives	1
<b>2 Methods</b>	<b>3</b>
2.1 Desktop assessment	3
2.2 Field survey	3
2.3 Collision risk assessment and ‘High Risk’ allocation	12
<b>3 Results</b>	<b>13</b>
3.1 Desktop results	13
3.2 Field results	14
3.3 Turbine collision risk assessment	24
<b>4 Conclusion</b>	<b>32</b>
<b>5 Recommendations</b>	<b>34</b>
<b>6 References</b>	<b>35</b>

# List of Tables

Table 1: Survey locations	4
Table 2: Fixed-point bird count survey schedule	8
Table 3: Echolocation detector survey schedule	10
Table 4: Megabat nocturnal survey schedule	11
Table 5: Known and likely to occur bird and bat species	13
Table 6: Species call records by turbine number / location (WTG01 - WTG14)	15
Table 7: Species call records by turbine number / location (WTG15 - WTG28)	17
Table 8: Bird species recorded at highest frequencies across fixed point surveys	20
Table 9: Most widely distributed birds across the Site	21
Table 10: Height of all bird observations	22
Table 11: Species observed within or above Rotor Sweep Area (RSA)	23
Table 12: Total bird species recorded during each BBUS	23
Table 13: Turbine collision risk assessment for known and likely occurring threatened and migratory species	25
Table 14: Incidental finds of migratory/threatened bird and bat species during operational phase	29
Table 15: Turbine risk profiles	30



## List of Figures

Figure 1: Project Location	2
Figure 2. Weather observations recorded from the BoM weather station (031200) closest to Site during the February 2024 survey period	4
Figure 3: Bird species accumulation curve	19
Figure 4: Number of bird species observed for all seven BBUS surveys during fixed point surveys	20
Figure 5. Observed bird heights for all fixed-point surveys: February 2024 BBUS.	22
Figure 6: Turbine risk profiles	31

## Appendices

Appendix A Species list
Appendix B Fixed-point survey results
Appendix C Bat call analysis
Appendix D Migratory species predicted time of occurrence within Site





## Definitions

Term	Definition
Kaban Wind Farm Pty Ltd	Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust
The Project	The Kaban Green Power Hub
The survey	Post-commissioning Wet Dry Season Bird and Bat Utilisation Survey (BBUS)
Rotor Sweep Area (RSA)	The maximum height and width range in which bird and bat species may be susceptible to turbine strike.
Suitable habitat	A species' preferred environment required to sustain a viable population. Suitable habitat may include breeding, foraging and shelter resources.
Site	The areas of Lot 1 on RP735194, Lot 33 on CWL374, Lot 35 on CWL391, Lot 2 on RP735194 and Lot 34 on CWL374 which contain proposed turbines.
Threatened species	Extinct (EX), extinct in the wild (XW), critically endangered (CE), endangered (E), vulnerable (V) or conservation dependent (CD) under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> or extinct in the wild (PE), Endangered, Vulnerable or Near Threatened (EVNT) under the <i>Nature Conservation Act 1992</i> .

## Abbreviations

Term	Definition
BBAMP	Bird and Bat Adaptive Management Plan
BBUS	Bird and Bat Utilisation Survey
DAWE	Commonwealth Government Department of Agriculture, Water and the Environment
DES	Department of Environment and Science
E2M	E2M Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
NC Act	<i>Nature Conservation Act 1992</i>
RSA	Rotor Sweep Area
sp.	Singular species. For example, <i>Eucalyptus</i> sp. refers to a single species of <i>Eucalyptus</i>
spp.	Multiple species. For example, <i>Eucalyptus</i> spp. refers to multiple species of <i>Eucalyptus</i>
WTG	Wind turbine generator



# 1 Introduction

## 1.1 Project background

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust (Kaban Wind Farm) have entered the commissioning stage of the Kaban Green Power Hub wind farm (the Project) in north Queensland. The wind farm is located near the township of Tumoulin, Queensland, within the Tablelands Regional Council Local Government Area. The wind farm contains 28 wind turbine generators (WTGs) located across the following land parcels, herein collectively referred to as the 'Site' (refer to Figure 1):

- Lot 1 on Plan RP735194
- Lot 2 on Plan RP735194
- Lot 33 on Plan CWL374
- Lot 34 on Plan CWL374 and a section of local road reserve.
- Lot 35 on Plan CWL391

## 1.2 Scope and objectives

Kaban Wind Farm has engaged E2M Consulting Pty Ltd (E2M) to undertake a post-commissioning 2024 Wet Season Bird and Bat Utilisation Survey (BBUS) (herein referred to as 'the survey') at the Kaban Green Power Hub. The survey was undertaken to meet the requirements of Conditions 5A, 6, 7, 9, and 11 of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) Variation of Conditions attached to approval EPBC 2018/8289 received from the (former) Department of Agriculture, Water and the Environment (DAWE) on 10 August 2022.

Specifically, the survey aimed to assess bird and bat utilisation of the Site during the 2023/2024 wet season with the following objectives:

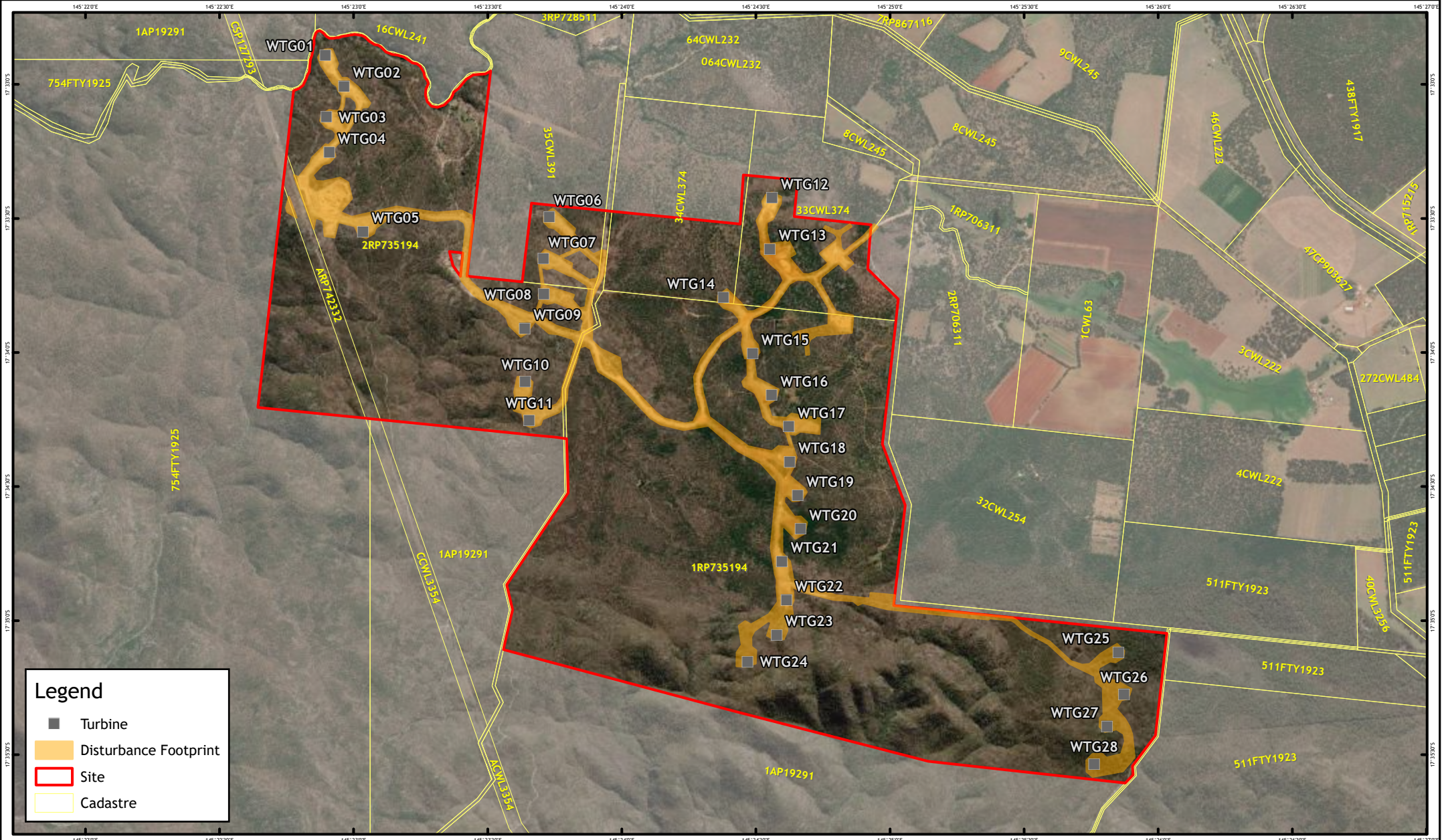
- Gathering wet season bird and bat utilisation survey data
- Ascertaining the risk of WTG collision with threatened and migratory bird and bat species
- Ensure survey timing is seasonally appropriate and is completed within the migratory periods of each EPBC Act listed migratory species as defined in the EPBC approval; and
- Determining a 'risk profile' for each WTG based on the results of the survey.

Bird and bat utilisation surveys have informed development of the Bird and Bat Adaptive Management Plan required per Conditions 5 and 10 of the EPBC approval.





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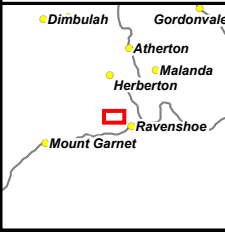
**Legend**

Turbine

Disturbance Footprint

Site

Cadastral



Scale     1:35,000     (A4)

0     0.5     1     1.5

Kilometres

Coordinate System: GCS GDA 1994

Notes:  
Aerial Imagery: © ESRI 2023  
Cadastral: © DoR 2023

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Rev	Description	Drawn	Approved	Date



**FIGURE 1: PROJECT LOCATION**

BIRD AND BAT UTILISATION  
2024 WET SEASON MONITORING REPORT  
KABAN GREEN POWER HUB

Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 2 Methods

### 2.1 Desktop assessment

Prior to construction, a desktop assessment was undertaken to identify species potentially occurring on site. This included a review of previous ecological reports for the Site, including:

- Kaban Green Power Hub: Post-commissioning Bird and Bat Utilisation 2023 Dry Season Monitoring Report (E2M Pty Ltd, 2023)
- Kaban Green Power Hub: Pre-commissioning Bird and Bat Utilisation 2022 Wet Season Monitoring Report (E2M Pty Ltd, 2022)
- Kaban Green Power Hub: Pre-commissioning Bird and Bat Utilisation 2022 Wet Season Monitoring Report (E2M Pty Ltd, 2021)
- Kaban Green Power Hub: Bird and Bat Utilisation Survey, Pre-commissioning 2020 Dry Season (E2M Pty Ltd, 2020)
- Kaban Green Power Hub: RFI - Ecological Assessment Report (E2M, 2019b)
- Kaban Green Power Hub: Ecological Gap Analysis (E2M, 2019a)
- Kaban Green Power Hub: Bird and Bat Adaptive Management Plan (E2M, 2020)
- Kaban Green Power Hub: Fauna Technical Report (AECOM, 2017); and
- Kaban Green Power Hub: Bird and Bat Pre-construction Utilisation Survey (Brett Lane & Associates Pty Ltd, 2017).

### 2.2 Field survey

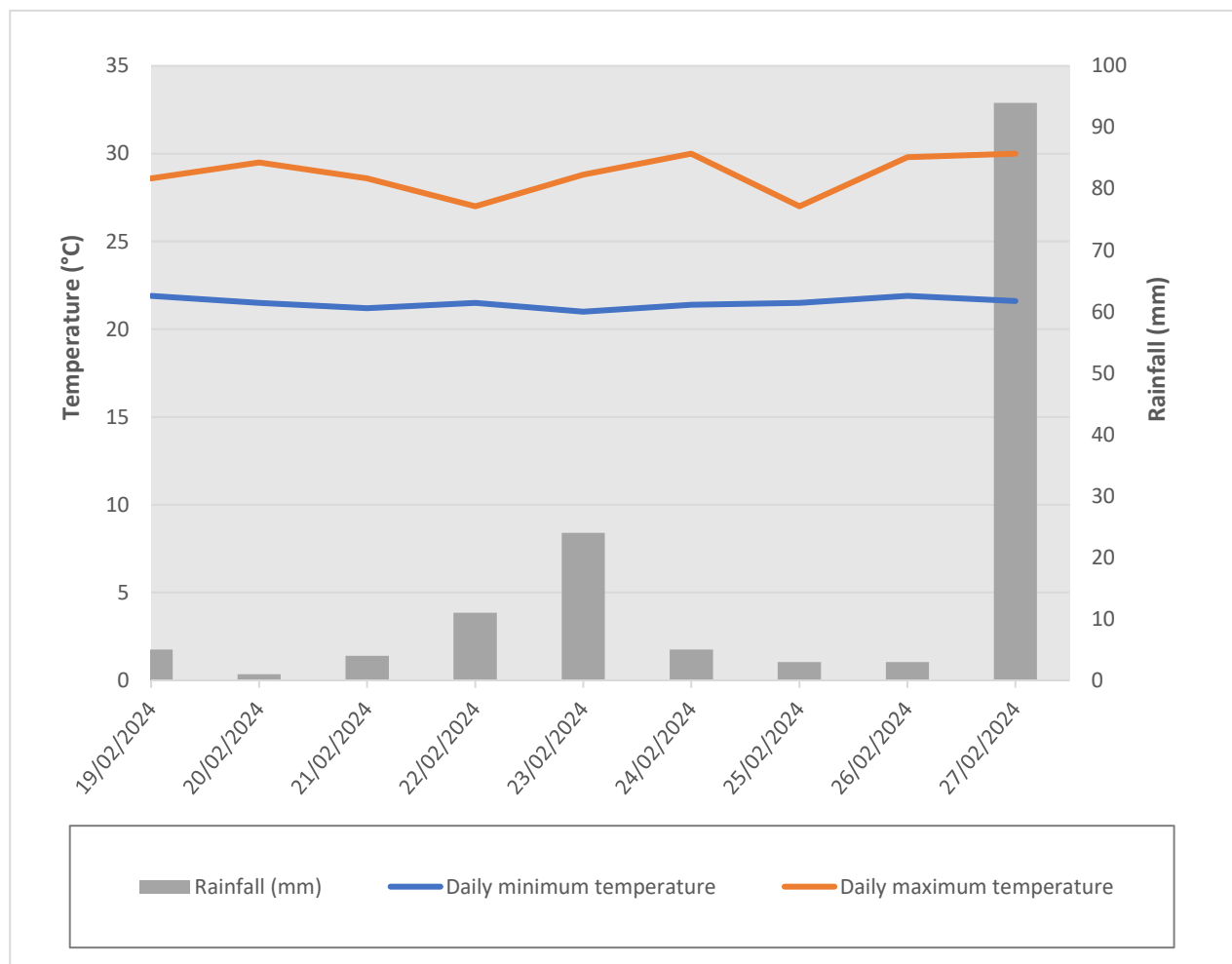
#### 2.2.1 Survey timing and conditions

The field survey was undertaken by two suitably qualified ecologists, Dean Jones and Wise Lum, between 19 and 27 February 2024.

Weather conditions in the region during the survey were warm with average daily temperatures in the mid-twenties and frequent periods of drizzle. During the survey period, daily rainfall totals at the closest Bureau of Meteorology weather station (station ID: 031200) ranged from 1 to 24 mm. Moderate easterly winds with gusts of up to 19.3 km/hr were recorded at the closest Weather Underground station (IQLDATHE4).



Figure 2. Weather observations recorded from the BoM weather station (031200) closest to Site during the February 2024 survey period



## 2.2.2 Survey locations

Utilisation surveys were conducted at all 28 WTGs (WTG01 - WTG28). The coordinates and habitat descriptions for each survey location are detailed in Table 1, with their location presented in Figure 1.

Table 1: Survey locations

WTG number / location	Ground-truthed Regional Ecosystem / habitat description	Coordinates
WTG01	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.548210 145.381571
WTG02	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.550126 145.38274
WTG03	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.552032 145.38164





WTG number / location	Ground-truthed Regional Ecosystem / habitat description	Coordinates
WTG04	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.55423 145.381818
WTG05	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland to low woodland on igneous hills and rocks	-17.559162 145.383913
WTG06	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.558235 145.395489
WTG07	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.560835 145.395136
WTG08	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.563049 145.395164
WTG09	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.565181 145.393968
WTG10	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.568497 145.393995
WTG11	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.570903 145.394247
WTG12	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.557055 145.409347
WTG13	Non-remnant / Non remnant vegetation, including artificial wetlands (dams)	-17.560235 145.409206
WTG15	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.563257 145.406316
WTG16	Remnant 7.8.8b: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.566732 145.408132
WTG17	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.569326 145.409315
WTG18	Non-remnant / Non remnant vegetation, including artificial wetlands (dams)	-17.571277 145.410381
WTG19	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.573464 145.410428
WTG20	Remnant 7.12.27a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.575547 145.410928
WTG21	Remnant 7.12.27a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.577627 145.411108
WTG22	Remnant 7.12.27a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.579659 145.40995
WTG23	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.582056 145.41024



WTG number / location	Ground-truthed Regional Ecosystem / habitat description	Coordinates
WTG24	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.584229 145.409627
WTG25	Remnant 9.12.30a: <i>Corymbia</i> and <i>Eucalypt</i> mixed woodland on igneous hills and rocks	-17.585886 145.407813
WTG26	Remnant 7.12.27c: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.585312 145.430873
WTG27	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.587917 145.431218
WTG28	Remnant 7.12.30a: <i>Corymbia citriodora</i> and mixed <i>Eucalypt</i> open woodland	-17.589915 145.430164

## 2.2.3 Bird utilisation survey

### 2.2.3.1 Fixed-point bird counts

Fixed-point bird counts were used to determine bird utilisation at each survey location. This involved an ecologist recording the presence and abundance of all bird species observed (heard and/or seen) within a 350 m radius of the survey point during a 20-minute survey period. Information collected during each survey included:

- Bird species
- Number of birds
- Observation type (seen or heard)
- Bird behaviour (flying or perched)
- Birds observed within the rotor sweep area (RSA)
- Height<sup>1</sup> at which bird was first observed, recorded in the following height categories:
  - Below RSA:
    - 0-10 m
    - 10-20 m
    - 20-30 m
    - 30-40 m
    - 40-50 m
    - 50-60 m
    - 60-80 m
  - RSA Height (80 - 255 m); and
  - Above RSA (>255 m).

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<sup>1</sup> Heights were estimated using landscape features such as trees and referencing against the WTG structure components.



Additionally, for threatened species and bird groups at greatest risk of WTG interaction (i.e. raptors and waterbirds) the maximum and minimum heights at which the birds were observed were recorded.

**Note:** Due to difficulties determining the number and height of birds based on call alone, only birds seen during surveys were included in the analysis of bird habitat/flight height utilisation. However, heard species were used when determining species presence and occurrence more broadly across the Site.

#### 2.2.3.2 Survey schedule

To identify variations in bird utilisation across different periods of the day, each survey location was assessed a minimum of 6 times throughout three different periods of the day (morning, mid-day and afternoon). Two surveys at each turbine were conducted during the morning, mid-day and afternoon sessions. A total of 168 surveys were conducted across the Site. Table 2 lists the date and time period each WTG location was surveyed during the February 2024 survey.

#### 2.2.3.3 Incidental observations

Whilst traversing the Site, incidental observations of threatened species, bird groups at greatest risk of WTG interaction (i.e., raptors and waterfowl) and species not previously recorded during fixed-point bird counts were also recorded.



Table 2: Fixed-point bird count survey schedule

Site	19/02/2024			20/02/2024			21/02/2024			22/02/2024			23/02/2024			25/02/2024	Total
	Mornin g	Midda y	After-noon	Mornin g	Midda y	After-noon	Mornin g	Midda y	After-noon	Mornin g	Midda y	After-noon	Mornin g	Midda y	After-noon	Morning	
WTG01			1					1		1			1	1	1		6
WTG02			1					1		1			1	1	1		6
WTG03			1					1		1			1	1	1		6
WTG04			1					1		1				1	1	1	6
WTG05			1	1				1	1	1				1			6
WTG06			1	1				1	1	1				1			6
WTG07			1	1				1	1	1				1			6
WTG08			1	1				1	1	1				1			6
WTG09			1	1	1		1	1	1								6
WTG10			1	1	1			1	1	1							6
WTG11				1	1			1	1	1					1		6
WTG12		1		1	1		1		1						1		6
WTG13		1		1	1	1	1								1		6
WTG14		1		1	1	1	1		1								6
WTG15		1		1	1		1					1			1		6
WTG16		1		1	1		1					1			1		6
WTG17	1			1	1			1				1			1		6
WTG18	1				1		1				1	1			1		6



	19/02/2024			20/02/2024		21/02/2024	22/02/2024		23/02/2024	25/02/2024	Total
WTG19	1			1	1	1	1		1		6
WTG20	1			1	1	1	1		1		6
WTG21	1	1			1	1	1	1			6
WTG22	1	1			1	1	1	1			6
WTG23	1	1			1	1	1	1			6
WTG24	1	1	1		1	1	1				6
WTG25	1	1			1		1	1	1		6
WTG26	1	1			1		1	1	1		6
WTG27	1	1			1		1	1	1		6
WTG28	1	1			1		1	1	1		6





## 2.2.4 Bat utilisation survey

### 2.2.4.1 Passive echolocation detection for microbats

Bat utilisation was determined through deployment of automated bat detection devices (Anabat Swift Detectors) that record species-specific echolocation call signatures of nearby microchiropteran bats (microbats). Detectors were fitted with an upward-facing, omnidirectional microphone and deployed approximately 2 m above ground at each of the WTG survey sites. All detectors were programmed to operate from dusk to dawn over two nights, yielding a total survey effort of 56 recorder-nights across the Site (see Table 3).

Following the field survey, all recordings were sent to a suitably qualified specialist (Greg Ford of Balance! Environmental) for analysis. Where possible, calls were identified to species level; however, where overlap exists between species' calls, calls were identified as belonging to a species complex.

**Table 3: Echolocation detector survey schedule**

Turbine number / location	Date set	Date retrieved	Survey nights
WTG01	21/02/2024	23/02/2024	2
WTG02	21/02/2024	23/02/2024	2
WTG03	21/02/2024	23/02/2024	2
WTG04	21/02/2024	23/02/2024	2
WTG05	21/02/2024	23/02/2024	2
WTG06	21/02/2024	23/02/2024	2
WTG07	21/02/2024	23/02/2024	2
WTG08	21/02/2024	23/02/2024	2
WTG09	23/02/2024	25/02/2024	2
WTG10	25/02/2024	27/02/2024	2
WTG11	25/02/2024	27/02/2024	2
WTG12	25/02/2024	27/02/2024	2
WTG13	25/02/2024	27/02/2024	2
WTG14	19/02/2024	21/02/2024	2
WTG15	19/02/2024	21/02/2024	2
WTG16	19/02/2024	21/02/2024	2
WTG17	19/02/2024	21/02/2024	2
WTG18	19/02/2024	21/02/2024	2
WTG19	19/02/2024	21/02/2024	2
WTG20	19/02/2024	21/02/2024	2
WTG21	19/02/2024	21/02/2024	2



Turbine number / location	Date set	Date retrieved	Survey nights
WTG22	23/02/2024	25/02/2024	2
WTG23	23/02/2024	25/02/2024	2
WTG24	23/02/2024	25/02/2024	2
WTG25	23/02/2024	25/02/2024	2
WTG26	23/02/2024	25/02/2024	2
WTG27	23/02/2024	25/02/2024	2
WTG28	23/02/2024	25/02/2024	2

#### 2.2.4.2 Megabat (flying-fox) nocturnal surveys

Two, 20-minute fixed-point surveys for megachiropteran bat (flying-fox) species were conducted at each WTG survey site, yielding a total of 56 surveys. Megachiropteran bat surveys commenced at dusk, when flying-fox species become active and leave their roost sites to forage. Observers conducting surveys recorded any observations of flying-fox, noting species and numbers. The surveys were completed over four nights with the sessions organised to capture an early evening and later survey period, between 6:30 and 9:30 pm. The megachiropteran bat survey timetable can be viewed in Table 4.

**Table 4: Megabat nocturnal survey schedule**

Start time	Date			
	24/02/2024	25/02/2024	26/02/2024	27/02/2024
18:30	WTG01 WTG12	WTG21 WTG28	WTG07 WTG10	WTG17 WTG22
19:00	WTG02 WTG13	WTG20 WTG27	WTG06 WTG11	WTG16 WTG24
19:30	WTG03 WTG14	WTG19 WTG26	WTG05 WTG09	WTG15 WTG23
20:00	WTG04 WTG10	WTG18 WTG25	WTG04 WTG08	WTG18 WTG25
20:30	WTG05 WTG11	WTG17 WTG24	WTG03 WTG14	WTG19 WTG26
21:00	WTG06 WTG09	WTG23 WTG25	WTG02 WTG12	WTG20 WTG27
21:30	WTG07 WTG08	WTG16 WTG22	WTG03 WTG13	WTG21 WTG28

**Note:** Survey times are rounded to the nearest half hour.



### 2.2.4.3 Incidental observations

Incidental observations of any megachiropteran bats (flying-foxes) or threatened microbats<sup>2</sup> throughout the Site were also recorded, along with information on behaviour (i.e. whether roosting or flying), height observed and number of individuals observed.

### 2.2.5 Survey limitations

- **Bird abundance:** Birds observed during a survey were included in counts only if observers were confident the same individual hadn't been counted earlier during the same survey event based on appearance (e.g., differences in plumage), behaviour (including movement/direction of travel when sighted), temporal overlap/separation of observations. Repeat observations of the same bird were not recorded unless the individual was observed within the RSA.
- **Microbats:** Data from bat echolocation detectors does not allow for the assessment of bat numbers, only relative activity (based on the number of calls detected per unit time). Data from bat detectors cannot be used to determine the flight height of bats recorded either. Due to the limited reach of bat detector microphones, the echolocation calls of microbats active within the RSA are unlikely to be captured on detectors deployed near ground level.
- **Megabats:** The presence/abundance of flying-foxes during surveys is likely dependent on the availability/abundance of flowering canopy trees on site, with flying-foxes more likely to occur on site when canopy trees are in flower. During the current survey period, flowering eucalypt and grevilleas were present at just 6 out of the 28 WTG sites surveyed and, as such, the paucity of flying-foxes during surveys may be attributed to the scarcity of flowering canopy trees.

## 2.3 Collision risk assessment and 'High Risk' allocation

Prior to construction, a desktop collision risk assessment was performed to identify threatened and migratory bird species potentially at risk of interacting with WTGs on Site (see Table 6 in 'Results' section).

Together with the result of the BBUS utilisation survey, the results of the desktop collision risk assessment were used to develop a 'risk profile' for each WTG. As per Condition 10 of the EPBC Act approval, WTGs have been assigned a 'low' or 'high' risk rating, as detailed below.

- **Low-risk:** A WTG that has not had an EPBC Act and/or *Nature Conservation Act* (NC Act) listed threatened or migratory bird or bat species detected within a 350 m radius; and
- **High-risk:** A WTG that has had an EPBC Act and/or NC Act listed threatened or migratory bird or bat species detected within a 350 m radius.

The purpose of determining WTG risk profiles is to guide WTG monitoring during the operational phase of the Project, with all high-risk WTG requiring ongoing monitoring.

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<sup>2</sup> While most microbats cannot be identified by flight alone, the threatened ghost bat (*Macroderma gigas*) can be readily identified due to its size, colour and flight pattern.



## 3 Results

### 3.1 Desktop results

Desktop assessment results identified eight bird species and two bat species listed as threatened or migratory under either the EPBC Act and/or NC Act as likely or known to occur on site.

**Table 5: Known and likely to occur bird and bat species**

Fauna species	EPBC Act status <sup>1</sup>	NC Act status <sup>1</sup>	Likelihood of occurrence
<b>Birds</b>			
<b>fork-tailed swift</b> ( <i>Apus pacificus</i> )	M	SLC	<sup>4</sup> <b>Known to occur:</b> Detected on site during incidental carcass searches
<b>Latham's snipe</b> ( <i>Gallinago hardwickii</i> )	M	SLC	<b>Likely to occur:</b> Suitable habitat occurs on site and the species has been previously recorded within 10km of the Site
<b>masked owl - northern</b> ( <i>Tyto novaehollandiae kimberli</i> )	V	V	<b>Likely to occur:</b> Suitable habitat occurs on site and the species has been previously recorded within 5km of the Site
<b>oriental cuckoo</b> ( <i>Cuculus optatus</i> )	M	SLC	<b>Likely to occur:</b> Suitable habitat occurs on site and the species has been previously recorded within 12km of the Site
<b>black-faced monarch</b> ( <i>Monarcha melanopsis</i> )	M	LC	<sup>4</sup> <b>Known to occur:</b> Detected on site during incidental carcass searches
<b>satin flycatcher</b> ( <i>Myiagra cyanoleuca</i> )	M	LC	<b>Likely to occur:</b> Suitable habitat occurs on site and the species has been previously recorded within 12km of the Site
<b>rufous fantail</b> ( <i>Rhipidura rufifrons</i> )	M	LC	<sup>4</sup> <b>Known to occur:</b> Detected on site during incidental carcass searches
<b>white-throated needletail</b> ( <i>Hirundapus caudacutus</i> )	V/M <sup>2</sup>	V <sup>2</sup>	<sup>4</sup> <b>Known to occur:</b> Detected on site during incidental carcass searches and seen utilising air space during BBUS survey
<b>Bats</b>			
<b>ghost bat</b> <i>Macroderma gigas</i>	V	E	<b>Known to occur:</b> A single individual has been recorded previously on site.
<b>spectacled flying-fox</b> <i>Pteropus conspicillatus</i>	V <sup>3</sup>	V <sup>3</sup>	<b>Known to occur:</b> Three individuals have been recorded previously on site.

<sup>1</sup> E = Endangered, V = Vulnerable, M = Migratory, SLC = Special Least Concern, LC = Least Concern

<sup>2</sup> Species is listed as Vulnerable under the EPBC Act as of the 4<sup>th</sup> July 2019, and NC Act as of 19<sup>th</sup> September 2019. However, assessment is based on the species status when the Project's EPBC Act referral was submitted. As such, the species has been assessed as a migratory species (EPBC Act) and SLC (NC Act).

<sup>3</sup> Species is listed as Endangered under the EPBC Act as of the 22<sup>nd</sup> February 2019, and NC Act as of 19<sup>th</sup> September 2019. However, assessment is based on the species status when the Project's EPBC Act referral was submitted. As such, the species has been assessed as Vulnerable (EPBC Act/ NC Act).

<sup>4</sup> These species have been detected on site or utilising the air space above the Site.



## 3.2 Field results

### 3.2.1 Bat utilisation

#### 3.2.1.1 Microbats

The microbat utilisation survey identified a total of 11,206 individual bat calls, from at least 17 distinct taxa and three “unresolved” call groups. About 49% of calls (5526) recorded during the current surveys were positively identified (Balance! Environmental, 2024) (see Appendix C for details). The majority (96%) of unresolved calls were attributed to *C. nigrogriseus/Scotorepens sp.* (Appendix C), (Balance! Environmental, 2024).

The frequency of calls and number of resolved species varied greatly between turbine locations. WTG 26 had two calls and two species, whereas WTG 20 had 2681 calls from at least 8 species. The highest number of confirmed microbat species was recorded at WTG 16 with 12 species (Appendix C).

Overall, the most frequently-detected, positively identified microbat species during surveys was *Ozimops ridei*, comprising up to 37% of calls recorded (i.e., 2,065 calls). This species was recorded at 27 out of 28 WTG sites.

There were no threatened microbat species recorded at any WTG sites.

#### 3.2.1.2 Megabats: Flying-foxes

No flying-foxes were recorded during any of the 56 nocturnal fixed-point surveys (totalling >186 hours of survey) conducted at the Site, nor were there any incidental observations of flying-fox species during the current survey period.



**Table 6: Species call records by turbine number / location (WTG01 - WTG14)**

Species	Turbine number / location													
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10	WTG11	WTG12	WTG13	WTG14
<b>Positively identified calls</b>														
Cape York Pipistrelle ( <i>Pipistrelle adamsi</i> )														1
Chocolate wattled bat ( <i>Chalinolobus morio</i> )														
eastern bentwing bat ( <i>Miniopterus orianae oceanensis</i> )		7	1	4	7	34	29	11	2			1	14	18
Eastern cave bat ( <i>Vespadelus troughtoni</i> )		2		3						1		1		
eastern freetail bat ( <i>Ozimops ridei</i> )	18	1	7	2	8	10	76	2	9	5	2	959	341	20
eastern horseshoe bat ( <i>Rhinolophus megaphyllus</i> )			1		1									
Gould's wattled bat ( <i>Chalinolobus gouldii</i> )	16		11	2	45	19	305	18	3	2	5	15	7	3
greater broad-nosed bat ( <i>Scoteanax rueppellii</i> )	2					9	2					5	3	4
hoary wattled bat ( <i>Chalinolobus nigrogriseus</i> )	1	3		1		18	17	16	2			32	10	5
little bentwing bat ( <i>Miniopterus australis</i> )	3	28	5	42	13	190	63	7	5	2		16	7	28
little broad-nosed bat ( <i>Scotorepens greyii</i> )						19	111	1				1	1	1
Northern broad-nosed bat ( <i>Scotorepens sanborni</i> )							67							



Species	Turbine number / location													
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10	WTG11	WTG12	WTG13	WTG14
northern free-tailed bat ( <i>Ozimops lumsdenae</i> )						1								
greater northern freetail bat ( <i>Chaerephon jobensis</i> )			4	3	1	1	3		1					
white-striped freetail bat ( <i>Austronomus australis</i> )	5		10	15	1	27	36	12				2	2	
yellow-bellied sheath-tail-bat ( <i>Saccolaimus flaviventris</i> )	2		1										5	
<i>Nyctophilus spp</i>	1	1	1	1				1				2		2
Unresolved calls														
<i>C. gouldii</i> or <i>O. ridei</i>	15		10		7	8	14	1			1	36	15	
<i>C. nigrogriseus</i> or <i>Scotorepens sp.</i>	7	7	4	4	3	184	762	163	12	17	2	338	66	24
<i>S. greyii</i> or <i>S. sanborni</i>							40							
<b>Turbine Site Total</b>	<b>70</b>	<b>49</b>	<b>55</b>	<b>77</b>	<b>86</b>	<b>519</b>	<b>1526</b>	<b>232</b>	<b>34</b>	<b>27</b>	<b>10</b>	<b>1408</b>	<b>471</b>	<b>106</b>



**Table 7: Species call records by turbine number / location (WTG15 - WTG28)**

Species	Turbine number / location													
	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
<b>Positively identified calls</b>														
Cape York Pipestrelle ( <i>Pipestrelle adamsi</i> )		2			9		3							
Chocolate wattled bat ( <i>Chalinolobus morio</i> )		1												
eastern bentwing bat ( <i>Miniopterus orianae oceanensis</i> )	28	38	6	13	26	24	11	2		1	10		6	
Eastern cave bat ( <i>Vespadelus troughtoni</i> )	1		1	3							1			
eastern forest bat ( <i>Vespadelus pumilus</i> )														
eastern freetail bat ( <i>Ozimops ridei</i> )	164	135	21	5	11	117	28	15	6	21	75	1	6	
eastern horseshoe bat ( <i>Rhinolophus megaphyllus</i> )					1	2	1							
Gould's wattled bat ( <i>Chalinolobus gouldii</i> )	172	47	1	1	5	576	7	2						
greater broad-nosed bat ( <i>Scoteanax rueppellii</i> )	3	5	2	1	27			2			1			
hoary wattled bat ( <i>Chalinolobus nigrogriseus</i> )	6	10	3	9	17	33	6	7	7	4	6		14	1
little bentwing bat ( <i>Miniopterus australis</i> )	20	113	16	29	4	306	69	9	1	9	43		11	





Species	Turbine number / location													
	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
little broad-nosed bat ( <i>Scotorepens greyii</i> )	1	1		43	9	51	1		3	6	4		2	
Northern broad-nosed bat ( <i>Scotorepens sanborni</i> )					5									
northern free-tailed bat ( <i>Ozimops lumsdenae</i> )								2		1				
greater northern freetail-bat ( <i>Chaerephon jobensis</i> )	1	1	1											
white-striped freetail bat ( <i>Austronomus australis</i> )	11	15	2	1			5	1		11	3	1	2	
yellow-bellied sheath-tail bat ( <i>Saccolaimus flaviventris</i> )														
<i>Nyctophilus spp.</i>	3	6	1			1							1	
Unresolved calls														
<i>C. gouldii</i> or <i>O. ridei</i>	24	13	2			1	3							
<i>C. nigrogriseus</i> or <i>Scotorepens sp.</i>	87	43	43	542	1076	1541	53	78	268	35	23	0	79	
<i>S. greyii</i> or <i>S. sanborni</i>				1		29								3
Turbine location total	521	430	99	648	1190	2681	187	118	285	88	166	2	121	521

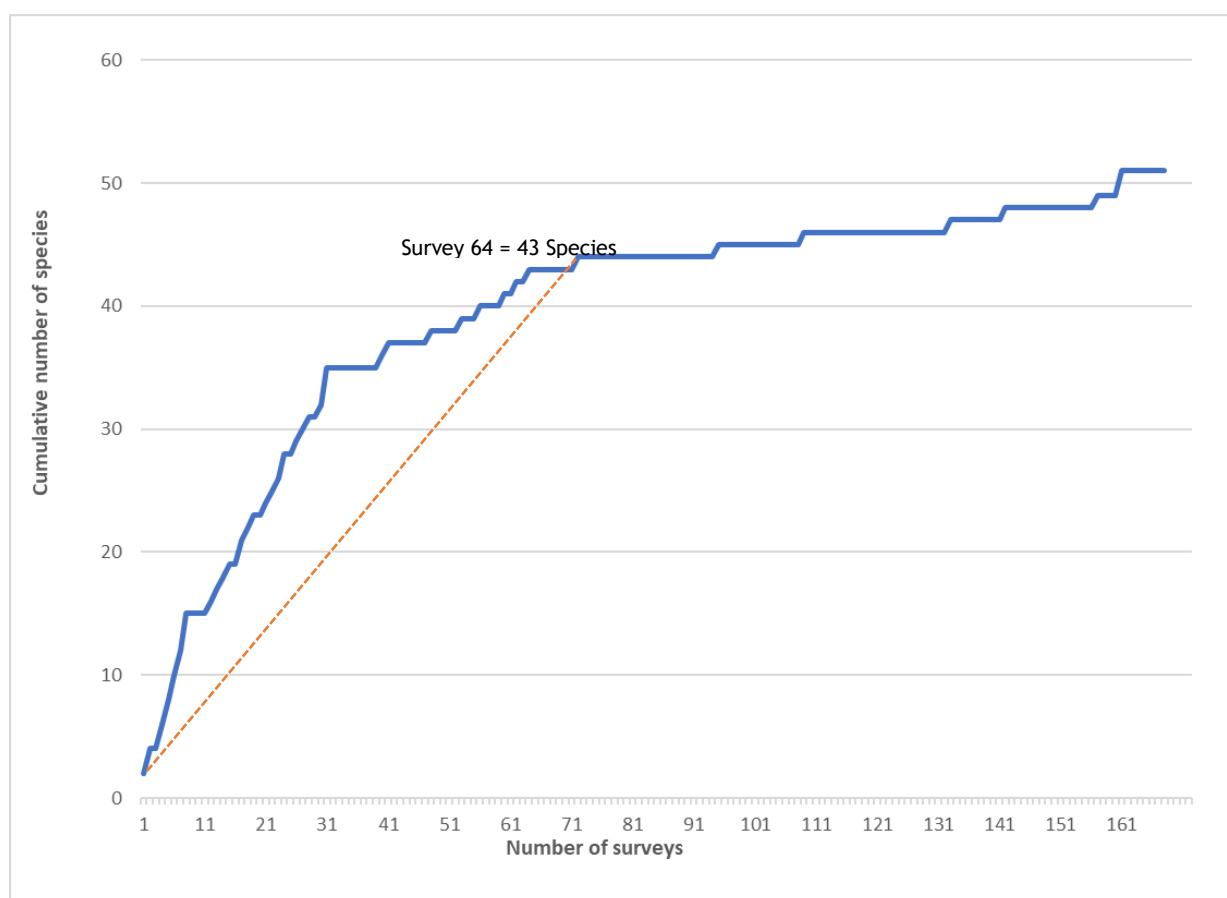


### 3.2.2 Bird utilisation

#### 3.2.2.1 Survey effort

Survey effort during the current survey period is considered adequate to account for the majority of bird species utilising the Site. From 168 surveys the species accumulation curve in Figure 3 shows that 43 (84%) of the 51 species recorded were detected in the first 64 surveys.

Figure 3: Bird species accumulation curve



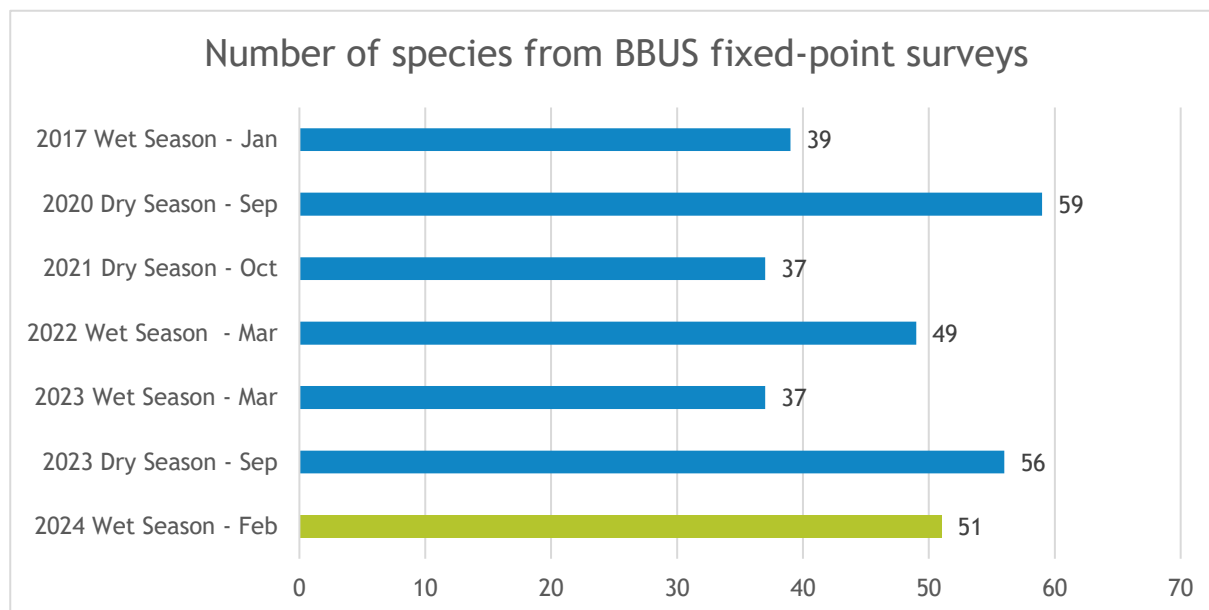
#### 3.2.2.2 Bird diversity, abundance and distribution

##### 3.2.2.2.1 Bird Diversity

A total of 51 bird species were observed during the field survey (Appendix A), which is considerably higher than the baseline number of 39 species identified during the 2107 BBUS survey ((Brett Lane & Associates Pty Ltd, 2017)). Fifty-one species is the third highest number recorded from all bird utilisation surveys conducted to date, with the highest total (59 species) recorded during the 2020 dry season survey (see Figure 4).



**Figure 4: Number of bird species observed for all seven BBUS surveys during fixed point surveys**



### 3.2.2.2.2 Detection frequencies

Of the 51 species observed during fixed-point surveys, 13 species were recorded within 10% or more, of surveys, as detailed in Table 8. Amongst the more frequently recorded species during surveys were spotted pardalote, noisy miner and yellow-faced honeyeater, all of which were recorded on >25% of surveys. All other species were recorded at lower frequencies than this.

**Table 8: Bird species recorded at highest frequencies across fixed point surveys**

Common name	Scientific name	Number of surveys recorded	Percent of surveys recorded
spotted pardalote	<i>Pardalotus punctatus</i>	68	39%
noisy miner	<i>Manorina melanocephala</i>	45	27%
yellow-faced honeyeater	<i>Lichenostomus chrysops</i>	42	26%
white-throated honeyeater	<i>Melithreptus albogularis</i>	37	23%
striated pardalote	<i>Pardalotus striatus</i>	36	22%
red-backed fairy-wren	<i>Malurus melanocephalus</i>	26	15%
Australian magpie	<i>Gymnorhina tibicen</i>	25	15%
noisy friarbird	<i>Philemon corniculatus</i>	25	15%
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	25	14%
grey butcherbird	<i>Cracticus torquatus</i>	24	14%
pale-headed rosella	<i>Platycercus adscitus</i>	22	14%



Common name	Scientific name	Number of surveys recorded	Percent of surveys recorded
laughing kookaburra	<i>Dacelo novaeguineae</i>	18	10%
brush cuckoo	<i>Cacomantis variolosus</i>	15	10%

### 3.2.2.2.3 Bird species distribution throughout site

Twelve of the 51 bird species recorded during surveys were recorded at 50% or more of survey sites, with the spotted pardalote recorded at all 28 (100% of) survey sites and the yellow-faced honeyeater and noisy miner recorded at 93 and 82% of survey sites respectively, as detailed in Table 9.

**Table 9: Most widely distributed birds across the Site**

Common name	Scientific name	Observations at different turbine locations	Percent of total turbine locations
spotted pardalote	<i>Pardalotus punctatus</i>	28	100
yellow-faced honeyeater	<i>Lichenostomus chrysops</i>	26	93
noisy miner	<i>Manorina melanocephala</i>	23	82
white-throated honeyeater	<i>Melithreptus albogularis</i>	21	75
striated pardalote	<i>Pardalotus striatus</i>	21	75
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	18	64
noisy friarbird	<i>Philemon corniculatus</i>	17	61
red-backed fairy-wren	<i>Malurus melanocephalus</i>	16	57
grey butcherbird	<i>Cracticus torquatus</i>	16	57
laughing kookaburra	<i>Dacelo novaeguineae</i>	14	50
pale-headed rosella	<i>Platycercus adscitus</i>	14	50
Lewin's honeyeater	<i>Meliphaga lewinii</i>	14	50

### 3.2.2.2.4 Threatened and migratory species

There were no migratory or threatened species recorded during fixed-point surveys.

### 3.2.2.3 Flight heights

Approximately 99% of bird observations during surveys were of birds perching or flying outside the Rotor Sweep Area height (Table 10 and Figure 5). Only two species were observed flying within or above the RSA. These were the pale-headed rosella and the wedge-tailed eagle.

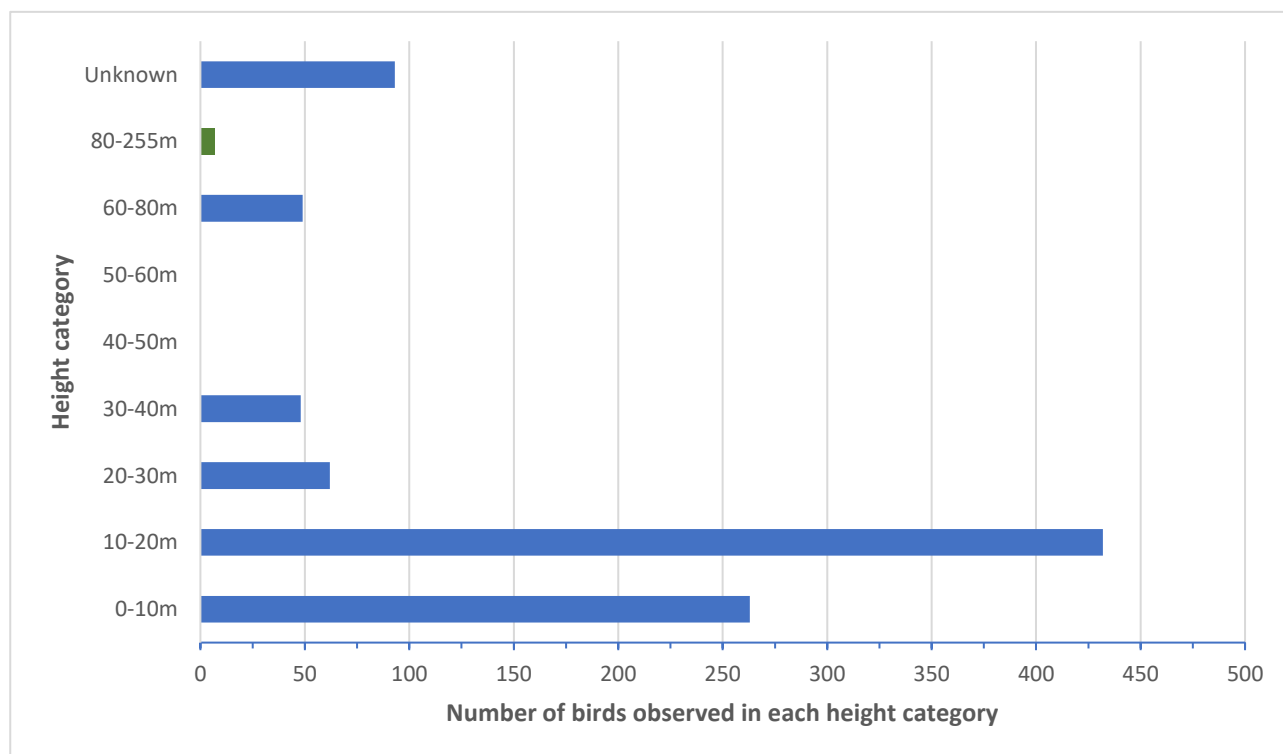
A full summary of the number and height of birds recorded during the February 2024 survey is provided in Table 10. Table 11 provides details of bird species observed flying within and above the RSA.



**Table 10: Height of all bird observations**

Height Observed	Number of observations	Percent of total observations
0-10m	263	28%
10-20m	432	45%
20-30m	62	6%
30-40m	48	5%
40-50m	0	0%
50-60m	0	0%
60-80m	49	5%
80-255m (RSA)	7	1%
Unknown	93	10%
<b>TOTAL</b>	<b>954</b>	<b>100</b>

**Figure 5. Observed bird heights for all fixed-point surveys: February 2024 BBUS.**



**Table 11: Species observed within or above Rotor Sweep Area (RSA)**

Common name	Scientific name	# of Survey Periods Observed	Number of birds observed within RSA	# birds above RSA
pale-headed rosella	<i>Platycercus adscitus</i>	1	4	0
wedge-tailed eagle	<i>Aquila audax</i>	2	4	0

### 3.2.2.4 Historical Observations

Bird and bat utilisation surveys undertaken on site since 2020 include the following:

1. January 2017 wet season survey
2. September 2020 dry season survey
3. October 2021 dry season survey
4. March 2022 wet season survey
5. March 2023 wet season survey
6. September 2023 dry season survey, and
7. February 2024 wet season survey.

The number of bird species recorded during fixed-point surveys for each BBUS is detailed in Table 12. The number of bird species recorded during the 2024 wet season survey is lower than the preceding 2023 dry season survey but still higher than all previous BBUSs except for the 2020 dry season survey.

**Table 12: Total bird species recorded during each BBUS**

BBUS	2020 Dry Season	2021 Dry Season	2022 Wet Season	2023 Wet Season	2023 Dry Season	2024 Wet Season
# of Species	58	38	49	39	57	51



## 3.3 Turbine collision risk assessment

### 3.3.1 Bird Survey

#### 3.3.1.1 Threatened species

No threatened bird species were observed during 2024 wet season bird and bat utilisation survey.

#### 3.3.1.2 Migratory species

No migratory bird species were recorded on site during the 168 fixed-point surveys conducted during the February 2024 wet season survey.

### 3.3.2 Bat Survey

#### 3.3.2.1 Threatened microbats

The only threatened microbat species assessed as likely or known to occur on Site is the ghost bat (*Macroderma gigas*). There has only been one observation of this bat species on Site during an earlier survey, however it has not been detected on any subsequent surveys. The infrequent occurrence of this bat and its flight behaviour make it a 'low risk' species in terms of turbine collision risk (Table 13).

No other threatened microbats are considered likely to occur on site .

#### 3.3.2.2 Threatened megabats

While no threatened flying-fox species were recorded during the 2024 wet season survey, the spectacled flying-fox (*Pteropus conspicillatus*) has been recorded during previous surveys and has been detected during incidental carcass searches (Table 14). No other threatened flying fox species are considered likely to occur within the Site (Table 13).



Table 13: Turbine collision risk assessment for known and likely occurring threatened and migratory species

Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
Threatened species					
masked owl ( <i>Tyto novaehollandiae kimberli</i> )	V	V	<p>The species is known to occur in riparian forest, rainforest, open forest and Melaleuca swamps and the edges of mangroves, as well as along margins of sugar cane fields (DAWE, 2021).</p> <p>While the species has previously recorded within 10km of the Site, records of the species across the Atherton Tablelands are scattered, infrequent and at low densities, reducing the risk of collision.</p>	<p>The species occupies permanent large home ranges and hunts primarily on the ground or within the canopy, taking small mammals (Curtis &amp; Dennis 2012, DAWE, 2021). It typically glides from perches in trees when foraging (Brett Lane &amp; Associates Pty Ltd, 2017). As such, the species is unlikely to occur within the RSA, and has a low risk of turbine collision.</p>	<p><b>Low risk:</b></p> <p>While the species is considered likely to occur on site, the risk of turbine collision is low because of the species' flight behaviour.</p>
red goshawk ( <i>Erythroriorchis radiatus</i> )	V	V	<p>The species is known to have a large home range covering between 50 and 220 square kilometres. The species prefers a mix of vegetation types including tall open forest, woodland, lightly treed savannah and the edge of rainforest (DES 2021).</p> <p>While the species has previously been recorded within 10km of the Site, records of the species across the Atherton Tablelands are scattered, infrequent and at low densities, reducing the risk of collision.</p>	<p>Typically the species perches in and hunts from canopy trees but it is known to undertake fast agile flights 10-50m above the tree canopy and soar 200-300 m above its territory (Brett Lane &amp; Associates Pty Ltd, 2017). These flight behaviours place the species at risk of turbine collision.</p>	<p><b>Low risk:</b></p> <p>While the species' flight behaviour makes the species susceptible to turbine collision, the overall risk of collision is considered low because of the species' large home range and paucity of records near to the site.</p>





Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
Migratory species					
fork-tailed swift ( <i>Apus pacificus</i> )	M	SLC	<p>In Australia, this species mostly occurs over inland plains but sometimes above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh (DAWE, 2021). The species also occurs over treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes (DAWE, 2021). On occasion, birds have also been sighted above rainforests, wet sclerophyll forest or plantations of pines (DAWE, 2021).</p> <p>The species has been previously recorded within 10 km of the Site and is predicted to intermittently forage within the airspace above the Site.</p>	The fork-tailed swift is an aerial forager spending large periods of within RSA heights foraging on insect prey (Higgins, 1999).	<b>High risk:</b> The species flight behaviour makes it highly susceptible to collision, however the frequency of collision is likely to be low given the species' highly dispersive, vagile nature.
Latham's snipe ( <i>Gallinago hardwickii</i> )	M	SLC	<p>Latham's snipe is a non-breeding visitor to south-eastern Australia and is a passage migrant through northern Australia (DAWE, 2021). In Australia, Latham's snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) (DAWE, 2021).</p> <p>Historical records show the species has previously recorded on site.</p>	While the species primarily forages on the ground, it is possible that the species may occur within the RSA during migration and dispersal. However, the species is unlikely to frequent the Site in large numbers given the lack of extensive wetland habitat.	<b>Moderate risk:</b> The species may occur within the RSA during migration and dispersal. However, it is only likely to occur infrequently and in low numbers due to the limited extent of wetland habitat on site.



Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
<b>oriental cuckoo</b> ( <i>Cuculus optatus</i> )	M	SLC	<p>In Australia this species is found in monsoon forest, rainforest edges, leafy trees in paddocks, river flats, roadsides, mangroves and islands (Pizzey &amp; Knight, 2007). Important habitat for this species is identified as monsoonal rainforest, vine thickets, wet sclerophyll forest or open <i>Casuarina</i>, <i>Acacia</i> or <i>Eucalyptus</i> woodlands.</p> <p>The species has been previously recorded within 12 km of the Site and may utilise the Site for foraging when present in Australia (November to May).</p>	The species is primarily restricted to the canopy layer where it forages on a variety of small invertebrates (Brett Lane & Associates Pty Ltd, 2017). It is therefore unlikely to occur at RSA height.	<p><b>Low risk:</b></p> <p>While the species is considered likely to occur within the Site, the risk of turbine collision is low owing to the species' flight behaviour.</p>
<b>white-throated needletail</b> ( <i>Hirundapus caudacutus</i> )	M	SLC	<p>In Australia, the white-throated needletail is almost exclusively aerial (DAWE, 2021). Because they are aerial, it is suggested that conventional habitat descriptions are inapplicable (DAWE, 2021). However, DAWE (2021) identifies the species is most commonly recorded over wooded areas, including open forest, rainforest, heathland, plantations, the edge of paddocks and less often over treeless areas such as grassland or swamps (DAWE, 2021).</p> <p>The species was recorded on two separate occasions during the 2021 survey, including one observation of 13 individuals at turbine WTG08 and one observation of three individuals at turbine WTG19.</p>	The white-throated needletail is an aerial forager which hunts insect prey at various heights above the canopy of woodland and forest habitats (Higgins, 1999). It is likely to forage at heights within the RSA.	<p><b>High risk:</b></p> <p>The species flight behaviour makes it highly susceptible to collision, however the frequency of collision is likely to be low given the species' highly dispersive, vagile nature.</p>



Species	Conservation status <sup>1</sup>		Habitat and occurrence	Flight behaviour	Risk of collision
	EPBC Act	NC Act			
Microbats					
ghost bat ( <i>Macroderma gigas</i> )	V	E	In Queensland the species occurs along the central and northern coast, from Rockhampton to Cape York (DES 2021). The species occurs in a wide range of habitats from rainforest, monsoon and vine scrub, to open woodlands in arid areas. These habitats are used for foraging while roost habitat is more specific and includes undisturbed caves or mineshafts which have several openings (DES 2021). A single individual has been recorded on site during previous surveys.	The species roosts in caves or undisturbed mineshafts, of which non are known to occur on site. Foraging typically occurs within 2km of the roost and consist of flying within the lower half of the canopy, between 1-8m. This behaviour makes it unlikely the species would occur within the RSA.	<b>Low risk:</b> While the species is known to occur on site, the species' flight behaviour puts it at low risk of collision.
Flying-foxes					
spectacled flying-fox ( <i>Pteropus conspicillatus</i> )	V	V	The species is known to occur in north-eastern Queensland, between Ingham and Cooktown, and between the McIlwraith and Iron Ranges on Cape York (DAWE, 2021). Spectacled flying foxes have long been considered to be primarily frugivorous and dependent on rainforest for foraging resources (DERM 2010). However, recent research suggests that this is not the case with satellite telemetry studies showing some individuals spend a significant proportion of the time in non-rainforest habitats. Many of these records were obtained from locations tens of kilometres from rainforest and included a range of wet and dry Eucalyptus, and Melaleuca vegetation types (DERM 2010).  The species has been recorded on site on multiple occasions, though only ever in low numbers (1-2 individuals). The nearest known roost is approximately 25km from the Site.	While the species forages primarily within the canopy, the species would only be susceptible to turbine collision during dispersal. However, given the Site is 25km from the nearest known roost it is considered unlikely that the Site would be utilised frequently and by large numbers of individuals.	<b>Moderate risk:</b> The species flight behaviour makes it a high risk of turbine collision; however, the distance to the nearest roosts makes it unlikely that the site would be utilised frequently or by large numbers of individuals.

<sup>1</sup>: E = Endangered, M = Migratory, SLC = Special Least Concern, V = Vulnerable



### 3.3.3 Post-Operation: Incidental Bird and Bat Observations

Turbines first become operational at Kaban in late September 2022. Since this time, a number of migratory bird and spectacled flying-fox deaths potentially attributable to turbine collision have been recorded on site. The records of these observations are detailed in Table 14.

**Table 14: Incidental finds of migratory/threatened bird and bat species during operational phase**

Common Name	Species Name	Date Found	# Individuals Found	Location of record
<b>Migratory Birds</b>				
Fork-tailed swift	<i>Apus pacificus</i>	January 2023	2	WTG2 & WTG11
White-throated needletail	<i>Hirundapus caudacutus</i>	March 2023	1	Between WTG16 & WTG17
Rufous fantail <sup>3</sup>	<i>Rhipidura rufifrons</i> <sup>3</sup>	March 2023	1	Between WTG16 & WTG17
Black-faced Monarch <sup>3</sup>	<i>Monarcha melanopsis</i> <sup>3</sup>	February 23	1	WTG4
<b>Flying-foxes</b>				
Spectacled flying-fox	<i>Pteropus conspicillatus</i>	January 2023	1	WTG16
		February 2023	1	WTG1

<sup>3</sup> While these migratory birds are unlikely to be found utilizing the site, they are potentially using the airspace above the windfarm during migration.



### 3.3.4 Turbine risk profiles

As per Condition 10 of the EPBC Act approval (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2022), individual WTGs were assessed as ‘high’ or ‘low’ risk as detailed in Section 2.3. Of the 28 WTGs on Site, 14 turbines have been assessed as high-risk, based on records of threatened and migratory species observed during scheduled bird and bat utilisation surveys or through incidental finds (as documented in Table 14). All observations have been included for the determination of turbine risk profiles (see Table 15). All ‘high risk’ turbines have been added to the monthly carcass monitoring program, bringing the total number of turbine monitoring sites to 24 (see Table 15).

**Table 15: Turbine risk profiles**

WTG	Risk profile	Carcass Monitoring	WTG	Risk profile	Carcass Monitoring
1	High <sup>A</sup>	YES	15	High <sup>A</sup>	YES
2	High <sup>A</sup>	YES	16	High <sup>A</sup>	YES
3	Low	YES <sup>D</sup>	17	High <sup>A</sup>	YES
4	High <sup>A</sup>	YES	18	High <sup>B</sup>	YES
5	Low	YES <sup>D</sup>	19	High <sup>B</sup>	YES
6	Low	YES <sup>D</sup>	20	High <sup>B</sup>	YES
7	High <sup>B</sup>	YES	21	Low	YES <sup>D</sup>
8	High <sup>B</sup>	YES	22	Low	NO
9	High <sup>B</sup>	YES	23	Low	NO
10	Low	YES <sup>D</sup>	24	Low	YES <sup>D</sup>
11	High <sup>A</sup>	YES	25	Low	YES <sup>D</sup>
12	Low	YES <sup>D</sup>	26	Low	NO
13	High <sup>C</sup>	YES	27	Low	NO
14	Low	YES <sup>D</sup>	28	Low	YES <sup>D</sup>

<sup>A</sup> Carcass found at this location during incidental searches since WTGs became operational (see Table 14)

<sup>B</sup> White-throated needletail observed within 350m of turbines during the 2021 dry season BBUS

<sup>C</sup> Spectacled flying-fox observed at turbine site during the 2020 dry season BBUS

<sup>D</sup> ‘Low risk’ turbines nominated within the BBAMP for monitoring effort prior to commissioning.







## 4 Conclusion

Kaban Wind Farm engaged E2M to conduct post-commissioning bird and bat utilisation surveys at the Kaban Green Power Hub during the 2023-2024 wet season. These surveys were undertaken to meet the requirements of Conditions 5A, 6, 7, 9, and 11 of the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) Variation of Conditions attached to approval EPBC 2018/8289 received from the Department of Agriculture, Water and the Environment (DAWE) on 10 August 2022. The February 2024 wet season survey is third of four scheduled post-commissioning surveys required under the conditions of approval for the Project.

Specifically, the survey aimed to evaluate bird and bat utilisation of turbine sites during the wet season in order to:

- assess the turbine collision risk for potentially occurring threatened and migratory bird and bat species, and
- develop a turbine collision ‘risk profile’ for each turbine based on the results of the bird and bat utilisation surveys.

Key findings from the current assessment are summarised below.

- Bird utilisation:
  - No threatened bird species or migratory bird species were observed during the 2024 wet season survey.
  - A total of 51 bird species were recorded across the Site during fixed-point surveys
  - The total bird species observed during this survey (51) compares favourably with the number recorded during pre-construction surveys. Thirty-nine species recorded during the 2017 baseline survey and 59 recorded during the 2020 pre-construction survey.
  - As with previous surveys, most bird species observed were woodland species, with spotted pardalote and yellow-faced honeyeater being the two most frequently recorded species.
  - Approximately 99% of birds observed occurred below the RSA height, with five observations (from four species) recorded at or above the RSA height.
  - Previous BBUS surveys have identified the white-throated needletail utilising the airspace at rotor sweep height.
  - Incidental observation of migratory bird carcasses, post operation, have identified that the white-throated needletail, fork-tailed swift, rufous fantail and the black-faced monarch are potentially using the airspace within the windfarm.
- Bat utilisation:
  - No threatened bat species were recorded during microbat and megabat surveys.
  - Seventeen bat species were recorded across the Site during the February 2024 wet season survey.
  - The species most frequently recorded calling during surveys was *Ozimops ridei*.
  - Previous surveys identified two threatened bat species on site: the spectacled flying-fox and the ghost bat. To date, both these species have been detected on site only once.
  - The ghost bat is considered to have a low risk of turbine collision based on its flight behaviour.
  - No other threatened bat species were considered likely to occur.





- The spectacled flying-fox was considered to have a moderate risk of turbine collision, with high risk flight behaviours but a low frequency of occurrence on site.
- Incidental observations of threatened and migratory bird/bat species since the commencement of operations:
  - Carcasses of four migratory bird species (black-faced monarch, rufous fantail, white-throated needletail and fork-tailed swift) and the spectacled flying-fox have been observed within 350 metres of turbines (WTGs) 1, 2, 4, 11, 15, 16 and 17. These WTGs have been added to the list of 'high risk' turbines.
- High risk turbines:
  - Based on the results of BBUSs conducted to date, fourteen (14) WTGs are considered as 'high risk' (as detailed in Table 15).
  - All 'high risk' WTGs have been included in the carcass monitoring schedule.
- Carcass Monitoring:
  - With the inclusion of additional 'high risk' turbines, a total of 24 turbines require monthly carcass monitoring for the annual bird and bat mortality assessment, ten of which are still classed as 'Low' risk.





## 5 Recommendations

To ensure compliance with conditions of the EPBC Act approval, Project impacts on EPBC-listed bird and bat species must be monitored and managed in accordance with the Bird and Bat Adaptive Management Plan. As such, monthly carcass searches will need to continue through to the last scheduled BBUS in August 2024.



## 6 References

- AECOM. (2017). *Kaban Green Power Hub—Fauna Technical Report*.
- Balance! Environmental. (2024). *Microbat Call Identification Report* (Expert Analysis E2M-2404; p. 8).
- Brett Lane & Associates Pty Ltd. (2017). *Neoen Kaban Wind Farm—Bird and Bat Pre-construction Utilisation Survey*.
- Curtis, L. K., & Dennis, A. J. (2012). *Queensland's threatened animals* (K. R. McDonald, P. M. Kyne, & S. J. S. Debus, Eds.). CSIRO Publishing.
- Department of Agriculture, Water and the Environment. (2021). *Species Profile and Threats Database*.  
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- Department of Climate Change, Energy, the Environment and Water (DCCEEW). (2022, August 10). *Kaban Green Power Hub, Kaban, Queensland (EPBC 2018/8289), Variation of Conditions Attached to Approval*. Department of Climate Change, Energy, the Environment and Water.
- Department of Environment and Resource Management. (2010). *National recovery plan for the spectacled flying fox Pteropus conspicillatus*. Department Sustainability, Environment, Water, Population and Communities, Canberra.
- Department of Environment and Science (DES). (2021). *Threatened species profile*.  
<https://environment.des.qld.gov.au/wildlife/threatened-species/>
- E2M. (2019a). *Kaban Green Power Hub - Ecological Gap Analysis*.
- E2M. (2019b). *Kaban Green Power Hub RFI - Ecological Assessment Report*.
- E2M. (2020). *Kaban Green Power Hub - Bird and Bat Adaptive Management Plan*.
- E2M Pty Ltd. (2020). *Kaban Green Power Hub Pre-Commissioning Bird and Bat Utilisation 2020 Dry Season Monitoring Report*.
- E2M Pty Ltd. (2022). *Kaban Green Power Hub: Pre-commissioning Bird and Bat Utilisation 2022 Wet Season Monitoring Report*.
- E2M Pty Ltd. (2023). *Kaban Green Power Hub: Post-commissioning Bird and Bat Utilisation 2023 Dry Season Monitoring Report*.
- Higgins, P. J. (1999). *Handbook of Australian, New Zealand and Antarctic Birds* (J. N. Davies & K. Y. Dabbagh, Eds.; Vol. 4). Oxford University Press.



Pizzey, G., & Knight, F. (2007). *The field guide to the birds of Australia*. Harper Collins Publishers.





## Appendix A Species list



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
<b>Birds</b>								
Australian king-parrot	<i>Alisterus scapularis</i>		✓					
Australian magpie	<i>Cracticus tibicen</i>		✓	✓	✓	✓	✓	✓
Australian owl-nightjar	<i>Aegotheles cristatus</i>				✓			
Australian swiftlets	<i>Aerodramus terraereginae</i>							✓
Australian pelican	<i>Pelecanus conspicillatus</i>		✓					
Australian raven							✓	
Australian wood duck	<i>Chenonetta jubata</i>		✓					
banded honeyeater	<i>Certhionyx pectoralis</i>	✓						
barking owl	<i>Ninox connivens</i>			✓				
bar-shouldered dove	<i>Geopelia humeralis</i>		✓					
barn owl	<i>Tyto alba</i>						✓	
black kite	<i>Milvus migrans</i>		✓	✓				✓
black-chinned honeyeater	<i>Melithreptus gularis</i>		✓					
black-faced cuckoo-shrike	<i>Coracina novaehollandiae</i>	✓	✓	✓	✓	✓	✓	✓
black-faced monarch	<i>Monarcha melanopsis</i>		✓					
blue-faced honeyeater	<i>Entomyzon cyanotis</i>		✓					
blue-winged kookaburra	<i>Dacelo leachii</i>		✓	✓				
brolga	<i>Grus rubicunda</i>		✓	✓			✓	
brown falcon	<i>Falco berigora</i>		✓			✓		
brown goshawk	<i>Accipiter fasciatus</i>			✓		✓	✓	
brown honeyeater	<i>Lichmera indistincta</i>	✓	✓	✓	✓	✓	✓	✓
brown quail	<i>Coturnix ypsilophora</i>		✓	✓	✓		✓	✓



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
Brown treecreeper	<i>Climacteris picumnus</i>						✓	
brush cuckoo	<i>Cacomantis variolosus</i>				✓			✓
buff-rumped thornbill	<i>Acanthiza reguloides</i>		✓	✓	✓	✓	✓	✓
bush stone-curlew	<i>Burhinus grallarius</i>		✓	✓	✓		✓	
cicadabird	<i>Coracina tenuirostris</i>	✓		✓	✓			✓
collared sparrowhawk	<i>Accipiter cirrocephalus</i>		✓					
common bronzewing	<i>Phaps chalcoptera</i>		✓				✓	
eastern spinebill	<i>Acanthorhynchus tenuirostris</i>	✓					✓	
eastern whipbird	<i>Psophodes olivaceus</i>		✓	✓				
eastern yellow robin	<i>Eopsaltria australis</i>	✓	✓	✓			✓	✓
fantail cuckoo	<i>Rhipidura rufifrons</i>						✓	✓
forest kingfisher	<i>Todiramphus macleayi</i>		✓	✓			✓	
fuscous honeyeater	<i>Lichenostomus fuscus</i>				✓			
golden whistler	<i>Pachycephala pectoralis</i>	✓						
great cormorant	<i>Phalacrocorax carbo</i>				✓			
grey butcherbird	<i>Cracticus torquatus</i>		✓	✓	✓		✓	✓
grey fantail	<i>Rhipidura albiscapa</i>		✓	✓	✓	✓	✓	✓
grey shrike-thrush	<i>Colluricincla harmonica</i>	✓	✓	✓	✓	✓	✓	✓
hardhead	<i>Aythya australis</i>		✓					
Horsfield's bronze-cuckoo	<i>Chrysococcyx basalis</i>		✓					
jacky winter	<i>Microeca fascinans</i>		✓					✓
laughing kookaburra	<i>Dacelo novaeguineae</i>	✓	✓	✓	✓	✓	✓	✓
leaden flycatcher	<i>Myiagra rubecula</i>	✓		✓	✓	✓	✓	✓



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
Lewin's honeyeater	<i>Meliphaga lewinii</i>	✓	✓			✓	✓	✓
little bronze-cuckoo	<i>Chrysococcyx minutillus</i>			✓			✓	
little friarbird	<i>Philemon citreogularis</i>		✓	✓			✓	✓
little kingfisher	<i>Alcedo pusilla</i>	✓						
little lorikeet	<i>Parvipsitta pusilla</i>		✓	✓	✓		✓	✓
little pied cormorant	<i>Microcarbo melanoleucos</i>		✓					
magpie-lark	<i>Grallina cyanoleuca</i>	✓	✓		✓	✓	✓	✓
mistletoebird	<i>Dicaeum hirundinaceum</i>		✓	✓	✓		✓	✓
nankeen kestrel	<i>Falco cenchroides</i>			✓	✓		✓	
noisy friarbird	<i>Philemon corniculatus</i>	✓	✓	✓	✓	✓	✓	✓
noisy miner	<i>Manorina melanocephala</i>	✓	✓	✓	✓	✓	✓	✓
olive-backed oriole	<i>Oriolus sagittatus</i>	✓	✓		✓			✓
Pacific black duck	<i>Anas superciliosa</i>		✓		✓			
pale-headed rosella	<i>Platycercus adscitus</i>	✓	✓	✓	✓	✓	✓	✓
pallid cuckoo	<i>Cacomantis pallidus</i>	✓						
peaceful dove	<i>Geopelia striata</i>		✓	✓	✓	✓	✓	✓
pheasant coucal	<i>Centropus phasianinus</i>	✓	✓	✓	✓	✓	✓	✓
pied butcherbird	<i>Cracticus nigrogularis</i>	✓	✓	✓	✓		✓	
pied currawong	<i>Strepera graculina</i>	✓	✓	✓	✓	✓	✓	✓
rainbow bee-eater	<i>Merops ornatus</i>	✓	✓	✓	✓	✓	✓	✓
rainbow lorikeet	<i>Trichoglossus haematodus moluccanus</i>	✓	✓	✓	✓	✓	✓	✓
red-backed button-quail	<i>Turnix maculosus</i>		✓		✓			



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
red-backed fairy-wren	<i>Malurus melanocephalus</i>	✓	✓	✓	✓	✓	✓	✓
red-browed finch	<i>Neochmia temporalis</i>	✓	✓	✓		✓		✓
red-tailed black-cockatoo	<i>Calyptorhynchus banksii</i>		✓	✓			✓	
rufous whistler	<i>Pachycephala rufiventris</i>		✓	✓	✓	✓	✓	✓
sacred kingfisher	<i>Todiramphus sanctus</i>		✓					
sarus crane	<i>Antigone antigone</i>			✓			✓	
satin flycatcher	<i>Myiagra cyanoleuca</i>							✓
scaly-breasted lorikeet	<i>Trichoglossus chlorolepidotus</i>	✓	✓	✓	✓	✓	✓	✓
scarlet honeyeater	<i>Myzomela sanguinolenta</i>		✓	✓	✓		✓	✓
shining bronze-cuckoo	<i>Chrysococcyx lucidus</i>						✓	
southern boobook	<i>Ninox novaeseelandiae</i>			✓				
spangled drongo	<i>Dicrurus bracteatus</i>		✓	✓	✓			✓
spotted pardalote	<i>Pardalotus punctatus</i>	✓	✓	✓	✓	✓	✓	✓
squatter pigeon (northern subspecies)	<i>Geophaps scripta peninsulae</i>		✓	✓	✓	✓	✓	✓
striated pardalote	<i>Pardalotus striatus</i>	✓	✓	✓	✓	✓	✓	✓
Torresian crow	<i>Corvus orru</i>	✓	✓	✓		✓		
varied sittella	<i>Daphoenositta chrysoptera</i>	✓		✓	✓	✓	✓	✓
varied triller	<i>Lalage leucomela</i>	✓						
wedge-tailed eagle	<i>Aquila audax</i>	✓	✓	✓	✓	✓	✓	✓
weebill	<i>Smicrornis brevirostris</i>	✓	✓	✓	✓	✓	✓	✓
whistling kite	<i>Haliastur sphenurus</i>		✓	✓	✓			
white-bellied cuckoo-shrike	<i>Coracina papuensis</i>	✓	✓	✓	✓	✓	✓	✓





Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
white-browed scrubwren	<i>Sericornis frontalis</i>	✓						
white-cheeked honeyeater	<i>Philidonyris niger</i>						✓	
white-faced heron	<i>Egretta novaehollandiae</i>		✓	✓				
white-necked heron	<i>Ardea pacifica</i>		✓					
white-throated gerygone	<i>Gerygone olivacea</i>		✓	✓	✓		✓	✓
white-throated honeyeater	<i>Melithreptus albogularis</i>		✓	✓	✓	✓	✓	✓
white-throated needletail	<i>Hirundapus caudacutus</i>			✓				
white-throated nightjar	<i>Eurostopodus mystacalis</i>				✓		✓	
white-throated treecreeper	<i>Cormobates leucophaea</i>	✓	✓			✓		
white-winged triller	<i>Lalage sueurii</i>	✓						
willie wagtail	<i>Rhipidura leucophrys</i>	✓	✓		✓	✓	✓	✓
yellow thornbill	<i>Acanthiza nana</i>					✓		
yellow-faced honeyeater	<i>Caligavis chrysops</i>	✓	✓	✓	✓	✓	✓	✓
yellow-tinted honeyeater	<i>Ptilotula flavescens</i>							✓
<b>Microbats</b>								
bare-rumped sheath-tail bat	<i>Saccolaimus saccolaimus</i>					✓		
Chocolate wattled bat	<i>Chalinolobus morio</i>							✓
eastern bentwing bat	<i>Miniopterus orianae oceanensis</i>	✓	✓	✓	✓	✓		✓
eastern cave bat	<i>Vespadelus troughtoni</i>				✓	✓		
eastern forest bat	<i>Vespadelus pumilus</i>					✓		



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
eastern freetail bat	<i>Ozimops ridei</i>	✓	✓	✓	✓	✓		
eastern horseshoe bat	<i>Rhinolophus megaphyllus</i>	✓	✓	✓	✓	✓		✓
eastern bentwing bat	<i>Miniopterus orianae oceanensis</i>						✓	✓
eastern forest bat	<i>Vespadelus pumilus</i>						✓	
eastern freetail bat	<i>Ozimops ridei</i>						✓	✓
eastern horseshoe bat	<i>Rhinolophus megaphyllus</i>						✓	
forest pipistrelle	<i>Pipistrellus adamsi</i>					✓		✓
ghost bat	<i>Pteropus conspicillatus</i>	✓						
Gould's wattled bat	<i>Chalinolobus gouldii</i>	✓	✓	✓	✓	✓	✓	✓
greater broad-nosed bat	<i>Scoteanax rueppellii</i>			✓	✓	✓	✓	✓
hoary wattled bat	<i>Chalinolobus nigrogriseus</i>	✓	✓	✓	✓	✓	✓	✓
inland broad-nosed bat	<i>Scotorepens balstoni</i>				✓			
little bentwing bat	<i>Miniopterus australis</i>	✓	✓	✓	✓	✓	✓	✓
little broad-nosed bat	<i>Scotorepens greyii</i>				✓	✓	✓	✓
northern broad-nosed bat	<i>Scotorepens sanborni</i>				✓			✓
greater northern freetail bat	<i>Chaerephon jobensis</i>		✓	✓	✓	✓	✓	✓
northern free-tailed bat	<i>Ozimops lumsdenae</i>			✓	✓			✓
south-eastern broad-nosed bat	<i>Scotorepens orion</i>				✓			
Troughton's sheath-tail bat	<i>Taphozous troughtoni</i>				✓	✓	✓	✓



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
white-striped freetail bat	<i>Austronomus australis</i>	✓	✓	✓	✓	✓	✓	✓
yellow-bellied sheath-tail-bat	<i>Saccolaimus flaviventris</i>		✓	✓	✓	✓	✓	✓
-	<i>Austronomus australis / Chaerephon jobensis</i>				✓	✓		
-	<i>Chalinolobus gouldii / Ozimops ridei</i>			✓		✓		✓
-	<i>Chalinolobus gouldii / Scotorepens balstoni</i>				✓			
-	<i>Chalinolobus nigrogriseus / Scotorepens greyii</i>				✓	✓	✓	
-	<i>Chalinolobus nigrogriseus / Scotorepens spp.</i>		✓	✓		✓		✓
-	<i>Miniopterus australis / Vespadelus pumilus</i>				✓		✓	
-	<i>M. o. oceanensis / P. adamsi</i>					✓		
-	<i>Nyctophilus sp.</i>		✓	✓				✓
-	<i>Nyctophilus sp. / Myotis macropus</i>	✓	✓		✓			
-	<i>Ozimops lumsdenae / Taphozous troughoni</i>				✓			
-	<i>Ozimops ridei and Chalinolobus nigrogriseus</i>			✓			✓	
-	<i>Ozimops ridei / Scoteanax rueppellii</i>				✓			
	<i>P. adamsi or Vespadelus troughoni</i>						✓	
-	<i>Scotorepens greyii / Scotorepens sanborni</i>	✓	✓	✓	✓	✓	✓	✓
	<i>S. sanborni / M. o. oceanensis</i>					✓		
-	<i>Scotorepens orion / Scoteanax rueppellii</i>	✓						



Common name	Scientific name	BLA 2017	E2M 2020	E2M 2021	E2M 2022	E2M 2023 Wet	E2M 2023 Dry	E2M 2024 Wet
	<i>S. rueppellii</i> or <i>S. orion</i>						✓	
-	<i>V. pumilus</i> / <i>M. australis</i>					✓		
-	<i>Vespadelus trougtoni</i> / <i>Chalinolobus morio</i>		✓					
<b>Flying-foxes</b>								
spectacled flying-fox	<i>Pteropus conspicillatus</i>	✓						



## Appendix B Fixed-point survey results

SPECIES	Turbine									
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10
Australian magpie	1	3	3	3	4	5	1			
Australian swiftlets										
black kite										
black-faced cuckoo-shrike				1	3	3		1		
brown honeyeater	1	2	2						1	
brown quail										
brush cuckoo							1		1	
buff-rumped thornbill									3	
cicada bird			1							
eastern yellow robin										
fantailed cuckoo										
grey butcherbird	2	3	1	3	4	6	3	2		
grey fantail				1				1		
grey shrike-thrush										
jacky winter				1						
laughing kookaburra						1	1			
leaden flycatcher		1	1	3					1	



SPECIES	Turbine									
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10
Lewin's honeyeater		1	1				1			
little friarbird										
little lorikeet						2				
magpie-lark										
mistletoebird										
noisy friarbird		5	3	2					1	2
noisy miner	7		1	10	1	10	8	6	2	1
olive-backed oriole										
pale-headed rosella		1	1	4	4		3		2	
peaceful dove						2	1			
pheasant coucal	1					1		1		
pieb currawong	1	1			2				2	1
rainbow bee-eater								1		
rainbow lorikeet				2		4				
red-backed fairy-wren	1	3		4					1	2
red-browed finch										
rufous whistler	1	1		1						2
satin flycatcher				3						



SPECIES	Turbine									
	WTG01	WTG02	WTG03	WTG04	WTG05	WTG06	WTG07	WTG08	WTG09	WTG10
scaly-breasted lorikeet	2									
scarlet honeyeater										
spangled drongo	2									
spotted pardalote	5	11	6	5	4	3	3	5	2	
squatter pigeon (northern subspecies)	2 10 1									
striated pardalote		9	3	4	4		2	1	1	3
varied sittella										
wedge-tailed eagle										
weebill	2	3		4						
white-bellied cuckoo-shrike	1	4	2	3			1	2	1	
white-throated gerygone										
white-throated honeyeater	1	20	6	6	2	4		2	8	
willie wagtail	1									
yellow thornbill										
yellow-faced honeyeater	1	36	1			2	1	15	1	11
yellow-tinted honeyeater	6									
<b>Grand Total</b>	<b>25</b>	<b>111</b>	<b>32</b>	<b>62</b>	<b>30</b>	<b>53</b>	<b>27</b>	<b>39</b>	<b>27</b>	<b>22</b>



Species	Turbine									
	WTG11	WTG12	WTG13	WTG14	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20
Australian magpie			4	1	2				1	
Australian swiftlets										24
black kite										
black-faced cuckoo-shrike			2	2						2
brown honeyeater	2									4
brown quail			1							
brush cuckoo	1	1	1						2	
buff-rumped thornbill										2
cicada bird										
eastern yellow robin										
fantailed cuckoo										
grey butcherbird	1	1		2						
grey fantail	1			2				1		1
grey shrike-thrush										1
jacky winter										
laughing kookaburra		1	3	2	2		2	1	4	
leaden flycatcher	3	1	3				1			
Lewin's honeyeater	1		1	1				1	1	
little friarbird										
little lorikeet										





Species	Turbine									
	WTG11	WTG12	WTG13	WTG14	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20
magpie-lark										
mistletoebird					1	1				
noisy friarbird			1	2	1	2	4	1	2	25
noisy miner	2		3	1	1	3	3	1		3
olive-backed oriole	1									
pale-headed rosella			3	5	2			2	3	4
peaceful dove				6		1				
pheasant coucal									1	1
pied currawong	1						1	1	1	1
rainbow bee-eater										
rainbow lorikeet										
red-backed fairy-wren	2	1	3					1	2	7
red-browed finch										4
rufous whistler	3				1	1				2
satin flycatcher										
scaly-breasted lorikeet		1								
scarlet honeyeater										
spangled drongo			1							
spotted pardalote	1	1	1	4	1	1		3	7	2
squatter pigeon (northern subspecies)										
striated pardalote	2			1			1	1		7
varied sittella				15			1			4



	Turbine									
Species	WTG11	WTG12	WTG13	WTG14	WTG15	WTG16	WTG17	WTG18	WTG19	WTG20
wedge-tailed eagle							2			
weebill	4	6								
white-bellied cuckoo-shrike	1		1						2	1
white-throated gerygone				1						
white-throated honeyeater	8			3	2	1	2	1	1	1
willie wagtail										
yellow thornbill	2									
yellow-faced honeyeater	6	1		1			6	1	3	3
yellow-tinted honeyeater										
<b>Grand Total</b>	<b>42</b>	<b>14</b>	<b>28</b>	<b>49</b>	<b>13</b>	<b>10</b>	<b>23</b>	<b>15</b>	<b>30</b>	<b>99</b>

	Turbine							
Species	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
Australian magpie		1						
Australian swiftlets								
black kite	1							
black-faced cuckoo-shrike		2						
brown honeyeater		1		1				
brown quail								
brush cuckoo	5	1	4		1	1		
buff-rumped thornbill								
cicada bird								



Species	Turbine							
	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
eastern yellow robin		2	2				1	1
fantailed cuckoo			1					
grey butcherbird	1		1					2
grey fantail	1							1
grey shrike-thrush	1		1	2			1	
jacky winter								
laughing kookaburra	1	2		1	4			1
leaden flycatcher		2	1					
Lewin's honeyeater	3	1	1	1			1	
little friarbird							1	1
little lorikeet								
magpie-lark					2			
mistletoebird					1			
noisy friarbird		1	1		3			
noisy miner	2	5	1			1		
olive-backed oriole								
pale-headed rosella	3	1						
peaceful dove		3	1		8	1		
pheasant coucal			1	1				1
pieb currawong	1		1					
rainbow bee-eater								
rainbow lorikeet								
red-backed fairy-wren	4	1		1	1		1	



Species	Turbine							
	WTG21	WTG22	WTG23	WTG24	WTG25	WTG26	WTG27	WTG28
red-browed finch								
rufous whistler				1		1		
satin flycatcher								
scaly-breasted lorikeet							1	
scarlet honeyeater					1			
spangled drongo						1		
spotted pardalote	5	6	2	3	1	1	3	2
squatter pigeon (northern subspecies)								
striated pardalote	4	3		3	1			2
varied sittella								
wedge-tailed eagle				1				
weebill				1				
white-bellied cuckoo-shrike	4	3	1			1	1	1
white-throated gerygone								
white-throated honeyeater	2	2		11			2	3
willie wagtail								
yellow thornbill								
yellow-faced honeyeater	8	4	2	2	3	1	3	2
yellow-tinted honeyeater								
Australian magpie								
<b>Grand Total</b>	<b>46</b>	<b>41</b>	<b>21</b>	<b>29</b>	<b>26</b>	<b>8</b>	<b>15</b>	<b>17</b>





## Appendix C Bat call analysis



## Microbat Call Identification Report

<b>Prepared for ("Client"):</b>	E2M Pty Ltd
<b>Survey location/project name:</b>	Kaban BUS, wet season 2024
<b>Survey dates:</b>	19-26 February 2024
<b>Client project reference:</b>	
<b>Job no.:</b>	E2M-2404
<b>Report date:</b>	5 June 2024

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## Methods

### Data received

*Balance! Environmental* received 53,108 full-spectrum ultrasonic acoustic files (WAV files), which were recorded at 28 sites using Anabat Swift detectors (Titley Scientific, Brisbane). Each site was sampled for two consecutive nights, with the detectors deployed from 19<sup>th</sup> – 26<sup>th</sup> February 2024.

### Bat-call analysis

Analyses were performed with *Anabat Insight* (Version 2.1.1; Titley Scientific).

All WAV files were first processed with a generic noise filter to exclude files containing only non-bat noise. Files that passed the filter (i.e., contained bat calls) were then processed as follows:

- A Decision Tree Analysis was used to group and label files according to the average zero-crossing metrics of calls within each file. Separation was based primarily on the characteristic frequency (Fc) metric, but metrics such as pulse duration (Dur), slope of characteristic section (Sc) and time between pulses (TBC) were included to further refine call recognition by the Decision Tree.
- Species present within each Decision Tree group were then confirmed using a combination of further species-specific metric-based filters and manual review of the call spectrograms.
- Where a Decision Tree group included a large number of files, the species verification process continued only until all potential species within the group were identified for each site. The remaining files retained the group label.

Manual species confirmation was based on comparing visual properties of call spectrograms and derived metrics with those of regionally relevant reference calls and/or with published call descriptions (e.g., Reinhold et al. 2001, Milne 2002). The likelihood of species' occurrence on site was confirmed by referring to published distributional information (e.g., Australasian Bat Society 2021, Churchill 2008; Baker & Gynther 2023).

### Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Armstrong *et al.* (2020).

## Results & Discussion

The noise filter excluded 42,345 WAV files from further analysis. The remaining 10,763 files contained at least 11,206 individual bat call passes. Some 49% (5526) of those calls were reliably attributed to 17 distinct taxa, while the remainder were assigned to three “unresolved” call groups.

The positively identified calls were attributed to 16 distinct species plus the undifferentiated *Nyctophilus* genus (see **Table 1**). Three *Nyctophilus* species – *N. bifax*, *N. geoffroyi*, *N. gouldi* - potentially occur in the study area.

All unresolved calls belonged to species that were otherwise positively identified, with most (5461 calls) representing *Chalinolobus nigrogriseus* and/or *Scotorepens greyii* and/or *Scotorepens sanborni*.

Sample call spectrograms for each identified species are presented in **Appendix 1**.

## References

- Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera. Australasian Bat Society. Version 2020-06-09.  
URL: <http://ausbats.org.au/species-list/4593775065>
- Australasian Bat Society (2021). *BatMap*. <http://ausbats.org.au/batmap>; accessed 3/6/2024.
- Baker, A. and Gynther, I. (ed.) (2023). *Strahan's Mammals of Australia*. 4th edition; New Holland; Sydney.
- Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.
- Milne, D.J. (2002). *Key to the Bat Calls of the Top End of the Northern Territory*. Technical Report No. 71, Parks and Wildlife Commission of the Northern Territory, Darwin.
- Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.
- Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.



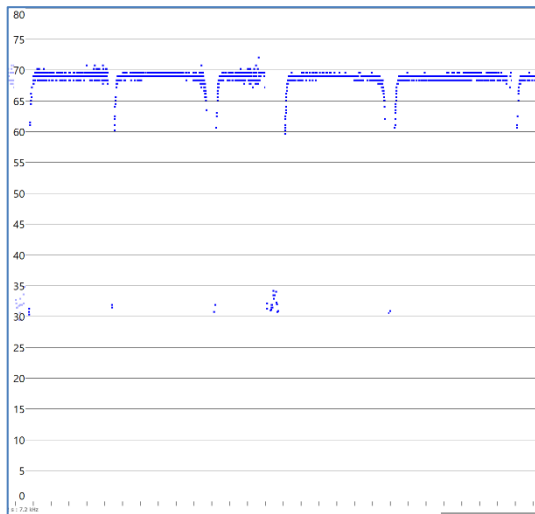
**Table 1A** Microbat species recorded during the Kaban BUS 2024 wet season survey, February 2024; **Sites WTG01-WTG14.**  
Number of calls identified per species and unresolved species group per site.

Site:	WTG 01	WTG 02	WTG 03	WTG 04	WTG 05	WTG 06	WTG 07	WTG 08	WTG 09	WTG 10	WTG 11	WTG 12	WTG 13	WTG 14	Species Total
<b>Positively identified calls</b>															
<i>Rhinolophus megaphyllus</i>			1		1										2
<i>Chalinolobus gouldii</i>	16		11	2	45	19	305	18	3	2	5	15	7	3	451
<i>Chalinolobus morio</i>															0
<i>Chalinolobus nigrogriseus</i>	1	3		1		18	17	16	2			32	10	5	105
<i>Nyctophilus</i> sp.	1	1	1	1				1				2		2	9
<i>Pipistrellus adamsi</i>														1	1
<i>Scoteanax rueppellii</i>	2					9	2					5	3	4	25
<i>Scotorepens greyii</i>						19	111	1				1	1	1	134
<i>Scotorepens sanborni</i>							67								67
<i>Vespadelus troughtoni</i>		2		3						1		1			7
<i>Miniopterus australis</i>	3	28	5	42	13	190	63	7	5	2		16	7	28	409
<i>Miniopterus orianae</i>		7	1	4	7	34	29	11	2			1	14	18	128
<i>Austronomus australis</i>	5		10	15	1	27	36	12				2	2		110
<i>Chaerephon jobensis</i>			4	3	1	1	3		1						13
<i>Ozimops lumsdenae</i>							1								1
<i>Ozimops ridei</i>	18	1	7	2	8	10	76	2	9	5	2	959	341	20	1460
<i>Saccolaimus flaviventris</i>	2		1										5		8
<b>Unresolved calls</b>															
<i>C. gouldii</i> / <i>O. ridei</i>	15		10		7	8	14	1			1	36	15		107
<i>S. greyii</i> / <i>S. sanborni</i>							40								40
<i>C. nigrogriseus</i> / <i>Scotorepens</i> sp.	7	7	4	4	3	184	762	163	12	17	2	338	66	24	1593
Site Total	70	49	55	77	86	519	1526	232	34	27	10	1408	471	106	4670

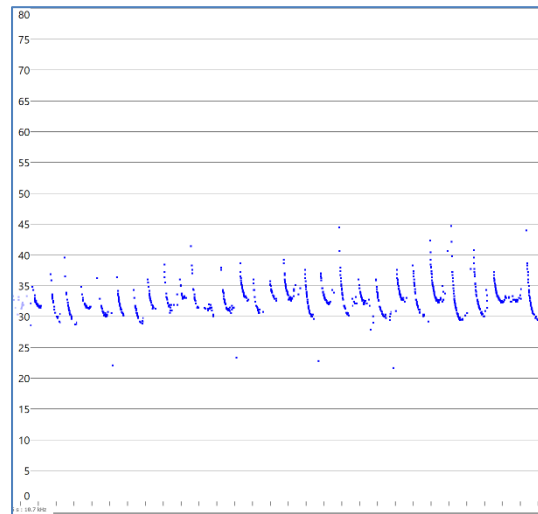
**Table 1B** Microbat species recorded during the Kaban BUS 2024 wet season survey, February 2024; **Sites WTG15-WTG28**  
Number of calls identified per species and unresolved species group per site.

Site:	WTG 15	WTG 16	WTG 17	WTG 18	WTG 19	WTG 20	WTG 21	WTG 22	WTG 23	WTG 24	WTG 25	WTG 26	WTG 27	WTG 28	Species Total
<b>Positively identified calls</b>															
<i>Rhinolophus megaphyllus</i>					1	2	1								4
<i>Chalinolobus gouldii</i>	172	47	1	1	5	576	7	2							811
<i>Chalinolobus morio</i>		1													1
<i>Chalinolobus nigrogriseus</i>	6	10	3	9	17	33	6	7	7	4	6		14	1	123
<i>Nyctophilus</i> sp.	3	6	1			1							1		12
<i>Pipistrellus adamsi</i>		2			9		3								14
<i>Scoteanax rueppellii</i>	3	5	2	1	27			2			1				41
<i>Scotorepens greyii</i>	1	1		43	9	51	1		3	6	4		2		121
<i>Scotorepens sanborni</i>					5										5
<i>Vespadelus trougtoni</i>	1		1	3							1				6
<i>Miniopterus australis</i>	20	113	16	29	4	306	69	9	1	9	43		11		630
<i>Miniopterus orianae</i>	28	38	6	13	26	24	11	2		1	10		6		165
<i>Austronomus australis</i>	11	15	2	1			5	1		11	3	1	2		52
<i>Chaerephon jobensis</i>	1	1	1												3
<i>Ozimops lumsdenae</i>								2		1					3
<i>Ozimops ridei</i>	164	135	21	5	11	117	28	15	6	21	75	1	6		605
<i>Saccolaimus flaviventris</i>															0
<b>Unresolved calls</b>															
<i>C. gouldii</i> / <i>O. ridei</i>	24	13	2			1	3								43
<i>S. greyii</i> / <i>S. sanborni</i>				1		29								3	33
<i>C. nigrogriseus</i> / <i>Scotorepens</i> sp.	87	43	43	542	1076	1541	53	78	268	35	23	0	79		3868
Site Total	521	430	99	648	1190	2681	187	118	285	88	166	2	121		6536

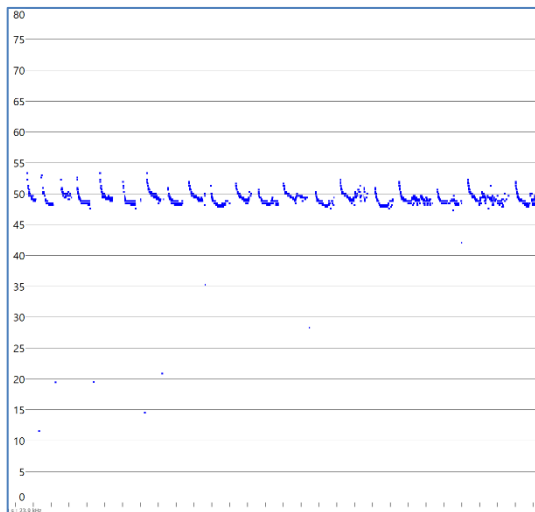
**Appendix 2** Representative call sequences from the Kaban BUS, February 2024.  
x-axis = 10 ms per tick-mark; time between pulses removed ("compressed")



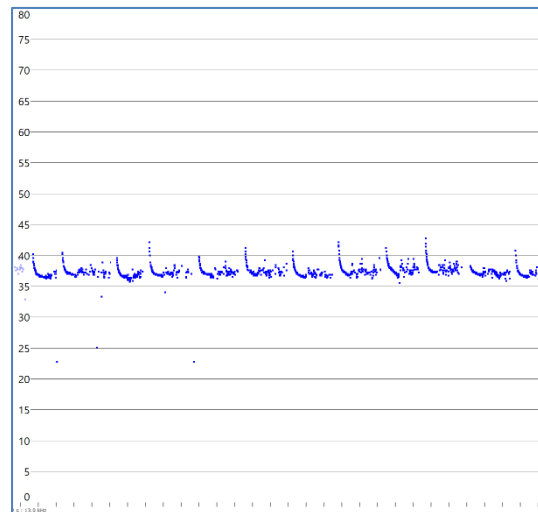
*Rhinolophus megaphyllus*



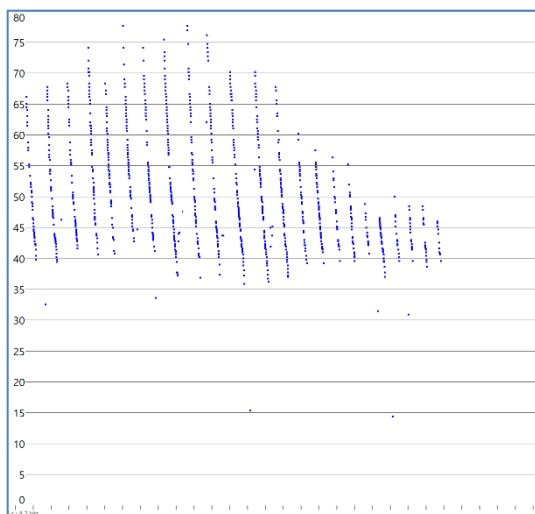
*Chalinolobus gouldii*



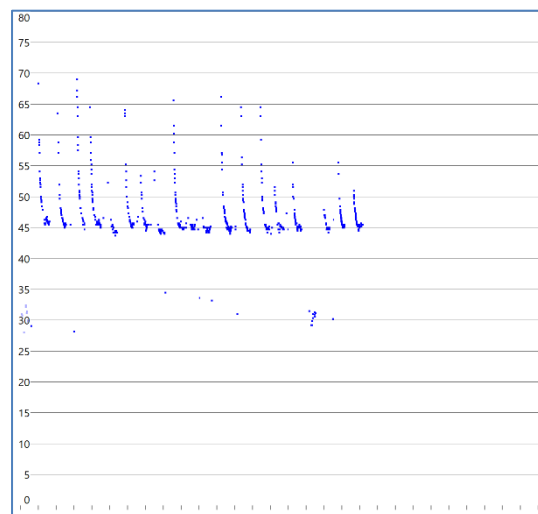
*Chalinolobus morio*



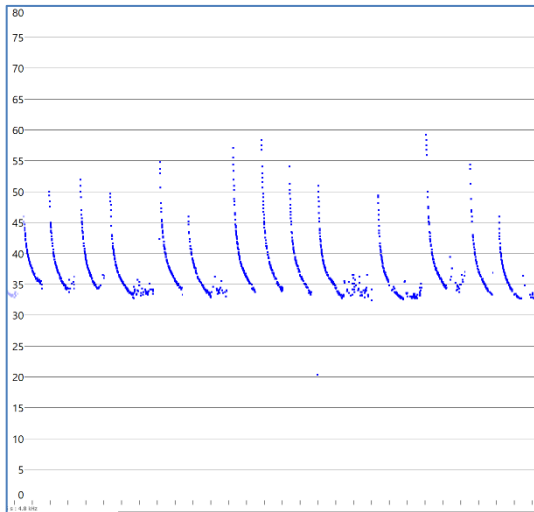
*Chalinolobus nigrogriseus*



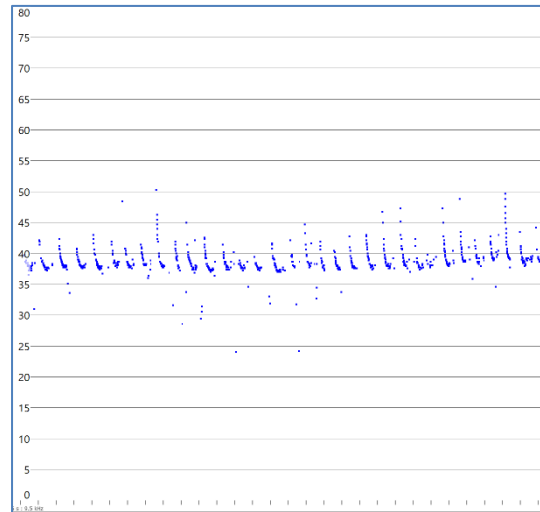
*Nyctophilus* sp.



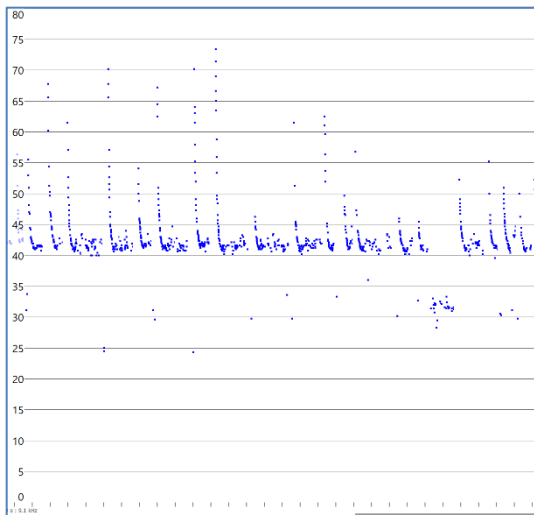
*Pipistrellus adamsi*



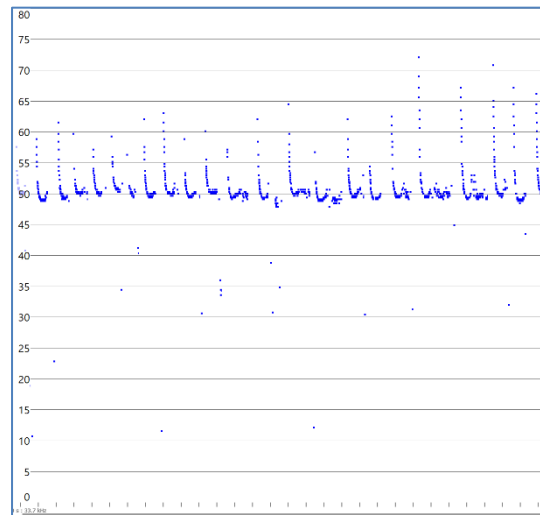
*Scoteanax rueppellii*



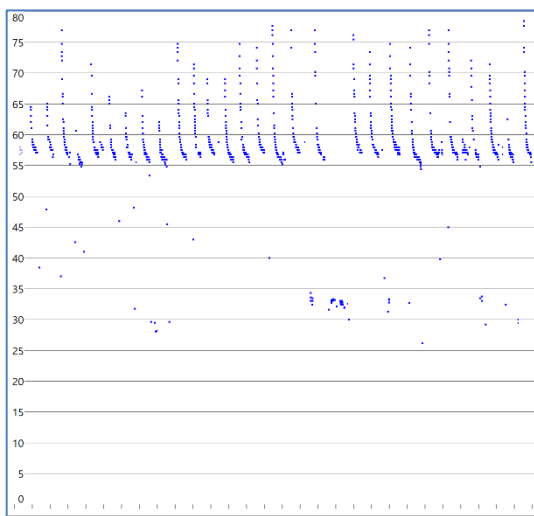
*Scotorepens greyii*



*Scotorepens sanborni*



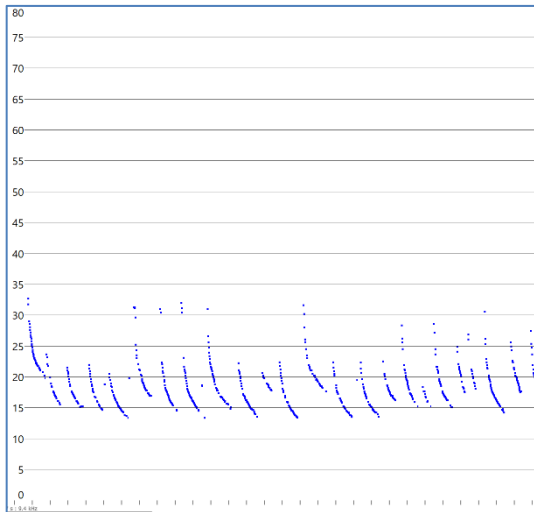
*Vespadelus trougtoni*



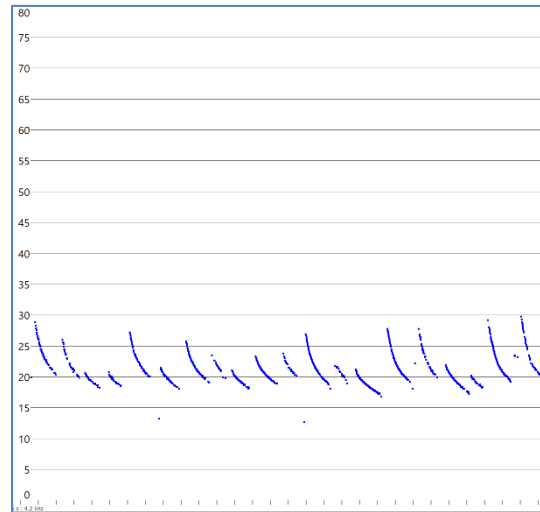
*Miniopterus australis*



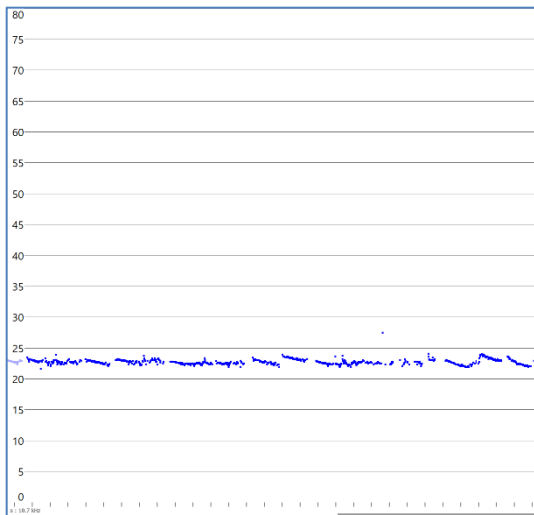
*Miniopterus orianae oceanensis*



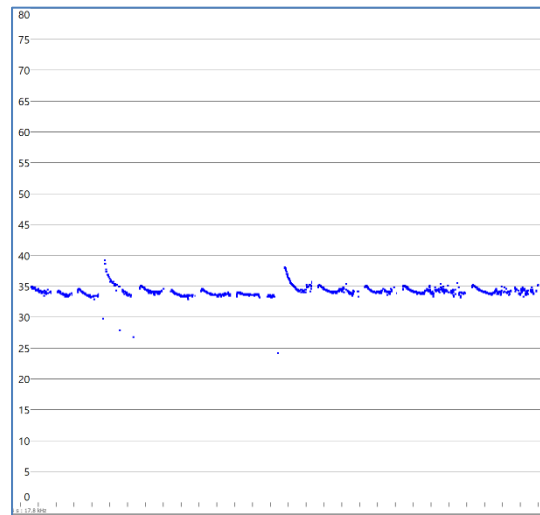
*Austronomus australis*



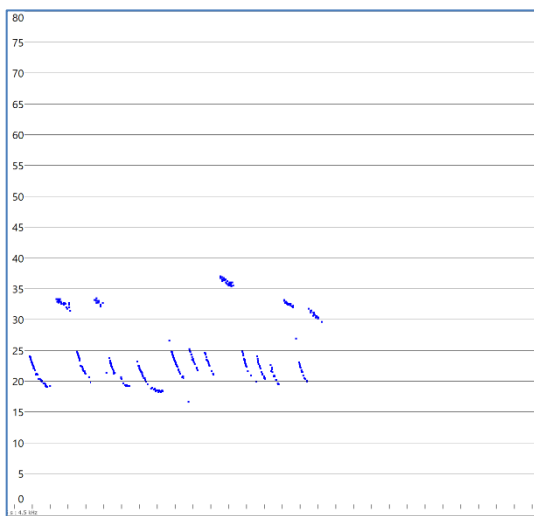
*Chaerephon jobensis*



*Ozimops lumsdenae*



*Ozimops ridei*



*Saccolaimus flaviventris*



## Appendix D Migratory species predicted time of occurrence at Site

Species	Wet Season						Dry Season					
	November	December	January	February	March	April	May	June	July	August	September	October
Fork-tailed swift ( <i>Apus pacificus</i> )												
Latham's snipe ( <i>Gallinago hardwickii</i> )												
oriental cuckoo ( <i>Cuculus optatus</i> )												
rufous fantail ( <i>Rhipidura rufifrons</i> )												
satin flycatcher ( <i>Myiagra cyanoleuca</i> )												
white-throated needletail ( <i>Hirundapus caudacutus</i> )												



= Optimum survey timing

#### Data Sources:

- Species Profile and Threats Database (DAWE 2020)
- The Field Guide to the Birds of Australia (Pizzey & Knight 2007)
- Handbook of Australian, New Zealand and Antarctic Birds (Higgins 1999)



## Appendix 3 BBAMP -Turbine Risk Profiles



### 3.3.4 Turbine risk profiles

As per Condition 10 of the EPBC Act approval (Department of Climate Change, Energy, the Environment and Water (DCCEE), 2022), individual WTGs were assessed as ‘high’ or ‘low’ risk as detailed in Section 2.3. Of the 28 WTGs on Site, 14 turbines have been assessed as high-risk, based on records of threatened and migratory species observed during scheduled bird and bat utilisation surveys or through incidental finds (as documented in Table 14). All observations have been included for the determination of turbine risk profiles (see Table 15). All ‘high risk’ turbines have been added to the monthly carcass monitoring program, bringing the total number of turbine monitoring sites to 24 (see Table 15).

**Table 15: Turbine risk profiles**

WTG	Risk profile	Carcass Monitoring	WTG	Risk profile	Carcass Monitoring
1	High <sup>A</sup>	YES	15	High <sup>A</sup>	YES
2	High <sup>A</sup>	YES	16	High <sup>A</sup>	YES
3	Low	YES <sup>D</sup>	17	High <sup>A</sup>	YES
4	High <sup>A</sup>	YES	18	High <sup>B</sup>	YES
5	Low	YES <sup>D</sup>	19	High <sup>B</sup>	YES
6	Low	YES <sup>D</sup>	20	High <sup>B</sup>	YES
7	High <sup>B</sup>	YES	21	Low	YES <sup>D</sup>
8	High <sup>B</sup>	YES	22	Low	NO
9	High <sup>B</sup>	YES	23	Low	NO
10	Low	YES <sup>D</sup>	24	Low	YES <sup>D</sup>
11	High <sup>A</sup>	YES	25	Low	YES <sup>D</sup>
12	Low	YES <sup>D</sup>	26	Low	NO
13	High <sup>C</sup>	YES	27	Low	NO
14	Low	YES <sup>D</sup>	28	Low	YES <sup>D</sup>

<sup>A</sup> Carcass found at this location during incidental searches since WTGs became operational (see Table 14)

<sup>B</sup> White-throated needletail observed within 350m of turbines during the 2021 dry season BBUS

<sup>C</sup> Spectacled flying-fox observed at turbine site during the 2020 dry season BBUS

<sup>D</sup> ‘Low risk’ turbines nominated within the BBAMP for monitoring effort prior to commissioning.





## Appendix 4 BBAMP: Annual Mortality Assessment & Trigger Assessment




# Year 1: Annual Mortality Assessment

5 August 2024

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind  
Farm Trust

Level 21, 570 George Street, Sydney NSW 2000

# Document Management

Rev.	Issue Date	Description	Author (s)	Reviewed	Approved	Signature
A	1/08/2024	Issue for Review	Dean Jones	Chays Ogston	Dean Jones	
0	5/08/2024	Issue for Review	Dean Jones	Chays Ogston	Dean Jones	

Document Reference: ...JOBS\~2021\QEJ21046\DELIVERABLES\4. FY25 Jul-Dec\1. Annual Mortality Assessment (Nov24)\3. Annual Trigger Evaluation Report\FirstAnnualBird&BatTriggerAssessment\_2024\_Rev0.pdf

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# Contents

<b>Definitions</b>	<b>iv</b>
<b>Abbreviations</b>	<b>iv</b>
<b>Executive Summary</b>	<b>v</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background	1
1.2 Scope of Works	1
<b>2 Methods</b>	<b>3</b>
2.1 Impact Triggers	3
2.2 Monthly Assessments	4
2.3 Annual Mortality Estimates	4
<b>3 Results</b>	<b>4</b>
3.1 Monthly Assessments	4
3.2 Annual Mortality Estimate	5
<b>4 Recommendations</b>	<b>5</b>
<b>5 Conclusion</b>	<b>6</b>
<b>6 References</b>	<b>7</b>

# Appendices

Appendix A Annual Mortality Estimate

# List of Tables

Table 1: Impact triggers for migratory species	3
Table 2: Migratory species carcasses recorded during Year 1	4
Table 3: Site-wide (total) percentiles of mortalities for threatened and migratory species	5

# List of Figures

Figure 1: Project Location	2
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## Definitions

Term	Definition
The Project	The Kaban Green Power Hub, also known as the Kaban Wind Farm
Bird and Bat Adaptive Management Plan	The Kaban Green Power Hub - Bird and bat Adaptive Management Plan
EPBC Approval	The EPBC Act Approval associated within the Kaban Green Power Hub (EPBC 2018/8289)
Impact Trigger	As defined in the EPBC Act Approval and BBAMP.
Migratory Species	Species listed as Migratory under the EPBC Act, at the date of EPBC Referral submission.
Threatened Species	Species listed as Critically Endangered, Endangered, Vulnerable or Near Threatened, under the EPBC Act or Nature Conservation Act 1992, at the date of EPBC Referral submission.

## Abbreviations

Term	Definition
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
BBAMP	Bird and Bat Adaptive Management Plan
DCCEEW	The Department of Climate Change, Energy the Environment and Water
E2M	E2M Pty Ltd



## Executive Summary

This report is the first Annual Mortality Assessment of the Kaban Green Power Hub, commonly known as the Kaban Wind Farm. This report assesses performance against Impact Triggers specified in the *Kaban Green Power Hub - Bird and bat Adaptive Management Plan (BBAMP)* (E2M, 2021). Assessment of Impact Triggers was assessed based on the *Kaban Wind Farm Mortality Estimate - Year 1*, conducted by statisticians, Symbolix Pty Ltd. (Symbolix) (Appendix A). The mortality estimate report provides the estimated mortality values of listed species identified during monthly and incidental carcass searches. The statistical model analysis incorporates results from monthly carcass searches, searcher efficiency and scavenger rate trial results to generate mortality estimates of threatened and migratory bird and bat species found onsite.

Results from the mortality estimate report, along with data collected during monthly carcass surveys and incidental carcass finds was used to inform this Annual Mortality Assessment. The Annual Mortality Assessment identified the follow Impact Triggers had been reached:

- Spectacled flying-fox (*Pteropus conspicillatus*): Two individuals were identified in two separate occasions, triggering the Impact Trigger on both occasions. The adaptive management procedure within the BBAMP was followed and DCCEEW notified. Both incidents were assessed as isolated events, and no additional mitigations measures were required.
- White-throated needletail (*Hirundapus caudacutus*): Based on two individuals being identified in two separate occasions, mortality estimates conducted by Symbolix identified approximately 5 individuals (50% median percentile) have been impacted. As such, a trigger event was reached and the Department notified and causation/mitigation investigations have commenced in consultation with DCCEEW, as per the adaptive management procedure within the BBAMP.

Based on these results the following recommendations have been identified:

1. Revise Impact Triggers for spectacled flying fox to determine at what level impacts on the species are likely to become significant
2. Complete causation/mitigation assessment related to white-throated needletail Impact Trigger exceedance
3. Where required, update BBAMP to reflect findings of white-throated needletail causation/mitigation assessment
4. Any species-specific survey effort to be done in consultation and guidance from the Department.



# 1 Introduction

## 1.1 Background

The Kaban Green Power Hub, commonly known as the Kaban Wind Farm and herein referred to as the 'Project', consists of 28 operational wind turbines and associated infrastructure. The Project is located approximately 4 kilometres west of Tumoulin, Queensland, Figure 1. Construction of the Project commenced in May 2021, with the last turbine constructed and commissioned by August 2023.

E2M Pty Ltd (E2M) was commissioned by Kaban Wind Farm Trustee for the Kaban Wind Farm Trust to prepare the first Annual Mortality Assessment pursuant to EPBC Approval (EPBC 2018/8289) and detailed within the *Kaban Green Power Hub - Bird and bat Adaptive Management Plan (BBAMP)* (E2M, 2021). This Annual Mortality Assessment reports details findings of Year 1 of operational monitoring, specifically between 01/09/2022 to 01/09/2023.

## 1.2 Scope of Works

The scope of the assessment was to review the annual mortality estimate (Appendix A) and data collected during monthly carcass surveys and incidental carcass finds, pursuant to Condition 14 of the EPBC Approval, against the Impact Triggers identified within the BBAMP, and where required report against any measures implemented to avoid and mitigate impacts.







## 2 Methods

To undertake assessment against Impact Triggers identified within the BBAMP and EPBC Approval (Section 2.1), the following assessments were undertaken:

- monthly assessment of targeted carcass searches and incidental carcass observations (Section 2.2); and
- annual mortality estimates undertaken by Symbolix (Section 2.3, Appendix A).

### 2.1 Impact Triggers

Assessment was undertaken against the following Impact Triggers identified within the BBAMP and EPBC Approval:

- Threatened Species<sup>1</sup>: Identification of any threatened bird or bat species carcass (or recognisable parts thereof) within 180<sup>2</sup> metres of any wind turbine.
- Migratory Species<sup>3</sup>: Accounting for scavenger rate and searcher efficiency, impacts on half of the nationally significant proportion of a population of any migratory species, as listed in the *Draft - referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment (DotE), 2015). A turbine collision impact on a migratory species is considered the identification of a migratory species carcass (or recognisable parts thereof) within 180<sup>2</sup> metres of a turbine. Specific Impact Triggers for relevant species are detailed in Table 1.
- Non-threatened / Non-migratory Species: Identification of a at least four carcasses of a single species (or recognisable parts thereof) within 180<sup>2</sup> metres of the same turbine in two consecutive months (i.e. four individuals recorded each month).

**Table 1: Impact triggers for migratory species**

Species	Impact trigger (0.05%) of total population
Fork-tailed swift ( <i>Apus pacificus</i> )	50
Rufous fantail ( <i>Rhipidura rufifrons intermedia</i> )	74 <sup>^</sup>
Black-faced monarch ( <i>Monarcha melanopsis</i> )	24 <sup>*</sup>
White-throated needletail ( <i>Hirundapus cauducutus</i> )	5

<sup>\*</sup> Trigger values were not identified within the BBAMP as this species was considered ‘unlikely’ to occur during the Fauna Technical Report, (AECOM, 2017). However, one individual was found during an incidental search within the first year of operation. As such, the 0.05% trigger has been included.

<sup>^</sup> This value has been updated using population estimates presented in Table 5 of the EPBC Act Referral guidelines for migratory bird species, (Department of the Environment (DotE), 2015)

<sup>1</sup> Species listed as Critically Endangered, Endangered, Vulnerable or Near Threatened, under the EPBC Act or Nature Conservation Act 1992, at the date of EPBC Referral submission.

<sup>2</sup> Maximum fall distance based on formula presented in (Hull & Muir, 2010)

<sup>3</sup> Species listed as Migratory under the EPBC Act, at the date of EPBC Referral submission.



## 2.2 Monthly Assessments

Following completion of twice monthly targeted carcass searches, assessment was undertaken to determine whether Impact Triggers had been reached for Threatened Species, Migratory Species and non-threatened / non-migratory species.

## 2.3 Annual Mortality Estimates

Annual mortality assessments were conducted by statisticians Symbolix and involved use of a statistical model which incorporates results from monthly carcass searches, searcher efficiency and scavenger rate trial to generate annual mortality estimates. Detailed methodology is provided in Appendix A.

# 3 Results

## 3.1 Monthly Assessments

### 3.1.1 Threatened Species

Assessment of Impact Triggers for threatened species identified triggers had been reached on two separate occasions with the single Spectacled flying-fox (*Pteropus conspicillatus*) individuals recorded in January 2023 and February 2023. As per the BBAMP, each of these finds was reported to the department ((Neoen Pty Ltd, personal communication, January 16, 2023) and (Neoen Pty Ltd, personal communication, February 20, 2023)) and the adaptive management procedure was followed. These incidents were investigated and viewed as isolated events and no further actions were required.

### 3.1.2 Migratory Species

Monthly assessment of impacts on migratory species against Impact Triggers identified no triggers had been reached based on direct observations of individuals. Table 2 summarises the total number of migratory species identified during Year 1, including targeted searches and incidental records.

**Table 2: Migratory species carcasses recorded during Year 1**

Species	Carcasses recorded
Fork-tailed swift ( <i>Apus pacificus</i> )	5
Rufous fantail ( <i>Rhipidura rufifrons intermedia</i> )	1
Black-faced monarch ( <i>Monarcha melanopsis</i> )	1
White-throated needletail ( <i>Hirundapus cauducutus</i> )	2

### 3.1.3 Non-threatened / non-migratory species

Impact Triggers for non-threatened / non-migratory species were assessed, on a month-to-month basis, and identified no triggers had been reached during Year 1.





## 3.2 Annual Mortality Estimate

Assessment of the annual mortality estimates prepared by Symbolix (Appendix A) against the Impact Triggers identified that a trigger had potentially been reached for white-throated needletail, with a total of 5 individuals estimated to be impacted by the Project (Table 3). However, precautionarily DCCEEW was notified of a potential trigger and causation/mitigation investigations have commenced in consultation with DCCEEW, as per the adaptive management procedure within the BBAMP. An additional three migratory species were also impacted during Year 1, though estimated mortalities were below Impact Triggers.

Mortality estimates for non-threatened and non-migratory species are detailed in Appendix A.

**Table 3: Site-wide (total) percentiles of mortalities for threatened and migratory species**

Species	0%	50% (Median)	90%	95%
Fork-tailed swift ( <i>Apus pacificus</i> )	1	9	18	21
Rufous fantail ( <i>Rhipidura rufifrons intermedia</i> )	1	3	8	10
Black-faced monarch ( <i>Monarcha melanopsis</i> ) <sup>1</sup>	1	3	8	10
White-throated needletail ( <i>Hirundapus cauducutus</i> )	2	5	11	14
Spectacled flying-fox ( <i>Pteropus conspicillatus</i> ) <sup>1</sup>	1	3	9	11

## 4 Recommendations

Based on the findings of the assessment the following recommendations have been identified:

1. Given two spectacled flying-fox carcasses have been identified and annual mortality estimates determine up to 3 (50% percentile) have been impacted, it is recommended that Impact Triggers for the species be investigated to determine at what number impacts are likely to result in a significant impact on the species.
2. Causation/Mitigation assessment related to white-throated needletail Impact Trigger event should be completed in consultation with DCCEEW.
3. Where required, update BBAMP to reflect findings of white-throated needletail causation/mitigation assessment. Additional survey effort, specific to determining seasonality and long-term impacts of white-throated needletail may be required.
4. Any species specific survey effort to be done in consultation and guidance from the Department.



## 5 Conclusion

The Year 1 Annual Mortality Assessment identified impacts on four migratory species and one threatened species; with impact triggers exceeded on up to three occasions, twice for spectacled flying-fox and once potentially for white-throated needletail. On all occasions the adaptive management procedure in the BBAMP was followed and DCCEEW notified. Based on these findings several recommendations have been proposed including:

1. Revise Impact Triggers for spectacled flying fox to determine at what level impacts on the species are likely to become significant
2. Complete causation/mitigation assessment related to white-throated needletail Impact Trigger exceedance
3. Where required, update BBAMP to reflect findings of white-throated needletail causation/mitigation assessment and revised Impact Triggers for spectacled flying-fox.



## 6 References

AECOM. (2017). *Kaban Green Power Hub—Fauna Technical Report*.

Department of the Environment (DotE). (2015, September). *Referral guideline for 14 birds listed as migratory species under the EPBC Act*. Commonwealth of Australia.

E2M. (2021). *Kaban Green Power Hub—Bird and Bat Adaptive Management Plan* (Management Plan Rev 10; p. 76).

Hull, C., & Muir, S. (2010).

Search areas for monitoring bird and bat carcasses at wind farms using a Monte-Carlo model. *Australasian Journal of Environmental Management*, 77-87.

Neoen Pty Ltd. (2023, January 16). *Notification letter to DCCEEW, regarding the incidental find of a spectacled-flying fox: January 2023* [Personal communication].

Neoen Pty Ltd. (2023, February 20). *Notification letter to DCCEEW, regarding the incidental find of a spectacled-flying fox: February 2023* [Personal communication].





## Appendix A Annual Mortality Estimate



symbolix

# Kaban Wind Farm Mortality Estimate - Year 1

Prepared for E2M, 5 July 2024, Ver. 2.0

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This report outlines an analysis of bird and bat mortality at Kaban Wind Farm from 2022-09-01 to 2023-09-01, the “first year period” of operation. The analysis is broken into the three related components below:

- Searcher efficiency / detectability – estimated from trials in October 2023
- Scavenger loss rates – estimated from trials in October 2023
- Mortality estimates - based on surveys at 25 turbines, from 2022-09-21 to 2023-08-29

We estimate overall bird and bat mortality, and mortality for the following species of interest:

- Black-faced Monarch
- Fork-tailed Swift
- Rufous Fantail
- Spectacled Flying-fox
- White-throated Needletail





## 1 Available data

Turbine data, mortality survey data, and adjunct survey data was provided by E2M<sup>1</sup>. Search area spatial files were also provided by E2M<sup>2</sup>.

Species archetype data was taken from Hull and Muir (2010) (bat and small/medium bird archetypes) and Smith (2005) (Spectacled Flying-fox).

### 1.1 Data cleaning

Carcass finds (formal), incidental finds, searcher efficiency, scavenger efficiency data:

- Unidentifiable/unknown birds were recoded to “Unidentified Bird”
- Unidentifiable/unknown bats were recoded to “Unidentified Bat”
- Capitalisation and hyphenation made consistent

Otherwise, data was used as provided by E2M.

---

<sup>1</sup>E2M\_MortalityTemplate.xlsx

<sup>2</sup>KABAN\_AllCarcassSearchAreas\_2023.shp



## 2 Statistical methodology overview

Mortality through collision is an ongoing environmental management issue for wind facilities. Different sites present different risk levels; consequently different sites have different monitoring requirements. In order to estimate the mortality loss at a given site (in a way that is comparable with other facilities) we must account for differences in survey effort, searcher and scavenger efficiency. We used a Monte Carlo method to achieve this.

Best practice estimators project the number of found carcasses ( $C$ ) up the number of actual mortalities ( $M$ ). They should account for:

- The probability a carcass will be detected by the searcher ( $p$ )
- The probability a carcass is not lost to scavenge or decay prior to the search ( $r$ )
- The probability a carcass falls within the searched area ( $a$ )
- The fraction of turbines searched ( $f$ )

Most mortality estimators, e.g. (M. M. Huso 2011), can be conceptualised as a ratio estimator

$$\hat{M} = \frac{C}{\hat{p} \cdot \hat{r} \cdot \hat{a} \cdot f} \quad (1)$$

with the terms in the denominator providing a “boost factor” to the number of carcasses found,  $C$ .

However, a limitation of analytical methods is estimating  $r$  when the time between surveys is not constant. In Australia, it is common for the time between searches to vary due to seasonal changes in effort or the use of a pulsed design in which the turbine is searched monthly with a return visit a few days later. Additionally, ratio estimators cannot handle the cases when zero carcasses are found, as zero multiplied by any number still gives zero.

To address this, Symbolix have developed a Monte Carlo algorithm. We have used this method for mortality estimates at over forty wind farms in Australia to date.

Monte Carlo methods (Sawilowsky (2003), Ripley (1987)) simulate a large set of possible survey results, by simulating the actual survey protocol, and sampling from empirical distributions for scavenge loss and searcher efficiency. In this way, we directly sample the probability a carcass was lost before the survey, negating the need to calculate  $r$  analytically each time.

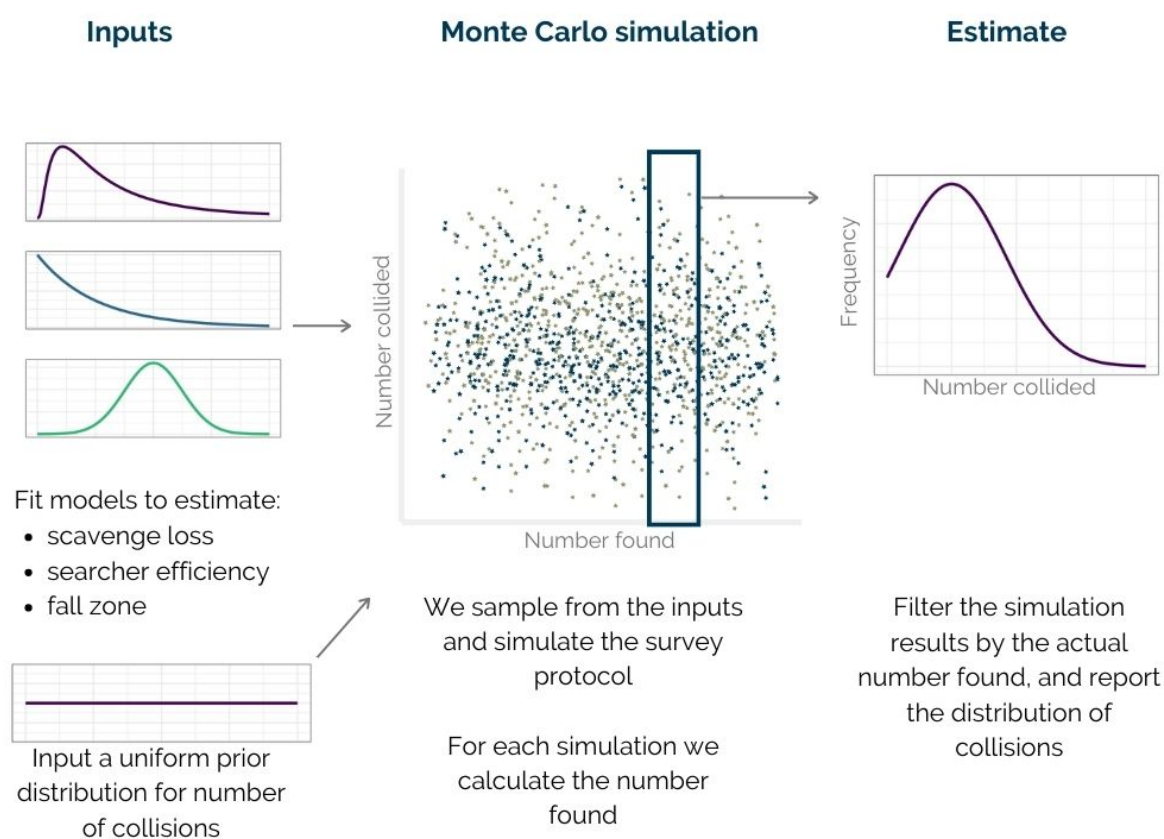
We then estimate how many carcasses were truly generated, given the range of searcher and scavenger efficiencies, the survey frequency and coverage, and the true “found” details. After many simulations, we can estimate the likely range of mortalities that could have resulted in the recorded survey outcome (number of carcasses found).

This method has been benchmarked against analytical approaches (M. M. Huso (2011), Korner-Nievergelt et al. (2011)). Its outputs are equivalent but it is able to robustly model more complex survey designs (e.g. pulsed surveys, rotating survey list).

Figure 1 provides an overview of the methodology. A detailed explanation can be found in Stark



and Muir (2020).



**Figure 1: Overview of how the mortality estimation works.**

The following sections outline how we estimate  $p$ ,  $r$  and  $a$ .  $C$  is given by the field observation data, and  $f$  is defined by the survey design.



### 3 Analysis and modelling

The survey program consisted of carcass searches, and adjunct scavenger and detection trials. We summarise the methods, field data and analysis results for each below.

#### 3.1 Carcass search data

Carcass searches for birds and bats were primarily undertaken by scent dog, with a trained handler. However, a small number of surveys were undertaken using human searchers at the start of the survey program.

The carcass searches provide the  $C$  and  $f$  terms in Section 2.

##### 3.1.1 Survey effort

The original survey was based upon a list of 15 selected turbines. According to the EPBC Approval Conditions 11 and 13 for Kaban Wind Farm (E2M 2021), all “high risk” turbines must be surveyed, and if a EPBC listed bird or bat species is detected in the vicinity of a “low risk” turbine, that turbine is re-classified as “high risk”. Therefore, the number of turbines searched evolved over time.

The searched area at each turbine did not remain constant over time, due to logistical and access issues. This is discussed and accounted for in Section 3.5.

Primarily, canine searchers with a trained ecologist handler were used. There were a number of searches with human searchers at the start of the program.

**Table 1: Number of surveys per month during the first year analysis period.**

Date	Dog	Human
2022 Sep		2
2022 Oct		2
2022 Nov		2
2022 Dec		2
2023 Jan		22
2023 Feb	32	
2023 Mar	34	
2023 Apr	34	
2023 Jun	35	
2023 Jul	44	
2023 Aug	51	



### 3.1.2 Carcass finds

The breakdown of found carcasses per species are summarised in Table 2.

**Table 2: Carcasses found during formal surveys over the first year of survey. Key species highlighted.**

Species	Bat	Bird
Brown Quail		2
<b>Fork-tailed Swift</b>		<b>2</b>
Laughing Kookaburra		2
Magpie Goose		1
Magpie-lark		1
Noisy Miner		2
Pale-vented Bush-hen		1
Peaceful Dove		4
Rainbow Lorikeet		1
Sacred Kingfisher		1
Superb Fruit-Dove		1
Unidentified Bird		4
Wedge-tailed Eagle		1
<b>White-throated Needletail</b>		<b>1</b>
Eastern Freetail Bat	8	
Hoary Wattled Bat	17	
Little Red Flying-fox	1	
Northern Freetail Bat	27	
Troughton's Sheath-tail Bat	1	
Unidentified Bat	26	
White-striped Freetail Bat	6	
Yellow-bellied Sheath-tail Bat	8	

A number of carcasses were also found incidentally. While these can't be included in the formal mortality estimate, we report them for completeness in Table 3.

**Table 3: Incidental finds. Key species highlighted.**

Species	Number found
Blue-winged Kookaburra	2
Brown Quail	4
Buff-breasted Paradise Kingfisher	1
<b>Fork-tailed Swift</b>	<b>3</b>
Little Red Flying-fox	1
<b>Rufous Fantail</b>	<b>1</b>
Rufous Songlark	1
Sacred Kingfisher	1
<b>Spectacled Flying-fox</b>	<b>2</b>
Squatter Pigeon	1
Superb Fruit-Dove	2
Unidentified Bat	10
White-striped Freetail Bat	4
<b>White-throated Needletail</b>	<b>1</b>

## 3.2 Searcher efficiency

The aim of searcher efficiency trials is to quantify the effectiveness of observers, at finding carcasses. They provide the  $p$  term in 2.

### 3.2.1 Field methods

The searcher efficiency data is primarily sourced from trials conducted in 2023 Oct. Carcasses were laid out in accordance to the specification in Section 5.2.2.5 of E2M (2021). Trained detection dogs (with a human handler) searched for the carcasses using the same protocol as the main mortality survey. If the carcass was found, “success” was recorded, else “failure” was the dog missing the carcass.

The detectability trials used bird (13 replicates) and bat (13 replicates) of various size classes.

**Table 4: Count of species types and sizes used during the detection trials.**

Species	Size	Replicates
Bat	Large	3
Bat	Medium	5
Bat	Small	5
Bird	Large	3
Bird	Medium	2
Bird	Small	8

### 3.2.2 Human searcher data

There were no trials for human searchers. Therefore, the aggregated data set of Stark and Muir (2020) was used. This dataset holds 435 bird records and 141 bat records, for an array of human searchers at Victorian wind farms.

### 3.2.3 Statistical methods

We estimated searcher efficiency by fitting binomial generalised linear models (GLMs). The optimal model was determined, guided by the small-sample Akaike Information Criterion (Anderson and Burnham 2004), otherwise known as the AICc.

The theory of AIC is deep and complex, and beyond the scope of this report. However, to summarise, AIC is a method for choosing the best approximating model of the “truth”. For each model we fit to the data, we calculate the AIC. We compare the differences in AIC between models, which in turn informs us of the weight of evidence for that particular model.

AIC is not the same as significance testing. We do not aim to state anything is significant at the 5% level, instead we aim to find a good model fit for the data. Additionally, we also consider two other principles guiding model selection. They are parsimony (a simpler model is preferable to a more complex model), and application (for example, it’s all well and good to find that cloud cover affects detection rates, but it’s not feasible to incorporate cloud cover into a mortality estimate).

AICc is a modification of AIC, which is appropriate for smaller sample sizes.

### 3.2.4 Results

For the dog surveys, the most parsimonious model of searcher efficiency models was the “intercept-only” model (i.e. all carcasses have the same expected searcher efficiency). Therefore, bird and bat detection efficiencies are aggregated in the following mortality estimate, for canine-based surveys.



For the human surveys, modelling from Stark and Muir (2020) found a difference between bat and bird detection rates, and therefore the detection rates are separated for human-based surveys.

**We assume that dogs have a 73% chance of detecting a carcass (birds and bats), with a 95% confidence interval of [52, 88]. Humans have a 52% [44%, 61%] chance of detecting a bat, and a 88% [85%, 91%] chance of detecting a bird.**

Table 5 shows the results from both data sources.

**Table 5: Detection efficiencies for canine and human searchers. The Dog trials were sourced from Kaban Wind Farm data, while the Human trial results were sourced from assorted Victorian surveys.**

Variable	Dogs (all species)	Humans (bats)	Humans (birds)
Number found	19	74	383
Number placed	26	141	435
Mean detectability proportion	0.73	0.52	0.88
Detectability lower bound (95% CI)	0.52	0.44	0.85
Detectability upper bound (95% CI)	0.88	0.61	0.91

### 3.3 Scavenger efficiency

In order to accurately estimate mortality, we must account for carcass loss to scavengers. Scavenger trials are performed to quantify the time until a carcass is completely lost as a result of scavenger activity, which is the  $r$  term in Section 2.

#### 3.3.1 Field methods

Scavenger efficiency trials were conducted in October 2023. The trials ran over approximately 30 days. In total, 14 bird carcasses and 13 bat carcasses were used. Trials used motion sensitive cameras in order to record exact times of scavenge events, and were held in accordance with Section 5.2.2.4 of E2M (2021).

**Table 6: Species types for scavenger trials.**

Species	Replicates
Bird	14
Bat	13





### 3.3.2 Statistical methods

Survival analysis (Kaplan and Meier (1958), Kalbfleisch and Prentice (2011)) was used to determine the distribution of time until complete loss from scavenge (or decay). Survival analysis was required to account for the fact that we do not necessarily know the exact time of scavenge loss, only an interval in which the scavenge event happened. For example, any carcass which is unscavenged at the end of the trial, has its scavenge event in the interval  $[x, \infty]$  (where  $x$  is the length of the trial).

By performing survival analysis we can estimate the time until carcass loss after a given length of time, despite these unknowns.

We fit parameterised models to analyse significant factors influencing time to scavenge (carcass species type etc), and to find the most appropriate distribution to fit the time-to-loss curve (e.g. log-normal, exponential).

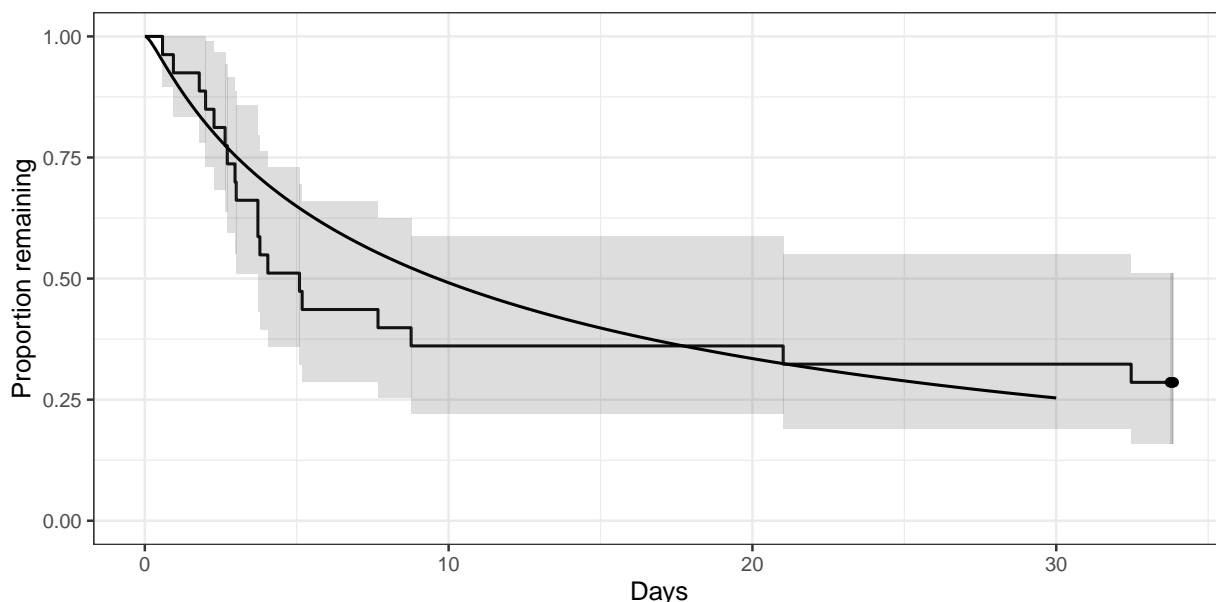
Time to carcass loss is influenced by the parameters discussed above and the distribution of the loss curve we fit to the data (M. M. P. Huso, Dalthorp, and Korner-Nievergelt 2015). The choice of loss function is important because it should capture the behaviours and relative time dependence of the various scavengers. Generally, the best distribution is the log-normal distribution (Stark and Muir 2020).

### 3.3.3 Results

AICc analysis of the survival regression models, showed the most parsimonious model was the “intercept-only” - i.e., no difference between the bat and bird scavenger rates. Therefore, in the following mortality estimations, aggregated survival curves are used.

Figure 2 shows the survival curve fitted to the combined set of bats and birds. The survival curve (smooth solid line for fitted regression curve, jagged step function for empirical removal rate) shows the estimated proportion of the set remaining at any given time. The shaded portions are the 95% confidence intervals on the estimate.

**Under these assumptions, the median time to carcass removal via scavenge is 9.6 days, with a 95% confidence interval of [5, 19.1] days. In other words, we expect that 50% of carcasses struck by wind turbines at Kaban will be removed by scavengers within 9.6 days, and 50% to be removed by scavengers after 9.6 days on the ground.**



**Figure 2: Empirical survival curve (the step function), with 95% confidence interval shaded. The smooth curve presents the fitted model.**

### 3.4 Proportion of turbines searched

In the Monte Carlo algorithm, we explicitly simulate the survey design. The proportion of turbines sampled is therefore accounted for in the simulation.

There are 28 total turbines at Kaban Wind Farm. Initially, 15 were selected to be surveyed, but due to the permit conditions, 25 were surveyed at some point during the first year period.

### 3.5 Coverage factor

The coverage factor estimates the probability that, given a carcass falls at a searched turbine, that the carcass falls within the searched area. This contributes to the  $a$  term in Section 2.

#### 3.5.1 Fall zone simulation - methods

We generated a carcass fall-zone distribution for the following species classes, given the turbine size at the wind farm:

- Medium birds (used as an archetype for the general bird mortality estimate)
- Microbats (used as an archetype for the general bat mortality estimate)
- Small birds (used as an archetype for the Black-faced Monarch, Fork-tailed Swift, Rufous Fantail, and White-throated Needletail estimates)
- Spectacled Flying-fox



The fall-zone distribution is the end result of the simulation method detailed in Hull and Muir (2010). The simulation method is a ballistics model describing avifauna strikes by turbine blades.

### 3.5.2 Coverage factor calculation - methods

The percentage of the fall zone not covered by the survey area, provides a correction factor in the mortality estimate. Because carcasses that fall outside the searched area have a zero probability of being detected by a survey, the likelihood of landing in this region is essential to understanding the relationship between detections and actual losses.

At Kaban Wind Farm, custom search areas were used. These areas sometimes evolved over time. To account for the unique shapes being searched, a technique similar to that in Box 3.4 of International Finance Corporation (2023) is used.

A two-dimensional fall zone distribution is generated from the rotating the one-dimensional output of Hull and Muir (2010). This 2-D distribution is a series of concentric annuli, with the probability density in each annulus, being equal to the density of the corresponding histogram bin in the one-dimensional Hull and Muir (2010) output. The annuli are then spatially intersected with the searched area, and hence the proportion of carcasses falling in searched area (the “coverage factor”) is found.

### 3.5.3 Simulation inputs

Table 7 displays the dimensions and RPM of the turbines at Kaban Wind Farm while Table 8 shows the bird and bat physical parameters used. These are input into the fall zone simulation.

Turbine specifications were provided by E2M. Bird and bat parameters were either sourced from the archetypes in Hull and Muir (2010) (medium and small birds, and bats), or for the Spectacled Flying-fox, weights from Churchill (2008) and dimensions from Smith (2005).

**Table 7: Turbine specifications for Kaban Wind Farm.**

Rotor diameter (m)	Tower hub height (m)	RPM
162	149	12.1

**Table 8: Species size archetype parameters.**

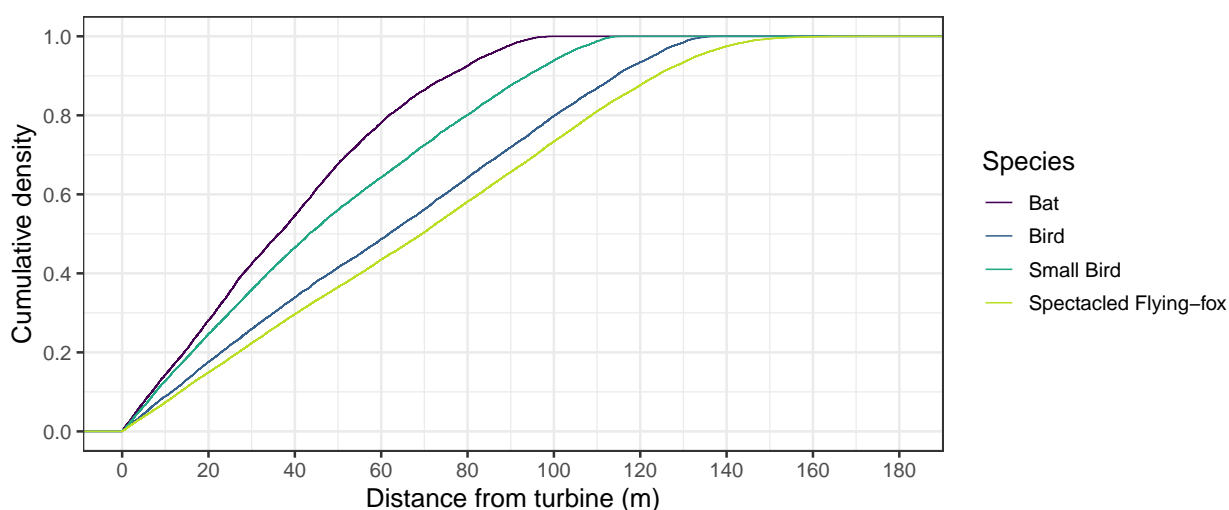
Species type	Archetype	Mass (kg)	Min. area (sq m)	Max. area (sq m)
Bat	Gould's Wattled Bat	0.014	0.0028	0.0140
Medium Bird	Raven	0.68	0.0450	0.1000
Small Bird	Silvereye Finch	0.012	0.0013	0.0036
Spectacled Flying-fox (M/F)		0.626/0.57	0.0230	0.0870



For the Spectacled Flying-fox, the Male and Female distributions were combined into a single overall distribution.

### 3.5.4 Results

Figure 3 displays the simulation results, given the factors specified above. We display the cumulative density function (CDF) on the y axis versus the distance from turbine (x axis). for each species type. The CDF describes the expected proportion of carcass which fall less than or equal to a certain distance from the turbine. For example, we see that we expect about 88% of Spectacled Flying-fox carcasses to fall within 120m of the turbine.



**Figure 3: Cumulative distribution function of the fall zone simulation output, for various species classes.**

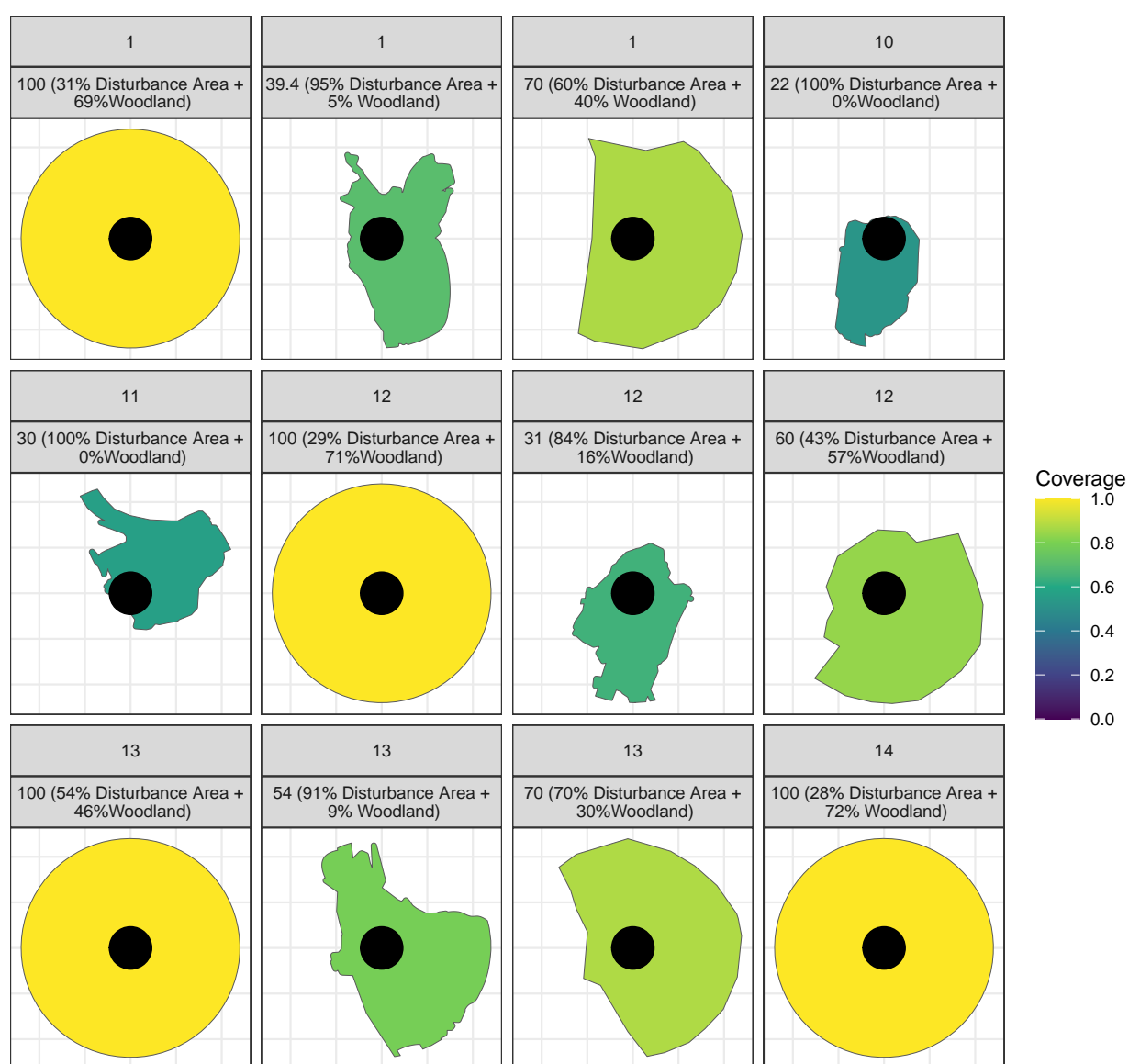
Once the fall zone distribution is calculated, we generate a “coverage factor” for each species type. The coverage factor represents the proportion of carcasses which fall within the searched area.

Figure 4 visualises some of the search areas, and shows the respective coverage factors. For example, when searching for the Small Bird archetype species, turbine 1’s survey type 39.4 (95% Disturbance Area + 5% Woodland) covers 70% of the fall zone. Or, turbine 14’s survey type 100 (28% Disturbance Area + 72% Woodland) covers 100% of the fall zone.

**Table 9 shows the average coverage factor for each species size class.**

**Table 9: Average coverage over the survey period, for each species class.**

Species type	Average coverage (%)
Bat	87
Medium Bird	71
Spectacled Flying-fox	66
Small Bird	82

**Figure 4: Search area shapes and coverage, for various turbines and survey types.**



## 4 Mortality estimate

We undertook general bird and bat estimates, as well as species-specific estimates for Black-faced Monarch, Fork-tailed Swift, Rufous Fantail, Spectacled Flying-fox, and White-throated Needletail. With estimates for scavenge loss, searcher efficiency, and survey coverage, we converted the number of carcasses detected, into an estimate of overall mortality at Kaban Wind Farm from 2022-09-01 to 2023-09-01.

Kaban Wind Farm had a staggered start of turbine commissioning, where turbines progressively came online and active (and therefore became available to strike avifauna) during the first year period. Each partition was assumed to start at a nominal start date - see Table 10. The nominal start date was derived from the turbine information provided by E2M, such that the difference in actual start date was within a few days of the nominal start date. This was incorporated into the mortality estimate, with the assumption that strikes could not occur before the nominal start date at that partition.

**Table 10: Split of turbines into various partitions.**

Partition	Nominal start date	Turbines
1	2022-11-09	1
2	2022-12-02	5
3	2022-12-16	2,3,4,6,7,8,9,10,11,12,14,15,16,17
4	2023-01-20	13
5	2023-05-07	19,20,21,22,23,24,25,26,27,28
6	2023-08-12	18

A single turbine, turbine 18, was only running for a few weeks during the analysis period. It had no surveys conducted at the time, and had a different commissioning date to other turbines. Therefore, analysis was not possible, and **it was excluded from the analysis**. This brings the number of turbines down from 28 to 27.

The mortality estimation is done via a Monte Carlo algorithm. We used 10000 simulations for each partition, with the survey design simulated each time. Random numbers of virtual mortalities were simulated, along with the scavenge time and searcher efficiency (based on the measured confidence intervals). The proportion of virtual carcasses that were “found” was recorded for each simulation. Finally, those trials that had the same outcome as the reported survey detections were collated, and the initial conditions (i.e. how many true losses there were) reported on.

The model assumptions are listed below:

- There were 27 turbines on site available to strike avifauna (note - ignoring turbine 18).
- Search frequency for each turbine was taken from a list of actual survey dates (see Table 1 for a summary).



- Mortalities were allowed to occur between the nominal start dates in Table 10, and 2023-09-01, for each partition.
- Birds are on-site at all times during this period.
- Bats are on-site at all times during this period.
- Bats and birds that are struck are immediately replaced (i.e. strikes one day do not affect the chance of strikes the next).
- We have used the standard practice of assuming that all carcasses and all feather spots (regardless of size or composition) are attributable to the wind turbines.
- Finds are random and independent, and not clustered with other finds.
- There was equal chance of any turbine being involved in a collision / mortality.
- We took scavenge loss and searcher efficiency rates as outlined above.
- We assumed a log-normal scavenge shape.
- The coverage factors were taken to be those calculated in Section 3.5.4.

## 4.1 Bias

The mortality estimation technique gives unbiased estimates for probability-based survey designs. However, the design at Kaban involves progressively adding turbines classed as “high risk” to the survey schedule, if certain key species are detected there. Given this is (potentially) favouring the design towards turbines with higher mortality rates, this may result in an estimate biased high.

## 4.2 Notes on results

**Per turbine per year estimate:** Given the progressive commissioning of turbines, we also present a per turbine per year estimate, (along with estimates of total mortality during the analysis period). The per turbine per year estimate is the total mortality, divided by the number of turbine-years at Kaban over that period. Effectively, it can be interpreted as “estimated number of mortalities per turbine, if each turbine was turning for a year”.

**Density:** the y-axis of the histograms shows the density. The “density” can be interpreted as the relative likelihood of taking a particular value. For example in Figure 5, a mortality of 250ish is about one-half as likely as a mortality of 350ish.

**Percentiles:** in tables such as Table 11, we present percentiles of the distribution. A  $k$ %-percentile gives the value such that  $k$ % of results that have a value less or equal to the  $k$ %-percentile. For example, in Table 11, we interpret:

- 50th percentile (338) as “50% of simulations had a value (mortality estimate) of less or equal to 338”.
- 90th percentile (439) as “90% of simulations had a value (mortality estimate) of less or equal to 439”.



### 4.3 Bats - overall

During the first year of surveys a total of 94 bats were found during formal surveys. The resulting (median) estimate of total mortality is 338 bats lost on site over the first year period.

The median mortality per turbine per year is 22 bats.

Table 11 and Figure 5 display the percentiles of the distributions, to show the confidence on the mortality estimate.

**Based on the detected carcasses, measured detectability, scavenge rate, and survey effort, we expect that there was a total site loss of around 338 bats over the full survey period, and are 95% confident that fewer than 462 individuals were lost. We expect the loss per turbine per year is around 22 bats, and are 95% confident that fewer than 30 bats were lost (on average) per turbine.**

Table 11: Percentiles of estimated bat losses.

Estimate	0%	50% (median)	90%	95%
Total (first year period)	208	338	439	462
Per turbine per year	14	22	29	30



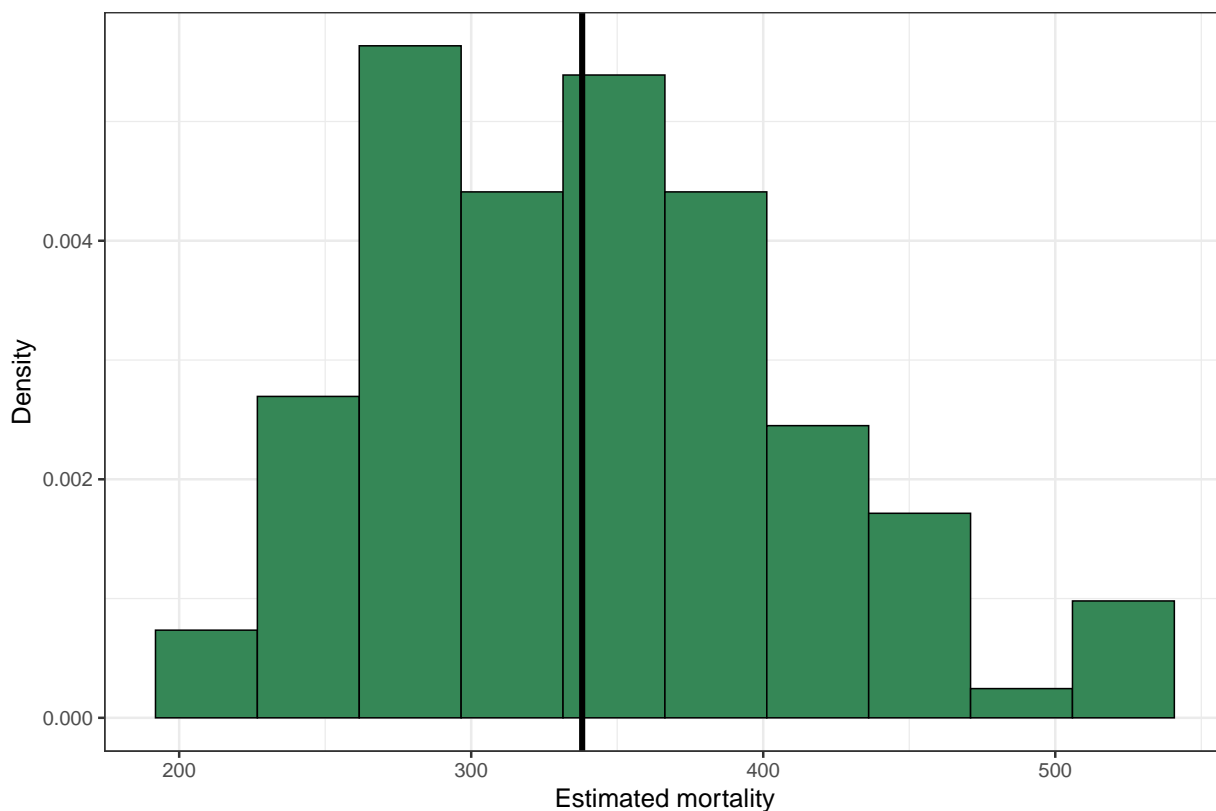


Figure 5: Histogram of the total losses distribution (bats). The black solid line shows the median.

#### 4.4 Birds - overall

During the first year period of surveys a total of 24 birds were found during formal surveys. The resulting (median) estimate of total mortality is 81 birds lost on site over the first year period.

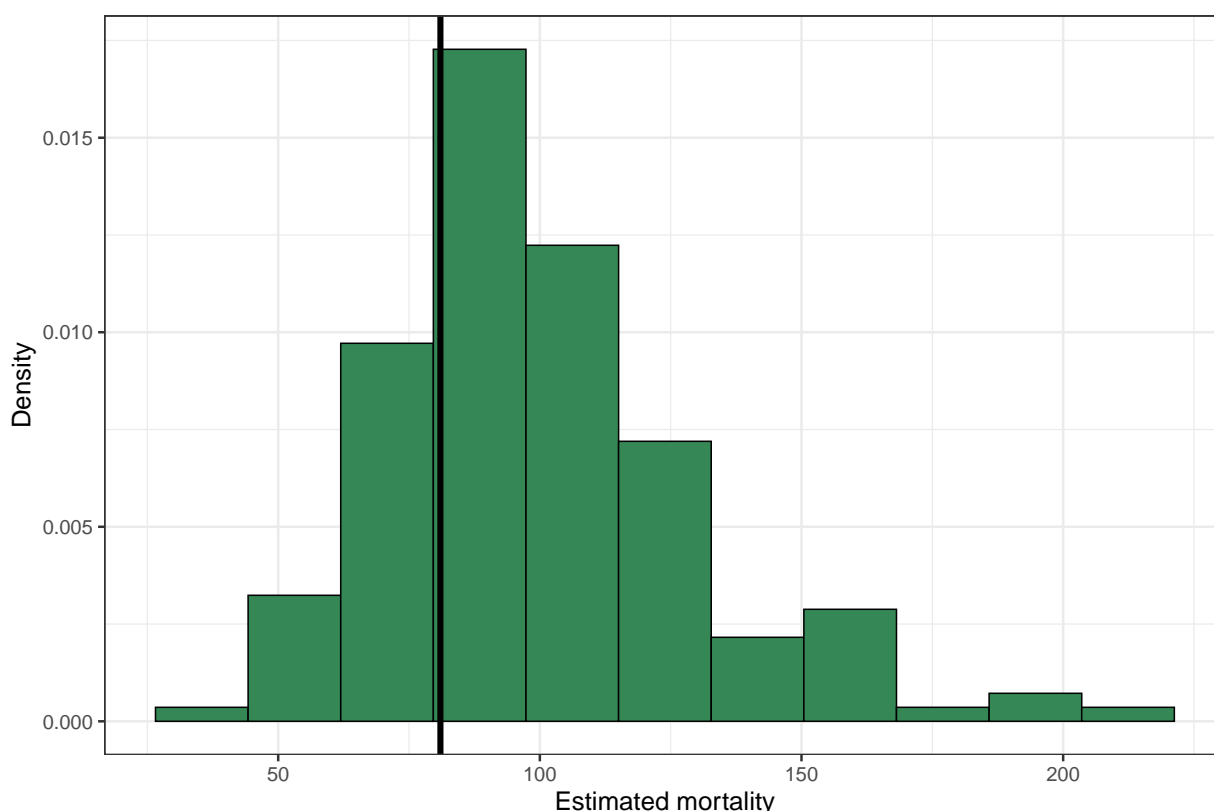
The median mortality per turbine per year is 5.

Table 12 and Figure 6 display the percentiles of the distributions, to show the confidence on the mortality estimate.

**Based on the detected carcasses, measured detectability, scavenge rate, and survey effort, we expect that there was a total site loss of around 81 birds over the full survey period, and are 95% confident that fewer than 111 individuals were lost. We expect the loss per turbine per year is around 5 birds, and are 95% confident that fewer than 7 birds were lost (on average), per turbine per year.**

**Table 12: Percentiles of estimated bird losses.**

Estimate	0%	50% (median)	90%	95%
Total (first year period)	37	81	98	111
Per turbine per year	2	5	6	7

**Figure 6: Histogram of the total losses distribution (birds). The black solid line shows the median.**

## 4.5 Single species estimates

We ran species-level estimates on the Black-faced Monarch, Fork-tailed Swift, Rufous Fantail, Spectacled Flying-fox, and White-throated Needletail. Note while these are not the only species of interest at Kaban Wind Farm, these were the only species for which we had tangible evidence of mortality, via either formal or incidental finds.

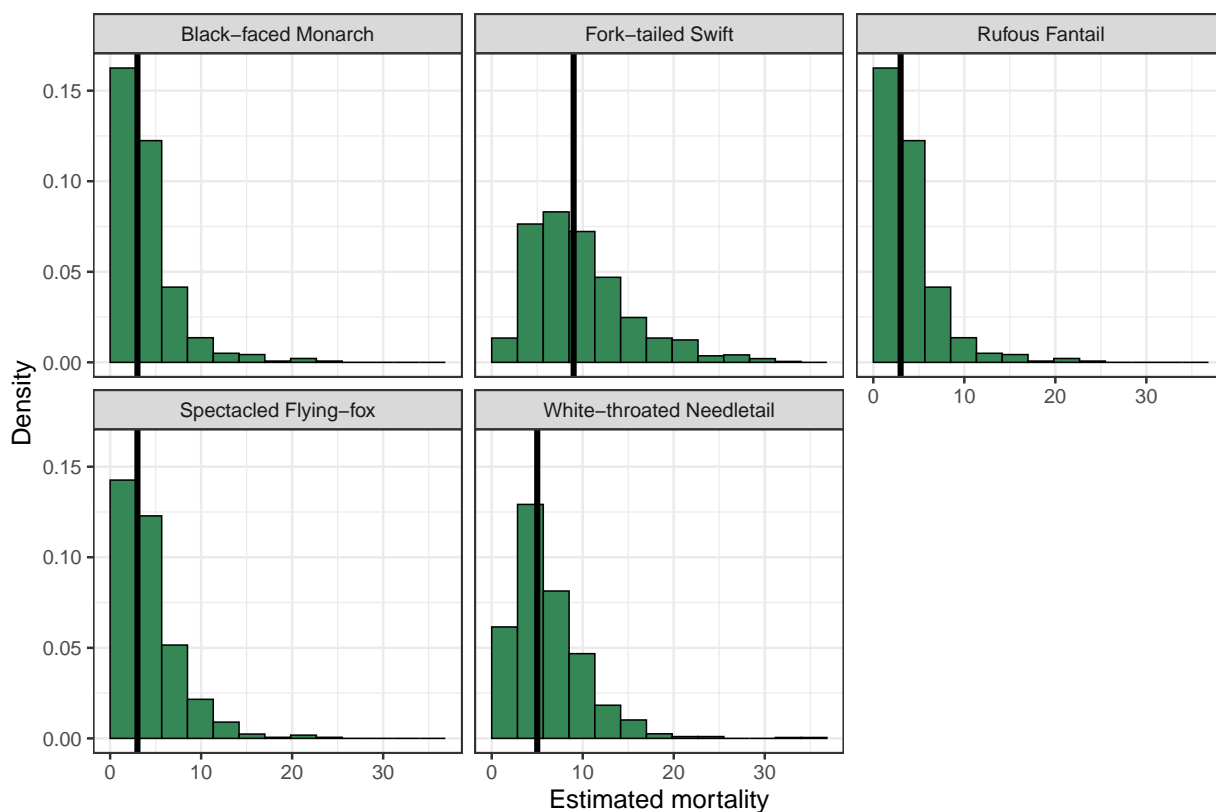
Again, we provide total (yearly) estimates in Table 13 and Figure 7, and rescaled (per turbine per year) estimates in Table 14.

**Table 13: Percentiles of mortalities for species of interest (total losses).**

Species	0%	50% (median)	90%	95%
Spectacled Flying-fox	1	3	9	11
Rufous Fantail	1	3	8	10
White-throated Needletail	1	5	11	14
Fork-tailed Swift	2	9	18	21
Black-faced Monarch	1	3	8	10

**Table 14: Percentiles of mortalities for species of interest (per turbine per year).**

Species	0%	50% (median)	90%	95%
Spectacled Flying-fox	0.1	0.2	0.6	0.7
Rufous Fantail	0.1	0.2	0.5	0.7
White-throated Needletail	0.1	0.3	0.7	0.9
Fork-tailed Swift	0.1	0.6	1.2	1.4
Black-faced Monarch	0.1	0.2	0.5	0.7

**Figure 7: Histogram of the total losses distribution for species of interest. The black solid line shows the median.**



## References

- Anderson, D, and K Burnham. 2004. "Model Selection and Multi-Model Inference." *Second. NY: Springer-Verlag* 63 (2020): 10.
- Churchill, S. 2008. *Australian Bats*. Allen & Unwin. <https://books.google.com.au/books?id=9winmAEACAAJ>.
- E2M. 2021. "Kaban Green Power Hub - Bird and Bat Adaptive Management Plan."
- Hull, CL, and Stuart Muir. 2010. "Search Areas for Monitoring Bird and Bat Carcasses at Wind Farms Using a Monte-Carlo Model." *Australasian Journal of Environmental Management* 17 (2): 77–87.
- Huso, Manuela M. P., Dan Dalthorp, and Fränzi Korner-Nievergelt. 2015. "Statistical principles of post-construction fatality monitoring." In *Wildlife and Wind Farms - Conflicts and Solutions, Volume 2*, 227–37. Pelagic Publishing.
- Huso, Manuela MP. 2011. "An Estimator of Wildlife Fatality from Observed Carcasses." *Environmetrics* 22 (3): 318–29.
- International Finance Corporation, KfW, European Bank for Reconstruction and Development. 2023. "Post-construction Bird and Bat Fatality Monitoring for Onshore Wind Energy Facilities in Emerging Market Countries - Good Practice Handbook and Decision Support Tool."
- Kalbfleisch, John D, and Ross L Prentice. 2011. *The Statistical Analysis of Failure Time Data*. John Wiley & Sons.
- Kaplan, Edward L, and Paul Meier. 1958. "Nonparametric Estimation from Incomplete Observations." *Journal of the American Statistical Association* 53 (282): 457–81.
- Korner-Nievergelt, Fränzi, Pius Korner-Nievergelt, Oliver Behr, Ivo Niermann, Robert Brinkmann, and Barbara Hellriegel. 2011. "A New Method to Determine Bird and Bat Fatality at Wind Energy Turbines from Carcass Searches." *Wildlife Biology* 17 (4): 350–63.
- Ripley, Brian D. 1987. *Stochastic Simulation*. USA: John Wiley & Sons, Inc.
- Sawilowsky, Shlomo S. 2003. "You Think You've Got Trivials?" *Journal of Modern Applied Statistical Methods* 2 (1): 218–25. <https://doi.org/10.22237/jmasm/1051748460>.
- Smith, Elissa N. 2005. "Husbandry Manual for Spectacled Flying Fox."
- Stark, E, and S Muir. 2020. "Post Construction Bird and Bat Monitoring at Wind Farms in Victoria."



## Appendix 5 Annual Relative Abundance Reports for Greater Gliders and Magnificent Brood Frogs




# Greater Glider Monitoring Program -Third Annual Survey, 2023

1 November 2023

Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust  
Level 21, 570 George Street, Sydney NSW 2000

# Document Management

Rev.	Issue Date	Description	Author (s)	Approved	Signature
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## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Project Overview	1
1.2	Scope and Objectives	1
1.3	Site Description	1
1.4	Improvements to Offset Areas	2
1.5	Survey Limitations	2
<b>2</b>	<b>Methods</b>	<b>5</b>
2.1	Survey Methodology	5
<b>3</b>	<b>Field assessment results</b>	<b>7</b>
3.1	Survey conditions	7
3.2	Greater glider observations	7
3.3	Impact triggers	9
<b>4</b>	<b>Discussion and Conclusion</b>	<b>11</b>
<b>5</b>	<b>References</b>	<b>12</b>

## List of Tables

Table 1: 2023 Greater glider (northern) spotlighting records	8
Table 2: Comparative greater glider ( <i>Petauroides minor</i> ) records for surveys 2021, 2022 and 2023	8
Table 3: Assessment against impact triggers	9

## List of Figures

Figure 1	Project location	3
Figure 2	Offset Area Locations	4
Figure 3	Greater glider (northern) monitoring sites	6
Figure 4	Greater glider ( <i>Petauroides minor</i> ) records	10





## Definitions

Term	Definition
Approval Conditions	The conditions pursuant to the EPBC Act Approval (EPBC2018/8289).
Greater glider	In the context of this report, we refer to the northern greater glider species, <i>Petauroides minor</i> .
Habitat	Greater glider habitat is characterised by connected eucalypt forests and woodlands containing large trees >30cm, for foraging and >50cm diameter at breast height (DBH) for denning. Contains known feed-trees such as <i>E. portuensis</i> , <i>E. teriticornis</i> , <i>C. citriodora</i> , <i>C. intermedia</i> , <i>E. crebra</i> and <i>E. moluccana</i> .
Kaban Wind Farm Pty Ltd	Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust
The Project	The construction of the Kaban Green Power Hub.
The Kaban site	The areas of Lot 1 on RP735194, Lot 33 on CWL374, Lot 35 on CWL391, Lot 2 on RP735194 and Lot 34 on CWL374 which contain proposed turbines.
Threatened species	Extinct (EX), extinct in the wild (XW), critically endangered (CE), endangered I, vulnerable (V) or conservation dependent (CD) under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> or extinct in the wild (PE), Endangered, Vulnerable or Near Threatened (EVNT) under the <i>Nature Conservation Act 1992</i> .

## Abbreviations

Abbreviation	Description
DAWE	Department of Agriculture, Water, and the Environment
E2M	E2M Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ha	Hectare
KGPH	Kaban Green Power Hub
RE	Regional Ecosystem



# 1 Introduction

## 1.1 Project Overview

The Kaban Green Power Hub (KGPH), developed by Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust (Kaban Wind Farm Pty Ltd), received *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval in April 2020 (EPBC 2018/8289). The KGPH (also referred to as 'the Project') is a wind farm towards the end of construction, consisting of 28 turbines as well as ancillary infrastructure including a substation, temporary and permanent meteorology masts, compounds/facilities, laydown areas, access tracks and underground cabling (Figure 1). As of early 2023, the wind farm is fully operational.

The Project has been designed to avoid and mitigate impacts on Matters of National Environmental Significance (MNES), however, the KGPH will have a significant residual impact on 61.2 ha of greater glider (northern) (*Petauroides minor*), herein referred to as greater glider, habitat (E2M, 2019). In accordance with the EPBC Act Environmental Offsets Policy (EOP) and the Commonwealth Department of Agriculture, Water and the Environment (DAWE) Approval Conditions, compensatory offsets are required.

A suitable Offset Area encompassing approximately 307.6 ha of greater glider habitat was identified adjacent to, but outside of, the Project disturbance footprint (Figure 2). The habitat will be managed according with the recommendations detailed in the Offset Area Management Plan (OAMP) (E2M Pty Ltd, 2021) to achieve a conservation gain for greater glider and compliance with the Approval Conditions (E2M Pty Ltd, 2021).

To monitor and guide the effectiveness of the OAMP over time, greater glider monitoring surveys are conducted within the Offset Area annually for the first five years and then once every five years thereafter for the life of the offset.

## 1.2 Scope and Objectives

E2M was commissioned by Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust to conduct the third annual survey (2023) for the Greater Glider Monitoring Program within the Offset Area. The objective of the survey is to monitor for the continued presence of the greater glider (*Petauroides minor*) over time. The scope of the survey includes:

- targeted greater glider surveys within three established transects and other incidental finds within the Offset Area in accordance with Commonwealth and State survey methodology; and
- the baseline dataset, and the dataset of future monitoring surveys, will be used to guide the effectiveness of the OAMP and ensure ongoing compliance with the Approval Conditions.

## 1.3 Site Description

Seven disjunct areas within three contiguous properties collectively form the Offset Area (Figure 2).

The three properties (formally 1RP735194, 2RP735194 and 32CWL254) are largely characterised by remnant vegetation composed of mixed eucalypt woodlands on metamorphic rock. Properties 1RP735194 and 2RP735194 are both bound by Bluff State Forest to the south and west, with rural properties to the north and east (Figure 2).



Property 32CWL254 is bound by Ravenshoe State Forest to the east and rural properties to the north, south and west (Figure 2). This property also contains an active mango orchard in the north-east corner.

## 1.4 Improvements to Offset Areas

During the first year of offset establishment, several important steps to improve greater glider habitat, within and adjacent to offset areas, have been conducted. These are:

- Removal of cattle from all offset areas
- Commencement of active weed treatment program
- Replacing the top barbed wire with barbless wire for all internal fences and most<sup>1</sup> boundary fences,
- Development of a project Fire Management Plan to ensure timely ecological burns are conducted; and
- Commencement of controlled ecological burns in offset areas, performed in 2022 and 2023.

## 1.5 Survey Limitations

The Kaban Green Power Hub project is situated on historic military training grounds containing unexploded ordnance. As such, all survey effort was conducted from pre-existing tracks due to the risk of potential interaction with unexploded ordnance away from tracks.

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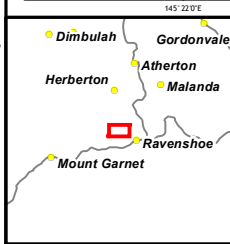
<sup>1</sup> Permission to replace, barbed with barbless, wire for some boundary fences was not granted by adjoining cattle graziers. In these circumstances, un-energised electric fence tape was stapled to the top strand to improve fenceline visibility to fauna moving throughout the landscape.











Scale 1:35,000 (A4)



Coordinate System: GDA 1994 MGA Zone 55  
Projection: Transverse Mercator

Notes:  
Aerial Imagery: © ESRI 2023  
Cadastre: © DoR 2023

0	Issued for Use	GO	DJ	11/12/2023
A	Issued for Review	GO	EA	13/11/2023
Rev	Description	Drawn	Approved	Date



FIGURE 2: OFFSET AREA LOCATIONS

2023 GREATER GLIDER SURVEY REPORT  
KABAN GREEN POWER HUB

Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 2 Methods

### 2.1 Survey Methodology

#### 2.1.1 Targeted greater glider survey

Spotlight surveys are a standard method used to survey nocturnal arboreal fauna, including greater gliders (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), 2011).

In accordance with the methods prescribed by the approved OAMP (E2M Pty Ltd, 2021), three 500 m spotlighting transects were established within the Offset Area (Figure 3). These transects are 'permanent transects' to be surveyed at each annual monitoring event.

Three permanent survey transects were established based on the:

- results of previous Offset Area survey
- habitat suitability and representation of Offset Areas
- spatial positioning (i.e. spread across the different Offset Areas)
- permanent access tracks with around the year access
- sites that have been examined for or have no history of unexploded ordnance

Each permanent transect was surveyed over three consecutive nights between the 7<sup>th</sup> and 9<sup>th</sup> of November commencing thirty minutes after sunset. Each transect was surveyed for a minimum of 60 person minutes. Incidental greater glider observations were also made off transect within the Offset Area.

#### 2.1.2 Impact triggers

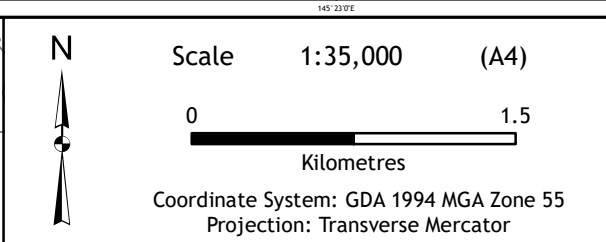
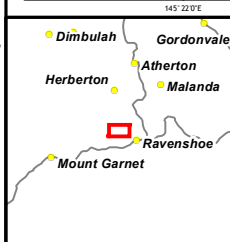
Section 7.5.2.1 of the Kaban Green Power Hub, Offset Area Management Plan (OAMP) provides details of triggers for corrective actions concerning greater glider monitoring

- The absence of the species across all monitoring sites in a single monitoring event; and/or
- The absence of the species at a single monitoring site for three consecutive years.

On completion of the survey, an assessment against each trigger will be undertaken and presented in the results section.







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<b>FIGURE 3: GREATER GLIDER (NORTHERN) MONITORING SITES</b>				
<b>2023 GREATER GLIDER SURVEY REPORT</b>				
<b>KABAN GREEN POWER HUB</b>				
Map Number	Job Number		Rev	
1 of 1	QEJ21046		0	

## 3 Field assessment results

### 3.1 Survey conditions

The Greater Glider Monitoring Program - Third Annual Survey was conducted during the early wet season (6<sup>th</sup> - 9<sup>th</sup> of November) by two Suitably Qualified Ecologists. The weather conditions during the three-night survey were optimal. The Kaban Windfarm Weather Station was offline during the survey, so climate data was recorded from nearby Ravenshoe. Night-time temperatures ranged between 18°C and 24°C and wind ranged from light to moderate (10 - 20 km/h). Rainfall during the survey was limited to 1.0 mm on 8<sup>th</sup> November. The region had received below average rainfall during the preceding month (Farmonline, 2023).

### 3.2 Greater glider observations

A total of five greater glider observations were recorded across three consecutive nights of spotlighting (Image 1). Greater gliders were observed on all three transects (Figure 4).



Image 1 Greater glider (northern) recorded during survey.

Greater gliders were observed in a variety of tree species including *Eucalyptus tereticornis*, *Eucalyptus crebra* and *Corymbia intermedia*. All data including the dates, times, coordinates and tree species for each individual was recorded and can be found in Table 1. A comparative table for the 2021, 2022 and 2023 season greater glider monitoring results has been included, see Table 2.





Table 1: 2023 Greater glider (northern) spotlighting records

Transect	Time & date of record	Number of individuals	Coordinates	Tree species
T1	8/11/2023 22:27	1	1 [REDACTED] [REDACTED]	<i>Eucalyptus crebra</i>
T2	7/11/2023 20:55	1	[REDACTED] [REDACTED]	<i>Eucalyptus tereticornis</i>
T2	9/11/2023 21:07	1	[REDACTED] [REDACTED]	<i>Eucalyptus crebra</i>
T3	7/11/2023 22:03	1	[REDACTED] [REDACTED]	<i>Eucalyptus tereticornis</i>
T3	9/11/2023 19:44	1	[REDACTED] [REDACTED] [REDACTED]	<i>Corymbia intermedia</i>

Table 2: Comparative greater glider (*Petauroides minor*) records for surveys 2021, 2022 and 2023

Transect	Greater glider observations 2021	Greater glider observations 2022	Greater glider observations 2023
T1	1	1	1
T2	3	1	2
T3	3	3	2



### 3.3 Impact triggers

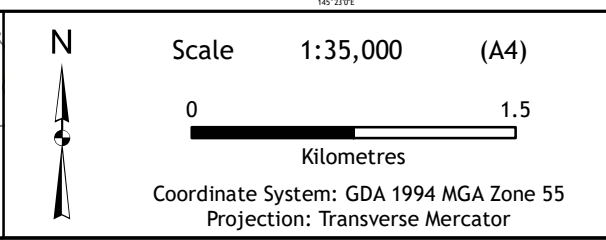
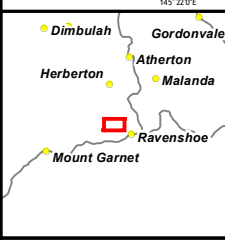
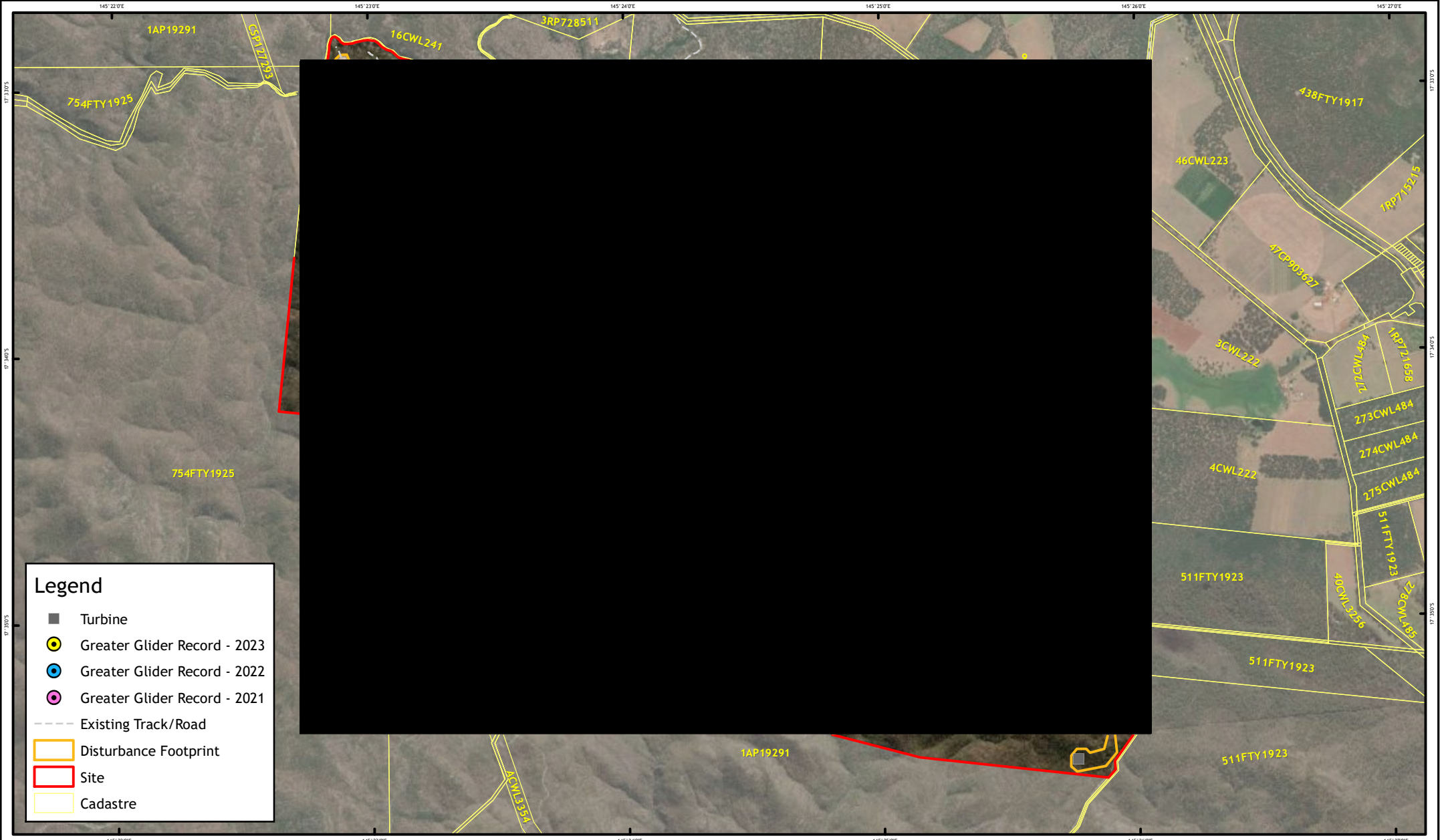
An assessment against the triggers, detailed in the OAMP, was performed and the results are detailed in Table 3.

**Table 3: Assessment against impact triggers**

Trigger Item	Result
1. The absence of the species across all monitoring sites in a single monitoring event	<b>No trigger:</b> All sites recorded the presence of greater glider
2. The absence of the species at a single monitoring site for three consecutive years	<b>No trigger:</b> All sites recorded the presence of greater glider over the last three years.



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**FIGURE 4: GREATER GLIDER (NORTHERN) RECORDS**  
**2023 GREATER GLIDER SURVEY REPORT**  
**KABAN GREEN POWER HUB**

Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 4 Discussion and Conclusion

The purpose of these surveys is to monitor the ongoing presence and/or absence of greater gliders within the offset areas and to measure the results against the impact trigger items detailed within the OAMP and perform corrective actions, if necessary. Greater gliders were observed in all three permanent spotlighting transects, during the 2021, 2022 and 2023 surveys with total observations ranging from five to seven animals during each annual survey.

Therefore, no impact triggers were activated and no corrective actions needed. However, ongoing management of the offset should be continued to assist in improving greater glider habitat within the offset areas.



## 5 References

Atlas of Living Australia. ‘*Atlas of Living Australia Occurrence Records*’, 2020. <https://www.ala.org.au/>

Department of Sustainability, Environment, Water, Population and Communities. (2011a). *Survey guidelines for Australia’s threatened mammals*. Australian Government.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). (2011).

Survey guidelines for Australia’s threatened mammals. Australian Government.

E2M Pty Ltd. (2019). Kaban Green Power Hub—RFI - Ecological Assessment Report.

E2M Pty Ltd. (2021). Kaban Green Power Hub—Offset Area Management Plan.

Farmonline. (2023). Ravenshoe daily rain summaries—[Www.farmonlineweather.com.au](http://www.farmonlineweather.com.au).

[https://www.farmonlineweather.com.au/station.jsp?lt=site&lc=31200&list=rb&of=of\\_a&ot=ot\\_a&mm=11&yyyy=2023&sub=go](https://www.farmonlineweather.com.au/station.jsp?lt=site&lc=31200&list=rb&of=of_a&ot=ot_a&mm=11&yyyy=2023&sub=go)






# Magnificent Brood Frog - Fourth Annual Abundance Monitoring Report February 2024

Kaban Wind Farm Pty Ltd as  
trustee for the Kaban Wind  
Farm Trust

227 Elizabeth Street, Sydney, NSW 2000

# Document Management

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Project overview	1
1.2	Scope and objectives	1
1.3	Project site description	2
<b>2</b>	<b>Methods</b>	<b>4</b>
2.1	Survey timing and conditions	4
2.2	Monitoring sites	4
2.3	Trigger Analysis	5
2.4	Cane Toad Monitoring	5
2.5	MBF target survey method	5
2.6	Microhabitat assessment method	6
2.7	Disturbance footprint photo monitoring method	6
2.8	MBF response to fire	8
<b>3</b>	<b>Results</b>	<b>9</b>
3.1	Trigger Assessment	9
3.2	MBF breeding activity	12
3.3	Cane toads	13
3.4	Potential Impacts of Fire	13
<b>4</b>	<b>Summary, conclusions and recommendations</b>	<b>16</b>
<b>5</b>	<b>References</b>	<b>17</b>

## List of Tables

Table 1: Relative abundance and minimum known alive of MBF recorded at all sites for 2021, 2022, 2023 and 2024.	10
Table 2: Trigger analysis comparing the mean relative abundance of MBF in 2023 and 2024 for each site grouping. A trigger is identified if the average relative abundance between consecutive annual monitoring events is reduced by more than 30%. Triggers are highlighted in red.	11
Table 3: Trigger analysis comparing the relative abundance of MBF in 2023 and 2024 for each site. A trigger is identified if the relative abundance between consecutive annual monitoring events is reduced by more than 50%. Triggers are highlighted red.	11
Table 4: Comparison of minimum number of cane toads observed from the 2022, 2023 and 2024 surveys	13
Table 5: Comparison of incidence of fire and subsequent changes to MBF abundance in the following breeding season. Cells highlighted Orange indicate significant fire event during the previous year, prior to abundance survey.	15





## List of Figures

Figure 1: Project Location	3
Figure 2. Rainfall recorded 7 days prior to and during the January 2024 survey.	4
Figure 3: MBF monitoring sites & 2024 observations.	7
Figure 4: Comparison of average relative abundance (MBF/10 m), for control or impact sites, between the 2021, 2022, 2023 and 2024 surveys.	9
Figure 5: Annual Fire Scar Mapping	14



## Definitions

Term	Definitions
EPBC Approval Holder	Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust
Disturbance footprint	The area approved to be impacted by the Project
Disturbance intercept	The point along a drainage line where the disturbance area intersects intact magnificent brood frog habitat (MBF)
Hydrocarbons	Petroleum-based or synthetic hydrocarbons (e.g., oil, diesel)
Habitat	Low stream order drainage lines occupied by MBF
Monitoring site / transect	Eleven survey sites, each consisting of a 200m transect, were established for ongoing monitoring.
Sedimentation	The deposition and accumulation of sediment in a body of water
The Project	Kaban Green Power Hub (KGPH) constructed and operated by Neoen Australia Pty Ltd
The Project Site	The site where the Project is situated, comprising 1,347 ha of freehold land across five lots.
Threatened species	Species listed as extinct (EX), extinct in the wild (XW), critically endangered (CE), endangered (E), vulnerable (V) or conservation dependent (CD) under the <i>Environmental Protection and Biodiversity Conservation Act 1999</i> , or extinct in the wild (PE), Endangered, Vulnerable or Near Threatened (EVNT) under the <i>Nature Conservation Act 1992</i> .

## Abbreviations

Abbreviation	Description
DAWE	Department of Agriculture, Water and the Environment
DNRME	Department of Natural Resources, Mines and Energy
E2M	E2M Pty Ltd
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FMP	Fauna Management Plan
KGPH	Kaban Green Power Hub
MBF	Magnificent Brood Frog
MKA	Minimum Known Alive
NATA	National Association Testing Authorities
Neoen	Neoen Australia Pty Ltd
NEPM	<i>National Environmental Protection (Assessment of Site Contamination) Measure 1999</i>
PMP	Photo Monitoring Point



# 1 Introduction

## 1.1 Project overview

The Kaban Green Power Hub (KGPB) (hereafter ‘the Project’) is a wind farm located approximately 6 km north of Ravenshoe on the Atherton Tablelands (see Figure 1). Owned and operated by Neoen Australia Pty Ltd, construction of the first of 28 turbines currently operating at KGPB was completed by Kaban Wind Farm Pty Ltd (as trustee for the Kaban Wind Farm Trust) in August 2023.

The Project was referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in 2018 based on a suite of technical reports and later supplemented by a series of environmental management plans before receiving approval by the Department of Agriculture, Water and the Environment (DAWE) in April 2020 (EPBC Number 2018/8289). Variation to the conditions was approved by DAWE in August 2020 and again in August 2022.

The Project approval (EPBC 2018/8289) was contingent upon the implementation of a *Fauna Management Plan* (FMP) (Part A, Condition 2). The FMP (E2M, 2021a) prescribes a *Magnificent Brood Frog Monitoring Program* which includes the requirement to complete annual monitoring throughout construction. In accordance with the FMP, a baseline monitoring survey for the Magnificent Brood Frog (MBF) was completed by E2M Pty Ltd (E2M) during the 2020/21 wet season (from 1-7 February 2021), prior to construction of the KGPB (E2M, 2021b). A second monitoring survey was completed during the 2021/22 wet season (in mid-January 2022) following the commencement of construction works (E2M, 2022) with a third monitoring survey completed during the 2022/23 wet season (in mid-to-late January 2023) (E2M Pty Ltd, 2023). This report details the results of the fourth annual monitoring survey completed during the 2023/24 wet season (from 16-23 January 2024).

During the January 2024 survey period, field assessments were also completed for magnificent brood frog (MBF) annual microhabitat and disturbance intercept monitoring. The results of these additional assessments can be found in the following documents:

- *Magnificent Brood Frog - Annual Disturbance Intercept Photo Monitoring Report - January 2024* (E2M Pty Ltd, 2024b), and
- *Magnificent Brood Frog Annual Microhabitat Monitoring Report—January 2023* (E2M Pty Ltd, 2024a).

## 1.2 Scope and objectives

E2M was commissioned by Kaban Wind Farm Pty Ltd as trustee for the Kaban Wind Farm Trust to conduct MBF monitoring surveys during the current (2023/24) wet season to identify and assess potential Project impacts on MBF abundance at the KGPB, in accordance with the FMP and the *Revised Magnificent Brood Frog Monitoring Program - Construction Phase only* (E2M, 2021). The scope of works for this monitoring event included:

1. Targeted MBF surveys to document MBF abundance across all eleven established monitoring sites
  2. Surveys to determine the relative abundance of cane toad at each MBF monitoring site
  3. Comparison of MBF survey results against reportable triggers, as detailed in the FMP and the *Revised Magnificent Brood Frog Monitoring Program - Construction Phase only* (E2M, 2021), and
  4. Providing recommendations for any mitigation or management measures to improve conditions for MBF on site.
- Additional information on MBF habitat quality monitoring at the KGPB gathered during the current (2023/24) wet season can be found in the *Magnificent Brood Frog - Annual Disturbance Intercept*



*Photo Monitoring Report - January 2024* (E2M Pty Ltd, 2024b), and *Magnificent Brood Frog Annual Microhabitat Monitoring Report—January 2023* (E2M Pty Ltd, 2024a) (E2M Pty Ltd, 2024a). Information included in these reports includes:

- The results of habitat monitoring across all eleven MBF monitoring sites, including
  - sedimentation
  - hydrocarbons, and;
  - any other project or non-project related influences impacting MBF populations.
- The results of photo monitoring.

Data from MBF abundance surveys, habitat monitoring, and MBF photo monitoring surveys will be used to identify Project impacts on the MBF population at KGHP, as well as assess the effectiveness of applicable mitigation and management measures detailed in the FMP.

### 1.3 Project site description

The Project is located within 1,347 ha of freehold land composed of five lots<sup>1</sup>. The disturbance footprint within the Project Site is 129 ha and largely characterised by remnant eucalypt woodland on basalt and granite rocky outcrops, hills and gullies. The Project Site and surrounds provide habitat for a variety of threatened flora and fauna species, including MBF.

Prior to construction of the KGPH, remnant vegetation was more or less contiguous across the Project Site, with clearing limited to access tracks, a residential dwelling and small timber mill. Historically, the Project site supported a sizeable military presence including a camp and a weapons training area. More recently, parts of the site have been used to support live-stock grazing.

The Project Site contains numerous slow-flowing first and second order streams/drainages, many of which provide habitat for MBF. Vegetation along these ephemeral streams/drainage comprises eucalypt woodland and open forest with a ground layer comprising mostly of native grasses (predominantly *Themeda triandra*).

The Project Site shares property boundaries with a number of protected areas, including Ravenshoe State Forest (as shown in Figure 1).

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<sup>1</sup> Lot 1 on RP734194, Lot 2 on RP735194, Lot 33 on CWL374, Lot 35 on CWL391, Lot 34 on CWL374 and a section of location road reserves



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FIGURE 1: PROJECT LOCATION				
Magnificent Brood Frog Monitoring Program Fourth Annual Monitoring Report Kaban Green Power Hub				
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## 2 Methods

### 2.1 Survey timing and conditions

The fourth annual MBF monitoring survey was conducted during the 2023/24 wet season (from 16-23 January 2024) by two suitably qualified ecologists. Weather conditions during the seven-day survey period were highly suitable for detection of MBF with significant rain falling prior to and during surveys (see below).

Seven days prior to the survey there was a total 153 mm of rainfall and 202 mm fell during the survey period (see data from nearby BOM Station 31200 in Figure 2). Night-time temperatures during surveys ranged from 19.5°C to 22°C. During surveys, humidity levels were high and wind levels low.

Rainfall was recorded daily throughout the survey period except for the last day of survey, with daily totals ranging from 18 and 79 mm (see Figure 2).

Total rainfall five days prior to the survey reached 153 mm (Figure 2), which surpasses the survey guidelines prescribed in the *Revised Magnificent Brood Frog Monitoring Program - Construction Phase Only* (E2M, 2021) (i.e. a minimum of 100 mm over a five day period, or when rainfall events offer favourable breeding conditions or are likely to trigger calling by the MBF).

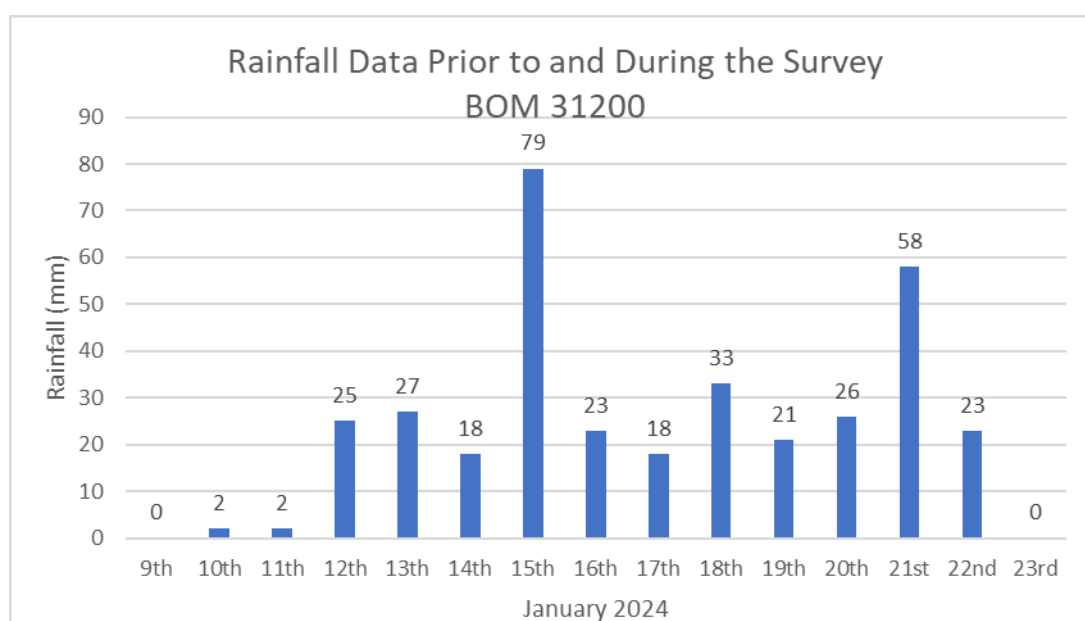


Figure 2. Rainfall recorded 7 days prior to and during the January 2024 survey.

### 2.2 Monitoring sites

The fourth annual MBF monitoring survey was conducted in accordance with the methods prescribed in Section 6.3 of the FMP (E2M, 2021a;).

Surveys for MBF were successfully conducted at all 11 monitoring sites under conditions suitable for the detection of the species. Microhabitat assessments (see E2M Pty Ltd, 2024a; in preparation) were conducted concurrently with MBF abundance surveys at all 11 monitoring sites. Photo monitoring was also conducted concurrently with MBF monitoring surveys but only at the 5 impact monitoring sites (see E2M Pty Ltd, 2024b, in preparation).





MBF surveys were conducted along a 200 m long ( $\pm 5$  m) transect on a stream or drainage line known to support breeding MBF, with the exception of Off-site Control 2, where the transect has been shortened to 136 m due to a lack of suitable habitat further downstream. The MBF monitoring site locations were the same as those surveyed in the first annual (baseline) monitoring survey conducted in January 2021.

The MBF annual monitoring sites are located within three treatment areas:

- Impact sites - five (5) survey sites located directly adjacent ( $<10$  m) or intersected by the disturbance footprint in areas of MBF habitat where the species is known to occur. These sites will determine whether the Project is impacting the abundance of MBF within the site.
- On-site Control sites - three (3) survey sites located within the proposed offset areas (minimum of 100 m from disturbance) in MBF habitat where the species is known to occur. These sites will act as an on-site control as they are unlikely to be impacted directly by the Project.
- Off-site Control sites - three (3) survey sites located within nearby National Parks and State Forests in suitable MBF habitat where the species is known to occur and anthropogenic impacts are minimal. These sites will act as an additional level of control and assist in determining if changes in MBF abundance at Impact sites are caused by project-related impacts or due to non-project related factors (e.g. climatic variation).

The location of the eleven MBF monitoring sites is shown in Figure 3.

## 2.3 Trigger Analysis

Pursuant to the FMP and the *Revised Magnificent Brood Frog Monitoring Program - Construction Phase Only* (E2M, 2021), annual MBF abundance estimates are assessed against the following triggers:

1. a 30% reduction in the average relative abundance of magnificent brood frogs across all impact sites between two consecutive monitoring events (i.e., over a one-year period), with no comparable reduction in brood frog abundance at control sites over the same period; and/or
2. a 50% reduction in the relative abundance of magnificent brood frogs at an individual impact site between two consecutive monitoring events (i.e., over a one-year period), with no comparable reduction in brood frog abundance at control sites over the same period; and/or
3. a continued 10% reduction (10% per year over five years) in the relative abundance of magnificent brood frogs across all impact sites, with no comparable reduction in brood frog abundance at control sites over the same period.

## 2.4 Cane Toad Monitoring

The FMP ((E2M, 2021a) recommends maintaining low densities of cane toads across the Project Site. The density of cane toads is monitored at each of the eleven MBF monitoring sites during the MBF surveys. The number of cane toads is recorded by each observer during each of the 2 survey nights. The highest number of cane toads from each night have been presented in this report and compared against previous years densities.

## 2.5 MBF target survey method

In accordance with federal survey guidelines (DEE, 2019) and the FMP (E2M, 2021a), surveys targeting MBF were conducted at night under conditions suitable for the detection of calling animals. During surveys, monitoring transects were walked slowly while listening out for calling MBF. To help quantify the number of animals calling along each transect, the location of calling animals along each transect was marked with a fluorescent flag, placed loosely in the grass near to each calling MBF (see Plate 1).



Each monitoring site was surveyed twice, over two nights, and at different times of night (between the hours of 7:00 pm and 10:15 pm), in order to account for temporal variation in MBF calling activity (due to daily and day-to-day variation in weather conditions and MBF calling activity).



Plate 1. Fluorescent flags placed near to each MBF location.

## 2.6 Microhabitat assessment method

In accordance with the prescribed methods in Table 10 of the FMP, a minimum of two Photo Monitoring Points (PMPs) were surveyed at each of the eleven monitoring sites. Each site is assessed for visible signs of sedimentation, hydrocarbons and any other changes in habitat that may impact the MBF.

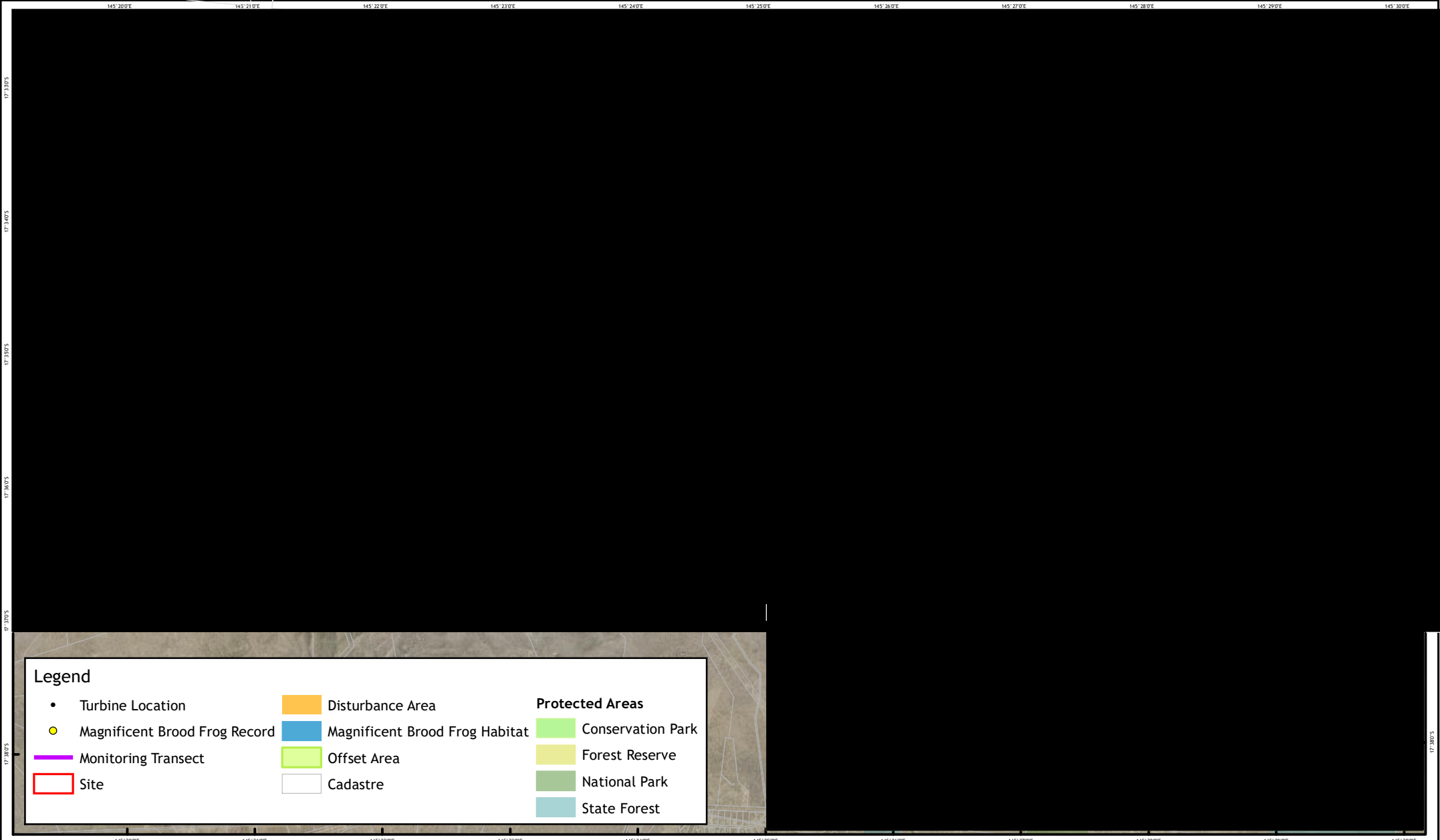
## 2.7 Disturbance footprint photo monitoring method

The disturbance footprint intercept photo monitoring is repeated annually, post construction, during the wet season and results presented in the Magnificent Brood Frog Disturbance Intercept Photo Monitoring Report (see E2M Pty Ltd, 2024a - in preparation). Photo monitoring points were established at each of the five (5) impact sites at the point where civil earthworks (disturbance) intercept the drainage line.





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**Legend**

- Turbine Location
- Magnificent Brood Frog Record
- Monitoring Transect
- Site

- Disturbance Area
- Magnificent Brood Frog Habitat
- Offset Area
- Cadastre

**Protected Areas**

- Conservation Park
- Forest Reserve
- National Park
- State Forest

N

Scale 1:70,000 (A4)

0 0.5 1 1.5 2 Kilometres

Coordinate System: GDA 1994 MGA Zone 55  
Projection: Transverse Mercator

**Notes:**  
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**FIGURE 3: MAGNIFICENT BROOD FROG MONITORING SITES**

Magnificent Brood Frog Monitoring Program  
Fourth Annual Monitoring Report  
Kaban Green Power Hub

Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 2.8 MBF response to fire

The response of MBF to fire is poorly documented and understood. Opportunistic observations following an uncontrolled fire at KGPH in November 2022, however, suggest fire is likely to impact negatively on the species.

During 2023, a series of controlled burns prescribed under the KGPH *Landscape Fire Management Plan* (Fireland Consultancy, 2023) were conducted throughout the Project Site. Evidence of recent controlled and possibly uncontrolled fires were also noted during this year's abundance surveys at Off-site Control sites. To better understand the impact these fires may have had on MBF monitoring results, additional desktop and field investigations were undertaken to document the extent and severity of fire at impact and control monitoring sites. These investigations included:

- the review of fire scar mapping from the Queensland Spatial Catalogue, Sentinel 2 Fire scar dataset (Queensland Government - Open Data Portal, 2023), and
- the collection of field data/observations to assess fire impacts at monitoring sites.



## 3 Results

During the January 2024 monitoring event, MBF were recorded calling at all eleven monitoring sites on both the first and second night of survey, with a minimum total of 232 MBF (sum of the minimum number of individuals known alive across all sites) detected. The relative abundance of MBF recorded at each site, expressed as the minimum known alive (MKA) per 10m of stream transect, is detailed in Table 1. The individual records for the minimum number known alive, at each monitoring site during the January 2024 survey event, is shown in Figure 3.

Relative abundance estimates for the January 2024 monitoring survey and previous annual monitoring surveys are compared in Figure 4. Data presented in this figure show a slight decrease in the average abundance of MBF at Impact sites and On-site Control sites when compared with 2023, while there was a further significant decrease in relative abundance at Off-site Control sites when compared with 2022 and 2023 (Figure 4).

### 3.1 Trigger Assessment

Trigger values for changes in MBF abundance were calculated as per section 2.3 of the *Revised Magnificent Brood Frog Monitoring Program*.

When compared with 2023, the average (mean) change in MBF abundance at Impact Sites (-20.6 %) and On-site Control sites (-6.5 %) was well below the 30 % average decrease trigger value, with the mean change in MBF abundance at Off-site Control Sites (-30.9 %) narrowly exceeding this value (see Table 3).

While the relative abundance of MBF at most sites was lower when compared with 2023 (see Tables 1 and 3), the only site to exceed the 50 % decrease site trigger value was Impact Site 4, where the abundance of MBF in 2024 was 79.2 % lower compared with 2023. Other sites with substantial decreases in MBF abundance compared to last year were Impact Site 3, On-site Control 2 and Off-site Controls 1, 2 and 3, with respective decreases of 42.4, 22.9, 29.4, 40.0 and 22.2 %.

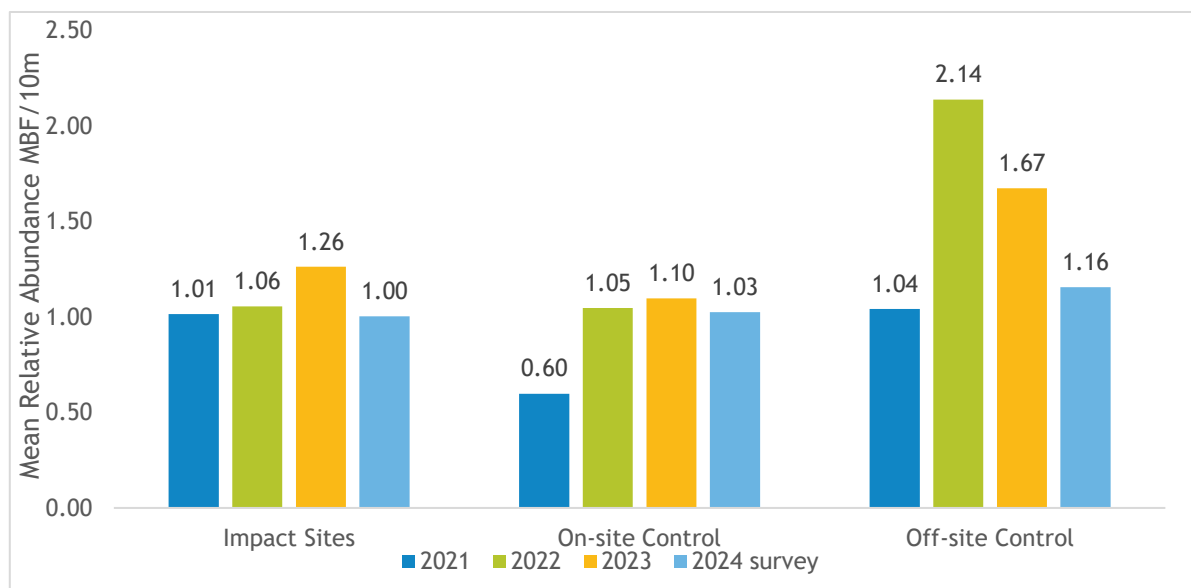


Figure 4: Comparison of average relative abundance (MBF/10 m), for control or impact sites, between the 2021, 2022, 2023 and 2024 surveys.



Table 1: Relative abundance and minimum known alive of MBF recorded at all sites for 2021, 2022, 2023 and 2024.

Monitoring site	2024 MBF records		Transect length (m)	Relative abundance (MBF/10m)*				Minimum number MBF			
	Night 1	Night 2		2021	2022 <sup>#</sup>	2023 <sup>#</sup>	2024	2021	2022 <sup>#</sup>	2023 <sup>#</sup>	2024
Impact Site 1	38	19	207	0.53	1.21	1.45	1.84	11	25	30	38
Impact Site 2	15	25	200	1.10	0.95	1.55	1.25	22	19	31	25
Impact Site 3	19	19	204	1.42	1.91	1.62	0.93	29	39	33	19
Impact Site 4	5	5	202	n/a	0.30	1.19	0.25	n/a	6	24	5
Impact Site 5	11	15	201	n/a	0.89	0.50	0.75	n/a	18	10	15
On-site Control 1	11	15	200	0.10	0.20	0.30	0.75	2	4	6	15
On-site Control 2	37	na <sup>1</sup>	203	0.93	1.92	2.36	1.82	19	39	48	37
On-site Control 3	10	10	199	0.75	1.01	0.60	0.50	15	20	12	10
Off-site Control 1	10	12	200	0.40	1.45	0.85	0.60	8	29	17	12
Off-site Control 2	6	3	136	0.96	1.54	0.74	0.44	13	21	10	6
Off-site Control 3	45	49	202	1.73	3.22	3.12	2.43	35	65	63	49

\* Relative abundance (MBF/10m) calculated by taking the minimum number of MBF individuals known to be present at a monitoring site and dividing it by the length of the transect, then multiplied by 10 m.

<sup>#</sup> Green shading indicates an increase from the previous year, amber is decrease but within acceptable levels and red text indicates a decrease from the previous year and trigger event.

<sup>1</sup> This site was not surveyed on the second night due to heavy rain and electrical storm.



**Table 2: Trigger analysis comparing the mean relative abundance of MBF in 2023 and 2024 for each site grouping. A trigger is identified if the average relative abundance between consecutive annual monitoring events is reduced by more than 30%. Triggers are highlighted in red.**

Site groupings	2023 - Average Relative Abundance (/10m)	2024 - Average Relative Abundance (/10m)	Trigger %	Calculated Difference (%)
Impact Sites	1.26	1.00	-30	-20.6
Onsite Control	1.10	1.03	-30	-6.5
Offsite Control	1.67	1.16	-30	-30.9
All Controls	1.37	1.09	-30	-20.3

**Table 3: Trigger analysis comparing the relative abundance of MBF in 2023 and 2024 for each site. A trigger is identified if the relative abundance between consecutive annual monitoring events is reduced by more than 50%. Triggers are highlighted red.**

Sites	2023 - Relative Abundance (/10m)	2024 - Relative Abundance (/10m)	Trigger %	Calculated Difference (%)
Impact Site 1	1.45	1.84	-50	26.7
Impact Site 2	1.55	1.25	-50	-19.4
Impact Site 3	1.62	0.93	-50	-42.4
Impact Site 4	1.19	0.25	-50	-79.2
Impact Site 5	0.50	0.75	-50	50.0
Onsite Control 1	0.30	0.75	-50	150.0
Onsite Control 2	2.36	1.82	-50	-22.9
Onsite Control 3	0.60	0.50	-50	-16.7
Offsite Control 1	0.85	0.60	-50	-29.4
Offsite Control 2	0.74	0.44	-50	-40.0
Offsite Control 3	3.12	2.43	-50	-22.2



## 3.2 MBF breeding activity

With the Project Site and surrounds receiving significant rain throughout December 2023 and January 2024, conditions on site during surveys were ideal for breeding - as indicated by the strong calling activity observed during monitoring surveys and incidental observations of MBF tadpoles during nocturnal surveys. Active searches for egg clutches were not undertaken during monitoring surveys, so as not to disturb breeding animals.



Plate 2: MBF at call site

### 3.3 Cane toads

Cane toads were observed at nine of the eleven monitoring sites surveyed, as detailed in Table 4 (below). Numbers of cane toad recorded at each site were generally low; however, cane toads were observed at higher abundance along vehicular access tracks and around flooded depressions elsewhere within the Project Site.

**Table 4: Comparison of minimum number of cane toads observed from the 2022, 2023 and 2024 surveys**

Monitoring site	Minimum number of cane toads		
	2022	2023	2024
Impact Site 1	2	1	1
Impact Site 2	1	1	0
Impact Site 3	1	1	4
Impact Site 4	0	1	2
Impact Site 5	2	0	4
On-site Control 1	2	0	0
On-site Control 2	0	0	1
On-site Control 3	2	2	3
Off-site Control 1	2	0	4
Off-site Control 2	2	2	1
Off-site Control 3	3	3	5

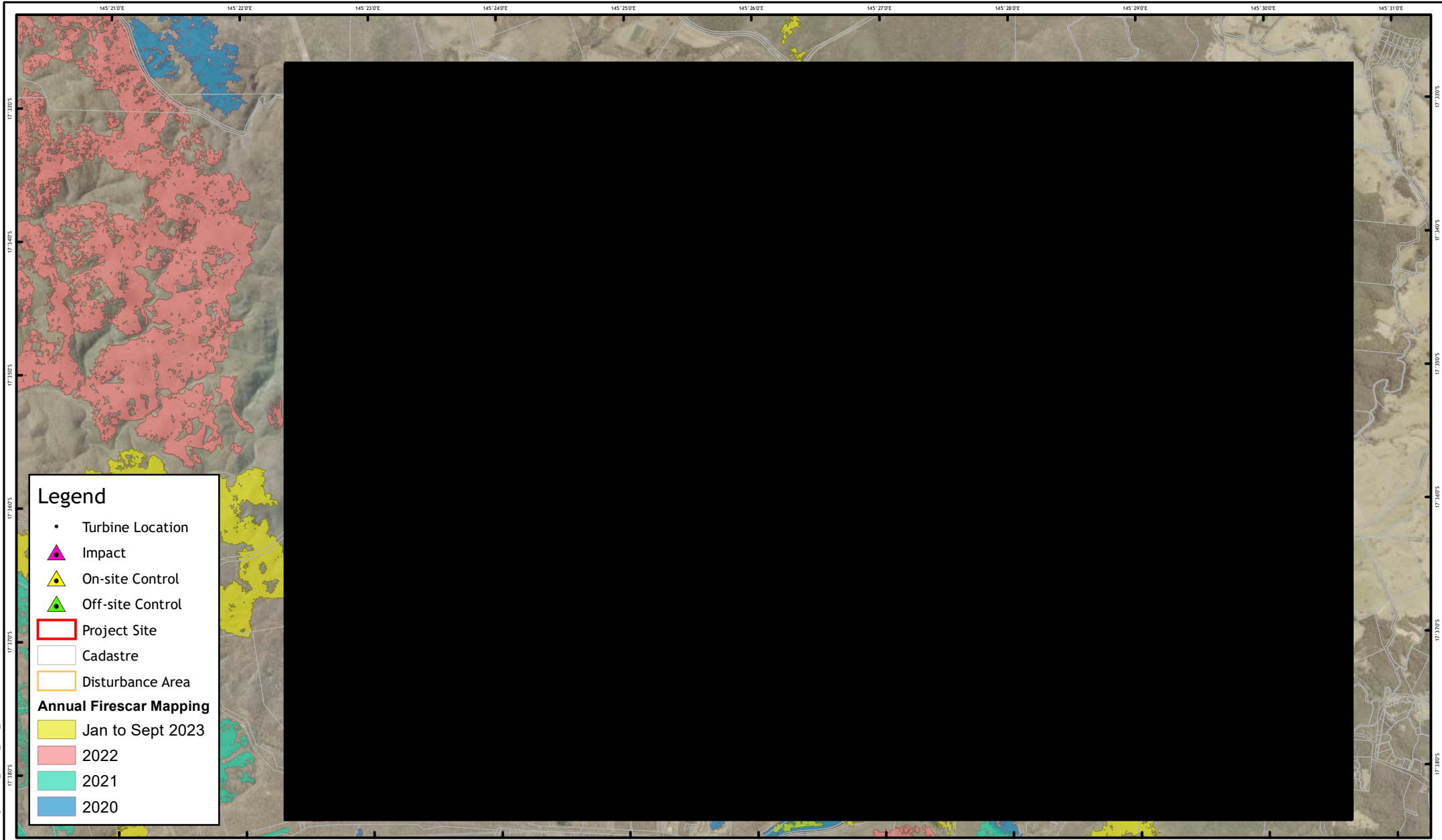
### 3.4 Potential Impacts of Fire


Sentinel fire scar mapping showing the extent of fire within the Project Site and wider surrounds, from January 2020 through to September 2023, is presented in Figure 5. The mapping in this figure shows evidence of recent fires at Impact Sites 3 and 4 (in 2023) and also Impact Site 5 (in 2022). Field observations also indicate recent fire (within the last 12 months) at On-site Control 3 and Off-site Control sites 1,2 and 3.

As shown in Table 5, all sites impacted by fires in 2022 and 2023 show a significant decrease in MBF abundance (from -22 to -79.2%) in the year following fire.









N


Scale 1:70,000 (A4)

0 0.5 1 1.5 2 Kilometres

Coordinate System: GDA 1994 MGA Zone 55  
Projection: Transverse Mercator

**Notes:**  
Aerial Imagery: © ESRI 2019  
Disturbance Footprint: © Neoen 2021  
Protected Areas: © DNRME 2017  
Annual Firescar data: © DES 2023

0	Issued for Use	GO	DJ	23/02/2024
A	Issued for Review	GO	DJ	12/02/2024
Rev	Description	Drawn	Approved	Date



**FIGURE 5: ANNUAL FIRESCAR MAPPING**

Magnificent Brood Frog Monitoring Program  
Fourth Annual Monitoring Report  
Kaban Green Power Hub

Map Number	Job Number	Rev
1 of 1	QEJ21046	0



**Table 5: Comparison of incidence of fire and subsequent changes to MBF abundance in the following breeding season. Cells highlighted Orange indicate significant fire event during the previous year, prior to abundance survey.**

Site	% change 2021 to 2022	% change 2022 to 2023	% change 2023 to 2024
Impact Site 1	128.3	19.8	26.7
Impact Site 2	-13.6	63.2	-19.4
Impact Site 3	34.5	-15.3	-42.4
Impact Site 4	n/a <sup>#</sup>	296.0	-79.2
Impact Site 5	n/a <sup>#</sup>	-44.1	50.0
On-site Control 1	100.0	50.0	150.0
On-site Control 2	106.5	23.2	-22.9
On-site Control 3	34.7	-40.3	-16.7
Off-site Control 1	262.5	-41.4	-29.4
Off-site Control 2	60.4	-52.3	-40.0
Off-site Control 3	86.1	-3.1	-22.2

<sup>#</sup> Impact sites 4 and 5 were not assessed as part of 2021 surveys.



## 4 Summary, conclusions and recommendations

The fourth annual monitoring survey of the Magnificent Brood Frog Monitoring Program was conducted from 16 to 23 January 2024. With the Project Site receiving significant rain before and during surveys (BOM, 2024), weather conditions over this period were ideal for the detection of MBF.

Surveys during January 2024 recorded a minimum total of 232 individuals, with MBF present at all eleven monitoring sites (Table 1). The majority of monitoring sites surveyed in January 2024 showed a decrease in relative MBF abundance compared with surveys in early 2023. Decreases in MBF abundance were documented at most Impact sites as well as On-site and Off-site Control sites, with decreases in MBF abundance observed at Onsite Control sites 2 and 3, Off-site Control sites 1, 2, and 3, as well as Impact Site 2, 3 and 4. The greatest decrease in abundance (-79.2 % when compared with 2023) occurred at Impact Site 4 resulting in a trigger event.

Field observations (including habitat and photo monitoring) indicate that the decline in MBF abundance at Impact Site 4 is unlikely to be related to Project impacts such as sedimentation, contamination or altered site drainage<sup>2</sup>. Instead, it appears that the decline in MBF abundance at this site is most likely due to fire.

On-ground evidence indicates that controlled burns conducted at the Project Site in August 2023 have significantly impacted MBF habitat at this site. From fire scar analysis and observations from other sites impacted by fire, it appears MBF are highly susceptible to the impacts of fire. Other sites impacted by fire in 2023 showing a substantial reduction in numbers of MBF in January 2024 include Impact Site 3, Off-site Control 1, Off-site Control 2 and Off-site Control 3. All 7 sites impacted by fire in the last 2 years have shown significant decreases in MBF abundance following fire.

Cane toad abundance remains relatively low for all sites. While current detection methods do not allow for accurate abundance estimates they will provide some measure of cane toad population dynamics over the long term. Though there has been a notable increase in cane toad densities on access roads across the site, cane toads do not appear to be encroaching on or significantly impacting MBF habitat and, as such, do not appear pose a significant threat to MBF at present.

Comparing the results of MBF surveys and MBF habitat monitoring over the past four years, there is little evidence to suggest that wind farm construction activities have impacted negatively upon MBF populations within the Project Site. Fire management within the Project Site does, however, appear to pose an emerging threat to the species, with substantial declines in MBF abundance noted at sites impacted by prescribed burns conducted in 2023. In order to address the threat posed by fire, fire management practices within the project Site will need be reviewed and, if necessary, modified in order to minimise impacts on MBF habitat. Changes to fire management will therefore need to be discussed by professionals completing controlled burns, representative/s of the approval holder, and ecologists involved in MBF monitoring at the Project Site.

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<sup>2</sup> See the *Magnificent Brood Frog - Annual Disturbance Intercept Photo Monitoring Report - January 2024* (E2M Pty Ltd, 2024b), and *Magnificent Brood Frog Annual Microhabitat Monitoring Report—January 2024* (E2M Pty Ltd, 2024a).



## 5 References

- BOM. (2024). *Australian Government, Bureau of Meteorology—Climate Data Online, Station 31200*.  
[https://bom.gov.au/jsp/ncc/cdio/weatherData/av?p\\_nccObsCode=136&p\\_display\\_type=dailyDataFile&p\\_startYear=&p\\_c=&p\\_stn\\_num=31200](https://bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=31200)
- Department of Environment and Energy. (2019). *Species Profile and Threats Database—Pseudophryne covacevichae (Magnificent Brood Frog)*. [http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon\\_id=64385](http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64385)
- E2M. (2021a). *Kaban Green Power Hub - Fauna Management Plan (Revision 9)*.
- E2M. (2021b). *Magnificent Brood Frog Monitoring Program—Baseline Survey*.
- E2M. (2022). *Magnificent Brood Frog Monitoring Program—Second Annual Monitoring Report*.
- E2M Pty Ltd. (2021). *Revised Magnificent Brood Frog Monitoring Program -Construction Phase only*.
- E2M Pty Ltd. (2023). *Magnificent Brood Frog - Third Annual Abundance Monitoring Report*.
- E2M Pty Ltd. (2023). *Magnificent Brood Frog Monitoring Program—Third Annual Monitoring Report*.
- E2M Pty Ltd. (2024a). *Magnificent Brood Frog Annual Microhabitat Monitoring Report—February 2024*. - in preparation.
- E2M Pty Ltd. (2024b). *Magnificent Brood Frog—Annual Disturbance Monitoring Report—February 2024* - in preparation.
- Fireland Consultancy. (2023). *Kaban Green Power Hub—Landscape Fire Management Plan*.  
 X:\JOBS\~2021\QEJ21046\DELIVERABLES\FY23\13. Offset Area Fire Management\Fire Mangement Plan\Kaban Green Power Hub LFMP V1.0\_3June23.pdf.
- Queensland Government - Open Data Portal. (2023). *Sentinel-2 Queensland Fire Scars Series [dataset]*.  
<https://www.data.qld.gov.au/dataset/sentinel-2-queensland-fire-scars-series>





## Appendix 6 Rehabilitation and Weeds Reports



# Post-construction: Rehabilitation and Weed Monitoring February 2024

Kaban Wind Farm Pty Ltd as trustee  
for the Kaban Wind Farm Trust  
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# Document Management

Rev.	Issue Date	Description	Author (s)	Approved	Signature
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# Contents

<b>Definitions</b>	<b>iii</b>
<b>Abbreviations</b>	<b>iii</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background	1
1.2 Scope of Works	1
<b>2 Methods</b>	<b>3</b>
2.1 Priority Weeds	3
2.2 Rehabilitation	4
<b>3 Results</b>	<b>6</b>
3.1 Priority Weed Assessment	6
3.1.1 Praxelis ( <i>Praxelis clematidea</i> )	8
3.1.2 Total Area of Priority Weed Cover	8
3.1.3 New Priority Weed Observations	8
3.2 Rehabilitation Assessment	10
3.2.1 Rehabilitation Observations for Turbine Sitings	10
3.2.2 Rehabilitation Observations for Access Tracks	10
3.2.3 Erosion Observations within Disturbance Footprint	11
3.2.4 Mapped areas of erosion and rehabilitation deficiencies	11
<b>4 Discussion &amp; Recommendations</b>	<b>23</b>
4.1.1 Priority Weeds	23
4.1.2 New Priority Weeds	23
4.2 Rehabilitation	23
<b>References</b>	<b>25</b>

## List of Tables

Table 1: Priority weeds known to occur within the site, extracted from VMP.	3
Table 2: Rehabilitation performance criteria (extracted from the VMP, Table 12)	4
Table 3: Priority weed infestations recorded within the disturbance footprint.	6
Table 4: Other weeds of environmental concern noted within the disturbance footprint	8
Table 5: Areas identified for improvements to rehabilitation.	11
Table 6: Rehabilitation and Erosion Assessment, 22 to 27 February 2024.	13

## List of Figures

Figure 1: Project Location	2
Figure 2: Areas within the disturbance footprint with notable priority weed infestations	9
Figure 3: Correlation between native species richness and percent native ground cover.	10



Figure 4: Areas noted for improved rehabilitation and erosion control

## Appendices

Appendix A: Photo records for monthly disturbance intercept monitoring

## Definitions

Term	Definition
Disturbance footprint	Any areas cleared for the purpose of the wind farm project. Total area of disturbance is 104.88 hectares
The Project	The Kaban Green Power Hub.
Vegetation Management Plan	Stipulate performance criteria / management objectives associated within vegetation relevant to the project.
Weed Polygon Area	The specific area in which the weeds were found.

## Abbreviations

Term	Definition
E2M	E2M Pty Ltd
WTG	Wind Turbine Generator
VMP	Vegetation Management Plan





# 1 Introduction

## 1.1 Background

The Kaban Green Power Hub, commonly known as the Kaban Wind Farm, herein referred to as the Project, consists of 28 operational wind turbines and associated infrastructure, and is located approximately 4 kilometres west of Tumoulin, Queensland (Figure 1). Construction commenced in May 2021, with the first turbine constructed and commissioned by August 2022.

E2M was commissioned by Kaban Wind Farm Trustee for the Kaban Wind Farm Trust to conduct post construction rehabilitation and weeds monitoring pursuant to EPBC approval 2018/8289. The last turbines were constructed and energised during June 2023, indicating the commencement of post-construction monitoring requirements. Conditions of the monitoring are detailed in the Vegetation Management Plan (VMP) (E2M, 2021). The VMP stipulates performance criteria / management objectives associated within vegetation relevant to the project, including:

- No introduction or spread of priority weed species within the site and successful removal of priority weed species within the disturbance footprint, and
- Progressive stabilisation of disturbed areas and rehabilitation of the disturbance footprint following construction.

## 1.2 Scope of Works

The aims of this monitoring event are to assess the Project's current rehabilitation success against the performance criteria specified in the VMP. Specifically:

- evaluate the relative abundance and distribution of priority weeds across the project disturbance footprint, and
- evaluate the effectiveness of rehabilitation of areas disturbed during, and post construction.

This report presents the findings of a nine-month post construction assessment and evaluation of rehabilitation works and of priority weeds present within the site disturbance areas.







## 2 Methods

### 2.1 Priority Weeds

Priority weeds within the context of this project have been defined as:

- *Biosecurity Act 2014* ‘Restricted Matter’ and ‘Prohibited Matter’ plant species
- Locally declared weeds under the *Tablelands Regional Council 2019-2024 Biosecurity Plan (TRC Biosecurity Plan)* (Tablelands Pest Management Advisory Committee, 2019); and
- High biomass exotic grasses and forbs which can quickly invade disturbed areas and degrade threatened species habitat. Of particular interest are species which may result in impacts to habitat quality for the magnificent brood frog (*Pseudophryne covacevichae*).

Prior to construction, priority weeds were identified on-site and summarised within the VMP. Priority weeds recorded are also outlined in Table 1.

**Table 1: Priority weeds known to occur within the site, extracted from VMP.**

Species	Biosecurity Act 2014	TRC Biosecurity Plan	High biomass species
Grader grass ( <i>Themeda quadrivalvis</i> )	-	-	Yes
Guinea grass ( <i>Megathyrsus maximus</i> )	-	-	Yes
Lantana ( <i>Lanata camara</i> )	Category 3 Restricted Matter	-	Yes
Praxelis ( <i>Praxelis clematidea</i> )	-	-	Yes
Rhodes grass ( <i>Chloris gayana</i> )	-	-	Yes
Signal grass ( <i>Urochloa decumbens</i> )	-	-	Yes
Singapore daisy ( <i>Sphagneticola trilobata</i> )	Category 3 Restricted Matter	-	Yes

As outlined in Section 2.2, the VMP identifies weed control measures to suppress weed growth as a post-construction rehabilitation management measure. To evaluate the relative abundance and distribution of priority weeds across the disturbance footprint and determine the effectiveness of post-construction rehabilitation actions, 6-month post-construction weed survey was conducted from 22 to 27 February 2024. The survey was completed by taking a series of photos at each wind turbine generator (WTG) siting and along site access tracks where priority weeds were visible. During the survey the following data was collected at each weed assessment site:

- Date
- Time
- Latitude
- Longitude
- Location name
- Weed Type/s
- Abundance of weeds as percent groundcover in the broader area.
- Photo series
- Abundance Ranking:
  - Scattered
  - Low
  - Moderate
  - High



## 2.2 Rehabilitation

Rehabilitation measures were to be progressively implemented throughout construction in accordance with Table 10 of the VMP. Four reports during construction provide details of the progress of rehabilitation and weeds throughout the site. These are (Horner, 2022), (Tucker, 2022), (Tucker, 2023a) and (Tucker, 2023b).

Post-construction rehabilitation management measures required by the VMP are:

1. Monitoring of rehabilitation against rehabilitation performance criteria with identification of required maintenance actions, and
2. Weed control measures such as spraying, physical removal, or planting native species to suppress weed growth.

The VMP states that the final rehabilitation would meet the following performance objectives:

- Self-sustaining vegetative cover
- No signs of subsidence or erosion
- Representative of species richness and diversity of pre-disturbed condition
- Plants showing healthy growth and signs of recruitment; and
- Free of priority weeds.

Rehabilitation performance criteria has been prescribed within the VMP and is summarised in Table 2.

**Table 2: Rehabilitation performance criteria (extracted from the VMP, Table 12)**

Indicator	3 months	6 months	9 months	12 months	18 months	24 months
<b>Seeded Areas / Natural Regeneration</b>						
Native Groundcover Species Richness	≥20% of pre-disturbance species richness	≥40% of pre-disturbance species richness	≥40% of pre-disturbance species richness	≥60% of pre-disturbance species richness	≥80% of pre-disturbance species richness	≥90% of pre-disturbance species richness
Priority Weeds	≤5% priority weed cover	≤5% priority weed cover	≤5% priority cover	No priority weeds	No priority weeds	No priority weeds
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	-	-	-	-
<b>*Assisted Revegetation Areas</b>						
Plant Survival	≥80% survival of planted stock	≥90% survival of planted stock	≥90% survival of planted stock	≥95% survival of planted stock	≥95% survival of planted stock	≥95% survival of planted stock
Plant Height	Evidence of growth	Evidence of growth	Evidence of growth	All planted canopy & shrub stock ≥0.3m high	All planted canopy & shrub stock ≥0.4m high	All planted canopy & shrub stock ≥0.6m high



\*Assisted revegetation is only to occur in areas where seeding and natural regeneration is not meeting performance criteria after 12 months.

To determine the effectiveness of rehabilitation measures against rehabilitation performance criteria and any ongoing maintenance actions required, a rehabilitation assessment was conducted at each of the weed assessment sites. The following data was collected at each weed assessment site:

- Date
- Time
- Latitude
- Longitude
- Location name
- Number of native species
- Dominant native species
- Percent ground cover
- Percent groundcover natives
- Percent groundcover weeds
- Abundance of native vegetation as percent groundcover in the broader area.
- Photo series as per weeds
- Treatment Priority:
  - Low
  - Moderate
  - High
- Erosion present: Yes/No
- Erosion Severity: Minor, Moderate, Severe.



## 3 Results

### 3.1 Priority Weed Assessment

Priority weeds were found throughout the disturbance area ranging from scattered individuals to high density patches. For each weed assessment point, an estimate of priority weed groundcover was recorded. The area in hectares was calculated for each priority weed area record and representative polygons generated (Figure 2). The 'Weed Polygon Area' is the specific area in which the weeds were found and not the total area of disturbance surrounding each turbine. 'Weed Polygon Areas' were generated to help inform the approval holder and contractors of priority weed infestation locations. The infestations were ranked Low, Moderate or High depending on the level of weed cover. Infestations were ranked low if less than 20 percent, Moderate between 20 and 50 percent, and High if greater than 50 percent cover. If priority weed cover was less than one percent, area polygons were not generated. A summary of results is included in Table 3.

**Table 3: Priority weed infestations recorded within the disturbance footprint during 22 to 27 February 2024 survey.**

Location	Weed Polygon Area Ha	% Priority Weed Cover	Area of Weeds Ha	Weed Infestation Rank	Priority Treatment 2024	Dominant Priority Weeds
<b>TURBINE SITINGS</b>						
WTG01	0.89	10	0.089	Low	YES	Signal grass
WTG02	0	<1	0	Scattered	SPOT	Signal grass
WTG03	0	<1	0	Scattered	SPOT	Signal grass
WTG04	0.25	20	0.0125	Moderate	YES	Signal grass
WTG05	0.19	10	0.0095	Low	NO	Signal grass
WTG06	1.1	2.5	0.055	Low	YES	Signal grass
WTG07	0.83	7.5	0.06225	Low	YES	Signal grass
WTG08	0.48	80	0.384	High	NO	Signal grass
WTG09	0	<1	0	Scattered	NO	Signal grass
WTG10	0	<1	0	Scattered	NO	Signal grass
WTG11	0	<1	0	Scattered	NO	Signal grass
WTG12	0	Unknown <sup>3</sup>	0	Unknown <sup>3</sup>	SPOT	Unknown <sup>3</sup>
WTG13	0	Unknown <sup>3</sup>	0	Unknown <sup>3</sup>	SPOT	Unknown <sup>3</sup>
WTG14	0.45	50	0.225	High	YES	Signal grass
WTG15	0.38	30	0.114	Moderate	YES	Signal grass
WTG16	0.64	90	0.576	High	POSTPONE <sup>2</sup>	Signal grass
WTG17	1.74	95	1.65	High	POSTPONE <sup>2</sup>	Signal grass



Location	Weed Polygon Area Ha	% Priority Weed Cover	Area of Weeds Ha	Weed Infestation Rank	Priority Treatment 2024	Dominant Priority Weeds
WTG18	0.7	80	0.56	High	POSTPONE <sup>2</sup>	Signal grass + Rhodes grass
WTG19	0.59	60	0.354	High	POSTPONE <sup>2</sup>	Signal grass
WTG20	0.66	50	0.33	High	POSTPONE <sup>2</sup>	Signal grass
WTG21	0.15	10	0.016	Low	YES	Signal grass
WTG22	0.16	10	0.016	Low	YES	Signal grass
WTG23	0.1	30	0.03	Moderate	YES	Signal grass
WTG24	0	<1	0	Scattered	SPOT	Signal grass
WTG25	0	<1	0	Scattered	SPOT	Signal grass
WTG26	0	<1	0	Scattered	SPOT	Signal grass
WTG27	0	<1	0	Scattered	SPOT	Signal grass
WTG28	0	<1	0	Scattered	SPOT	Signal grass
<b>Access tracks</b>						
Track 11	0.38	40	0.038	Moderate	Not priority	Signal grass
Sawmill - 1	0.0406	25	0.01015	High	YES	Grader grass + GRT <sup>1</sup>
Sawmill - 2	0.008	80	0.0064	Moderate	YES	Grader grass
Sawmill - 3	0.008	30	0.0024	High	YES	Grader grass
Petes Ck to Mevs	0.61	75	0.4575	High	POSTPONE <sup>2</sup>	Signal grass
Mevs to WTG18	0.68	60	0.408	High	YES	Signal grass
WTG20 to 21 Roadside	0.35	75	0.2625	Moderate	POSTPONE <sup>2</sup>	Signal + Grader grass
WTG21 to 22	0.17	30	0.051	High	YES	Signal grass
Mevs to Hamburger Hill	0.08	75	0.06	High	YES	Grader grass
Gravel stockpile	0.039	100	0.039	High	YES	Grader grass

1. Giant rat's tail grass (GRT), (*Sporobolus pyramidalis*); under the Biosecurity Act 2014 is listed as a Category 3, Restricted Invasive Plant.

2. Weed management to be postponed until the planned rehabilitation works are completed in the early wet season of 2024 to 2025.

3. Previous reports, (Tucker, 2023a) Figure 2, Site RH014, indicate a significant population of weeds. During this survey these sites were well grazed and species identification and percent ground cover was not possible.



### 3.1.1 Praxelis (*Praxelis clematidea*)

While praxelis was identified as a priority weed within the VMP, there is little risk that it will have any significant impact within the context of this project. It is unlikely that it will inhabit the magnificent brood frog creeklines, it does not present as a high fire risk due to its low fuel load capacity and over time this weed will be outcompeted by natives, as they establish. Neldner & Butler, 2021, demonstrate that praxelis did not out-compete native ground layer species or persist as a dominant ground layer species within eucalypt woodlands of northern Queensland dominated by *Themeda triandra* (Kangaroo greass). As such, praxelis will not be discussed any further in relation to weed management strategies.

### 3.1.2 Total Area of Priority Weed Cover

The total area of priority weeds was calculated by the sum of the proportion of priority weeds within each weed polygon (Table 3). The total project disturbance area is 104.88 hectare and the total area of priority weed cover was 5.91 hectares. Therefore, the percent priority weed cover across the project disturbance area was 5.55%.

### 3.1.3 New Priority Weed Observations

Additional priority weed species that were not originally identified prior to construction were recorded during the survey. These were in relatively low densities scattered throughout the project disturbance area. These weeds are listed in Table 4, along with their biosecurity risk profile. All of these plants are regarded as environmental weeds and have been added to the list of priority weeds and should be treated as such with regards to monitoring and treatment.

**Table 4: Other weeds of environmental concern noted within the disturbance footprint**

Species	Biosecurity Act 2014	TRC Biosecurity Plan	Regarded as Environmental Weed
Devil's Fig ( <i>Solanum torvum</i> )	No	No	Yes
Giant rat's tail ( <i>Sporobolus pyramidalis</i> )	Category 3 restricted plant	Yes	Yes <sup>1, 2</sup>
Inkweed ( <i>Phytolacca octandra</i> )	No	No	Yes
Mexican poppy ( <i>Argemone mexicana</i> )	No	No	Yes
Navua sedge ( <i>Cyperus aromaticus</i> )	No	Yes	Yes <sup>2, 3</sup>
Sensitive weed ( <i>Mimosa pudica</i> )	No	No	Yes <sup>2</sup>
Spiny sida ( <i>Sida spinosa</i> )	No	No	Yes <sup>2</sup>
Tobacco weed ( <i>Solanum mauritianum</i> )	No	No	Yes

1. High fuel load

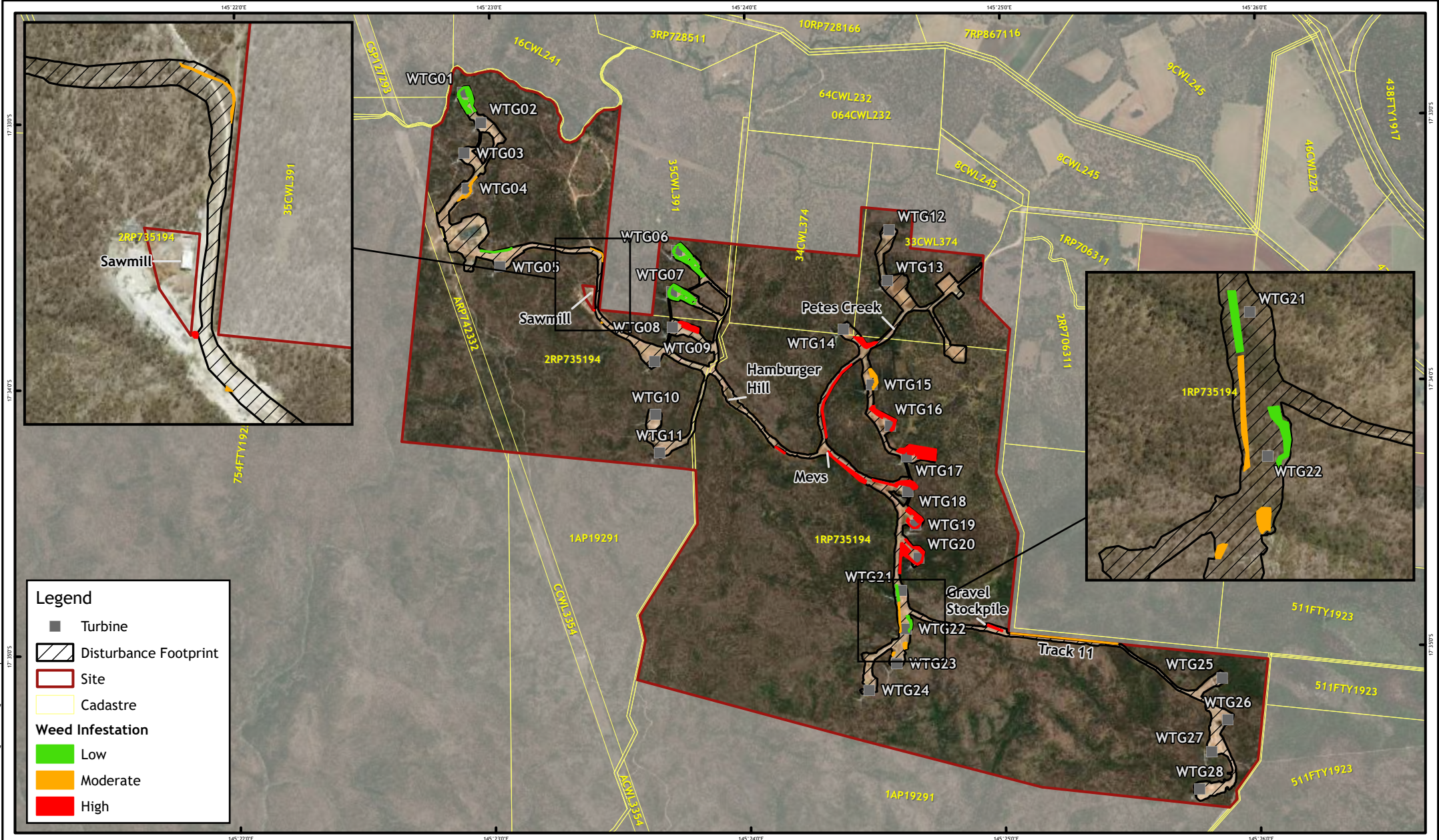
2. Out competes natives

3. Poses significant threat to waterways and wetlands

Of note were the patches of giant rat's tail (*Sporobolus pyramidalis*), found mostly between the Sawmill and WTG05, and Navua sedge (*Cyperus aromaticus*) found at WTG17. Giant rat's tail is identified by the *Biosecurity Act 2014* as a Category 3 restricted invasive plant and Navua sedge is listed as a priority species in the Tablelands Biosecurity Plan 2019-24.







**Legend**

Turbine

Disturbance Footprint

Site

Cadastre

**Weed Infestation**

Low

Moderate

High



Scale     1:35,000     (A4)

0     0.5     1     1.5

Kilometres

Coordinate System: GCS GDA 1994

Notes:  
Aerial Imagery: © ESRI 2020  
Cadastre: © DNRME 2020

0	Issued for Use	GO	DJ	20/06/2024
A	Issued for Review	GO	DJ	08/04/2024
Rev	Description	Drawn	Approved	Date



FIGURE 2: WEED DISTRIBUTION

KABAN ANNUAL REHABILITATION AND WEED REPORT  
KABAN GREEN POWER HUB

Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 3.2 Rehabilitation Assessment

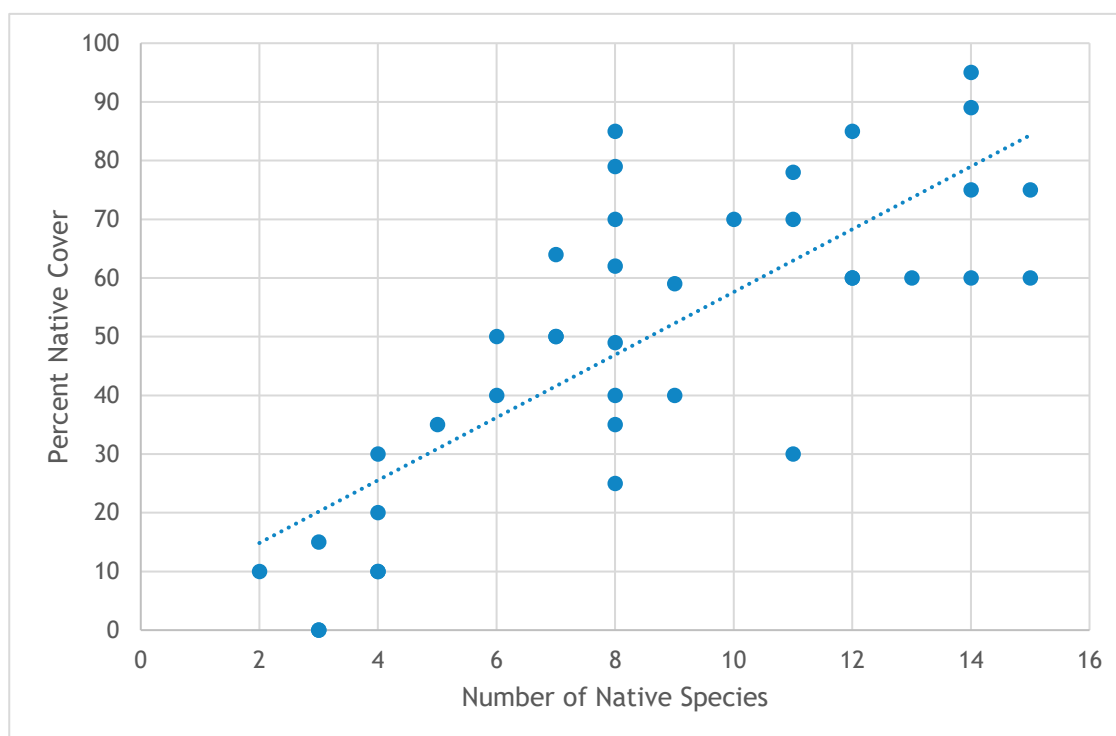
An assessment of rehabilitation performance was conducted at each weed assessment point and data collected as per Section 2.2. The observations are described in Table 6 Observations for any areas under threat of forming erosion or those sites with notable erosion were recorded. Refer to Appendix A for monitoring photographs.

### 3.2.1 Rehabilitation Observations for Turbine Sitings

There was good native species diversity across many of the turbine sitings. Seventeen (17) of the 28 turbine sitings had eight or greater native species present. Those sites with greater native diversity were likely to have greater native species ground cover. Figure 3 demonstrates the strong correlation between the number of native species and percentage of native ground cover. Eighteen turbine sites had native ground cover equal to or greater than 50 percent. All sites had total ground cover greater than or equal to 50 percent, except for WTG25 which had 20 percent total ground cover.

Five turbine sitings had weeds which dominated the total ground cover, with observations greater than 50 percent weed cover. These turbine sitings were WTG's 14, 17, 18, 20 and 25. Turbine sitings WTG16 and WTG21 also had a large weed presence, with 47 percent weed cover.

**Figure 3: Correlation between native species richness and percent native ground cover.**



### 3.2.2 Rehabilitation Observations for Access Tracks

Rehabilitation observations were made along access tracks between turbine sitings. Overall, native species richness was seven or greater for all locations and total groundcover was 60 percent or greater. However, there were observations of significant priority weed infestations within six of the eight locations. Some priority weed infestations were isolated smaller patches, however there are larger priority weed populations as identified in Section 3.1.





### 3.2.3 Erosion Observations within Disturbance Footprint

There was no severe erosion noted within the entire project disturbance footprint. Minor erosion was noted at WTG's 23, 25 and 28 - refer to photo plates included in Appendix A. This was typically in the form of shallow (<20 cm) gully erosion within exposed banks of little or no groundcover. A moderate level of erosion was noted at WTG17, along the cutting batters adjacent to the woodland approximately 100 metres east of the turbine, see Plate 133 in Appendix A. Minor sheet and gully erosion was also noted on the northside of the road from Hamburger Hill to WTG09. This section had reoccurring disturbance during cable and drainage works. As such, the rehabilitation was also disturbed, and consequently has less cover compared to sites not disturbed after rehabilitation.

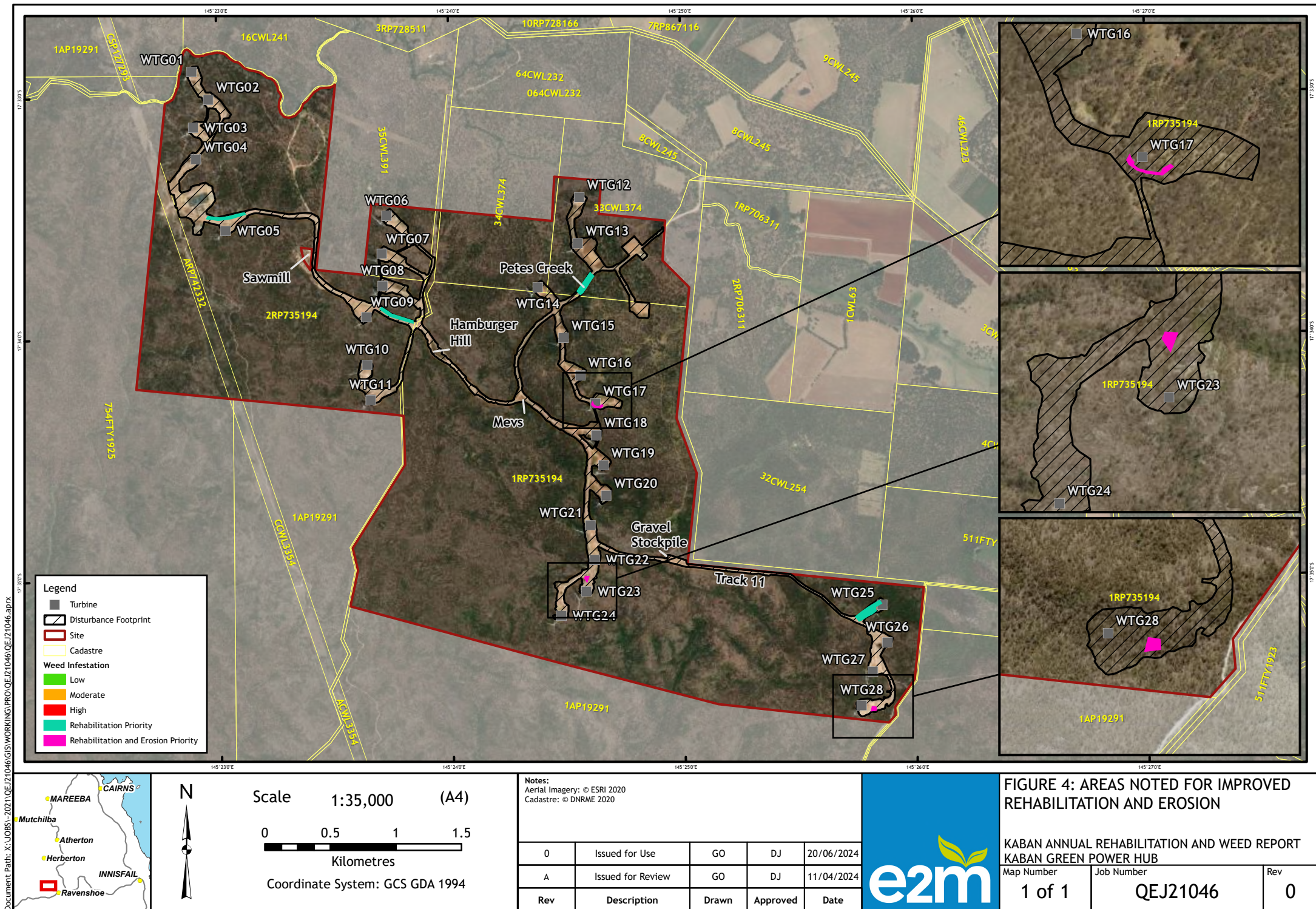
### 3.2.4 Mapped areas of erosion and rehabilitation deficiencies

In addition to weed treatment, remedial actions are required to improve areas of rehabilitation with insufficient groundcover and areas that present with erosion, to achieve compliance with the rehabilitation performance objectives for final rehabilitation, and rehabilitation performance criteria. Sites requiring additional remediation are described in Table 5, and the locations are depicted in Figure 4.

**Table 5: Areas identified for improvements to rehabilitation.**

Site Location	Defect/s	Reference
Adjacent WTG05	Insufficient groundcover	Plate 213
Adjacent WTG09	Insufficient groundcover & species richness	Plate 212
Adjacent WTG17	Insufficient groundcover & erosion	Plate 133
Adjacent WTG23	Insufficient groundcover & erosion	Plate 173
Adjacent WTG25	Insufficient groundcover & species richness	Plate 183, Plate 185, Plate 187, Plate 188
Adjacent WTG28	Insufficient groundcover & erosion	Plate 210
Adjacent Pete's Creek	Insufficient groundcover & species richness	Plate 214







**Table 6: Rehabilitation and Erosion Assessment, 22 to 27 February 2024.**

Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG01	12	5	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Eragrostis</i> spp. (x2)	4	<i>Gonocarpus acanthocarpus</i> , <i>Acacia</i> spp. x2	3	<i>Euc</i> spp. x2, <i>Grevillia</i> spp.,	70	63	NO	NA	NA		Low
WTG02	15	8	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i> , <i>Eragrostis</i> spp. (x2), <i>Panicum mitchelli</i> , <i>Arundinella setosa</i>	3	<i>Grevillia</i> spp., <i>Acacia</i> spp. x3	4	<i>Eucalyptus shirleyi</i> , <i>Euc</i> spp. x2, <i>Grevillia</i> spp.,	85	75	NO	NA	NA		Scattered
WTG03	11	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i>	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Jacksonia thesioides</i>	2	<i>Euc</i> spp. x2,	75	70	NO	NA	NA		Scattered



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG04	12	5	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i> , <i>Eragrostis</i> spp. (x2), <i>Panicum mitchelli</i> , <i>Arundinella setosa</i>	4	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Jacksonia thesioides</i>	3	<i>Euc</i> spp. x2,	90	85	NO	NA	NA		Moderate
WTG05	14	7	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Eragrostis</i> spp. (x2), <i>Cyperus</i> spp. (x2)	5	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Acacia</i> spp.,	2	<i>Euc</i> spp. x2,	80	75	NO	NA	NA		Low
WTG06	12	5	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2), <i>Digitaria</i> spp.	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Other</i> spp. (x1)	4	<i>Euc</i> spp. x2, <i>Lophostemon suaveolens</i> , <i>Terminalia</i> spp.	65	60	NO	NA	NA		Low



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG07	11	3	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2)	4	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , Other spp. (x1), <i>Grevillia 15ryandra</i> , <i>Trema tomentosa</i>	2	<i>Euc</i> spp. x2,	50	30	NO	NA	NA		Low
WTG08	14	5	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2), <i>Lomandra</i> spp.	5	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Grevillia 15ryandra</i> , <i>hibiscus</i> spp., <i>Trema tomentosa</i>	4	<i>Eucalyptus shirleyi</i> , <i>Euc</i> spp. x2, <i>Grevillia</i> spp.,	90	60	NO	NA	NA		High
WTG09	15	6	<i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2), <i>Gonocarpus acanthocarpus</i>	5	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Grevillia dryandri</i>	4	<i>Eucalyptus shirleyi</i> , <i>Euc</i> spp x2, <i>Grevillia</i> spp.	90	60	NO	NA	NA		Scattered



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG10	14	7	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp., <i>Gonocarpus</i> spp. (x2), <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i>	4	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Grevillia 16ryandra</i> , <i>Jacksonia thesioides</i>	3	<i>Eucalyptus shirleyi</i> , <i>Euc</i> spp. x2, <i>Grevillia</i> spp.,	95	95	NO	NA	NA		Scattered
WTG11	14	7	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2), <i>Gonocarpus</i> spp. (x2), <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i>	4	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Grevillia 16ryandra</i> , <i>Jacksonia thesioides</i>	3	<i>Eucalyptus shirleyi</i> , <i>Euc</i> spp. x2, <i>Grevillia</i> spp.,	90	89	NO	NA	NA		Scattered
WTG12	3	3	Mostly agricultural grazing species including wynn cassia, <i>Digitaria</i> spp.	0	None observed	0	None observed	95	Unknown	NO	NA	NA	Well grazed by cattle	Unknown
WTG13	3	4	Mostly agricultural grazing species including wynn cassia, <i>Digitaria</i> spp.	0	None observed	0	None observed	90	Unknown	NO	NA	NA	Well grazed by cattle	Unknown





Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG14	6	3	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp.	90	40	NO	NA	NA	Well grazed by cattle	High
WTG15	8	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Eragrostis</i> spp.	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Acacia flavescens</i>	1	<i>Euc</i> spp. x1	95	85	NO	NA	NA	Mostly grass cover, with some tree seedlings	Moderate
WTG16	6	3	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp. x1	95	50	NO	NA	NA	Mostly grass cover, with some tree seedlings	Large areas of signal grass
WTG17	4	1	<i>Themeda triandra</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp. x1	95	10	YES	Gully	Moderate	Mostly grass cover, with some tree seedlings	Large areas of signal grass
WTG18	4	1	<i>Themeda triandra</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp. x1	95	10	NO	NA	NA	Mostly grass cover, with some tree seedlings	Large areas of signal & Rhodes grass



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG19	4	1	<i>Themeda triandra</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp. x1	50	30	NO	NA	NA	Mostly grass cover, with some shrub & tree seedlings	Large areas of signal grass
WTG20	5	2	<i>Themeda triandra</i> , <i>Sporobolus</i> spp.	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp. x1	75	35	NO	NA	NA	Mostly grass cover, with some shrub & tree seedlings	Large areas of signal grass
WTG21	7	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Cyperus</i> spp.	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i> ,	1	<i>Euc</i> spp. x1	95	50	NO	NA	NA	Mostly grass cover, with some tree seedlings	Low
WTG22	7	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Cyperus</i> spp.	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	1	<i>Euc</i> spp. x1	75	50	NO	NA	NA	Mostly grass cover, with some tree seedlings	Low
WTG23	8	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Gonocarpus acanthocarpus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	2	<i>Euc</i> spp. x2	80	70	YES	Gully	Minor		Moderate



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG24	11	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Gonocarpus acanthocarpus</i>	4	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Acacia</i> spp., <i>Grevillia dryandri</i>	3	<i>Euc</i> spp. x2, <i>Casuarina</i> spp.	80	78	NO	NA	NA		Scattered
WTG25	3	2	<i>Themeda triandra</i> , <i>Sporobolus</i> spp.	0		1	<i>Euc</i> spp. x1	20	10	YES	Gully	Minor	Mostly grass cover, with some shrub & tree seedlings	Scattered
WTG26	8	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Gonocarpus acanthocarpus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	2	<i>Euc</i> spp. x2	65	62	NO	NA	NA		Scattered
WTG27	8	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Gonocarpus acanthocarpus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	2	<i>Euc</i> spp. x2	50	49	NO	NA	NA		Scattered



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
WTG28	9	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Gonocarpus acanthocarpus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Grevillia</i> spp	2	<i>Euc</i> spp. x2	60	59	YES	Gully	Minor		Scattered
4-Ways to WTG11	10	5	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2), <i>Gonocarpus</i> spp.	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Jacksonia thesioides</i>	2	<i>Euc</i> spp. x2	75	70	NO	NA	NA		Scattered
Mevs to Hamburger Hill	>10	7	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2), <i>Gonocarpus acanthocarpus</i> , <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i> , <i>Cymbopogon queenslandicus</i>	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Grevillia dryandri</i> ,	3	<i>Euc</i> spp. x2, <i>Grevillia</i> spp,	75	60	NO	NA	NA		High
WTG9 to Sawmill	8	4	<i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Cyperus</i> spp., <i>Gonocarpus acanthocarpus</i>	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i> ,	2	<i>Euc</i> spp. x2	80	79	NO	NA	NA		Scattered



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
Sawmill to WTG5	7	3	<i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Cyperus</i> spp.,	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i> ,	2	<i>Euc</i> spp. x2	65	64	NO	NA	NA		Scattered
Petes to Mevs	8	3	<i>Themeda triandra</i> , <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i> ,	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> ,	2	<i>Euc</i> spp. x2	90	25	NO	NA	NA		High
Mevs to WTG18	9	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Heteropogon triticeus</i>	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i>	2	<i>Euc</i> spp. x2	65	35	NO	NA	NA		High
Track 11	8	3	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp.	2	<i>Acacia holosericea</i> , <i>Acacia simsii</i> ,	3	<i>Euc</i> spp. x2, <i>Allocasuarina</i> spp.	80	50	NO	NA	NA		Moderate
WTG20 to WTG21 Roadside	8	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Heteropogon contortus</i> , <i>Cyperus</i> spp.	3	<i>Acacia holosericea</i> , <i>Acacia simsii</i> , <i>Trema tomentosa</i>	1	<i>Euc</i> spp. x1	75	35	NO	NA	NA		Large areas of signal grass



Location	# Native Spp.	# Dom Grass Spp.	Dominant Grass & Herb Spp.	# Dom Shrub Spp.	Dom Shrub Spp.	# Dom Tree Spp.	Dom Tree Species Names	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments	Priority Weeds Rank
Hamburger Hill to WTG09 - North side of road	4	4	<i>Themeda triandra</i> , <i>Sporobolus</i> spp., <i>Cyperus</i> spp. (x2)	0	NA	0	NA	20	20	YES	Gully & Sheet	Minor		Scattered



## 4 Discussion & Recommendations

Weed and rehabilitation assessments were performed across the project disturbance area from the 22 to 27 February 2024. There has been good rainfall throughout the wet season promoting good revegetation growth but also promoting significant growth of priority weeds. The aim of this assessment was to evaluate rehabilitation works and priority weeds present in accordance with the requirements of the VMP. Weeds

### 4.1.1 Priority Weeds

The priority weed cover throughout the site represents approximately 5.55 percent of total ground cover. This is slightly higher than the six-month post-construction target of 5 percent, Table 2. The most abundant priority weeds were grader grass and signal grass. Both of these species compete strongly with native vegetation and increase fire risk, offering higher fuel loads. It is important to limit the spread of these across site. As such, the recommendation is to firstly treat those sites where the infestations are Scattered, Low, Moderate, and those small isolated patches that have been scored as High, see Table 3. Any extensive infestations (>0.1 hectares) with High infestation ranking will need special management strategies to contain and treat. Those sites with a High infestation ranking are typically located in the central portion of the site, on good basalt soils, from WTG14 through to WTG20, including the main access tracks from Pete's Creek through to WTG18. The aim is to firstly treat peripheral infestations from WTG01 through to Mevs, and those priority weed populations from WTG28 back through to WTG21. Initial treatment of the peripheral infestations will help prevent the spread of these weeds further throughout the site. Once smaller infestations are controlled, then there can be a focussed effort on managing the larger infestations.

### 4.1.2 New Priority Weeds

There were several other weeds of note recorded during this survey (Table 4: Other weeds of environmental concern noted within the disturbance footprint that were not identified as Priority Weeds within the VMP, but meet the criteria of Priority Weeds. Of note, Giant rat's tail (*Sporobolus pyramidalis*) is a Category 3 Restricted Plant under the *Biosecurity Act 2014*, and Navua sedge (*Cyperus aromaticus*) is identified as a priority species within the Tablelands Biosecurity Plan 2019-24. Efforts must be made to control the spread of these species to meet the requirements of the *Biosecurity Act 2014*. The new suite of weeds, identified on-site, also included, devil's fig (*Solanum torvum*), inkweed (*Phytolacca octandra*), Mexican poppy (*Argemone Mexicana*), sensitive weed (*Mimosa pudica*), spiny sida (*Sida spinosa*) and tobacco weed (*Solanum mauritianum*).

The new weeds identified above, should be viewed as environmental weeds and treated as such. These weeds can become difficult to remove once established and can pose a fire risk to greater glider and MBF habitat, and can out-compete natives plants along sensitive MBF creek lines. The recommendation is to keep monitoring and remove these weeds while performing scheduled weed treatment activities before they become a more significant risk to protected matters. Treatment can be performed through spot spraying with recommended herbicides, or by physical removal. Physical removal should involve thoughtful containment and disposal, including the management of fruiting bodies and seeds, to prevent further spread.

## 4.2 Rehabilitation

Adequate ground cover was noted across much of the disturbance footprint along with good native species richness. However, there were sites with inadequate ground cover, inadequate species richness and some



noted with erosion. The deficiencies were identified in Table 5, and various treatments such as hydroseeding, hydromulching or hand planting are recommended. Where erosion is present, appropriate soil preparation, stabilisation and top dressing will be required before commencement of any revegetation activities. Any measures to improve rehabilitation and erosion should be done in consultation with those experts qualified to perform these activities. Prior to implementing these activities, advice from ecologists familiar with the site, should be sought, to ensure that the appropriate measures are taken to protect site matters of environmental significance.





## References

- E2M. (2021). *Kaban Green Power Hub - Vegetation Management Plan*.
- Horner, G. (2022). *Kaban Green Power Hub Rehabilitation Monitoring Report 1* (1; p. 48). BIOTROPICA.
- Neldner, V. J., & Butler, D. W. (2021). Dynamics of the ground layer communities of tropical eucalypt woodlands of northern Queensland. *AUSTRALIAN JOURNAL OF BOTANY*, 69, 85-101.
- Tablelands Pest Management Advisory Committee. (2019). *Tablelands Regional Council 2019-2024 Biosecurity Plan V2.0*.
- Tucker, N. (2022). *Kaban Green Power Hub Rehabilitation Monitoring Report 2* (Rehabilitation Monitoring 2; p. 48).
- Tucker, N. (2023a). *Kaban Green Power Hub Rehabilitation Monitoring Report 3* (Rehabilitation Monitoring 3; p. 48).
- Tucker, N. (2023b). *Kaban Green Power Hub Weed Assessment Report 3* (Weed Assessment 2; p. 19).





## Appendix A: Photo records for weeds and rehabilitation monitoring sites.



Note: All image directions are described firstly from the direction of the turbine, then the direction in which the image was taken.

## A.1 WTG01

### WTG01: Directional PMP photos



Plate 1: WTG01



Plate 2: Southern side looking north



Plate 3: Southern side looking south



Plate 4: Northern side looking east





Plate 5: Western side looking south



Plate 6: Southern side looking east





## A.2 WTG02

WTG02: Directional PMP photos



Plate 7: WTG02



Plate 8: Eastern side looking north



Plate 9: Eastern side looking south



Plate 10: Southern end looking south







Plate 11: Eastern side looking south



Plate 12: Eastern side looking south



Plate 13: South east looking west



Plate 14: South east looking north west





## A.3 WTG03

### WTG03: Directional PMP photos



Plate 15: South east looking north west



Plate 16: South east looking north west



Plate 17: South east looking north



Plate 18: South east looking north





Plate 19: South east looking south





## A.4 WTG04

### WTG04: Directional PMP photos



Plate 20: WTG04



Plate 21: West side looking south



Plate 22: West side looking south



Plate 23: West side looking south



Plate 24: West side looking south east



Plate 25: Southern end looking south







Plate 26: Southeast looking south



Plate 27: Southeast looking northeast



Plate 28: Southeast looking northeast



Plate 29: Southeast looking north



Plate 30: South central looking northeast



Plate 31: Northeast looking north







Plate 32: Northeast looking north



Plate 33: Northwest looking north





## A.5 WTG05

### WTG05: Directional PMP photos



Plate 34: Northeast looking south west



Plate Northeast looking south west



Plate 35: Northeast looking west



Plate 36: Northeast looking north



Plate 37: Northeast looking east





## A.6 WTG06

### WTG06: Directional PMP photos



Plate 38: Southeast looking northwest



Plate 39: Southeast looking northwest



Plate 40: Southwest looking northeast



Plate 41: Southwest looking southeast



Plate 42: South looking north



Plate 43: South looking southeast





## A.7 WTG07

### WTG07: Directional PMP photos



Plate 44: Southeast looking northwest



Plate 45: Southeast looking northwest



Plate 46: Southeast looking southeast



Plate 47: Southeast looking northwest



Plate 48: Southwest looking northeast



Plate 49: Southwest looking south to WTG08.





Plate 50: Looking southeast exiting WTG07





## A.8 WTG08

### WTG08: Directional PMP photos



Plate 51: WTG08



Plate 52: East looking westerly



Plate 53: East looking north



Plate 54: East looking north



Plate 55: East looking east



Plate 56: Northeast looking east







Plate 57: East looking southeast



Plate 58: East looking southeast



Plate 59: : East looking southeast



Plate 60: : East looking southeast



Plate 61: Exiting WTG08 looking east along cutting.



Plate 62: Exiting WTG08 looking west



## A.9 WTG09

### WTG09: Directional PMP photos



Plate 63: WTG09



Plate 64: Northwest looking southeast



Plate 65: Northwest looking south



Plate 66: Northwest looking southwest



Plate 67: Southwest looking north to WTG08



Plate 68: Southwest looking northwest







**Plate 69: Northwest looking northwest**



**Plate 70: Northwest looking northwest to WTG05**



**Plate 71: Northwest looking northeast**



**Plate 72: Northwest looking north**



**Plate 73: Northwest looking north**



**Plate 74: Northwest from access track looking southeast**





## A.10 WTG10

### WTG10: Directional PMP photos



Plate 75: South looking north



Plate 76: South looking east



Plate 77: South looking south



Plate 78: South looking north



Plate 79: South looking south



Plate 80: South looking south







Plate 81: South looking north



## A.11 WTG11

### WTG11: Directional PMP photos



Plate 82: East looking west



Plate 83: East looking southwest



Plate 84: East looking west



Plate 85: East looking north



Plate 86: East looking northeast



Plate 87: East looking west







Plate 88: Northeast looking northeast



Plate 89: Northeast looking northeast



Plate 90: Northeast looking northeast



Plate 91: Northeast looking southwest



Plate 92: Northeast looking southwest





## A.12 WTG12

### WTG12: Directional PMP photos



Plate 93: Southwest looking northeast



Plate 94: Southwest looking northeast



Plate 95: Southwest looking southwest



Plate 96: Southwest looking south



Plate 97: Southwest looking west



Plate 98: Southwest looking northwest







Plate 99: WTG12 - Upstream



Plate 100: WTG12 - Upstream



Plate 101: Southwest looking south



Plate 102: WTG12 - Downstream





## A.13 WTG13

### WTG13: Directional PMP photos



Plate 103: Southeast looking northwest



Plate 104: Southeast looking northwest



Plate 105: Southeast looking north



Plate 106: Southeast looking northeast



Plate 107: Southeast looking southeast



Plate 108: Southeast looking east





## A.14 WTG14

### WTG14: Directional PMP photos



Plate 109: Southeast looking northwest



Plate 110: Southeast looking north



Plate 111: Southeast looking northeast



Plate 112: Southeast looking southeast



Plate 113: Southeast looking south



Plate 114: Southeast looking southwest







Plate 115: WTG12 gate looking west



Plate 116: Southeast looking southeast





## A.15 WTG15

### WTG15: Directional PMP photos



Plate 117: North looking south



Plate 118: North looking south



Plate 119: North looking north



Plate 120: North looking north



Plate 121: North looking southeast



Plate 122: East looking east







Plate 123: East looking south



Plate 124: East looking north





## A.16 WTG16

### WTG16: Directional PMP photos



Plate 125: North looking south



Plate 126: North looking south



Plate 127: North looking south



Plate 128: North looking south west



Plate 129: North looking northwest



Plate 130: North looking northwest





## A.17 WTG17

### WTG17: Directional PMP photos



Plate 131: East looking west



Plate 132: East looking south



Plate 133: East looking south. Note moderate erosion.



Plate 134: East looking east



Plate 135: East looking east



Plate 136: East looking northeast

Plate 137: Further east looking west





## A.18 WTG18

### WTG18: Directional PMP photos



Plate 138: West looking east



Plate 139: West looking southeast



Plate 140: West looking east



Plate 141: West looking west. Note some minor erosion.





## A.19 WTG19



Plate 142: Northwest looking southeast



Plate 143: Northwest looking east



Plate 144: Northwest looking southeast



Plate 145: Northeast looking south



Plate 146: West looking north



Plate 147: Northwest looking north







Plate 148: Lantana seedling at WTG19



## A.20 WTG20

### WTG20: Directional PMP photos



Plate 149: Northwest looking southeast



Plate 150: West looking south



Plate 151: West looking northwest



Plate 152: West looking north





## A.21 WTG21

### WTG21: Directional PMP photos



Plate 153: Southwest looking north



Plate 154: Southwest looking north



Plate 155: Southwest looking southeast



Plate 156: Southwest looking south



Plate 157: Southeast looking north



Plate 158: Southeast looking south





Plate 159: West looking south





## A.22 WTG22

### WTG22: Directional PMP photos



Plate 160: North looking south



Plate 161: North looking south



Plate 162: North looking north



Plate 163: Northeast



Plate 164: Northeast looking south



Plate 165: Northeast looking north







Plate 166: North looking north





## A.23 WTG23

### WTG23: Directional PMP photos



Plate 167: North looking south



Plate 168: North looking north



Plate 169: Further north looking south



Plate 170: North looking east



Plate 171: North looking southwest



Plate 172: Northwest looking west







Plate 173: Northwest looking north



Plate 174: Northwest looking north





## A.24 WTG24

### WTG24: Directional PMP photos



Plate 175: North looking south



Plate 176: North looking north



Plate 177: Northwest looking south



Plate 178: Northwest looking north



Plate 179: Southwest looking south



Plate 180: Southwest looking east





Plate 181: Southeast looking north east along cable trenching





## A.25 WTG25

### WTG25: Directional PMP photos



Plate 182: Southwest looking northeast



Plate 183: Southwest looking southwest



Plate 184: Southwest looking northeast



Plate 185: Northeast looking north



Plate 186: North looking southeast



Plate 187: north looking southwest







Plate 188: Southwest looking southwest



## A.26 WTG26

### WTG26: Directional PMP photos



Plate 189: Northwest looking southeast



Plate 190: Northwest looking northwest



Plate 191: Northwest looking west



Plate 192: Northwest looking southwest



Plate 193: Northwest looking southeast



Plate 194: Northwest looking southwest







Plate 195: Northwest looking southeast



Plate 196: Northwest looking east



Plate 197: Further northwest looking southeast





## A.27 WTG27

### WTG27: Directional PMP photos



Plate 198: WTG27



Plate 199: Northwest looking southwest



Plate 200: Northwest looking northwest



Plate 201: Northwest looking northwest



Plate 202: North looking north



Plate 203: North looking south







Plate 204: North looking south



Plate 205: North looking south



Plate 206: North looking south





## A.28 WTG28

### WTG28: Directional PMP photos



Plate 207: South looking north



Plate 208: South looking northwest



Plate 209: East looking west



Plate 210: East looking east



Plate 211: East looking north





## A.29 Adjacent WTG09 (Hamburger Hill to WTG09)



Plate 212: From the main access track northeast of WTG09 looking east up to Hamburger Hill

## A.30 Adjacent WTG05



Plate 213: From the main access track north of WTG05 looking east

## A.31 Adjacent Pete's Creek



Plate 214: From the main access facing northeast to Pete's Creek






# Post-construction: Rehabilitation and Weed Monitoring Survey: May 2024

Kaban Wind Farm Pty Ltd as trustee  
for the Kaban Wind Farm Trust  
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# Contents

<b>Definitions</b>	<b>iv</b>
<b>Abbreviations</b>	<b>iv</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Background	1
1.2 Scope of Works	1
1.3 Weed Treatment Update	1
<b>2 Methods</b>	<b>3</b>
2.1 Priority Weed Assessment Methods	3
2.2 Rehabilitation Assessment Methods	4
<b>3 Results</b>	<b>6</b>
3.1 Priority Weed Assessment	6
3.1.1 Total Area of Priority Weed Cover	8
3.1.2 New Priority Weed Observations	8
3.2 Rehabilitation Assessment	12
3.2.1 Rehabilitation Observations for Turbine Sitings	12
3.2.2 Rehabilitation Observations along Access Tracks	12
3.2.3 Erosion Observations within Disturbance Footprint	13
3.2.4 Mapped areas of erosion and rehabilitation deficiencies	13
<b>4 Latest weed treatment report</b>	<b>17</b>
<b>5 Discussion and Recommendations</b>	<b>18</b>
5.1.1 Priority Weeds	18
5.1.2 New Priority Weeds	18
5.2 Rehabilitation	18
<b>References</b>	<b>20</b>

## List of Tables

Table 1: Priority weeds known to occur within the site, extracted from VMP	3
Table 2: Rehabilitation performance criteria (extracted from the VMP, Table 12)	4
Table 3: Priority weed infestations recorded within the disturbance footprint	6
Table 4: Other weeds of environmental concern noted within the disturbance footprint	8
Table 5: Areas identified for improvements to rehabilitation.	13
Table 6: Rehabilitation and Erosion Assessment, 30 to 31 May 2024.	14

## List of Figures

Figure 1: Project Location	2
Figure 2A: Areas within the disturbance footprint with rehabilitation deficiencies	10



Figure 3B: Areas within the disturbance footprint with rehabilitation deficiencies

## Appendices

Appendix A: Photo reports for all rehabilitation and weeds assessment sites.

Appendix B: Kaban - Post-construction Annual Weed Report

## Definitions

Term	Definition
Disturbance footprint	Any areas cleared for the purpose of the Project. The total area of disturbance is 104.88 hectares
The Project	The Kaban Green Power Hub
Vegetation Management Plan	The Vegetation Management Plan (VMP) stipulates performance criteria and management objectives for vegetation relevant to the Project
Weed Polygon Area	A specific area in which priority weeds were found

## Abbreviations

Term	Definition
E2M	E2M Pty Ltd
WTG	Wind Turbine Generator
VMP	Vegetation Management Plan



# 1 Introduction

## 1.1 Background

The Kaban Green Power Hub, commonly known as the Kaban Wind Farm and herein referred to as ‘the Project’, consists of 28 operational wind turbines and associated infrastructure, and is located approximately 4 kilometres west of Tumoulin, Queensland (Figure 1). Construction commenced in May 2021, with the first turbine constructed and commissioned by August 2022.

E2M was commissioned by Kaban Wind Farm Trustee for the Kaban Wind Farm Trust to conduct post construction rehabilitation and weed monitoring pursuant to EPBC approval 2018/8289. The last turbines were constructed and energised during June 2023, indicating the commencement of post-construction monitoring requirements. Conditions of the monitoring are detailed in the Vegetation Management Plan (VMP) (E2M, 2021). The VMP stipulates performance criteria / management objectives associated with vegetation relevant to the Project, including:

- No introduction or spread of priority weed species within the site and successful removal of priority weed species within the disturbance footprint, and
- Progressive stabilisation of disturbed areas and rehabilitation of the disturbance footprint following construction.

## 1.2 Scope of Works

The aims of this monitoring event are to assess the Project’s current rehabilitation success against the performance criteria specified in the VMP. Specifically:

- evaluate the relative abundance and distribution of priority weeds across the Project disturbance footprint, and
- evaluate the effectiveness of rehabilitation of areas disturbed during construction.

A six-month post-construction weed survey was conducted from 22 to 27 February 2024, (E2M Pty Ltd, 2024). This report presents the findings of a nine-month post construction assessment and evaluation of rehabilitation works and priority weeds present within the site disturbance areas, assessed in May 2024.

## 1.3 Weed Treatment Update

A weed treatment program has continued to help control and reduce abundance of priority weeds within the disturbance footprint, as per the VMP. The treatment program conducted between March and April 2024 was informed by the outcomes of the February 2024 weed monitoring survey.







## 2 Methods

### 2.1 Priority Weed Assessment Methods

Priority weeds within the context of this project have been defined as:

- Biosecurity Act 2014 'Restricted Matter' and 'Prohibited Matter' plant species
- Locally declared weeds under the *Tablelands Regional Council 2019-2024 Biosecurity Plan (TRC Biosecurity Plan)* (Tablelands Pest Management Advisory Committee, 2019); and
- High biomass exotic grasses and forbs which can quickly invade disturbed areas and degrade threatened species habitat. Of particular interest are species which may result in impacts to habitat quality for the magnificent brood frog (*Pseudophryne covacevichae*).

Prior to construction, priority weeds were identified on-site and summarised within the VMP. Priority weeds recorded are also outlined in Table 1.

**Table 1: Priority weeds known to occur within the site, extracted from VMP**

Species	Biosecurity Act 2014	TRC Biosecurity Plan	High biomass species
Grader grass ( <i>Themeda quadrivalvis</i> )	-	-	Yes
Guinea grass ( <i>Megathyrsus maximus</i> )	-	-	Yes
Lantana ( <i>Lanata camara</i> )	Category 3 Restricted Matter	-	Yes
Praxelis ( <i>Praxelis clematidea</i> )	-	-	Yes
Rhodes grass ( <i>Chloris gayana</i> )	-	-	Yes
Signal grass ( <i>Urochloa decumbens</i> )	-	-	Yes
Singapore daisy ( <i>Sphagneticola trilobata</i> )	Category 3 Restricted Matter	-	Yes

The survey was completed by taking a series of photos at each wind turbine generator (WTG) siting and along site access tracks. During the survey the following data were collected at each weed assessment site:

- Date
- Time
- Latitude
- Longitude
- Location name
- Weed species
- Abundance of weeds as percent groundcover in the broader area.
- The assignment of specific polygons indicating the area of significant weed infestations
- Photo series
- Abundance ranking:
  - Scattered
  - Low
  - Moderate
  - High
- Treatment priority





## 2.2 Rehabilitation Assessment Methods

Rehabilitation measures are to be progressively implemented throughout construction in accordance with Table 10 of the VMP. Four reports during construction provide details of the progress of rehabilitation and management of weeds throughout the disturbance footprint. These are (Horner, 2022), (Tucker, 2022), (Tucker, 2023a) and (Tucker, 2023b).

Post-construction rehabilitation management measures required by the VMP are:

1. Monitoring of rehabilitation against rehabilitation performance criteria with identification of required maintenance actions, and
2. Weed control measures such as spraying, physical removal, or planting native species to suppress weed growth.

The VMP states that the final rehabilitation would meet the following performance objectives:

- Self-sustaining vegetative cover
- No signs of subsidence or erosion
- Representative of species richness and diversity of pre-disturbed condition
- Plants showing healthy growth and signs of recruitment; and
- Free of priority weeds.

Rehabilitation performance criteria have been prescribed within the VMP and are summarised in Table 2.

**Table 2: Rehabilitation performance criteria (extracted from the VMP, Table 12)**

Indicator	3 months	6 months	9 months	12 months	18 months	24 months
<b>Seeded Areas / Natural Regeneration</b>						
Native Groundcover Species Richness	≥20% of pre-disturbance species richness	≥40% of pre-disturbance species richness	≥40% of pre-disturbance species richness	≥60% of pre-disturbance species richness	≥80% of pre-disturbance species richness	≥90% of pre-disturbance species richness
Priority Weeds	≤5% priority weed cover	≤5% priority weed cover	≤5% priority cover	No priority weeds	No priority weeds	No priority weeds
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	-	-	-	-
<b>*Assisted Revegetation Areas</b>						
Plant Survival	≥80% survival of planted stock	≥90% survival of planted stock	≥90% survival of planted stock	≥95% survival of planted stock	≥95% survival of planted stock	≥95% survival of planted stock
Plant Height	Evidence of growth	Evidence of growth	Evidence of growth	All planted canopy & shrub stock ≥0.3m high	All planted canopy & shrub stock ≥0.4m high	All planted canopy & shrub stock ≥0.6m high



*\*Assisted revegetation is only to occur in areas where seeding and natural regeneration is not meeting performance criteria after 12 months.*

To determine the effectiveness of rehabilitation measures against rehabilitation performance criteria and any ongoing maintenance actions required, a rehabilitation assessment was conducted at each of the weed assessment sites. The following data were collected at each weed/rehabilitation assessment site:

- Date
- Time
- Latitude
- Longitude
- Location name
- Native species names
- Number of native species
- Percent ground cover - total
- Percent groundcover natives
- Percent groundcover weeds
- Photo series as per weeds
- Erosion present: Yes/No
- Erosion severity: Minor, Moderate, Severe
- Remedial work priority:
  - Low
  - Moderate
  - High



## 3 Results

A nine-month post-construction rehabilitation survey was completed between 30 and 31 May 2024.

### 3.1 Priority Weed Assessment

Priority weeds were found throughout the disturbance footprint, ranging from scattered individuals to high density patches. For each weed assessment site, an overall abundance estimate of priority weed groundcover was recorded. The area in hectares was calculated for each priority weed infestation record and representative polygons generated (Figure 2). The 'Weed Polygon Area' is the specific area in which the weed infestation was found. 'Weed Polygon Areas' were generated to help inform the approval holder and contractors of priority weed infestation locations. The infestations were ranked Low, Moderate or High depending on the density of weed cover. Infestations were ranked low if less than 20 percent, Moderate between 20 and 50 percent, and High if greater than 50 percent cover. If priority weed cover was less than one percent, area polygons were not generated. A summary of results is included in Table 3.

**Table 3: Priority weed infestations recorded within the disturbance footprint**

Location	Weed Polygon Area Ha	% Priority Weed Cover	Area of Weeds Ha	Weed Infestation Rank	Priority Treatment 2024	Dominant Priority Weeds
<b>TURBINE SITINGS</b>						
WTG01	0	<1	0	None observed	NO	No signs of weeds <sup>1</sup>
WTG02	0	<1	0	None observed	NO	No signs of weeds <sup>1</sup>
WTG03	0	<1	0	None observed	NO	No signs of weeds <sup>1</sup>
WTG04	0.25	30	0.01	Moderate	YES	Signal grass
WTG05	0.19	30	0.06	Low	NO	Signal grass
WTG06	1.1	15	0.01	Low	YES	Signal grass
WTG07	0	<1	0	Scattered	YES	Grader grass
WTG08	0.47	75	0.35	High	NO	Signal grass
WTG09	0.06	15	0.01	Scattered	NO	Signal grass
WTG10	0	<1	0	Scattered	NO	No signs of weeds <sup>1</sup>
WTG11	0	<1	0	None observed	NO	No signs of weeds <sup>1</sup>
WTG12	0.32	20	0.06	Moderate	NO <sup>4</sup>	Grader grass
WTG13	0.96	20	0.19	Moderate	NO <sup>4</sup>	Grader grass
WTG14	0.56	40	0.31	High	YES	Signal grass





Location	Weed Polygon Area Ha	% Priority Weed Cover	Area of Weeds Ha	Weed Infestation Rank	Priority Treatment 2024	Dominant Priority Weeds
WTG15	0	<1	0	None observed	NO	No signs of weeds <sup>1</sup>
WTG16	0.83	65	0.56	High	POSTPONE <sup>2</sup>	Signal grass
WTG17	1.74	90	1.57	High	POSTPONE <sup>2</sup>	Signal grass
WTG18	0.71	80	0.57	High	POSTPONE <sup>2</sup>	Signal grass + Rhodes grass
WTG19	0.61	20	0.12	High	POSTPONE <sup>2</sup>	Signal grass
WTG20	0.68	20	0.14	High	POSTPONE <sup>2</sup>	Signal grass
WTG21	0	<1	0	None observed	NO	No signs of weeds <sup>1</sup>
WTG22	0.10	25	0.02	Low	YES	Signal grass
WTG23	0.07	70	0.05	Moderate	YES	Signal grass
WTG24	0	<1	0	Scattered	SPOT	Signal grass
WTG25	0	<1	0	Scattered	SPOT	Signal grass
WTG26	0	<1	0	Scattered	SPOT	Signal grass
WTG27	0	<1	0	Scattered	SPOT	Signal grass
WTG28	0	<1	0	Scattered	SPOT	Signal grass
<b>Access tracks</b>						
Track 11	0	<1	0	Moderate	NO	Signal grass
Sawmill	0	<1	0	High	YES	Grader grass + GRT <sup>3</sup>
Mevs to WTG 18 South of road	0.76	25	0.19	Moderate	YES	Rhodes grass, grader grass, spiny sida
Petes Ck to Mevs	0.63	80	0.51	High	POSTPONE <sup>2</sup>	Signal, grader and Rhodes grass plus spiny sida
WTG20 to 21 Roadside	0.33	75	0.25	Moderate	POSTPONE <sup>2</sup>	Signal + Grader grass
Mevs to Hamburger Hill	0.19	50	0.09	High	YES	Grader grass
Gravel stockpile	0.13	35	0.04	High	YES	Grader grass

1. Weed treatment very effective. No priority weeds observed. Continue monitoring.

2. Weed management to be postponed until the planned rehabilitation works are completed in the early wet season of 2024 to 2025.



3. Giant rat's tail grass (GRT) (*Sporobolus pyramidalis*) is listed as a Category 3, Restricted Invasive Plant under the *Biosecurity Act 2014*.

4. Cattle graze these areas and are being used to control growth of weeds. Weeds are small and scattered and hard to treat with chemical and too vast for manual removal. Maintain monitoring and treat using herbicides when desirable. Alternatively, slashing during flowering to reduce seed production.

### 3.1.1 Total Area of Priority Weed Cover

The total area of priority weeds was calculated as the sum of the proportion of priority weeds (area of weeds ha) within each weed polygon (Table 3). The total project disturbance area is 104.88 ha and the total area of priority weed cover was 5.15 ha. Therefore, the percent priority weed cover across the Project disturbance footprint was 4.91%.

### 3.1.2 New Priority Weed Observations

As noted in the previous report, additional priority weed species not originally identified prior to construction were recorded during the February 2024 survey. These were in relatively low densities scattered throughout the Project disturbance footprint. New priority weeds are listed in Table 4, along with their biosecurity risk profile. All of these plants are regarded as environmental weeds and have been added to the list of priority weeds and should be treated as such with regards to monitoring and treatment.

**Table 4: Other weeds of environmental concern noted within the disturbance footprint**

Species	Biosecurity Act 2014	TRC Biosecurity Plan	Regarded as Environmental Weed
Devil's fig ( <i>Solanum torvum</i> )	No	No	Yes
Giant rat's tail ( <i>Sporobolus pyramidalis</i> )	Category 3 restricted plant	Yes	Yes <sup>1, 2</sup>
Inkweed ( <i>Phytolacca octandra</i> )	No	No	Yes
Mexican poppy ( <i>Argemone mexicana</i> )	No	No	Yes
Navua sedge ( <i>Cyperus aromaticus</i> )	No	Yes	Yes <sup>2, 3</sup>
Sensitive weed ( <i>Mimosa pudica</i> )	No	No	Yes <sup>2</sup>
Spiny sida ( <i>Sida spinosa</i> )	No	No	Yes <sup>2</sup>
Tobacco weed ( <i>Solanum mauritianum</i> )	No	No	Yes

1. High fuel load

2. Out competes natives

3. Poses significant threat to waterways and wetlands

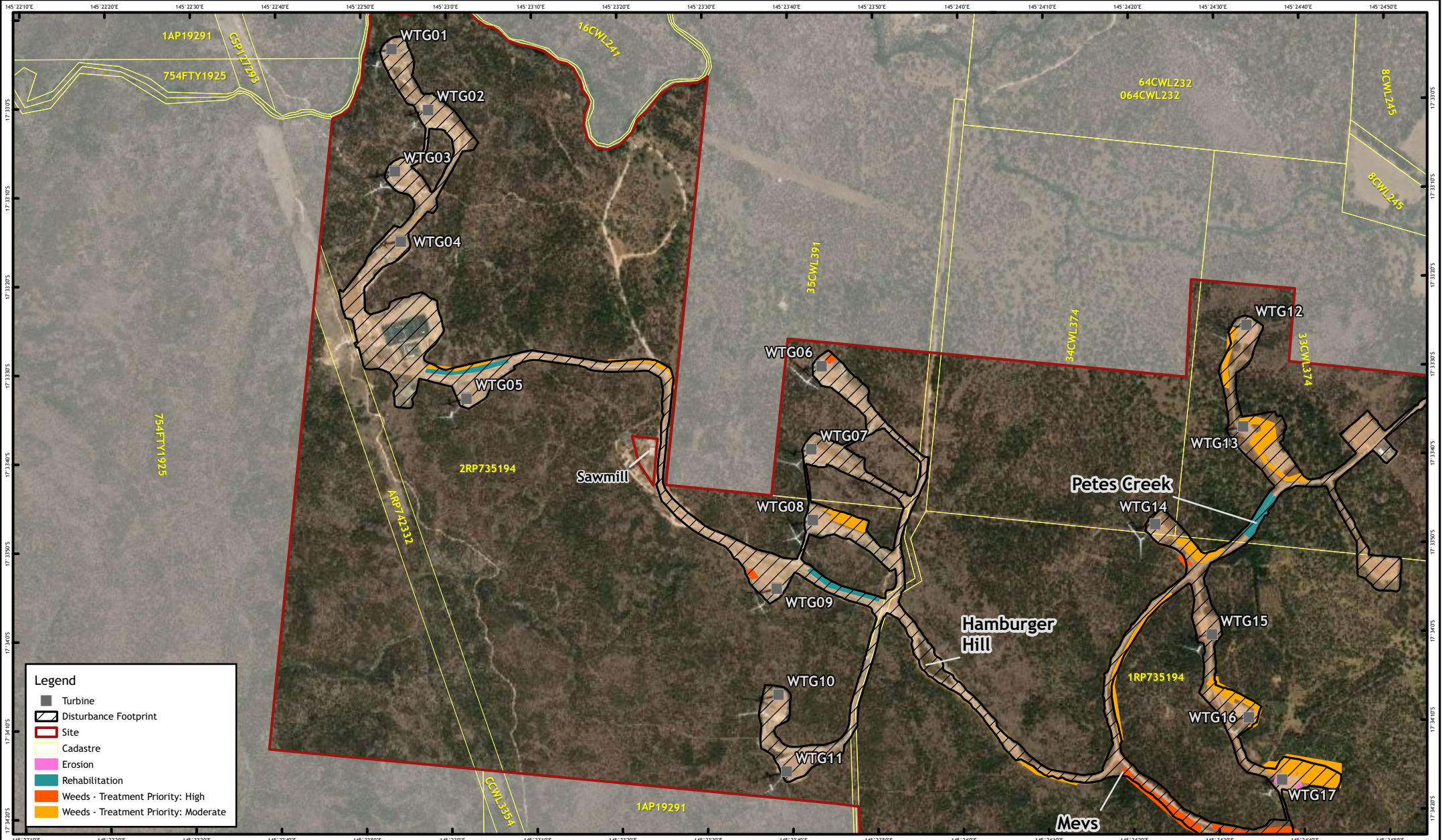
Of note were the patches of giant rat's tail (*Sporobolus pyramidalis*), found mostly between the Sawmill and WTG05, and Navua sedge (*Cyperus aromaticus*) found at WTG17. Giant rat's tail is identified, within the *Biosecurity Act 2014*, as a Category 3 restricted invasive plant and Navua sedge is listed as a priority species in the TRC Biosecurity Plan 2019-24.

During this survey there were no signs of devil's fig (*Solanum torvum*), Mexican poppy (*Argemone Mexicana*), inkweed (*Phytolacca octandra*) or tobacco weed (*Solanum mauritianum*). Giant rat's tail (*Sporobolus pyramidalis*) were less abundant, while sensitive weed was observed on turbine hardstands in low numbers. Spiny sida was detectable in several locations.

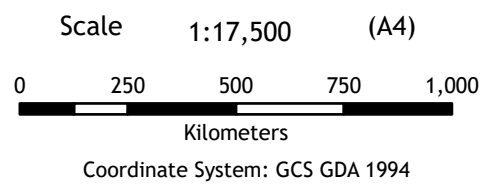
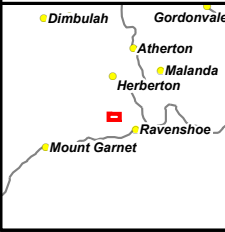




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- Legend**
- Turbine
  - Disturbance Footprint
  - Site
  - Cadastre
  - Erosion
  - Rehabilitation
  - Weeds - Treatment Priority: High
  - Weeds - Treatment Priority: Moderate



**Notes:**  
Aerial Imagery: © ESRI 2024  
Cadastre: © DNRME 2020

0	Issued for Use	PR	DJ	29/07/2024
A	Issued for Review	PR	DJ	26/06/2024
Rev	Description	Drawn	Approved	Date



**FIGURE 2A: REHABILITATION AND WEED DEFECT OBSERVATIONS**  
KABAN POST-CONSTRUCTION REHABILITATION MONITORING  
KABAN GREEN POWER HUB

Map Number	Job Number	Rev
1 of 2	QEJ21046	0







## 3.2 Rehabilitation Assessment

An assessment of rehabilitation performance was conducted at each weed assessment point and data collected as per Section 2.2. The observations are summarised in Table 6, and detailed reports of each site can be viewed in Appendix A. Observations for any areas under threat of developing erosion, or those sites with notable erosion, were also recorded. Refer to Appendix A for monitoring photographs.

### 3.2.1 Rehabilitation Observations for Turbine Sitings

There was good native species diversity across most turbine sitings. Twenty (20) of the 28 turbine sitings had eight or greater native species present. Twenty-two (22) turbine sites had native ground cover equal to or greater than 50 percent of total cover. All sites had total ground cover greater than or equal to 50 percent, except for WTG25 which had 20 percent total ground cover.

Five turbine sitings had weeds which dominated the total ground cover, with observations greater than 50 percent weed cover. These turbine sitings were WTG's 14, 16, 17, 18, and 20. WTG19 also had a significant weed cover of 42 percent.

### 3.2.2 Rehabilitation Observations along Access Tracks

Rehabilitation observations were made along access tracks between turbine sitings. Overall, native species richness was seven or greater for all locations and total groundcover was 60 percent or greater. However, there were observations of significant priority weed infestations within six of the eight locations. Some of these priority weed infestations were isolated smaller patches, however there are larger priority weed populations as identified in Section 3.1.





### 3.2.3 Erosion Observations within Disturbance Footprint

There was no severe erosion noted within the entire Project disturbance footprint. Minor erosion was noted at WTGs 23, 25 and 28 - refer to photo plates included in Appendix A. This was typically in the form of shallow (<20 cm) gully erosion within exposed banks of little or no groundcover. A moderate level of erosion was noted at WTG17, along the cutting batters adjacent to the woodland approximately 100 metres east of the turbine, see Appendix A. Minor sheet and gully erosion was also noted on the northside of the road from Hamburger Hill to WTG09. This section had reoccurring disturbance during cable and drainage works. As such, the rehabilitation was also disturbed, and consequently has less cover compared to sites not disturbed after primary rehabilitation work.

### 3.2.4 Mapped areas of erosion and rehabilitation deficiencies

Table 5 and Figure 2 identify those locations for remedial works to fix rehabilitation defects, such as insufficient groundcover and erosion.

**Table 5: Areas identified for improvements to rehabilitation.**

Site Location	Defect/s	Reference
Adjacent WTG05	Insufficient groundcover	Figure 2A, Appendix A
4 Ways to WTG09 north side of road	Insufficient groundcover & species richness	Figure 2A, Appendix A
Adjacent WTG17	Insufficient groundcover & erosion	Figure 2B, Appendix A
Adjacent WTG23	Insufficient groundcover & erosion	Figure 2B, Appendix A
Adjacent WTG25	Insufficient groundcover & species richness	Figure 2B, Appendix A
Adjacent WTG28	Insufficient groundcover & erosion	Figure 2B, Appendix A
Adjacent Pete's Creek	Insufficient groundcover & species richness	Figure 2B, Appendix A



**Table 6: Rehabilitation and Erosion Assessment, 30 to 31 May 2024.**

Location	Total # Native Spp.	# Dom Groundcover Spp.	# Dom Shrub Spp.	# Dom Tree Spp.	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments
WTG01	9	6	3	3	75	100	NO	NA	NA	
WTG02	14	7	2	4	90	99	NO	NA	NA	
WTG03	15	7	3	3	90	99	NO	NA	NA	
WTG04	17	7	3	4	90	99	NO	NA	NA	
WTG05	13	7	1	4	75	80	NO	NA	NA	
WTG06	7	5	0	2	85	98	NO	NA	NA	Well grazed by cattle
WTG07	9	4	3	2	85	98	NO	NA	NA	Well grazed by cattle
WTG08	11	5	3	3	75	60	NO	NA	NA	
WTG09	8	4	3	1	80	90	NO	NA	NA	
WTG10	12	7	3	2	90	99	NO	NA	NA	
WTG11	12	7	3	2	90	100	NO	NA	NA	
WTG12	7	4	0	3	85	80	NO	NA	NA	Well grazed by cattle
WTG13	6	4	0	2	90	80	NO	NA	NA	Well grazed by cattle
WTG14	7	4	1	2	85	50	NO	NA	NA	Well grazed by cattle



Location	Total # Native Spp.	# Dom Groundcover Spp.	# Dom Shrub Spp.	# Dom Tree Spp.	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments
WTG15	7	4	2	1	85	96	NO	NA	NA	
WTG16	6	3	3	0	90	15	NO	NA	NA	
WTG17	5	3	2	0	90	10	YES	Gully	Moderate	See erosion polygon Figure 2
WTG18	8	4	3	1	90	3	NO	NA	NA	
WTG19	8	5	2	1	70	60	NO	NA	NA	
WTG20	9	5	3	1	70	80	NO	NA	NA	
WTG21	17	7	4	3	70	99	NO	NA	NA	
WTG22	12	5	4	2	70	99	NO	NA	NA	
WTG23	14	7	4	1	80	99	YES	Gully	Moderate	See erosion polygon Figure 2
WTG24	12	7	4	1	50	100	NO	NA	NA	
WTG25	13	7	4	2	25	99	YES	Gully	Minor	See erosion polygon Figure 2
WTG26	12	7	3	2	65	100	NO	NA	NA	
WTG27	10	5	4	1	55	100	NO	NA	NA	
WTG28	9	4	3	2	65	100	YES	Gully	Moderate	See erosion polygon Figure 2
4-Ways to WTG11	10	5	3	2	75	70	NO	NA	NA	



Location	Total # Native Spp.	# Dom Groundcover Spp.	# Dom Shrub Spp.	# Dom Tree Spp.	Total % Ground Cover	Total % Native Cover	Erosion Present	Erosion Type	Erosion Severity	Comments
4-Ways Intersection	6	4	2	0	80	99	NO	NA	NA	
Gravel Stockpile	1	1	0	0	65	35	NO	NA	NA	
Hamburger Hill to WTG09 - North side of road	4	4	0	0	20	20	YES	Gully & Sheet	Minor	See erosion polygon Figure 2
Mevs to WTG18	9	4	3	2	80	75	NO	NA	NA	
Mevs to Hamburger Hill	>10	7	3	3	75	60	NO	NA	NA	
Petes to Mevs	8	3	3	2	95	20	NO	NA	NA	
Track 11 to WTG25	8	3	2	3	80	50	NO	NA	NA	
WTG5 to Sawmill	12	6	2	4	60	90	NO	NA	NA	
WTG9 to Sawmill	8	4	2	2	80	99	NO	NA	NA	
WTG20 to WTG21 Roadside	8	4	3	1	95	20	NO	NA	NA	



## 4 Latest weed treatment report

An informed weed treatment program was conducted between March and April 2024, using the information gathered during the February 2024 weed monitoring survey. Please refer to the Annual Weed Monitoring and Treatment report within Appendix B.





## 5 Discussion and Recommendations

The nine-month, post-construction, rehabilitation monitoring survey was performed across the Project disturbance area from 30 to 31 May 2024. While there is no requirement to perform a weed survey during this survey interval, the presence of weeds is an important factor in the success of rehabilitation. As such, the details of priority weed infestations were monitored across the disturbance footprint and observations presented in this report. There has been good rainfall throughout the wet season and extending into May, promoting good revegetation growth but also promoting significant growth of priority weeds. The aim of this assessment is to evaluate rehabilitation works and priority weeds present in accordance with the requirements of the VMP.

### 5.1.1 Priority Weeds

The priority weed cover has dropped from 5.55 to 4.91 percent of total ground cover. This decrease is wholly attributable to the weed treatment program conducted during March and April 2024. This figure is marginally under the target figure of 5 percent or less priority weed ground cover, as defined within the VMP (see Table 2). The most abundant priority weeds are grader grass and signal grass. However, there was a notable decline in signal grass within those sites receiving treatment. WTG15 photos C, D and E in Appendix A illustrate the dead weeds treated in March and April 2024. Some priority weeds, such as Mexican poppy, devil's fig, tobacco weed and inkweed, notable during the February survey were absent during the latest survey. There was also a significant decrease in giant rat's tail grass across the disturbance footprint. The absence and decline of these priority weeds re-enforce the importance and success of the weed treatment program.

The previous report provided some details around a weed treatment program. It is recommended that a Weed Treatment Management Plan be developed to ensure the execution of the most effective ways in reducing priority weeds across site. Continued monitoring and treatment, at the most appropriate times, will provide the most effective solution for weed reduction and control across the site.

### 5.1.2 New Priority Weeds

As noted in 5.1.1, several of the new priority weeds were not detected during the latest survey. However, some weeds such as spiny sida, navua sedge and sensitive weed remain scattered throughout various locations throughout the site.

It is important that the new 'priority' weeds be added to the VMP and included in the Weed Treatment Management Plan. Continued vigilance and treatment is very important to control any new weed with the capability of causing degradation to the surrounding environment.

## 5.2 Rehabilitation

As with the February 2024 survey, adequate ground cover and good native species richness was noted within most sites. However, there were a few locations noted with inadequate ground cover, inadequate species richness and some with erosion. The deficiencies were identified in Table 5, and various treatments such as hydroseeding, hydromulching or hand planting are recommended. Where erosion is present, appropriate soil preparation, stabilisation and top dressing will be required before commencement of any revegetation activities. Any measures to improve rehabilitation and erosion should be done in consultation with those experts qualified to perform these activities. Prior to implementing these activities, advice from ecologists familiar with the site should be sought to ensure that the appropriate measures are taken to protect site matters of environmental significance. Scheduled rehabilitation work, later in 2024/early 2025 should be informed by ecologist to achieve the best



outcomes. During any significant, broad acre, weed treatment program, rehabilitation should be performed congruently, to improve the chances of weed eradication and rehabilitation. These strategies are to be included in the Weed Treatment Management Plan.



## References

E2M. (2021). *Kaban Green Power Hub - Vegetation Management Plan*.

E2M Pty Ltd. (2024). *Post-construction: Rehabilitation and Weed Monitoring, February 2024* [Vegetation Management Plan Monitoring].

Horner, G. (2022). *Kaban Green Power Hub Rehabilitation Monitoring Report 1* (1; p. 48). BIOTROPICA.

Neldner, V. J., & Butler, D. W. (2021). Dynamics of the ground layer communities of tropical eucalypt woodlands of northern Queensland. *AUSTRALIAN JOURNAL OF BOTANY*, 69, 85-101.

Tablelands Pest Management Advisory Committee. (2019). *Tablelands Regional Council 2019-2024 Biosecurity Plan V2.0*.

Tucker, N. (2022). *Kaban Green Power Hub Rehabilitation Monitoring Report 2* (Rehabilitation Monitoring 2; p. 48).

Tucker, N. (2023a). *Kaban Green Power Hub Rehabilitation Monitoring Report 3* (Rehabilitation Monitoring 3; p. 48).

Tucker, N. (2023b). *Kaban Green Power Hub Weed Assessment Report 3* (Weed Assessment 2; p. 19).





## Appendix A: Photo reports for all rehabilitation and weeds assessment sites.



Note: All image directions are described firstly from the direction of the turbine, then the direction in which the image was taken.





Site ID	WTG 1	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	75	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Jacksonia thesioides</i>	<i>Eucalyptus spp 1</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 2</i>	
Weed Density	Scattered	<i>Gonocarpus acanthocarpus</i>	<i>Trema tomentosa</i>	<i>Eucalyptus teriticornis</i>	
Weed Treatment Priority	Low	<i>Sporobolus spp 1</i>			
Erosion Observed	None	<i>Digitaria spp</i>			
Erosion Type	NA	<i>Schizachyrium fragile</i>			
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5301680240530DJ

**Photo Notes:** Facing Northwest



**Site photo B:** P5301681240530DJ

**Photo Notes:** 80m south facing south



**Site photo C:** P5301682240530DJ

**Photo Notes:** 100m south facing north



Site ID	WTG 10	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>	<i>Acacia holosericea</i>	<i>Grevillea spp</i>	
Weed Density	-	<i>Cyperus spp 1</i>	<i>Jacksonia thesioides</i>		
Weed Treatment Priority	NA	<i>Digitaria spp</i>			
Erosion Observed	None	<i>Sporobolus spp 1</i>			
Erosion Type	NA	<i>Panicum mitchellii</i>			
Remedial Works Priority	NA	<i>Gonocarpus acanthocarpus</i>			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	Good groundcover, good composition no priority weeds observed				







**Site photo A:** P5301711240530DJ

**Photo Notes:** 100m south facing north



**Site photo B:** P5301712240530DJ

**Photo Notes:** 100m southwest facing south



Site ID	WTG 11	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>	<i>Acacia holosericea</i>	<i>Grevillea spp</i>	
Weed Density	-	<i>Cyperus spp 1</i>	<i>Jacksonia thesioides</i>		
Weed Treatment Priority	NA	<i>Digitaria spp</i>			
Erosion Observed	None	<i>Sporobolus spp 1</i>			
Erosion Type	NA	<i>Panicum mitchellii</i>			
Remedial Works Priority	NA	<i>Gonocarpus acanthocarpus</i>			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	Good groundcover, good composition no priority weeds observed				





**Site photo A:** P5301713240530DJ

**Photo Notes:** 120m north east facing southwest



**Site photo B:** P5301714240530DJ

**Photo Notes:** 120m north east facing west



**Site photo C:** P5301715240530DJ

**Photo Notes:** 120m east facing northeast



**Site photo D:** P5301716240530DJ

**Photo Notes:** 120m east facing west

Site ID	WTG 12	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	85	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	20	<i>Themeda triandra</i>		<i>Eucalyptus spp 1</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>		<i>Eucalyptus spp 2</i>	
Weed Density	Medium	<i>Cyperus spp 1</i>		<i>Casuarina spp</i>	
Weed Treatment Priority	Moderate	<i>Eragrostis spp 1</i>			
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good ground cover albeit some weeds. See weed polygon				
Priority Weeds Notes	signal grass, gg reshooting after grazing. See pol				
Erosion Notes	-				
Other Observations	cattle grazing				







**Site photo A:** P5301732240530DJ

**Photo Notes:** 130m west facing east



**Site photo B:** P5301733240530DJ

**Photo Notes:** 130m west facing west





**Site photo C:** P5301734240530DJ

**Photo Notes:** 130m south facing south



Site ID	WTG 13	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	20	<i>Themeda triandra</i>		<i>Eucalyptus spp 1</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>		<i>Eucalyptus spp 2</i>	
Weed Density	Medium	<i>Cyperus spp 1</i>			
Weed Treatment Priority	Moderate	<i>Eragrostis spp 1</i>			
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good ground cover albeit some weeds. See weed polygon				
Priority Weeds Notes	See polygon				
Erosion Notes	-				
Other Observations	cattle grazing				





**Site photo A:** P5301735240530DJ

**Photo Notes:** 80m south facing north



**Site photo B:** P5301736240530DJ

**Photo Notes:** 80m south facing south





**Site photo C:** P5301737240530DJ

**Photo Notes:** 80m south facing east



Site ID	WTG 14	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	85	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	10	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>		<i>Eucalyptus spp 2</i>	
Weed Density	Medium	<i>Cyperus spp 1</i>			
Weed Treatment Priority	Moderate	<i>Eragrostis spp 1</i>			
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good ground cover albeit some weeds. See weed polygon				
Priority Weeds Notes	signal grass, gg reshooting after grazing				
Erosion Notes	-				
Other Observations	cattle grazing				







**Site photo A:** P5301729240530DJ

**Photo Notes:** 100m south facing north



**Site photo B:** P5301730240530DJ

**Photo Notes:** 100m south facing west





**Site photo C:** P5301731240530DJ

**Photo Notes:** 100m south facing south



Site ID	WTG 15	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	85	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	4	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	
Weeds Marked with Polygon	No	<i>Eragrostis spp 1</i>	<i>Acacia flavescens</i>		
Weed Density	-	<i>Sporobolus spp 1</i>			
Weed Treatment Priority	-	<i>Cyperus spp 1</i>			
Erosion Observed	-				
Erosion Type	-				
Remedial Works Priority	-				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				







**Site photo A:** P5311794240531DJ

**Photo Notes:** 200m north facing south



**Site photo B:** P5311795240531DJ

**Photo Notes:** 120m north facing south



**Site photo C:** P5311796240531DJ

**Photo Notes:** 100m northwest facing south



**Site photo D:** P5311797240531DJ

**Photo Notes:** 50m NE facing south





**Site photo E:** P5311798240531DJ

**Photo Notes:** 50m NE facing. treated signal grass



Site ID	WTG 16	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	15	<i>Themeda triandra</i>	<i>Acacia simsii</i>		<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Digitaria spp</i>	<i>Acacia holosericea</i>		
Weed Density	High	<i>Legume spp</i>	<i>Acacia leptostachya</i>		
Weed Treatment Priority	Moderate				
Erosion Observed	Low				
Erosion Type	Gully				
Remedial Works Priority	Low				
Rehabilitation Notes	Good ground cover but very high density of priority weeds. See polygons				
Priority Weeds Notes	some Rhodes grass				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5311799240531DJ

**Photo Notes:** Erosion 30m west of turbine



**Site photo B:** P5311780240531DJ

**Photo Notes:** 150m NW facing SE

Site ID	WTG 17	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	80	<i>Themeda triandra</i>	<i>Acacia simsii</i>		<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Digitaria spp</i>	<i>Acacia holosericea</i>		
Weed Density	High	<i>Legume spp</i>			
Weed Treatment Priority	Moderate				
Erosion Observed	Low				
Erosion Type	Gully				
Remedial Works Priority	Low				
Rehabilitation Notes	Good ground cover but very high density of priority weeds. See polygons. Some erosion				
Priority Weeds Notes	See polygons				
Erosion Notes	-				
Other Observations	-				







**Site photo A:** P5311801240531DJ

**Photo Notes:** 40m NW facing east



**Site photo B:** P5311802240531DJ

**Photo Notes:** erosion SW turbine. see polygon





**Site photo C:** P5311803240531DJ

**Photo Notes:** erosion 100m SE turbine. see polygon



**Site photo D:** P5311804240531DJ

**Photo Notes:** 100m SW facing SW

Site ID	WTG 18	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	3	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Eragrostis spp 1</i>	<i>Trema tomentosa</i>		
Weed Density	High	<i>Cyperus spp 1</i>	<i>Acacia flavescens</i>		
Weed Treatment Priority	Moderate	<i>Lomandra spp</i>			
Erosion Observed	Low				
Erosion Type	Gully				
Remedial Works Priority	Moderate				
Rehabilitation Notes	Good ground cover but very high density of priority weeds. See polygons				
Priority Weeds Notes	Rhodes gr, fleabane & grader grass & Macroptilium				
Erosion Notes	remedial works this coming wet season				
Other Observations	weed legume Macroptilium atrpurpureun. 80%weeds in polygon				







**Site photo A:** P5311785240531DJ  
**Photo Notes:** 100m nww facing SE



**Site photo B:** P5311786240531DJ  
**Photo Notes:** 70m NW facing east





**Site photo C:** P5311787240531DJ

**Photo Notes:** 60m NW facing east



**Site photo D:** P5311788240531DJ

**Photo Notes:** 150m nww facing north

Site ID	WTG 19	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	70	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	40	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Eragrostis spp 1</i>	<i>Trema tomentosa</i>		
Weed Density	Medium	<i>Panicum mitchellii</i>			
Weed Treatment Priority	Moderate	<i>Cyperus spp 1</i>			
Erosion Observed	None	<i>Lomandra spp</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good ground cover but priority weeds present. See polygons				
Priority Weeds Notes	scattered fleabane & grader grass.				
Erosion Notes	-				
Other Observations	-				







**Site photo A:** P5311783240531DJ

**Photo Notes:** 150m nnw facing SE



**Site photo B:** P5311784240531DJ

**Photo Notes:** 100m NW facing south

Site ID	WTG 2	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Jacksonia thesioides</i>	<i>Eucalyptus</i> spp 1	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>	<i>Acacia simsii</i>	<i>Coymbia</i> spp 1	
Weed Density	Scattered	<i>Gonocarpus acanthocarpus</i>		<i>Eucalyptus shirleyi</i>	
Weed Treatment Priority	Low	<i>Sporobolus</i> spp 1		<i>Grevillea</i> spp	
Erosion Observed	None	<i>Digitaria</i> spp			
Erosion Type	NA	<i>Heteropogon triticeus</i>			
Remedial Works Priority	NA	<i>Eragrostis</i> spp 1			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5301683240530DJ

**Photo Notes:** Facing Northwest



**Site photo B:** P5301684240530DJ

**Photo Notes:** 80m south facing north





**Site photo C:** P5301685240530DJ

**Photo Notes:** 100m south facing south



Site ID	WTG 20	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	70	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	20	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Sporobolus spp 1</i>	<i>Acacia holosericea</i>		
Weed Density	Medium	<i>Cyperus spp 1</i>	<i>Trema tomentosa</i>		
Weed Treatment Priority	Moderate	<i>Eragrostis spp 1</i>			
Erosion Observed	None	<i>Lomandra spp</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good ground cover but priority weeds present. See polygons				
Priority Weeds Notes	scattered fleabane. see prev polyg for distribn				
Erosion Notes	-				
Other Observations	rehab remedial works this wet season				







**Site photo A:** P5311781240531DJ

**Photo Notes:** 200m NW facing SE



**Site photo B:** P5311782240531DJ

**Photo Notes:** 80m west facing SE

Site ID	WTG 21	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	70	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Gonocarpus acanthocarpus</i>	<i>Acacia holosericea</i>	<i>Grevillea spp</i>	
Weed Density	Medium	<i>Eragrostis spp 1</i>	<i>Acacia flavescens</i>	<i>Eucalyptus shirleyi</i>	
Weed Treatment Priority	Moderate	<i>Digitaria spp</i>	<i>Trema tomentosa</i>		
Erosion Observed	None	<i>Eragrostis spp 2</i>			
Erosion Type	NA	<i>Panicum mitchellii</i>			
Remedial Works Priority	NA	<i>Lomandra spp</i>			
Rehabilitation Notes	Good native ground cover. Previous weed populations treated and little signs of priority weeds.				
Priority Weeds Notes	patchy most dead from treatment,				
Erosion Notes	-				
Other Observations	most signal grass dead in previous polygon<1% remain				







**Site photo A:** P5311775240531DJ

**Photo Notes:** 30m west facing south



**Site photo B:** P5311776240531DJ

**Photo Notes:** 50m NW facing north





**Site photo C:** P5311777240531DJ

**Photo Notes:** 10m north facing north



**Site photo D:** P5311778240531DJ

**Photo Notes:** 30m east facing south

Site ID	WTG 22	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	70	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Gonocarpus acanthocarpus</i>	<i>Acacia holosericea</i>	<i>Grevillea spp</i>	
Weed Density	Medium	<i>Eragrostis spp 1</i>	<i>Acacia flavescens</i>		
Weed Treatment Priority	Moderate	<i>Digitaria spp</i>	<i>Trema tomentosa</i>		
Erosion Observed	None	<i>Eragrostis spp 2</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover. Previous weed populations treated and little signs of priority weeds.				
Priority Weeds Notes	small patch				
Erosion Notes	-				
Other Observations	most signal grass dead in previous polygon<1% remain				







**Site photo A:** P5311771240531DJ

**Photo Notes:** 30m west facing south



**Site photo B:** P5311772240531DJ

**Photo Notes:** 30m west facing east



**Site photo C:** P5311773240531DJ

**Photo Notes:** 10m east facing south, signal grass patch



**Site photo D:** P5311774240531DJ

**Photo Notes:** 30m east facing north

Site ID	WTG 23	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	80	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Gonocarpus acanthocarpus</i>	<i>Acacia holosericea</i>		
Weed Density	Medium	<i>Eragrostis spp 1</i>	<i>Acacia flavescens</i>		
Weed Treatment Priority	Moderate	<i>Digitaria spp</i>	<i>Trema tomentosa</i>		
Erosion Observed	Low	<i>Eragrostis spp 2</i>			
Erosion Type	Gully	<i>Heteropogon contortus</i>			
Remedial Works Priority	Moderate	<i>Cymbopogon spp</i>			
Rehabilitation Notes	Good native ground cover. Some weed infestation and erosion. See polygons.				
Priority Weeds Notes	small patch				
Erosion Notes	see polygon				
Other Observations	-				







**Site photo A:** P5311768240531DJ

**Photo Notes:** 200m north facing south



**Site photo B:** P5311769240531DJ

**Photo Notes:** 80m now facing north



**Site photo C:** P5311770240531DJ

**Photo Notes:** 70m nnw facing south, signal grass





Site ID	WTG 24	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	50	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	
Weeds Marked with Polygon	No	<i>Gonocarpus acanthocarpus</i>	<i>Acacia holosericea</i>		
Weed Density	None	<i>Eragrostis spp 1</i>	<i>Alphitonia spp</i>		
Weed Treatment Priority	Low	<i>Digitaria spp</i>	<i>Pimelia linifolia</i>		
Erosion Observed	None	<i>Eragrostis spp 2</i>			
Erosion Type	NA	<i>Cymbopogon spp</i>			
Remedial Works Priority	NA	<i>Lomandra spp</i>			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5311763240531DJ

**Photo Notes:** 100m new facing SE



**Site photo B:** P5311764240531DJ

**Photo Notes:** 100m new facing north





**Site photo C:** P5311765240531DJ

**Photo Notes:** 30m NW facing south



**Site photo D:** P5311766240531DJ

**Photo Notes:** 30m SW facing SW



**Site photo E:** P5311767240531DJ

**Photo Notes:** 15m SE facing north. Area to rehab

Site ID	WTG 25	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	25	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Acacia holosericea</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	No	<i>Cyperus spp 1</i>	<i>Acacia simsii</i>	<i>Grevillea spp</i>	
Weed Density	Scattered	<i>Sporobolus spp 1</i>	<i>Pimelea linifolia</i>		
Weed Treatment Priority	Spot Spray	<i>Gonocarpus acanthocarpus</i>	<i>Shrub 1</i>		
Erosion Observed	None	<i>Cyperus spp 2</i>			
Erosion Type	NA	<i>Schizachyrium fragile</i>			
Remedial Works Priority	NA	<i>Imperata cylindrica</i>			
Rehabilitation Notes	Insufficient ground cover. See rehabilitation polygon.				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	rehab required, large areas with less than 30% cover				







**Site photo A:** P5311755240531DJ

**Photo Notes:** 100m SW facing NE



**Site photo B:** P5311756240531DJ

**Photo Notes:** 30m NE facing north



**Site photo C:** P5311757240531DJ

**Photo Notes:** 50m NW facing west



Site ID	WTG 26	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	65	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Gonocarpus acanthocarpus</i>	<i>Acacia simsii</i>	<i>Casuarina spp</i>	
Weeds Marked with Polygon	N/A	<i>Themeda triandra</i>	<i>Acacia holosericea</i>	<i>Eucalyptus spp 1</i>	
Weed Density	-	<i>Cyperus spp 1</i>	<i>Grevillea dryandri</i>		
Weed Treatment Priority	NA	<i>Eragrostis spp 1</i>			
Erosion Observed	None	<i>Digitaria spp</i>			
Erosion Type	NA	<i>Cyperus spp 1</i>			
Remedial Works Priority	NA	<i>Lomandra spp</i>			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				







**Site photo A:** P5311752240531DJ

**Photo Notes:** 100m north facing south



**Site photo B:** P5311753240531DJ

**Photo Notes:** 120m NN east facing south



**Site photo C:** P5311754240531DJ

**Photo Notes:** 60m NE facing SW





Site ID	WTG 27	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	55	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Gonocarpus acanthocarpus</i>	<i>Acacia simsii</i>		
Weeds Marked with Polygon	N/A	<i>Themeda triandra</i>	<i>Acacia flavescens</i>	<i>Eucalyptus spp 1</i>	
Weed Density	-	<i>Cyperus spp 1</i>	<i>Pultenaea millarii</i>		
Weed Treatment Priority	NA	<i>Eragrostis spp 1</i>	<i>Pimelia linifolia</i>		
Erosion Observed	None	<i>Lomandra spp</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				





**Site photo C:** P5311748240531DJ

**Photo Notes:** 100m north facing south



**Site photo D:** P5311749240531DJ

**Photo Notes:** 130m north facing north





**Site photo E:** P5311750240531DJ

**Photo Notes:** 120m north east facing SW



**Site photo F:** P5311751240531DJ

**Photo Notes:** 100m north east facing sw

Site ID	WTG 28	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	65	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Gonocarpus acanthocarpus</i>	<i>Acacia simsii</i>		
Weeds Marked with Polygon	No	<i>Themeda triandra</i>	<i>Acacia flavescens</i>		
Weed Density	-	<i>Heteropogon contortus</i>	<i>Pultenaea millarii</i>		
Weed Treatment Priority	NA	<i>Lomandra spp</i>			
Erosion Observed	Low				
Erosion Type	Gully				
Remedial Works Priority	Moderate				
Rehabilitation Notes	Good native ground cover. Except small section with little cover; see rehabilitation polygon.				
Priority Weeds Notes	<1%				
Erosion Notes	as previous survey, see polygon				
Other Observations	-				





**Site photo A:** P5311743240531DJ

**Photo Notes:** 80m east facing west



**Site photo B:** P5311744240531DJ

**Photo Notes:** 80m east facing SW





Site photo C: P5311745240531DJ

Photo Notes: 80m east facing east



Site ID	WTG 5 to Sawmill	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	60	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Sporobolus spp 1</i>	<i>Acacia holosericea</i>	<i>Corymbia citriodora</i>	
Weeds Marked with Polygon	Yes	<i>Digitaria spp</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 2</i>	
Weed Density	High	<i>Eragrostis spp 1</i>		<i>Eucalyptus tindaliae</i>	
Weed Treatment Priority	Moderate	<i>Gonocarpus acanthocarpus</i>		<i>Casuarina spp</i>	
Erosion Observed	None	<i>Digitaria spp</i>			
Erosion Type	NA	<i>Schizachyrium fragile</i>			
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	Treated weeds dying. See wee polygons				
Erosion Notes	-				
Other Observations	no signs of signal grass				





**Site photo A:** P5301698240530DJ

**Photo Notes:** 120m northeast facing west



**Site photo B:** P5301701240530DJ

**Photo Notes:** facing east





**Site photo C:** P5301702240530DJ

**Photo Notes:** facing west





Site ID	WTG 3	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Jacksonia thesioides</i>	<i>Eucalyptus</i> spp 1	Grader grass ( <i>Themeda quadrivalvis</i> )
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>	<i>Acacia simsii</i>	<i>Eucalyptus</i> spp 2	
Weed Density	Scattered	<i>Gonocarpus acanthocarpus</i>	<i>Acacia holosericea</i>		
Weed Treatment Priority	Low	<i>Sporobolus</i> spp 1		<i>Grevillea</i> spp	
Erosion Observed	None	<i>Digitaria</i> spp			
Erosion Type	NA	<i>Heteropogon triticeus</i>			
Remedial Works Priority	NA	<i>Eragrostis</i> spp 1			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5301686240530DJ

**Photo Notes:** 120m East Facing Northwest



**Site photo B:** P5301687240530DJ

**Photo Notes:** 80m east facing northwest



**Site photo C:** P5301688240530DJ

**Photo Notes:** 100m south facing northwest



Site ID	WTG 9 to Sawmill	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	60	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Gonocarpus acanthocarpus</i>	<i>Jacksonia thesioides</i>		
Weeds Marked with Polygon	No	<i>Themeda triandra</i>	<i>Acacia simsii</i>		
Weed Density	-	<i>Lomandra spp</i>	<i>Dodonaea spp</i>		
Weed Treatment Priority	-	<i>Hovea clavata</i>	<i>Petalostigma spp</i>		
Erosion Observed	None	<i>Schizachyrium fragile</i>			
Erosion Type	NA	<i>Cymbopogon spp</i>			
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	Treated weeds dying				
Erosion Notes	-				
Other Observations	-				







**Site photo A:** P5301704240530DJ

**Photo Notes:** Facing southeast



Site ID	Sth: 4-Ways to WTG9	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	
Weeds Marked with Polygon	No	<i>Heteropogon contortus</i>	<i>Acacia holosericea</i>		
Weed Density	-	<i>Cyperus spp 1</i>	<i>Jacksonia thesioides</i>		
Weed Treatment Priority	-	<i>Digitaria spp</i>			
Erosion Observed	None	<i>Sporobolus spp 1</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover except portion indicated by polygon on north side of road.				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	observations for south side of road				





**Site photo A:** P5301710240530DJ

**Photo Notes:** four ways intersection facing wtg 9



Site ID	4-Ways Intersection	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	80	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Dodonaea spp</i>		<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Gonocarpus acanthocarpus</i>	<i>Pultenaea millarii</i>		
Weed Density	High	<i>Lomandra spp</i>			
Weed Treatment Priority	Moderate	<i>Cymbopogon spp.</i>			
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover at the intersection and recent remedial works area				
Priority Weeds Notes	very little signal grass after treatment				
Erosion Notes	-				
Other Observations	polygon weeds mapped around Mevs				







**Site photo A:** P5301727240530DJ

**Photo Notes:** facing north



**Site photo B:** P5301728240530DJ

**Photo Notes:** facing SE

Site ID	Mevs to WTG 18	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	80	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	25	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Eragrostis spp 1</i>	<i>Acacia holosericea</i>		
Weed Density	Medium	<i>Cyperus spp 1</i>	<i>Acacia flavescens</i>		
Weed Treatment Priority	Moderate	<i>Digitaria spp</i>			
Erosion Observed	None	<i>Lomandra spp</i>			
Erosion Type	-				
Remedial Works Priority	-				
Rehabilitation Notes	Good ground cover but priority weeds present. See polygons				
Priority Weeds Notes	Rhodes gr, fleabane & grader grass.				
Erosion Notes	-				
Other Observations	-				





Site photo A: P5311790240531DJ

Photo Notes: WTG18 track to Mevs facing NW

Site ID	WTG 18 to WTG 21	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	95	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	20	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes	<i>Sporobolus spp 1</i>	<i>Acacia holosericea</i>		
Weed Density	Medium	<i>Cyperus spp 1</i>	<i>Trema tomentosa</i>	<i>Eucalyptus spp 2</i>	
Weed Treatment Priority	Moderate	<i>Lomandra spp</i>			
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	See polygons. Priority weeds present.				
Priority Weeds Notes	See polygons				
Erosion Notes	-				
Other Observations	-				







**Site photo A:** P5311779240531DJ

**Photo Notes:** east of road looking towards WTG20



**Site photo B:** P5311780240531DJ

**Photo Notes:** looking south from WTG20 exit

Site ID	Gravel Pile	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	65	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	75	<i>Themeda triandra</i>			<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes				
Weed Density	Medium				
Weed Treatment Priority	Moderate				
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Weed management to be ongoing to prevent spread of weeds throughout site.				
Priority Weeds Notes	Weeds mostly dead after treatment a few weeks ago				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5311762240531DJ

**Photo Notes:** Gravel stockpile



Site ID	Gravel Pile to WTG 25	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	75	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	0	<i>Themeda triandra</i>	<i>Acacia holosericea</i>	<i>Eucalyptus spp 1</i>	
Weeds Marked with Polygon	No	<i>Sporobolus spp 1</i>	<i>Acacia simsii</i>	<i>Allocasuarina spp</i>	
Weed Density	-	<i>Gonocarpus acanthocarpus</i>	<i>Hibiscis spp</i>		
Weed Treatment Priority	NA	<i>Eragrostis spp 1</i>			
Erosion Observed	None	<i>Cyperus spp 1</i>			
Erosion Type	NA	<i>Digitaria spp</i>			
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	-				







Site photo A: P5311758240531DJ

Photo Notes:



Site photo B: P5311759240531DJ

Photo Notes:



Site photo C: P5311760240531DJ

Photo Notes:



Site photo D: P5311761240531DJ

Photo Notes:



Site ID	Petes Ck to Mevs	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover	100	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	80	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Signal grass (Urochloa decumbens)</i>
Weeds Marked with Polygon	Yes		<i>Acacia holosericea</i>		
Weed Density	High				
Weed Treatment Priority	Moderate				
Erosion Observed	None				
Erosion Type	-				
Remedial Works Priority	-				
Rehabilitation Notes	Good ground cover but very high density of priority weeds. See polygons				
Priority Weeds Notes	Rhodes gr, fleabane & grader grass.				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5311792240531DJ

**Photo Notes:** facing north



**Site photo B:** P5311793240531DJ

**Photo Notes:** facing north east



Site ID	Sawmill to Cattleyards	Date	31/05/2024	Investigator Name	Dean Jones
Percent Groundcover		Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds					<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	No				
Weed Density	High				
Weed Treatment Priority	High				
Erosion Observed	-				
Erosion Type	-				
Remedial Works Priority	-				
Rehabilitation Notes	Off disturbance but shared farm tracks have high abundance of weeds. Treatment on tracks has been successful.				
Priority Weeds Notes	GRT also at cattle yards. Weeds sprayed are dead				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5301704240530DJ

**Photo Notes:** track showing dead treated weeds (30.5.24, am)



Site ID	WTG 4	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	90	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Jacksonia thesioides</i>	<i>Corymbia citriodora</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 2</i>	
Weed Density	Scattered	<i>Gonocarpus acanthocarpus</i>	<i>Acacia holosericea</i>	<i>Eucalyptus tindaliae</i>	
Weed Treatment Priority	Low	<i>Sporobolus spp 1</i>		<i>Grevillea spp</i>	
Erosion Observed	None	<i>Digitaria spp</i>			
Erosion Type	NA	<i>Heteropogon triticeus</i>			
Remedial Works Priority	NA	<i>Eragrostis spp 1</i>			
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	no signs of signal grass				





**Site photo A:** P5301689240530DJ

**Photo Notes:** 100m west facing east



**Site photo B:** P5301690240530DJ

**Photo Notes:** 100m east facing south





**Site photo C:** P5301691240530DJ

**Photo Notes:** 100m west facing north



**Site photo D:** P5301692240530DJ

**Photo Notes:** 10m north facing north



**Site photo E:** P5301694240530DJ

**Photo Notes:** 50m east facing south



**Site photo F:** P5301696240530DJ

**Photo Notes:** 130m southwest facing north





**Site photo G:** P5301697240530DJ

**Photo Notes:** 130m south facing north



Site ID	WTG 5	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	75	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	2	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus spp 1</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>		<i>Eucalyptus spp 2</i>	
Weed Density	High	<i>Gonocarpus acanthocarpus</i>		<i>Eucalyptus tindaliae</i>	
Weed Treatment Priority	Moderate	<i>Sporobolus spp 1</i>		<i>Grevillea spp</i>	
Erosion Observed	None	<i>Digitaria spp</i>			
Erosion Type	NA	<i>Heteropogon triticeus</i>			
Remedial Works Priority	NA	<i>Eragrostis spp 1</i>			
Rehabilitation Notes	Good native ground cover except portion indicated by polygon to the north				
Priority Weeds Notes	<1%				
Erosion Notes	-				
Other Observations	no signs of signal grass				







**Site photo A:** P5301698240530DJ

**Photo Notes:** 120m northeast facing west



**Site photo B:** P5301699240530DJ

**Photo Notes:** 120m northeast facing south



**Site photo C:** P5301700240530DJ

**Photo Notes:** 150m northeast facing west



Site ID	WTG 6	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	85	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	2	<i>Themeda triandra</i>		<i>Lophostomon saueolens</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>		<i>Lophostomon saueolens</i>	
Weed Density	Scattered	<i>Cyperus spp 1</i>			
Weed Treatment Priority	Low	<i>Digitaria spp</i>			
Erosion Observed	None	<i>Dicanthium spp</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	small patches				
Erosion Notes	-				
Other Observations	Good groundcover, good composition no signal grass observed				





**Site photo A:** P5301719240530DJ

**Photo Notes:** 80m east facing west





Site ID	WTG 7	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	85	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	2	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Casuarina spp</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>	<i>Acacia holosericea</i>	<i>Eucalyptus shirleyi</i>	
Weed Density	Scattered	<i>Cyperus spp 1</i>	<i>Acacia flavescens</i>		
Weed Treatment Priority	Low	<i>Digitaria spp</i>			
Erosion Observed	None				
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	scattered on northeastern side				
Erosion Notes	-				
Other Observations	Good groundcover, good composition scattered signal grass observed less than 1%				





**Site photo A:** P5301721240530DJ

**Photo Notes:** 120m east facing west



**Site photo B:** P5301722240530DJ

**Photo Notes:** 120m east facing east

Site ID	WTG 8	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	75	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	1	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Casuarina spp</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>	<i>Acacia holosericea</i>	<i>Eucalyptus shirleyi</i>	
Weed Density	High	<i>Cyperus spp 1</i>	<i>Trema tomentosa</i>	<i>Eucalyptus spp 2</i>	
Weed Treatment Priority	Low	<i>Digitaria spp</i>			
Erosion Observed	None	<i>Gonocarpus acanthocarpus</i>			
Erosion Type	NA				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover except for weeds polygon				
Priority Weeds Notes	scattered on northeastern side				
Erosion Notes	-				
Other Observations	Good groundcover, good composition scattered signal grass observed in non polygon				





**Site photo A:** P5301723240530DJ

**Photo Notes:** 80m east facing west



**Site photo B:** P5301722240530DJ

**Photo Notes:** area of high weed infestation, grader grass, signal grass, Rhodes grass





**Site photo C:** P5301724240530DJ

**Photo Notes:** 100m SE facing NW



**Site photo D:** P5301725240530DJ

**Photo Notes:** 100m SE facing east

Site ID	WTG 9	Date	30/05/2024	Investigator Name	Dean Jones
Percent Groundcover	80	Groundcover Species	Shrub Species	Tree Species	Priority Weed Species
Percent Priority Weeds	2	<i>Themeda triandra</i>	<i>Acacia simsii</i>	<i>Eucalyptus shirleyi</i>	<i>Grader grass (Themeda quadrivalvis)</i>
Weeds Marked with Polygon	Yes	<i>Heteropogon contortus</i>	<i>Acacia holosericea</i>		
Weed Density	Low	<i>Cyperus spp 1</i>	<i>Jacksonia thesioides</i>		
Weed Treatment Priority	Low	<i>Digitaria spp</i>			
Erosion Observed	None				
Erosion Type	-				
Remedial Works Priority	NA				
Rehabilitation Notes	Good native ground cover				
Priority Weeds Notes	includes signal grass				
Erosion Notes	-				
Other Observations	-				





**Site photo A:** P5301705240530DJ

**Photo Notes:** 200m northwest facing southeast



**Site photo B:** P5301706240530DJ

**Photo Notes:** 100m northwest facing southeast





**Site photo C:** P5301707240530DJ

**Photo Notes:** patch of grader grass



**Site photo D:** P5301708240530DJ

**Photo Notes:** 50m southwest facing north east





**Site photo E:** P5301709240530DJ

**Photo Notes:** 150m north facing southeast





## Appendix B: Kaban - Post-construction Annual Weed Report






# Kaban Wind Farm: Post-construction Annual Weed Report

17 July 2024

Kaban Wind .30Farm Pty Ltd as trustee  
for the Kaban Wind Farm Trust  
Level 21/570 George St, Sydney, NSW 2000

# Document Management

Rev.	Issue Date	Description	Author (s)	Approved	Signature
A	1/07/2024	Issue for Review	Dean Jones	Megan Ward	
0	17/07/2024	Issue for Use	Dean Jones	Megan Ward	

Document Reference: ...\\JOBS\\-2021\\QEJ21046\\DELIVERABLES\\FY24\\13. Post Construction Annual Weed Report\\Rev0\\21046\_Kaban Annual Weed Report June24\_Rev0.pdf

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## Contents

<b>Definitions</b>	<b>2</b>
<b>1 Introduction</b>	<b>3</b>
1.1 Background	3
1.2 Scope of Works	3
<b>2 Methods</b>	<b>5</b>
<b>3 Results</b>	<b>6</b>
3.1 Weed Monitoring Program	6
3.2 Weed Treatment Program	6
<b>4 Discussion and Recommendations</b>	<b>14</b>
<b>References</b>	<b>15</b>

## List of Tables

Table 1: List of priority weeds found within the disturbance footprint	6
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## List of Figures

Figure 1. Kaban Wind Farm Location	4
Figure 2: Figure overview for weed treatment effort, provided by weed treatment contractor, from mid-March to mid-April 2024.	8

## Definitions

Term	Definition
Disturbance footprint	Any areas cleared for the purpose of the Kaban Green Power Hub. The total area of disturbance is 104.88 hectares
The Project	The Kaban Green Power Hub, also known as the Kaban Wind Farm
Vegetation Management Plan	The Vegetation Management Plan (VMP) stipulates performance criteria and management objectives for vegetation relevant to the Project



# 1 Introduction

## 1.1 Background

The Kaban Green Power Hub, commonly known as the Kaban Wind Farm and herein referred to as 'the Project', consists of 28 operational wind turbines and associated infrastructure. The Project is located approximately 4 kilometres west of Tumoulin, Queensland Figure 2. Construction of the Project commenced in May 2021, with the last turbine constructed and commissioned by August 2023.

E2M was commissioned by Kaban Wind Farm Trustee for the Kaban Wind Farm Trust to prepare the first annual post-construction weed monitoring report described within the Vegetation Management Plan (VMP) (E2M, 2021).

During construction, weed monitoring and treatment programs were co-ordinated by Vestas Australia Wind Technology Pty Ltd. Rehabilitation and weed monitoring reports were completed by independent environmental consultants, with the following reports: (Horner, 2022) and (Tucker, 2022, 2023a, 2023b).

## 1.2 Scope of Works

The scope of this assessment was to review the weed survey monitoring data and current treatment program and provide a summary report on current effectiveness. Based on the current understanding of weed infestations within the disturbance footprint, provide broad recommendations for updating the VMP. While the reporting period finishes 31 August 24, this report was written prior to this to complement the May 2024, 9-month post-construction survey to ensure recommendations for weed management were provided in a timely manner, to advise weed monitoring and treatment, ahead of the next growing season.





## 2 Methods

To achieve the purpose of this assessment, data that was collected during two previous weed monitoring surveys was reviewed to gain an understanding of the effectiveness of weed management. Specifically, data concerning the identities, locations and extent of priority weed species within the disturbance footprint from the first survey (February 2024), was compared to the data collected during the second survey (May 2024) so as to evaluate the effectiveness of the weed treatment program that had been undertaken between the two survey events. The 15-day weed treatment effort is also presented in this report.





## 3 Results

### 3.1 Weed Monitoring Program

E2M Pty Ltd has conducted two weed monitoring surveys post-construction. The first survey was performed in February 2024, followed by the second survey in May 2024. The reports of these surveys detailing the weed types, the locations, and the size of priority weed infestations are provided in documents: *Kaban: Post-construction Rehabilitation and Weed Monitoring, February 2024* (E2M Pty Ltd, 2024a) and *Kaban: Post-construction Rehabilitation and Weed Monitoring, May 2024* (E2M Pty Ltd, 2024b).

### 3.2 Weed Treatment Program

A weed treatment program was provided to a certified weed treatment contractor to conduct chemical and manual treatment of priority weed species. Priority weeds, within the context of this Project, are those weeds which pose immediate and long-term threat to the surrounding woodlands and the conservation significant flora and fauna within. The weeds observed within the February 2024 monitoring survey regarded as priority weeds are listed in Table 1. The weed treatment program was designed to eliminate scattered populations of priority weeds located within the periphery of the disturbance footprint, as well as maintain and prevent the spread of the larger infestations found within the central regions of the disturbance footprint. Further details of the priority weed infestations and treatment recommendations are available in the February 2024 weed monitoring report (E2M Pty Ltd, 2024a).

**Table 1: List of priority weeds found within the disturbance footprint**

Species	Biosecurity Act 2014	Tablelands Regional Council Biosecurity Plan	High biomass species
Grader grass ( <i>Themeda quadrivalvis</i> )	-	-	Yes
Guinea grass ( <i>Megathyrsus maximus</i> )	-	-	Yes
Lantana ( <i>Lanata camara</i> )	Category 3 Restricted Matter	-	Yes
Praxelis ( <i>Praxelis clematidea</i> )	-	-	Yes
Rhodes grass ( <i>Chloris gayana</i> )	-	-	Yes
Signal grass ( <i>Urochloa decumbens</i> )	-	-	Yes
Singapore daisy ( <i>Sphagneticola trilobata</i> )	Category 3 Restricted Matter	-	Yes
Devil's fig ( <i>Solanum torvum</i> )	No	No	Yes
Giant rat's tail ( <i>Sporobolus pyramidalis</i> )	Category 3 restricted plant	Yes	Yes <sup>1, 2</sup>
Inkweed ( <i>Phytolacca octandra</i> )	No	No	Yes
Mexican poppy ( <i>Argemone mexicana</i> )	No	No	Yes
Navua sedge ( <i>Cyperus aromaticus</i> )	No	Yes	Yes <sup>2, 3</sup>
Sensitive weed ( <i>Mimosa pudica</i> )	No	No	Yes <sup>2</sup>



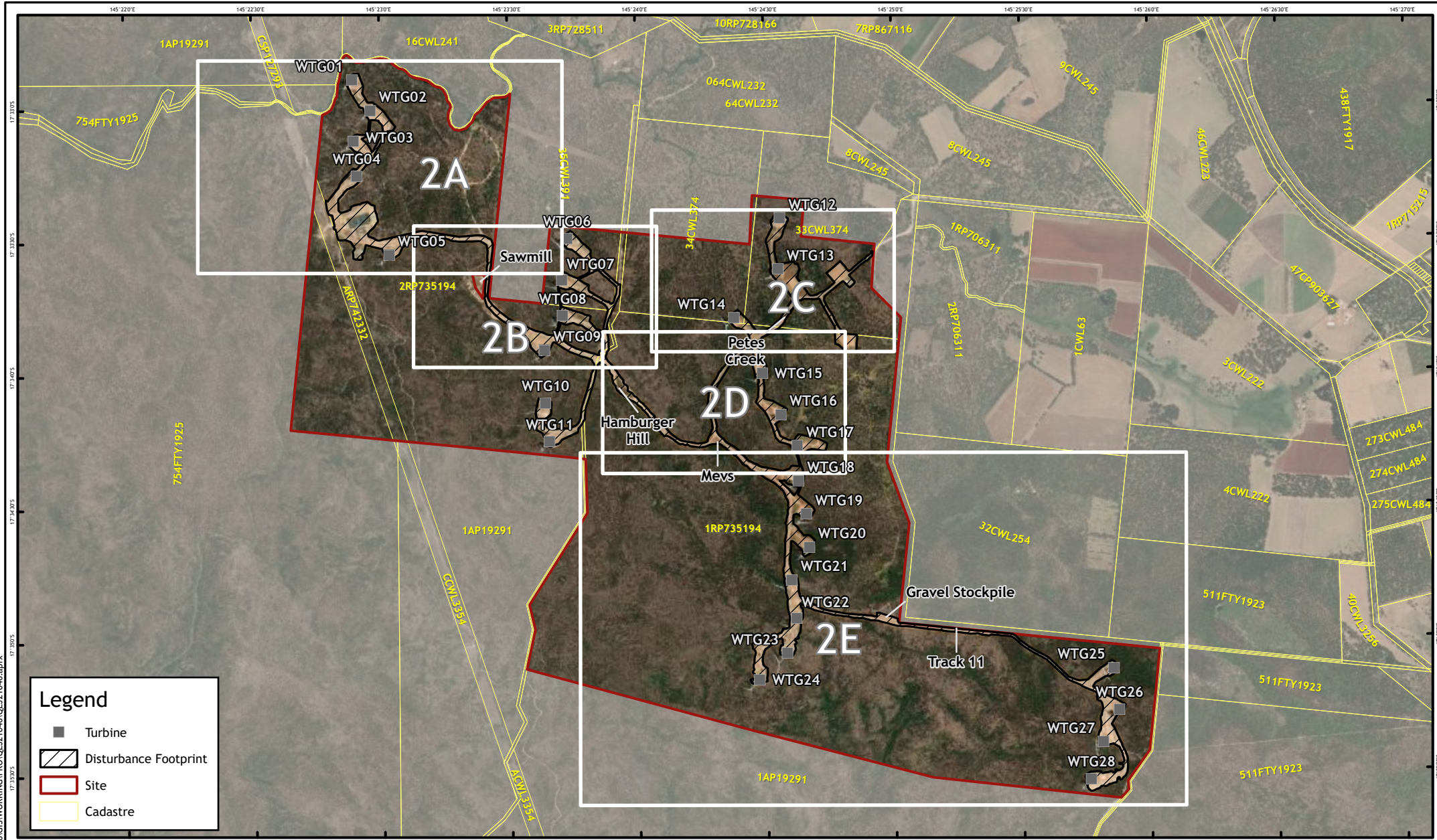
Species	Biosecurity Act 2014	Tablelands Regional Council Biosecurity Plan	High biomass species
Spiny sida ( <i>Sida spinosa</i> )	No	No	Yes <sup>2</sup>
Tobacco weed ( <i>Solanum mauritianum</i> )	No	No	Yes

1. High fuel load
2. Out competes natives
3. Poses significant threat to waterways and wetlands

The weed treatment program was conducted over fifteen (15) days between mid-March through to mid-April 2024, when weather conditions permitted. The weed treatment effort, detailed in Figure 2, was provided by the weed treatment contractor.

The February 2024 weed survey indicated that priority weed cover within the disturbance footprint was 5.55%, a slight exceedance of the 6-month objective of 5% total priority weed cover. However, after the March to April 2024 weed treatment program, priority weed cover was reduced to 4.91% for the 9-month post-construction assessment period as described in the May 2024 weed monitoring report (E2M Pty Ltd, 2024b).





Legend

Turbine

Disturbance Footprint

Site

Cadastre

N

Scale

1:35,000 (A4)

0

500

1,000

1,500

2,000

Metres

Coordinate System: GCS GDA 1994

Notes:

Aerial Imagery: © ESRI 2024

Cadastre: © DNRME 2020

A	Issued for Review	PR	DJ	12/07/2024
Rev	Description	Drawn	Approved	Date

FIGURE 2: WEED TREATMENT EFFORT - FIGURE OVERVIEW

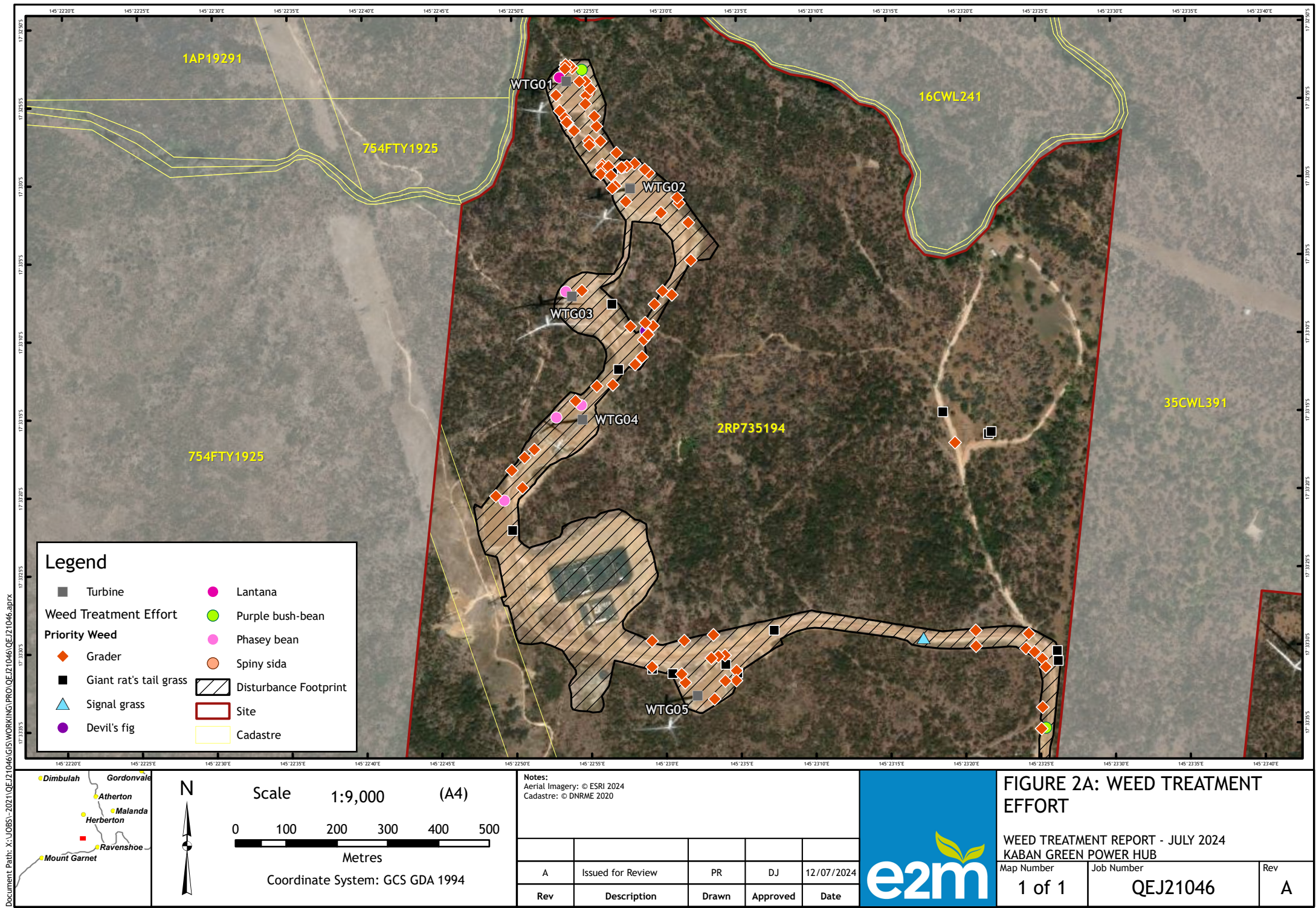
WEED TREATMENT REPORT - JULY 2024

KABAN GREEN POWER HUB

Map Number	Job Number	Rev
1 of 1	QEJ21046	A

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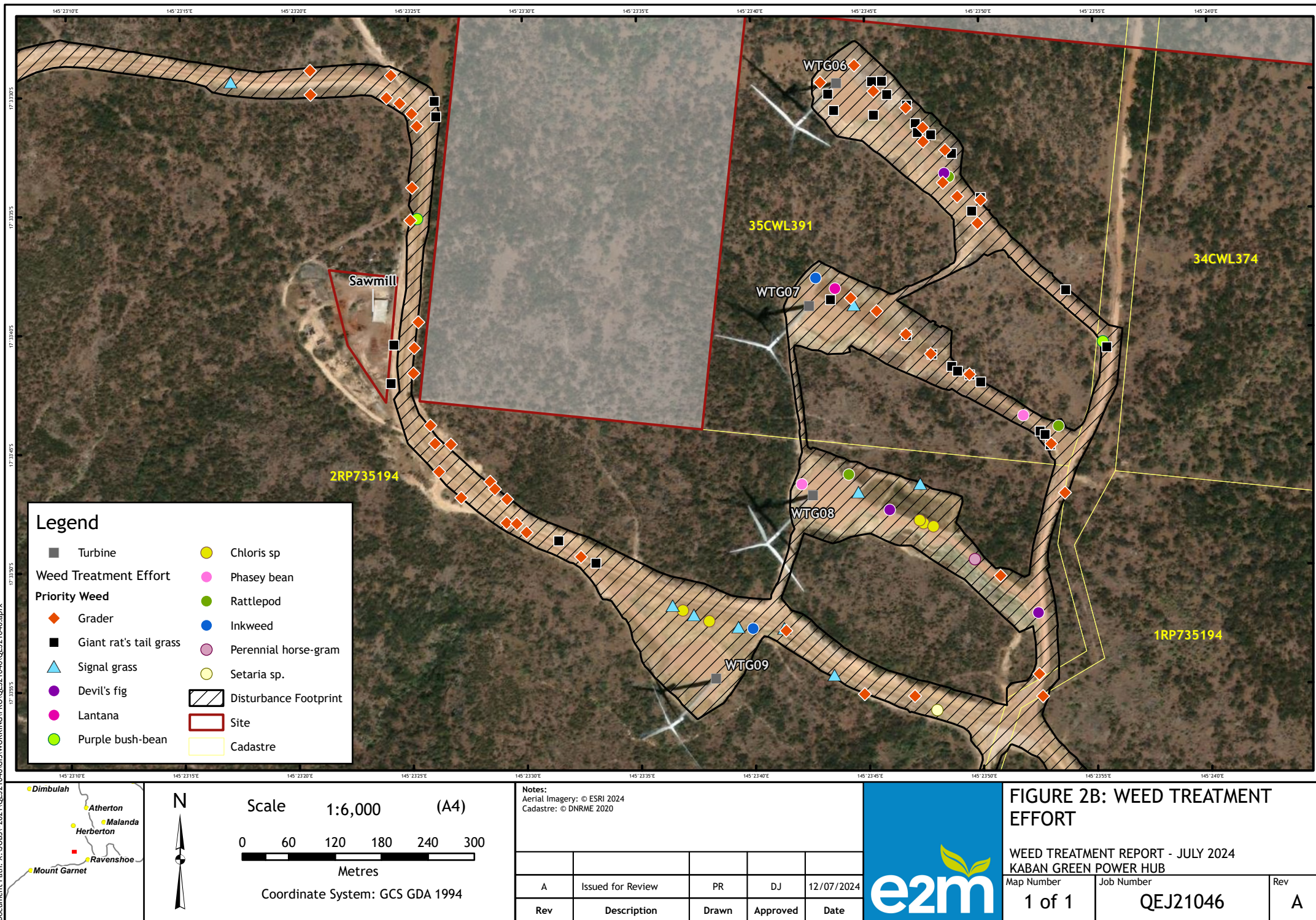




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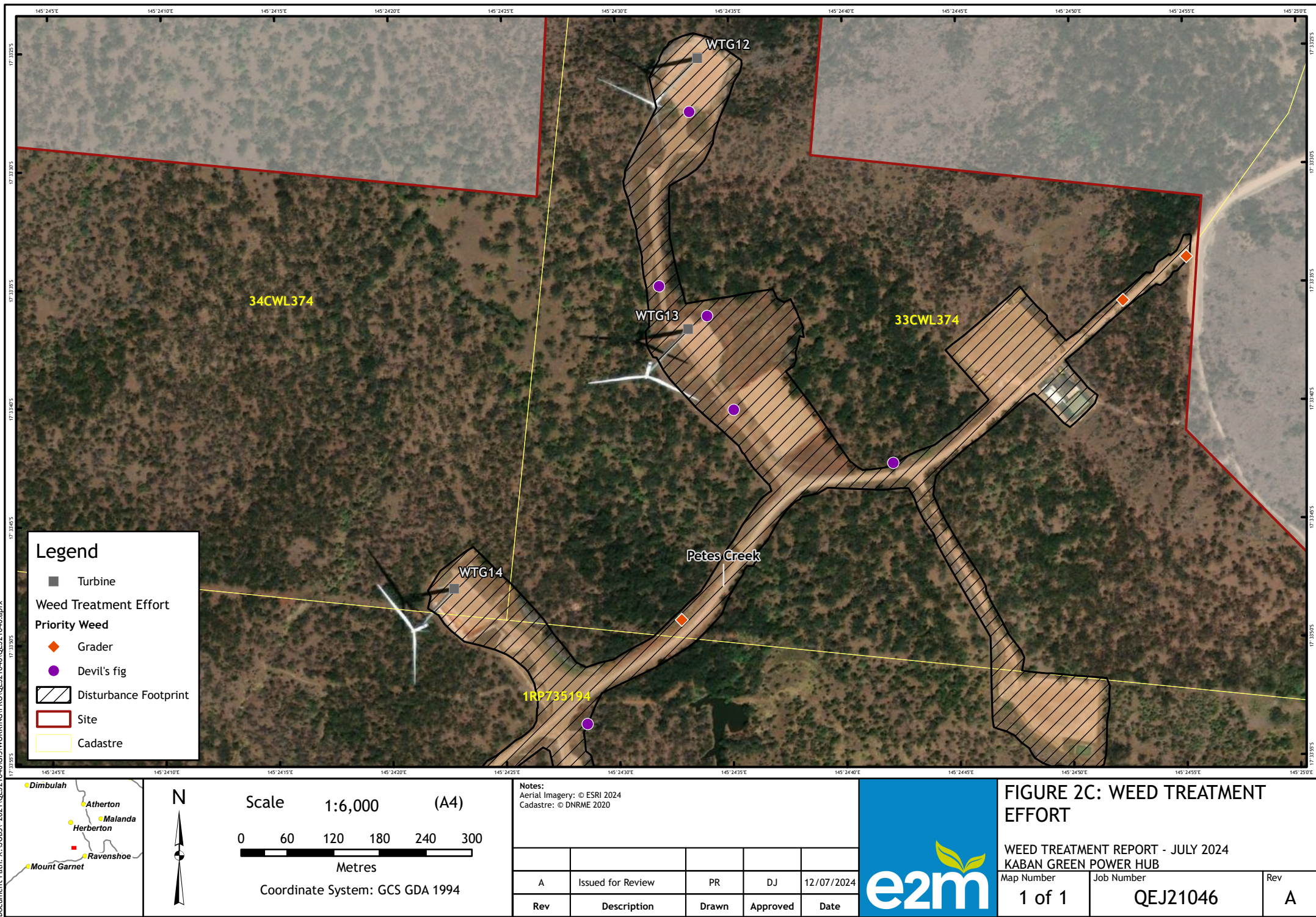


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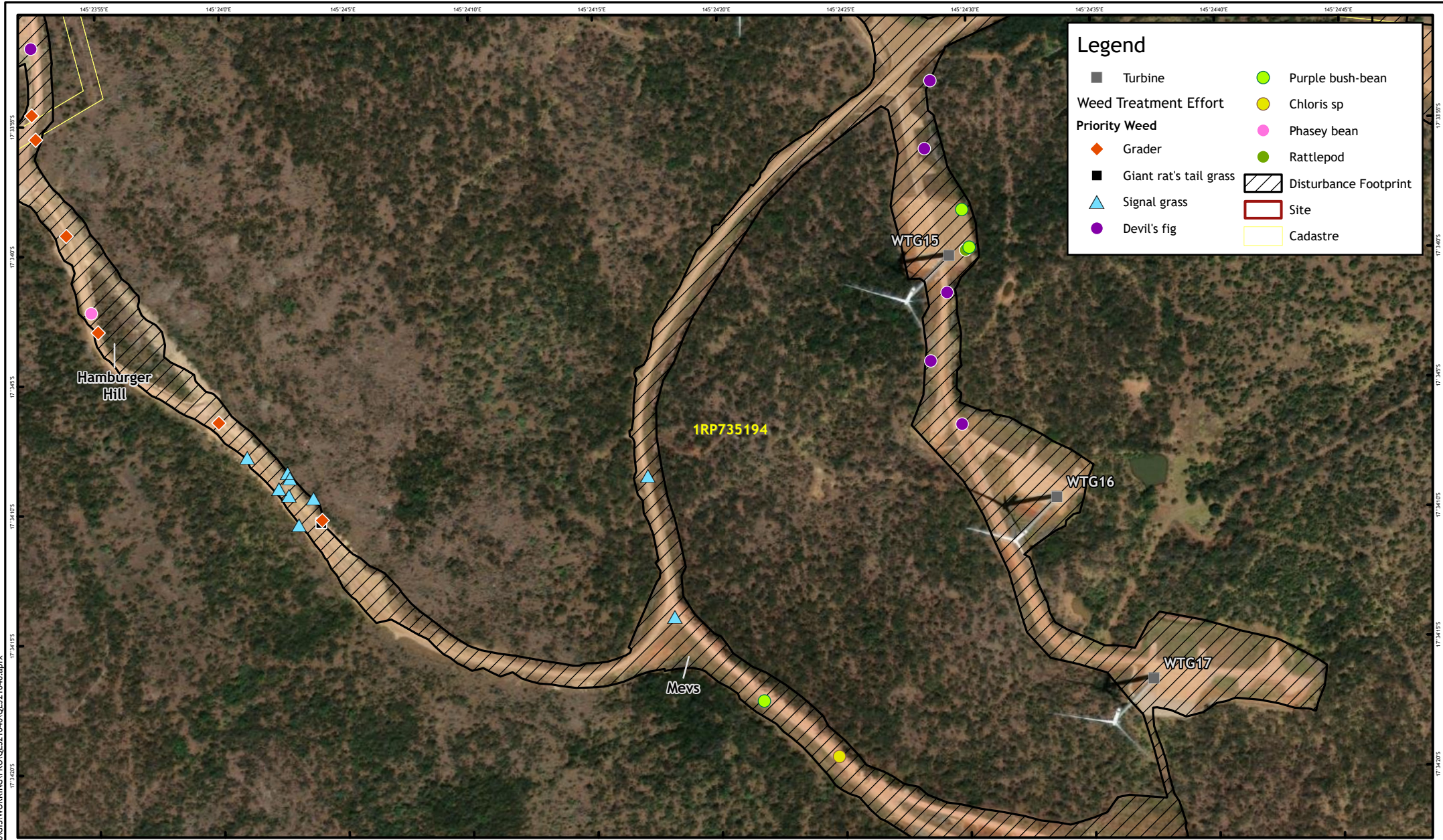




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■ Turbine

◆ Grader

■ Giant rat's tail grass

▲ Signal grass

● Devil's fig

● Purple bush-bean

● Chloris sp

● Phasey bean

● Rattlepod

▨ Disturbance Footprint

▭ Site

▭ Cadastre

Weed Treatment Effort

Priority Weed

Dimbulah

Atherton

Malanda

Herberton

Ravenshoe

Mount Garnet

N

Scale 1:6,000 (A4)

0 60 120 180 240 300

Metres

Coordinate System: GCS GDA 1994

Notes:

Aerial Imagery: © ESRI 2024

Cadastre: © DNRME 2020

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FIGURE 2D: WEED TREATMENT EFFORT

WEED TREATMENT REPORT - JULY 2024

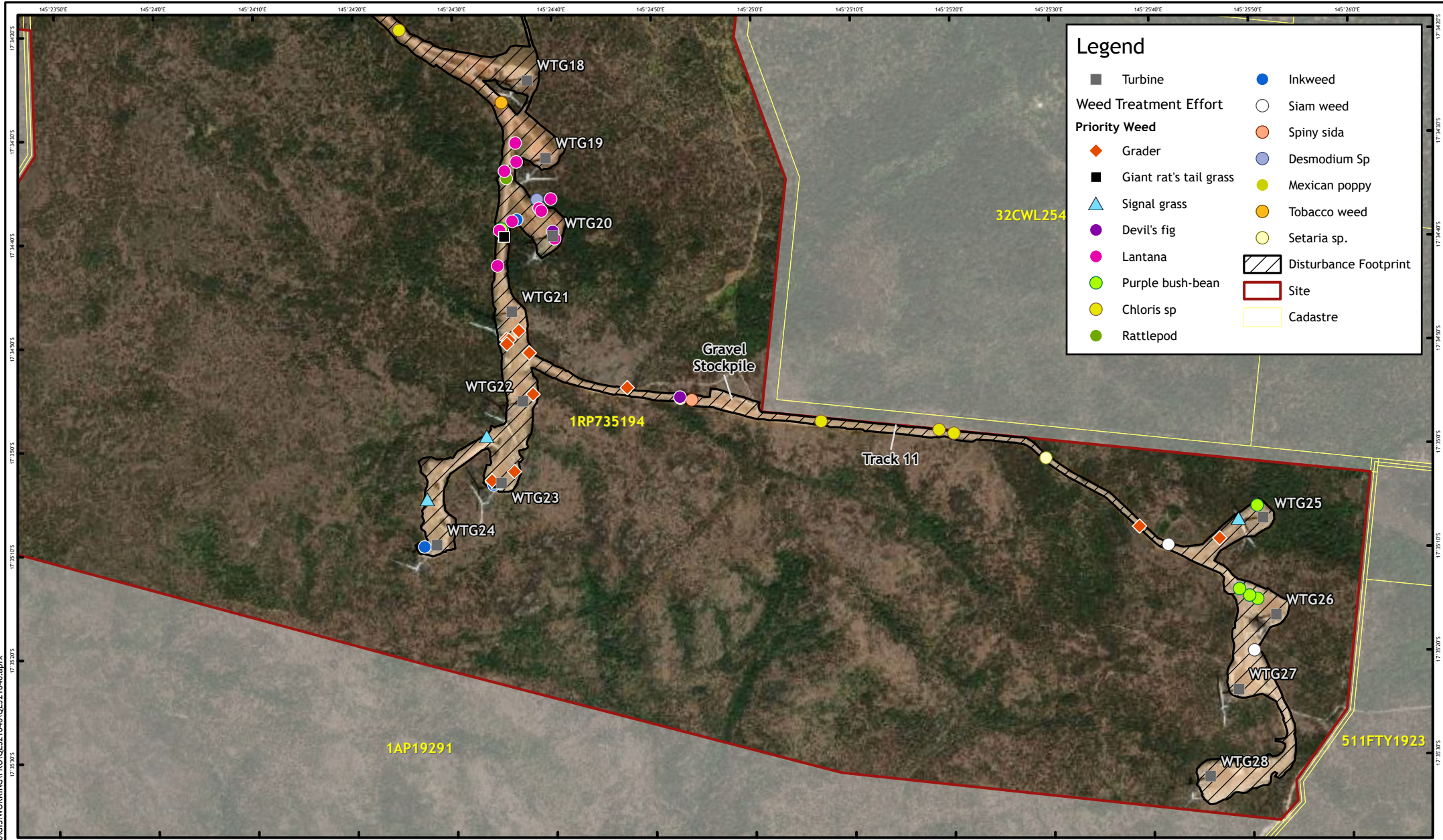
KABAN GREEN POWER HUB

Map Number 1 of 1

Job Number QEJ21046

Rev A





Turbine

Weed Treatment Effort

Priority Weed

Grader

Giant rat's tail grass

Signal grass

Devil's fig

Lantana

Purple bush-bean

Chloris sp

Rattlepod

Inkweed

Siam weed

Spiny sida

Desmodium Sp

Mexican poppy

Tobacco weed

Setaria sp.

Disturbance Footprint

Site

Cadastre

Dimbulah

Atherton

Malanda

Herberton

Ravenshoe

Mount Garnet

N

Scale 1:15,000 (A4)

0 175 350 525 700 875

Metres

Coordinate System: GCS GDA 1994

Notes:

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FIGURE 2E: WEED TREATMENT EFFORT

WEED TREATMENT REPORT - JULY 2024

KABAN GREEN POWER HUB

Map Number 1 of 1

Job Number QEJ21046

Rev A



## 4 Discussion and Recommendations

Large populations of priority weeds were identified during the February 2024 weed monitoring survey. The February 2024 survey was conducted and documented by E2M (E2M Pty Ltd, 2024a). Eight new priority weed species were identified during the February 2024 survey and added to the list of the seven priority weeds identified prior to construction (Table 1). The May 2024 survey identified that the March - April 2024 treatment program was successful in eliminating many of the errant weed populations found in lower densities within the periphery elements of the Project. Treating the periphery weed infestations will play a significant role in mitigating the widespread of priority weeds.

While the May 2024 weed survey (E2M Pty Ltd, 2024b) identified that priority weed abundance is within the post-construction objectives, specifically <5% at 9-months post-construction, it is unlikely that the 12-month objective of zero percent priority weeds will be achieved. Priority weeds within the wet tropics of Australia are prolific and very difficult to control in the short term, and it is unrealistic that priority weeds can be eliminated in such a short period, and it is unrealistic to suggest that these weeds can be eliminated altogether. As such, it is recommended that a Weed Management Plan be developed to reflect the control of current weed infestations and with more realistic objectives. The plan should focus on the medium to long-term strategy to maintain and progressively reduce weed infestations, to such a point that minimal effort is required to control and prevent the spread of problematic weeds into sensitive habitat containing flora and fauna of conservation status.



## References

E2M. (2021). *Kaban Green Power Hub - Vegetation Management Plan*.

E2M Pty Ltd. (2024a). *Kaban: Post-construction Rehabilitation and Weed Monitoring, February 2024* (p. 82) [Field survey].

E2M Pty Ltd. (2024b). *Kaban: Post-construction Rehabilitation and Weed Monitoring, May 2024*.

Horner, G. (2022). *Kaban Green Power Hub Rehabilitation Monitoring Report 1* (1; p. 48). BIOTROPICA.

Tucker, N. (2022). *Kaban Green Power Hub Rehabilitation Monitoring Report 2* (Rehabilitation Monitoring 2; p. 48).

Tucker, N. (2023a). *Kaban Green Power Hub Rehabilitation Monitoring Report 3* (Rehabilitation Monitoring 3; p. 48).

Tucker, N. (2023b). *Kaban Green Power Hub Weed Assessment Report 3* (Weed Assessment 2; p. 19).





## Appendix 7 MBF Microhabitat and Disturbance Intercept Survey Reports



# Magnificent Brood Frog Annual Microhabitat Photo Monitoring Report

January 2024

Neoen Australia Pty Ltd  
227 Elizabeth Street, Sydney, NSW 2000



# Document Management

Rev.	Issue Date	Description	Author (s)	Approved	Signature
A	5/03/2024	Issued for review	Eamon Amsters	Dean Jones	

Document Reference: X:\JOBS\~2021\QEJ21046\DELIVERABLES\FY24\7. MBF Habitat & Disturbance Intercept Monitoring\Microhabitat PMP Report\Rev0\QEJ21046\_Annual\_Microhabitat\_PMP\_Report\_January\_2024\_Rev0.docx

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# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Methods</b>	<b>1</b>
<b>3</b>	<b>Results</b>	<b>4</b>
3.1	Climatic conditions	4
3.2	Microhabitat site observations	4
3.2.1	Impact Site 1	5
3.2.2	Impact Site 2	9
3.2.3	Impact Site 3	10
3.2.4	Impact Site 4	11
3.2.5	Impact Site 5	12
3.2.6	On-site Control Site 1	14
3.2.7	On-site Control Site 2	15
3.2.8	On-site Control Site 3	16
3.2.9	Off-site Control Site 1	17
3.2.10	Off-site Control Site 2	18
	Off-site Control Site 3	20
3.3	Impacts of Fire	21
3.3.1	Fire - Impact Site 3	22
3.3.2	Fire - Impact Site 4	23
3.3.3	Fire - Impact Site 5	24
3.3.4	Fire - On-site Control Site 3	25
3.3.5	Fire - Off-site Control Site 1	26
3.3.6	Fire - Off-site Control Site 2	27
3.3.7	Fire - Off-site Control Site 3	28
3.4	Supporting documents	28
<b>4</b>	<b>Discussion and recommendations</b>	<b>29</b>
	Impact Site 1	29
	Impact Site 2	29
	Impact Site 3	29
	Impact Site 4	29
	Impact Site 5	29
	General notes	29
<b>5</b>	<b>References</b>	<b>31</b>

## List of Tables

Table 1 : PMP habitat assessment results	6
Table 2. Sites which have been impacted by fire over the last 24 months. 'Yes', indicates the presence of fire with approximate date of fire included.	21



## List of Figures

Figure 1: PMP monitoring sites	3
Figure 2. Rainfall recorded 7 days prior to, and during survey.	4

## Appendices

Appendix A Impact sites habitat photos	
Appendix B On-site control sites habitat photos	
Appendix C Off-site control sites habitat photos	



# 1 Introduction

E2M was commissioned by Neoen Australia Pty Ltd (Neoen) to conduct Magnificent Brood Frog (MBF) microhabitat assessment photo monitoring pursuant to EPBC approval 2018/8289. Conditions of the monitoring are detailed in the *Kaban Green Power Hub - Fauna Management Plan* (E2M, 2021a). This report includes the microhabitat assessment of all eleven monitoring sites. There are 5 on-site impact sites, 3 on-site control sites and 3 off-site control sites.

The results of the photo monitoring surveys are compared with the *Magnificent Brood Frog Monitoring Program - Baseline Survey* (E2M, 2021b) (baseline survey) which was conducted from the 1 to 7 February 2021 prior to the commencement of construction. They are also compared with the results of the *Magnificent Brood Frog Monitoring Program - Second Annual Monitoring Report* (E2M, 2022) for two of the monitoring sites (Impact Site 4 and Impact Site 5) which were not surveyed as part of the baseline survey. Comparisons with these baseline surveys allow an assessment of potential impacts to the watercourses and associated magnificent brood frog (MBF) habitat resulting from construction and post-construction activities.

**Supporting documents:** During the January 2024 survey period, assessments were also completed for magnificent brood frog annual relative abundance and disturbance intercept monitoring. The details of these E2M Pty Ltd supporting surveys can be found respectively in the *Magnificent Brood Frog - Fourth Annual Abundance Monitoring Report* (E2M Pty Ltd, 2024b) and the *Magnificent Brood Frog Monthly Disturbance Intercept Photo Monitoring Report* (E2M Pty Ltd, 2024a).

## 2 Methods

The microhabitat photo monitoring survey was undertaken between 16 and 21 January 2024. In accordance with the prescribed method in the *Fauna Management Plan* (FMP) (E2M, 2021a) and revised MBF monitoring program, a minimum of two PMPs were surveyed at each of the 11 monitoring sites, including five impact sites, three on-site control sites and three off-site control sites (see Figure 1).

Each photo monitoring point (PMP) was situated at a ponded area along the watercourse considered to be suitable MBF habitat. The assessment at each PMP includes:

- One spot photograph taken looking vertically down at the pond from approximately 1 m above the water surface (covering an approximate area of 1x1 m) to capture the pond / seep and surrounding habitat features including;
  - visual evidence of sedimentation; and
  - visual evidence of hydrocarbon contamination (e.g. rainbow sheen on surface)
- One surface photograph taken just above the water surface looking across the surface of the water to capture the potential presence of hydrocarbon sheen
- One upstream photograph taken from approximately 1.5 m above the water surface and directed upstream (photograph includes the PMP for locational context), and
- One downstream photograph taken from approximately 1.5 m above the water surface and directed downstream (photograph includes the PMP for locational context).

Furthermore, additional assessment data recorded at each PMP included:

- observation of tadpoles or cane toads
- observation of macroinvertebrates,





- brief description of the microhabitat, and
- any other threatening processes, such as fire or disturbance from grazing or pest animals.

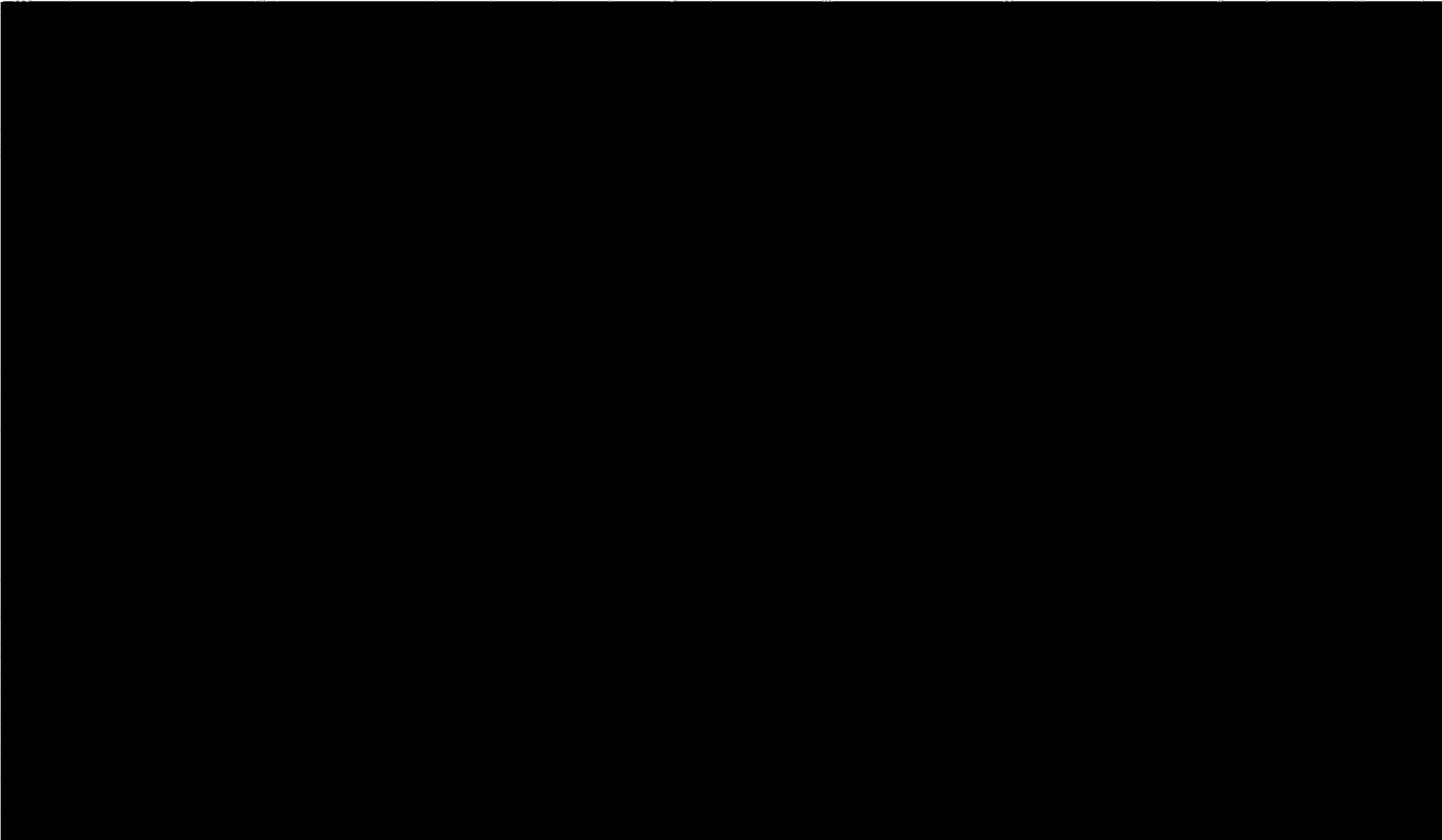
Additional photos and/or assessment data was taken or recorded to provide context or evidence of the status of the monitoring site (e.g. observed active threatening processes).

Local climatic conditions were also noted prior to and during the survey. These are presented in the results section.

Note: While in-stream erosion has not been included in the recommended monitoring program it was included within this report due to its potential negative impact on MBF habitat quality.



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Coordinate System: GDA 1994 MGA Zone 55  
Projection: Transverse Mercator

**Notes:**  
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**FIGURE 1: MICROHABITAT PHOTO MONITORING POINTS**  
MBF Monthly Microhabitat Photo Monitoring report - January 2024  
Kaban Green Power Hub

Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 3 Results

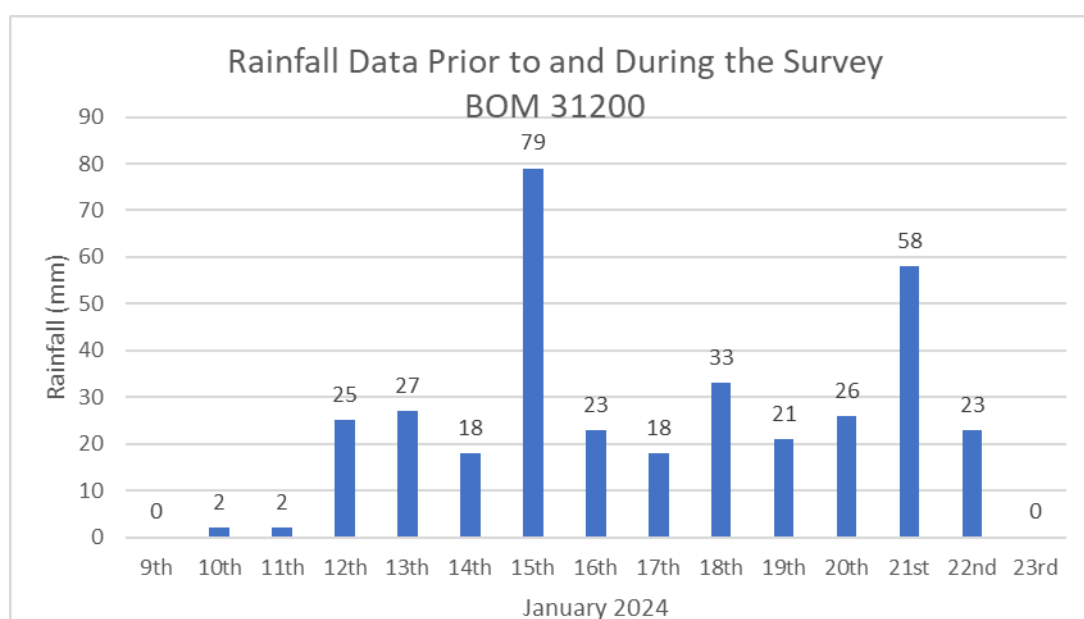
### 3.1 Climatic conditions

The fourth annual MBF monitoring survey was conducted during the wet season (16-23 January 2024) by two fauna ecologists. The weather conditions during the seven-day period were suitable for amphibian activity. Seven days prior to the survey there was a total 153 mm of rainfall and 202 mm fell during the survey period, BOM Station 31200, see Figure 3. Night-time temperatures, during survey, ranged between 19.5°C and 22°C, humidity was high and wind was light.

Rainfall was daily throughout the survey, ranging between 18 and 79 mm, except for the last day which recorded no rain, Figure 2.

Rainfalls five days prior to the survey reached 153 mm (Figure 2), which surpasses the survey guidelines prescribed in the *Fauna Management Plan* (FMP) (E2M, 2021a) (i.e. minimum of 100 mm over a five day period, or when rainfall events offer favourable breeding conditions or are likely to trigger calling by the MBF).

Figure 2. Rainfall recorded 7 days prior to, and during survey.



### 3.2 Microhabitat site observations

Twenty-four microhabitat PMPs within 11 sites were re-surveyed on 16 and 21 January 2024. All habitat assessment results are detailed in Table 1 and discussed below. All habitat quality photographs are presented in Appendix A (impact sites) and Appendix B (on-site control sites).

Macroinvertebrates were observed at four PMPs including Impact Site 1 (upstream and downstream site), Impact Site 4 (upstream site) and Impact Site 5 (midstream site) (Table 1). Tadpoles were not observed at any of the PMP sites. Water was present at all PMP locations, ranging from 10 to 60 cm in depth with varying turbidity levels.



### 3.2.1 Impact Site 1

A small amount of sedimentation was observed at the downstream PMP location. Water was observed at all PMP locations during the January 2024 survey, in comparison to only the downstream site in the April 2023 Survey. The water was clear at upstream and midstream site, however turbidity was higher at the downstream site from low to moderate (Plate 1). A small amount of erosion has occurred at the downstream site.

#### A Upstream



#### B Midstream



#### C Downstream



Plate 1: Impact Site 1, Upstream (A), Midstream (B) and Downstream (C) PMP, comparison between January 2021 (left) and January 2024 (right) surveys.





Table 1 : PMP habitat asses

Monitoring site	PMP	imentation	Erosion	Hydrocarbons	Macroinvert ebrates	Tadpoles	Pool Depth	Waterflow	Impacted by fire in last 12 months
Impact Site 1	Upstream	No	No	No	Yes	No	22	Gentle	No
	Midstream	No	No	No	No	No	22	Gentle	No
	Downstrea	Yes	No	No	Yes	No	25	Gentle	No
Impact Site 2	Upstream	No	No	No	No	No	10	Moderate	No
	Downstrea	No	No	No	No	No	30	Moderate	No
Impact Site 3	Upstream	Yes	Yes	No	No	No	20	Moderate	Yes
	Downstrea	No	Yes	No	No	No	10	Moderate	Yes
Impact Site 4	Upstream	No	No	No	Yes	No	17	Low	Yes
	Downstrea	No	No	No	No	No	15	Low	Yes
Impact Site 5	Upstream	No	No	No	No	No	30	Moderate	No



Monitoring site	PMP	Location	Sedimentation	Erosion	Hydrocarbons	Macroinvertebrates	Tadpoles	Pool Depth	Waterflow	Impacted by fire in last 12 months
	Upstream (feeder creek)		No	No	No	Yes	No	25	Low	No
	Downstream		No	No	No	No	No	25	Moderate	No
On-site Control 1	Upstream		No	No	No	No	No	33	Gentle	No
	Downstream		No	No	No	No	No	55	Moderate	No
On-site Control 2	Upstream		No	No	No	No	No	50	High	No
	Downstream		No	No	No	No	No	60	High	No
On-site Control 3	Upstream		No	No	No	No	No	18	Moderate	No
	Downstream		No	No	No	No	No	32	Moderate	No
Off-site Control 1	Upstream		No	No	No	No	No	15	Gentle	Yes
	Downstream		Yes	No	No	No	No	20	Gentle	Yes
Off-site Control 2	Upstream		Yes	No	No	No	No	11	Gentle	Yes



Monitoring site	PMP	Location	Sedimentation	Erosion	Hydrocarbons	Macroinvert ebrates	Tadpoles	Pool Depth	Waterflow	Impacted by fire in last 12 months
	Downstream		No	No	No	No	No	20	Gentle	Yes
Off-site Control 3	Upstream		No	No	No	No	No	25	Moderate	Yes
	Downstream		No	No	No	No	No	27	Moderate	Yes



### 3.2.2 Impact Site 2

No sedimentation was observed at both PMP locations which is consistent with the findings from previous surveys, (Plate 2). There was no erosion or any other observations indicating degradation of the MBF habitat.

#### A Upstream



#### B Downstream



Plate 2: Impact Site 2, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### 3.2.3 Impact Site 3

Some instream sedimentation consisting of fine silts as observed at the upstream PMP location. Water depth has increased at the upstream PMP location compared to the previous survey but remained the same at the downstream PMP location. Turbidity was low to moderate at both PMP locations. In-creek erosion present during the previous survey at both PMP locations continues, (Plate 3). There is a higher discharge of water at this site compared to pre-construction waterflows. There was evidence of fire impacting the creekline, please refer to section 3.3.

#### A Upstream



#### B Downstream



Plate 3: Impact Site 3, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### 3.2.4 Impact Site 4

Both PMP locations recorded no in-stream sedimentation or erosion, (Plate 4). The upper portion of the creekline was significantly impacted by fire during last years (2023) controlled burns, please refer to section 3.3.

#### A Upstream



#### B Downstream



Plate 4: Impact Site 4, Upstream (A) and Downstream (B) PMP, comparison between January 2022 (left) and January 2024 (right) surveys



### 3.2.5 Impact Site 5

#### 3.2.5.1 Main disturbance intercept

No sedimentation was observed at any of the PMP locations which is consistent with the findings of the April 2023 survey, (Plate 5). No additional erosion was noted. The groundcover has continued to improve following the uncontrolled bushfire occurring in November 2022, refer to section 3.3.

#### A Upstream



#### B Downstream



Plate 5: Impact Site 5, Upstream (A) and Downstream (B) PMP, comparison between January 2022 (left) and January 2024 (right) surveys

### 3.2.5.2 Feeder Creek intercept

A significant reduction in grass groundcover is still observable due to an uncontrolled fire that occurred during November 2022, see section 3.3. However, vegetation reshooting is continuing to progress in affected areas. Erosion, sedimentation, and hydrocarbons were not recorded at this PMP, (Plate 6).



Plate 6: Impact Site 5 (15 m from Feeder Creek disturbance intercept) comparison between April 2022 (left) and January 2024 (right) surveys



### 3.2.6 On-site Control Site 1

No instream sedimentation was observed which is consistent with the January 2021 survey. Turbidity levels have remained low (Plate 7). There was no evidence of fire impacting this site.

#### A Upstream



#### B Downstream



Plate 7. On-site control site 1, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### 3.2.7 On-site Control Site 2

As in the January 2021 survey, sedimentation and erosion was not observed at this site. Moderately turbid water with a high water flow was recorded at this PMP location Plate 8). No fires have impacted this site.

#### A Upstream



#### B Downstream



Plate 8. On-site control site 2, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### 3.2.8 On-site Control Site 3

No instream sedimentation or erosion was recorded during the January 2024 survey. (Plate 9). Ground cover continues to improve since the uncontrolled 2022 fires but the amount of ground debris along the banks is visibly lower than that prior to the fires, refer to section 3.3.

#### A Upstream



#### B Downstream



Plate 9. On-site control site 3, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### 3.2.9 Off-site Control Site 1

In contrast to the January 2023, two centimetres of instream sedimentation was observed at the downstream PMP location, while sedimentation was observed at the upstream PMP which his consistent with the findings of the previous survey. More water was observed at both PMP locations, compared to the previous surveys, (Plate 10). Recent fire has significantly reduced the groundcover surrounding the creekline, refer to section 3.3.

#### A Upstream



Plate 10: Off-site control site 1, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### 3.2.10 Off-site Control Site 2

Instream sedimentation, consisting of leaf litter up to 5cm deep, was observed at the upstream PMP site. This represents an increase in sedimentation compared to the previous survey (B Downstream



Plate 11). No evidence of erosion was recorded at either PMP. Recent fire has significantly reduced the groundcover surrounding the creekline, refer to section 3.3.

#### A Upstream



#### B Downstream





Plate 11: Off-site control site 2, Upstream (A) and Downstream (B) PMP, comparison between January 2021 (left) and January 2024 (right) surveys



### Off-site Control Site 3

In contrast to the January 2023 survey, moderate turbidity was observed at both PMP locations during the current survey compared to low turbidity observed previously. However, during the current survey significantly greater waterflow was present (Plate 12). No evidence of erosion was recorded at either PMP. Recent fire has significantly reduced the groundcover surrounding the creekline, refer to section 3.3.

#### A Upstream



#### B Downstream



Plate 12: Off-site Control Site 3 (upstream PMP) comparison between January 2021 (left) and January 2024 (right) surveys

### 3.3 Impacts of Fire

Other influence impacting the microhabitat of the MBF have been fire. This section provides further details of fires that have impacted the sites over the last two years. Table 2 provides information on those sites that were impacted by fires and the approximate dates over the last 2-years.

**Table 2. Sites which have been impacted by fire over the last 24 months. 'Yes', indicates the presence of fire with approximate date of fire included.**

SITE	Fire 2022 to 2023	Date	Fire 2023 to 2024	Date
Impact Site 1	No	NA	No	NA
Impact Site 2	No	NA	No	NA
Impact Site 3	No	NA	Yes	August 2023 <sup>2</sup>
Impact Site 4	No	NA	Yes	August 2023 <sup>2</sup>
Impact Site 5	Yes	Nov 2022 <sup>1</sup>	No	NA
On-site Control Site 1	No	NA	No	NA
On-site Control Site 2	No	NA	No	NA
On-site Control Site 3	Yes	Nov 2022 <sup>1</sup>	No	NA
Off-site Control Site 1	No	NA	Yes	Late 2023 <sup>3</sup>
Off-site Control Site 2	No	NA	Yes	Late 2023 <sup>3</sup>
Off-site Control Site 3	No	NA	Yes	Late 2023 <sup>3</sup>

1. Uncontrolled fire starting off-site during November 2022.
2. Controlled low-intensity fire from scheduled burns during August 2023.
3. Cause of fires unknown. Fires occurred during late 2023.

Some representative Images depicting the changes to each site resulting from fire can be viewed in Plates 13 to 19. Those sites impacted in fire typically resulted in a significant decline in creek ground cover.





### 3.3.1 Fire - Impact Site 3

There was a significant decline in groundcover in the top portion of the MBF habitat. Approximately 80% of cover was removed from the seepage zone prior to the proper creekline. Plate 13, depicts the extensive loss of cover after the August 2023 controlled burns. Approximately 50% of cover has returned to the site but it still lacks clumps of moist leaf litter that the frogs like to brood amongst. Prior to the fire there was a large proportion of MBF within this impacted seepage zone.

February 2022, before burn



September 2023, one month after burn



January 2024, 4 months after burn



Plate 13 Impact Site 3, Impacts of the August 2023 controlled burns as demonstrated by the September 2023 image. Cover beginning to return several months later.

### 3.3.2 Fire - Impact Site 4

There was a significant decline in groundcover in the top portion of the MBF habitat. Nearly all cover was impacted within the seepage zone prior to the proper creekline. Plate 14, depicts the extensive loss of cover after the August 2023 controlled burns. Approximately 40% of cover has returned to the site but it still lacks clumps of moist leaf litter and the thick grass cover that the frogs like to brood and hide amongst. Prior to the fire there was a large proportion of MBF within this impacted seepage zone.

February 2022, before burn



September 2023, one month after burn



January 2024, 4 months after burn



Plate 14 Impact Site 4, Extensive fire damage within the seep zone, September 2023. Cover showing good signs of returning by January 2024.



### 3.3.3 Fire - Impact Site 5

Impact Site 5 was disturbed by uncontrolled fire during November 2022. There was a significant decline in groundcover in the top portion of the MBF habitat as depicted in Plate 15. Two months after the fire, approximately 30% of groundcover had returned. By January 2024, 15 months after the fire event, 90 % of ground cover had returned, although groundcover biomass was less than before the fire event.

January 2022, before burn



December 2022, one month after burn



January 2023, 2 months after burn



January 2024, 14 months after burn



Plate 15 Impact Site 5, December 2022 is one month post fire. Some groundcover had returned by January 2023 and continues to improve through to January 2024.



### 3.3.4 Fire - On-site Control Site 3

There was a significant decline in groundcover in the top portion of the MBF habitat and along most of the creekline. Approximately 80% of cover was removed from the seepage zone. Plate 16, depicts the extensive loss of cover after the November 2022 uncontrolled burns. Approximately 80% of cover has returned to the site but it still lacks grass density that existed prior to the fire. Prior to the fire there was a large proportion of MBF within this impacted seepage zone.

February 2022, before burn



December 2022, one month after burn



January 2024, 14 months after burn



Plate 16 On-site Control Site 3, Impacts of the August 2023 controlled burns as demonstrated by the September 2023 image. Cover beginning to return several months later and continues improving through to January 2024.



### 3.3.5 Fire - Off-site Control Site 1

There was a significant decline in groundcover along most of the creekline. Approximately 70% of cover was removed throughout. Plate 17, depicts the changes over time. Approximately 40% of cover has returned since the late 2023 fires.

January 2022, before burn



January 2023, before burn



January 2024, several months after burn



Plate 17 Off-site Control Site 1, Impacts of the late 2023 fires as demonstrated by the January 2024 image.

### 3.3.6 Fire - Off-site Control Site 2

There was a significant decline in groundcover along most of the creekline. Approximately 70% of cover was removed throughout. Plate 18, depicts the changes over time. Approximately 40% of cover has returned since the late 2023 fires. However, the grass and leaf biomass are much lower than that observed prior to the fires.

January 2022, before burn



January 2023, before burn



January 2024, several months after burn



Plate 18 Off-site Control Site 2, Impacts of the late 2023 fires as demonstrated by the January 2024 image.



### 3.3.7 Fire - Off-site Control Site 3

There was a significant decline in groundcover along most of the lower two-thirds of the creekline. Approximately 70% of cover was removed throughout. Plate 19, depicts the changes over time. Approximately 30% of cover has returned since the late 2023 fires. However, the grass and leaf biomass are much lower than that observed prior to the fires.

January 2022, before burn



January 2023, before burn



January 2024, several months after burn



Plate 19 Off-site Control Site 3, Impacts of the late 2023 fires as demonstrated by the January 2024 image.

## 3.4 Supporting documents

To meet the requirements of the EPBC approval and Revised Magnificent Brood Frog Monitoring program, E2M 2021, two other surveys were conducted and during the same survey period. These reports compliment each other and are as follows:

- Magnificent Brood Frog Monthly Disturbance Intercept Photo Monitoring Report - January 2023 (E2M Pty Ltd, 2023b)
- Magnificent Brood Frog Monitoring Program—Third Annual Monitoring Report - January 2023, E2M Pty Ltd. (2023b).



## 4 Discussion and recommendations

The January 2024 annual microhabitat photo monitoring survey was completed between 16 and 21 January 2024. There was excellent MBF breeding rainfalls prior to and during the survey.

### Impact Site 1

Habitat conditions have not changed for the Upstream and Midstream monitoring sites compared to baseline results. The MBF habitat above the disturbance area is in excellent condition. The Downstream site continues to experience a small amount of erosion at the discharge point. As previously discussed, there was historical erosion at this point resulting from changed flows generated by the original farm access road. There would be some benefit in adding a culvert/floodway uphill along the access road to divert water shed from the road and upper catchment, to mitigate the impacts of concentrated waterflows at the discharge point.

### Impact Site 2

The habitat within Impact Site 2 is in excellent condition. There are no visible signs of MBF habitat being impacted by the wind farm project.

### Impact Site 3

The upper portion of the MBF habitat has been significantly impacted by the controlled fires during August 2023. There has been a significant reduction in ground cover in the seepage zone where many frogs were recorded during the 2023 annual survey (E2M Pty Ltd, 2023a). Fewer frogs were noted in the seepage zone during the most recent annual abundance survey (E2M Pty Ltd, 2024b).

While there is excellent sediment and erosion controls within the disturbance footprint there remains increased waterflows from the increased catchment, directing concentrated waterflows to the creek. The increased flows are causing some erosion within the MBF habitat. As previously discussed, waterflows could be reduced by the addition of a culvert/floodway uphill along the main access track, diverting a significant amount of water westward away from Impact Site 3.

### Impact Site 4

There is no evidence of erosion or sedimentation within this site as a result of wind farm activities. However, this site was significantly impacted by the controlled burns during August 2023. The seepage zone, within the top section of the MBF habitat was completely burnt. This section contained many of those MBF recorded during the 2023 survey and fewer frog were observed during the 2024 annual abundance survey (E2M Pty Ltd, 2024b).

### Impact Site 5

Ground cover has almost returned to those levels prior to the uncontrolled fire in November 2022. However, the biomass from leaves and grasses remains lower than pre fire levels. There has been no additional erosion since the significant rainfall event during December 2022. There is no evidence of sedimentation within this system.

### General notes

While ground cover is returning quickly to those sites impacted by fires, there is less vegetation biomass. The biomass of dense grasses and decaying leaves is important in providing suitable conditions for





breeding MBF. Those sites significantly impacted by fire may take 2 or more years to return to pre-fire conditions.

There is no sign of flora or fauna pest impacts at any of the monitoring sites within the wind farm site. Previously, On-site Control Site 3 was noted as having some feral pig damage. There was no evidence of feral pigs throughout the entire wind farm site.

The ground cover at On-site Control Site 3 has almost returned to levels noted prior to the November 2022 uncontrolled burn. However, biomass remains lower.

Turbidity was generally higher throughout all 11 monitoring sites during this survey period. The increased turbidity is a direct result from the sustained rainfalls prior to and during the survey, and not from wind farm activities.

Further impacts from fire events has been discussed within the 2024 annual MBF relative abundance report (E2M Pty Ltd, 2024b), along with recommendations to mitigate these impacts.



## 5 References

E2M. (2021a). *Kaban Green Power Hub - Fauna Management Plan* (Revision 9).

E2M. (2021b). *Magnificent Brood Frog Monitoring Program—Baseline Survey*.

E2M. (2022). *Magnificent Brood Frog Monitoring Program—Second Annual Monitoring Report*.

E2M Pty Ltd. (2023a). *Magnificent Brood Frog Monitoring Program—Third Annual Monitoring Report*.

E2M Pty Ltd. (2023b). *Magnificent Brood Frog Monthly Disturbance Intercept Photo Monitoring Report—January 2023*.

E2M Pty Ltd. (2024a). *Magnificent Brood Frog—Annual Disturbance Monitoring Report—January 2024*.

E2M Pty Ltd. (2024b). *Magnificent Brood Frog—Fourth Annual Abundance Monitoring*.





## Appendix A Impact sites habitat photos

## A.1 Impact Site 1 - Upstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.2 Impact Site 1 - Midstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



### A.3 Impact Site 1 - Downstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.4 Impact Site 2 - Upstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.5 Impact Site 2 - Downstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.6 Impact Site 3 - Upstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.7 Impact Site 3 - Downstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.8 Impact Site 4 - Upstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.9 Impact Site 4 - Downstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.10 Impact Site 5 - Upstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.11 Impact Site 5 - Upstream (feeder creek)



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## A.12 Impact Site 5 - Downstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## Appendix B On-site control sites habitat photos



## B.1 On-site Control 1 - Upstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph



## B.2 On-site Control 1 - Downstream



Pond context photograph



Surface photo



Upstream photograph



Downstream photograph

## B.3 On-site Control 2 - Upstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## B.4 On-site Control 2 - Downstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## B.5 On-site Control 3 - Upstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## B.6 On-site Control 3 - Downstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## Appendix C Off-site control sites habitat photos



## C.2 Off-site Control 1 - Upstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



### C.3 Off-site Control 1 - Downstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## C.4 Off-site Control 2 - Upstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## C.5 Off-site Control 2 - Downstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## C.6 Off-site Control 3 - Upstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph



## C.7 Off-site Control 3 - Downstream



Pond context photograph



Surface photograph



Upstream photograph



Downstream photograph




# Magnificent Brood Frog Annual Disturbance Intercept Photo Monitoring January 2024

Neoen Australia Pty Ltd

Level 21/570 George Street, Sydney, NSW 2000

# Document Management

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# Contents

<b>Executive Summary</b>	<b>v</b>
<b>Definitions</b>	<b>vi</b>
<b>Abbreviations</b>	<b>vi</b>
<b>1 Introduction</b>	<b>1</b>
<b>2 Methods</b>	<b>1</b>
<b>3 Results</b>	<b>4</b>
3.1 Climatic conditions	4
3.2 Impact Site Assessment	4
3.2.1 Impact Site 1	4
3.2.2 Impact Site 2	6
3.2.3 Impact Site 3	7
3.2.4 Impact Site 4	8
3.2.5 Impact Site 5	10
3.2.6 Main drainage disturbance intercept	10
3.2.7 Feeder creek disturbance intercept	11
<b>4 Conclusion</b>	<b>13</b>
<b>5 References</b>	<b>14</b>
Feeder Creek disturbance intercept	22
Main drainage disturbance intercept	25

## List of Tables

Table 1. Disturbance intercept PMP locations	1
Table 2: Erosion and sediment observations made at Impact Site 1	5
Table 3: Erosion and sediment observations made at Impact Site 2	6
Table 4: Erosion and sediment observations made at Impact Site 3	7
Table 5: Erosion and sediment observations made at Impact Site 4	9
Table 6: Erosion and sediment observations made at Impact Site 5 main disturbance intercept	10
Table 7: Erosion and sediment observations made at Impact Site 5 feeder creek intercept	11

## List of Figures

Figure 1: Impact site locations	2
Figure 2: Disturbance intercept photo monitoring locations	3
Figure 3. Rainfall recorded 7 days prior to, and during survey.	4





# Appendices

## Appendix A Photo records for monthly disturbance intercept monitoring



## Executive Summary

Disturbance intercept photo monitoring was performed at all five impact sites on the 20<sup>th</sup> and 21<sup>th</sup> January 2024. A significant amount of rain fell prior to and during the survey, providing good conditions to examine existing erosion and sedimentation mitigation measures for the preservation of magnificent brood frog (MBF) and its habitat.

Rehabilitation and groundcover has improved across most disturbance intercepts, however improvements to the recently disturbed section, on the northern side of the road, at Impact Site 1, needs further work to improve ground cover and species diversity. Close monitoring and/or additional effort, opposite Impact Site 3 disturbance intercept is required to ensure suitable rehabilitation is achieved.

Weeds growing within some of the sediment traps are to be monitored to ensure they do not spread within the MBF habitat. This is especially critical after significant disturbance events such as fire.

Impact Site 1: The addition of a culvert/floodway installed along the access road, would help re-establish normal waterflows and volumes back to the MBF creekline. The installation of the culvert is proposed later this year during suitable weather conditions. There are signs of gully and sheet erosion forming in the exposed disturbance areas north of the access track between 4-Ways intersection and Impact Site 1.

Impact Site 2: Some sediments are accumulating within the large sediment trap and may need servicing before the next wet season. Weeds are to be monitored to ensure they do not spread into the creek. Last year there was a significant effort in re-designing the 4-Ways intersection. The re-design has been largely successful in reducing erosion and sedimentation.

Impact Site 3: While there was a significant improvement to the re-design of the water discharge infrastructure into the MBF creekline, by altering the berm to form a level spreader, there remains the threat of higher volumes of water discharging due to the increased catchment area. The higher water volumes will increase the likelihood of erosion within the MBF creekline, and potentially causing long-term impacts to the MBF population. The recommendation is to divert the current flows, from WTG 19 and WTG 20, in a westward direction and away from the MBF creekline at Impact Site 3.

Impact Site 4: It is advised to monitor the recovery of vegetation impacted by the August fires to ensure that weeds do not encroach into the seepage zone adjacent to the sediment trap.

Impact Site 5: Rehabilitation is excellent in most parts through this disturbance section. There are few weeds, good native tree, bush and grass diversity, and good groundcover.

Recommendations for all sites include:

- ongoing maintenance and servicing of existing ESCs such as rock checks
- check existing controls after significant rainfall events,
- ongoing improvements to roadside drainage,
- ongoing monitoring and continued establishment of groundcover in disturbed areas<sup>1</sup>. This includes treatment of threatening weed populations<sup>2</sup>,
- any weed treatment proximate to the disturbance intercept will need to be done manually or with 'frog-friendly' chemicals. Careful consideration to when chemicals are applied. Chemicals

---

<sup>1</sup> A structured rehabilitation plan is scheduled early in the 2024 wet season. This plan will address priority rehabilitation areas, focusing on sections where there is insufficient groundcover.

<sup>2</sup> A weed treatment program will continue through March 2024 to focus on the treatment of priority weed populations.



only to be applied when water is not flowing from the disturbance area and only when there is no-rain forecasted on the day of, and the day following application; and

- installment of drainage to help return water flows to pre-construction levels at Impact Site 1 and Impact Site 3.

**Supporting documents:** During the January 2024 survey period, assessments were also completed for annual abundance (E2M Pty Ltd, 2024b) and microhabitat monitoring (E2M Pty Ltd, 2024a) for the magnificent brood frog (MBF). These two surveys along with the disturbance intercept survey and report, form a thorough assessment of MBF habitat and associated MBF populations that are potentially affected by the wind farm project and the means in which to mitigate any impacts to this species.

## Definitions

Term	Definition
Disturbance Area	Any disturbed area upstream of the disturbance intercept.
Disturbance Intercept	The point where the disturbance area intercepts the undisturbed magnificent brood frog creekline.
Significant rainfall	Any persistent or moderate to heavy rainfall events that result in watershed from the disturbance area.
Main sediment trap (rock filled dam)	Large rock filled sediment trap installed at the disturbance intercept.

## Abbreviations

Term	Definition
MBF	Magnificent Brood Frog
WTG	Wind Turbine Generator



# 1 Introduction

E2M was commissioned by Neoen Australia Pty Ltd to conduct magnificent brood frog (MBF) annual disturbance impact monitoring pursuant to EPBC approval 2018/8289. Conditions of the monitoring are detailed in the Fauna Management Plan (E2M, 2021). In accordance with the monitoring program, disturbance intercept photo monitoring is required at all five impact sites.

# 2 Methods

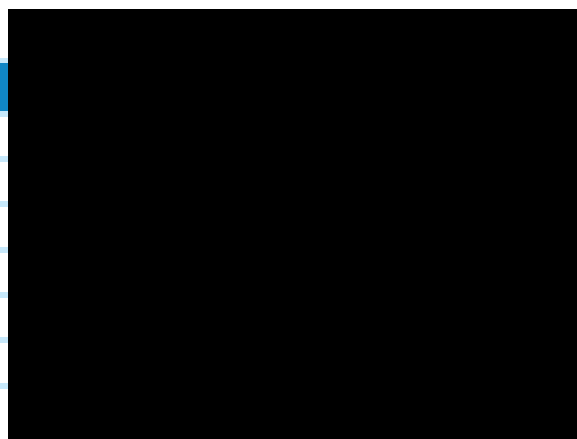
Photo monitoring surveys and observations were conducted on 20 and 21 January 2024, at the point where the civil earthworks (i.e. disturbance) intercepts the drainage line at each impact site for magnificent brood frog (MBF) monitoring (see Figure 1 and Table 1). At each point (Figure 2), a minimum of four photos were taken, including upstream, downstream and cross slope (both directions), to identify any erosion and sedimentation features present. Additionally, photos of observations of interest were also taken if not visible in the four primary photos. Any erosion and sedimentation within the creekline was also noted along with any other disturbance features with the potential to cause impacts to the MBF habitat.

The following habitat characteristics were recorded:

- Identification of failed or incorrectly installed erosion or sediment control devices resulting in sediment deposits into MBF habitat
- Evidence of gully<sup>3</sup>, rill and sheet erosion within the Project disturbance footprint
- Assessment of rehabilitation adjacent to the impact sites, and/or,
- Assessment of any other observations, such as environmental weeds, potentially harmful to the MBF habitat.

**Table 1. Disturbance intercept PMP locations**

Site Name	Monitoring Location
Impact Site 1	Disturbance Intercept
Impact Site 2	Disturbance Intercept
Impact Site 3	Disturbance Intercept
Impact Site 4	Disturbance Intercept
Impact Site 5	Disturbance Intercept
Impact Site 5	Feeder Creek - DI

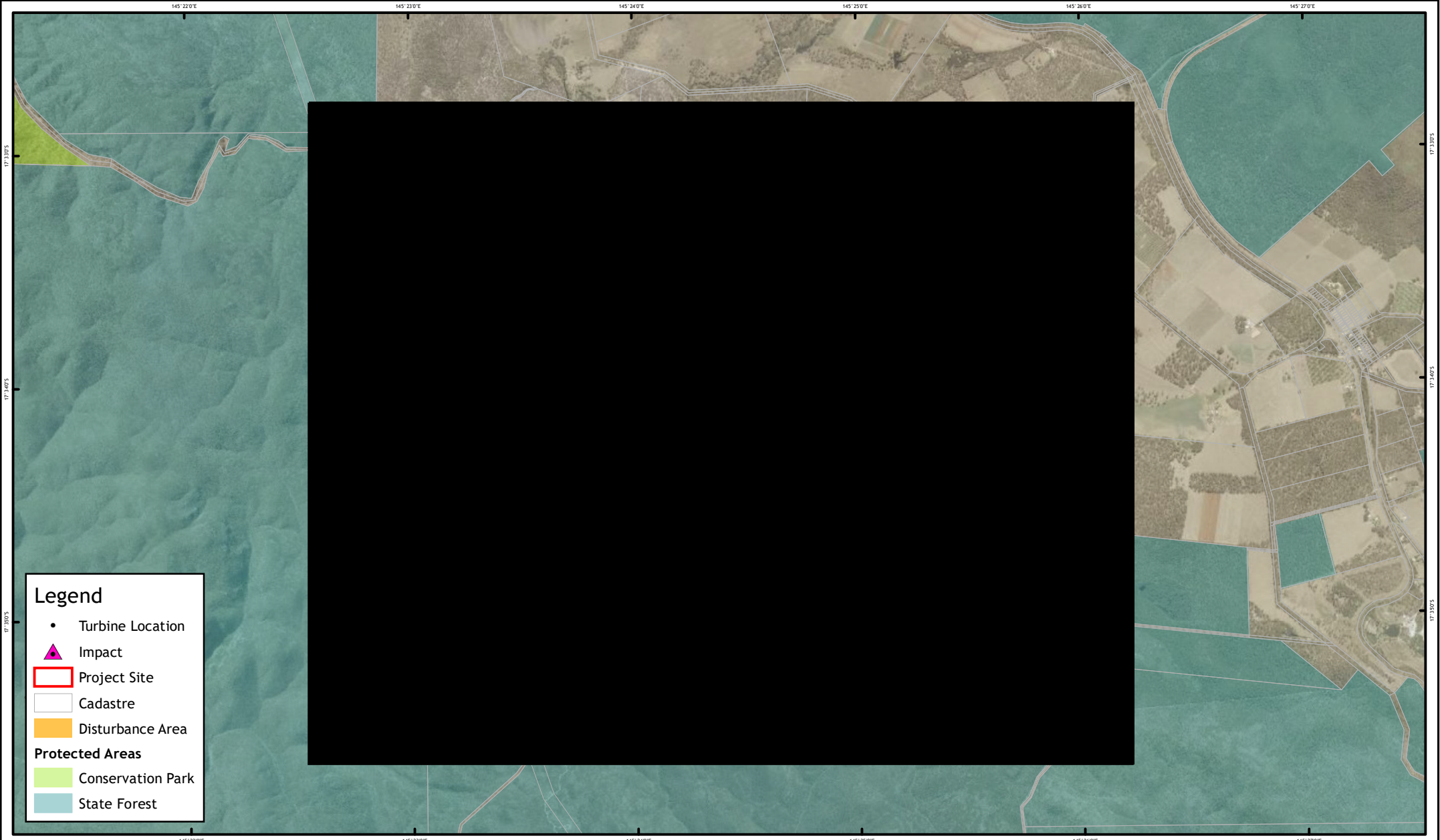


<sup>3</sup> **Gully erosion** is defined as any erosion greater than 30 cm deep.





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Kilometres

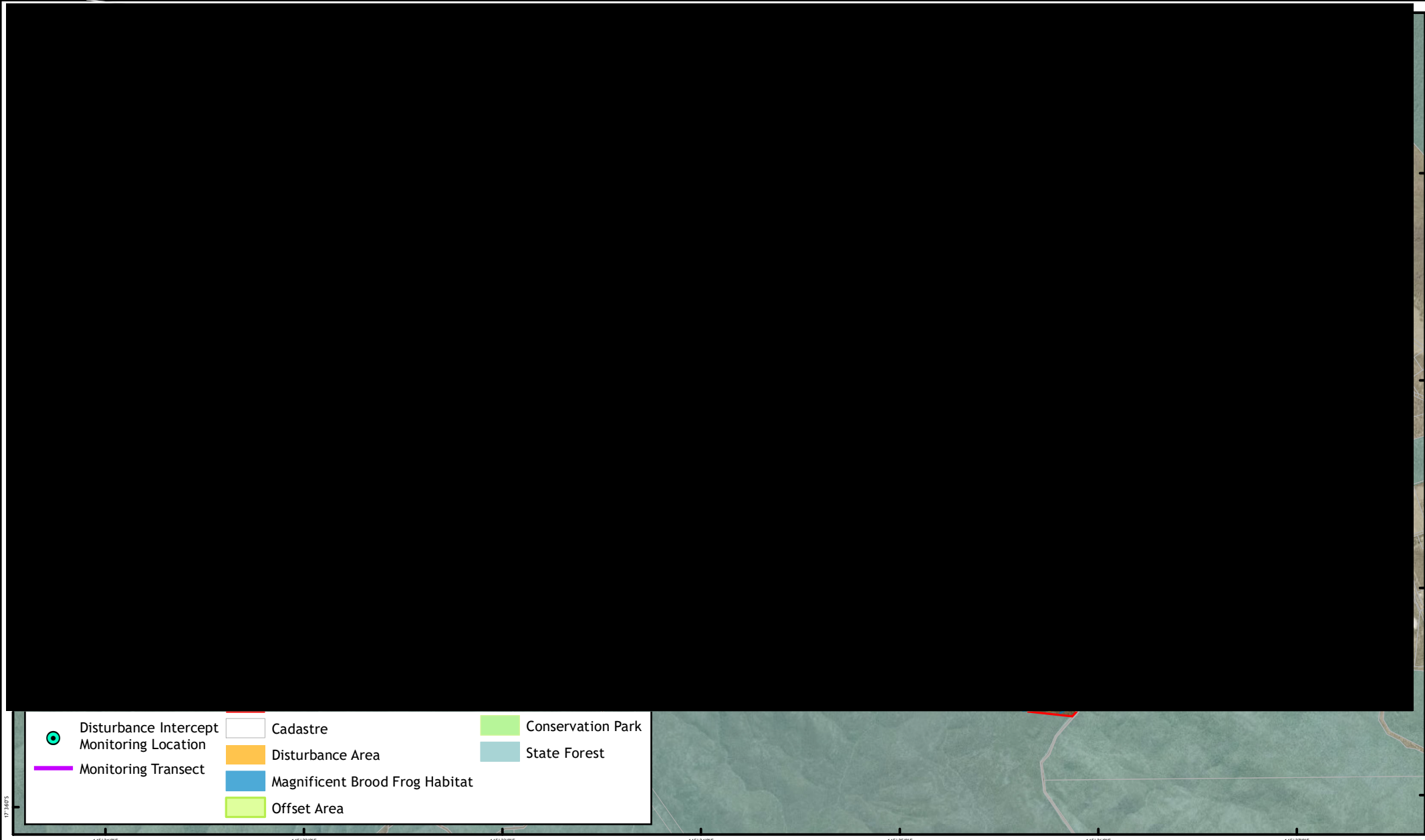
Coordinate System: GDA 1994 MGA Zone 55  
Projection: Transverse Mercator


<b>Notes:</b> Aerial Imagery: © ESRI 2022 Disturbance Footprint: © Neoen 2021 Protected Areas: © DES 2022				
0	Issued for Use	GO	EA	09/02/2024
Rev	Description	Drawn	Approved	Date





<b>FIGURE 1: IMPACT SITE LOCATIONS</b>				
Magnificent Brood Frog Monthly Disturbance Intercept Photo Monitoring - January 2024 Kaban Green Power Hub				
Map Number	Job Number	Rev		
1 of 1	QEJ21046	0		


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 Disturbance Intercept Monitoring Location


 Monitoring Transect


 Cadastre

 Disturbance Area

 Magnificent Brood Frog Habitat

 Offset Area

 Conservation Park

 State Forest



Scale 1:45,000 (A4)

0 0.5 1 1.5 2

Kilometres

Coordinate System: GDA 1994 MGA Zone 55  
Projection: Transverse Mercator

Notes:  
Aerial Imagery: © ESRI 2022  
Disturbance Footprint: © Neoen 2021  
Protected Areas: © DES 2022

0	Issued for Use	PR	EA	05/03/2024
Rev	Description	Drawn	Approved	Date



**FIGURE 2: DISTURBANCE INTERCEPT PHOTO MONITORING LOCATIONS**  
Magnificent Brood Frog Monthly Disturbance Intercept Photo Monitoring - January 2024  
Kaban Green Power Hub

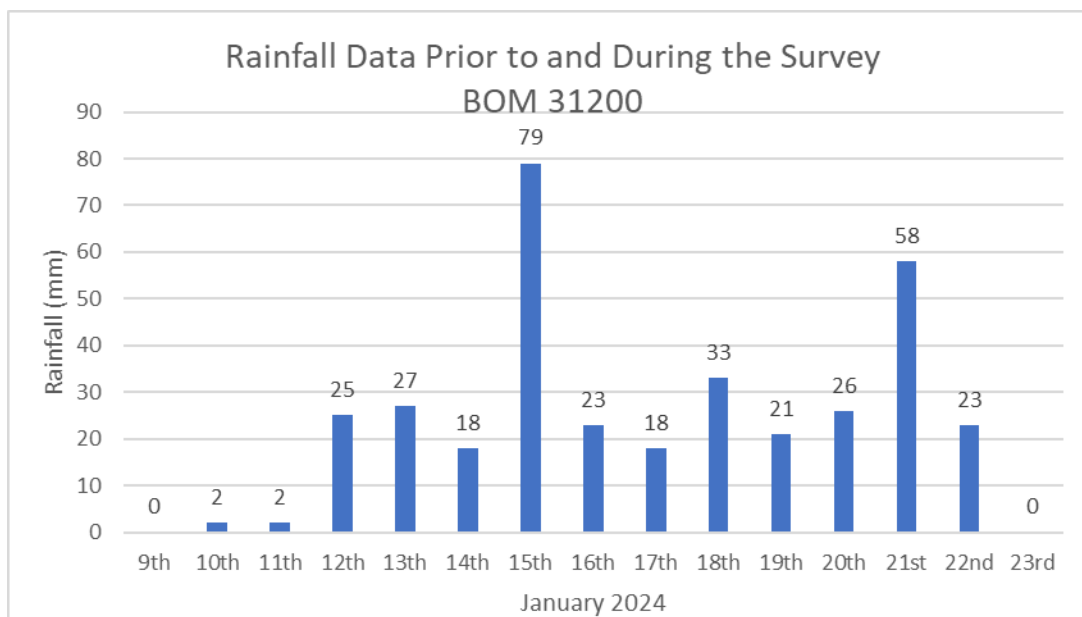
Map Number	Job Number	Rev
1 of 1	QEJ21046	0

## 3 Results

### 3.1 Climatic conditions

There were good rainfalls prior to and during the survey that provided good field observations relating to waterflows off the disturbance footprint and important visual feedback regarding erosion and sediment control measures. The local BOM weather station at Ravenshoe, Station 31200, recorded over 200 mm during the ten days prior to survey (Figure 3).

**Figure 3. Rainfall recorded 7 days prior to, and during survey.**



### 3.2 Impact Site Assessment

Disturbance photo monitoring was conducted at all five impact monitoring sites. An additional assessment was conducted at the feeder creek disturbance intercept at Impact Site 5. Erosion and sedimentation features were assessed at all disturbance intercepts along with rehabilitation measures. Any other notes were made in relation to the protection of MBF habitat. Results for each assessment follow. Please refer to Appendix A for photo library of each disturbance intercept.

The assessment for the sediment control fences have been removed now that bulk earth works have been completed and these measures have not been utilised for some months.

#### 3.2.1 Impact Site 1

The results of the January 2024 survey largely mirror that of the April 2023 survey. Sediment traps and rock checks appear to be structurally sound. Minimal instream sedimentation was observed, consisting of fine silts, was observed downstream of the disturbance. Sediment has begun to accrue within the sediment trap, continued monitoring is required to ensure this does not impede the effectiveness of the trap. Some sheet and gully erosion is forming within the rehabilitation area north of the access track, Plate 8. Rehabilitation has made little progress along the northern side of the road with additional



setbacks resulting from works to further improve the rock-lined roadside drainage, Plate 6. The drain was widened, and additional rocks added during December 2023. Concentrated waterflows into the discharge remain a concern for continued erosion within the upper portion of the creek immediately downstream of the access track, Plate 1.

Observations are detailed in Table 2.

**Table 2: Erosion and sediment observations made at Impact Site 1**

Item #	Matter	Assessment	Description & Remedial Notes	Photo
1	In-stream sedimentation present	Yes	In stream sedimentation was observed just downstream of disturbance as a fine layer coating the creek bed of the watercourse.	Plate 1
2	In-stream erosion	Yes	Instream erosion was noted in the first 15 m of the water course beginning at the discharge. Historic erosion is still present downstream of the disturbance intercept.  Waterflows to the discharge have been mitigated somewhat through the large rock filled dams (sediment traps) on either side of the culvert, rock checks and rock lined drainage.	Plate 1
3	Main sediment trap installed	Yes	Large sediment trap installed at disturbance intercept.	Plate 2 Plate 3 Plate 4
4	Main sediment trap service and maintained	Yes	Sediment trap was in good condition with some sedimentation present. Ongoing monitoring and maintenance will be required to ensure sedimentation levels do not increase further.	Plate 2 Plate 3 Plate 4
5	Adequate rock checks and sediment controls installed	Yes	Rock checks installed within roadside drainage along the east and west sides.	Plate 5 Plate 6
6	Existing rock check service and maintained	Yes	Rock checks were in good condition with considerable sedimentation present. Ongoing servicing and maintenance are required to remove sediments.	Plate 6 Plate 7
7	Erosion present in disturbed areas	Yes	There are some points of sheet erosion and early signs of gully erosion present in disturbed areas.	Plate 8
8	Additional erosion and sedimentation controls needed	Yes	Improved groundcover required.  Installation of causeway, approximately halfway between the MBF creek and Four-ways was previously recommended to mitigate concentrated waterflows from discharging into the creek.	-





Item #	Matter	Assessment	Description & Remedial Notes	Photo
9	Rehabilitation started	Yes	Rehabilitation is a work in progress. The western side is progressing well but additional efforts to increase groundcover on the eastern side are needed. Some new disturbance to rehab was noted on the eastern side from recent drainage works.	-
10	Rehabilitation adequate	No	Groundcover is progressing well along the western side but insufficient along the eastern side. Ongoing monitoring and work is required to improve overall groundcover.	-

### 3.2.2 Impact Site 2

The sediment trap is in good order, with some sediment accumulating within the trap. Water was also observed pooling within the trap after prolonged rainfall, Plate 11. Groundcover has improved with over 70 percent coverage. There has been a re-design to the 4-Ways intersection that has mitigated erosion and subsequent sedimentation into the MBF habitat. There was no sedimentation, erosion or any other wind farm related impacts noted within the MBF habitat. Results are detailed in Table 3.

**Table 3: Erosion and sediment observations made at Impact Site 2**

Item #	Matter	Assessment	Description & Remedial Notes	Photo
1	In-stream sedimentation present	No	Minimal deposition of fine silts were observed.	-
2	In-stream erosion	No	In stream erosion was not observed.	Plate 9
3	Main sediment trap installed	Yes	Large sediment trap installed at disturbance intercept.	Plate 12 Plate 13
4	Main sediment trap service and maintained	Yes	Sediment trap was in good condition. Some sediment has accumulated within the trap and should continue to be monitored.	Plate 11 Plate 12 Plate 13
5	Adequate rock checks and sediment controls installed	Yes	Some small rock checks are used, however, there remains a concern that this may not be effective in controlling sedimentation. Rock lined drainage has been used in the upper section near the four-ways intersection.	Plate 14
6	Existing rock check service and maintained	Yes	The small rock checks and sandbags along the roadside drain have deteriorated. Sediment has begun to accumulate at the rock checks and requires ongoing monitoring and maintenance to ensure ongoing function.	Plate 14



Item #	Matter	Assessment	Description & Remedial Notes	Photo
7	Erosion present in disturbed areas	No	Some minor rill erosion is present in the rehabilitation areas containing lower ground cover. Rill and minor gully erosion present at the Four-ways intersection which may contribute to instream sedimentation during future rain events.	-
8	Additional erosion and sedimentation controls needed	Yes	Re-design of Four-ways intersection to prevent erosion and sedimentation. Improved ground cover along northern side to reduce likelihood of erosion. Improvements to roadside drainage to capture sediments.	-
9	Rehabilitation started	Yes	Ground cover has increased significantly from the previous survey.	Plate 15
10	Rehabilitation adequate	No	Ground cover is approaching adequate levels. Monitoring and additional actions to improve groundcover and weeds treated, as required.	Plate 15

### 3.2.3 Impact Site 3

Minor sedimentation was observed at the base of the sediment trap, Plate 18. No additional instream erosion was observed. The sediment trap and rock filled drainage lines are present and appear to be in good order. A small amount of sedimentation has accumulated within the sediment trap, as well as the germination of weed species. Continued monitoring of the sediment trap is required to ensure it functions optimally. Those rehabilitated sites not recently disturbed have good groundcover, albeit containing some environmental weeds. Ground disturbance opposite the disturbance intercept and adjacent to WTG 20 will need ongoing efforts to achieve satisfactory groundcover, Plate 22. Intervention may be required to remove weeds and increase the prevalence of native species in the ground cover of rehabilitated areas. Currently, species diversity is skewed towards introduced species. Results are detailed in Table 4. Increased water flows within the roadside drainage coming from WTG 19 and 20 were evident from previous rainfall events.

**Table 4: Erosion and sediment observations made at Impact Site 3**

Item #	Matter	Assessment	Description & Remedial Notes	Photo
1	In-stream sedimentation present	Yes	Minor sedimentation was observed at the base of the sediment trap comprising of fine silts.	Please refer to E2M 2024a
2	In-stream erosion	Yes	Moderate instream erosion was observed which was attributed to the December 2022 rain event. No new erosion noted.	Please refer to E2M 2024a
3	Main sediment trap installed	Yes	Large sediment trap installed at disturbance intercept.	Plate 16 Plate 17



Item #	Matter	Assessment	Description & Remedial Notes	Photo
4	Main sediment trap service and maintained	Yes	Sediment trap was in good condition and is of adequate size. A low level of sedimentation has accumulated in the trap. Ongoing monitoring and maintenance will be required to prevent excessive sedimentation build up. Some weed species are beginning to germinate in the sediment trap, this should also be monitored.	Plate 18 Plate 19
5	Adequate rock checks and sediment controls installed	Yes	Rock filled drainage is present along the roadside drainage and at the disturbance intercept. These controls appears to be effectively assisting with sediment management.	Plate 20 Plate 21
6	Existing rock check serviced and maintained	Yes	Rock lining appears largely well maintained, however there are signs of sediment accumulation beginning to occur. Ongoing monitoring and maintenance will be required to ensure this sediment does not build up to a level that impacts the performance of the rock lining.	Plate 20 Plate 21
7	Erosion present in disturbed areas	No	Some minor rill erosion is present in the rehabilitation areas containing lower ground cover.	-
8	Additional erosion and sedimentation controls needed	Yes	Existing ESC measures are currently performing effectively. However more work to return water flows to pre-construction levels is needed. Current design has increased water flow into the MBF habitat. Please see recommendations in the Executive Summary and Discussion.	Plate 20 Plate 21
9	Rehabilitation started	Yes	Groundcover on the eastern side of the road is very good, albeit consisting largely of non-priority weeds such as <i>Urochloa decumbens</i> and <i>Chloris gayana</i> . Groundcover is less than 50 percent on the western side of the road but has good native species composition.	Plate 20 Plate 21 Plate 22
10	Rehabilitation adequate	No	Groundcover is becoming established in this area; however the floristic diversity is skewed towards non-native species.	Plate 20 Plate 21

### 3.2.4 Impact Site 4

Minimal instream sedimentation was observed but is consistent with that of which can be found within control sites. No additional instream erosion was observed. The sediment trap and rock filled drainage lines are present and appear to be in good condition, Plate 24. Minimal sedimentation was noted within the main sediment trap. Some weeds were noted within and surrounding the sediment trap that will



require ongoing monitoring and possibly treatment. Minor rill erosion attributed to the December 2022 rain event is still present in association with disturbed areas on the northern side of the intercept. Erosion is not increasing and is unlikely to increase as rehabilitation continues to improve. The presence of native species including *Acacia simsii*, *Acacia holosericea*, *Heteropogon contortus* and *Themida triandra* suggests that native recruitment is occurring. However, further monitoring and proactive measures may need to be taken to ensure this positive trajectory continues. Results are detailed in Table 5.

**Table 5: Erosion and sediment observations made at Impact Site 4**

Item #	Matter	Assessment	Description & Remedial Notes	Photo
1	In-stream sedimentation present	Yes	Minor sedimentation was observed comprising of fine silts.	-
2	In-stream erosion	No	In stream erosion was not observed.	-
3	Main sediment trap installed	Yes	Large sediment trap installed at disturbance intercept.	Plate 23 Plate 24
4	Main sediment trap service and maintained	Yes	Sediment trap was in good condition. Minimal sediment has accumulated within the trap. Some weed species are beginning to germinate within the trap. Ongoing monitoring and maintenance will be required to ensure trap efficacy and spread of weeds does not occur.	Plate 24
5	Adequate rock checks and sediment controls installed	Yes	Rock filled drainage is present along the south side of the road and appears to be effectively assisting with sediment management. Rock checks are absent however are not currently required under current design. Vegetation windrow along the woodland boundary assists in mitigating waterflows and sedimentation from leaving the disturbance area.	Plate 25 Plate 26
6	Existing rock check service and maintained	Yes	Rock filled drainage was in good condition and largely free of sedimentation, and the vegetation windrow on the southern side is also catching sediments. Ongoing monitoring and maintenance will be required to ensure sedimentation does not increase.	Plate 26
7	Erosion present in disturbed areas	No	Some minor rill erosion was observed in association with disturbed areas on the northern side of the intercept. This erosion is attributed to the significant December 2022 rainfall event.	-
8	Additional erosion and sedimentation controls needed	No	Existing ESC measures are currently performing effectively. Ongoing monitoring and maintenance will be required to ensure performance continues.	-
9	Rehabilitation started	Yes		Plate 25 Plate 26





Item #	Matter	Assessment	Description & Remedial Notes	Photo
10	Rehabilitation adequate	No	Ongoing rehabilitation efforts are required by way of monitoring and treating any rehabilitation deficiencies as they appear. Improvements to groundcover are needed, especially along the northern side disturbance. There is evidence of recruitment of native species, particularly <i>Acacia</i> spp and native grass species which suggests native recruitment will improve with time.	Plate 25 Plate 26

### 3.2.5 Impact Site 5

There are two drainage lines for this site. The main drainage feeding in at the western end of the MBF drainage feature, Plate 39 and a second drainage, noted as a feeder creek further downstream (Figure 2 and Plate 29).

Performance observations are detailed in Table 6 and Table 7, with associated photos presented in Appendix A.5.

There was no instream sedimentation or new erosion noted. Details of in-stream condition is discussed comprehensively in the Microhabitat Monitoring Report (E2M Pty Ltd, 2023). Both sediment traps contained minimal sediment. Continued monitoring is required to ensure these traps continue to function optimally.

The erosion noted in last years survey, above the main sediment trap along the fenceline, has been addressed with the installation of a drainage feature that directs flow away from the fence and into the roadside drainage.

Rehabilitation has continued to improve across most disturbance areas adjacent to the creek. There is good ground cover represented by native species, see Plate 32 and Plate 33.

### 3.2.6 Main drainage disturbance intercept

**Table 6: Erosion and sediment observations made at Impact Site 5 main disturbance intercept**

Item #	Matter	Assessment	Description & Remedial Notes	Photo
1	In-stream sedimentation present	No	In-stream sedimentation was not observed.	-
2	In-stream erosion	Yes	No additional instream erosion was observed.	Plate 27 Plate 31
3	Main sediment trap installed	Yes	Two large sediment traps installed at disturbance intercept.	Plate 28



Item #	Matter	Assessment	Description & Remedial Notes	Photo
4	Main sediment trap service and maintained	Yes	Sediment trap was in good condition, with little sediment present. Ongoing monitoring and maintenance will be required to ensure trap function.	Plate 28
5	Adequate rock checks and sediment controls installed	Yes	Rock filled drainage is present along the roadside and appears to be effectively assisting with sediment management.	Plate 29 Plate 30 Plate 32 Plate 33
6	Existing rock check service and maintained	Yes	Rock filled drainage was in good condition and largely free of sedimentation. Ongoing monitoring and maintenance will be required to ensure sedimentation does not increase.	Plate 32 Plate 33
7	Erosion present in disturbed areas	No	No erosion was observed in disturbed areas.	-
8	Additional erosion and sedimentation controls needed	No	Existing ESC measures are not currently performing effectively. Erosion is occurring along the fence lines associated with the disturbance area. Drainage systems need to be improved so that this water is directed into the roadside drainage. Ongoing monitoring and maintenance will be required to ensure performance improves.	-
9	Rehabilitation started	Yes	Native recruitment is evident in disturbance areas adjacent MBF habitat.	Plate 34 Plate 35
10	Rehabilitation adequate	No	Despite evidence of effective recruitment of native species, ongoing rehabilitation efforts are required by way of monitoring and treating any rehabilitation deficiencies as they appear.	Plate 34 Plate 35

### 3.2.7 Feeder creek disturbance intercept

Table 7: Erosion and sediment observations made at Impact Site 5 feeder creek intercept

Item #	Matter	Assessment	Description	Photo
1	In-stream sedimentation present	No	In-stream sedimentation was not observed.	-
2	In-stream erosion	No	In stream erosion was not observed.	-
3	Main sediment trap installed	Yes	Large sediment trap installed at disturbance intercept.	Plate 36 Plate 37



Item #	Matter	Assessment	Description	Photo
4	Main sediment trap service and maintained	Yes	Sediment trap was in good condition and well maintained. Ongoing monitoring is still required to ensure the sediment trap is functioning optimally.	Plate 37
5	Adequate rock checks and sediment controls installed	Yes	Rock filled drainage was in good condition and largely free of sedimentation. Ongoing monitoring and maintenance will be required to ensure sedimentation does not increase.	Plate 38 Plate 39
6	Existing rock check service and maintained	Yes	Rock lined drainage is in good condition and appears well maintained.	Plate 38 Plate 39
7	Erosion present in disturbed areas	No	No additional erosion was noted in disturbed area.	-
8	Additional erosion and sedimentation controls needed	No	Existing ESC measures appear to be performing effectively, potential for increased flow after steady rain at the discharge needs to be monitored.	Plate 37 Plate 38 Plate 39
9	Rehabilitation started	Yes	Native recruitment is evident in disturbance areas adjacent MBF habitat.	Plate 40
10	Rehabilitation adequate	Yes	Sufficient native recruitment has occurred, however ongoing rehabilitation efforts are required by way of monitoring and treating any rehabilitation deficiencies as they appear.	Plate 40



## 4 Conclusion

Photo monitoring was undertaken at all five magnificent brood frog disturbance intercept locations and assessed for erosion and sedimentation performance, and any other matters relating to the preservation of MBF populations.

A summary of survey findings and recommendations can be viewed in the Executive Summary.





## 5 References

E2M. (2021). *Kaban Green Power Hub - Fauna Management Plan* (Revision 9).

E2M Pty Ltd. (2024a). *Magnificent Brood Frog Annual Microhabitat Monitoring Report—February 2024*.

X:\JOBS\~2021\QEJ21046\DELIVERABLES\FY24\6. Magnificent Brood Frog Monitoring - Annual\MBF  
Fourth Annual Monitoring\Rev0.

E2M Pty Ltd. (2024b). *Magnificent Brood Frog—Fourth Annual Abundance Monitoring*.



## Appendix A Photo records for monthly disturbance intercept monitoring

### A.1 Impact Site 1

Impact Site 1: Directional PMP photos



Plate 1: Impact Site 1 - Upstream



Plate 2: Impact Site 1 - Downstream



Plate 3: Impact Site 1 - Cross slope left facing downstream



Plate 4: Impact Site 1 - Cross slope right facing downstream



## Impact Site 1: Sediment control devices



**Plate 5: Rock checks installed on western side of road**



**Plate 6: Rock-lined drainage on eastern side of road**



**Plate 7: Additional image of rock lined-drainage upgraded from previous years**



**Plate 8: Sheet and gully erosion beginning to form**

## A.2 Impact Site 2

### Impact Site 2: Directional PMP photos



Plate 9: Impact Site 2 - Upstream



Plate 10: Impact Site 2 - Downstream



Plate 11: Impact Site 2 - Cross slope left facing downstream



Plate 12: Impact Site 2 - Cross slope right facing downstream



## Impact Site 2: Sediment control devices



Plate 13: Sediment trap with some sedimentation present and water pooling after recent rain



Plate 14: Small rock checks installed on the southern roadside with some sedimentation present

## Impact Site 2: Rehabilitation



Plate 15: Improved groundcover with some non-priority weeds present

## A.3 Impact Site 3

### Impact Site 3: Directional PMP photos



Plate 16: Impact Site 3 - Upstream



Plate 17: Impact Site 3 - Downstream



Plate 18: Impact Site 3 - Cross slope left facing downstream



Plate 19: Impact Site 3 - Cross slope right facing downstream



### Impact Site 3: Sediment control devices



**Plate 20: Rock-lined drainage with some sediment accumulation and weeds present**



**Plate 21: Rock-lined drainage install**



**Plate 22: Area opposite Impact Site 3 MBF requiring improved groundcover.**

## A.4 Impact Site 4

### Impact Site 4: Directional PMP photos



Plate 23: Impact Site 4 - Upstream



Plate 24: Impact Site 4 - Downstream



Plate 25: Impact Site 4 - Cross slope left facing downstream



Plate 26: Impact Site 4 - Cross slope right facing downstream



## A.5 Impact Site 5

### Feeder Creek disturbance intercept

Impact Site 5 - Feeder creek disturbance intercept: Directional PMP photos



Plate 27: Impact Site 5 (main intercept) - Upstream



Plate 28: Impact Site 5 (main intercept) - Downstream



Plate 29: Impact Site 5 (main intercept) - Cross slope left facing downstream



Plate 30: Impact Site 5 (main intercept) - Cross slope right facing downstream

Impact Site 5 - main disturbance intercept: sediment control devices



Plate 31: Instream erosion



Plate 32: Roadside rock-lined drainage



Plate 33: Additional image of Roadside rock-lined drainage



## Impact Site 5 main disturbance intercept: Rehabilitation



Plate 34: Recruitment of *Acacia* spp. on the opposite side of the sediment trap



Plate 35: Recruitment of *Acacia* spp. on the opposite side of the sediment trap

## Main drainage disturbance intercept

### Impact Site 5 - Main drainage intercept: Directional PMP photos



**Plate 36: Impact Site 5 (feeder creek) - Upstream**



**Plate 37: Impact Site 5 (feeder creek) - Downstream**



**Plate 38: Impact Site 5 (feeder creek) - Cross slope left facing downstream**



**Plate 39: Impact Site 5 (feeder creek) - Cross slope right facing downstream**



## Impact Site 5 - feeder creek intercept: Rehabilitation



**Plate 40: Evidence of native recruitment and groundcover rehabilitation**