umwelt
Environmental & Social Consultants

NEOEN

MINOR CHANGE APPLICATION

Mount Hopeful Wind Farm

FINAL

May 2023

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MINOR CHANGE APPLICATION

Mount Hopeful Wind Farm

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

Report No. 7053/R29
Date: May 2023

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

This report has been prepared by Umwelt (Australia) Pty Ltd (Umwelt) on behalf of Neoen Australia Pty Ltd (Neoen) in support of a minor change application for the Mount Hopeful Wind Farm Project (the Project) in accordance with Section 78 of the *Planning Act 2016* (Planning Act).

On 17 June 2022, the Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) approved a Development Permit for a Material Change of Use (Wind Farm) and Operational Work (Native Vegetation Clearing) for the Project subject to conditions (2109-24892 SDA). The approved Project provided for the development of a wind farm containing up to 97 wind turbine generators (WTGs) and ancillary infrastructure with a nameplate capacity of approximately 700 megawatts (MW).

Refinements to engineering and constructability assessments resulted in further optimisation of the Project, including a reduction in the proposed number of turbines and amendments to the infrastructure layout and disturbance footprint.

Table 1-1 provides an overview of documentation that has been prepared in support of this minor change application.

Table 1-1 Documentation in Support of Minor Change Application

Document	Overview
Appendix A	Maps showing: • The layout of the proposed minor change to the Project. • A comparison between the layout approved by SARA in June 2022 and the proposed Project changes.
Appendix B	Responses to State Code 23 and State Code 16.
Appendix C – Appendix L	Technical assessments of the proposed Project changes.
Appendix M	Supporting material to accompany the minor change application including Owner's Consent, DA Form 1 and correspondence from Department of Resources.

2.0 Proposed Changes

Following the initial approval in June 2022, Neoen have made changes to the Project's infrastructure layout and disturbance footprint to reflect further engineering and constructability assessments of the Study Area.

These Project changes have resulted in an amended design that has optimised the location of wind turbines and associated infrastructure, resulting in a smaller Project that now incorporates up to 63 WTGs and ancillary infrastructure as shown in **Appendix A**. The proposed changes are considered to constitute a minor change as defined in Schedule 2 of the Planning Act and are discussed in further detail in **Section 3.0** of this report.

2.1 Summary of Project Design Changes

A summary of the proposed changes to the Project are outlined in **Table 2-1**.

Table 2-1 Summary of Project Changes

Project Element	Description of Proposed Project Change
Project Study Area and Involved Landowners	The proposed Project change does not result in a change to the Study Area or any involved landowners. The Project is still proposed to be developed across the same 17 freehold land parcels described in the initial Planning Report.
Development Corridor and Disturbance Footprint	The Project change includes an updated Development Corridor and Disturbance Footprint resulting from the design optimisation works. The changed Development Corridor and Disturbance Footprint provide for: • the removal of 34 WTGs and minor changes to retained WTG locations • the removal and realignment of some access tracks and underground and overhead electrical reticulation • minor changes to the location and extent of ancillary infrastructure. Materially, the Development Corridor, Disturbance Footprint, and infrastructure proposed to be developed for the Project remains generally consistent with that previously approved in June 2022. This can be seen in a comparison of the previously approved design with the changed design (**Appendix A**). Whilst the Project has not materially changed from that previously approved, it is important to note that: • The Development Corridor has been reduced from 1,975 hectares (ha) to 1,346 ha. This constitutes a 629 ha reduction in the Development Corridor for the Project. • The Disturbance Footprint has been reduced from 1,332 ha to 875.3 ha. This constitutes a 456.7 ha reduction in the Disturbance Footprint for the Project.
Wind Turbine Generators (WTGs)	The Project change has involved a reduction in the number of WTGs for the Project from 'up to 97' to 'up to 63' (**Appendix A**). Whist the Project change has removed 34 WTGs from the layout, the location of WTGs that remain within the development footprint are generally consistent with the layout approved in June 2022. Further, the maximum clearing extent for WTGs remains consistent with that previously approved by SARA in June 2022. The anticipated WTG dimensions, including maximum tip height and blade length, have not changed for the Project.

Project Element	Description of Proposed Project Change
Meteorological Masts	The Project change retains 10 permanent meteorological masts in the layout, which is consistent with the design approved by SARA in June 2022. The location of several permanent meteorological masts has been changed (**Appendix A**); however, their design and clearing extent remains unchanged and their distribution across Project parcels is generally consistent with the design approved in June 2022.
Access Tracks and Site Access	The reduction in WTGs for the Project has resulted in a reduction in the extent of access tracks required to service the Project (**Appendix A**). The proposed Project changes have included several minor amendments to the alignment of waterway crossings to ensure that the design crosses waterways at a generally perpendicular angle. This measure has been included in the updated design to further reduce the extent of vegetation clearing and soil disturbance within riparian areas for the Project. Importantly, the design parameters previously utilised to determine the construction and operational widths for access tracks remains generally consistent with that previously approved by SARA in June 2022. The two site access points in the proposed Project change remain unchanged from the June 2022 design.
Electrical Reticulation and Grid Connection	The proposed change to the Project has resulted in a reduction in the extent of electrical reticulation required to service the Project; however, the proposed Project changes makes provision for a mix of underground and overhead electrical reticulation and is shown in **Appendix A**. The amended design makes provision for an additional substation to service the southern portion of the Project and approximately 5 km of 275 kV transmission line to connect the substation to the grid (**Appendix A**). Whilst the substation connection is new, it is noted that the previous Planning Report flagged that 'up to six' substations may be required for the Project. Further, the new substation has been sited within an area containing Category X (non-remnant) vegetation and is co-located with other Project infrastructure to minimise fragmentation impacts. Further, the design parameters previously utilised to determine the construction and operational widths for electrical reticulation and 275 kV transmission lines remains generally consistent with that previously approved by SARA in June 2022.
Project Construction and Operational Infrastructure	Construction and operational infrastructure included within the proposed design change remains generally consistent with the design approved by SARA in June 2022 and is shown in **Appendix A**. The design change makes provision for: • a site operations and maintenance facility • three temporary concrete batching plants • three temporary construction laydown areas and one construction compound • a 9.87 ha temporary accommodation facility for the Project's construction workforce (up to 450 people). • Temporary workforce accommodation has been included in the proposed design change in response to further investigations undertaken for the Project, which has identified that nearby centres are unlikely to have the capacity to accommodate the construction workforce required for the Project. Furthermore, the temporary workforce accommodation addresses health and safety concerns for the construction workforce driving long distances to and from the nearest town.

2.2 Native Vegetation Clearing Impacts

The proposed changes have resulted in a significant decrease in impacts on native vegetation clearing required for the Project, most notably reducing the overall impact on Category B vegetation from 548.50 ha to 519.94 ha. The overall impacts of the disturbance footprint for the proposed Project changes, calculated using the Regulated Vegetation Management Map v6.06 under the *Vegetation Management Act 1999*, are shown in **Table 2-2**. Further detail regarding the ecological impacts of the proposed changes are provided in **Appendix E** and **Appendix F** of this report.

Table 2-2 Native Vegetation Clearing Impacts

Regulated Vegetation Type	Approved Extent of Vegetation Clearing – Development Corridor (ha)	Proposed Extent of Vegetation Clearing – Disturbance Footprint (ha)	Proposed Extent of Vegetation Clearing – Development Corridor (ha)
Category X	703.03	546.52	817.69
Category R	6.19	3.63	5.59
Category C	-	3.50	4.14
Category B Total	**548.50**	**323.89**	**519.94**
Category B – Least Concern	548.50	323.82	519.85
Category B – Of Concern	-	0.07	0.08
Category B – Endangered	-	-	-
TOTAL	**1,973.30**	**877.55**	**1,347.36**

2.3 Updated Technical Assessments

Several technical assessments for the Project have been updated to reflect the changes described in **Section 2.1**. These updated technical assessments are summarised below, and a summary of the Project's compliance against State Code 23 and State Code 16 is attached to this report as **Appendix B**.

2.3.1 Aviation

An updated Aviation Impact Assessment (AIA) Report has been prepared by Aviation Projects for the revised Project layout and is attached to this report as **Appendix C**.

The updated AIA confirms that the blade tip elevation of the highest WTG (WTG52) will not exceed 828 metres (m) Australian Height Datum (AHD). This is a reduction in the blade tip elevation of the highest WTG from the Project layout approved by SARA in June 2022, which was 844 m AHD. Further, the AIA confirms that the changed Project layout will infringe PANS-OPS surfaces and may infringe on Radar Terrain Clearance Chart (RTCC) surfaces. These impacts were previously documented in the AIA prepared for the existing Project approval.

The updated AIA confirms that the changed Project layout remains compliant with PO1 and PO2 of State Code 23.

2.3.2 Electromagnetic Interference

An updated Electromagnetic Interference (EMI) Assessment Report has been prepared by WSP Australia Pty Ltd (WSP) for the revised Project layout and is attached to this report as **Appendix D**.

The updated EMI assessment prepared by WSP was informed by an updated search of the Australian Communications and Media Authority (ACMA) Database, which identified an additional 41 new towers within a 30 km boundary of the Project. Whilst there were a number of new towers within 30 kms of the Project, no new operators were identified within a 10 km boundary of the Project, and therefore further engagement was not deemed necessary to inform the preparation of the updated EMI assessment. Further, the updated EMI assessment confirms that the Project changes to not introduce any near field exclusion zone impacts or 2nd fresnel zone impacts.

The updated EMI assessment confirms that the changed Project layout remains compliant with PO3 of State Code 23.

2.3.3 Shadow Flicker

Appendix 2 of the *Planning guidance State code 23: Wind farm development February 2022* (the State Code 23 Planning Guidance) states that a detailed shadow flicker assessment is not required for residences beyond a distance of 265 m x the maximum blade chord width for the selected WTG model.

The maximum blade chord width of the WTGs proposed for the Project is 5 m, equating to a shadow flicker assessment distance of 1,325 m. A 1,325 m buffer has been applied to the updated Project layout, as shown on **Figure 2-1**, which demonstrates that the Project changes remain compliant with PO4 of State Code 23 and further detailed shadow flicker assessment is not required.

2.3.4 Ecology

Between 2019 and 2023, extensive field survey programs have been undertaken by Umwelt to document vegetation communities, fauna habitat values, and bird and bat utilisation across the study area . Furthermore, several targeted surveys have been undertaken to document the extent and distribution of Queensland and Commonwealth listed threatened flora and fauna species.

The updated Flora and Fauna Impact Assessments assesses the impacts associated with the Project and confirms there are no changes to the outcomes of the significant residual impact assessments for the Matters of State Environmental Significance (MSES) that occur within the Development Corridor.

Updated ecological reporting has been prepared for the Project change to confirm compliance with PO5 of State Code 23: Wind Farm Development (State Code 23) and State Code 16: Native Vegetation Clearing (State Code 16). The updated Flora and Fauna Impact Assessments are attached to this report as **Appendix E** and **Appendix F** respectively.

In addition to the above, a Preliminary Fauna Management Plan (**Appendix G**) and Preliminary Vegetation Management Plan (**Appendix H**) have been prepared in support of the Project and to comply with Condition 12 of the approval package received by SARA in June 2022.

2.3.5 Traffic and Transport

An updated Traffic Impact Assessment (TIA) Report has been prepared by Access Traffic Consulting (Access Traffic) for the revised Project layout and is attached to this report as **Appendix I**.

The updated TIA identified that the construction phase would introduce the majority of traffic volumes and impacts associated with the Project, with only negligible traffic volumes and impacts expected to occur during the operational phase. Based on the forecast traffic volumes, both the construction and operational phases of the Project are expected to have a minor impact to the surrounding road network. Further, the TIA notes that off-site traffic impacts during the construction phase may be further mitigated due to the possible installation of an onsite temporary accommodation facility provided for in the updated Project layout.

In addition to the above, a preliminary pavement impact assessment of the road network was also undertaken for the construction phase of the Project. The results of the assessment indicate that the heavy vehicle movements associated with the development of the Project is expected to lead to negligible increases in pavement loadings on the majority of the state-controlled road network, with calculated values of loading increase generally below the typical 5% increase trigger threshold.

The updated TIA confirms that the Project changes remain compliant with PO6 and PO13 of State Code 23.

As the WTG specifications, site access, and receiving port for the Project have not changed from the initial Project approval, an updated Transport Route Assessment is not considered necessary for this minor change application.

2.3.6 Stormwater and Drainage

Owing the nature of the Project footprint changes, and the conceptual nature of the stormwater management plan and concept erosion and sediment control plan previously prepared to satisfy PO7 and PO8 of State Code 23, no further updated specialist assessments of stormwater and drainage are considered necessary. Assessments prepared by Umwelt in support of the original development approval are still considered to be relevant and appropriate for the purposes of this minor change application.

2.3.7 Landscape and Visual Amenity

A Landscape and Visual Impact Assessment (LVIA) was prepared by LatStudios for the Project layout approved by SARA in June 2022 to demonstrate compliance with PO9 of State Code 23. LatStudios have prepared a Technical Note for the revised Project design that confirms that the updated layout will have a landscape and visual impact 'of equal or lower significance' to the previously approved layout. Further, the technical note confirms that the findings of the LVIA previously prepared by LatStudios remains valid for the changed Project layout; therefore, the Project is considered to remain consistent with PO9 of State Code 23. A copy of the Technical Note provided by LatStudios is attached to this report as **Appendix J**.

2.3.8 Acoustic

A 1,500 m buffer has been applied to the updated Project layout, as shown on **Figure 2-2**, which demonstrates compliance with the separation distances established by PO10 of State Code 23.

An updated Noise Impact Assessment (NIA) has been prepared by Sonus Pty Ltd (Sonus) for the revised Project layout and is attached to this report as **Appendix K**. The updated NIA includes predictive noise modelling for the updated Project layout in accordance with the methodology established by the State Code 23 Planning Guidance. The updated NIA confirms that the updated layout remains compliant with the noise criteria established by PO11 and PO12 of State Code 23.

2.3.9 Construction Management

Traffic-related construction impacts of the Project changes have been considered through the updates to the TIA attached to this report as **Appendix I**. Owing the nature of the Project footprint changes, and the preliminary nature of construction management documentation previously provided to demonstrate compliance with PO13 of State Code 23, no further updates to existing reporting are considered necessary. Assessments prepared by Umwelt in support of the original development approval are still considered to be relevant and appropriate for the purposes of this minor change application.

2.3.10 Bushfire Management Plan

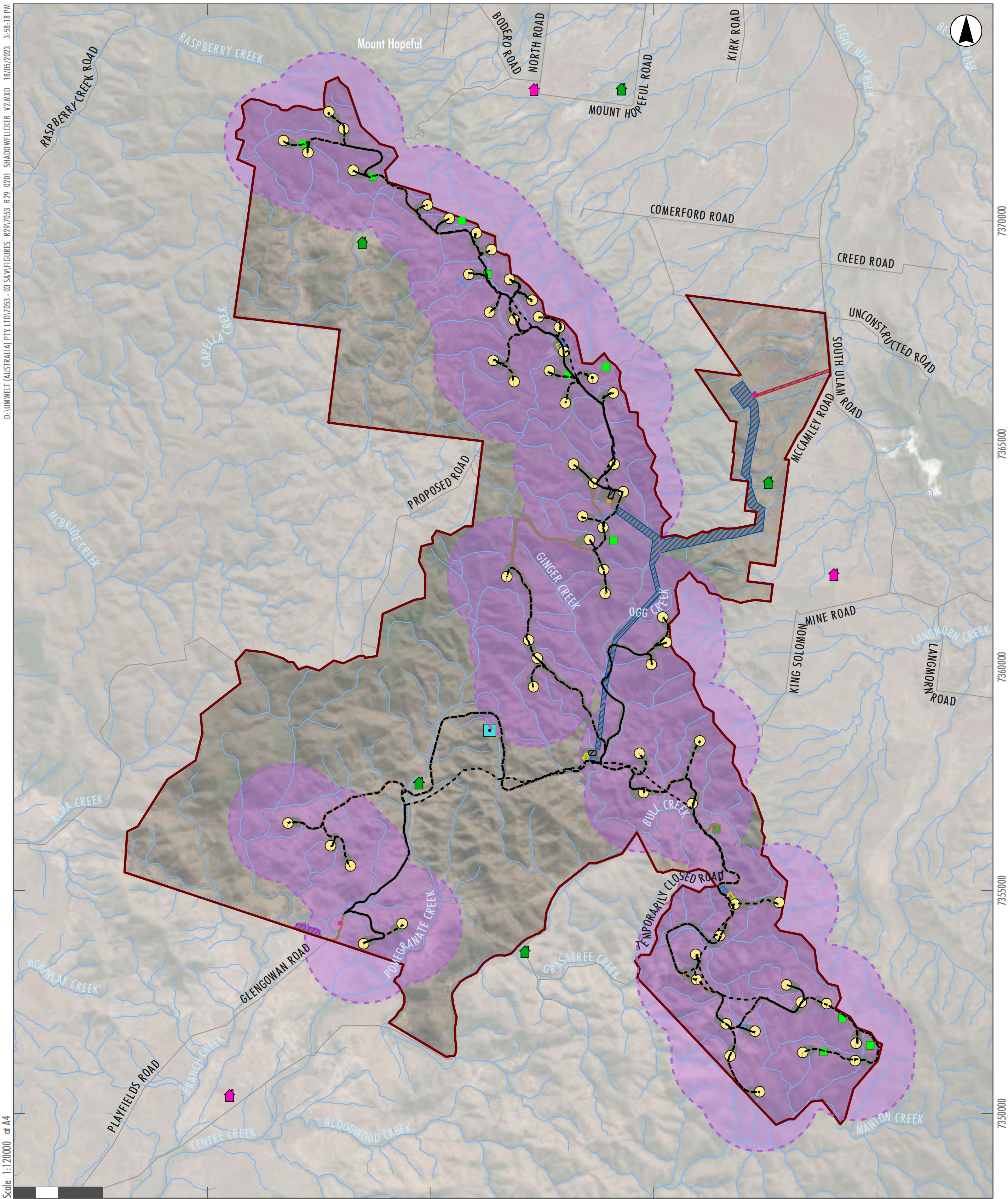
Whilst not required under State Code 23, Neoen have engaged Land and Environment Consultants Pty Ltd (LEC) to prepare a Bushfire Management Plan (BMP) for the Project. The BMP is attached to the report as **Appendix L**.

The BMP confirmed that the Project is within a combination of medium, high and very high potential bushfire intensity areas and the 100 m wide potential impact buffer from these areas. The BMP identifies asset protection zones (APZs) for ground infrastructure based on the requirements of the State Planning Policy bushfire prone area overlay code. Further, the BMP identifies mitigation measures to be implemented to minimise bushfire risk during the construction and operational phases of the Project.

The BMP confirms that with the implementation of all identified mitigation measures the Project will comply with the requirements of the SPP.

2.3.11 Approval Conditions

A review of the development approval conditions has been undertaken and no substantial changes are warranted as part of this minor change request. As such, it is requested that SARA as assessment manager make administrative changes only to the conditions of approval.



0 1,000 2,000 Metres

GDA 1994 MGA Zone 56

Legend

- Study Area (16,757 ha)
- Development Corridor (1347 ha)
- Existing Met Mast
- Involved Dwelling
- Uninvolved Dwelling
- Extent of Potential Shadow Flicker

Proposed Project Infrastructure

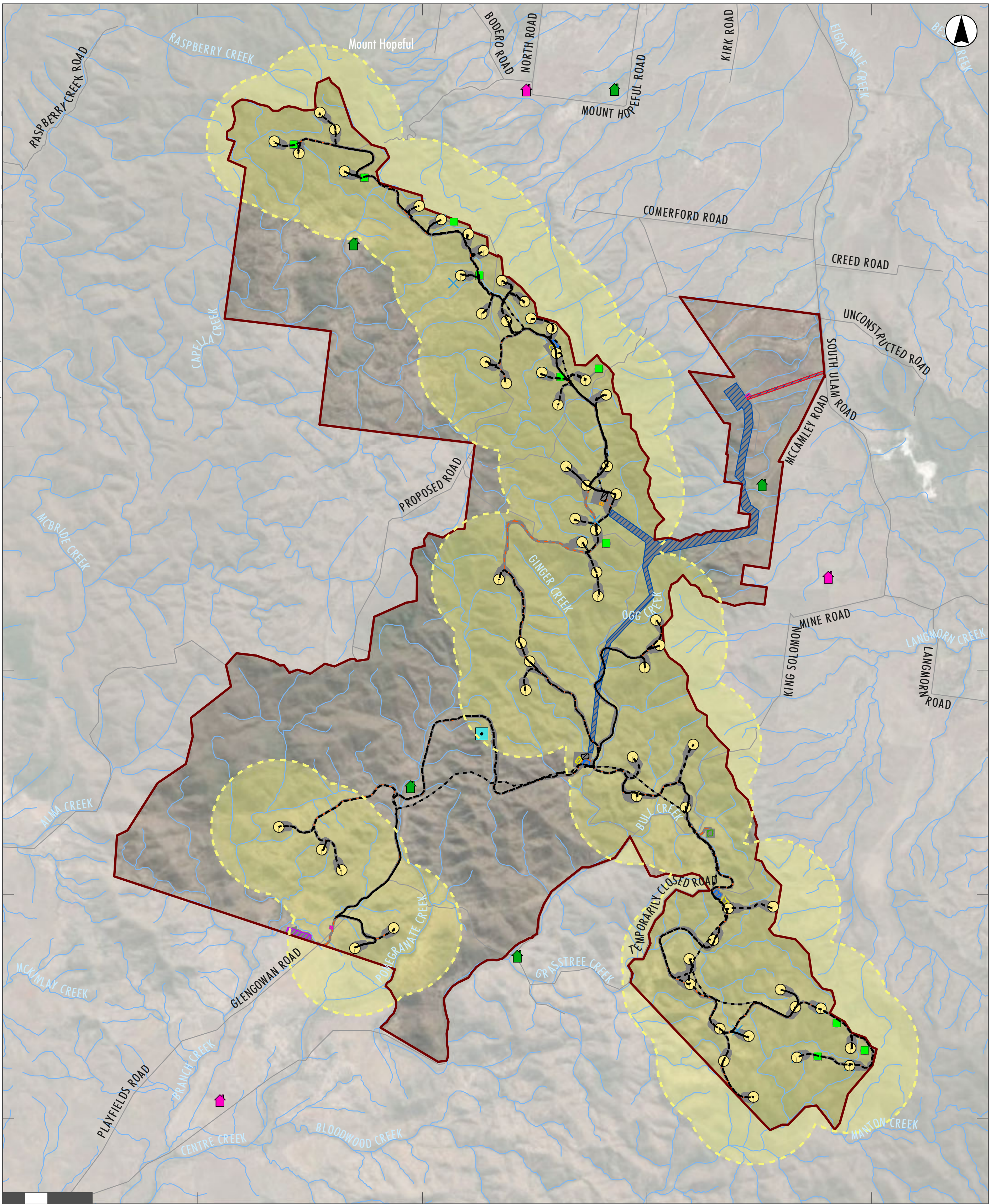
- Overhead / Underground Cabling
- Access Roads
- Turbines
- Permanent Met Masts
- Temporary Met Masts
- Grid Connection Easement
- Access
- Compound
- Concrete Batching Plant
- Temporary Accommodation Camp
- Laydown
- Operation and Maintenance Area
- Site Entry
- Substation
- Transmission Infrastructure

FIGURE 2.1

Potential Shadow Flicker

Image Source: ESRI Basemap (2023) Data source: QLD Spatial (2023)

NB: Layout is Indicative Only



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Legend

- Study Area (16,757 ha)
- Development Corridor (1347 ha)
- Existing Met Mast
- Involved Dwelling
- Uninvolved Dwelling
- Extent of Separation Distances (1500m)

Proposed Project Infrastructure

- Overhead / Underground Cabling
- Access Roads
- Turbines
- Permanent Met Masts
- Temporary Met Masts
- Grid Connection Easement
- Access
- Compound
- Concrete Batching Plant
- Temporary Accommodation Camp
- Laydown
- Operation and Maintenance Area
- Site Entry
- Substation
- Transmission Infrastructure

FIGURE 2.2

Separation Distances

Image Source: ESRI Basemap (2023) Data source: QLD Spatial (2023)

NB: Layout is Indicative Only

3.0 Statutory Provisions

Chapter 3, Part 5, Division 2, Subdivision 2 of the Planning Act prescribes the process, responsibilities, and requirements for changing development approvals after the appeal period lapses.

Under Section 78 of the Planning Act, a person may make a change application to change a development approval to the responsible entity for the application. Change applications must be made in accordance with the requirements established under Section 79 of the Planning Act. Minor change applications are assessed and decided in accordance with Section 81 and Section 81A of the Planning Act respectively.

For a change to be accepted as a 'minor change', the proposed change must comply with minor change definition prescribed under Schedule 2 of the Planning Act:

> ***minor change*** *means a change that—*
>
> *(b) for a development approval—*
>
> > *(i) would not result in substantially different development; and*
> >
> > *(ii) if a development application for the development, including the change, were made when the change application is made would not cause—*
> >
> > > *(A) the inclusion of prohibited development in the application; or*
> > >
> > > *(B) referral to a referral agency, other than to the chief executive, if there were no referral agencies for the development application; or*
> > >
> > > *(C) referral to extra referral agencies, other than to the chief executive; or*
> > >
> > > *(D) a referral agency, in assessing the application under section 55(2), to assess the application against, or have regard to, a matter, other than a matter the referral agency must have assessed the application against, or had regard to, when the application was made; or*
> > >
> > > *(E) public notification if public notification was not required for the development application.*

3.1 Substantially Different Development

Schedule 1 of the Development Assessment Rules (DA Rules) provides guidance to assist applicants and assessment managers to determine whether a proposed change to a development is considered to constitute 'substantially different development'. An assessment of the proposed Project changes against the criteria established under Schedule 1 of the DA Rules is provided in **Table 3-1**.

Table 3-1 Compliance with Substantially Different Development Criterion

DA Rules Schedule 1 Criteria	Compliance
Involves a new use.	**Complies.** The proposed Project change does not introduce or facilitate a new use.
Results in the application applying to a new parcel of land.	**Complies.** The proposed Project change does not apply to a new parcel of land.
Dramatically changes the built form in terms of scale, bulk and appearance.	**Complies.** The proposed change does not dramatically change the built form of the Project in terms of scale, bulk, and appearance. Materially, the Project remains for a wind farm, and the location of retained WTGs is generally consistent with the layout approved by SARA in June 2022. Whilst the proposed change does reduce the number of WTGs associated with the Project from that previously approved, it is noted that the existing approval was for 'up to 97 WTGs'. Further, the design criteria for the WTGs and ancillary infrastructure have not changed from that previously approved by SARA.
Changes the ability of the proposed development to operate as intended.	**Complies.** The proposed Project change does not alter the ability of the wind farm to operate as intended.
Removes a component that is integral to the operation of the development.	**Complies.** The proposed Project change does not remove a component that is integral to the operation of the wind farm.
Significantly impacts on traffic flow and the transport network, such as increasing traffic to the site.	**Complies.** As described in **Section 2.3.5**, the proposed Project has been determined by an RPEQ to have an overall negligible impact on the traffic network during both the construction and operational phases. The proposed changes are expected to result in a reduction of construction traffic particularly as a product of the temporary construction accommodation facility. It is expected that traffic during the operational phase of the Project will remain largely unchanged from that previously approved by SARA.
Introduces new impacts or increases the severity of known impacts.	**Complies.** The proposed Project change does not introduce new impacts or increase the severity of known impacts. Several technical assessments have been prepared for the proposed Project change that confirm compliance with this criterion and are summarised in **Section 2.3** of this report. The proposed change will result in a reduction in vegetation clearing from the original development approval, including a reduction in the clearing of Category B remnant vegetation from 548.5 ha to 323.9 ha.
Removes an incentive or offset component that would have balanced a negative impact of the development.	**Complies.** The proposed Project change does not remove an incentive or offset component that would have balanced a negative impact of the Project.
Impacts on infrastructure provisions.	**Complies.** The proposed Project change does not impact on the provision of infrastructure.

3.2 Remaining Planning Act Criteria

An assessment of the proposed Project changes against the remaining criteria established under (b) (ii) (A) – (E) of the minor change definition is provided in **Table 3-2**.

Table 3-2 Compliance with Planning Act Criterion

<table>
<tr><th>Planning Act Criterion</th><th>Compliance</th></tr>
<tr><td>(A) The inclusion of prohibited development in the application.</td><td>Complies.
The proposed change does not result in the inclusion of any prohibited development.</td></tr>
<tr><td>(B) Referral to a referral agency, other than to the chief executive, if there were no referral agencies for the development application.</td><td rowspan="3">Complies.
The original development application did not trigger any referral agencies and the proposed change will not trigger the need for any additional referral agencies.
Version 3.0 of the State Development Assessment Provisions (SDAP) came into effect in February 2022. The code provisions have not been significantly changed between the previous and current versions.
An assessment against State Code 16 and State Code 23, version 2.6, has been undertaken in consideration of the proposed Project changes. The proposed changes will maintain compliance with SDAP.
A copy of the code responses is provided in Appendix B.</td></tr>
<tr><td>(C) Referral to extra referral agencies, other than to the chief executive.</td></tr>
<tr><td>(D) A referral agency, in assessing the application under section 55(2), to assess the application against, or have regard to, a matter, other than a matter the referral agency must have assessed the application against, or had regard to, when the application was made.</td></tr>
<tr><td>(E) Public notification if public notification was not required for the development application.</td><td>Complies.
The original development application did not require public notification as the development was code assessable. The proposed change will not alter the design to require public notification.</td></tr>
</table>

3.3 Supporting Materials

To support the timely lodgement and assessment of this Minor Change application, Owner's Consent, DA Form 1 and correspondence from Department of Resources that the Relevant Purpose Determination is still suitable is provided within **Appendix M**.

4.0 Conclusion

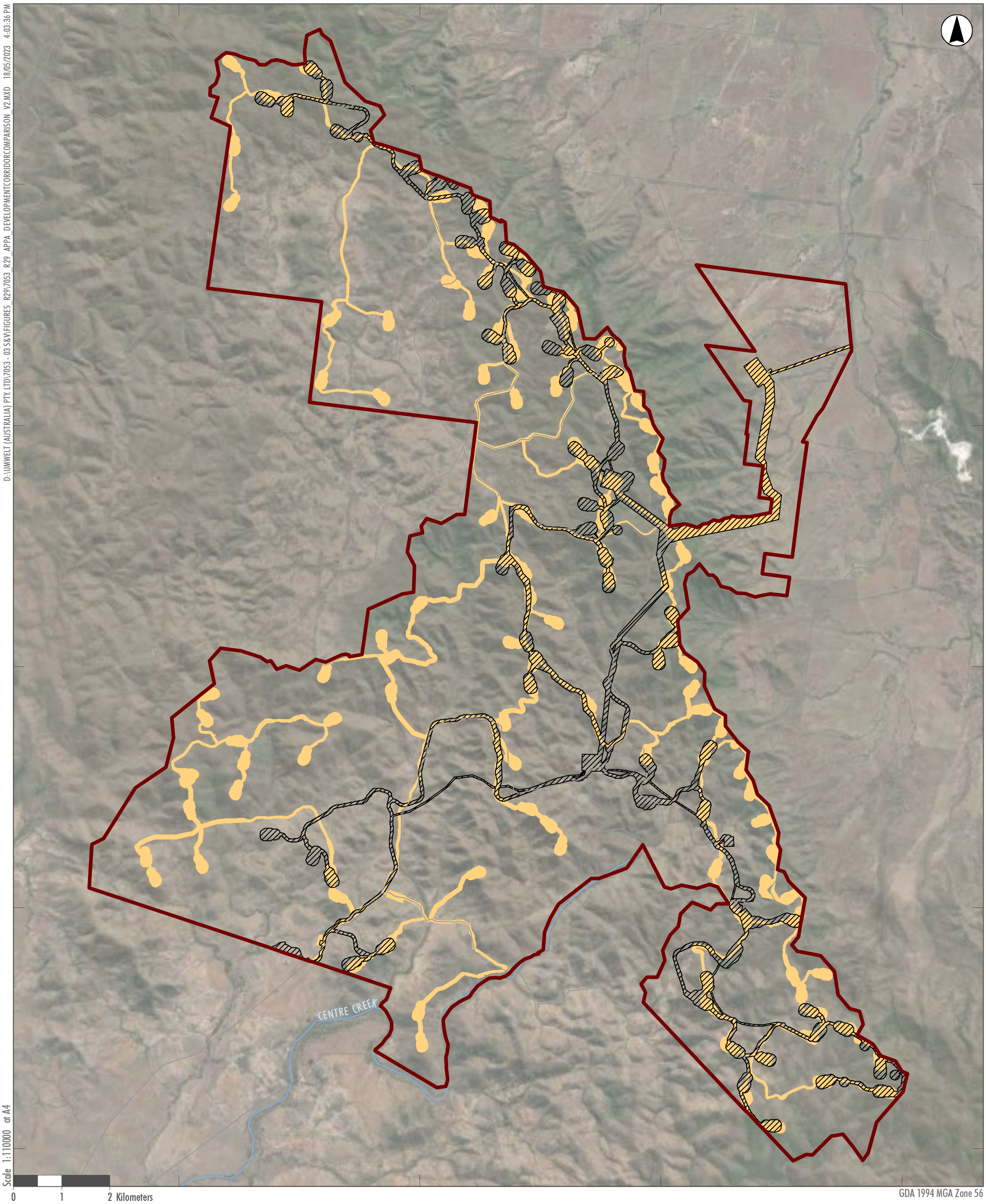
This report has been prepared on behalf of Neoen to support a requested to change to the development approval issued for the Mount Hopeful Wind Farm Project (2109-24892 SDA). The proposed Project changes will not result in substantially different development and is considered to comply with the relevant minor change criteria established under Schedule 2 of the Planning Act.

The Project's design and layout has been refined and optimised based on the consideration of engineering and constructability assessments of the Study Area. The Project remains generally consistent with the layout approved by SARA in June 2022; however, the changes result in a significant reduction in impacts on regulated vegetation when compared with the existing approval.

The proposed changes represent a positive change that ensures that the Project appropriately responds to onsite constraints, whilst optimising overall Project efficiency, and delivers an outcome that remains compliant with the overall purpose and intent of State Code 23 and State Code 16. It is recommended that SARA, as Assessment Manager, favourably consider the application.

APPENDIX A

Project Layout and Comparison

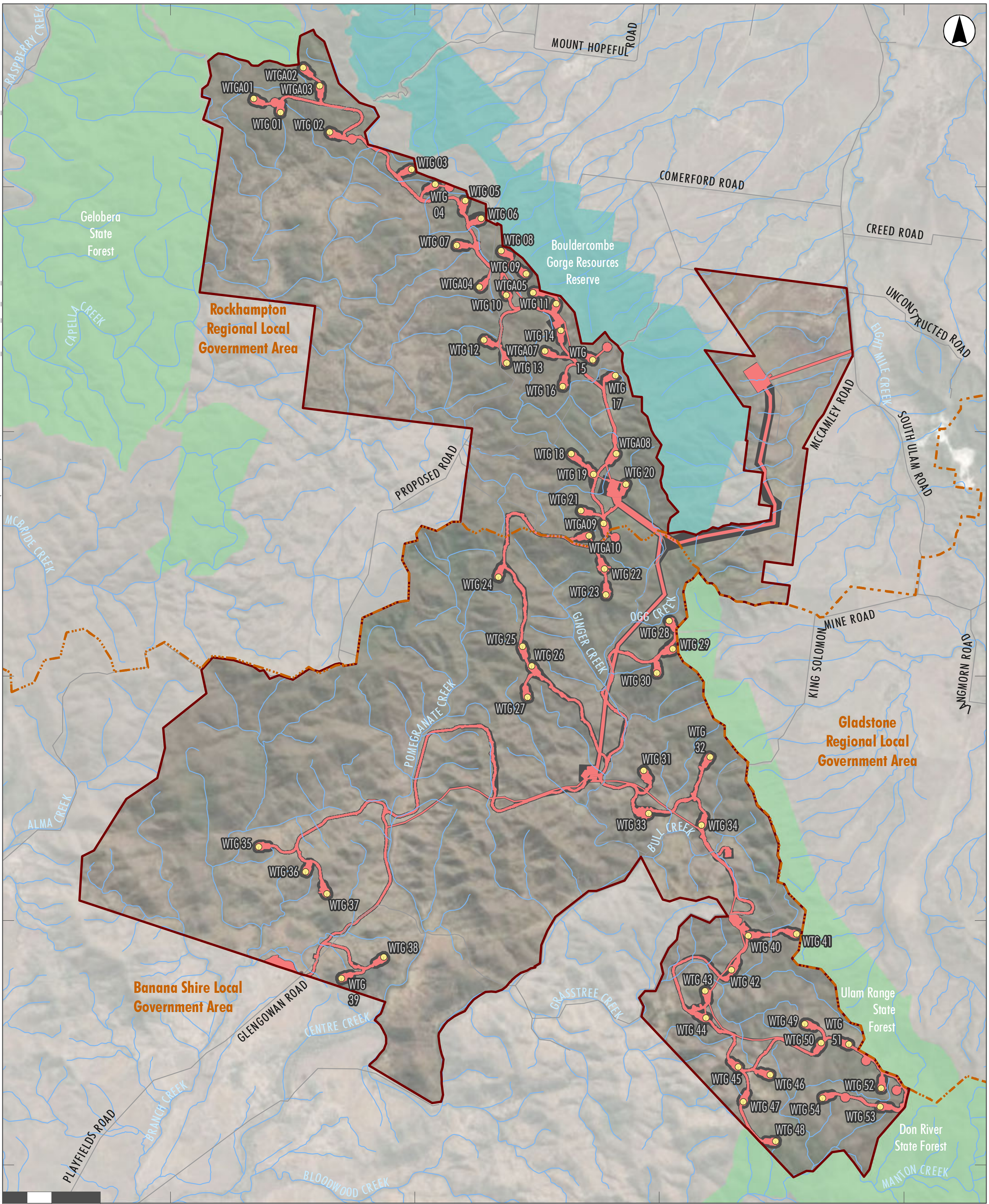


Legend

- Study Area (16,758 Ha)
- Proposed Development Corridor - 1346 ha (2023)
- Approved Development Corridor- 1975 ha (2022)

APPENDIX A

Development Corridor Comparison



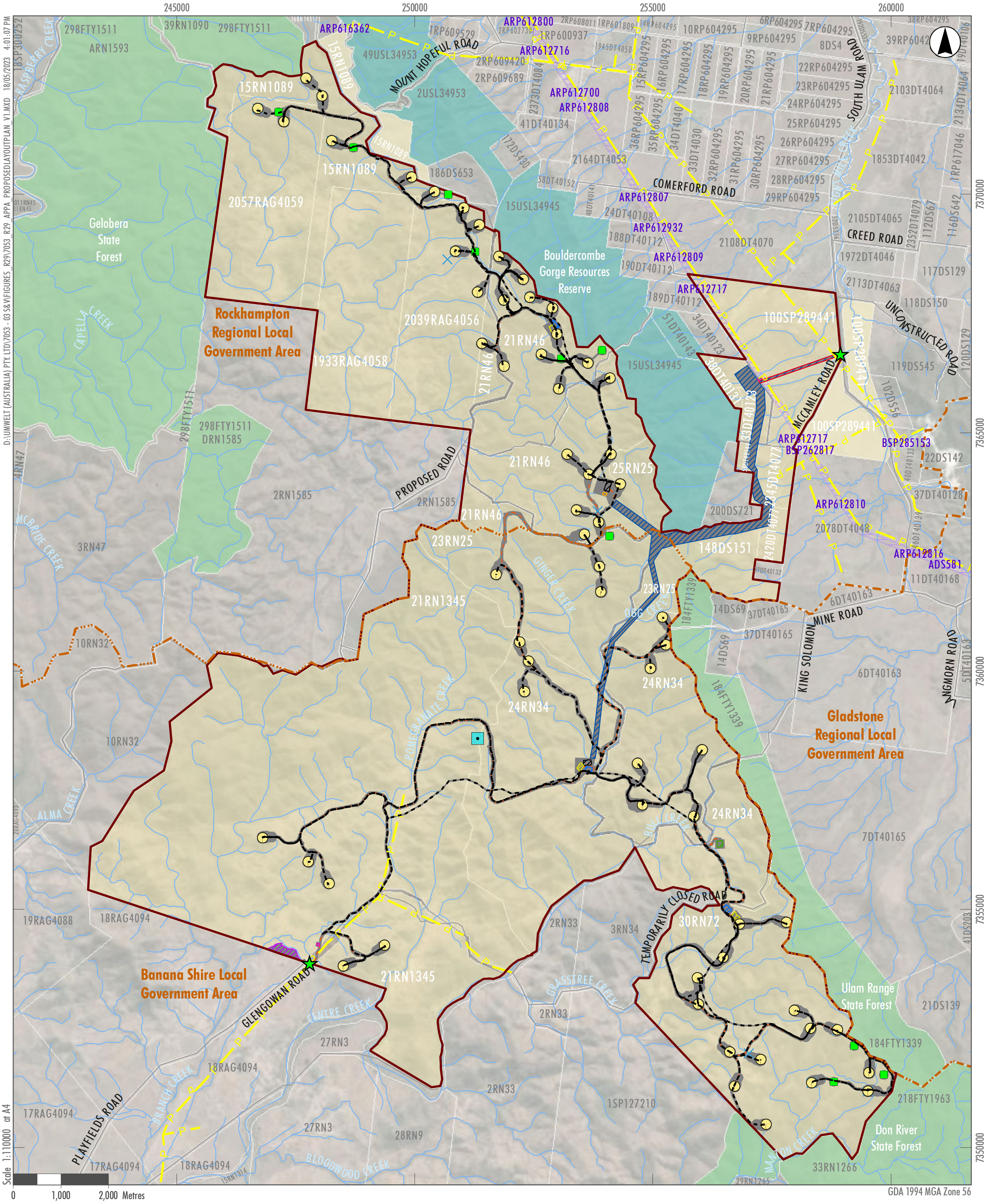
Legend

- Study Area (16,757 ha)
- Disturbance Footprint (877.5 ha)
- Development Corridor (1347 ha)
- Turbines
- Local Government Area (LGA)
- Resources Reserve
- State Forest

APPENDIX A

Extent of Disturbance Footprint and Development Corridor

Image Source: ESRI Basemap (2021) Data source: QLD Spatial (2021)
NB: Layout is Indicative Only



Legend

- Study Area (16,757 ha)
- Project Site (Development Corridor - 1347 ha)
- Participating Properties
- Property Boundaries
- Local Government Area (LGA)
- HV Electricity Network
- Existing Met Mast
- Resources Reserve
- State Forest
- Easments

Proposed Project Infrastructure

- Overhead / Underground Cabling
- Access Roads
- Turbines
- Permanent Met Masts
- Temporary Met Masts
- Site Access
- Compound
- Concrete Batching Plant
- Temporary Accommodation Camp
- Laydown
- Operation and Maintenance Area
- Site Entry
- Substation
- Transmission Infrastructure
- Grid Connection Easement
- Access

APPENDIX A

Proposed Layout Plan

Image Source: ESRI Basemap (2021) Data source: QLD Spatial (2021)

NB: Layout is Indicative Only

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APPENDIX B

State Code 23 and State Code 16 Responses

State code 16: Native vegetation clearing

Table 16.2: General

Performance outcomes	Acceptable outcomes	Response
PO1 Clearing of **vegetation** is consistent with any **notice requiring compliance** on the land subject to the development application, unless a **better environmental outcome** can be achieved.	No acceptable outcome is prescribed.	**Not applicable.**
PO2 Clearing of **vegetation** is consistent with **vegetation management requirements** for **particular regulated areas** unless a **better environmental outcome** can be achieved.	No acceptable outcome is prescribed.	**Not applicable.**
PO3 Clearing of **vegetation** in a **legally secured offset area**: 1. is consistent with the **offset** delivery plan; or 2. is consistent with an **agreement** for the **offset area** on the land subject to the development application; or 3. only occurs if an additional **offset** is provided.	No acceptable outcome is prescribed.	**Not applicable.**

Table 16.3: Public safety, relevant infrastructure activities and / or consequential development of IPA approval

Performance outcomes	Acceptable outcomes	Response
Clearing avoids and minimises impacts		
PO4 Clearing of **vegetation** and **adverse impacts of clearing vegetation** do not occur unless the application has demonstrated that the **clearing** and the **adverse impacts of clearing** have been: 1. reasonably avoided; or	No acceptable outcome is prescribed.	**Complies with PO4.** The proposed Project changes have resulted in a significant decrease in impacts on native vegetation clearing required for the Project, most notably reducing the overall impact on Category B vegetation from 548.5 ha to 323.9 ha. Further, the proposed Project changes have included several minor amendments to the alignment of waterway crossings to ensure that the

Performance outcomes	Acceptable outcomes	Response
2. reasonably minimised where it cannot be reasonably avoided.		design crosses waterways at a generally perpendicular angle. This measure has been included in the updated design to further reduce the extent of vegetation clearing and soil disturbance within riparian areas for the Project.
Clearing associated with wetlands		
PO5 Clearing of **vegetation** within a natural **wetland** and/or within 100 metres of the **defining bank** of a natural **wetland** maintains the composition, structure and function of any **regional ecosystem** associated with any natural **wetland** to protect all of the following: 1. bank stability by protecting against bank erosion; 2. water quality by filtering sediments, nutrients and other pollutants; 3. aquatic habitat; 4. terrestrial habitat.	**AO5.1 Clearing** does not occur in a natural **wetland** or within 100 metres of the **defining bank** of any natural **wetland**. OR **AO5.2 Clearing** within 100 metres of the **defining bank** of any natural **wetland**: 1. does not occur within 10 metres of the **defining bank** of any natural **wetland**; and 2. does not exceed widths in reference table 1 in this code.	**Complies with PO5.1** The Project does not occur within 100 m of the defining bank of any natural wetlands identified on the Vegetation management wetlands map.
PO6 Where **clearing** of **vegetation** in a **regional ecosystem** associated with a natural **wetland** does not maintain the composition, structure and function of the **regional ecosystem**, and cannot be avoided and has been mitigated, an **offset** is provided for any acceptable **significant residual impact**.	No acceptable outcome is prescribed.	**Not applicable.**
Clearing associated with watercourses and drainage features		
PO7 Clearing of **vegetation** within a **watercourse** and/or **drainage feature** and/or within the relevant distance (listed in reference table 2) of a **watercourse** and/or **drainage feature,** maintains the composition, structure and function of the **regional ecosystem** associated with the **watercourse** and/or **drainage feature** to protect all of the following:	**AO7.1 Clearing** does not occur in any of the following areas: 1. inside the **defining bank** of a **watercourse** or **drainage feature**; and 2. within the relevant distance of the **defining bank** of any **watercourse** or **drainage feature** in reference table 2 of this code.	**Complies with PO7.** The Planning Report provided as part of the original development application describes the design approach and measures employed to avoid and minimise ecological impacts associated with the Project layout, including vegetation associated with watercourses and drainage features. Clearing of vegetation associated with watercourses or drainage features will generally only be carried out where access tracks are required to cross these features. The proposed changes to the disturbance footprint for the Project will result in the clearing of 10.68 ha of vegetation within a defined distance of a

Performance outcomes	Acceptable outcomes	Response
1. bank stability by protecting against bank erosion; 2. water quality by filtering sediments, nutrients and other pollutants; 3. aquatic habitat; 4. terrestrial habitat.	OR **AO7.2 Clearing** within any **watercourse** or **drainage feature**, or within the relevant distance of the **defining bank** of any **watercourse** or **drainage feature** in reference table 2 of this code: 1. does not exceed the widths in reference table 1 of this code; and 2. does not occur within 10 metres of the **defining bank**, unless **clearing** is required into or across the **watercourse** or **drainage feature**.	watercourse or drainage feature, and is broken down in detail in Table D 3 of Appendix D of **Appendix G**. Additionally, rehabilitation will be undertaken in temporarily cleared areas within the defined distance from the defining banks of a mapped VM Act watercourse or drainage feature with a stream order of 2 or higher to the extent possible.
PO8 Where **clearing** of **vegetation** in a **regional ecosystem** associated with a **watercourse** and/or **drainage feature** does not maintain the composition, structure and function of the **regional ecosystem**, and cannot be avoided and has been mitigated, an **offset** is provided for any acceptable **significant residual impact**.	No acceptable outcome is prescribed.	**Complies with PO8.** A significant residual impact (SRI) assessment for impacts to remnant vegetation within a defined distance of a watercourse or drainage feature has been undertaken for the Project and is included within Table D 4 of Appendix D of **Appendix G**. This assessment has determined that the clearing of remnant vegetation within a defined distance of a watercourse or drainage feature for the Project is unlikely to result in a SRI on these values.
Connectivity		
PO9 Regional ecosystems on the subject land and any adjacent land retain sufficient **vegetation** to: 1. maintain **ecological processes**; and 2. ensure the **regional ecosystem** remains in the landscape despite **threatening processes**.	**AO9.1 Clearing** occurs in accordance with reference table 3 in this code.	**Complies with PO9** The Landscape Fragmentation and Connectivity (LFC) tool has been used as a decision support tool to quantify any significant impact on connectivity. The results of the LFC tool determined any impact on connectivity areas is not significant. Refer to Section 2.0 of Appendix F of **Appendix D**. Flora and Fauna Assessments have been undertaken for the Project to ensure sufficient vegetation is retained to maintain ecological processes and the regional ecosystem remains in the landscape despite threatening processes.
Soil erosion if the local government is not the assessment manager for the development application		

Performance outcomes	Acceptable outcomes	Response
PO10 Clearing of **vegetation** does not result in **accelerated soil erosion** within or outside the land the subject of the development application.	**AO10.1 Clearing** only occurs if an **erosion and sediment control plan** is developed and implemented to prevent increased **soil erosion and instability** resulting from the **clearing**.	**Complies with AO10.1.** A preliminary erosion and sediment control plan (ESCP) has previously been prepared for the Project and was provided with the original development application. This plan includes mitigation measures to ensure rates of soil loss and sediment movement associated with clearing are maintained within an acceptable level.
Salinity		
PO11 Clearing of **vegetation** within 100 metres of a **salinity expression area** does not contribute to or accelerate **land degradation** through either of the following: 1. **waterlogging**; 2. the **salinisation** of **groundwater**, surface water or soil.	**AO11.1 Clearing** does not occur within 100 metres of a **salinity expression area**.	**Complies with AO11.1.** The Project does not involve clearing within 100 m of a salinity expression area.
Conserving least concern regional ecosystems - Minimising clearing of areas temporarily required to enable construction of the infrastructure		
PO12 Clearing of **vegetation** for temporary use areas to construct necessary infrastructure, such as temporary use roads or access tracks, maintains the composition, structure and function of **least concern regional ecosystems**.	**AO12.1 Clearing** for temporary use areas to construct necessary infrastructure does not occur in a **least concern regional ecosystem**. OR **AO12.2** Total **clearing** for temporary use areas to construct necessary infrastructure in any **regional ecosystem** combined does not exceed the widths prescribed in table reference table 1 of this code. OR **AO12.3** Total **clearing** for temporary use areas to construct necessary infrastructure in any **regional ecosystem** combined does not exceed areas prescribed in table reference table 1 of this code.	**Complies with PO12.** The proposed Project changes have resulted in a significant decrease in impacts on native vegetation clearing required for the Project. Importantly, the Project changes result in a reduction in the overall impact on Category B vegetation from 548.5 ha to 323.9 ha, with 323.8 ha of this extent occurring in Category B 'least concern' areas. Rehabilitation for the Project remains consistent with the original development approval issued by SARA in June 2022. Generally, rehabilitation is proposed to occur in areas of the disturbance footprint that have been subject to temporary clearing. Rehabilitation will include the planting of native species known to the region, consistent with the characteristics of surrounding retained vegetation. It is estimated that approximately 20% of the total disturbance footprint will be rehabilitated. However, the specific locations of rehabilitation will not be determined until detailed design of the Project has been completed.

Performance outcomes	Acceptable outcomes	Response
PO13 Where **clearing** of **vegetation** in a **regional ecosystem** for temporary use areas to construct necessary infrastructure does not maintain the composition, structure and function of the **regional ecosystem**, and cannot be avoided and has been mitigated, the **cleared** area is **rehabilitated**.	No acceptable outcome is prescribed.	The proposed Project changes have resulted in a significant decrease in impacts on native vegetation clearing required for the Project. Importantly, the Project changes result in a reduction in the overall impact on Category B vegetation from 548.5 ha to 323.9 ha, with 323.8 ha of this extent occurring in Category B 'least concern' areas. Rehabilitation for the Project remains consistent with the original development approval issued by SARA in June 2022. Generally, rehabilitation is proposed to occur in areas of the disturbance footprint that have been subject to temporary clearing. Rehabilitation will include the planting of native species known to the region, consistent with the characteristics of surrounding retained vegetation. It is estimated that approximately 20% of the total disturbance footprint will be rehabilitated. However, the specific locations of rehabilitation will not be determined until detailed design of the Project has been completed.
Conserving endangered and of concern regional ecosystems		
PO14 Clearing of **vegetation** maintains the composition, structure and function of **endangered regional ecosystems** and/or **of concern regional ecosystems**.	**AO14.1 Clearing** does not occur in an **endangered regional ecosystem** or an **of concern regional ecosystem**. OR **AO14.2** Total **clearing** of **endangered regional ecosystems** and **of concern regional ecosystems** combined does not exceed the widths prescribed in table reference table 1 of this code. OR **AO14.3** Total **clearing** of **endangered regional ecosystems** and **of concern regional ecosystems** combined does not exceed areas prescribed in table reference table 1 of this code.	**Complies with PO14.** The Planning Report provided as part of the original development application describes the design approach and measures employed to avoid and minimise ecological impacts associated with the Project layout. The proposed changes to the disturbance footprint for the Project will result in the clearing of 0.02 ha of Category B 'of concern' vegetation, including 0.01 ha of RE 11.3.2 and 0.01 ha of RE 11.3.4. This 'of concern' vegetation is contained within a heterogenous polygon that also contains 0.04 ha of Category B 'least concern' RE 11.3.25. Areas presented in Table 2-2 of the Minor Change Report represent this entire polygon and have been rounded to 0.1 ha. Further to the above, the disturbance footprint for the Project does not impact on Category B 'endangered' vegetation.
PO15 Where **clearing** of **vegetation** in an **endangered regional ecosystem** or an **of concern regional ecosystems** does not maintain the composition,	No acceptable outcome is prescribed.	**Complies with PO15.** A SRI assessment for impacts to Category B 'of concern' vegetation has been undertaken for the Project and is included within Table D 2 of Appendix D of **Appendix G**. This assessment has determined that the

Performance outcomes	Acceptable outcomes	Response
structure and function of the **regional ecosystem**, and cannot be avoided and has been mitigated, the cleared area: 1. is **rehabilitated**; or 2. where the **cleared** area cannot reasonably be **rehabilitated**, an **offset** is provided for any acceptable **significant residual impact**.		clearing of Category B 'of concern' vegetation is unlikely to result in a SRI on these values.
Essential habitat excluding essential habitat for *Phascolarctos cinereus* (koalas) if development is assessable under Schedule 10, Part 10 of the Planning Regulation 2017		
PO16 Clearing of **vegetation** in a **regional ecosystem** that is an area of **essential habitat** maintains the composition, structure and function of the **regional ecosystem** for each **protected wildlife** species individually.	**AO16.1 Clearing** does not occur in **essential habitat**. OR **AO16.2 Clearing** in **essential habitat** does not exceed the widths prescribed in reference table 1 of this code. OR **AO16.3 Clearing** in **essential habitat** does not exceed the areas prescribed in table reference table 1 of this code.	**Not applicable.**
PO17 Where **clearing** of **vegetation** in a **regional ecosystem** that is an area of **essential habitat** does not maintain the composition, structure and function of the **regional ecosystem**, and cannot be avoided and has been mitigated, an **offset** is provided for any acceptable **significant residual impact for** each **protected wildlife** species individually.	No acceptable outcome is prescribed.	**Not applicable.**
Acid sulfate soils if the local government is not the assessment manager for the development application		
PO18 Clearing of **vegetation** does not result in, or accelerate, disturbance of acid sulfate soils or changes to the	**AO18.1 Clearing** does not occur in **land zone 1**, **land zone 2** or **land zone 3**.	**Complies with AO18.2.** The Project occurs on land ranging between 190 m AHD and 500 m AHD and accordingly is not expected to impact on acid sulfate soils.

Performance outcomes	Acceptable outcomes	Response
hydrology of the location that will result in either of the following: 1. aeration of horizons containing iron sulphides; 2. mobilisation of acid or metals.	OR **AO18.2 Clearing** in **land zone 1**, **land zone 2** or **land zone 3** in areas below the five metre Australian Height Datum only occurs where: 1. **mechanical clearing** does not disturb the soil to a depth greater than 30 centimetres; and 2. acid sulfate soils are managed consistent with the soil management guidelines in the Queensland Acid Sulfate Soil Technical Manual.	

State code 23: Wind farm development

Wind farm state code planning guidelines provides direction on how to address this code.

Table 23.1: Material change of use

Performance outcomes	Acceptable outcomes	Response
Aviation safety, integrity and efficiency		
PO1 Development does not adversely affect the safety, operational integrity and efficiency of **air services** and aircraft operations as a result of its: 1. location; 2. siting; 3. design; 4. operation.	No acceptable outcome is prescribed.	**Complies with PO1** An aviation risk assessment including stakeholder consultation has been undertaken for the Project. The aviation risk assessment demonstrates that the Project will not adversely affect the safety, operational integrity or efficiency of air services and aircraft operations subject to the implementation of proposed mitigation of impacts to PANS-OPS and amendment to the RTCC sector.
PO2 Development includes lighting and marking measures that ensure the safety, operational integrity and efficiency of **air services** and aircraft operations.	No acceptable outcome is prescribed.	**Complies with PO2** An aviation risk assessment concluded the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft. Turbines will be marked with white colour to provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents. Consideration will given to marking any meteorology masts according to the requirements set out in MOS 139 Section 8 Division 10 Obstacle Markings (as modified by the guidance in NASF Guideline D).
Electromagnetic interference		
PO3 Development is designed, located and sited to protect pre-existing television, radar and radio transmission and reception from **electromagnetic interference**.	No acceptable outcome is prescribed.	**Complies with PO3** The Project has completed an electromagnetic interference assessment which demonstrates that the Project is unlikely to adversely affect pre-existing television, radio transmission and

Performance outcomes	Acceptable outcomes	Response
		reception. Neoen and the Bureau of Meteorology are in negotiations to mitigate the impact on the Gladstone meteorological radar, either through technical interventions, or through the use of potential operational limits to ensure that the radar can maintain operational efficiency.
Shadow flicker		
PO4 Development is designed so that the modelled blade **shadow flicker** impacts on existing or approved **sensitive land uses** do not exceed 30 hours per annum and 30 minutes per day.	No acceptable outcome is prescribed.	**Complies with PO4** Turbines have been located at a distance greater than 265 metres x maximum blade chord ensuring that sensitive land uses do not exceed 30 hours per annum and 30 minutes per day of shadow flicker impacts. No assessment is required for residences beyond this distance.
Flora and fauna		
PO5 Development is designed, sited and operated to ensure that flora, fauna and associated ecological processes are protected from adverse impacts.	No acceptable outcome is prescribed.	**Complies with PO5** Neoen has provided an ecological assessment that identifies and assesses the potential risk to flora, fauna and associated ecological processes. The reports demonstrates how potential risks to ecological values have been avoided or minimised through the siting and design of the Project.
Vehicular access and movement		
PO6 Development provides suitable vehicular access, manoeuvring areas and parking for the ongoing operation and maintenance activities associated with the **wind farm**.	No acceptable outcome is prescribed.	**Complies with PO6** The Project demonstrates suitable vehicular access, manoeuvring areas and parking for the ongoing operation and maintenance activities associated with the Project. Two permanent access points to the Project have been proposed for the construction and operational phases of the Project.
Water quality		
PO7 Development maintains the water quality of receiving waters.	No acceptable outcome is prescribed.	**Complies with PO7** The Project complies with PO7 by demonstrating that the location of Project infrastructure has been designed to avoid, minimise or mitigate adverse impacts on water quality objectives to achieve no worsening to receiving waters during the operation

Performance outcomes	Acceptable outcomes	Response
		of the Project. The stormwater assessment completed for the Project demonstrates that the potential impacts can be appropriately managed by implementing of a range of industry standard mitigation measures throughout the construction and operational phases of the Project.
Natural drainage patterns		
PO8 Development maintains the natural drainage patterns on the site by protecting: 1. bank stability by limiting bank erosion; 2. **water quality objectives** by filtering sediments, nutrients and other pollutants; 3. aquatic habitats; 4. terrestrial habitats.	No acceptable outcome is prescribed.	**Complies with PO8** The clearing of vegetation within watercourses or drainage features has been avoided or minimised as far as practicable. Details on the location of the Project infrastructure and its interaction with vegetation has been provided. The Project will seek to avoid locating any non-linear infrastructure (e.g. turbine hardstands, substations etc.) within watercourses, whilst linear infrastructure (i.e. roads and powerlines) have been designed to limit to the greatest extent possible the number of waterway crossings required for this type of infrastructure. Where waterway crossings are required, these will be designed to reduce the width of clearing within the waterway corridor. Impacts to waterways will be further minimised through the implementation of rehabilitation, weed and soil and water management plans. The stormwater report addresses the impacts of the Project and demonstrates that the quantity and quality of stormwater, wastewater, discharges and overland flow leaving the Project site can be suitably managed and treated to the quality and quantity of receiving waters prior to discharge.
Areas identified by a local government as having high scenic amenity		
PO9 Development in an area identified by a local government as having high **scenic amenity** is sited and designed to protect the character, **scenic amenity** and **landscape values** of the locality and region.	No acceptable outcome is prescribed.	**Complies with PO9** Adverse impacts on the character, scenic amenity and landscape values of the locality and region have been minimised through effective siting and design. A landscape and visual assessment was undertaken for the Project and determined that the

Performance outcomes	Acceptable outcomes	Response
		visual effect of the Project is likely to be low from the majority of publicly accessible locations surrounding the Project. No nationally significant landscapes are directly affected, no regionally important scenic viewpoints would be significantly affected and the number of visual receptors anticipated to experience significant impacts is low due to the rural location of the Site.
Acoustic amenity		
PO10 Development is sited and designed to protect the amenity of existing or approved **sensitive land uses** on **non-host lots** from acoustic impacts.	**AO10.1** A separation distance of at least 1500 metres is achieved between **wind turbines** and existing or approved **sensitive land uses** on **non-host lots**. OR **AO10.2** Where **wind turbines** are proposed within 1500 metres of existing or approved **sensitive land uses** on **non-host lots**, written agreements (**deeds of release**) from all affected **non-host lot** owners are provided accepting the reduced setback.	**Complies with PO10.1** The Project provides a setback of at least 1,500 metres from existing or approved sensitive land uses on non-host lots.
PO11 The predicted acoustic level at all noise affected existing or approved **sensitive land uses** on **host lots** does not exceed the criteria stated in table 23.2.	No acceptable outcome is prescribed.	**Complies with PO11** The predicted acoustic level at all noise affected existing or approved sensitive land uses does not exceed the criteria stated in table 23.2 a noise impact assessment was conducted for the operation of the Project in general accordance with the requirements of the Planning guidance State code 23: Wind farm development.
PO12 The predicted acoustic level at all noise affected existing or approved **sensitive land uses** on **non-host lots** does not exceed the criteria stated in table 23.3.	No acceptable outcome is prescribed.	**Complies with PO12** The predicted acoustic level at all noise affected existing or approved sensitive land uses does not exceed the criteria stated in table 23.3 a noise impact assessment was conducted for the operation of the Project in general accordance with the requirements of the Planning guidance State code 23: Wind farm development.
Construction management		

Performance outcomes	Acceptable outcomes	Response
PO13 Construction activities associated with the development do not adversely impact **transport networks** and road infrastructure.	No acceptable outcome is prescribed.	**Complies with PO13** A preliminary construction management plan has been prepared that lists the activities to be undertaken during construction of the Project and demonstrates how the Project will avoid, minimise and mitigate adverse impacts on environmental values, water quality objectives, amenity, local transport networks and road infrastructure

APPENDIX C

Aviation Impact Assessment

March 2023

AVIATION IMPACT ASSESSMENT

MOUNT HOPEFUL WIND FARM

Prepared for Neoen Australia Pty Ltd

AVIATION PROJECTS

AVIATION PROJECTS

DOCUMENT CONTROL

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1.0	Final Draft	20 March 2023		

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AVIATION PROJECTS

TABLE OF CONTENTS

AVIATION PROJECTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

AAAA	Aerial Application Association of Australia
AC	Advisory Circular
AFAC	Australasian Fire and Emergency Services Council
AGL	above ground level
AHD	Australian Height Datum
AIA	aviation impact assessment
AIP	Aeronautical Information Package
AIS	aviation impact statement
ALA	aircraft landing area
ALARP	as low as reasonably practicable
AMSL	above mean sea level
ARP	Aerodrome Reference Point
AS	Australian Standards
AsA	Airservices Australia
BSC	Banana Shire Council
CAO	Civil Aviation Orders
CAR	Civil Aviation Regulation (1988)
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation (1998)
CFIT	controlled flight into terrain
CNS	communications, navigation and surveillance
CTAF	common traffic advisory frequency
DAH	Designated Airspace Handbook
ERC-H	en-route chart high
ERC-L	en-route chart low
ERSA	En Route Supplement Australia
GA	general aviation
ICAO	International Civil Aviation Organization

IFR	instrument flight rules
IMC	instrument meteorological conditions
LGA	local government area
LSALT	lowest safe altitude
MOC	minimum obstacle clearance
MOS	Manual of Standards
MSA	minimum sector altitude
NASAG	National Airports Safeguarding Advisory Group
NASF	National Airports Safeguarding Framework
NDB	non-directional beacon
OLS	obstacle limitation surface
PANS-OPS	Procedures for Air Navigation Services - Aircraft Operations
RFDS	Royal Flying Doctor Service
RNAV	Area Navigation
RNP	Required Navigation Performance
RPT	regular public transport
RRC	Rockhampton Regional Council
RSR	route surveillance radar
SARA	State Assessment and Referral Agency
SDAP	State Development Assessment Provisions
VFR	visual flight rules
VFRG	visual flight rules guide
VMC	visual meteorological conditions
VOR	very high frequency omni-directional range
WMTs	wind monitoring towers
WTGs	wind turbine generators

UNITS OF MEASUREMENT

ft	feet	(1 ft = 0.3048 m)
km	kilometres	(1 km = 0.5399 nm)
m	metres	(1 m = 3.281 ft)
nm	nautical miles	(1 nm = 1.852 km)

DEFINITIONS

Definitions of key aviation terms are included in Annexure 2.

EXECUTIVE SUMMARY

Introduction

Neoen seeks planning approval for the proposed Mount Hopeful Wind Farm (the Project).

The Project consists of up to 63 wind turbines and associated infrastructure to be developed over the project area. The project area is located approximately 60 km (32 nm) west from Gladstone Airport, 40 km (22 nm) south from Rockhampton Airport and 61 km (33 nm) north of Thangool Aerodrome.

The maximum tip height of the WTGs will be up to 260 m above ground level (AGL).

Aviation Projects has been engaged by UMWELT to prepare an Aviation Impact Assessment (AIA) for the proposed Project and formally consult with aviation agencies before submitting the DA for consideration by the State Assessment and Referral Agency (SARA) of the Queensland Department of State Development, Infrastructure, Local Government and Planning (DSDILGP).

The AIA will review potential impacts and provide aviation safety advice in respect of relevant requirements of air safety regulations and procedures and undertake consultation with relevant aviation agencies.

The AIA and supporting technical data will provide evidence and analysis for the planning application to demonstrate that appropriate risk mitigation strategies have been identified.

Project description

The proposed Project will comprise the following:

- up to 63 wind turbines
- maximum overall height (tip height) of the wind turbines is up to 260 m above ground level (AGL)
- highest wind turbine is T52 with ground elevation of 568 m Australian Height Datum (AHD) and maximum height of a WTG vertical blade tip of 828 m (2716.5 ft above mean sea level (AMSL))
- highest wind turbine within 30 nm of Rockhampton Airport is T18 with ground elevation of 545 m AHD and maximum height of a WTG vertical blade tip of 805 m (2641 ft AMSL)
- 10 temporary or permanent wind monitoring towers (WMTs) with a maximum height of up to 170 m (558ft) AGL, which will be reported to Airservices Australia once the final locations are confirmed prior to construction.

Conclusions

Based on a comprehensive analysis and assessment detailed in this report, the following conclusions were made:

Planning considerations

The Project as proposed satisfies the following Acceptable Outcomes of State Code 23:

Performance outcomes	*Acceptable outcomes - Compliance*
Aviation safety, integrity and efficiency	
PO1 Development does not adversely affect the safety, operational integrity and efficiency of air services and aircraft operations as a result of its: 1. location 2. siting 3. design 4. operation.	No acceptable outcome is prescribed
PO2 Development includes lighting and marking measures to ensure the safety, operational integrity and efficiency of air services and aircraft operations.	No acceptable outcome is prescribed

Based on performance outcomes PO1 and PO2, the following actions will support an application in demonstrating compliance with State Code 23 addressing aviation safety, integrity and efficiency:

- Demonstrate that all potential risks to air services have been identified
- Provide evidence from a suitably qualified aerodrome consultant / specialist that the development will not adversely affect the safety, operational integrity and efficiency of air services: and
- The methodology for preparing the risk assessment is contained in the NASF Guideline D *Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation*.

The risk assessment will have regard to all potential aviation activities within the vicinity of the Project site including recreation, commercial, civil (including for agricultural purposes) and military operations.

The AIS of this report identifies high level risks, risk mitigation measures and development constraints that are likely to be applicable to the aviation risk assessment.

Certified airports

1. Rockhampton Airport (YBRK) is the only certified airport located within 30 nm of the Project.

2. The Project is located outside the 10 nm MSA of Rockhampton Airport but within the 25 nm MSA of Rockhampton Airport with limiting height (PANS-OPS) of 2500 ft AMSL, based on the published MSA of 3500 ft.
3. The maximum overall height of a WTG located within 30 nm of the airport is T18, with a reported height of 805 m AHD (2641.1 ft AMSL), which means that WTG T18 will infringe the PANS-OPS surface by 141.1 ft, requiring the 25 nm MSA PANS-OPS surface of 2500 to be increased by 200 ft to 2700, bringing the published 25 nm MSA minimum altitude up to 3700 ft AMSL.
4. An alternative and potentially less impactful solution would be to sectorise the 25 nm MSA so that the relevant sector over the wind farm would have an MSA of 3700 ft AMSL (based on the highest overall wind turbine T18 at 805 m AHD (2641.1 ft AMSL), while the remaining majority of the 25 nm MSA area would retain the lower 3500 ft AMSL.
5. The YBRK area navigation global navigation satellite system (RNP) approach procedures to both runways 15 and 33 have an initial approach altitude and missed approach altitude of 3500 ft AMSL, based on the 25 nm MSA. The minimum holding altitude for the holding patterns for all approaches is also at 3500 ft.
6. Similarly, the ground-based non-directional beacon (NDB)-A or very high frequency omni-directional range (VOR)-A, VOR RWY 15 and VOR RWY 33 procedures have a missed approach altitude of 3500 ft AMSL, based on the 25 nm MSA.
7. If the 25 nm MSA is increased as a result of the wind turbines, whether through sectorising or increasing the overall MSA, then there will be a consequential increase in the initial approach and/or missed approach altitudes and holding altitudes of these procedures.
8. There will be no impact on other altitudes, including descent minima, of either of these procedures.
9. There will be no impact on circling areas or obstacle limitation surfaces of any certified airport.

Obstacle Limitation Surfaces (OLS)

10. The Project is located outside the horizontal extent of and will not affect Rockhampton Airport OLS.

Aircraft Landing Areas (ALAs)

11. As a guide, an area of interest within a 3 nm radius of an aircraft landing area (ALA) is used to assess potential impacts of proposed developments on aircraft operations at or within the vicinity of the ALA.
12. There are no ALAs within 3 nm of the project.

Air Routes and Lowest Safe Altitude

13. The Project will not impact on any nearby air routes or grid lowest safe altitudes (LSALT).

Airspace

14. The project area is located outside of controlled airspace (wholly within Class G airspace), within the horizontal extent but below Rockhampton Airport's controlled airspace (lower limit for Class D airspace of 3500 ft AMSL during operational hours for Rockhampton Air Traffic Control Tower). Outside of operational hours of Rockhampton Tower, the Lower Limit of Class C above the project site is 4500 ft AMSL.

Aviation Facilities

15. The wind turbines of the Project will not infringe any protection areas associated with aviation facilities.

Radar

16. The Mt Alma Route Surveillance Radar (RSR) is located approximately 16.6 km south of the project. It is unlikely that the Project will impact Mt Alma RSR.

Aviation Impact Statement

17. Based on the proposed Project layout and overall turbine overall blade tip height limit of 260 m AGL, the blade tip elevation of the highest wind turbine, which is WTG52, will not exceed 828 m AHD (2716.5 ft AMSL).

18. This AIS concludes that the proposed Project:

    - will not infringe any OLS surfaces
    - will infringe PANS-OPS associated with the 25 nm MSA and consequential impacts to approach commencement altitudes, missed approach final altitude and minimum holding altitudes
    - may infringe Radar Terrain Clearance Chart surfaces
    - will not have an impact on nearby designated air routes
    - will not have an impact on the grid LSALT
    - is wholly contained within Class G airspace
    - is outside the clearance zones associated with aviation navigation aids and communication facilities.

Obstacle lighting risk assessment

19. Aviation Projects has undertaken a safety risk assessment of the Project and concludes that WTGs and WMTs will not require obstacle lighting to maintain an acceptable level of safety to aircraft.

Consultation

20. An appropriate and justified level of consultation was undertaken with relevant parties. Refer to Section 5 for details of the stakeholders and a summary of the consultation.

Summary of key recommendations

Recommended actions resulting from the conduct of this assessment are provided below.

Notification and reporting

1. 'As constructed' details of WMT and WTG coordinates and elevation should be provided to Airservices Australia, by submitting the form at this webpage: https://www.airservicesaustralia.com/wp-content/uploads/ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf to the following email address: vod@airservicesaustralia.com.
   Although Airservices Australia has reviewed the previous wind farm, details of the revised wind farm must be provided to Airservices Australia, at this email address: airport.developments@airservicesaustralia.com prior to the construction of the wind farm. This will occur when approval to provide this AIA to Airservices Australia is provided.

2. CASR 139.165 requires the owner of a structure (or proponents of a structure) that will be 100 m or more above ground level to inform CASA. This must be given in written notice and contain information on the proposal, the height and location(s) of the object(s) and the proposed timeframe for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.
   The proponent is required to report the WMT to CASA in accordance with CASR 139.165, as soon as practicable after forming the intention to construct or erect the proposed object or structure.
   The notification should be provided to CASA via email to Airspace.Protection@casa.gov.au.

3. Department of Defence should be consulted again as there has been a subsequent modification in the wind turbine height or scale of development, using the following email address: land.planning@defence.gov.au

4. Any obstacles above 110 m AGL (including temporary construction equipment) should be reported to Airservices Australia NOTAM office until they are incorporated in published operational documents. With respect to crane operations during the construction of the Project, a notification to the NOTAM office may include, for example, the following details:

   a. The planned operational timeframe and maximum height of the crane

   b. Either the general area within which the crane will operate and/or the planned route with timelines that crane operations will follow.

5. Details of the wind farm have provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations.

6. To facilitate the flight planning of aerial application operators, details of the Project, including location and height information of wind turbines, wind monitoring towers and overhead transmission lines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.

Operation

7. Whilst not a statutory requirement, Neoen should consider engaging with local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.

Marking of turbines

8. The rotor blades, nacelle and the supporting mast of the wind turbines should be painted white, typical of most wind turbines operational in Australia. No additional marking measures are required for WTGs.

Lighting of turbines

9. Aviation Projects has assessed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft.

Marking of wind monitoring towers

10. Consideration should be given to marking the wind monitoring towers according to the requirements set out in MOS 139 Chapter 8, Division 10, (as modified by the guidance in NASF Guideline D). Specifically:

    a. marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires; and

    b. guy wire ground attachment points should be in contrasting colours to the surrounding ground/vegetation; and

    c. paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast. For ease of application, it would be reasonable to simplify the requirement to paint in bands with a width of approximately 1/7 of the longest dimension, by painting whole sections of the mast to the nearest whole section with an overall width of approximately 1/7 of the longest dimension, in three equal bands – red/orange, white, red/orange, so that at least the top 1/3 of the tower is marked.

Micrositing

11. The potential micrositing of the turbines and wind monitoring towers have been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level is within 100 m of the nominal turbine and wind monitoring tower positions. Providing the micrositing is within 100 m of the turbines and wind monitoring towers is likely to not result in a change in the maximum overall blade tip height of the Project. No further assessment is likely to be required from micrositing and the conclusions of this aviation impact assessment would remain the same.

Triggers for review

12. Triggers for review of this risk assessment are provided for consideration:

    a. prior to construction to ensure the regulatory framework has not changed

    b. following any significant changes to the context in which the assessment was prepared, including the regulatory framework

    c. following any near miss, incident or accident associated with operations considered in this risk assessment.

1. INTRODUCTION

1.1. Overview

Neoen seeks planning approval for the proposed Mt Hopeful Wind Farm (the Project).

The Project consists of up to 63 wind turbines and associated infrastructure to be developed over the project area. The project area is located approximately 60 km (32 nm) west from Gladstone Airport, 40 km (22 nm) south from Rockhampton Airport and 61 km (33nm) north of Thangool Aerodrome.

The maximum tip height of the WTG will be up to 260 m above ground level (AGL).

Umwelt has engaged Aviation Projects to prepare an Aviation Impact Assessment (AIA) for the proposed Project and formally consult with aviation agencies before submitting the development application (DA) for consideration by the State Assessment and Referral Agency (SARA) of the Queensland Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP).

The AIA will review potential impacts and provide aviation safety advice in respect of relevant requirements of air safety regulations and procedures and undertake consultation with relevant aviation agencies.

The AIA and supporting technical data will provide evidence and analysis for the planning application to demonstrate that appropriate risk mitigation strategies have been identified.

1.2. Purpose and Scope

The purpose and scope of work is to prepare an AIA for consideration by Airservices Australia, CASA and Department of Defence and progress any ongoing dialogue through the planning process.

The assessment will specifically respond to the:

- Queensland State Code 23: *Wind farm development (State Code 23)* of the State Development Assessment Provisions, specifically Performance Outcomes PO1 and PO2 and their associated acceptable outcomes
- National Airport Safeguarding Framework (NASF), Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms) /Wind Monitoring Towers*.

Assistance will be provided in support of stakeholder consultation and engagement in preparing the assessment and negotiating acceptable mitigation to identified impacts.

1.3. Methodology

Aviation Projects conducted the task in accordance with the following methodology:

1. confirmed the scope and deliverables with Neoen via Umwelt
2. reviewed client material, including the initial constraints analysis and identified mitigation measures
3. conducted a site visit to properly investigate aviation safety aspects and identifying existing tall structures within or adjacent to the proposed project area

4. reviewed relevant regulatory requirements and information sources
5. prepared a draft AIA and supporting technical data that provides evidence and analysis for the planning application to demonstrate that appropriate risk mitigation strategies have been identified. The draft AIA report includes an Aviation Impact Statement (AIS) and a qualitative risk assessment to determine need for obstacle lighting and of applicable aspects for client review and acceptance before submission to external aviation regulators
6. identified risk mitigation strategies that provide an acceptable alternative to night lighting. The risk assessment was completed following the guidelines in *ISO 31000:2018 Risk Management –Guidelines*
7. consulted with relevant councils, Part 173 procedure designers (Airservices Australia) and aerodrome operators of the nearest aerodrome/s to seek endorsement of the proposal to change instrument procedures (if applicable)
8. consulted/engaged with stakeholders to negotiate acceptable outcomes (if required)
9. finalised the AIA report for client acceptance when response received from stakeholders for client review and acceptance.

1.4. Aviation Impact Statement

The AIS includes the following specific requirements as advised by Airservices Australia:

Aerodromes:

- Specify all certified aerodromes that are located within 30 nm (55.56 km) of the project area
- Nominate all instrument approach and landing procedures at these aerodromes
- Review the potential effect of the Project operations on the operational airspace of the aerodrome(s)

Air Routes:

- Nominate air routes published in ERC-L & ERC-H which are located near/over the project area and review potential impacts of Project operations on aircraft using those air routes
- Define the relevant route segment by specifying the two waypoint names located on the routes which are located before and after the obstacles

Airspace:

- Nominate the airspace classification – A, B, C, D, E, G etc where the project area is located

Navigation/Radar:

- Nominate radar navigation systems with coverage overlapping the site.

1.5. Material reviewed

Material provided by Neoen for preparation of this assessment included:

- Neoen, Mt Hopeful Wind Farm – Project Layout:

  Mount Hopeful 116 WTG_with_labels.kmz
  Mt-Hopeful_20210114_electrical_ifra_McCamley.kmz
  Mt-Hopeful-20210112_project_boundaries.kmz
  Met mast locations.kmz

- 230125_Umwelt_TWilliamson_DesignData_Transfer (1).zip
  - DESIGN_Umwelt_Turbines_221102_GDA94z56.shp
  - DESIGN_Umwelt_PermanentMetMasts_221128_GDA9456.shp
- 20221027_Mount Hopeful WTG Coordinates.xlsx

2. BACKGROUND

2.1. Site overview

An overview of the Project layout and area relative to nearby towns, is provided in Figure 1 (source: Neoen, Google Earth).

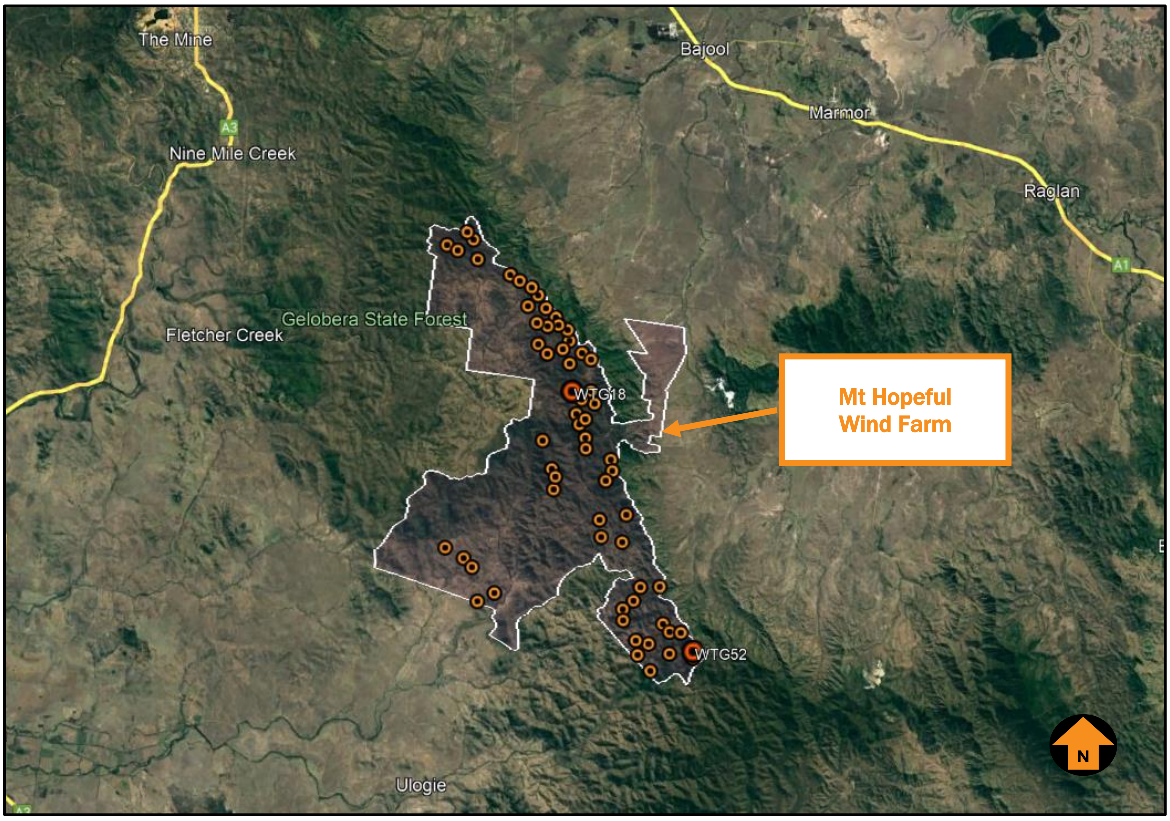

Figure 1 Project area overview and indicative layout

2.2. Project description

The Project may consist of up to 63 WTGs and associated infrastructure to be developed over the project area. The project area is located east of the Burnett Highway within the boundaries of Banana Shire Council (BSC) and Rockhampton Regional Council (RRC) local government areas (LGAs) in Queensland and approximately 60 km (32 nm) west from Gladstone Airport, 40 km (22 nm) south from Rockhampton Airport and 61 km (33nm) north of Thangool Aerodrome.

Refer to Figure 2 for the Project boundary within the boundaries of BSC and RRC (source: Neoen, QLD Globe).

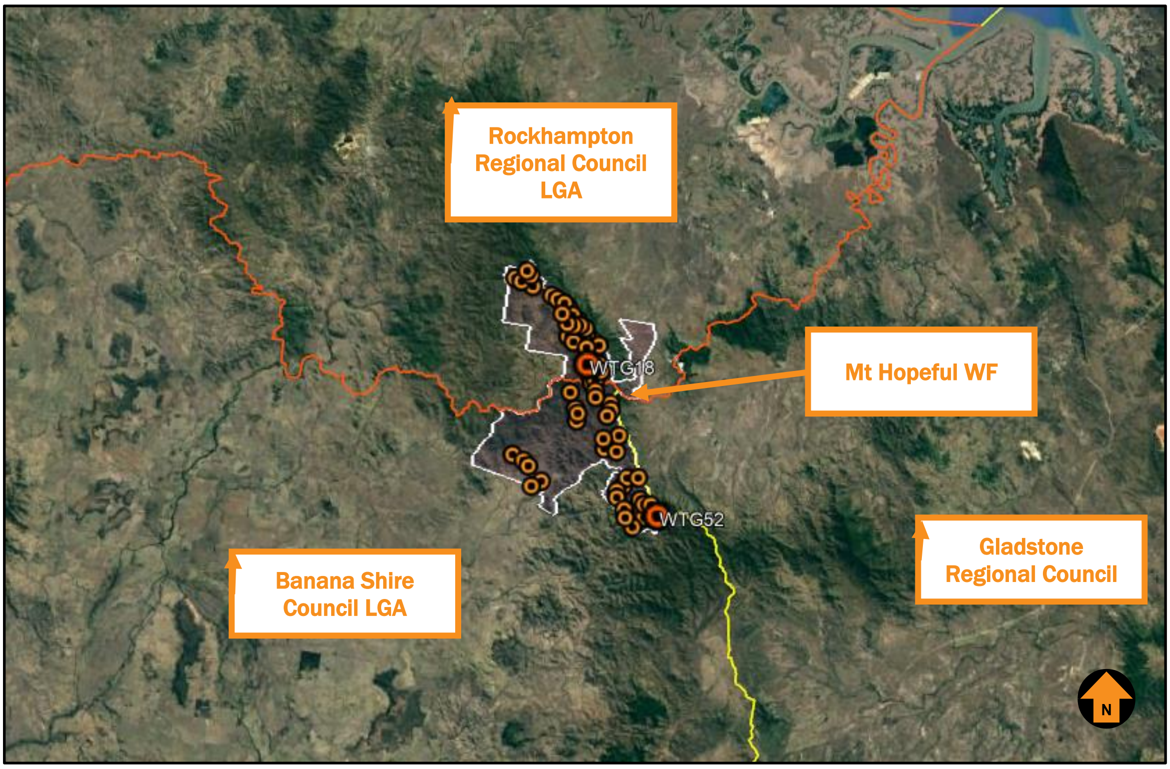

Figure 2 Project boundary relative to LGA

3. EXTERNAL CONTEXT

3.1. Department of State Development, Manufacturing, Infrastructure and Planning

The Department of State Development, Manufacturing, Infrastructure and Planning released the State Development Assessment Provisions (SDAP), version 3, commencing in February 2022.

SDAP sets out the matters of interest to the state for development assessment, where the Director-General of the department is responsible for assessing or deciding development applications. State Code 23 addresses wind farm development.

The code applies to a material change of use for a new or expanding wind farm. The purpose of State Code 23 is:

> *to protect individuals, communities and the environment from adverse impacts as a result of the construction, operation and decommissioning of wind farm development.*
>
> *Wind farms should be appropriately located, sited, designed and operated to ensure:*
>
> *(1) the safety, operational integrity and efficiency of air services and aircraft operations.*

State Code 23 contains Performance Outcomes (PO) and Acceptable Outcomes (AO). PO1 and PO2 and associated Acceptable Outcomes address aviation safety, integrity and efficiency and are provided in Table 1.

Table 1 State Code 23 - Aviation safety, integrity and efficiency for Material Change of Use

Performance outcomes	*Acceptable outcomes*
Aviation safety, integrity and efficiency	
PO1 Development does not adversely affect the safety, operational integrity and efficiency of air services and aircraft operations as a result of its: 1. location 2. siting 3. design 4. operation.	No acceptable outcome is prescribed
PO2 Development includes lighting and marking measures to ensure the safety, operational integrity and efficiency of air services and aircraft operations.	No acceptable outcome is prescribed

Based on performance outcomes PO1 and PO2, the following actions will support an application in demonstrating compliance with State Code 23 addressing aviation safety, integrity and efficiency:

- Demonstrate all potential risks to air services have been identified
- Provide evidence from a suitably qualified aerodrome consultant / specialist that the development will not adversely affect the safety, operational integrity and efficiency of air services.

The methodology for preparing the risk assessment is contained in the NASF Guideline D: *Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms) /Wind Monitoring Towers*.

The risk assessment will have regard to all potential aviation activities within the vicinity of the project area including recreation, commercial, civil (including for agricultural purposes) and military operations.

The AIS of this report identifies high level risks, risk mitigation measures and development constraints that are likely to be applicable to the aviation risk assessment.

3.2. Banana Shire Council

The 2021 Banana Planning Scheme is the in-force planning scheme for the Banana Shire.

The analysis provided in Section 6 demonstrates that the Project is sufficiently distant from Thangool that it will not be affected by the project.

The Planning Scheme does not incorporate an Airport environs overlay code for the three certified airports in the shire (Taroom (YTAM), Thangool (YTNG) and Theodore (YTDR)). However, it does highlight protecting the airports in section 2.4 Rural Areas:

> *Taroom, Thangool and Theodore Airports are important regional resources, creating opportunities for transporting residents to places of interest, business or employment, produce to market and for establishing aviation-based activities. New development does not compromise aircraft safety or airport operations.*

Another mention of the airports in the shire is in section 2.8 Infrastructure and Servicing more specifically in section 2.8.1.1 Specific outcomes:

> *(13) The operation of the Shire's aerodromes and regionally strategic aviation facilities integrates with land uses and transport infrastructure and is protected from incompatible development and is expanded to support greater accessibility in the region.*

Given that there is not a specific aviation section in the Planning Scheme document, an area of 30 nm (55.56 km) from Thangool's aerodrome reference point (ARP) is used to identify possible constraints from the Project. Thangool is the closest of the three airports in the shire; however, since the airport is located beyond 30 nm from the Project, there will be no impact on the airport's operational airspace.

3.3. Rockhampton Regional Council

RRC published its regional planning scheme on 24 August 2015, the document has since been updated, the latest version of the planning scheme version 2.2 was released on 14 June 2021. The planning scheme incorporates an Airport environs overlay code for Rockhampton Airport. As stated in section **8.2.2.2 Purpose:**

> *(1) The purpose of the airport environs overlay code is to ensure that:*
>
> > *(a) the current and future operations of the Rockhampton Airport and associated aviation facilities are not adversely impacted by development and land uses;*
>
> *(2) The purposes of the code will be achieved through the following overall outcomes:*
>
> > *(c) development and associated activities do not adversely impact on airport operations and aviation facilities by creating incompatible intrusions into operational airspace;*
> > *(e) development ensures that the operational airspace of the airport is not put at risk from artificial light sources or wildlife interference generated by development.*

Table 2 shows the performance and acceptable outcomes regarding the operational airspace (obstacle limitation surface) as found in section **8.2.2.3 Specific benchmarks for assessment**.

Table 2 Development outcomes for assessable development and requirements for accepted development

Performance outcomes	*Acceptable outcomes*
Operational airspace (obstacle limitation surface)	
PO1 Development does not involve permanent, temporary or transient physical obstruction (natural or man-made) of operational airspace.	AO1.1 Development does not allow the following to infringe the airport's operational airspace as identified on overlay map OM-2A: (b) wind farms or wind monitoring equipment

Figure 3 shows map OM-2A, on this map the operational airspace of Rockhampton Airport is shown as well as height limits of proposed developments. The project area is highlighted in orange. As can be seen the project area is clear of the operational airspace and the Project meets the performance and acceptable outcomes of Rockhampton Region Planning Scheme.

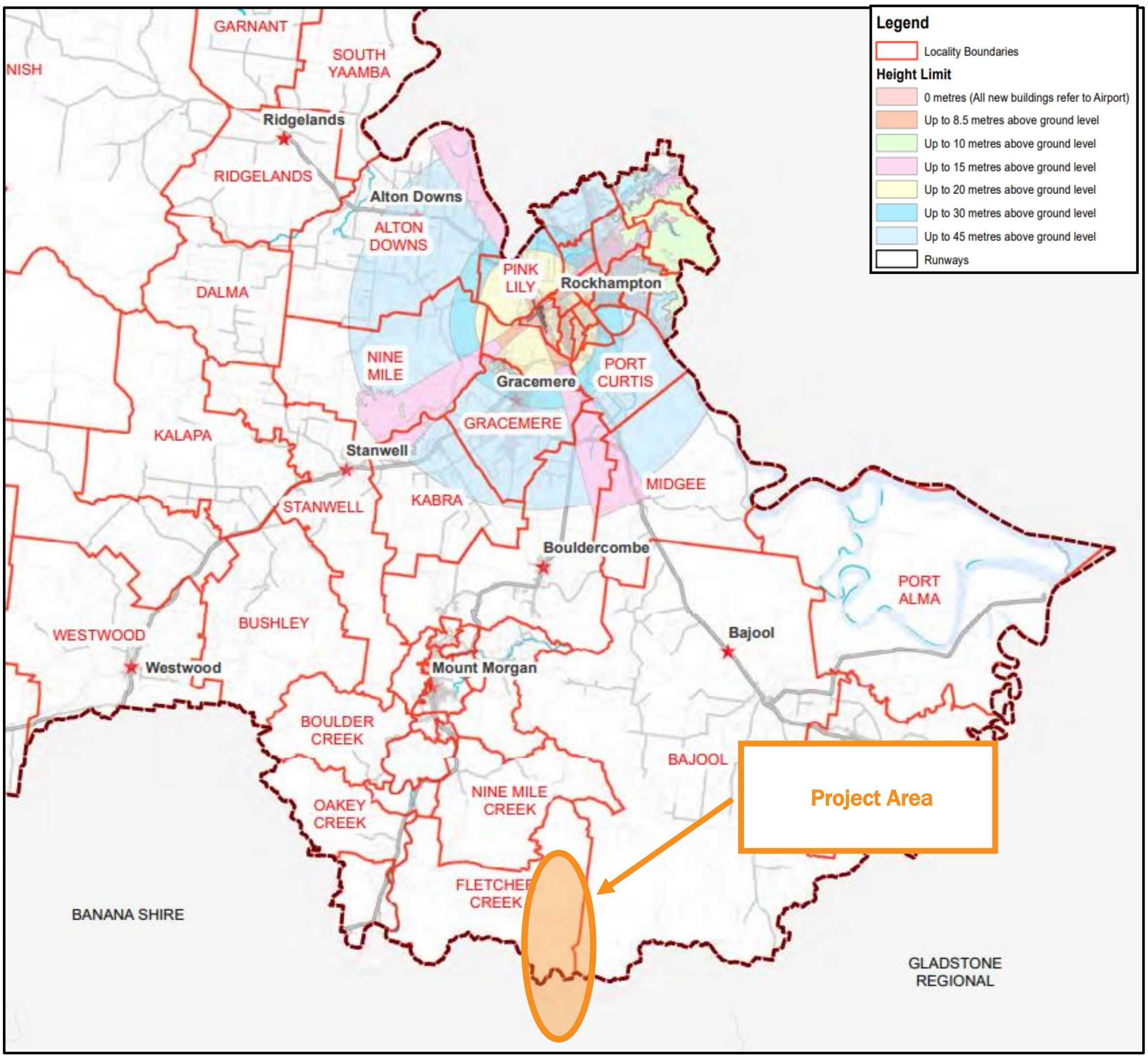

Figure 3 Map OM-2A-0 (source: Rockhampton Regional Council)

3.4. Rockhampton Airport Master Plan

Rockhampton Airport published its latest airport master plan in 2017. This document does not indicate any new developments that would restrict the construction of a new wind farm. The current obstacle limitations associated with the airport still apply.

3.5. Gladstone Airport Master plan

A search conducted on the Gladstone Regional Council website and Google revealed that Gladstone Airport has not published a Master Plan.

3.6. Thangool Aerodrome

A search conducted on the Banana Shire Council website and Google revealed that Thangool Aerodrome does not have a Master Plan.

3.7. Aircraft operations at non-controlled aerodromes

CASA Advisory Circulars (AC) are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of compliance with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

AC 91-10 v1.1 – *Operations in the vicinity of non-controlled aerodromes* – provides guidance on procedures that, when followed, will improve situational awareness and safety for all pilots when flying at, or in the vicinity of, non-controlled aerodromes. Section 7 describes the standard aerodrome traffic circuit procedures.

The standard circuit consists of a series of flight paths known as *legs* when departing, arrival or when conducting circuit practice. The standard circuit consists of a series of flight paths known as *legs* when departing, arrival or when conducting circuit practice. Illustrations of the standard aerodrome traffic circuit procedures are provided in Figure 4 and Figure 5.

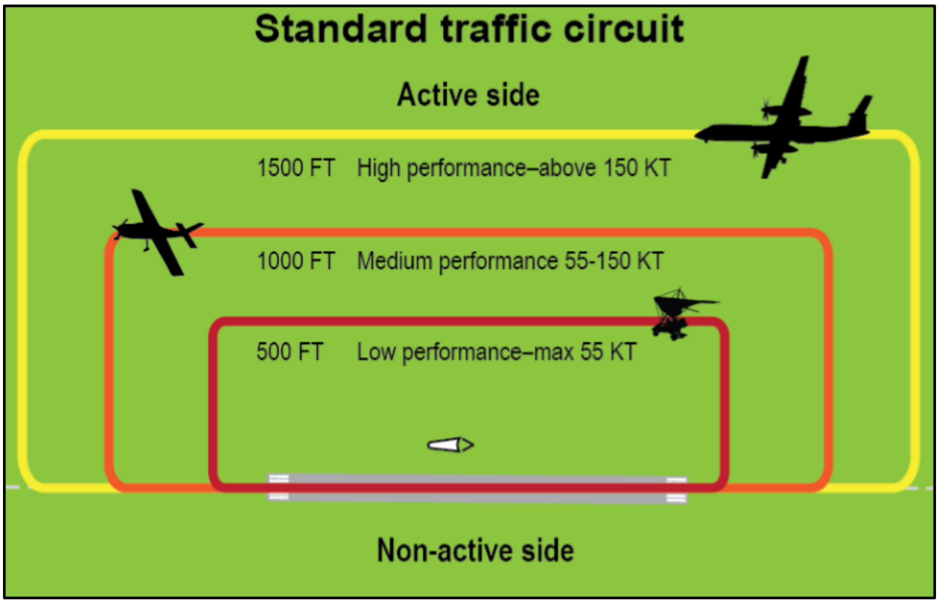

Figure 4 Lateral and vertical separation in the standard aerodrome traffic circuit

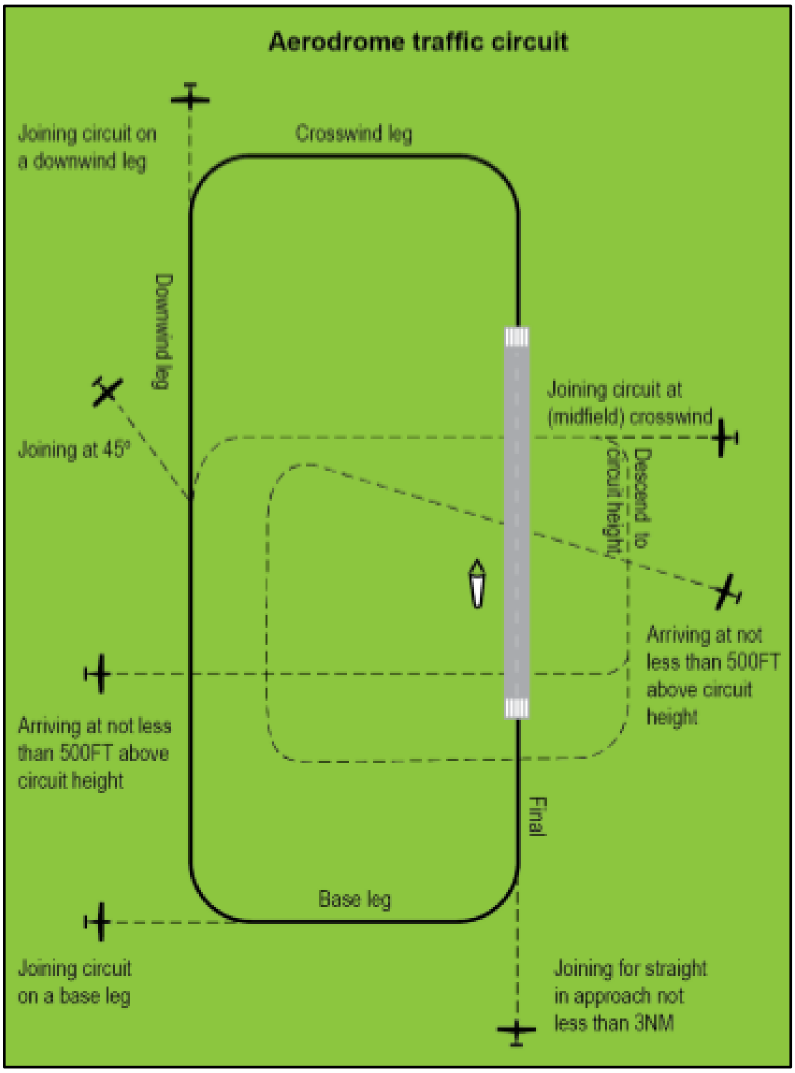

Figure 5 Aerodrome standard traffic circuit, showing arrival and joining procedures

AC 91-10 v1.1. paragraph 7.10 makes reference to a distance that is "normally" well outside the circuit area and where no traffic conflict exists, which is at least 3 nm (5556 m). The paragraph is copied below:

> *7.10 Departing the circuit area*
>
> *7.10.1 Aircraft should depart the aerodrome circuit area by extending one of the standard circuit legs or climbing to depart overhead. However, the aircraft should not execute a turn to fly against the circuit direction unless the aircraft is well outside the circuit area and no traffic conflict exists. This will normally be at least 3 NM from the departure end of the runway, but may be less for aircraft with high climb performance. In all cases, the distance should be based on the pilot's awareness of traffic and the ability of the aircraft to climb above and clear of the circuit area.*

3.8. Rules of flight

3.8.1. Flight under Day Visual Flight Rules (VFR)

According to Aeronautical Information Publication (AIP) the meteorological conditions required for visual flight in the applicable (Class G) airspace at or below 3000 ft AMSL or 1000 ft AGL whichever is the higher are: 5000 m visibility, clear of clouds and in sight of ground or water.

Civil Aviation Safety Regulation (1998) 91.267 (Minimum height rules—other areas) prescribes the minimum height for flight. Generally speaking, and unless otherwise approved, aircraft are restricted to a minimum height of 500 ft AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built-up areas, and 1000 ft AGL over built up areas (within a horizontal radius of 600 m of the point on the ground or water immediately below the aeroplane).

These height restrictions do not apply if through stress of weather or any other unavoidable cause it is essential that a lower height be maintained.

Flight below these height restrictions is also permitted in certain other circumstances.

3.8.2. Night VFR

With respect to flight under the VFR at night, Civil Aviation Safety Regulations (1998) 91.277 requires that the pilot in command of an aircraft flying VFR at night must not fly below the following heights (unless during take-off and landing operations, within 3 nm of an aerodrome, or with an air traffic control clearance):

a) the published lowest safe altitude for the route or route segment (if any);

b) the minimum sector altitude published in the authorised aeronautical information for the flight (if any);

c) the lowest safe altitude for the route or route segment;

d) 1,000 ft above the highest obstacle on the ground or water within 10 nautical miles ahead of, and to either side of, the aircraft at that point on the route or route segment;

e) the lowest altitude for the route or route segment calculated in accordance with a method prescribed by the Part 91 Manual of Standards for the purposes of this paragraph.

3.8.3. Instrument Flight Rules (Day or night) (IFR

According to CASR 91, flight under the instrument flight rules (IFR) requires an aircraft to be operated at a height clear of obstacles that is calculated according to an approved method. Obstacle lights on structures not within the vicinity of an aerodrome are effectively redundant to an aircraft being operated under the IFR.

3.9. Aircraft operator characteristics

Flying training may be conducted under either the instrument flying rules (IFR) or visual flying rules (VFR). Other general aviation operations under either IFR or VFR are also likely to be conducted at various aerodromes in the area.

Operations conducted under VFR are required to remain in visual meteorological conditions (VMC) (at least 5,000 m horizontal visibility at a similar height of the wind turbines) and clear of the highest point of the terrain by 500 ft vertical distance and 600 m horizontal distance. In VMC, the wind turbines will likely be sufficiently conspicuous to allow adequate time for pilots to avoid the obstacles. VFR operators will most likely avoid the project area once wind turbines are erected.

Flight under day VFR is conducted above 500 ft (152.4 m) above the highest point of the terrain within a 300 m radius unless the operation is approved to operate below 500 ft above the highest point of the terrain.

It is expected that the wind turbines will be sufficiently visually conspicuous to pilots conducting VFR operations within the vicinity of the Project to enable appropriate obstacle avoidance manoeuvring.

IFR and Night VFR (which are required to conform to IFR applicable altitude requirements) aircraft operations are addressed in Section 6.

3.10. Passenger transport operations

Regular public transport (RPT) and passenger carrying charter operations are generally operated under the IFR.

Air Route Lowest Safe Altitudes (LSALT), Grid LSALT and PANS-OPS surfaces associated with instrument approach and departure procedures protect IFR flight operations from the terrain and obstacle environment.

3.11. Private operations

Private operations are generally conducted under day or night VFR, with some IFR.

3.12. Military operations

There may be some high-speed low-level military jet aircraft and helicopter operations conducted in the area.

3.13. Aerial application operations

Aerial application operations including such activities as fertiliser, pest and crop spraying are generally conducted under day VFR below 500 ft AGL; usually between 6.5 ft (2 m) and 100 ft (30.5 m) AGL.

There is likely to be a low rate of aerial application operations in the area due to the mountainous nature of the terrain.

Due to the nature of the operations conducted, aerial application pilots are subject to rigorous training and assessment requirements in order to obtain and maintain their licence to operate under these conditions.

The Aerial Application Association of Australia (AAAA) has a formal risk management program which is recommended for use by its members.

The impact of the proposed turbines on the safe and efficient aerial application of agricultural fertilisers and pesticides in the vicinity of the Project was assessed.

3.14. Aerial Application Association of Australia

In previous consultation with the AAAA, Aviation Projects has been directed to the AAAA Windfarm Policy (dated March 2011) which states in part:

> *As a result of the overwhelming safety and economic impact of wind farms and supporting infrastructure on the sector, AAAA opposes all wind farm developments in areas of agricultural production or elevated bushfire risk.*
>
> *In other areas, AAAA is also opposed to wind farm developments unless the developer is able to clearly demonstrate they have:*
>
> > *1. consulted honestly and in detail with local aerial application operators;*
> >
> > *2. sought and received an independent aerial application expert opinion on the safety and economic impacts of the proposed development;*
> >
> > *3. clearly and fairly identified that there will be no short or long term impact on the aerial application industry from either safety or economic perspectives;*
> >
> > *4. if there is an identified impact on local aerial application operators, provided a legally binding agreement for compensation over a fair period of years for loss of income to the aerial operators affected; and*
> >
> > *5. adequately marked any wind farm infrastructure and advised pilots of its presence.*

AAAA had developed National Windfarm Operating Protocols (adopted May 2014). These protocols note the following comments:

> *At the development stage, AAAA remains strongly opposed to all windfarms that are proposed to be built on agricultural land or land that is likely to be affected by bushfire. These areas are of critical safety importance to legitimate and legal low-level operations, such as those encountered during crop protection, pasture fertilisation or firebombing operations.*
>
> *However, AAAA realises that some wind farm proposals may be approved in areas where aerial application takes place. In those circumstances, AAAA has developed the following national operational protocols to support a consistent approach to aerial application where windfarms are in the operational vicinity.*

The protocols list considerations for developers during the design/build stage and the operational stage, for pilots/aircraft operators during aircraft operations and discusses economic compensation. NASF Guideline D is included in the Protocols document as Appendix 1, and AAAA Aerial Application Pilots Manual – excerpts on planning are provided as Appendix II.

3.15. Local aerial application operators

Aerial application operators consulted in previous studies undertaken by Aviation Projects have stated that a wind farm would, in all likelihood, prevent aerial agricultural operations in that particular area, but that properties adjacent to the wind farm would have to be assessed on an individual basis.

Aerial application operators generally align their positions with the AAAA policies.

Based on previous studies undertaken by Aviation Projects, it is reasonable to conclude that safe aerial application operations would be possible on properties within the project area and neighbouring the project area, subject to final turbine locations and by implementing recommendations provided in this report.

To facilitate the flight planning of aerial application operators, details of the Project, including location and height information of wind turbines, wind monitoring towers and overhead powerlines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.

The use of helicopters enables aerial application operations to be conducted in closer proximity to obstacles than would be possible with fixed wing aircraft due to their greater manoeuvrability.

3.16. Aerial firefighting

Aerial firefighting operations (firebombing in particular) are conducted in Day VFR, sometimes below 500 ft AGL. Under certain conditions visibility may be reduced/limited by smoke/haze.

Most aerial firefighting organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained. For example, pilots require specific training and approvals, additional equipment is installed in the aircraft, and special procedures are developed.

The Australasian Fire and Emergency Services Council (AFAC) has developed a national position on wind farms, their development and operations in relation to bushfire prevention, preparedness, response and recovery, set out in the document titled *Wind Farms and Bushfire Operations*, version 3.0, dated 25 October 2018.

Of specific interest in this document is the section extracted from under the 'Response' heading, copied below:

> *Wind farm operators should be responsible for ensuring that the relevant emergency protocols and plans are properly executed in an emergency event. During an emergency, operators need to react quickly to ensure they can assist and intervene in accordance with their planned procedures.*
>
> *The developer or operator should ensure that:*
>
> - *liaison with the relevant fire and land management agencies is ongoing and effective*
> - *access is available to the wind farm site by emergency services response for on-ground firefighting operations*
> - *wind turbines are shut down immediately during emergency operations – where possible, blades should be stopped in the 'Y' or 'rabbit ear' position, as this positioning allows for the maximum airspace for aircraft to manoeuvre underneath the blades and removes one of the blades as a potential obstacle.*
>
> *Aerial personnel should assess risks posed by aerial obstacles, wake turbulence and moving blades in accordance with routine procedures.*

Refer to Section 5 for detailed responses from aerial firefighting stakeholders including QFES.

3.17. Emergency services - Royal Flying Doctor Service

Royal Flying Doctor Service (RFDS) and other emergency services operations are generally conducted under the IFR, except when arriving/departing a destination that is not serviced by instrument approach aids or procedures.

Most emergency aviation services organisations have formal risk management programs to assess the risks associated with their operations and implement applicable treatments to ensure an acceptable level of safety can be maintained.

For example, pilots and crew require specific training and approvals, additional equipment is installed in the aircraft, and special procedures are developed.

4. INTERNAL CONTEXT

4.1. Wind farm description

The wind farm is situated in an area comprised mainly of farming properties with an undulating rural landscape. The site is located east of the intersection of the Queensland State highways A3 (Burnett Hwy) and A5 (Leichhardt Hwy).

Figure 6 shows the proposed project area from the north.

Figure 6 Landscape of the proposed project area as seen from the A1 (Bruce Hwy)

Figure 7 shows a view standing on Nine Mile Creek Road looking south-east towards the project area where the proposed WTGs are located.

Figure 7 Nine Mile Creek Road looking south-east at the project area

Figure 8 shows a view from state highway 60 (Dawson Highway) looking to the north towards the proposed project area where an existing overhead power line is located.

Figure 8 Dawson Highway looking to the north at the proposed project area

Figure 9 shows a view from Playfields Road looking to the east towards the proposed project area, where existing overhead powerlines are located.

Figure 9 Playfields Road looking to the east towards the project area

Figure 10 shows a 2478 ft AHD unlit telecommunication tower which is located on top of Mt Hopeful approximately 2 km north of the project area. The photo was taking looking west, standing at South Ulam Road near the intersection with Beak Road,

Figure 10 Existing telecommunication tower, view from South Ulam Road

4.2. Wind turbine description

The maximum blade tip height of the proposed wind turbines will be up to 260 m AGL.

The maximum ground elevation for the proposed WTG52 wind turbine is 568 m AHD, which results in a maximum overall height of 828 m AHD (2716.5 ft AMSL).

Figure 11 demonstrates the Project layout identifying the highest WTG52 and WTG 18, the highest WTG within 30 nm of Rockhampton Airport (source: Neoen, Google Earth).

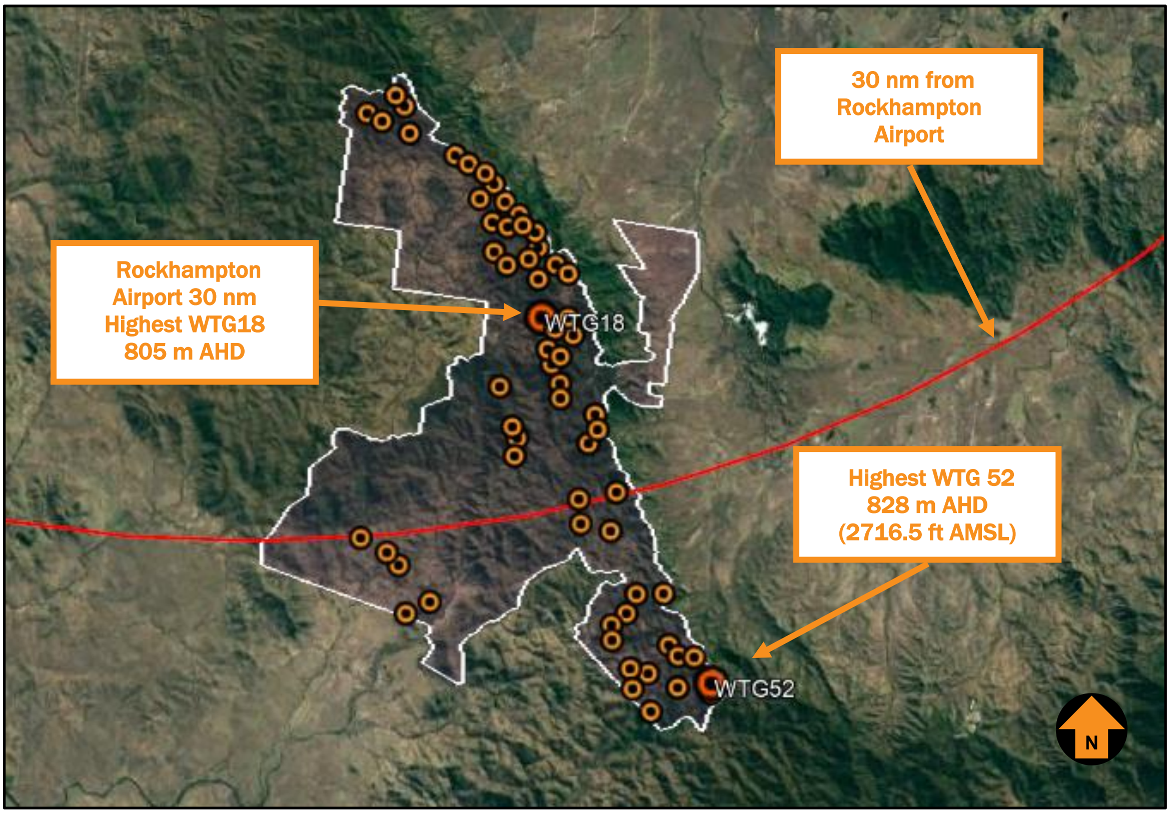

Figure 11 Project layout and highest wind turbines

'Micrositing of turbines' and wind monitoring towers means an alteration to the siting of a turbine or wind monitoring towers by not more than 100 m and any consequential changes to access tracks and internal power cable routes. The potential micrositing of the turbines and wind monitoring towers have been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level is within 100 m of the nominal turbine position. The micrositing of the turbines and wind monitoring towers is not likely to result in a change in the maximum overall blade tip height of the Project.

The coordinates and ground elevations of the Project wind turbines are listed in Annexure 3.

4.3. Wind monitoring tower description

The single existing WMT on site is of steel lattice construction and 120 m AGL high.

There are 10 permanent WMTs proposed as part of the Project.

The WMTs will be of steel lattice construction with a maximum of 170 m (558 ft) AGL in height.

The WMTs will be guyed at several levels in three directions. The guy wires will have aviation markers located near the top of the proposed WMT.

Indicative locations are provided in Figure 12 (source: Neoen).

Once the details of the WMTs are finalised, they will be reported to Airservices Australia for entry into Vertical Obstruction Database when the construction is completed.

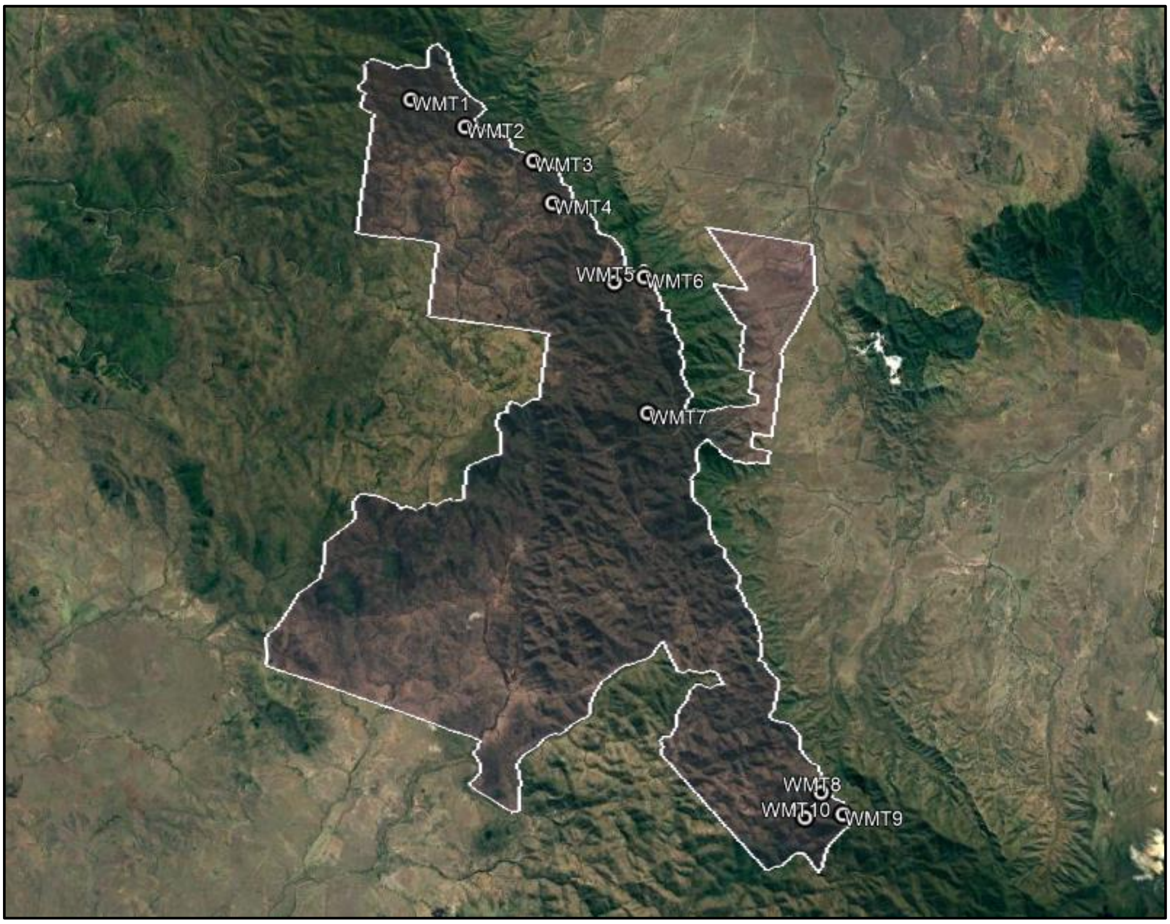

Figure 12 Indicative WMT locations

4.4. Overhead transmission line

There are existing 275 kV transmission lines available to the east and west of the proposed Project location.

Neoen is considering options for overhead and/or underground connections to the existing transmission lines through a proposed large substation/battery energy storage system (BESS) according to detailed design requirements.

Refer to Figure 13 (source: Neoen, Google Earth).

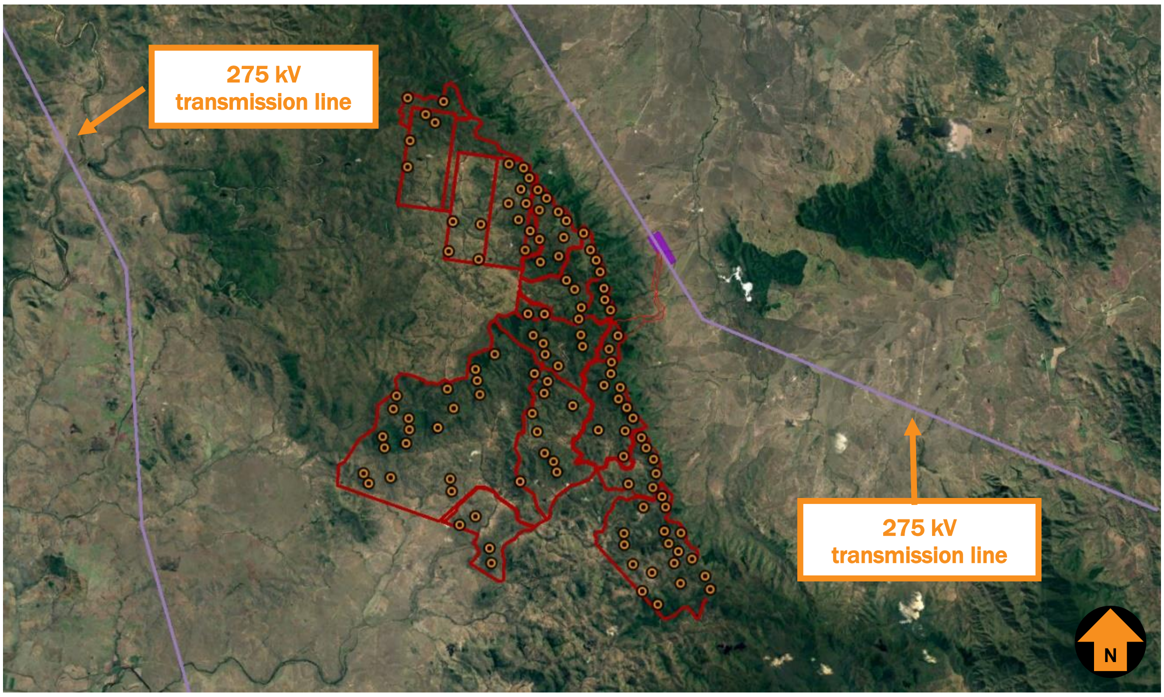

Figure 13 Existing distribution and transmission network

5. CONSULTATION

The stakeholders consulted include:

- Airservices Australia
- Aerodrome operators (Rockhampton Regional Council)
- CASA
- Department of Defence
- Queensland Fire and Emergency Services (QFES)
- Royal Flying Doctor Service.

Details and results of the consultation activities are provided in Table 3.

Due to the changes to the project, Airservices Australia will be consulted again.

Table 3 Stakeholder consultation details conducted in 2021

Agency/Contact	*Activity/Date*	*Response/ Date*	*Issues Raised During Consultation*	*Action Proposed*
Airservices Australia	28 January 2021 Email to Airservices Australia Airport Developments	30 March 2021 Response from John Graham, Airport Development Applications Coordinator	*Airservices Australia was informed of the Project.* *In the email response, Mr Graham advised the Project would have an impact on the 25 nm MSA and the RNAV-Z (GNSS) RWY 33 for Rockhampton Airport. Other changes to procedures would also be required.* *The wind farm will also affect the Rockhampton Radar Terrain Clearance Chart (RTCC). (The extent of the impacts was not disclosed).* *Furthermore, he advised that the proposed wind farm will not adversely impact the performance of any Airservices Precision/Non-Precision Nav Aids, Anemometers, HF/VHF/UHF Comms, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.*	Any Airservices work associated with amending the Rockhampton RTCC boundary, the 25NM MSA (including other changes to procedures that will be required), and the RNAV-Z (GNSS) RWY 33 instrument procedure at Rockhampton aerodrome will be undertaken on a commercial basis and require further consultation. Responses from aviation operators and Rockhampton Airport regarding the nominated impacts are summarised herein.
Aerodrome operators	28 January 2021 Email to Rockhampton Regional Council 17 May 2021	2 June 2021 Email response from Deb McKee-Hegarty – Compliance Officer Rockhampton Airport	*RRC was informed of the Project and subsequently requested a stakeholder workshop to further discuss the project.* *RRC requested additional consultation with Alliance Airlines and Republic of Singapore Air Force.* *Formal advice was provided via letter as follows:*	Request to sectorise the YBRK 25nm MSA to account for the obstacles in the wind farm area

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
	Stakeholder Workshop with Rockhampton Regional Council		*RRC has reviewed the Aviation Impact Assessment and the response from a number of potentially affected parties. RRC notes that CASA is yet to make an assessment of the project and provide any recommendations.* *RRC note that the ASA response advises that the Radar Terrain Clearance Chart will be affected, as are procedural approach and departures which will require ASA redesign. Any cost in such procedural design changes should be met by the proponent.* *RRC supports the option of putting in place a sectored area within the MSA that encompasses the proposed Wind Farm Project.*	
Alliance Airlines	19 May 2021 Email to Alliance Airlines Fleet Manager Fokker 70/100	19 May 2021 Response from Brendan McMahon Fleet Manager Fokker 70/100	*Alliance Airlines was informed of the Project* *The response of Alliance Airlines offered a brief summary regarding the impact to the 25 nm MSA at YBRK as this will potentially impact:* • *The descent path angle or descent point on the RNAV-Z (GNSS) RWY 33 YBRK from IAF's 'LALIS' and 'SARUS'.* • *Descent path on the VOR RWY 33 YBRK and the GLADSTONE VOR TO ROK VOR DME/GNSS ARRIVAL & Sector B & C DME/GNSS ARRIVAL.*	Request to sectorise the YBRK 25nm MSA to account for the obstacles in the wind farm area

Agency/Contact	*Activity/Date*	*Response/ Date*	*Issues Raised During Consultation*	*Action Proposed*
			A response was provided to the effect that the identified issues were not necessarily correct, but no further correspondence was received at the time of finalising this report. Alliance Airlines indicated support for sectorising the 25 nm MSA.	
Banana Shire Council	1 February 2021 Email to Banana Shire Regional Council	12 February 2021 Response from Jaz Dodd, Coordinator Aerodrome Operations	*Banana Shire Regional Council was informed of the Project as operator of Thangool Aerodrome.* *Subsequently Council advised to have no objections on the condition that the project will have no impact on any Banana Shire Council aerodromes*	N/A
CASA	*CASA has advised that it will only review assessments referred to it by a planning authority or agency.*			No further action required; Project will be referred to CASA by planning authority
Department of Defence	28 January 2021 Email to Department of Defence	19 February 2021 Response from mr Charles Mangion, Director Land Planning & Regulation	*Department of Defence was informed of the Project.* *In an email and formal letter response, Mr Mangion advised Defence has conducted an assessment of proposed wind farm for potential impacts on the safety of Defence flying operations as well as possible interference to Defence communications and radar.* *Defence advised that the proposed 260 metre AGL turbines and 170 metre WMTs meet the requirements for reporting of tall structures.*	The proposed structures will meet the above definition of a tall structure. Defence therefore requests that the applicant provide ASA with "as constructed" details. The details can be emailed to ASA at vod@airservicesaustralia.com. Send the risk assessment of this proposal to CASA for consideration.

Agency/Contact	*Activity/Date*	*Response/ Date*	*Issues Raised During Consultation*	*Action Proposed*
			Defence also recommends that the risk assessment be submitted to the Civil Aviation Safety Authority (CASA) to determine whether the proposal is a hazard to aircraft safety and requires approved lighting or marking. Defence supports this requirement and believes that, in this instance, it would be prudent for the risk assessment of this proposal to be sent to CASA for consideration. *If CASA determines that obstacle lighting is to be provided, it should be compatible with persons using night vision devices. If LED lighting is proposed, the frequency range of the LED light emitted should be within the range of wavelengths 665 to 930 nanometres.* *Defence has no objection to the proposed wind farm provided that the project complies with the above conditions.*	
Qantas Link	28 January 2021 Email to Qantas Link	3 February 2021 Response from Adrian Young - AOC Accountable Manager	*QantasLink was informed of the Project.* *QantasLink has advised the proposed wind farm will not impact on their operations.*	N/A
QFES	28 January 2021 Email to Queensland Fire	9 March 2021 Response from Karen Warwick – Executive Officer	*QFES was informed of the Project. QFES is very supportive of the project and is aware of many similar wind farms across Queensland.*	Inform QFES of Project location through aeronautical charting – once construction commences Project is reported to Airservices Australia.

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
	and Emergency Service		*QFES has offered the following information for consideration when developing the project:* *- The accessibility to the wind farm for a QFES response to any type of incident.* *- What are the risks to QFES air operations capability (water bombing) in responding to a bushfire while the turbines are operating, given the water bombing aircraft operate at very low levels, sometimes at 100 metres depending on fire conditions?* *- What risk considerations are required from QFES for flight plans considering wind patterns, smoke plum, access to site and flight standards?* *- Due to the history of bushfires within the general areas of the wind farm, the consideration of vegetation management as part of your bushfire preparation will be important to QFES and the community.*	
RFDS	29 January 2021 Email to Royal Flying Doctor Service	29 January 2021 Response from Anthony Hooper – Manager Line Operations	*RFDS was informed of the Project.* *The response from RFDS advised that the Project will not have any significant impact on RFDS operations into and out of Rockhampton Airport*	*N/A*
Republic of Singapore Air Force	25 May 2021	N/A	*No response was received at the time of finalising this report*	*N/A*

Agency/Contact	Activity/Date	Response/ Date	Issues Raised During Consultation	Action Proposed
Virgin Australia	28 January 2021 Email to Virgin Australia	22 February 2021 Response from Duncan Poon – Flight Operations Engineer	*Virgin Australia was informed of the Project.* *No objection pursuant to Air Services Australia indicating the proposed development will not require additional changes to existing airspace procedures, the performance of any navigational aids, sector or circling altitudes or any Communication/ Navigation/ Surveillance (CNS) facilities over and above what has been proposed*	Request to sectorise the YBRK 25nm MSA to account for the obstacles in the wind farm area

6. AVIATION IMPACT STATEMENT

6.1. Nearby certified aerodromes

The closest certified airport to the project area is Rockhampton Airport (YBRK), which is located approximately 40 km (22 nm) to the north. Other certified airports in the area are Gladstone Airport (YGLA) and Thangool Aerodrome (YTNG)

The area of 30 nm (55.56 km) from an airport's aerodrome reference point (ARP) is used to identify possible constraints from the Project.

The location of the Project relative to the nearest certified airports with 30 nm buffers is shown in Figure 14 (source: Neoen, OzRunways, Australian 250K Topographical Chart).

As shown in Figure 14, the Project boundary extends into the 30 nm area around Rockhampton Airport (YBRK), hence this airport may be impacted by the Project. Gladstone Airport (YGLA), and Thangool Aerodrome (YTNG) are located beyond 30 nm from the Project and will not be impacted.

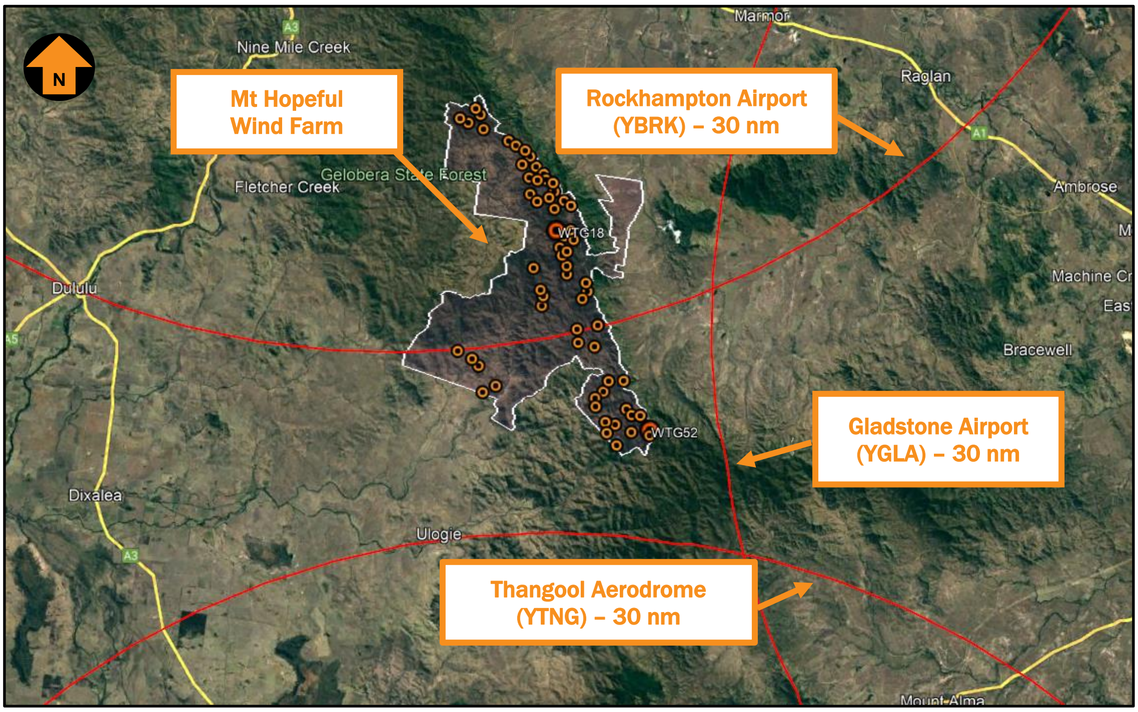

Figure 14 General location of the Project boundary and surrounding aerodromes

6.2. Rockhampton Airport

Rockhampton (YBRK) is a certified, non-precision approach aerodrome, operated by RRC), with a published aerodrome elevation of 11 m AHD (36 ft AMSL) (source: Airservices Australia, FAC chart, 5 November 2020).

Rockhampton Airport has two runways:

- Runway 04/22, length of 1645 m, width 23 m and runway strip 80 m.
- Runway 15/33, length of 2570 m, width 45 m and runway strip 300 m.

Figure 15 shows the Rockhampton Airport Runway layout (source: Google Earth).

Figure 15 Rockhampton Airport (YBRK) runway layout

Rockhampton Airport's ARP coordinates published in Airservices Australia's Designated Airspace Handbook are Latitude 23°22'55"S and Longitude 150°28'31"E.

6.3. Obstacle limitation surfaces

The maximum horizontal distance that an obstacle limitation surface (OLS) may extend for an aerodrome in Australia is 15 km (8.1 nm) from the edge of a runway strip.

The Project is located outside the horizontal extent of and will not affect Rockhampton Airport OLS.

6.4. Rockhampton Airport - circling areas

The Project is located beyond the horizontal extent of circling areas at Rockhampton Airport.

6.5. PANS-OPS surfaces

Figure 16 shows the location of the Project layout with buffer areas for Rockhampton Airport 10 nm and 25 nm MSAs (including associated 5 nm buffer areas) (source: Neoen, Google Earth).

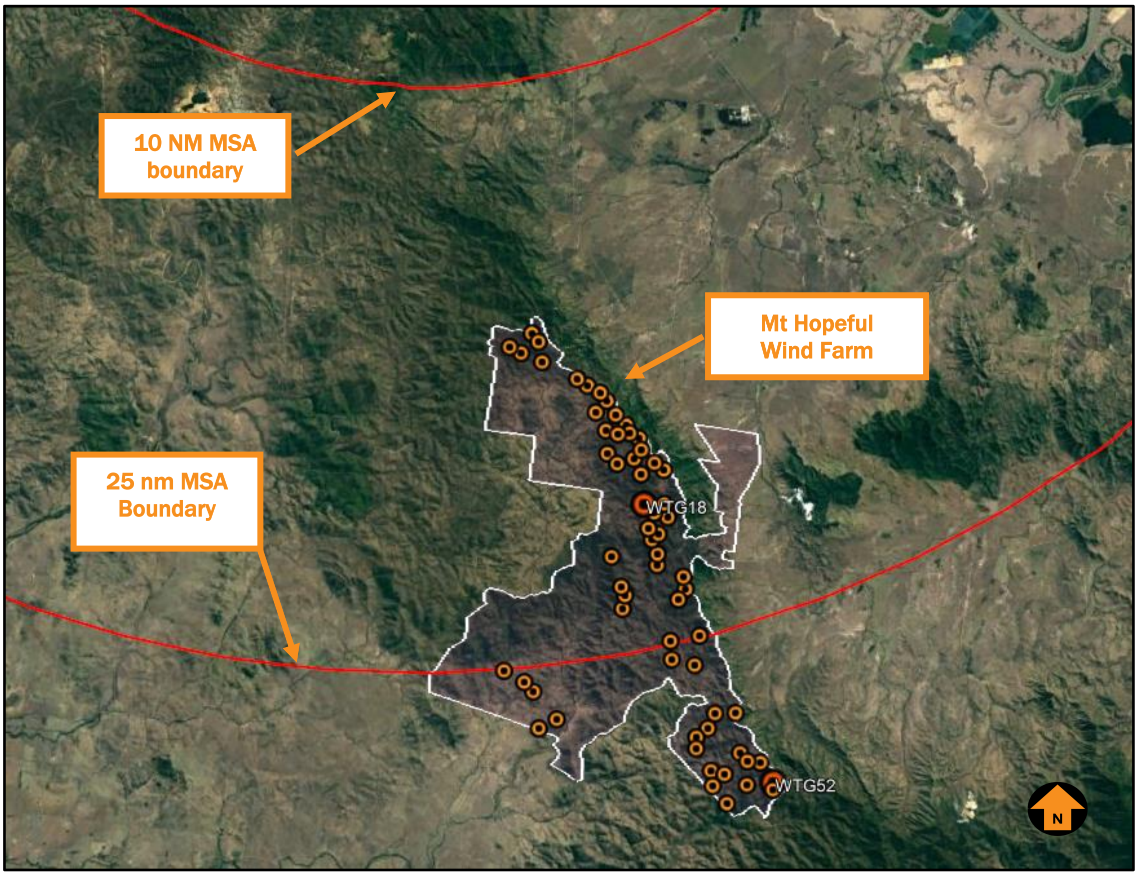

Figure 16 Rockhampton Airport - 15 nm and 30 nm buffer areas

The minimum safe altitude (MSA) is applicable for each instrument approach procedure at Rockhampton Airport. An image of the MSA published for the aerodrome is shown in Figure 17 (source: Airservices Australia).

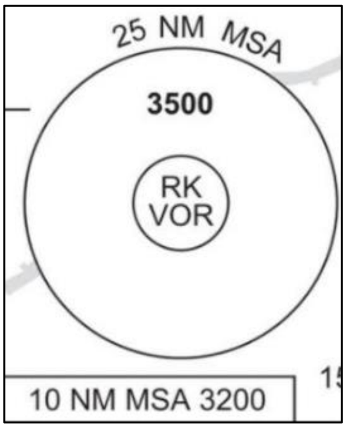

Figure 17 MSA at Rockhampton

The Manual of Standards 173 *Standards Applicable to Instrument Flight Procedure Design* (MOS 173), requires that a minimum obstacle clearance (MOC) of 1000 ft above the highest obstacle within the boundary of the relevant MSA.

Obstacles within the 10 nm MSA (10 nm radius + 5 nm buffer) and within the 25 nm MSA (25 nm radius + 5 nm buffer) of Rockhampton Airport's ARP define the minimum height at which an IFR aircraft can fly when within 10 nm and 25 nm without visual reference to the ground or water, prior to commencing an instrument approach or climbing following a missed approach.

The Project is located outside the 10 nm MSA of Rockhampton Airport but within the 25 nm MSA of Rockhampton Airport with a minimum altitude of 3500 ft AMSL and an associated PANS-OPS surface of 2500 ft AMSL.

The maximum overall height of a WTG located within 30 nm of the airport is WTG18, with a reported height of 805 m AHD (2641.1 ft AMSL), which means that WTG18 will infringe on the 2500 ft AMSL PANS-OPS surface. The PANS-OPS surface will need to be raised by 200 ft to 2700 ft, with the 25 nm MSA minimum altitude would need to be raised by 200 ft to an altitude of 3700 ft AMSL.

An alternative and potentially less impactful solution would be to sectorise the 25 nm MSA so that the relevant sector over the wind farm would have an MSA of 3700 ft AMSL (based on the highest overall wind turbineWTG18 while the remaining majority of the 25 nm MSA area would retain the lower 3500 ft AMSL.

An image showing the highest turbine within the 30 nm buffer area is provided at Figure 18.

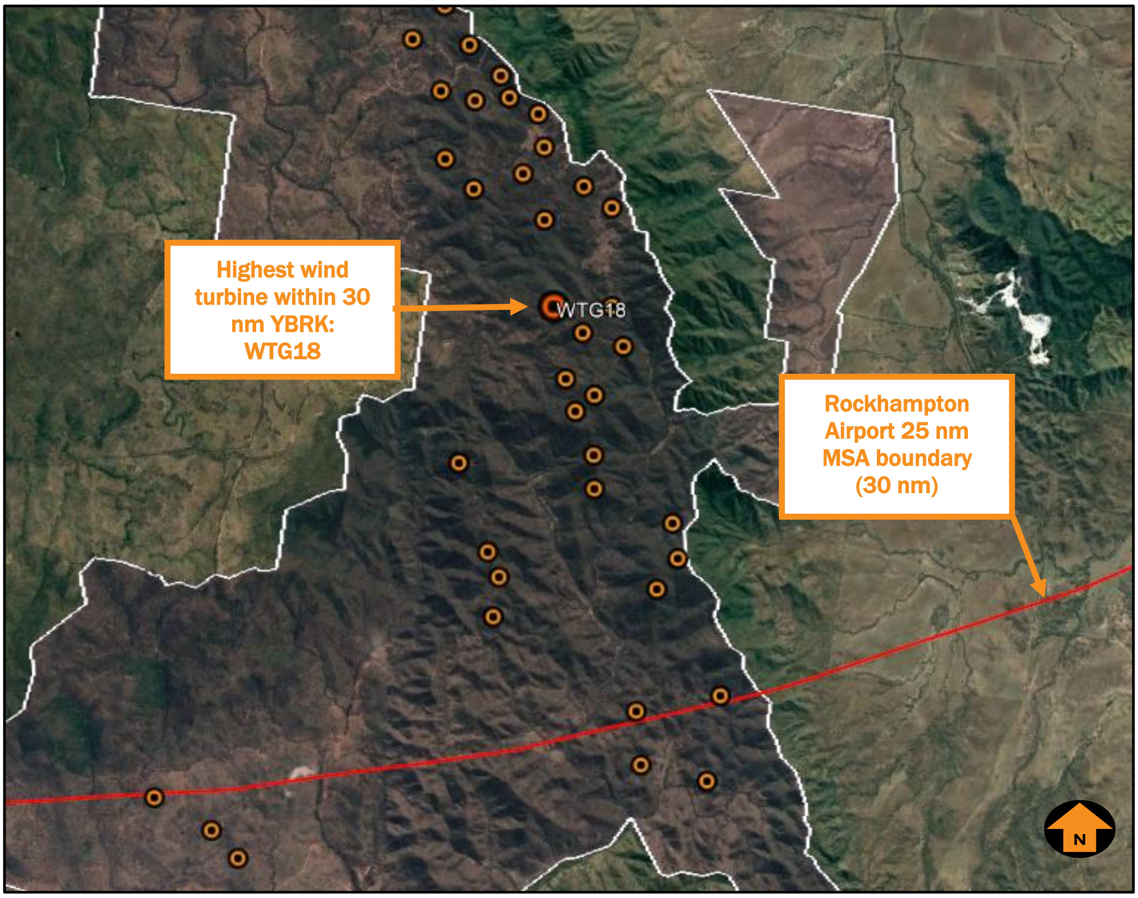

Figure 18 Highest WTG within 30 nm buffer area from Rockhampton Airport

6.6. Instrument flight procedures at Rockhampton Airport – impact analysis

A check of the AIP via OZ Runways shows that Rockhampton Airport is served by various ground and satellite-based non-precision instrument flight procedures for aircraft. These procedures, all designed by Airservices Australia, as published in AIP effective 05 November 2020, are listed in Table 4 (source: Airservices Australia).

Table 4 Instrument flight procedures at Rockhampton Airport

Procedure name	*Effective date*
AERODROME CHART PAGE 1	23-Mar-2023 (Am 174)
AERODROME CHART PAGE 2	1-Dec-2022 (Am 173)
APRON CHART	17-Jun-2021 (Am 167)
NOISE ABATEMENT PROCEDURE	30-May-2013 (Am 135)
SID ROCKHAMPTON THREE DEPARTURE(RADAR) RWY 15 & 33	1-Dec-2022 (Am 173)
SID BUDGI TWO DEP (RNAV)	1-Dec-2022 (Am 173)
SID TARES FOUR DEP (RNAV)	8-Sep-2022 (Am 172)
STAR ABVAS ONE ARR (RNAV)	1-Dec-2022 (Am 173)
STAR DADBO ONE ARR (RNAV)	1-Dec-2022 (Am 173)
DME OR GNSS ARRIVAL PAGE 1	1-Dec-2022 (Am 173)
DME OR GNSS ARRIVAL PAGE 2	1-Dec-2022 (Am 173)
VOR RWY 15	1-Dec-2022 (Am 173)
VOR RWY 33	1-Dec-2022 (Am 173)
NDB-A OR VOR-A	1-Dec-2022 (Am 173)
RNP RWY 15	1-Dec-2022 (Am 173)
RNP (GNSS) RWY 33	1-Dec-2022 (Am 173)

The RNP approach procedures have an initial approach altitude, minimum holding altitude and missed approach altitude of 3500 ft AMSL, based on the 25 nm MSA.

Similarly, the NDB-A or VOR-A, VOR RWY 15 and VOR RWY 33 procedures have a missed approach altitude of 3500 ft AMSL, based on the 25 nm MSA.

If the 25 nm MSA is increased as a result of the wind turbines, whether through sectorising or increasing the overall MSA, then there will be a consequential increase in the initial approach and/or missed approach altitudes of these procedures.

There will be no impact on other altitudes, including descent minima, of either of these procedures.

6.7. Air routes and LSALT

MOS 173 requires that a minimum obstacle clearance of 1000 ft above the highest terrain or obstacle is maintained along each air route.

The Project is solely located in the area with a grid lowest safe altitude of 1189 m AHD (3900 ft AMSL) with a protection surface of 884 m AHD (2900 ft AMSL).

The highest WTG has a maximum overall height of 828 m AHD (2716.5 ft AMSL) and is below the LSALT MOC of 2900 ft AMSL. Therefore, the Project will not affect the grid LSALT of 3900 ft AMSL.

Figure 19 shows the grid LSALT and air routes in the vicinity of the Project boundary (source: Neoen, OzRunways, ERC Low National, 13 August 2020).

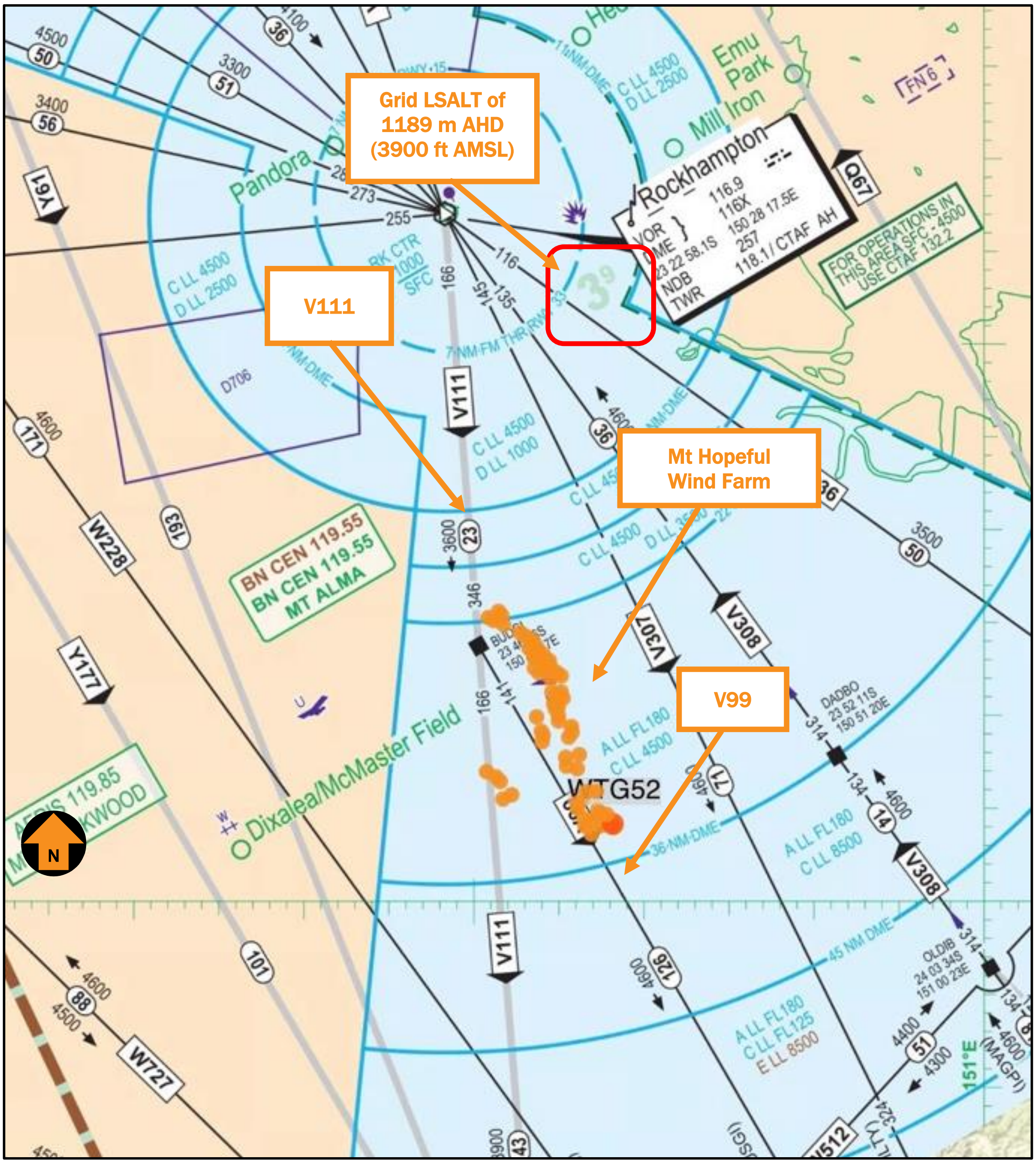

Figure 19 Air routes in the vicinity of the Project boundary

An impact analysis of the surrounding air routes is provided at Table 5.

Table 5 Air route impact analysis

Air route	Waypoint pair	Route LSALT	Protection Surface	Impact on airspace design	Potential solution	Impact on aircraft ops
V111	One way route - southbound Rockhampton to BUDGI	1189 m AHD 3900 ft AMSL	884 m AHD 2900 ft AMSL	Nil (below the controlling surface)	N/A	N/A
V111	BUDGI to Thangool	1097 m AHD 3900 ft AMSL	793 m AHD 2900 ft AMSL	Nil (below the controlling surface)	N/A	N/A
V99	One way route BUDGI to Gayndah	1402 m AHD 4600 ft AMSL	1097 m AHD 3600 ft AMSL	Nil (below the controlling surface)	N/A	N/A

The Project will not impact on air route or grid LSALT.

6.8. Nearby aircraft landing areas

As a guide, an area of interest within a 3 nm radius of an aircraft landing area (ALA) is used to assess potential impacts of proposed developments on aircraft operations at or within the vicinity of the ALA.

A search on OzRunways, which sources its data from Airservices Australia (AIP), and website www.nationalmap.gov.au discovered a number of nearby non-regulated aerodromes within proximity of the project area. The aeronautical data provided by OzRunways is approved under CASA CASR Part 175.

Figure 20 shows the location of nearby ALAs relative to the Project and a nominal 3 nm buffer from the ALAs (source: Neoen, Google Earth).

The closest ALA to the project area is an unknown aerodrome at a distance of 9.5 km (5.1 nm).

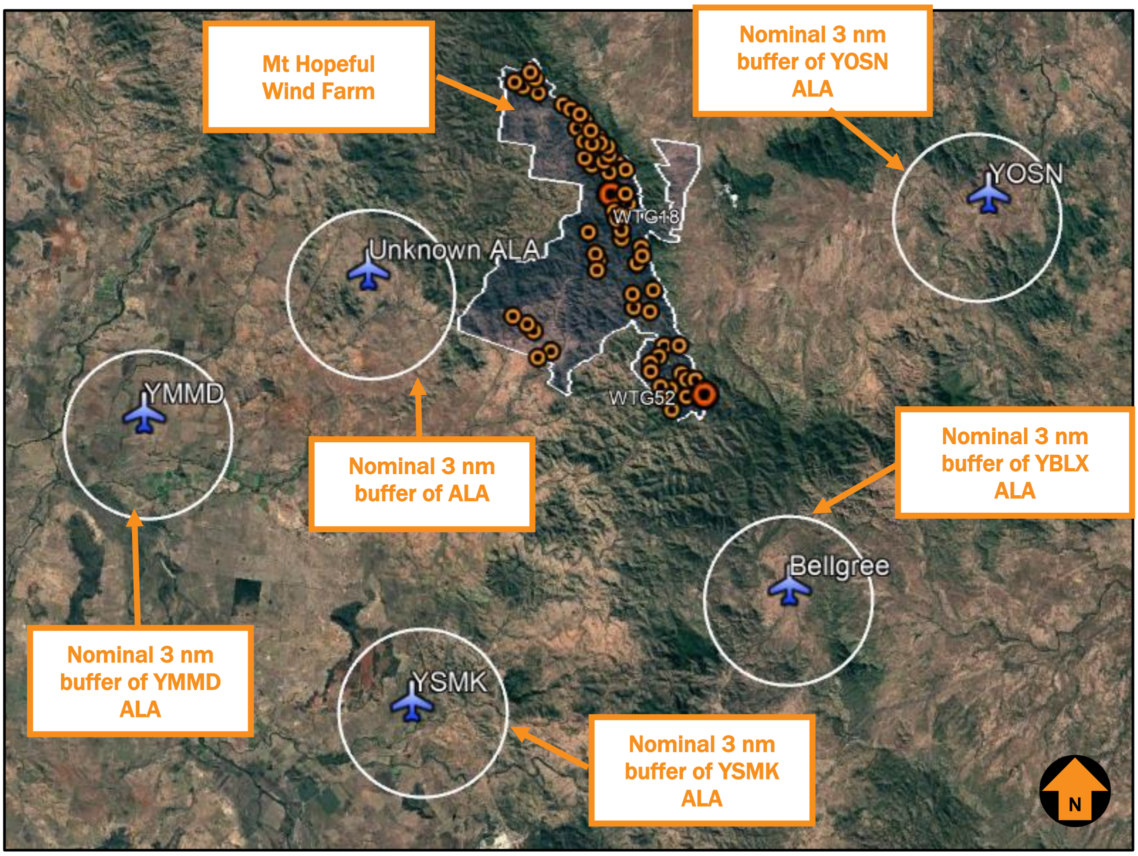

Figure 20 Project layout and the closest ALAs

Given that the closest ALA to the project area is the unknown aerodrome at a distance of 9.5km (5.1 nm), take-off and landing operations there will not be impacted.

6.9. Airspace

The project area is located outside controlled airspace (wholly within Class G airspace), within the horizontal extent but below Rockhampton Airport's controlled airspace (Class D airspace lower limit of 3500 ft AMSL).

6.10. Aviation facilities and Radar

A search was conducted of State Planning Policy (SPP) interactive mapping and SPP – state interest guideline Strategic airports and aviation facilities Appendix 5, to identify any aviation facilities that may be affected by the Project. With help of these online resources, the Mt Alma Route Surveillance Radar (RSR) has been identified. This facility has a 15 km Building restricted area surrounding it. The project area is located just outside this 15 km area as can be seen in Figure 21.

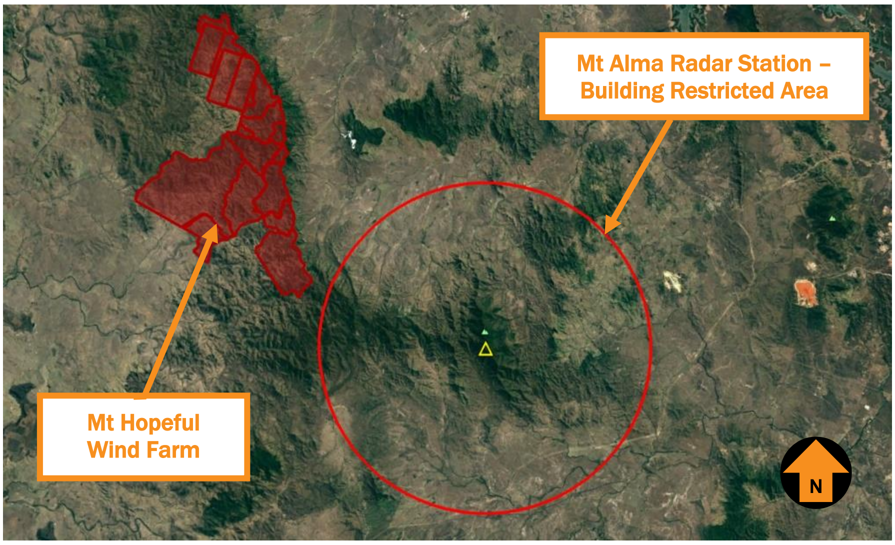

Figure 21 Mt Alma Radar Station – Building Restricted Area

Airservices Australia requires an assessment of the potential for wind turbines to affect radar line of sight.

Mt Alma (RSR) is located approximately 16.6 km (9 nm) south east of the closest WTG.

The EUROCONTROL guidelines state:

> *When further than 16 km from an SSR the impact of a wind turbine (3-blades, 30-200 m height, and horizontal rotation axis) is considered to be tolerable.*

Therefore, it is unlikely that the Project will impact Mt Alma RSR.

6.11. Consultation

An appropriate and justified level of consultation was undertaken with relevant parties in 2021. The extent of the Project does not change the responses in a significant way.

Airservices Australia will need to review this report to update their response due to the lower height of the WTGs, the infringements to the 25 nm MSA and the consequential changes required to holding pattern, missed approach and commencement altitude adjustments required.

Refer to Section 5 for details of the stakeholders and a summary of the consultation.

6.12. Summary

Based on the Project layout and overall turbine blade tip height limit of 260 m AGL, the blade tip elevation of the highest wind turbine, which is WTG 56, will not exceed 828 m AHD (2716.1 ft AMSL) and:

- will not infringe any OLS surfaces
- will infringe PANS-OPS associated with the 25 nm MSA and consequential impacts to approach commencement altitudes, missed approach final altitude and minimum holding altitudes
- may infringe Radar Terrain Clearance Chart surfaces
- will not have an impact on nearby designated air routes
- will not have an impact on the grid LSALT
- is wholly contained within Class G airspace
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

Airservices Australia has previously advised that the wind farm will affect the Rockhampton RTCC. The extent of the impacts was not disclosed.

The list of wind turbines (obstacles), showing coordinates and elevation data that are applicable to this AIS, is provided in Annexure 3.

7. HAZARD LIGHTING AND MARKING

Based on the risk assessment set out in Section 9 it has been concluded that aviation lighting is not required for WTGs and WMTs, but relevant lighting standards and guidelines are summarized in **Annexure 5.**

7.1. Wind monitoring towers

Given that aerial operators might frequently use the area within the project area and that the proposed WMTs will be constructed prior WTGs, the WMTs will be free-standing and not surrounded by any other obstacles. Therefore, the proposed WMTS should be marked with red/white/red bands as per the NASF Guideline D.

Consideration could be given to marking any WMTs according to the requirements set out in MOS 139 Chapter 8, Division 10 Obstacle Markings; specifically:

> *8.110 (5) As illustrated in Figure 8.110 (5), long, narrow structures like masts, poles and towers which are hazardous obstacles must be marked in contrasting colour bands so that:*
>
> a) *the darker colour is at the top; and the bands are, as far as physically possible, marked at right angles along the length of the long, narrow structure; and*
>
> b) *have a length ("z" in Figure 8.110 (5)) that is, approximately, the lesser of:*
>
> A. *1/7 of the height of the structure; or*
>
> B. *30 m.*

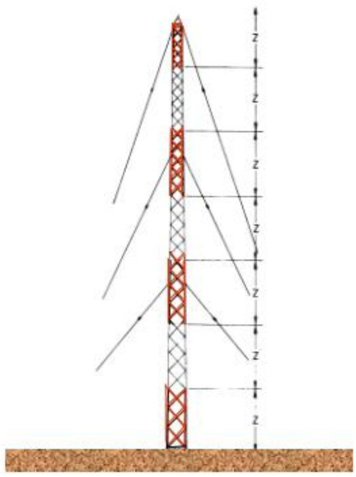

Figure 8.110 (5) Marking of mast, pole and tower (illustrates matters)

> *8.110 (7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables.*
>
> *Note: Spheres and pyramids are examples of 3-dimensional objects. (8) The objects mentioned in subsection (7) must: be approximately equivalent*

NASF Guideline D suggests consideration of the following measures specific to the marking and lighting of WMTs:

- *the top 1/3 of wind monitoring towers to be painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers;*
- *marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires;*
- *ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation;* ***or***
- *a flashing strobe light during daylight hours.*

Neoen proposes to place aviation marker balls on the outside guy wires and paint the top 1/3 of WMTs structures in red and white bands.

8. ACCIDENT STATISTICS

This section establishes the external context to ensure that stakeholders and their objectives are considered when developing risk management criteria, and that externally generated threats and opportunities are properly taken into account.

8.1. General aviation operations

The general aviation (GA) activity group is considered by the Australian Transport Safety Bureau (ATSB) to be all flying activities that do not involve commercial air transport (activity group), including scheduled (RPT) and non-scheduled (charter) passenger and freight type. It may involve Australian civil (VH–) registered aircraft, or aircraft registered outside of Australia. General aviation/recreational encompasses:

- Aerial work (activity type). Includes activity subtypes: agricultural mustering, agricultural spreading/spraying, other agricultural flying, photography, policing, firefighting, construction – sling loads, other construction, search and rescue, observation and patrol, power/pipeline surveying, other surveying, advertising, and other aerial work.
- Own business travel (activity type).
- Instructional flying (activity type). Includes activity subtypes: solo and dual flying training, and other instructional flying.
- Sport and pleasure flying (activity type). Includes activity subtypes: pleasure and personal transport, glider towing, aerobatics, community service flights, parachute dropping, and other sport and pleasure flying.
- Other general aviation flying (activity type). Includes activity subtypes: test flights, ferry flights and other flying.

8.2. ATSB occurrence taxonomy

The ATSB uses a taxonomy of occurrence sub-type. Of specific relevance to the subject assessment are terms associated with **terrain collision**. Definitions sourced from the ATSB website are provided below:

- **Collision with terrain**: Occurrences involving a collision between an airborne aircraft and the ground or water, where the flight crew were aware of the terrain prior to the collision.
- **Controlled flight into terrain (CFIT):** Occurrences where a serviceable aircraft, under flight crew control, is inadvertently flown into terrain, obstacles, or water without either sufficient or timely awareness by the flight crew to prevent the event.
- **Ground strike:** Occurrences where a part of the aircraft drags on, or strikes, the ground or water while the aircraft is in flight, or during take-off or landing.
- **Wirestrike:** Occurrences where an aircraft strikes a wire, such as a powerline, telephone wire, or guy wire, during normal operations.

8.3. National aviation occurrence statistics 2010-2019

The Australian Transport Safety Bureau recently published a summary of aviation occurrence statistics for the period 2010-2019 (AR-2020-014, Final - 29 April 2020).

According to the report, there were no fatalities in high or low capacity RPT operations during the period 2010-2019. In 2019, 220 aircraft were involved in accidents in Australia, with a further 154 aircraft involved in serious incidents (an incident with a high probability of becoming an accident). In 2019 there was 35 fatalities from 22 fatal accidents. There have been no fatalities in scheduled commercial air transport in Australia since 2005.

Of the 326 fatalities recorded in the 10-year period, almost two thirds (175 or 53.68%) occurred in the general aviation segment. On average, there were 1.51 fatalities per aircraft associated with a fatality in this segment. The fatalities to aircraft ratio ranges from 1.09 to 177:1. Whilst it can be inferred from the data that the majority of fatal accidents are single person fatalities, it is reasonable to assert that the worst credible effect of an aircraft accident in the general aviation category will be multiple fatalities.

A breakdown of aircraft and fatalities by general aviation sub-categories is provided in Table 6 (source: ATSB).

Table 6 Number of fatalities by GA sub-category – 2010 to 2019

Sub-category	*Aircraft assoc. with fatality*	*Fatalities*	*Fatalities to aircraft ratio*
Aerial work	37	44	1.18:1
Instructional flying	11	19	1.72:1
Own business travel	3	5	1.6:1
Sport and pleasure flying	53	94	1.77:1
Other general aviation flying	11	12	1.09:1
Totals	115	174	1.51:1

Figure 22 refers to Fatal Accident Rate by operation type per million departures over the 6-year period (source: ATSB). Note the rates presented are not the full year range of the study (2010–2019). This was due to the availability of exposure data (departures and hours flown) which was only available between these years. According to the ATSB report, the number of fatal accidents per million departures for GA aircraft over the 6-year reporting period ranged between 6.6 in 2014 and 4.9 in 2019.

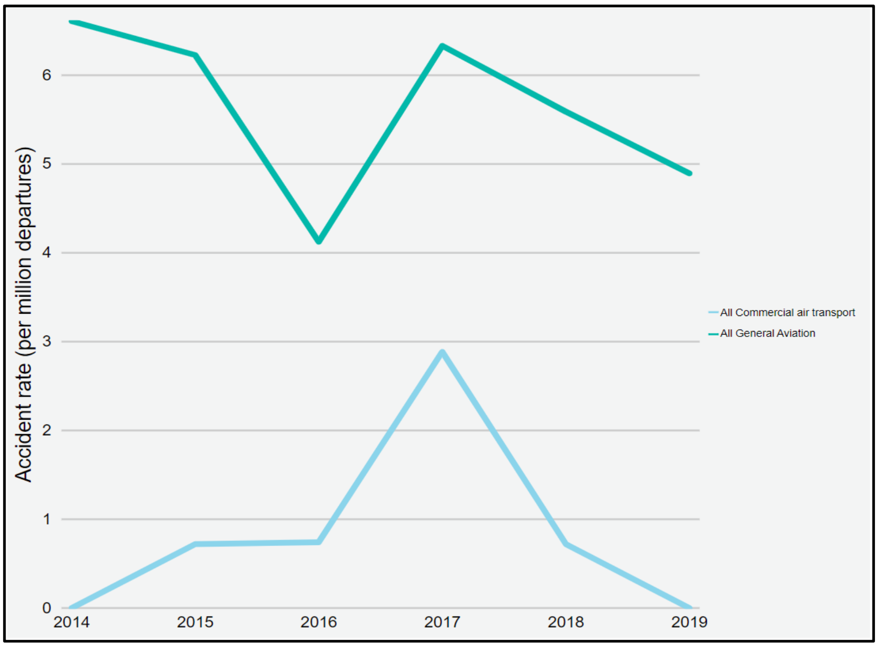

Figure 22 Fatal Accident Rate (per million departures) by Operation Type

In 2018, there were 9 fatal accidents and 9 fatalities involving GA aircraft, resulting in a rate of 5.6 fatal accidents per million departures and 7.7 fatal accidents per million hours flown.

In 2019, there were 1,760,000 landings, and 1,320,000 hours flown by VH-registered general aviation aircraft in Australia, with 8 fatal accidents and 17 fatalities. Based on these results, in 2019 there were 4.9 fatal accidents per million departures and 6.4 fatal accidents per million hours flown. A summary of fatal accidents from 2010-2019 by GA sub-category is provided in Table 7 (source: ATSB).

Table 7 Fatal accidents by GA sub-category – 2010 -2019

Sub-category	*Fatal accidents*	*Fatalities*
Agricultural spreading/spraying	13	13
Agricultural mustering	11	12
Other agricultural	1	1
Survey and photographic	5	10
Search and rescue	2	2
Firefighting	2	2
Other aerial work	3	4
Instructional flying	11	19

Sub-category	*Fatal accidents*	*Fatalities*
Own business travel	3	5
Sport and pleasure flying	53	94
Other general aviation flying	11	12
Total	115	174

Over the 10-year period, no aircraft collided with a wind turbine or a wind monitoring tower.

Of the 20,529 incidents, serious incidents and accidents in GA operations in the 10-year period, 1404 (6.83%) were terrain collisions.

The underlying fatality rate for GA operations discussed above is considered tolerable within Australia's regulatory and social context.

8.4. Worldwide accidents involving wind farms

To provide some perspective on the likelihood of a VFR aircraft colliding with a wind turbine, a summary of the four accidents that involved an aircraft colliding with a wind turbine, and the relevant factors applicable to this assessment, is incorporated in this section.

Based on the statistic of the Global Wind Energy Council (GWEC) report 2016, there were 341,320 wind turbines operating around the world at the end of 2016. In 2019, approximately 60.4 GW of wind power had been installed worldwide.

Based on the Australia's Clean Energy Council statistics there were 102 wind farms in Australia at the end of 2019.

Aviation Projects has researched public sources of information, accessible via the world wide web, regarding aviation safety occurrences associated with wind farms. Occurrence information published by Australia, Canada, Europe (Belgium, Denmark, France, Germany, Norway, Sweden and The Netherlands), New Zealand, the United Kingdom and the United States of America was reviewed.

Of the four known accidents, one was caused by inflight separation of the majority of the right canard and all of the right elevator resulting from a failure of the builder to balance the elevators per the kit manufacturer's instructions. The accident occurred overhead a wind farm, and the aircraft struck a wind turbine on its descent. This accident is not applicable to the circumstances under consideration.

There have been two accidents involving collision with a wind turbine during the day.

Only one of these (Melle, Germany 2017) resulted in a single fatality, as the result of a collision with a wind turbine steel lattice mast at a very low altitude during the day with good visibility and no cloud. If the mast was solid and painted white, then it more than likely would have been more visible than if it was equipped with an obstacle light.

In the other case (Plouguin, France, 2008), the pilot decided to descend below cloud in an attempt to find the destination aerodrome. The aircraft was in conditions of significantly reduced horizontal visibility in fog where the top of the turbine was obscured by cloud. The turbines became visible too late for avoidance manoeuvring and the aircraft made contact with two turbines. The aircraft was damaged but landed safely.

In both cases, is difficult to conclude that obstacle lighting would have prevented the accident.

The other fatal accident occurred at night in IMC and is not applicable to the circumstances under consideration.

There is one other accident mentioned in a database compiled by an anti-wind farm lobby group, which suggests a Cessna 182 collided with a wind turbine near Baraboo, Wisconsin, on 29 July 2000. The NTSB database records details of an accident involving a Cessna 182 that occurred on 28 July 2000 in the same area but suggests that the accident was caused by IFR flight into IMC encountered by the pilot and exceeding the design limits of the aircraft. A factor was flight to a destination alternate not performed by the pilot. No mention is made of wind turbines or a wind farm.

A summary of the four accidents is provided in Table 8.

Table 8 Summary of accidents involving collision with a wind turbine

ID	Description	Date	Location	Fatalities	Flight rules	Turbine height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
1	Diamond DA320-A1 D-EJAR Collided with a wind turbine approximately 20 m above the ground, during the day in good visibility. The mast was grey steel lattice, rather than white, although the blades were painted in white and red bands.	02 Feb 2017	Melle, Germany	1	Day VFR No cloud and good visibility	Not specified	Not specified	Not specified	Not applicable

ID	Description	Date	Location	Fatalities	Flight rules	Turbine height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
2	The Piper PA-32R-300, N8700E, was destroyed during an impact with the blades of a wind turbine tower, at night in IMC. The wind turbine farm was not marked on either sectional chart covering the accident location; however, the pilot was reportedly aware of the presence of the wind farm.	27 Apr 2014	10 miles south of Highmore, South Dakota	4	Night IMC Low cloud and rain	420 ft AGL overall	Fitted but reportedly not operational on the wind turbine that was struck	The NTSB determined the probable cause(s) of this accident to be the pilot's decision to continue the flight into known deteriorating weather conditions at a low altitude and his subsequent failure to remain clear of an unlit wind turbine. Contributing to the accident was the inoperative obstruction light on the wind turbine, which prevented the pilot from visually identifying the wind turbine.	An operational obstacle light may have prevented the accident

3	Beechcraft B55 The pilot was attempting to remain in VMC by descending the aircraft through a break in the clouds. The pilot, distracted by trying to visually locate the aerodrome, flew into an area of known wind turbines. After sighting the turbines, he was unable to avoid them. The tip of the left wing struck the first turbine blade, followed by the tip of the right wing striking the second turbine. The pilot was able to maintain control of the aircraft and landed safely.	04 Apr 2008	Plougin, France	0	Day VFR The weather in the area of the wind turbines had deteriorated to an overcast of stratus cloud, with a base between 100 ft to 350 ft and tops of 500 ft.	328 ft AGL hub height, 393 ft AGL overall	Not specified	This pilot reported having been distracted by a troubling personal matter which he had learned of before departing for the flight. The wind farm was annotated on aeronautical charts.	Not applicable

ID	Description	Date	Location	Fatalities	Flight rules	Turbine height	Obstacle lighting	Cause of accident	Relevant to obstacle lighting at night
4	VariEze N25063 The aircraft collided with a wind turbine following in-flight separation of the majority of the right canard and all of the right elevator	20 July 2001	Palm Springs, USA	2	Day VFR	N/A	N/A	The failure of the builder to balance the elevators per the kit manufacturer's instructions	Not applicable

9. RISK ASSESSMENT

A risk management framework is comprised of likelihood and consequence descriptors, a matrix used to derive a level of risk, and actions required of management according to the level of risk.

The risk assessment framework used by Aviation Projects and risk event description is provided in Annexure 4.

9.1. Risk Identification

The primary risk being assessed is that of aviation safety associated with the proposed wind farm and WMTs.

Based on an extensive review of accident statistics data (see summary in Section 8 above) and input from stakeholders, five (5) identified risk events associated with wind turbines and WMTs relate to aviation safety, and are listed as follows:

1. potential for an aircraft to collide with a wind turbine, controlled flight into terrain (CFIT)
2. potential for an aircraft to collide with a wind monitoring tower (CFIT)
3. potential for a pilot to initiate manoeuvring in order to avoid colliding with a wind turbine or monitoring tower resulting in collision with terrain
4. potential for the hazards associated with the Project to invoke operational limitations or procedures on operating crew
5. effect of obstacle lighting on neighbours.

It should be noted that according to guidance provided by the Commonwealth Department of Infrastructure and Regional Development, and in line with generally accepted practice, the risk to be assessed should primarily be associated with passenger transport services. The risk being assessed herein is primarily associated with smaller aircraft likely to be flying under the VFR, and so the maximum number of passengers exposed to the nominated consequences is likely to be limited.

A fifth identified risk event associated with WTGs and WMTs is the potential visual impact associated with obstacle lighting (if fitted) on surrounding residents.

The five risk events identified here are assessed in detail in the following section.

9.2. Risk Analysis, Evaluation and Treatment

For the purpose of considering applicable consequences, the concept of worst credible effect has been used. Untreated risk is first evaluated, then, if the resulting level of risk is unacceptable, further treatments are identified to reduce the level of risk to an acceptable level.

A summary of the level of risk associated with the proposed Project, under the proposed treatment regime, with specific consideration of the effect of obstacle lighting, is provided in Tables 8 to 12.

Table 9 Aircraft collision with wind turbine

Risk ID:	1. Aircraft collision with wind turbine (CFIT)

Discussion

An aircraft collision with a wind turbine would result in harm to people and damage to property. Property could include the aircraft itself, as well as the wind turbine.

There have been four reported occurrences worldwide of aircraft collisions with a component of a wind turbine structure since the year 2000 as discussed in Section 8. These reports show a range of situations where pilots were conducting various flying operations at low level and in the vicinity of wind farms in both IMC and VMC. No reports of aircraft collisions with wind farms in Australia have been found.

In consideration of the circumstances that would lead to a collision with a wind turbine:

- GA VFR aircraft operators generally do not individually fly a significant number of hours in total, let alone in the area in question;
- There is a very small chance that a pilot, suffering the stress of weather, will continue into poor weather conditions (contrary to the rules of flight) rather than divert away from it, is not aware of the wind farm, will not consider it or will not be able to accurately navigate around it; and
- If the aircraft was flown through the wind farm, there is still a very small chance that it would hit a wind turbine.

Refer to the discussion of worldwide accidents at Section 8.

There are no known aerial agriculture operations conducted at night in the vicinity of the Project.

The Project is clear of the OLS of any aerodrome.

Consequence

If an aircraft collided with a wind turbine, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.

Consequence	Catastrophic

Untreated Likelihood

There have been four reports of aircraft collisions with wind turbines worldwide, which have resulted in a range of consequences, where aircraft occupants sustained minor injury in some cases and fatal injuries in others. Similarly, aircraft damage sustained ranged from minor to catastrophic. One of these accidents resulted from structural failure of the aircraft before the collision. Only two relevant accidents occurred during the day, and only one resulted in a single fatality. It is assessed that collision with a wind turbine resulting in multiple fatalities and damage beyond repair is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.

Untreated Likelihood	Possible

Current Treatments (without lighting) • The Project is clear of the OLS of any aerodrome. • Aircraft are restricted to a minimum height of 500 ft (152.4 m) AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built up areas. The proposed turbines will be a maximum of 260 m (853 ft) AGL at the top of the blade tip. The rotor blade at its maximum height will be approximately 107.6 m (353 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • In the event that descending cloud forces an aircraft lower than 500 ft (152.4 m) AGL, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines. • If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The wind turbines are typically coloured white so they should be visible during the day. • The ‘as constructed’ details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts. • Because the turbines are above 110 m AGL, there is a statutory requirement to report the towers to CASA.
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.

Current Level of Risk	8 - Unacceptable
Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Recommended Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Details of the Project should be communicated to local and regional aircraft operators prior to, during and following construction to heighten their awareness of its location and so that they can plan their operations accordingly. Specifically:	

- Provide the details to the Queensland Regional Airspace and Procedures Advisory Committee for consideration by its members in relation to VFR transit routes in the vicinity of the wind farm. - Engage with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, determining the best times for commencement of the local aerial agricultural operations or shutting down wind turbines altogether in bushfire emergencies requiring aerial firefighting operations within the project area. - Arrangements should be made to publish details of the wind farm in ERSA for surrounding aerodromes.	
Residual Risk With the additional recommended treatments, the likelihood of an aircraft collision with a wind turbine resulting in multiple fatalities and damage beyond repair will be **Unlikely**, and the consequence remains **Catastrophic**, resulting in an overall risk level of **7 - Tolerable**. It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified. In the circumstances, the level of risk under the proposed treatment plan is considered **as low as reasonably practicable (ALARP).** **It is our assessment that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project.**	
Residual Risk	7 - Tolerable

Table 10 Aircraft collision with wind monitoring tower

Risk ID:	2. Aircraft collision with a wind monitoring tower (CFIT)
Discussion An aircraft collision with a WMT would result in harm to people and damage to property. There is one existing WMT and 10 permanent WMTs are proposed as part of the Project. The proposed WMTs will be of steel lattice construction with a maximum of 170 m (558 ft) AGL in height. The towers will be installed at different locations around the project area. The proposed WMTs will have high visibility aviation marker balls up on the top-level guy wires. The location of the proposed WMT locations and other applicable details will be advised to Airservices Australia. There are only a few instances of aircraft colliding with a WMT, but they were all during the day with good visibility, and no instance was in Australia. There is a relatively low rate of aircraft activity in the vicinity of the wind farm. There are no known aerial agriculture operations conducted at night in the vicinity of the wind farm. If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing: a) whether the object or structure will be a hazard to aircraft operations b) whether it requires an obstacle light that is essential for the safety of aircraft operations	
Consequence If an aircraft collided with a WMT, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.	
Consequence	Catastrophic
Untreated Likelihood There are a few occurrences of an aircraft colliding with a WMT, but all were during the day with good visibility when obstacle lighting would arguably be of no effect, and none were in Australia. It is assessed that collision with a wind monitoring tower without obstacle lighting that would be effective in alerting the pilot to its presence is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.	
Untreated Likelihood	Possible
Current Treatments • The WMT locations will be advised to CASA and Airservices Australia. • Aircraft are restricted to a minimum height of 152.4 m (500 ft) AGL above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built up areas. The WMTs will be at a maximum height of 170 m (558 ft) AGL, which will be 17.8 m (58 ft) above the minimum height of 500 ft AGL for an aircraft flying at this height.	

• In the event that descending cloud forces an aircraft lower than 152.4 m AGL (500 ft), the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of the tower. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The towers will be constructed from grey steel. • Since the towers will be higher than 110 m AGL, there is a statutory requirement to report them to CASA.
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.

Current Level of Risk	8 - Unacceptable

Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.

Risk Decision	Unacceptable

Recommended Treatments The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Details of any WMTs when they are constructed should be advised to Airservices Australia. • Consideration could be given to marking any wind monitoring towers according to the requirements set out in MOS 139 Section 8.10 Obstacle Markings (as modified by the guidance in NASF Guideline D); specifically: *8.10.2.6 Masts, poles and towers must be marked in contrasting bands with the darker colour at the top, as shown in Figure 8.10-3. The bands must be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less.* *8.10.2.8 Wires or cable obstacles must be marked using three-dimensional coloured objects such as spheres and pyramids, etc; of a size equivalent to a cube with 600 mm sides, spaced 30 m apart.* • Ensure details of any additional WMTs on the project area have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators before, during and following construction.

Residual Risk With the additional recommended treatments, the likelihood of an aircraft colliding with a WMT resulting in multiple fatalities and damage beyond repair will be **Unlikely**. The consequence remains **Catastrophic**, resulting in an overall risk level of **7 – Tolerable**. It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision, given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified. Only if a WMT exceeds 150 m AGL in height and is not in relatively close proximity to a wind turbine. In the circumstances, the level of risk under the proposed treatment plan is considered **ALARP**. **It is our assessment that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with the WMTs, without obstacle lighting on the WMT of the Project.**	
Residual Risk	7 - Tolerable

Table 11 Harsh manoeuvring leading to controlled flight into terrain

Risk ID:	3. Harsh manoeuvring leads to controlled flight into terrain (CFIT)

Discussion

An aircraft colliding with terrain as a result of manoeuvring to avoid colliding with a wind turbine would result in harm to people and damage to property.

There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day.

The Project is clear of the OLS of any aerodrome.

Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built up areas.

The proposed turbines will be a maximum of 260 m (853 ft) at the top of the blade tip. The rotor blade at its maximum height will be approximately 107.6 m (353 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft).

Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines.

If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective.

Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).

Aircraft authorised to intentionally fly below 152.4 m (500 ft) AGL (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities.

Assumed risk treatments

- The wind turbines are typically coloured white so they should be visible during the day
- The ‘as constructed’ details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts.
- Since the turbines will be higher than 110 m AGL, there is a statutory requirement to report the turbines to CASA.

Consequence

If an aircraft collided with terrain, the worst credible effect would be multiple fatalities and damage beyond repair. This would be a Catastrophic consequence.

Consequence	Catastrophic

Untreated Likelihood

There are a few ground collision accidents resulting from manoeuvring to avoid wind farms, but none in Australia, and all were during the day. It is assessed that a ground collision accident following manoeuvring to avoid a wind turbine is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.

Untreated Likelihood	Possible

Current Treatments (without lighting) • The Project is clear of the OLS of any aerodrome. • Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built up areas. • The proposed turbines will be a maximum of 260 m (853 ft) at the top of the blade tip. The rotor blade at its maximum height will be approximately 107.6 m (353 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines. • If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night). • Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The wind turbines are typically coloured white, typical of most wind turbines operational in Australia, so they should be visible during the day. • The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts. • Since the turbines will be higher than 110 m AGL, there is a statutory requirement to report the turbines to CASA.	
Level of Risk The level of risk associated with a Possible likelihood of a Catastrophic consequence is 8.	
Current Level of Risk	8 – Unacceptable
Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Recommended Treatments	

The following treatments which can be implemented at little cost will provide an acceptable level of safety: • Ensure details of the Project have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators before, during and following construction. • Although there is no requirement to do so, Neoen may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for their safe operation within the project area.
Residual Risk With the additional recommended treatments, the likelihood of ground collision resulting from manoeuvring to avoid a wind turbine resulting in multiple fatalities and damage beyond repair will be **Unlikely**, and the consequence remains **Catastrophic**, resulting in an overall risk level of **7 – Tolerable**. It is considered that the significant cost of obstacle lighting (which is not a preventative control), may only slightly reduce the likelihood of a collision given that the pilot is already in a highly undesirable situation (and not in all situations – such as where the obstacle light may be obscured by cloud) and hence is not justified. In the circumstances, the level of risk under the proposed treatment plan is considered **ALARP**. **It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for ground collision resulting from manoeuvring to avoid a wind turbine, without obstacle lighting on the turbines of the Project.**

Residual Risk	7 - Tolerable

Table 12 Effect of Project on operating crew

Risk ID:	4. Effect of the Project on operating crew	
Discussion Introduction or imposition of additional operating procedures or limitations can affect an aircraft's operating crew. There are no known aerial agriculture operations conducted at night in the vicinity of the Project.		
Consequence The worst credible effect a wind farm could have on flight crew would be the imposition of operational limitations, and in some cases, the potential for use of emergency procedures. This would be a Minor consequence.		
	Consequence	Minor
Untreated Likelihood The imposition of operational limitations is unlikely to occur, but possible (has occurred rarely), which is classified as Possible.		
	Untreated Likelihood	Possible
Current Treatments (without lighting) • The Project is clear of the OLS of any aerodrome. • Aircraft are restricted to a minimum height of 152.4 m (500 ft) above the highest point of the terrain and any object on it within a radius of 300 m in visual flight during the day when not in the vicinity of built up areas. • The proposed turbines will be a maximum of 260 m (853 ft) at the top of the blade tip. The rotor blade at its maximum height will be approximately 107.6 m (353 ft) above aircraft flying at the minimum altitude of 152.4 m AGL (500 ft). • In the event that descending cloud forces an aircraft lower than 500 ft (152.4 m) AGL, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines. • Nevertheless, the minimum visibility of 5000 m required for visual flight during the day should provide adequate time for pilots to observe and manoeuvre their aircraft clear of wind turbines. • If cloud descends below the turbine hub, obstacle lighting would be obscured and therefore ineffective. • Aircraft are restricted to a minimum height of 304.8 m (1000 ft) above obstacles within 10 nm of the aircraft in visual flight at night and potentially even higher during instrument flight (day or night).		

• Aircraft authorised to intentionally fly below 152.4 m AGL (500 ft) (day) or below safety height (night) are operated in accordance with procedures developed as an outcome of thorough risk management activities. • The wind turbines are typically coloured white so they should be visible during the day. • The 'as constructed' details of wind turbines are required to be notified to Airservices Australia so that the location and height of wind farms can be noted on aeronautical maps and charts. • Since the turbines will be higher than 110 m AGL, there is a statutory requirement to report the turbines to CASA.	
Level of Risk The level of risk associated with a Possible likelihood of a Minor consequence is 5.	
Current Level of Risk	5 - Tolerable
Risk Decision A risk level of 5 is classified as Tolerable: Treatment action possibly required to achieve ALARP - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.	
Risk Decision	Accept, conduct cost benefit analysis
Proposed Treatments Given the current treatments and the limited scale and scope of flying operations conducted within the vicinity of the Project, there is likely to be little additional safety benefit to be gained by installing obstacle lighting, other than if a WMT is not in relatively close proximity to a wind turbine. However, the following treatments, which can be implemented at little cost, will provide an additional margin of safety: • Ensure details of the Project have been communicated to Airservices Australia, and local and regional aerodrome and aircraft operators before, during and following construction. • Although there is no requirement to do so, Neoen may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures for such aircraft operations in the vicinity of the Project.	
Residual Risk Notwithstanding the current level of risk is considered **Tolerable**, the additional recommended treatments will enhance aviation safety. The likelihood remains **Possible**, and consequence remains **Minor**. In the circumstances, the risk level of 5 is considered **ALARP.** **It is our assessment that there is an acceptable level of aviation safety risk associated with the potential for operational limitations to affect aircraft operating crew, without obstacle lighting on the WTGs and WMTs of the Project.**	
Residual Risk	**5 - Tolerable**

Table 13 Effect of obstacle lighting on neighbours

Risk ID:	5. Effect of obstacle lighting on neighbours
Discussion This scenario discusses the consequential impact of a decision to install obstacle lighting on the wind farm. Installation and operation of obstacle lighting on wind turbines or WMT can have an effect on neighbours' visual amenity and enjoyment, specifically at night and in good visibility conditions. If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing: a) whether the object or structure will be a hazard to aircraft operations b) whether it requires an obstacle light that is essential for the safety of aircraft operations	
Consequence The worst credible effect of obstacle lighting specifically at night in good visibility conditions would be: • Moderate site impact, minimal local impact, important consideration at local or regional level, possible long-term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences. This would be a Moderate consequence.	
Consequence	Moderate
Untreated Likelihood The likelihood of moderate site impact, minimal local impact is Almost certain - the event is likely to occur many times (has occurred frequently).	
Untreated Likelihood	Almost certain
Current Treatments If a proposed object or structure is identified as likely to be an obstacle, details of the relevant proposal must be referred to CASA for CASA to determine, in writing: a) whether the object or structure will be a hazard to aircraft operations b) whether it requires an obstacle light that is essential for the safety of aircraft operations	
Level of Risk The level of risk associated with an Almost certain likelihood of a Moderate consequence is 8.	
Current Level of Risk	8 - Unacceptable

Risk Decision A risk level of 8 is classified as Unacceptable: Immediate action required by either treating or avoiding risk. Refer to executive management.	
Risk Decision	Unacceptable
Recommended Treatments Not installing obstacle lighting would completely remove the source of the impact. If lighting is required, there are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours, including: • reducing the number of wind turbines equipped with obstacle lights • specifying an obstacle light that minimises light intensity at ground level • specifying an obstacle light that matches light intensity to meteorological visibility • mitigating light glare from obstacle lighting through measures such as baffling. There are impact reduction measures that can be implemented to reduce the impact of lighting on surrounding neighbours. These measures are designed to optimise the benefit of the obstacle lights to pilots while minimising the visual impact to those on the ground. Consideration may be given to activating the obstacle lighting via a pilot activated lighting system. An option is to consider using Aircraft Detection Lighting Systems (referred in the United States Federal Aviation Administration Advisory Circular AC70/7460-1L CHG1 – *Obstruction Marking and Lighting*). Such a system would only activate the lights when an aircraft is detected in the near vicinity and deactivate the lighting once the aircraft has passed. This technology reduces the impact of night lighting on nearby communities and migratory birds and extends the life expectancy of obstruction lights.	
Residual Risk Not installing obstacle lights would clearly be an acceptable outcome to those potentially affected by visual impact. If lighting is required, consideration of visual impact in the lighting design should enable installation of lighting that reduces the impact to neighbours. The likelihood of a **Moderate** consequence remains **Likely**, with a resulting risk level of **7 – Tolerable**. **It is our assessment that visual impact from obstacle lights can be negated if they are not installed.** If obstacle lights are to be installed, they can be designed so that there is an acceptable risk of visual impact to neighbours.	
Residual Risk	7 - Tolerable

10. CONCLUSIONS

The results of this study are summarised as follows:

10.1. Project description

The Project will comprise the following:

- up to 63 wind turbines
- maximum overall height (tip height) of the wind turbines is up to 260 m AGL
- highest wind turbine is WTG52 with ground elevation of 568 m AHD and overall height of 828 m (2716.1 ft AMSL)
- 10 permanent WMTs with a maximum height of up to 170 m (558 ft) AGL, which will be reported to Airservices Australia once the final locations are confirmed prior to construction.

10.2. Regulatory requirements

The following regulatory requirements apply:

- With respect to MOS 139 Chapter 8, Division 10, 8.109, the proposed wind turbines and wind monitoring towers must be reported to CASA if they are considered a hazardous obstacle.
- Wind turbines and wind monitoring towers must be marked in accordance with respect to MOS 139 Chapter 8, Division 10, 8.110.
- Wind turbines must be lit in accordance with MOS 139 Chapter 9 Division 4 9.30 and 9.31, unless an aeronautical study assesses they are of no operational significance.

10.3. Planning considerations

The project satisfies performance and acceptable outcomes in Banana Planning Scheme regarding aircraft affected land as found in Table 5.2.2 Economic Resources Overlays.

The project satisfies performance and acceptable outcomes in Rockhampton Region Planning Scheme regarding operational airspace (obstacle limitation surface) as found in section 8.2.2.3 Specific benchmarks for assessment.

The Project as proposed satisfies the following Acceptable Outcomes of State Code 23:

Performance outcomes	*Acceptable outcomes - Compliance*
Aviation safety, integrity and efficiency	
PO1 The safety, operational integrity and efficiency of air services and aircraft operations are not adversely affected by the location, siting, design and operation of the development.	No acceptable outcome is prescribed
PO2 Development includes lighting and marking measures to ensure the safety, operational integrity and efficiency of air services and aircraft operations.	No acceptable outcome is prescribed

10.4. Consultation

An appropriate and justified level of consultation was undertaken with relevant parties in 2021, refer to Section 5 for details of the stakeholders and a summary of the consultation.

Airservices Australia must be provided with this report to update their assessment and response, and to adjust the PANS-OPS surfaces to accommodate the Project.

10.5. Aviation Impact Statement

Based on the Project layout and overall turbine overall blade tip height limit of 260 m AGL, the blade tip elevation of the highest wind turbine, which is T086, will not exceed 1029 m AHD (3375 ft AMSL) and:

- will not infringe any OLS surfaces
- will infringe PANS-OPS associated with the 25 nm MSA and consequential impacts to approach commencement altitudes, missed approach final altitude and minimum holding altitudes
- may infringe Radar Terrain Clearance Chart surfaces
- will not have an impact on nearby designated air routes
- will not have an impact on the grid LSALT
- is wholly contained within Class G airspace
- is outside the clearance zones associated with aviation navigation aids and communication facilities.

Airservices Australia advised that the wind farm will affect the Rockhampton RTCC. The extent of the impacts was not disclosed. An amendment to the RTCC sector to accommodate the Project is unlikely to have cause an adverse impact to aviation safety in the area.

10.6. Aircraft operator characteristics

Aircraft will be required to navigate around the project area in low cloud conditions where aircraft need to fly at 500 ft AGL.

Neoen may consider engaging with local aerial agricultural and aerial firefighting operators to develop procedures, which may include, for example, determining the best times for commencement of the local aerial agricultural operations or shutting down wind turbines altogether in bushfire emergencies requiring aerial firefighting operations within the project area.

Wind turbines are generally not a safety concern to aerial agricultural operators. WMTs remain the primary safety concern to aerial agricultural operators, who have expressed a general desire for these towers to be more visible.

The Project is located outside a nominal 3 nm buffer from all identified aircraft landing areas.

10.7. Hazard lighting and marking

The following conclusions apply to hazard marking and lighting:

- With respect to MOS 139 Chapter 8, Division 10, para 8.109, the proposed wind turbines and wind monitoring towers must be reported to CASA if they are considered a hazardous obstacle.
- Wind turbines and wind monitoring towers must be marked in accordance with respect to MOS 139 Chapter 8, Division 10, para 8.110.
- Wind turbines must be lit in accordance with MOS 139 Chapter 9, Division 4 9.3 and 9.31, unless an aeronautical study assesses they are of no operational significance.
- **Aviation Projects has assessed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft.**
- CASA has advised that it will only review assessments referred to it by a planning authority or agency.
- With respect to marking of turbines, a white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.
- There will be 10 WMTs at a height of up to 170 m (538 ft) AGL. The proposed WMTs will be reported to Airservices Australia.
- Consideration should be given to marking any WMT according to the requirements set out in MOS 139 Section 8 Division 10 Obstacle Markings (as modified by the guidance in NASF Guideline D).

10.8. Summary of risks

A summary of the level of residual risk associated with the proposed Project with the Recommended Treatments implemented, is provided in Table 14.

Table 14 Summary of Risks

Risk Element	*Consequence*	*Likelihood*	*Risk*	*Actions Required*
Aircraft collision with wind turbine	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Aircraft collision with wind monitoring tower	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Although there is no obligation to do so, consider marking the wind monitoring towers according to the requirements set out in MOS 139 Chapter 8 Division 10 Obstacle Markings, specifically 8.110 (5), (7) and (8). Communicate details of wind monitoring towers to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes following construction.
Avoidance manoeuvring leads to ground collision	Catastrophic	Unlikely	7	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Effect on crew	Minor	Possible	5	Acceptable without obstacle lighting (ALARP). Communicate details of the Project to local and regional operators and make arrangements to publish details in ERSA for surrounding aerodromes before, during and following construction.
Visual impact from obstacle lights	Moderate	Likely	7	Acceptable without obstacle lighting (zero risk of visual impact from obstacle lighting). If lights are installed, design to minimise impact.

11. RECOMMENDATIONS

Recommended actions resulting from the conduct of this assessment are provided below.

Notification and reporting

1. 'As constructed' details of WMT and WTG coordinates and elevation should be provided to Airservices Australia, by submitting the form at this webpage: https://www.airservicesaustralia.com/wp-content/uploads/ATS-FORM-0085_Vertical_Obstruction_Data_Form.pdf to the following email address: vod@airservicesaustralia.com.
   Although Airservices Australia has reviewed the previous wind farm, details of the revised wind farm must be provided to Airservices Australia, at this email address: airport.developments@airservicesaustralia.com prior to the construction of the wind farm. This will occur when approval to provide this AIA to Airservices Australia is provided.

2. CASR 139.165 requires the owner of a structure (or proponents of a structure) that will be 100 m or more above ground level to inform CASA. This must be given in written notice and contain information on the proposal, the height and location(s) of the object(s) and the proposed timeframe for construction. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.
   The proponent is required to report the WMT to CASA in accordance with CASR 139.165, as soon as practicable after forming the intention to construct or erect the proposed object or structure.
   The notification should be provided to CASA via email to Airspace.Protection@casa.gov.au.

3. Department of Defence should be consulted again as there has been a subsequent modification in the wind turbine height or scale of development, using the following email address: land.planning@defence.gov.au

4. Details of the wind farm should be provided to local and regional aircraft operators prior to construction in order for them to consider the potential impact of the wind farm on their operations.

5. To facilitate the flight planning of aerial application operators, details of the Project, including location and height information of wind turbines, wind monitoring towers and overhead transmission lines should be provided to landowners so that, when asked for hazard information on their property, the landowner may provide the aerial application pilot with all relevant information.

Operation

6. Whilst not a statutory requirement, Neoen should consider engaging with local aerial agricultural operators and aerial firefighting operators in developing procedures for such aircraft operations in the vicinity of the Project.

Marking of turbines

7. The rotor blades, nacelle and the supporting mast of the wind turbines should be painted white, typical of most wind turbines operational in Australia. No additional marking measures are required for WTGs.

Lighting of turbines

8. **Aviation Projects has assessed that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft.**

Marking of wind monitoring towers

9. Consideration should be given to marking the wind monitoring towers according to the requirements set out in MOS 139 Chapter 8, Division 10, (as modified by the guidance in NASF Guideline D). Specifically:

    a. marker balls or high visibility flags or high visibility sleeves should be placed on the outside guy wires; and

    b. guy wire ground attachment points should be in contrasting colours to the surrounding ground/vegetation; and

    c. paint markings should be applied in alternating contrasting bands of colour to at least the top 1/3 of the mast. For ease of application, it would be reasonable to simplify the requirement to paint in bands with a width of approximately 1/7 of the longest dimension, by painting whole sections of the mast to the nearest whole section with an overall width of approximately 1/7 of the longest dimension, in three equal bands – red/orange, white, red/orange, so that at least the top 1/3 of the tower is marked.

Micrositing

10. The potential micrositing of the turbines and wind monitoring towers have been considered in the assessment with the estimate of the overall maximum height being based on the highest ground level is within 100 m of the nominal turbine and wind monitoring tower positions. Providing the micrositing is within 100 m of the turbines and wind monitoring towers is likely to not result in a change in the maximum overall blade tip height of the Project. No further assessment is likely to be required from micrositing and the conclusions of this aviation impact assessment would remain the same.

Triggers for review

11. Triggers for review of this risk assessment are provided for consideration:

    a. prior to construction to ensure the regulatory framework has not changed

    b. following any significant changes to the context in which the assessment was prepared, including the regulatory framework

    c. following any near miss, incident or accident associated with operations considered in this risk assessment.

ANNEXURES

1. References
2. Definitions
3. Turbine coordinates and heights
4. Risk Assessment Framework
5. CASA Regulatory Requirements – Lighting and Marking

ANNEXURE 1 – REFERENCES

References used or consulted in the preparation of this report include:

- Airservices Australia
  - Aeronautical Information Package; including AIP Book, Departure and Approach Procedures and En Route Supplement Australia dated 23 March 2023
  - AIP Designated Airspace Handbook, effective 1 December 2022
- Civil Aviation Safety Authority
  - Civil Aviation Regulations 1998 (CAR)
  - Civil Aviation Safety Regulations 1998 (CASR)
  - *Civil Aviation Advisory Circular (AC) 91-10 v1.1, Operations in the vicinity of non-controlled aerodromes*
  - *Advisory Circular (AC) 139-08 v2.0: Reporting of Tall Structures*, dated March 2018
  - *Manual of Standards CASR Part 173 – Standards Applicable to Instrument Flight Procedure Design*, version 1.7, dated August 2020
  - *Manual of Standards CASR Part 139 (Aerodromes) Manual of Standards 2019*, dated 5 September 2019
- Commonwealth Department of Infrastructure Transport, Regional Development, Communication and the Arts: National Airport Safeguarding Framework, Guideline D *Managing the Risk to Aviation Safety of Wind Turbine Installations (WindFarms) /Wind Monitoring Towers,* dated July 2012
- Department of State Development, Infrastructure and Planning, QLD State Government, Development Assessment mapping system and State Planning Policy Planning interactive mapping system
- Department of State Development, Infrastructure and Planning, QLD State Government, State Development Assessment Provisions (SDAP), State Code 23: Wind Farm Development and State Code 23: Wind farm development Planning Guideline (June 2018), SDAP version 3, date of commencement 18 February 2022
- International Civil Aviation Organization (ICAO) Doc 8168 Procedures for Air Navigation Services—Aircraft Operations (PANS-OPS)
- ICAO Standards and Recommended Practices, Annex 14—Aerodromes
- OzRunways, aeronautical navigation charts extracts, dated 5 November 2020
- Standards Australia, ISO 31000:2018 *Risk management – Guidelines*.

ANNEXURE 2 – DEFINITIONS

Term	*Definition*
Aerial Agricultural Operator	Specialist pilot and/or company who are required to have a commercial pilot's licence, an agricultural rating and a chemical distributor's licence
Aerodrome	A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure, and surface movement of aircraft.
Aerodrome facilities	Physical things at an aerodrome which could include: a. the physical characteristics of any movement area including runways, taxiways, taxilanes, shoulders, aprons, primary and secondary parking positions, runway strips and taxiway strips b. infrastructure, structures, equipment, earthing points, cables, lighting, signage, markings, visual approach slope indicators.
Aerodrome reference point (ARP)	The designated geographical location of an aerodrome.
Aeronautical Information Publication (AIP)	Details of regulations, procedures, and other information pertinent to the operation of aircraft
Aeronautical Information Publication En-route Supplement Australia (AIP ERSA)	Contains information vital for planning a flight and for the pilot in flight as well as pictorial presentations of all licensed aerodromes
Civil Aviation Safety Regulations 1998 (CASR)	Contain the mandatory requirements in relation to airworthiness, operational, licensing, enforcement.
Instrument meteorological conditions (IMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minimum specified for visual meteorological conditions.
Manual of Standards (MOS)	The means CASA uses in meeting its responsibilities under the Act for promulgating aviation safety standards
National Airports Safeguarding Framework (NASF)	Framework has the objective of developing a consistent and effective national framework to safeguard both airports and communities from inappropriate on and off airport developments.

Term	Definition
Obstacles	All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight.
Runway	A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.
Runway strip	A defined area including the runway and stopway, if provided, intended: a. to reduce the risk of damage to aircraft running off a runway b. to protect aircraft flying over it during take-off or landing operations.
Safety Management System	A systematic approach to managing safety, including organisational structures, accountabilities, policies and procedures.

ANNEXURE 3 – TURBINE COORDINATES AND HEIGHTS

Source: Neoen, Mt Hopeful Wind Farm – Project Layout:

- 230125_Umwelt_TWilliamson_DesignData_Transfer (1).zip
  - DESIGN_Umwelt_Turbines_221102_GDA94z56.shp
  - DESIGN_Umwelt_PermanentMetMasts_221128_GDA9456.shp

WTG Coordinates			Approx Elevation (m)	WTG Height (m AGL)	WTG Max Height (m AHD)	WTG Max Height (ft AMSL)	Notes
WTG Ref	Easting (m)	Northing (m)					
WTG 01	247250.0	7371525.0	525.0	260.0	785.0	2575.5	
WTG 02	248260.0	7371125.0	455.0	260.0	715.0	2345.8	
WTG 03	249930.0	7370355.0	460.0	260.0	720.0	2362.2	
WTG 04	250420.0	7370050.0	480.0	260.0	740.0	2427.8	
WTG 05	251030.0	7369720.0	495.0	260.0	755.0	2477.0	
WTG 06	251360.0	7369350.0	445.0	260.0	705.0	2313.0	
WTG 07	250850.0	7368800.0	468.0	260.0	728.0	2388.5	
WTG 08	251770.0	7368690.0	512.0	260.0	772.0	2532.8	
WTG 09	252280.0	7368220.0	502.0	260.0	762.0	2500.0	
WTG 10	251870.0	7367780.0	513.0	260.0	773.0	2536.1	
WTG 11	252890.0	7367610.0	483.0	260.0	743.0	2437.7	
WTG 12	251408.0	7366866.0	515.0	260.0	775.0	2542.7	
WTG 13	251875.0	7366390.0	540.0	260.0	800.0	2624.7	
WTG 14	252990.0	7367060.0	472.0	260.0	732.0	2401.6	
WTG 15	253640.0	7366460.0	505.0	260.0	765.0	2509.8	
WTG 16	253020.0	7365920.0	495.0	260.0	755.0	2477.0	
WTG 17	254100.0	7366140.0	492.0	260.0	752.0	2467.2	
WTG 18	253200.0	7364540.0	545.0	260.0	805.0	2641.1	YBRK 25 nm MSA
WTG 19	253660.0	7364120.0	533.0	260.0	793.0	2601.7	

WTG 20	254320.0	7363920.0	512.0	260.0	772.0	2532.8	
WTG 21	253400.0	7363380.0	532.0	260.0	792.0	2598.4	
WTG 22	253880.0	7362180.0	495.0	260.0	755.0	2477.0	
WTG 23	253910.0	7361650.0	495.0	260.0	755.0	2477.0	
WTG 24	251710.0	7362020.0	495.0	260.0	755.0	2477.0	
WTG 25	252200.0	7360600.0	430.0	260.0	690.0	2263.8	
WTG 26	252390.0	7360200.0	410.0	260.0	670.0	2198.2	
WTG 27	252310.0	7359560.0	412.0	260.0	672.0	2204.7	
WTG 28	255200.0	7361120.0	395.0	260.0	655.0	2149.0	
WTG 29	255280.0	7360550.0	487.0	260.0	747.0	2450.8	
WTG 30	254950.0	7360050.0	490.0	260.0	750.0	2460.6	
WTG 31	254680.0	7358060.0	360.0	260.0	620.0	2034.1	
WTG 32	256040.0	7358340.0	348.0	260.0	608.0	1994.8	
WTG 33	254780.0	7357180.0	310.0	260.0	570.0	1870.1	
WTG 34	255860.0	7356940.0	340.0	260.0	600.0	1968.5	
WTG 35	246800.0	7356500.0	305.0	260.0	565.0	1853.7	
WTG 36	247760.0	7355990.0	320.0	260.0	580.0	1902.9	
WTG 37	248200.0	7355540.0	310.0	260.0	570.0	1870.1	
WTG 38	249360.0	7354240.0	300.0	260.0	560.0	1837.3	
WTG 39	248500.0	7353800.0	335.0	260.0	595.0	1952.1	
WTG 40	256820.0	7354680.0	385.0	260.0	645.0	2116.1	
WTG 41	257810.0	7354720.0	362.0	260.0	622.0	2040.7	
WTG 42	256480.0	7353980.0	365.0	260.0	625.0	2050.5	
WTG 43	255940.0	7353550.0	388.0	260.0	648.0	2126.0	
WTG 44	255960.0	7353000.0	416.0	260.0	676.0	2217.8	
WTG 45	256620.0	7352000.0	451.0	260.0	711.0	2332.7	
WTG 46	257270.0	7351840.0	445.0	260.0	705.0	2313.0	
WTG 47	256720.0	7351280.0	460.0	260.0	720.0	2362.2	
WTG 48	257380.0	7350480.0	494.0	260.0	754.0	2473.8	
WTG 49	257980.0	7352870.0	485.0	260.0	745.0	2444.2	

WTG 50	258310.0	7352490.0	520.0	260.0	780.0	2559.1	
WTG 51	258880.0	7352460.0	560.0	260.0	820.0	2690.3	
WTG 52	259540.0	7351560.0	568.0	260.0	828.0	2716.5	Highest WTG
WTG 53	259520.0	7351180.0	542.0	260.0	802.0	2631.2	
WTG 54	258340.0	7351360.0	450.0	260.0	710.0	2329.4	
WTGA01	246700.0	7371800.0	490.0	260.0	750.0	2460.6	
WTGA02	247720.0	7372440.0	545.0	260.0	805.0	2641.1	
WTGA03	248050.0	7372060.0	557.0	260.0	817.0	2680.4	
WTGA04	251320.0	7367950.0	485.0	260.0	745.0	2444.2	
WTGA05	252420.0	7367840.0	535.0	260.0	795.0	2608.3	
WTGA07	252660.0	7366640.0	503.0	260.0	763.0	2503.3	
WTGA08	254120.0	7364540.0	520.0	260.0	780.0	2559.1	
WTGA09	253860.0	7363120.0	565.0	260.0	825.0	2706.7	
WTGA10	253560.0	7362860.0	510.0	260.0	770.0	2526.2	
MET1	247135.8	7371729	506.9	170.0	676.9	2220.7	
MET2	248711.1	7370983	445.4	170.0	615.4	2018.9	
MET3	250701	7369998	469.0	170.0	639.0	2096.4	
MET4	251274.6	7368796	460.4	170.0	630.4	2068.1	
MET5	253934.3	7366726	515.2	170.0	685.2	2248.0	
MET6	253084.5	7366549	488.9	170.0	658.9	2161.8	
MET7	254097.2	7362830	519.6	170.0	689.6	2262.4	
MET8	259231	7352130	535.2	170.0	705.2	2313.8	
MET9	259856	7351524	553.7	170.0	723.7	2374.3	
MET10	258804.5	7351379	457.5	170.0	627.5	2058.7	

ANNEXURE 4 – RISK ASSESSMENT FRAMEWORK

A risk management framework is comprised of likelihood and consequence descriptors, a matrix used to derive a level of risk, and actions required of management according to the level of risk.

The risk assessment framework used by Aviation Projects has been developed in consideration of ISO 31000:2018 *Risk management—Guidelines* and the guidance provided by CASA in its Safety Management System (SMS) for Aviation guidance material, which is aligned with the guidance provided by the International Civil Aviation Organization (ICAO) in Doc 9589 *Safety Management Manual*, Third Edition, 2013. Doc 9589 is intended to provide States (including Australia) with guidance on the development and implementation of a State Safety Programme (SSP), in accordance with the International SARPs, and is therefore adopted as the primary reference for aviation safety risk management in the context of the subject assessment.

Section 2.1 of the ICAO Doc 9589 *The concept of safety* defines safety as follows [author's underlining]:

> *2.1.1 Within the context of aviation, safety is "the state in which the possibility of harm to persons or of property damage is reduced to, and maintained <u>at or below, an acceptable level</u> through a continuing process of hazard identification and safety risk management."*

Likelihood

Likelihood is defined in ISO 31000:2018 as the chance of something happening. Likelihood descriptors used in this report are as indicated in Table 1.

Table 1 Likelihood Descriptors

No	Descriptor	Description
1	Rare	It is almost inconceivable that this event will occur
2	Unlikely	The event is very unlikely to occur (not known to have occurred)
3	Possible	The event is unlikely to occur, but possible (has occurred rarely)
4	Likely	The event is likely to occur sometimes (has occurred infrequently)
5	Almost certain	The event is likely to occur many times (has occurred frequently)

Consequence

Consequence is defined as the outcome of an event affecting objectives, which in this case is the safe and efficient operation of aircraft, and the visual amenity and enjoyment of local residents.

Consequence descriptors used in this report are as indicated in Table 2.

Table 2 Consequence Descriptors

No	Descriptor	People Safety	Property/Equipment	Effect on Crew	Environment
1	Insignificant	Minor injury – first aid treatment	Superficial damage	Nuisance	No effects or effects below level of perception
2	Minor	Significant injury – outpatient treatment	Moderate repairable damage – property still performs intended functions	Operations limitation imposed. Emergency procedures used.	Minimal site impact – easily controlled. Effects raised as local issues, unlikely to influence decision making. May enhance design and mitigation measures.
3	Moderate	Serious injury - hospitalisation	Major repairable damage – property performs intended functions with some short-term rectifications	Significant reduction in safety margins. Reduced capability of aircraft/crew to cope with conditions. High workload/stress on crew. Critical incident stress on crew.	Moderate site impact, minimal local impact, and important consideration at local or regional level, possible long-term cumulative effect. Not likely to be decision making issues. Design and mitigation measures may ameliorate some consequences.
4	Major	Permanent injury	Major damage rendering property ineffective in achieving design functions without major repairs	Large reduction in safety margins. Crew workload increased to point of performance decrement. Serious injury to small number of occupants. Intense critical incident stress.	High site impact, moderate local impact, important consideration at state level. Minor long-term cumulative effect. Design and mitigation measures unlikely to remove all effects.
5	Catastrophic	Multiple Fatalities	Damaged beyond repair	Conditions preventing continued safe flight and landing. Multiple deaths with loss of aircraft	Catastrophic site impact, high local impact, national importance. Serious long-term cumulative effect. Mitigation measures unlikely to remove effects.

Risk matrix

The risk matrix, which correlates likelihood and consequence to determine a level of risk, used in this report is shown in Table 3.

Table 3 Risk Matrix

		CONSEQUENCE				
		INSIGNIFICANT 1	MINOR 2	MODERATE 3	MAJOR 4	CATASTROPHIC 5
LIKELIHOOD	ALMOST CERTAIN 5	6	7	8	9	10
	LIKELY 4	5	6	7	8	9
	POSSIBLE 3	4	5	6	7	8
	UNLIKELY 2	3	4	5	6	7
	RARE 1	2	3	4	5	6

Actions required

Actions required according to the derived level of risk are shown in Table 4.

Table 4 Actions Required

8-10	Unacceptable Risk	Immediate action required by either treating or avoiding risk. Refer to executive management.
5-7	Tolerable Risk	Treatment action possibly required to achieve As Low As Reasonably Practicable (ALARP) - conduct cost/benefit analysis. Relevant manager to consider for appropriate action.
0-4/5	Broadly Acceptable Risk	Managed by routine procedures and can be accepted with no action.

ANNEXURE 5 – CASA REGULATORY REQUIREMENTS - LIGHTING

In considering the need for aviation hazard lighting and marking, the applicable regulatory context was determined.

The Civil Aviation Safety Authority (CASA) regulates aviation activities in Australia. Applicable requirements include the Civil Aviation Regulations 1988 (CAR), Civil Aviation Safety Regulations 1998 (CASR) and associated Manual of Standards (MOS) and other guidance material. Relevant provisions are outlined in further detail in the following section.

Civil Aviation Safety Regulations 1998, Part 139—Aerodromes

In areas remote from an aerodrome, CASR 139.365 requires the owner of a structure (or proponents of a structure) that will be 110 m or more above ground level to inform CASA. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.

Manual of Standards Part 139—Aerodromes

Chapter 9 sets out the standards applicable to Visual Aids Provided by Aerodrome Lighting.

Section 9.30 provides guidance on Types of Obstacle Lighting and Their Use:

1. *The following types of obstacle lights must be used, in accordance with this MOS, to light hazardous obstacles:*
    a. *low-intensity;*
    b. *medium-intensity;*
    c. *high-intensity;*
    d. *a combination of low, medium or high-intensity.*
2. *Low-intensity obstacle lights:*
    a. *are steady red lights; and*
    b. *must be used on non-extensive objects or structures whose height above the surrounding ground is less than 45 m.*
3. *Medium-intensity obstacle lights must be:*
    a. *flashing white lights; or*
    b. *flashing red lights; or*
    c. *steady red lights.*

    Note CASA recommends the use of flashing red medium-intensity obstacle lights.
4. *Medium-intensity obstacle lights must be used if:*

a. *the object or structure is an extensive one; or*

b. *the top of the object or structure is at least 45 m but not more than 150 m above the surrounding ground; or*

c. *CASA determines in writing that early warning to pilots of the presence of the object or structure is desirable in the interests of aviation safety.*

Note For example, a group of trees or buildings is regarded as an extensive object.

5. *For subsection (4), low-intensity and medium-intensity obstacle lights may be used in combination.*

6. *High-intensity obstacle lights:*

    a. *must be used on objects or structures whose height exceeds 150 m; and*

    b. *must be flashing white lights.*

7. *Despite paragraph (6) (b), a medium-intensity flashing red light may be used if necessary, to avoid an adverse environmental impact on the local community.*

Sections 9.31 (8) and (9) provide guidance on obstacle lighting specific to wind farms:

8. *Subject to subsection (9), for wind turbines in a wind farm, medium-intensity obstacle lights must:*

    a. *mark the highest point reached by the rotating blades; and*

    b. *be provided on a sufficient number of individual wind turbines to indicate the general definition and extent of the wind farm, but such that intervals between lit turbines do not exceed 900 m; and*

    c. *all be synchronised to flash simultaneously; and*

    d. *be seen from every angle in azimuth.*

    Note: This is to prevent obstacle light shielding by the rotating blades of a wind turbine and may require more than 1 obstacle light to be fitted.

9. *If it is physically impossible to light the rotating blades of a wind turbine:*

    a. *the obstacle lights must be placed on top of the generator housing; and*

    b. *a note must be published in the AIP-ERSA indicating that the obstacle lights are not at the highest position on the wind turbines.*

10. *If the top of an object or structure is more than 45 m above:*

    a. *the surrounding ground (ground level); or*

    b. *the top of the tallest nearby building (building level); then the top lights must be medium-intensity lights, and additional low-intensity lights must be:*

    c. *provided at lower levels to indicate the full height of the structure; and*

> d. *spaced as equally as possible between the top lights and the ground level or building level, but not so as to exceed 45 m between lights.*

Advisory Circular 139-08 v2—Reporting of Tall Structures

In Advisory Circular (AC) 139-08 v2—*Reporting of Tall Structures*, CASA provides guidance to those authorities and persons involved in the planning, approval, erection, extension or dismantling of tall structures so that they may understand the vital nature of the information they provide.

Airservices Australia has been assigned the task of maintaining a database of tall structures, the top measurement of which is:

a) 30 metres or more above ground level—within 30 kilometres of an aerodrome; or

b) 45 metres or more above ground level elsewhere.

The purpose of notifying Airservices Australia of these structures is to enable their details to be provided in aeronautical information databases and maps/charts etc used by pilots, so that the obstacles can be avoided.

The proposed wind turbines must be reported to Airservices Australia. This action should occur once the final layout after micrositing is confirmed and prior to construction.

International Civil Aviation Organisation

Australia, as a contracting State to the International Civil Aviation Organisation (ICAO) and signatory to the Chicago Convention on International Civil Aviation (the Convention), has an obligation to implement ICAO's standards and recommended practices (SARPs) as published in the various annexes to the Convention.

Annex 14 to the Convention — *Aerodromes, Volume 1,* Section 6.2.4 provides SARPs for the obstacle lighting and marking of wind turbines, which is copied below:

> *6.2.4 Wind turbines*
>
> *6.2.4.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.*
>
> *Note 1. — Additional lighting or markings may be provided where in the opinion of the State such lighting or markings are deemed necessary.*
>
> *Note 2. — See 4.3.1 and 4.3.2*
>
> *Markings*
>
> *6.2.4.2 Recommendation. — The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study.*
>
> *Lighting*
>
> *6.2.4.3 Recommendation. — When lighting is deemed necessary, in the case of a wind farm, i.e. a group of two or more wind turbines, the wind farm should be regarded as an extensive object and the lights should be installed:*
>
> *a) to identify the perimeter of the wind farm;*

b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;

c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;

d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and

e) at locations prescribed in a), b) and d), respecting the following criteria:

i) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle should be provided;

ii) for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate should be provided in case of failure of the operating light. The lights should be installed to assure that the output of either light is not blocked by the other; and

iii) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, should be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights may be used.

Note. — The above 6.2.4.3 e) does not address wind turbines of more than 315 m of overall height. For such wind turbines, additional marking and lighting may be required as determined by an aeronautical study.

6.2.4.4 Recommendation. — The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

6.2.4.5 Recommendation. — Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation should be in accordance with 6.2.4.3 e) or as determined by an aeronautical study.

As referenced in Section 6.2.4.3(e)(iii), Section 6.2.1.3 is copied below:

6.2.1.3 The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked shall be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object, or by an adjacent object, additional lights shall be provided on that adjacent object or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

As referenced in Section 6.2.4.3(b), Section 6.2.3.15 is copied below:

6.2.3.15 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and *a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and*

b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.

Section 4.3 Objects outside the OLS states the following:

4.3.1 Recommendation.— Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.

4.3.2 Recommendation. — In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

Note. — This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

ICAO Doc 9774 Manual on Certification *of Airports* defines an aeronautical study as:

An aeronautical study is a study of an aeronautical problem to identify potential solutions and select a solution that is acceptable without degrading safety.

Light characteristics

If obstacle lighting is required, installed lights should be designed according to the criteria set out in the applicable regulatory material and taking CASA's recommendations into consideration in the case that CASA has reviewed this risk assessment and provided recommendations.

The characteristics of the obstacle lights should be in accordance with the applicable standards in MOS 139.

The characteristics of low and medium intensity obstacle lights specified in MOS 139, Chapter 9, are provided below.

MOS 139 Chapter 9 Division 4 – Obstacle Lighting section 9.32 outlines Characteristics of Low Intensity Obstacle Lights.

1. *Low-intensity obstacle lights must have the following:*
   a. *fixed lights showing red;*
   b. *a horizontal beam spread that results in 360-degree coverage around the obstacle;*
   c. *a minimum intensity of 100 candela (cd);*
   d. *a vertical beam spread (to 50% of peak intensity) of 10 degrees;*
   e. *a vertical distribution with 50 cd minimum at +6 degrees and +10 degrees above the horizontal;*

   f. *not less than 10 cd at all elevation angles between –3 degrees and +90 degrees above the horizontal.*

Note: The intensity requirement in paragraph (c) may be met using a double-bodied light fitting. CASA recommends that double-bodied light fittings, if used, should be orientated so that they show the maximum illuminated surface towards the predominant, or more critical, direction of aircraft approach.

2. *To indicate the following:*
   a. *taxiway obstacles;*
   b. *unserviceable areas of the movement area; low-intensity obstacle lights must have a peak intensity of at least 10 cd.*

MOS 139 Chapter 9 Division 4 – Obstacle Lighting section 9.33 outlines Characteristics of Medium Intensity Obstacle Lights.

1. *Medium-intensity obstacle lights must:*
   a. *be visible in all directions in azimuth; and*
   b. *if flashing — have a flash frequency of between 20 and 60 flashes per minute.*
2. *The peak effective intensity of medium-intensity obstacle lights must be 2 000 ☐ 25% cd with a vertical distribution as follows:*
   a. *for vertical beam spread — a minimum of 3 degrees;*
   b. *at -1-degree elevation — a minimum of 50% of the lower tolerance value of the peak intensity;*
   c. *at 0 degrees elevation — a minimum of 100% of the lower tolerance value of the peak intensity.*
3. *For subsection (2), vertical beam spread means the angle between 2 directions in a plane for which the intensity is equal to 50% of the lower tolerance value of the peak intensity.*
4. *If, instead of obstacle marking, a flashing white light is used during the day to indicate temporary obstacles in the vicinity of an aerodrome, the peak effective intensity of the light must be increased to 20 000 ± 25% cd when the background luminance is 50 cd/m² or greater.*

Visual impact of night lighting

Annex 14 Section 6.2.4 and MOS 139 Chapter 9 are specifically intended for wind turbines and recommends that medium intensity lighting is installed.

Generally accepted considerations regarding minimisation of visual impact are provided below for consideration in this aeronautical study:

- To minimise the visual impact on the environment, some shielding of the obstacle lights is permitted, provided it does not compromise their operational effectiveness

- Shielding may be provided to restrict the downward component of light to either, or both, of the following:
    - such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal
    - such that no light is emitted at or below 10 degrees below horizontal
- If a light would be shielded in any direction by an adjacent object or structure, the light so shielded may be omitted, provided that such additional lights are used as are necessary to retain the general definition of the object or structure
- If flashing obstacle lighting is required, all obstacle lights on a wind farm should be synchronised so that they flash simultaneously
- A relatively small area on the back of each blade near the rotor hub may be treated with a different colour or surface treatment, to reduce reflection from the rotor blades of light from the obstacle lights, without compromising the daytime visibility of the overall turbine.

Marking of turbines

ICAO Annex 14 Vol 1 Section 6.2.4.2 recommends that the rotor blades, nacelle and upper 2/3 of the supporting mast of the wind turbines should be painted a shade of white, unless otherwise indicated by an aeronautical study.

It is generally accepted that a shade of white colour will provide sufficient contrast with the surrounding environment to maintain an acceptable level of safety while lowering visual impact to the neighbouring residents.

Wind monitoring towers

The details of the WMTs were introduced in Section 0 of this report.

Consideration could be given to marking any WMTs according to the requirements set out in MOS 139 Chapter 8 Division 10 Obstacle Markings; specifically:

> *8.110 (5) As illustrated in Figure 8.110 (5), long, narrow structures like masts, poles and towers which are hazardous obstacles must be marked in contrasting colour bands so that the darker colour is at the top; and the bands are, as far as physically possible, marked at right angles along the length of the long, narrow structure; and have a length ("z" in Figure 8.110 (5)) that is, approximately, the lesser of: 1/7 of the height of the structure; or 30 m.*
>
> *8.110 (7) Hazardous obstacles in the form of wires or cables must be marked using 3-dimensional coloured objects attached to the wire or cables. Note: Spheres and pyramids are examples of 3-dimensional objects. (8) The objects mentioned in subsection (7) must: be approximately equivalent*

NASF Guideline D suggests consideration of the following measures specific to the marking and lighting of WMTs:

- the top 1/3 of wind monitoring towers to painted in alternating contrasting bands of colour. Examples of effective measures can be found in the Manual of Standards for Part 139 of the Civil Aviation

Safety Regulations 1998. In areas where aerial agriculture operations take place, marker balls or high visibility flags can be used to increase the visibility of the towers

- marker balls or high visibility flags or high visibility sleeves placed on the outside guy wires
- ensuring the guy wire ground attachment points have contrasting colours to the surrounding ground/vegetation
- a flashing strobe light during daylight hours.

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APPENDIX D

Electromagnetic Interference Assessment

NEOEN AUSTRALIA PTY LTD

MT HOPEFUL WIND FARM

ELECTROMAGNETIC INTERFERENCE STUDY

FEBRUARY 2023

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Question today

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Mt Hopeful Wind Farm
Electromagnetic Interference Study

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REV	DATE	DETAILS
A	3/03/2021	Initial Release
B	23/04/2021	Updated project boundary and WTG layout
C	09/06/2021	Added consultation responses
D	18/06/2021	Minor amendments after Client's feedback
E	25/06/2021	Further minor amendments after Client feedback
F	17/02/2023	Updated project boundary and WTG layout
G	9/03/2023	Minor amendments after Client feedback

	NAME	DATE
Prepared by:		9/03/2023
Reviewed/Approved by:		9/03/2023

TABLE OF CONTENTS

GLOSSARY

ACMA	Australian Communications and Media Authority
AM	Amplitude Modulation
BoM	Bureau of Meteorology
EMI	Electromagnetic Interference
FM	Frequency Modulation
GIS	Geographic Information System
ISP	Internet Service Provider
MHWF	Mount Hopeful Wind Farm
P2MP	Point-to-Multipoint
P2P	Point-to-Point
RADCOM	Register of radio licences, radio communication towers and radio services
RFNSA	Radio Frequency National Site Archive
TV	Television
UHF	Ultra-High Frequency
WSP	WSP Australia Pty Limited
WTG	Wind Turbine Generator

EXECUTIVE SUMMARY

Neoen Australia Pty Limited (Neoen) has requested WSP Australia Pty Limited (WSP) to undertake an updated assessment of the potential electromagnetic interference (EMI) impacts arising from the development and operation of the proposed Mount Hopeful Wind Farm (MHWF) project. The MHWF project is located approximately 45 km south of Rockhampton, in Central Queensland (QLD).

WSP previously conducted an EMI assessment of MHWF in June 2021 [1] including consultation with relevant identified licensees from February to May 2021. This updated assessment considers an updated layout consisting of 63 WTGs with a maximum blade tip height of 260 m above ground level (AGL), and an updated site boundary provided by Neoen [2]. As part of this study, WSP has considered potential impacts of the MHWF project on registered point-to-point, point-to-multipoint, point-to-area and broadcast services in the vicinity of the wind farm.

The previous consultation process considered registered licensees within 10 km of MHWF. WSP commenced consultation with identified licensees on 19 February 2021, based on the information accessed via the ACMA database on 30 November 2020 [3]. The responses received from the licensees have been detailed throughout the report where applicable. A summary of contacted licensees and responses can be found in Appendix A. It should be noted that WSP has updated the ACMA database on the 25 January 2023. At this time, no further consultation has been conducted with regards to the updated WTG locations and the updated ACMA database.

For this updated investigation, WSP identified existing radio communication services registered within the ACMA register of radio licences, radio communication towers and radio services (RADCOM). This database was reviewed and sites within 70 km of the MHWF project boundary were identified. 746 radio communication sites were found within 70 km of the provided site boundary, and 66 towers within 30 km of the site boundary. Sites were mapped against the wind farm layout provided by Neoen [4]. Communication towers and point-to-point links identified in the vicinity of the project area were selected for further investigation.

It should be noted in the previous assessments, distances were calculated from a set point within the site (-23.86°, 150.6°), which was understood to be representative of the centre of the location. In this revision the methodology has been updated, with the distance calculated from the site boundary. The previous assessment identified 513 communication towers within 75 km of the project and 25 towers within 30 km of the site. As a result of the updated methodology, significantly more towers were identified in this assessment. Within 30 km of the site boundary, an additional 41 towers were identified in this update.

COMMUNICATION TOWERS

A refined search was undertaken to identify any communication towers located within 2 km of the proposed wind farm and assessed for potential near-field impacts. Eight (8) towers were identified within 2 km of the project boundary, with no towers located within 500 m of any proposed WTGs. The licensees registered were contacted as part of WSP's consultation process in the previous assessment [1]. Please refer to Section 3.1.1 for additional information regarding the communication towers identified in the vicinity of the MHWF project.

POINT-TO-POINT LICENCES

17 fixed point-to-point links were identified to intersect with the provided site boundary of MHWF [2]. The 2nd Fresnel zones were calculated for each link and it was observed that there are no WTG locations within one (1) blade length of the 2nd Fresnel zones for any of the 17 links. Additional information regarding the point-to-point links identified in the vicinity of MHWF can be found in Section 3.2. In the previous assessment, WSP contacted all the relevant licensees within 10 km of MHWF. Details of the licensees contacted can be found in Appendix A.

POINT-TO-MULTIPOINT, POINT-TO-AREA AND BROADCASTING LICENCES

Point-to-multipoint licences, point-to-area licences and broadcast services were assessed in the vicinity of MHWF. In the previous assessment WSP contacted all the relevant licensees within 10 km of MHWF. Details of the licensees contacted can be found in Appendix A.

Residences close to MHWF may experience some interference to their television (TV) services if they are located in a region of existing marginal coverage. Due to the limited TV coverage identified during this study, WSP recommends that a ground survey of TV signal strength is undertaken amongst the residences surrounding the site prior to the construction of the wind farm. Should some residences experience TV interference, a number of mitigation options are available as discussed in Section 4 .

1 INTRODUCTION

WSP Australia Pty Limited (WSP) has been engaged by Neoen Australia Pty Limited to conduct an updated assessment of the potential Electromagnetic Interference (EMI) impacts of the Mount Hopeful Wind Farm (MHWF).

The EMI assessment conducted by WSP includes but is not limited to the analysis of

- Fixed point to point radio communication links in the vicinity of the proposed WTG locations
- Fixed point to multipoint licenses within 30 km of the site
- Radar operations within 250 nautical miles of the site
- Television and radio broadcasting services in operation around MHWF
- Mobile phone services
- Internet services, and
- Licences operated by emergency services in proximity to the development.

This report details the methodology adopted to assess the potential EMI impact resulting from the development and operation of MHWF. It also describes potential mitigation options to manage and minimise the likely EMI impacts arising from MHWF development and operations. It should be noted that further consultation was not included within the scope of this updated assessment as no new licences were identified within 10 km of the site boundary, and as per WSP's agreement with the Client.

1.1 PROJECT UNDERSTANDING

MHWF is located approximately 45 km south of Rockhampton as shown in Figure 1.1. As the project is in the early development phase, a preferred WTG model has not been selected. To assess a worst-case impact scenario, this EMI assessment assumes a maximum blade tip height of up to 260 m AGL and a rotor diameter of up to 180 m. The site is proposed to consist of 63 WTGs, as summarised in Table 1.1.

Table 1.1 Proposed WTG dimensions for MHWF

HUB HEIGHT	ROTOR DIAMETER [M]	TIP HEIGHT [M]	BLADE LENGTH [M]	NO. OF WTGS
170	180	260	90	63

In the previous assessment, WSP noted that Neoen have also proposed a 400 MW/800 MWh battery facility in the eastern section of the project. The assessment of the potential EMI impacts arising from the battery is considered outside of the scope of the current assessment.

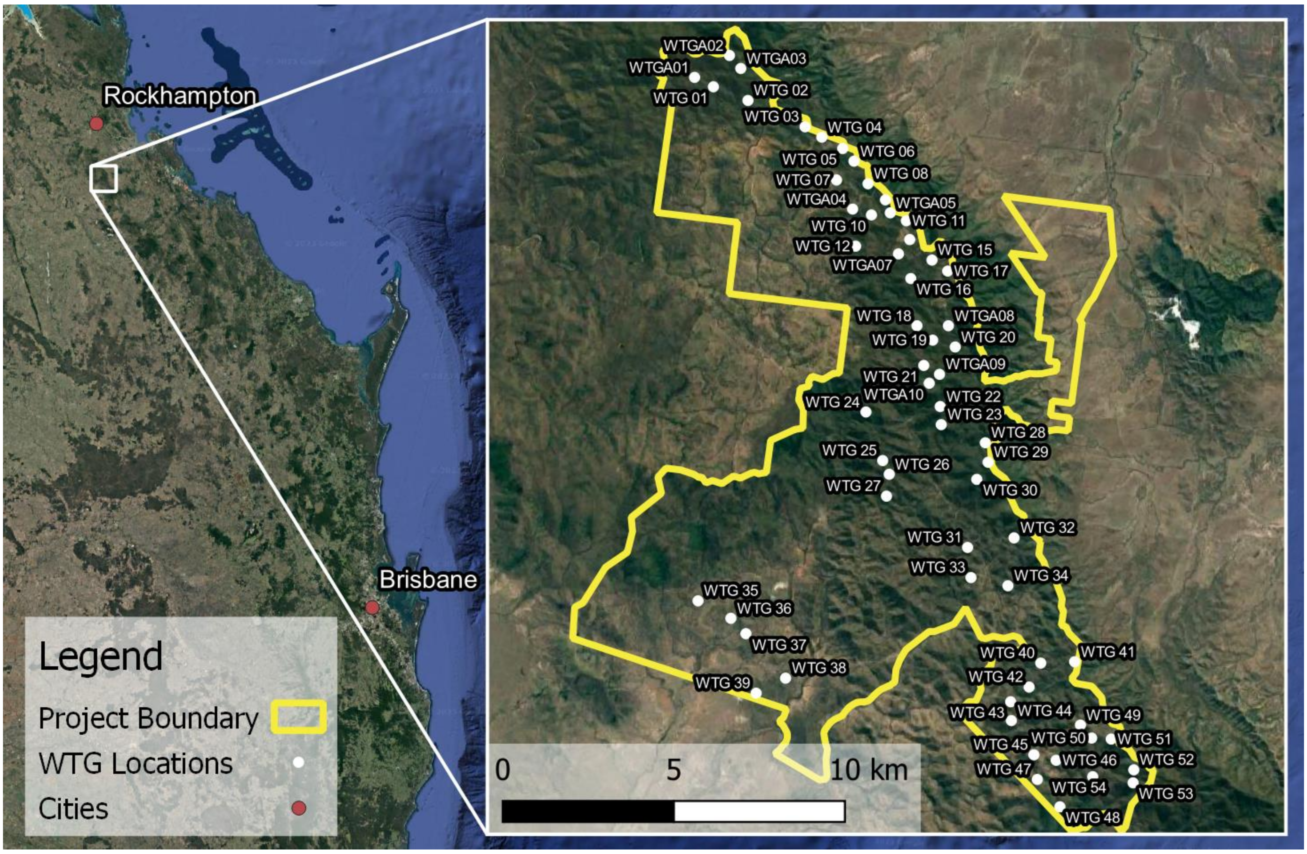

Figure 1.1 Location of MHWF, with site area and WTG locations shown

1.2 APPLICABLE GUIDELINES

The following industry standard guidelines and references have been used in this EMI assessment:

- Draft National Wind Farm Development Guidelines [5]
- Fixed link WTG exclusion zone method [6]
- Queensland State code 23: Wind farm development [7]
- Guidelines for Minimizing the Impact of Wind Farms on the SAGRN (Doc: TR049-SA) [8]

1.3 LIMITATIONS OF THE REPORT

This Report is provided by WSP Australia Pty Limited (WSP) for Neoen Australia Pty Limited (Client) in response to specific instructions from the Client and in accordance with WSP's proposal dated 16 October 2020 and agreement with the Client dated 26 October 2020 (Agreement), under variation *Work Order Proforma Mount Hopeful Wind Farm - VAR20 – RevA* dated 16 January 2023.

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2 METHODOLOGY

2.1 WIND FARMS AND ELECTROMAGNETIC INTERFERENCE

Communication systems using radio waves are heavily utilised in Australia. Mobile phones, television (TV), commercial radio, land mobile radio and emergency radio are common examples of systems that rely on radio and telecommunication. These systems generally use radio towers to transmit and receive signals across a wide area. In the context of wind farm development and operation, electromagnetic interference (EMI) is the impact of WTGs on surrounding communication services resulting in an unacceptably detrimental effect to the communication service. Radar services (such as aviation and weather) can potentially be impacted by wind farms also. This is discussed further in this report.

2.1.1 TYPES OF IMPACTS AND EXCLUSION ZONES

The different effects WTGs can have on communication services are summarised below.

- *Near field impact:* A property of a transmitting and/or receiving antenna is a "near field" zone that is present around the antenna. Any object that can conduct or absorb radio waves, placed within the near field zone, can alter the behaviour of the antenna.
- *Obstruction impact*: If a conductive object is placed in the path of an advancing radio wavefront, wave energy can be absorbed, detrimentally affecting the signal detected at the receiver.
- *Reflection and scattering impacts*: If an object reflective to radio waves is placed in the path of an advancing radio wavefront, it may reflect energy away. The reflected signal may be reflected from the transmitting or receiving antenna which can interfere with the desired signal.
- *Electromagnetic fields / Radio frequency interference:* The operation of a WTG and the associated electrical transmission infrastructure creates an electromagnetic emission that can, theoretically, interact with radio communications.

In many cases, impacts can be sufficiently characterised and mitigated using calculated "exclusion zones" and ensuring these zones are free from WTGs. In other cases, such as when exclusion zones are not feasible to calculate or not appropriate for the communication service, mitigation options are available, as discussed in Section 4. Details of the calculated exclusion zones are given below [6].

- *Near field impact:* The recommended methodology for determining exclusion zones to mitigate near field impacts as discussed above are given by the 'Fixed-link wind-turbine exclusion zone method' [6] and exclusion zones for the MHWF project can be calculated using this approach. Communication towers in proximity to the site were reviewed and are discussed in Section 3.1. In many cases, the required exclusion zones can be very small. However, WSP recommends a minimum standard 1 km radio tower exclusion zone from WTGs as a precautionary measure for any reflection and scattering impacts that may be produced. Consultation with identified licensees is still required and has been undertaken for all communication towers within 2 km of a proposed WTG location.
- *Obstruction impact:* Recommendations for determining exclusion zones to mitigate obstruction are given by 'Fixed-link wind-turbine exclusion zone method' [6]. Exclusion zones have been calculated at MHWF using this method (2^{nd} Fresnel zone method) and are discussed in Section 3.2.
- *Reflection and scattering:* The accepted methods for calculating these impacts generally require information on signal performance requirements specific to each service and client. Additionally, impact calculations from this effect require complex modelling to determine. The scope of this assessment does not include the calculation of reflection/scattering impacts. WSP has undertaken a qualitative assessment to determine potentially affected

licensees within the vicinity of MHWF. Further, all licensees identified within 10 km of MHWF were previously contacted as part of the consultation process to provide further feedback on any potential EMI impacts. All feedback received was forwarded to Neoen. Note that this updated assessment does not include any further consultations.

2.1.2 RELEVANT CATEGORIES

In assessing EMI impacts resulting from wind farm development and operation, radio systems are commonly broken into several different categories based on type. For the purposes of the current investigation, the following categories of services are considered.

- *Fixed point-to-point:* Radio links that transmit and receive between two (2) fixed points fall under this category. For example, network backhaul (such as a dedicated transport core network) commonly utilises point-to-point communication.
- *Fixed point-to-multipoint:* A central location transmits to, and sometimes receives from, several independent locations, such as remote control or base stations for utility and power providers. Some land mobile systems fall under this category.
- *Other/Point-to-area*: TV and radio broadcasting and reception, mobile phones (to the cell site mast) and land mobile systems fall under this category.
- *Radar:* Radar transmits a signal which is reflected back to the transmitting station (some systems involve communication between a radar station and a transponder). Services that utilise radar technology include aircraft detection and weather services.

Point-to-point, point-to-multipoint and radar impacts are considered separately in this assessment. WSP has also considered the impact of the wind farm development on nearby mobile phone networks, internet services, TV broadcasting services and other types of point-to-area licences.

In order to assess the potential EMI impacts arising from the MHWF project development and operation, WSP has adopted the following methodology in line with the Draft National Wind Farm Development Guidelines [5] (or the "Guidleine") as well as State Code 23: Wind farm development [7] (or "State Code 23"), noting substantial overlap between the Guideline and State Code 23:

1. Using the Australian Communications and Media Authority (ACMA) radio communication towers and radio services (RADCOM) database, all licences currently registered within 70 km of MHWF have been identified.
2. All communication towers within 2 km of the MHWF project were investigated and assessed for potential near-field and obstruction effects.
3. All registered fixed point-to-point licences passing through or near the proposed WTG locations were identified and assessed for potential EMI impacts.
4. All fixed point-to-multipoint licences within 30 km of MHWF were identified and assessed for potential EMI impacts.
5. All other remaining registered licences were assessed for potential impacts within 30 km of MHWF.
6. Operators of radar services, including the Bureau of Meteorology (BoM) and aviation services, were identified within 250 nautical miles of MHWF.
7. Network coverage of mobile phone services, internet services and TV broadcast services were assessed in the vicinity of MHWF.
8. Emergency services operating licences within 30 km of MHWF were also identified.
9. A consultation process with identified licensees within 10 km of MHWF. As part of the previous consultation, feedback was requested on any potential impacts that licensees envisage on their respective services from the development and operation of MHWF. Note that no consultation was conducted as part of this updated assessment.

2.2 AUSTRALIAN COMMUNICATIONS AND MEDIA AUTHORITY

ACMA is the Australian Government body that regulates the use of Australia's radio spectrum. ACMA maintains a register of radio licences, radio communication towers and radio services (RADCOM). The RADCOM database contains a register of all radio apparatus, each having a unique radio assignment number. WSP initially accessed the ACMA RADCOM database in November 2020 to conduct the preliminary EMI assessment and the results are detailed in 'PS122878-WIN-MEM-001 RevA' [9]. Revisions of the report up to and including Revision E were produced without re-accessing the database. For the purposes of this report, the RADCOM database was accessed on the 25th January 2023 [3].

The RADCOM database has been known to potentially contain inaccurate information. Additionally, the precision of some tower location coordinates can be considered low for the purposes of this assessment. As part of the previous consultation process, WSP had requested feedback from identified licensees to confirm the accuracy of the information sourced from the RADCOM database. WSP has included responses where feedback was supplied by the licensees.

2.3 ASSESSMENT INPUTS

Table 2.1 outlines the inputs which were considered in this assessment.

Table 2.1 Inputs to the EMI assessment

INPUT	DESCRIPTION	REFERENCE
WTG Layout/Model	WTG layout and model at MHWF, corresponding to a maximum tip height of 260 m and a blade length of 90 m.	[4]
RADCOM Database	Details of licences in operation in Australia, publicly available in the RADCOM database	[3]
BoM data	Locations of nearby weather radars and stations as per the Bureau of Meteorology (BoM) website	[10]
Broadcasting data	Location of nearby TV and radio broadcast towers	[11]
Mobile phone coverage	Mobile phone coverage areas as provided by Telstra, Optus and Vodafone	[12] [13] [14]

2.4 CONSULTATION PROCESS

The Draft National Wind Farm Guidelines [5] recommend that organisations operating within 5 km of a prospective site are consulted regarding the potential EMI impacts of the wind farm on their operations and services. In the previous EMI assessment, WSP considered organisations within 10 km of MHWF.

WSP contacted identified licensees on 19 February 2021, based on the information downloaded from the ACMA database [15]. The responses from licensees where WSP received feedback have been included in the relevant sections in future revisions of this report. The consultation process was concluded in May 2021. A summary of contacted licensees and any associated responses can be found in Appendix A.

2.5 EXCLUSIONS

As mentioned previously, this assessment does not include the calculation of reflection/scattering impacts. WSP has undertaken a qualitative assessment to determine potential affected licensees within the vicinity of MHWF (up to 10 km). Further, all licensees identified within 10 km of MHWF were contacted as part of the previous consultation process conducted in 2021 to provide further feedback on any potential EMI impacts. Of the received consultation responses so far, no licensees flagged potential reflection and/or scattering impacts.

This EMI study only qualitatively assesses the potential impact caused from WTGs, and it does not consider the EMI impact of other wind farm infrastructure such as overhead powerlines, substations, or met masts etc. Further, this Report does not include an Electromagnetic Radiation (EMR) assessment.

3 POTENTIAL IMPACTS

Following the methodology and inputs described in Section 2, WSP has undertaken an independent analysis of the potential EMI impacts arising from the development and operation of the MHWF project.

The RADCOM database [3] was accessed in January 2023 and was used to identify all licences in operation within 70 km of the project.

3.1 RADCOM DATABASE

The ACMA RADCOM database [3] was used to identify all licences within 70 km of the MHWF project boundary. The Draft National Wind Farm Guidelines recommend that all licences within 50-60 km of a project are identified and assessed. It is noted that it is possible that point-to-point licences span over greater distances and as such, WSP has considered 70 km as a first-pass analysis.

746 communication towers were identified within 70 km of the MHWF project boundary, with approximately 66 towers within 30 km of the site boundary.

3.1.1 NEAR FIELD EXCLUSION

A refined search was undertaken to identify any towers located within 2 km of the site boundary and further assessed for potential WTG near-field and scattering effects. Eight (8) communication towers were identified, as shown in Table 3.1.

Table 3.1 Communication towers within a 2 km vicinity of the MHWF boundary

SITE ID	LATITUDE [°]	LONGITUDE [°]	SITE NAME
17392	-23.910	150.566	Telstra Customer GLENGOWAN
17465	-23.875	150.542	Telstra Customer POMEGRANATE
17134	-23.726	150.531	TMR RoadTek Site MT HOPEFUL
17138	-23.730	150.536	BA Site Mount Hopeful 1046 Mount Hopeful Rd BAJOOL
17136	-23.730	150.534	Ergon Site 38 km S of Rockhampton MT HOPEFUL
17135	-23.730	150.534	Nixons Site 38 km S of Rockhampton MT HOPEFUL
17442	-23.730	150.536	Broadcast Australia Site 1046 Mt Hopeful Rd MOUNT HOPEFUL
151579	-23.730	150.532	Broadcast Site 38 km S of Rockhampton MT HOPEFUL

Towers with Site ID 17465 and 17392 to the southern section of the site boundary are located further than 2 km from the nearest proposed WTG locations as shown in Figure 3.1. Both towers are operated by Telstra Corporation Limited. In the previous assessment, WSP contacted the relevant licensees but did not receive a response by the end of the consultation period. See Section 3.2 for the point-to-point impact assessment of these towers.

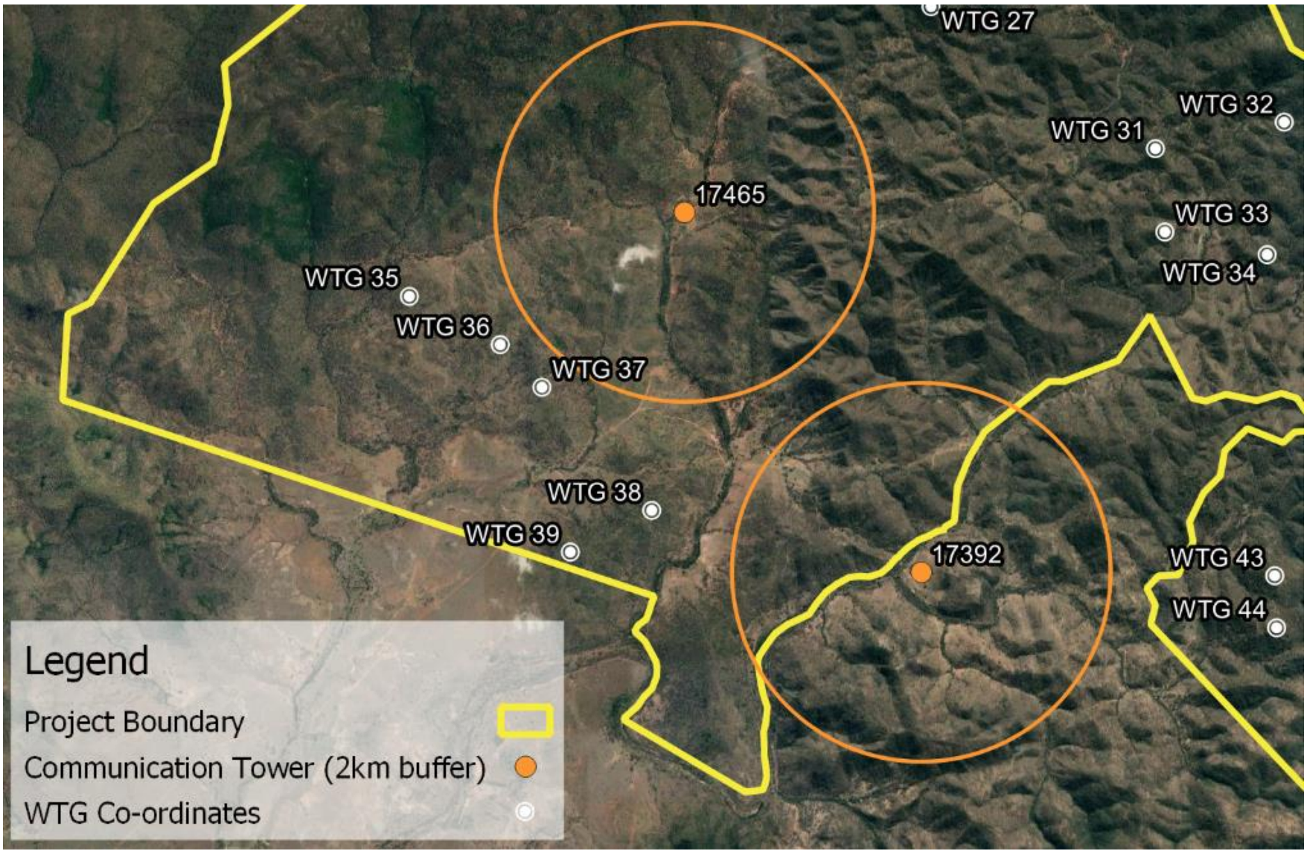

Figure 3.1 Communication towers 17465 and 17392

To the north of the project boundary, there are six communications towers (Site ID's 17134, 17135, 17136, 17138, 17442, 151579). As a conservative approach, WSP generally recommends a 2 km exclusion zone to mitigate near field effects, and to avoid reflection and/or scattering of the radio signals. According to State Code 23 [7], it is recommended that communications towers within 1 km of the WTG locations are considered in relation to near-field effects.

WSP notes that the proposed locations of WTGA02 and WTGA03 lie within a 2 km radius of these towers, but outside a 1 km radius. This is shown in Figure 3.2 below and the point-to-point impact assessment of these towers is assessed in Section 3.2.

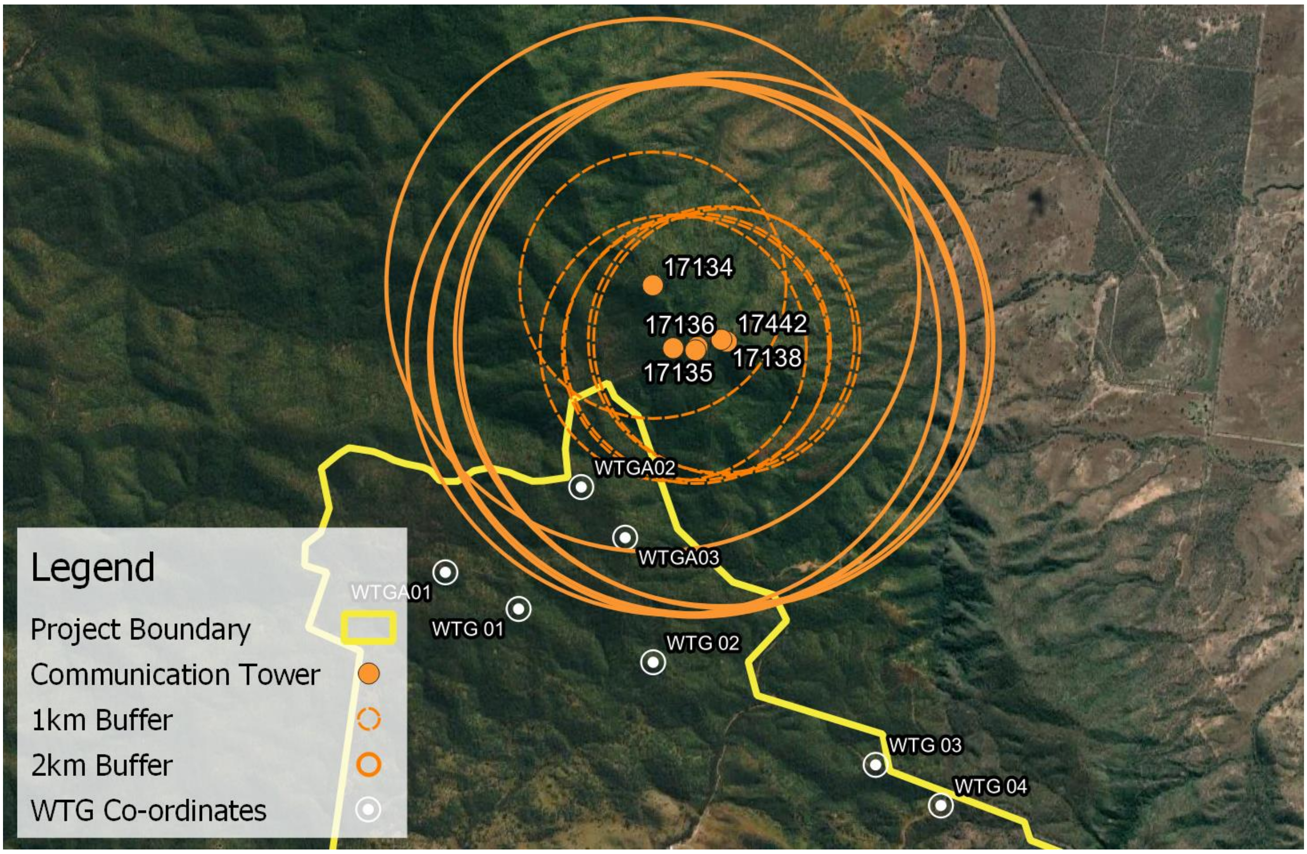

Figure 3.2 Communication towers to the north of the project boundary

3.2 POINT-TO-POINT LICENCES

All registered fixed point-to-point links within 70 km of MHWF have been identified and further analysed for potential intersection with the WTGs within the MHWF site. 17 point-to-point links were identified to intersect or come within 500m of the site boundary. The details of the links are shown in Table 3.2 and Figure 3.3.

Table 3.2 Registered point-to-point links in vicinity to MHWF

LINK NUMBER	SITE 1 ID [LAT, LONG]	SITE 2 ID [LAT, LONG]	LICENCEES	MINIMUM FREQUENCY
1	17134 [-23.725746°, 150.530646°]	17739 [-24.448326°, 150.315667°]	Department of Transport and Main Roads	450.575 MHz
2	17136 [-23.729977°, 150.533851°]	460744 [-24.448554°, 150.31581°]	Queensland Police Services	404.275 MHz
3	17500 [-24.070876°, 150.40958°]	17465 [-23.875481°, 150.542044°]	Telstra Corporation Limited	149.550 MHz
4	17500 [-24.070876°, 150.40958°]	17392 [-23.910163°, 150.565935°]	Telstra Corporation Limited	150.0875 MHz
5	17135 [-23.7302°, 150.533699°]	17740 [-24.448332°, 150.316012°]	Nixon Communications Pty Ltd	404.625 MHz
6	17514 -23.729651, 150.536014	17136 [-23.729977°, 150.533851°]	Ergon Energy Corporation Limited	6.500 GHz
7	17442 [-23.729651°, 150.536014°]	9000353 [-23.922387°, 150.086236°]	Optus Mobile Pty Limited	6.019 GHz
8	17136 [-23.729977°, 150.533851°]	55466 [-23.922296°, 150.076255°]	Queensland Fire and Emergency Services	404.600 MHz
9	17135 [-23.7302°, 150.533699°]	17533 [-23.751029°, 149.051231°]	Nixon Communications Pty Ltd	404.625 MHz
10	17136 [-23.729977°, 150.533851°]	17537 [-23.773166°, 149.116817°]	Queensland Police Service	404.975 MHz
11	17136 [-23.729977°, 150.533851°]	17533 [-23.751029°, 149.051231°]	Department of Health (Queensland Ambulance Service)	450.700 MHz
12	17442 [-23.729651°, 150.536014°]	404292 [-23.749794°, 149.979364°]	Optus Mobile Pty Limited	5.945 GHz
13	9021588 [-23.959662, 150.804856]	17138 [-23.729509, 150.535625]	Airservices Australia	7.435 GHz
14	17568 [-23.908641, 150.762348]	17138 [-23.729509, 150.535625]	Telstra Corporation Limited	404.325 MHz
15	10002893 [-23.810400, 150.647777]	17442 [-23.729651, 150.536014]	Vertical Telecoms Pty Ltd	11.095 GHz
16	17134 [-23.725746, 150.530646]	16905 [-24.311781, 151.624440]	Department of Transport and Main Roads	450.575 MHz
17	151579 [-23.73003, 150.532065]	404292 [-23.749794, 149.979364]	Digital Distribution Australia Pty Ltd	6.720 GHz

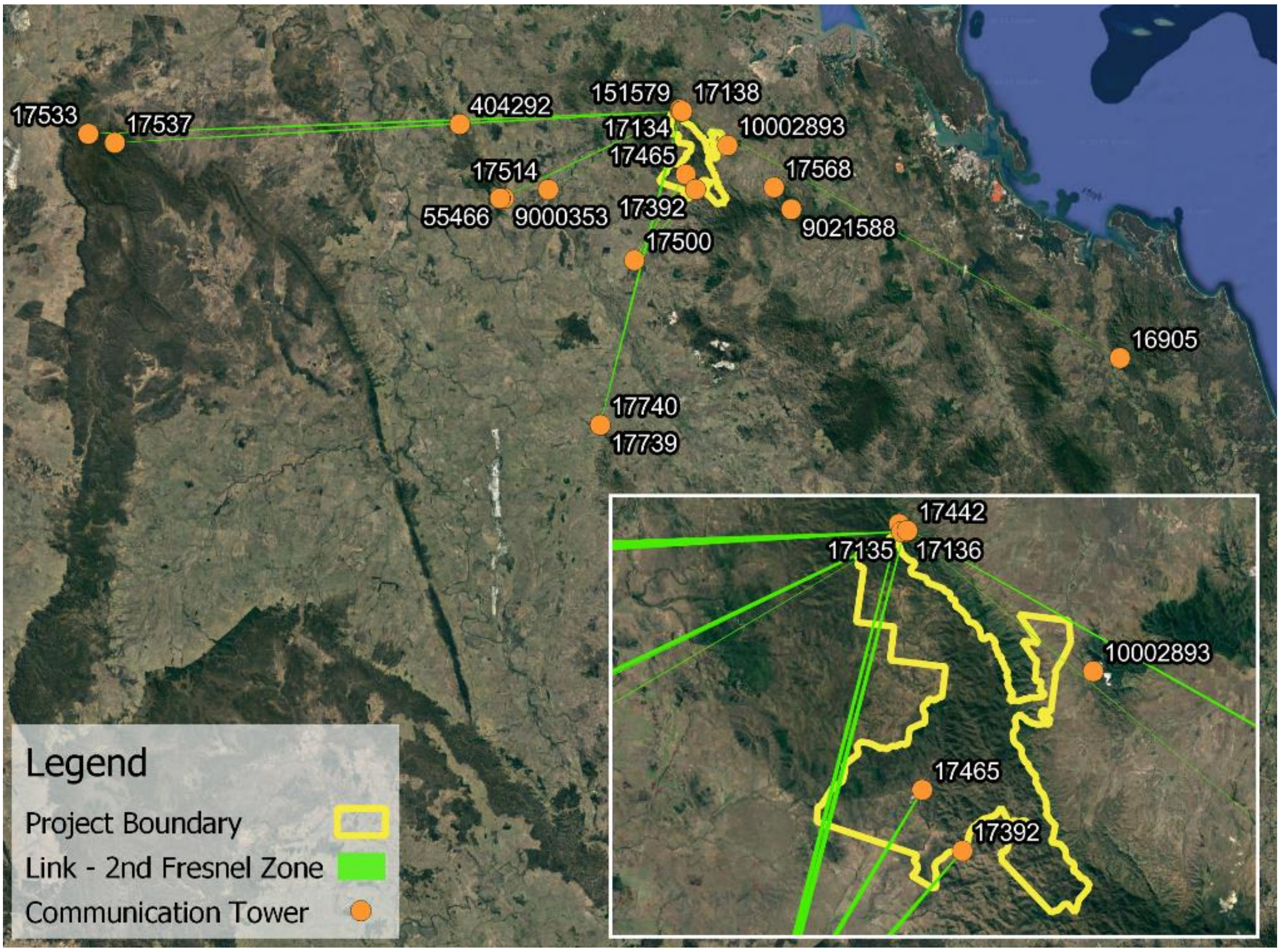

Figure 3.3 Point-to-point links identified in vicinity of MHWF

To assess the likely impact of the MHWF project development and operation on the nearby point to point links, WSP has assessed the 2nd Fresnel exclusion zones for each identified link. As a conservative approach, the lowest frequency associated with each link has been used to develop the 2nd Fresnel zones as this results in the largest Fresnel zone radius. Furthermore, it is noted that the Fresnel zone analysis does not consider the vertical position (elevation above ground level) of the point-to-point link. As such, the exclusion zones reflect a worst case, 2D impact scenario.

To avoid all potential EMI impacts on the links, WSP recommends that no WTG (including blade tip) encroach the 2nd Fresnel zones of the identified links and had previously adopted this approach as part of the layout development process. A set-back distance of one blade length (90 m) has also been considered from the 2nd Fresnel zones to avoid blade overhang.

In the previous revision of this report, WSP contacted the operators of the identified point-to-point links. Any feedback received is discussed further in the following subsections. It is important to note that Link 17 was not identified in the previous revision and the licensee has not been contacted yet. The WTG layout has also changed significantly since the previous revision. WSP recommends a consultation process is to be conducted to ensure the proposed WF is to not adversely impact the signal strength of Link 17. Further details for Link 17 can be found in Section 3.2.17.

3.2.1 LINK 1 DETAILS

Table 3.3 lists the details for Link 1, between the communication towers 17134 and 17739, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.3 Point-to-point assignments between 17134 and 17739

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Department of Transport and Main Roads	17134 [TMR RoadTek Site MT HOPEFUL]	17739 [QR Site BANANA RANGE]	710552-710553	460.075 MHz
			710555-710554	**450.575 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 450.575 MHz, shown in Figure 3.4.

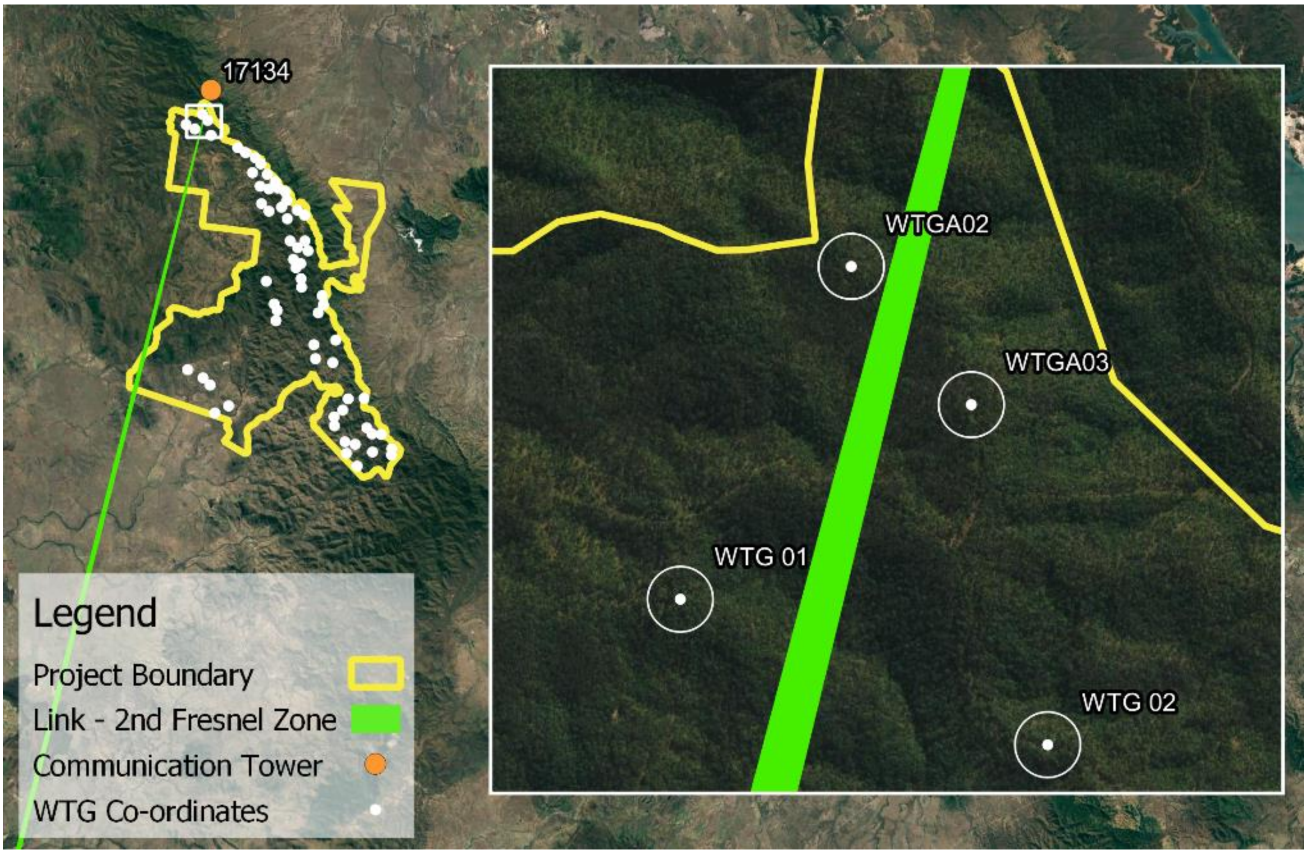

Figure 3.4 Point-to-point Link 1, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 1, with the closest WTG being WTGA02. The blade tip of WTGA02 (assuming a 180 m rotor diameter) is approximately 13 m to the west of the 2nd Fresnel zone, but remains outside the 2nd Fresnel zone based on a rotor diameter of 180 m.

In the previous assessment, WSP contacted the relevant licensees and did not receive any feedback by the end of the 4-month consultation period (May 2021).

It should be noted that the updated WTG layout has resulted in a shorter distance between the 2nd Fresnel zone and the nearest WTG.

3.2.2 LINK 2 DETAILS

Table 3.4 lists the details for Link 2, between the communication towers 17136 and 460744, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.4 Point-to-point assignments between 17136 and 460744

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Queensland Police Service	17136 [Ergon Site 38 km S of Rockhampton MT HOPEFUL]	460744 [Emergency Services Site BANANA RANGE]	1338270-1338271	460.725 MHz
			1338273-1338272	451.225 MHz
			1453023-1453022	414.050 MHz
			1453024-1453025	404.600 MHz
			709158-709157	413.725 MHz
			709159-709160	**404.275 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 404.275 MHz, shown in Figure 3.5.

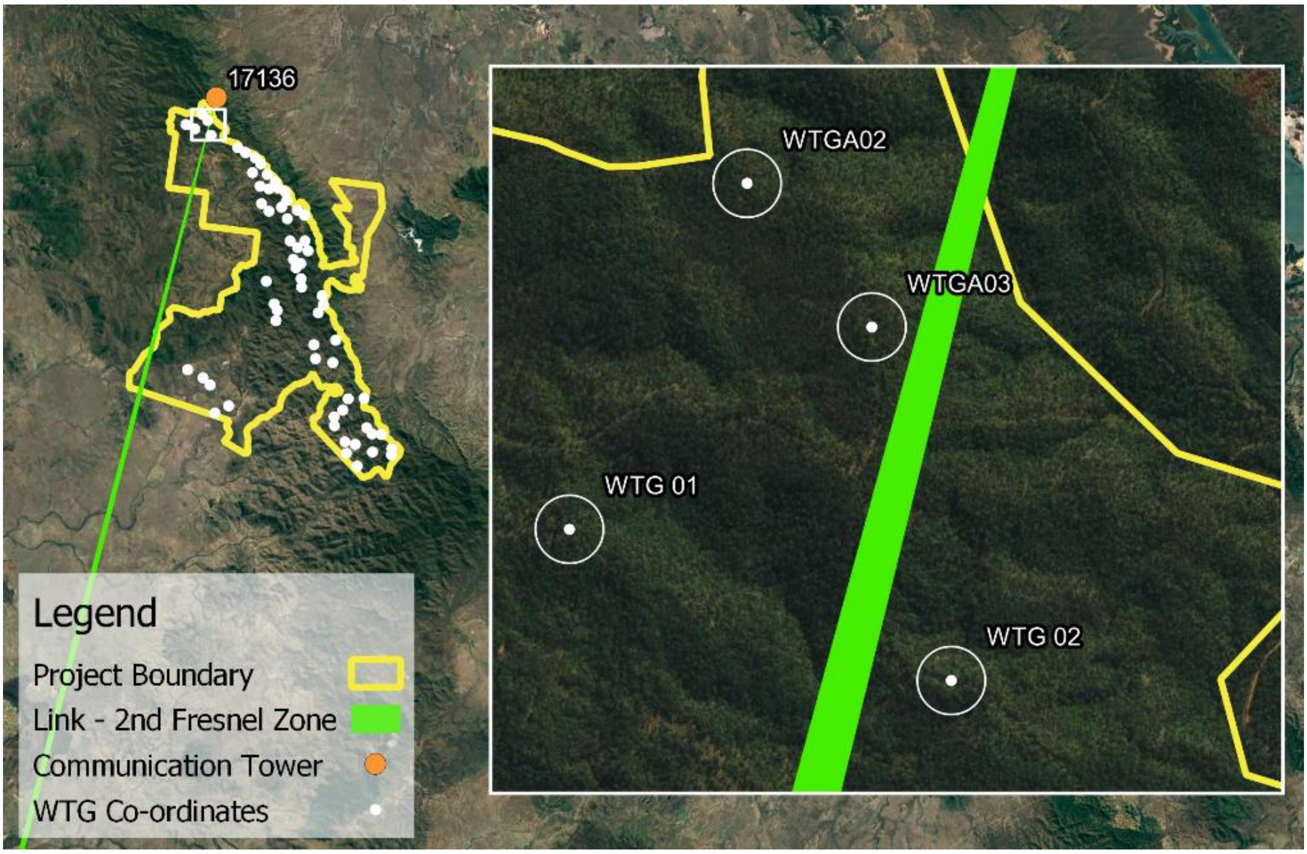

Figure 3.5 Point-to-point Link 2, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 2, with the closest WTG being WTGA03. The blade tip of WTGA03 is approximately 30 m west of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the Queensland Ambulance Service (QAS) seeking feedback on the potential EMI impact of MHWF on their operations and services. QAS stated that *"the link paths and radio sites at Banana Range and My Spencer are not obstructed and the wind farm location should not have any impact on nearby PSA radio communication facility services."* [16] [17]

It should be noted that since the previous assessment, the licencee for this link has changed from the QAS to Queensland Police. The updated WTG layout has also resulted in a shorter distance between the 2nd Fresnel zone and the nearest WTG.

3.2.3 LINK 3 DETAILS

Table 3.5 lists the details for Link 3, between the communication towers 17500 and 17465, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.5 Point-to-point assignments between 17500 and 17465

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Telstra Corporation Limited	17500 [Telstra Radio Terminal TOMLIN]	17465 [Telstra Customer POMEGRANATE]	688248-688249	154.75 MHz
			688251-688250	**149.55 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 149.55 MHz, shown in Figure 3.6.

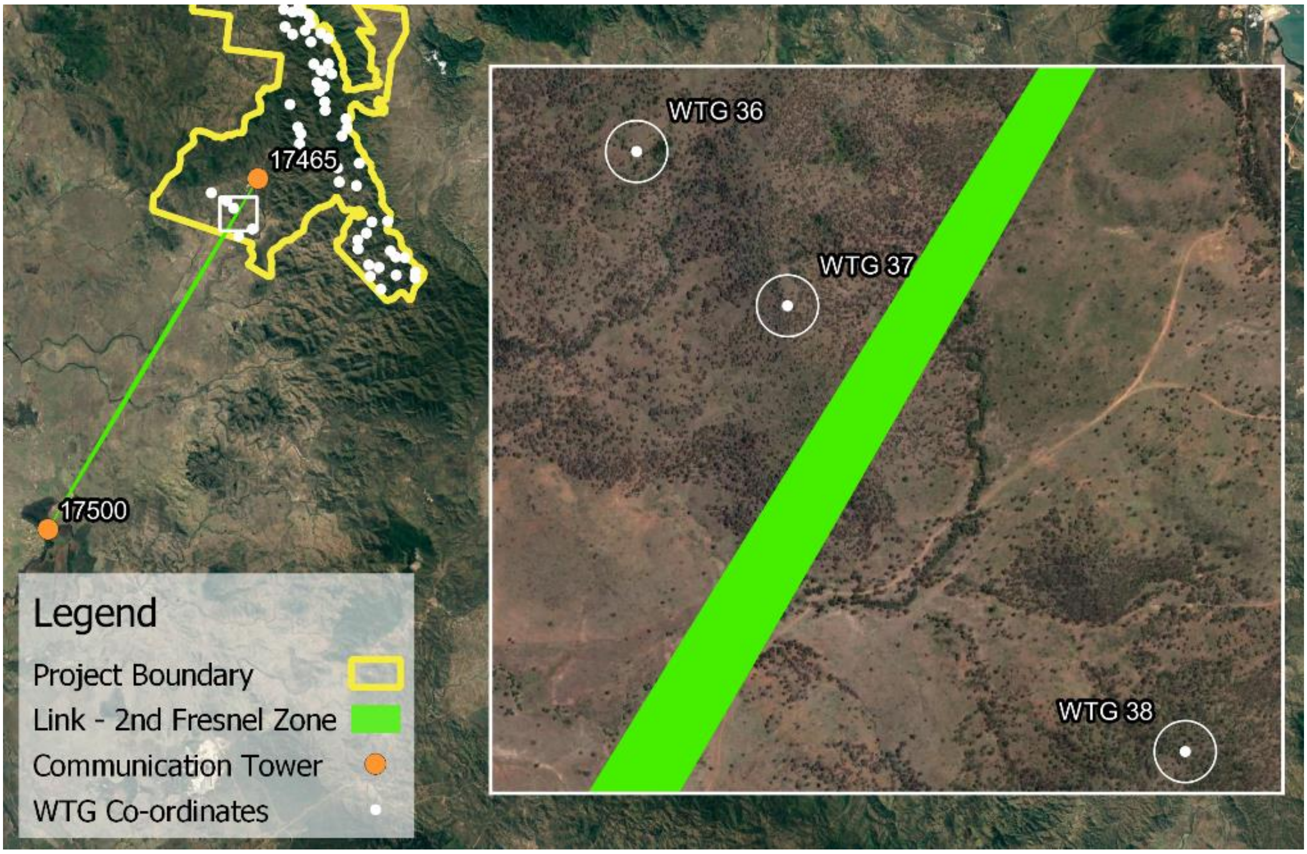

Figure 3.6 Point-to-point Link 3, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 3, with the closest WTG being WTG37. The blade tip of WTG37 is approximately 160 m west of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the relevant licensees and did not receive any feedback by the end of the 4-month consultation period (May 2021).

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.4 LINK 4 DETAILS

Table 3.6Table 3.20 lists the details for Link 4, between the communication towers 17500 and 17392, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.6 Point-to-point assignments between 17500 and 17392

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Telstra Corporation Limited	17500 [Telstra Radio Terminal TOMLIN]	17392 [Telstra Customer GLENGOWAN]	688244-688245	154.6875 MHz
			688247-688246	**150.0875 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 150.0875 MHz, shown in Figure 3.7.

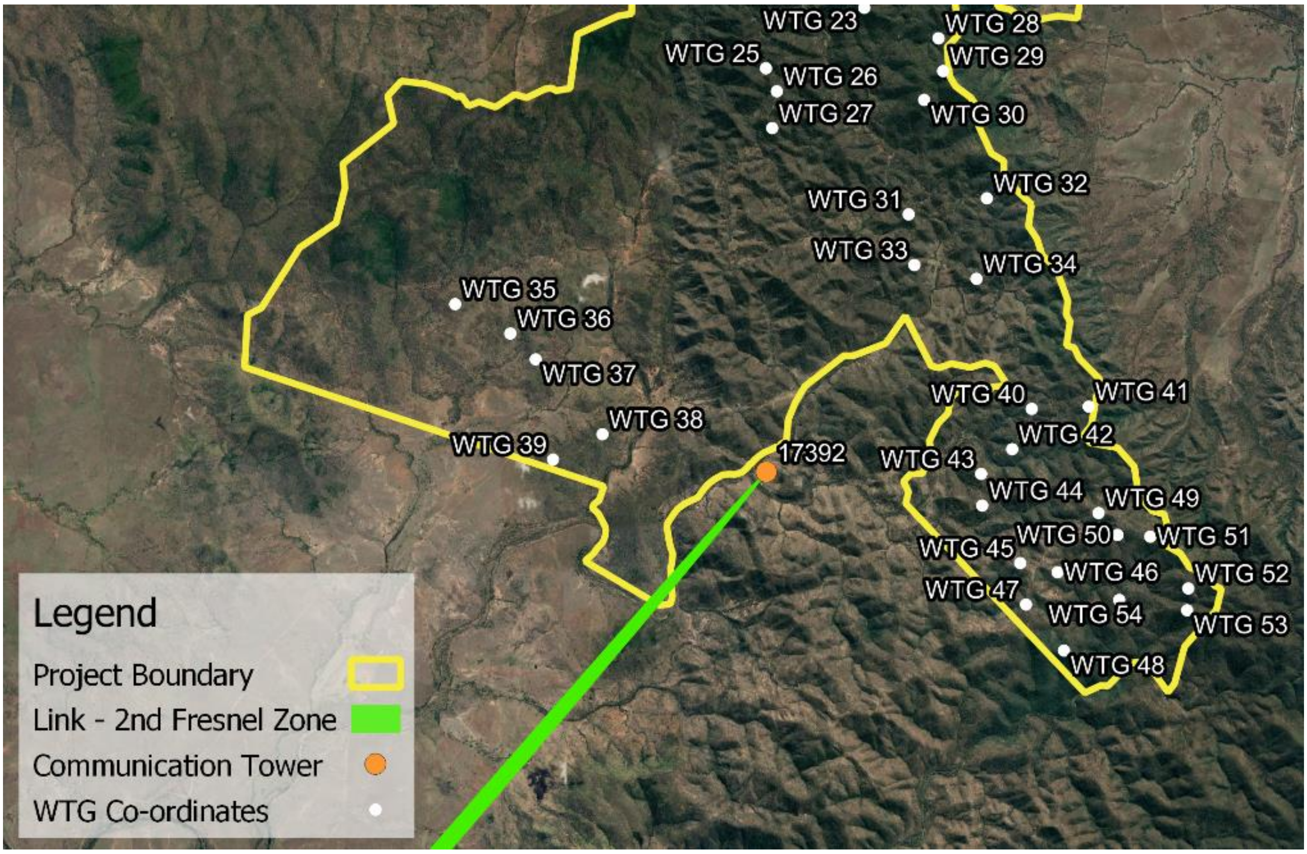

Figure 3.7 Point-to-point Link 4, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 4. The closest WTG is over 2km distance from the 2nd Fresnel zone.

In the previous assessment WSP contacted the relevant licensees and did not receive any feedback by the end of the 4-month consultation period (May 2021).

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.5 LINK 5 DETAILS

Table 3.7 lists the details for Link 5, between the communication towers 17135 and 17740, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.7 Point-to-point assignments between 17135 and 17740

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Nixon Communications Pty Ltd	17135 [Nixons Site 38 km S of Rockhampton MT HOPEFUL]	17740 [Council Site BANANA RANGE]	821276-821275	414.075 MHz
			821277-821278	**404.625 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 404.625 MHz, shown in Figure 3.8.

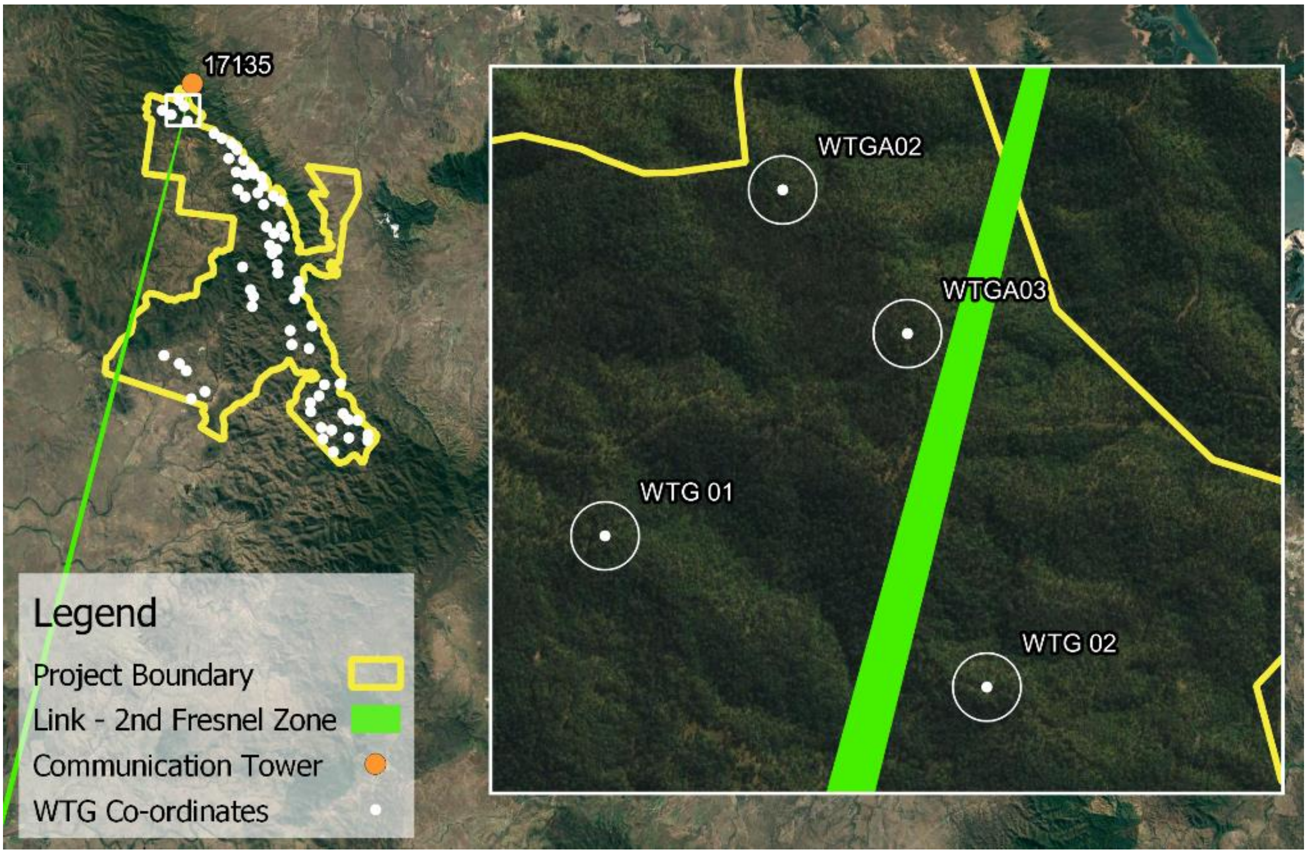

Figure 3.8 Point-to-point Link 5, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 5, with the closest WTG being WTGA03. The blade tip of WTGA03 is approximately 20 m east of the 2nd Fresnel zone, and remains outside of the 2nd Fresnel zone based on the proposed rotor diameter of 180 m.

In the previous assessment, WSP contacted Nixon Communications seeking feedback on the potential EMI impact of MHWF on their operations and services. Nixon Communications stated *"We assumed no impact due to the frequencies we use at Mt Hopeful and have noted no impact to date."* [18]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.6 LINK 6 DETAILS

Table 3.8 lists the details for Link 6, between the communication towers 17514 and 17136, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.8 Point-to-point assignments between 17514 and 17136

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Ergon Energy Corporation Limited	17514 [Sub Station Railway Ave WOWAN]	17136 [Ergon Site 38 km S of Rockhampton MT HOPEFUL]	898793-898794	6.84 GHz
			898796-898795	**6.50 GHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 6.50 GHz, shown in Figure 3.9.

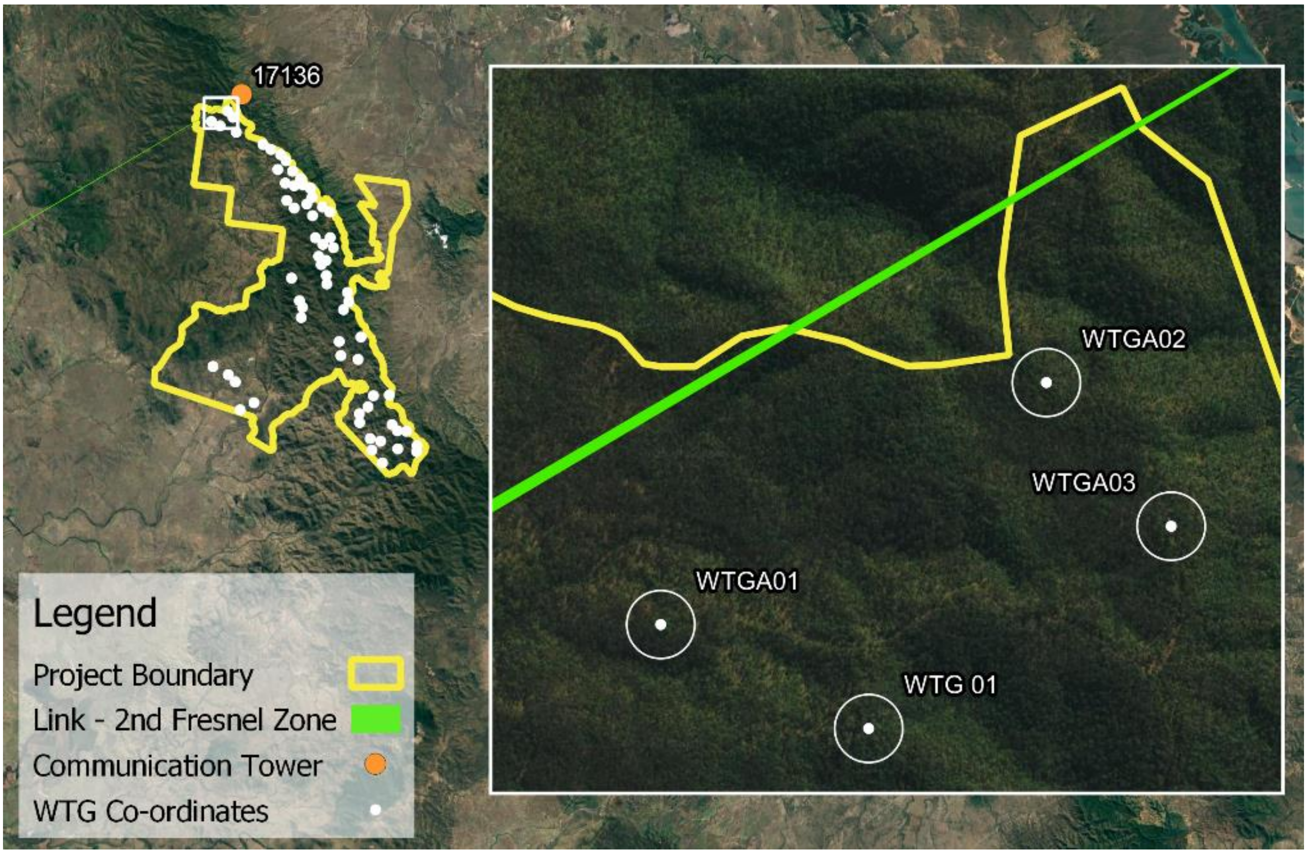

Figure 3.9 Point-to-point Link 6, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 6, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 360 m south-east of the 2nd Fresnel zone.

In the previous assessment, WSP contacted Ergon Energy Corporation Limited seeking feedback on the potential EMI impact of MHWF on their operations and services. Ergon Energy stated that; *"No Impact identified with the currently proposed turbine locations."* [19]

It should be noted that the updated WTG layout results in a shorter distance between the 2nd Fresnel zone and the nearest WTG.

3.2.7 LINK 7 DETAILS

Table 3.9 lists the details for Link 7, between the communication towers 17442 and 9000353, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.9 Point-to-point assignments between 17442 and 9000353

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Optus Mobile Pty Limited	17442 [Broadcast Australia Site 1046 Mt Hopeful Rd MOUNT HOPEFUL]	9000353 [Optus Tower Lot 106 RN231 WOWAN]	6641011-6641010	6.271365 GHz
			6641012-6641013	**6.019325 GHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 6.019325 GHz, shown in Figure 3.10.

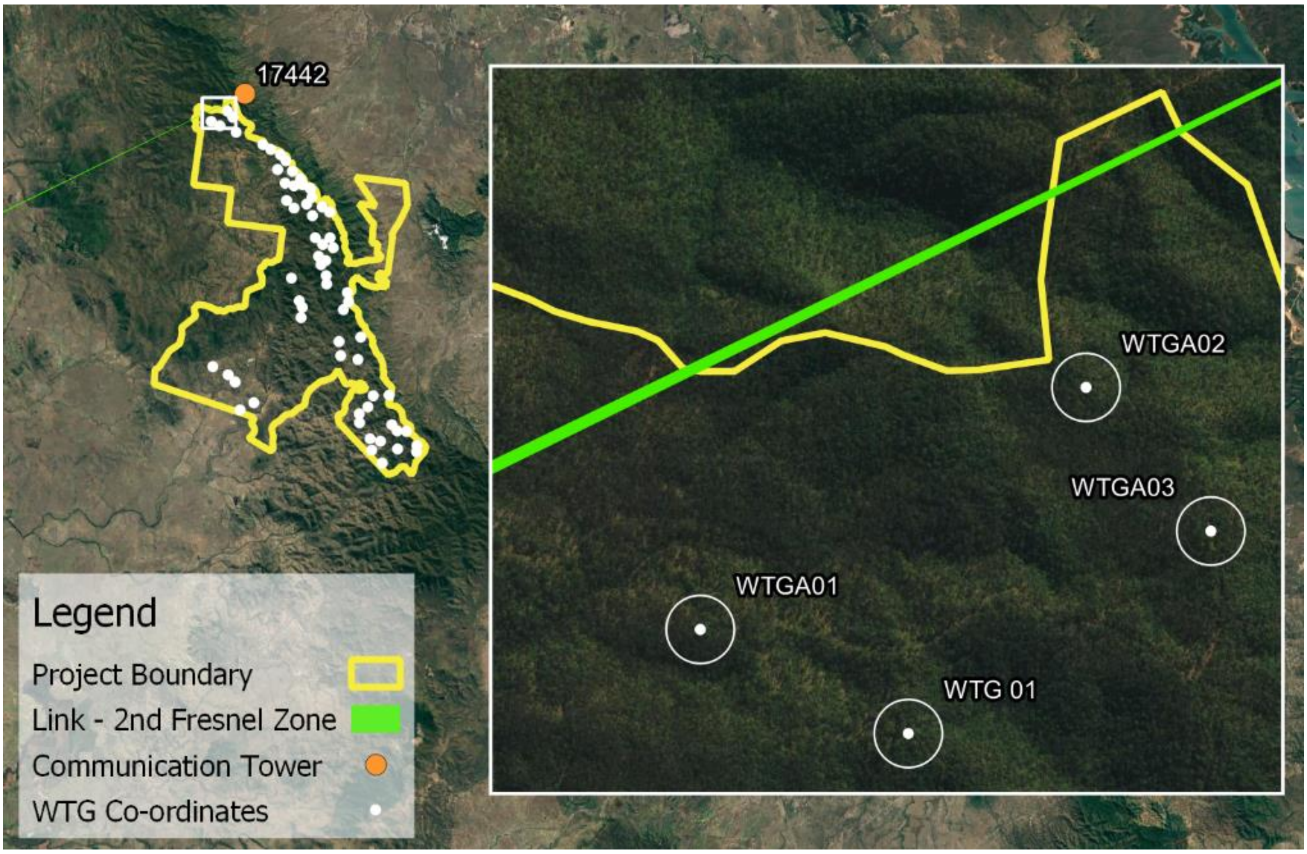

Figure 3.10 Point-to-point Link 7, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 7, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 400m south-east of the 2nd Fresnel zone.

In the previous assessment, WSP contacted Optus Mobile Pty Limited (Optus) seeking feedback on the potential EMI impact of MHWF on their operations and services. Optus stated that; *"while there may be some impacts on Optus network and services in the area, the impacts is not expected to be unacceptable. Hence, Optus does not have any objection to the proposed Mt Hopeful Wind Farm located near Rockhampton, QLD."* [20]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.8 LINK 8 DETAILS

Table 3.10 lists the details for Link 8, between the communication towers 17136 and 55466, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.10 Point-to-point assignments between 17136 and 55466

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Queensland Fire and Emergency Services	17136 [Ergon Site 38 km S of Rockhampton MT HOPEFUL]	55466 [Police Site MT SPENCER]	1453119-1453118	414.05 MHz
			1453120-1453121	**404.60 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 404.60 MHz, shown in Figure 3.11.

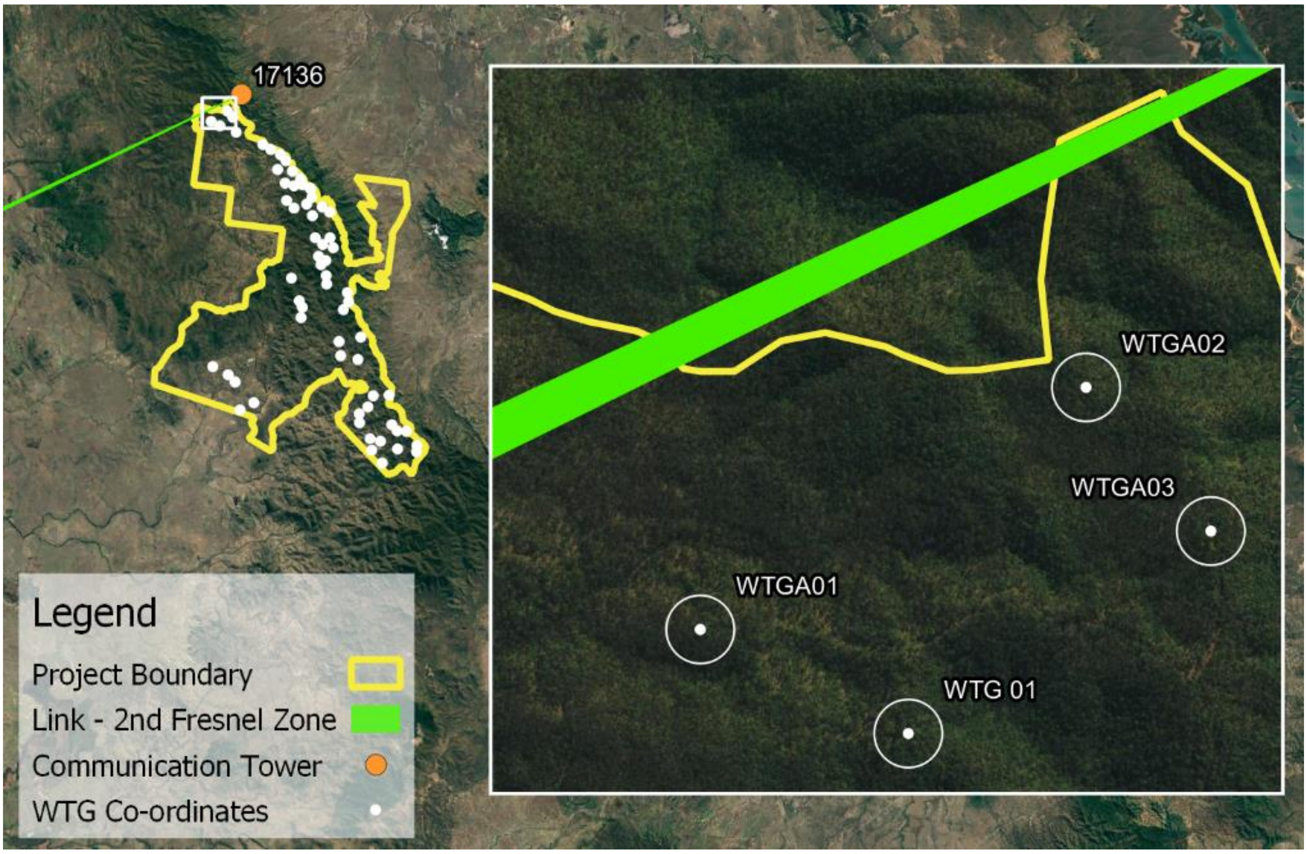

Figure 3.11 Point-to-point Link 8, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 8, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 435 m south-east of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the Queensland Fire and Emergency Services (QFES) seeking feedback on the potential EMI impact of MHWF on their operations and services. QFES stated that *"the link paths and radio sites at Banana Range and My Spencer are not obstructed and the wind farm location should not have any impact on nearby PSA radio communication facility services."* [16] [17]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.9 LINK 9 DETAILS

Table 3.11 lists the details for Link 9, between the communication towers 17135 and 17533, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.11 Point-to-point assignments between 17135 and 17533

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Nixon Communications Pty Ltd	17135 [Nixons Site 38 km S of Rockhampton MT HOPEFUL]	17533 [QAS Site BLACKDOWN TABLELAND]	820269-820267	414.075 MHz
			820271-820272	**404.625 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 404.625 MHz, shown in Figure 3.12.

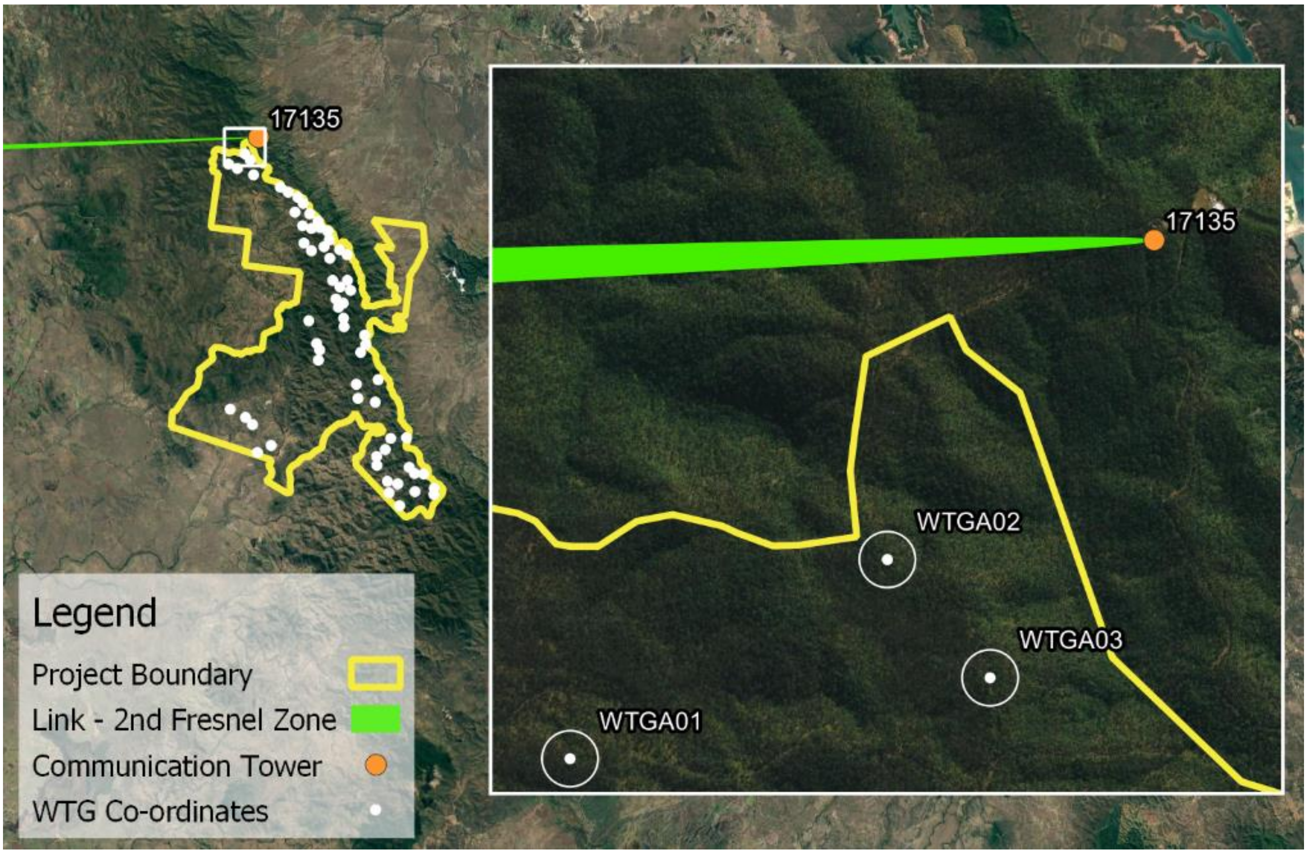

Figure 3.12 Point-to-point Link 9, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 9, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 860 m south of the 2nd Fresnel zone.

As noted in the previous assessment WSP contacted Nixon Communications seeking feedback on the potential EMI impact of MHWF on their operations and services. Nixon Communications stated *"We assumed no impact due to the frequencies we use at Mt Hopeful and have noted no impact to date."* [18]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.10 LINK 10 DETAILS

Table 3.12 lists the details for Link 10, between the communication towers 17136 and 17537, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.12 Point-to-point assignments between 17136 and 17537

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Queensland Police Service	17136 [Ergon Site 38 km S of Rockhampton MT HOPEFUL]	17537 [TMR RoadTek Site BLACKDOWN TABLELAND]	709074-709073	414.425 MHz
			709075-709076	**404.975 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 404.975 MHz, shown in Figure 3.13.

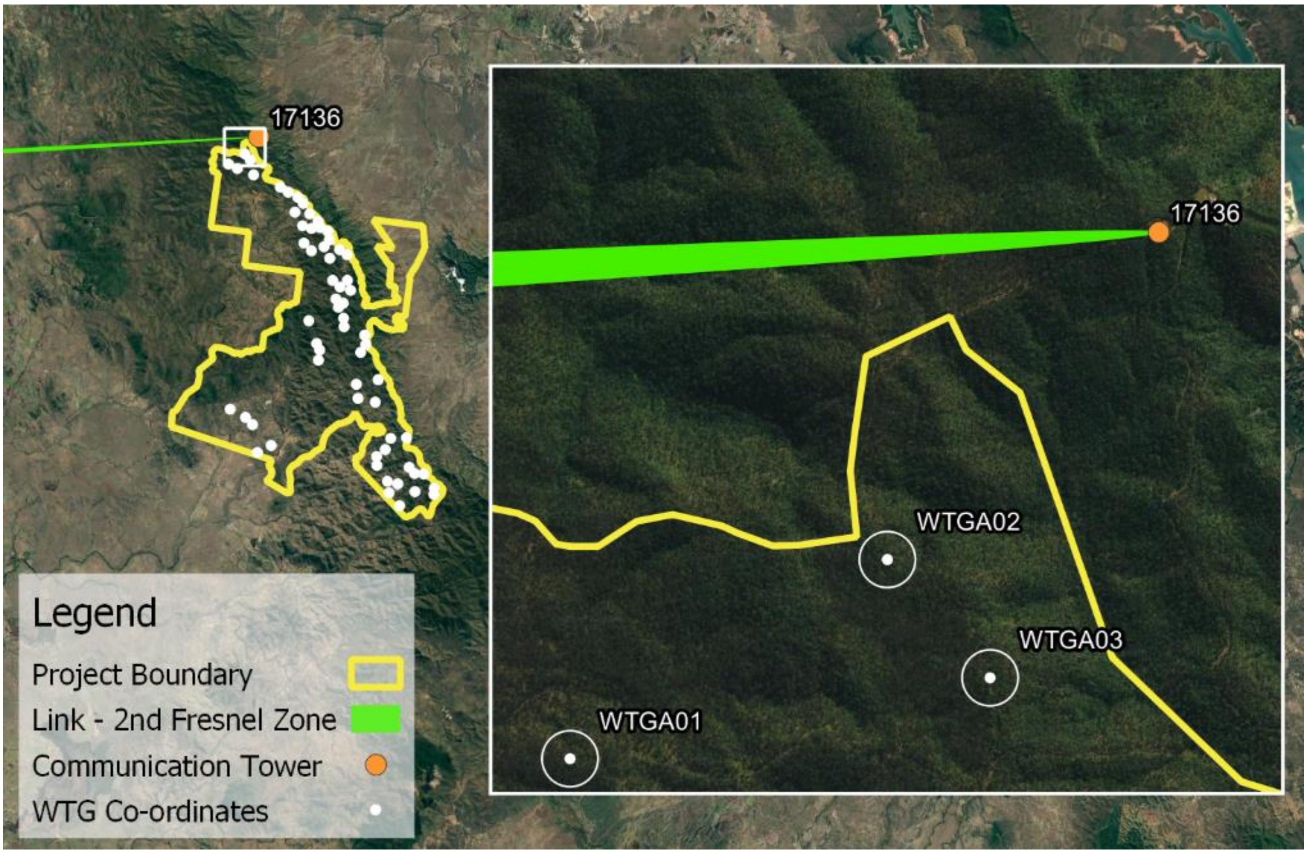

Figure 3.13 Point-to-point Link 10, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 10, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 870 m south of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the Queensland Police Service (QPS) seeking feedback on the potential EMI impact of MHWF on their operations and services. QPS stated that *"the link paths and radio sites at Banana Range and My Spencer are not obstructed and the wind farm location should not have any impact on nearby PSA radio communication facility services."* [16] [17]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.11 LINK 11 DETAILS

Table 3.13 lists the details for Link 11, between the communication towers 17136 and 17533, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.13 Point-to-point assignments between 17136 and 17533

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Department of Health (Queensland Ambulance Service)	17136 [Ergon Site 38 km S of Rockhampton MT HOPEFUL]	17533 [QAS Site BLACKDOWN TABLELAND]	1338298-1338299	460.2 MHz
			1338301-1338300	**450.7 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 450.7 MHz, shown in Figure 3.14.

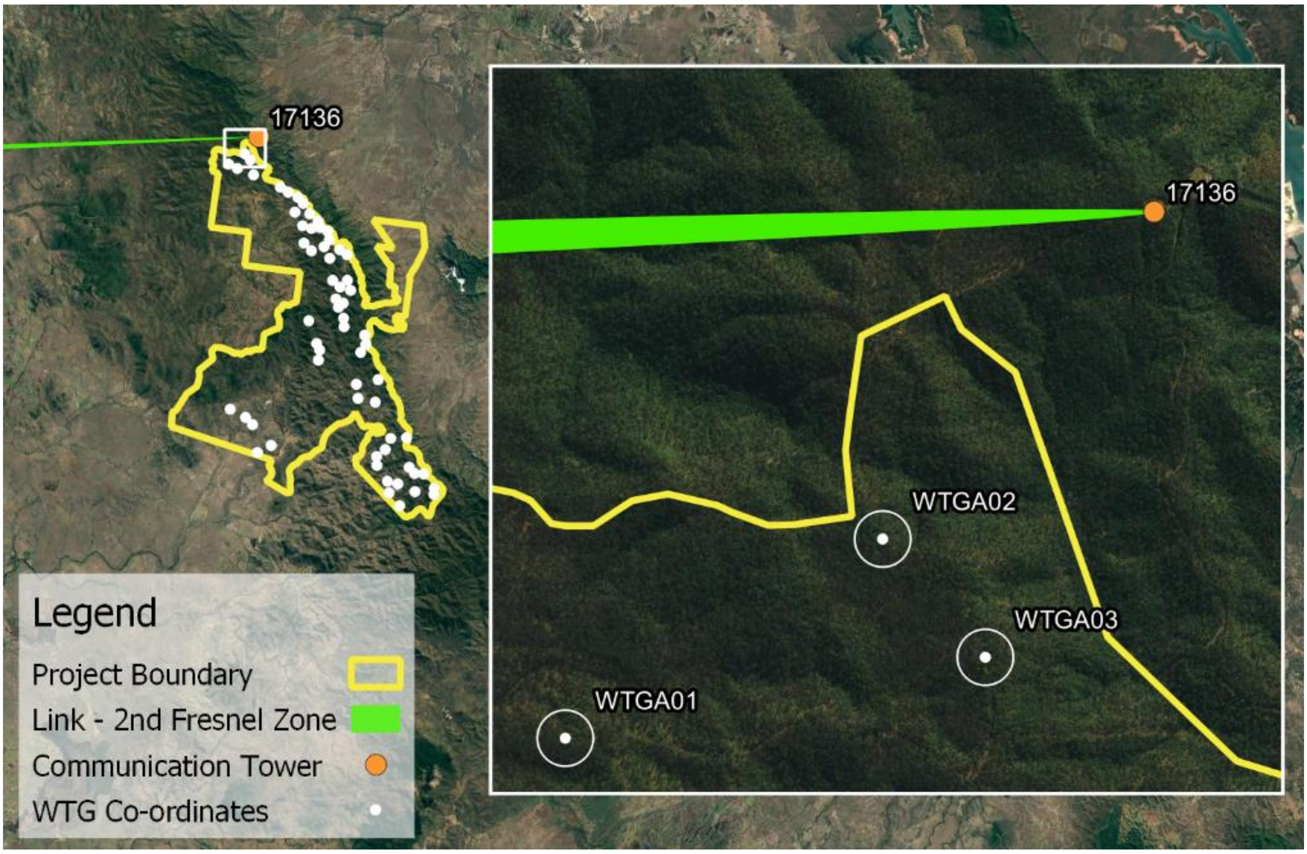

Figure 3.14 Point-to-point Link 11, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 11, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 890 m south of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the Queensland Ambulance Service (QAS) seeking feedback on the potential EMI impact of MHWF on their operations and services. QAS stated that *"the link paths and radio sites at Banana Range and My Spencer are not obstructed and the wind farm location should not have any impact on nearby PSA radio communication facility services."* [16] [17]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.12 LINK 12 DETAILS

Table 3.14 lists the details for Link 12, between the communication towers 17442 and 404292, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.14 Point-to-point assignments between 17442 and 404292

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Optus Mobile Pty Limited	17442 [Broadcast Australia Site 1046 Mt Hopeful Rd MOUNT HOPEFUL]	404292 [Optus Site Grantleigh Rd GOGANGO]	1313232-1313231	6.22689 GHz
			1313233-1313234	5.97485 GHz
			990939-990938	6.19724 GHz
			990940-990941	**5.9452 GHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 5.9452 GHz, shown in Figure 3.15.

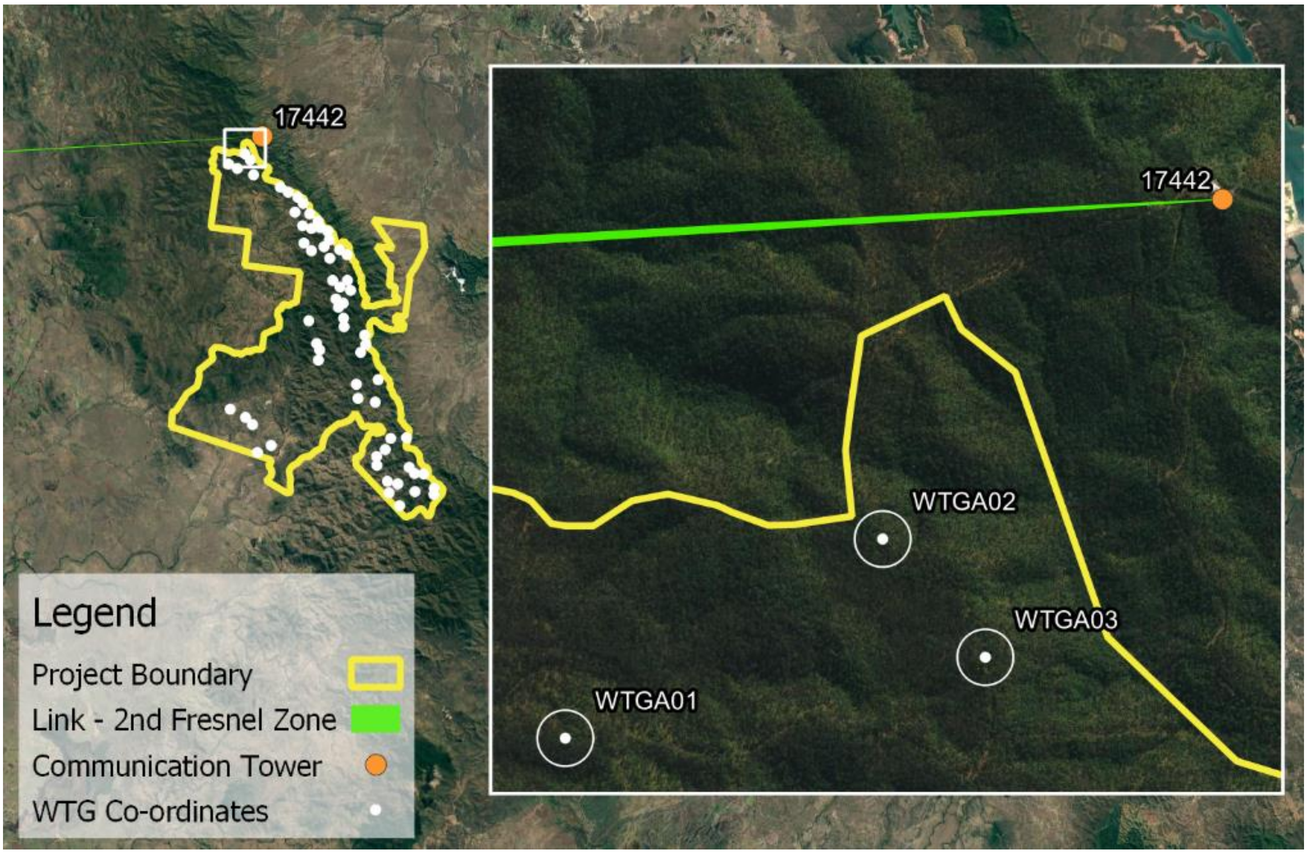

Figure 3.15 Point-to-point Link 12, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 12, with the closest WTG being WTGA02. The blade tip of WTHA02 is approximately 920 m south of the 2nd Fresnel zone.

In the previous assessment, WSP contacted Optus Mobile Pty Limited (Optus) seeking feedback on the potential EMI impact of MHWF on their operations and services. Optus stated that; *"while there may be some impacts on Optus network and services in the area, the impacts is not expected to be unacceptable. Hence, Optus does not have any objection to the proposed Mt Hopeful Wind Farm located near Rockhampton, QLD."* [20]

It should be noted that the updated WTG layout results in a greater distance between the 2nd Fresnel zone and the nearest WTG.

3.2.13 LINK 13 DETAILS

Table 3.15 lists the details for Link 13, between the communication towers 9021588 and 17138, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.15 Point-to-point assignments between 9021588 and 17138

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Airservices Australia	9021588 [Airservices Radar Tower Mt Alma Radar Site MT ALMA]	17138 [BA Site Mount Hopeful 1046 Mount Hopeful Rd BAJOOL]	2340341-2340342	7.596 GHz
			2340344-2340343	**7.435 GHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 7.435 GHz, shown in Figure 3.16.

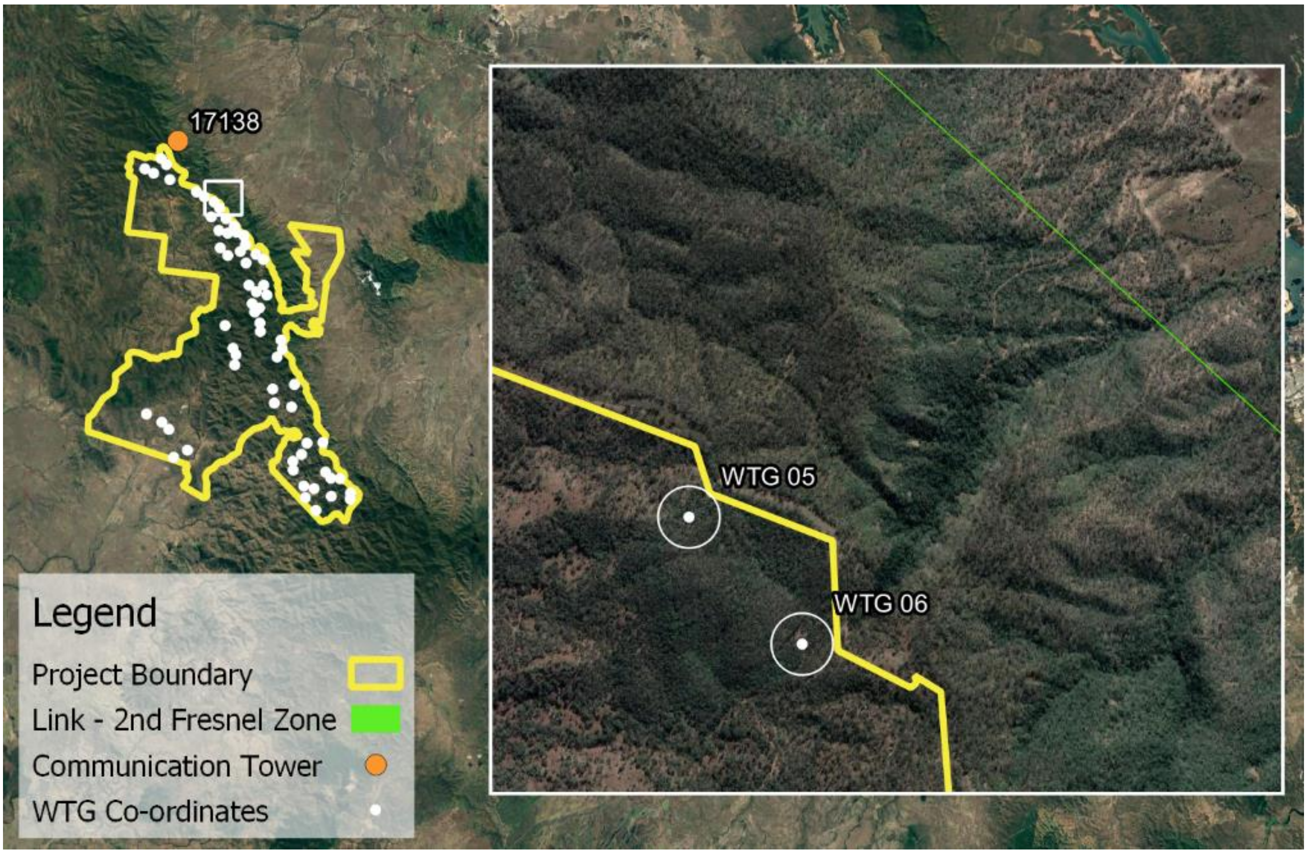

Figure 3.16 Point-to-point Link 13, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 13, with the closest WTG being WTG 05. The blade tip of WTG 05 is approximately 1250 m south-west of the 2nd Fresnel zone.

In the previous assessment, WSP contacted Airservices Australia seeking feedback on the potential EMI impact of MHWF on their operations and services. Airservices Australia stated that *"This proposal will not adversely impact the performance of any Airservices Precision/Non-Precision Nav Aids, Anemometers, HF/VHF/UHF Comms, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links."* [21]

It should be noted that the updated WTG layout results in a roughly similar distance between the 2nd Fresnel zone and the nearest WTG.

3.2.14 LINK 14 DETAILS

Table 3.16 lists the details for Link 14, between the communication towers 17568 and 17138, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.16 Point-to-point assignments between 17568 and 17138

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Telstra Corporation Limited	17568 [Telstra Customer Creed MT BENNET HOMESTEAD]	17138 [BA Site Mount Hopeful 1046 Mount Hopeful Rd BAJOOL]	705297-705298	413.775 MHz
			705300-705299	**404.325 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 404.325 MHz, shown in Figure 3.17.

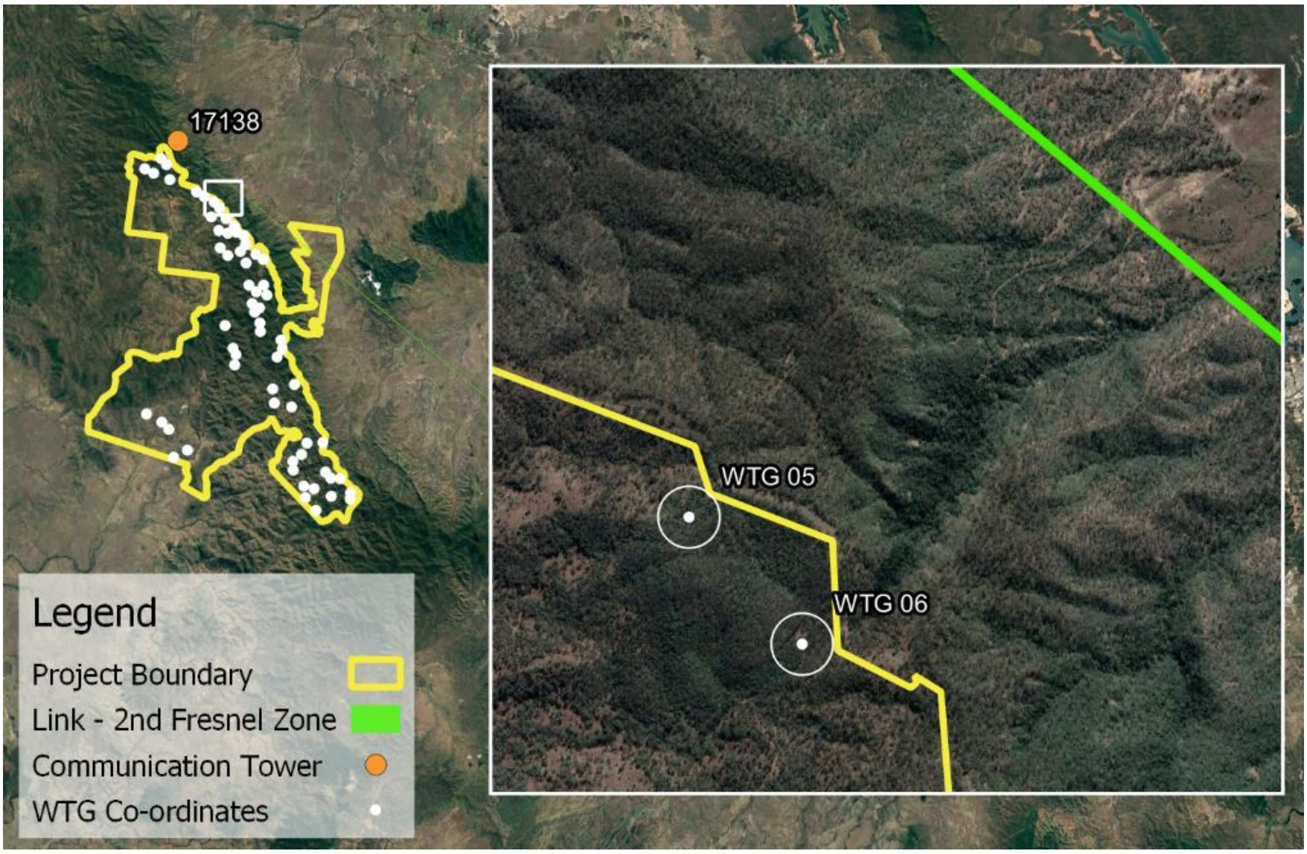

Figure 3.17 Point-to-point Link 14, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 14, with the closest WTG being WTG 05. The blade tip of WTG05 is approximately 1400 m south of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the relevant licensees and did not receive any feedback by the end of the 4-month consultation period (May 2021).

3.2.15 LINK 15 DETAILS

Table 3.17 lists the details for Link 15, between the communication towers 10002893 and 17442, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.17 Point-to-point assignments between 10002893 and 17442

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Vertical Telecoms Pty Ltd	10002893 [1879 South Ulam Road Bajool]	17442 [Broadcast Australia Site 1046 Mt Hopeful Rd MOUNT HOPEFUL]	2338761-2338760	11.585 GHz
			2338762-2338763	**11.095 GHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 11.095 GHz, shown in Figure 3.18.

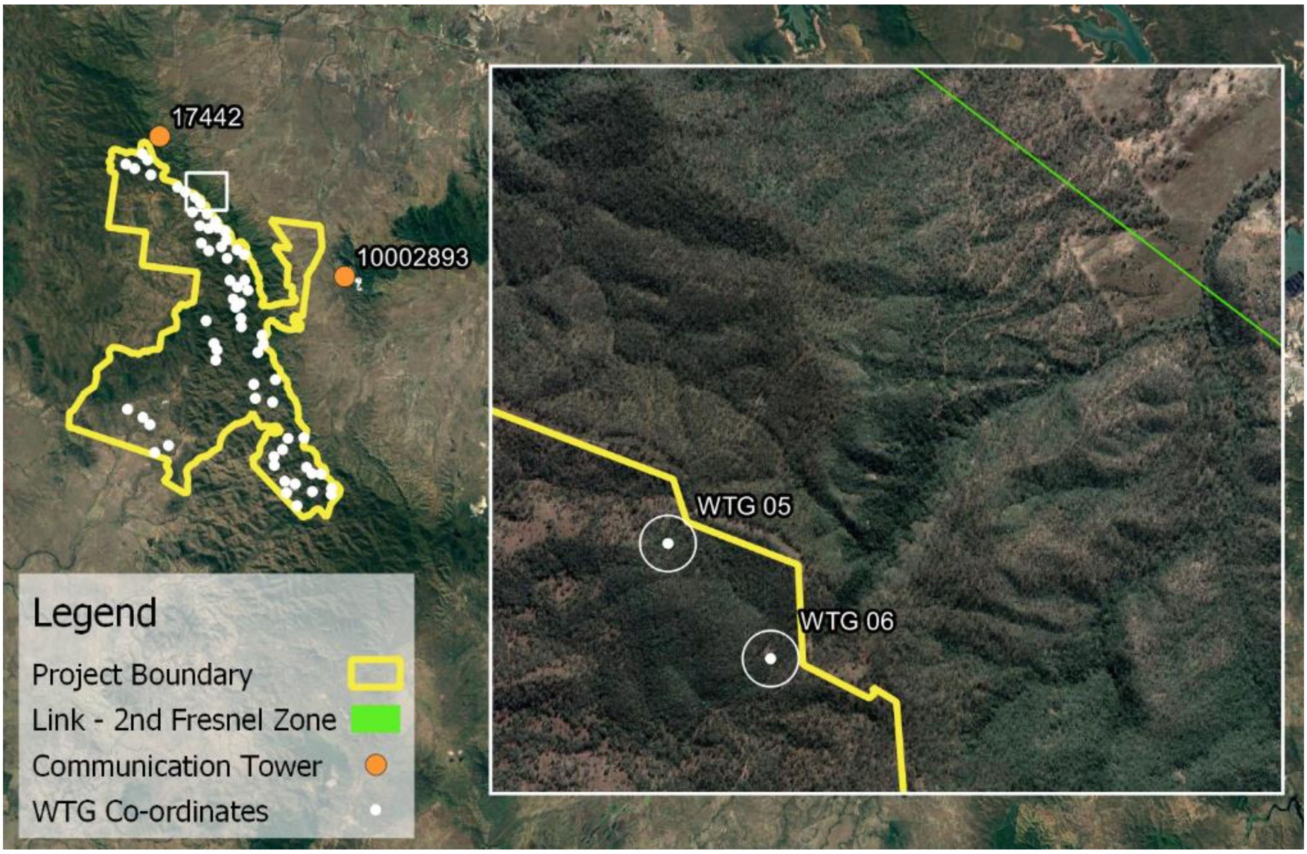

Figure 3.18 Point-to-point Link 15, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 14, with the closest WTG being WTG 05. The blade tip of WTG 05 is approximately 1600 m south of the 2nd Fresnel zone.

In the previous assessment, WSP contacted the relevant licensees and did not receive any feedback by the end of the 4-month consultation period (May 2021).

3.2.16 LINK 16 DETAILS

Table 3.18 lists the details for Link 16, between the communication towers 17134 and 16905, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold**.

Table 3.18 Point-to-point assignments between 17134 and 16905

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Department of Transport and Main Roads	17134 [TMR RoadTek Site MT HOPEFUL]	16905 [Powerlink Site WESTWOOD RANGE]	915246-915247	460.075 MHz
			915249-915248	**450.575 MHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 450.575 Hz, shown in Figure 3.19.

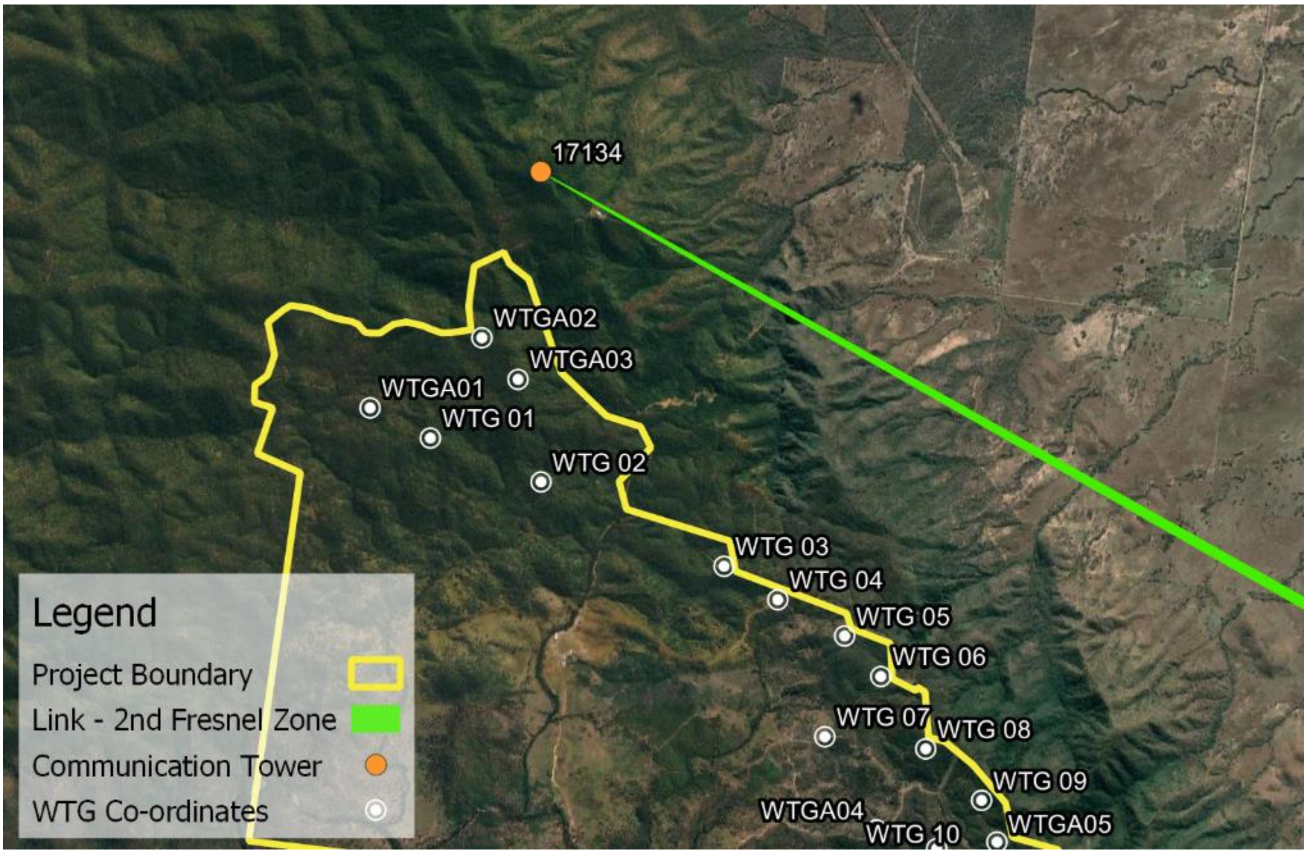

Figure 3.19 Point-to-point Link 16, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 16. The closest WTG is over 2km distance from the 2nd Fresnel zone.

In the previous assessment, WSP contacted the relevant licensees and did not receive any feedback by the end of the 4-month consultation period (May 2021).

3.2.17 LINK 17 DETAILS

Table 3.19 lists the details for Link 17, between the communication towers 151579 and 404292, including the associated Assignment IDs and frequencies. The minimum frequency, used to determine the 2nd Fresnel zone, is highlighted in **bold.**

Table 3.19 Point-to-point assignments between 151579 and 404292

LICENCEE	SITE 1	SITE 2	ASSIGNMENT ID	FREQUENCY
Digital Distribution Australia Pty Ltd	151579 [Broadcast Site 38 km S of Rockhampton MT HOPEFUL]	404292 [Optus Site Grantleigh Rd GOGANGO]	7432482-7432483	7.06 GHz
			7432485-7432484	**6.72 GHz**
			7432486-7432487	7.06 GHz
			7432489-7432488	**6.72GHz**

WSP has calculated the 2nd Fresnel zone for the lowest frequency of 6.72 GHz, shown in Figure 3.20.

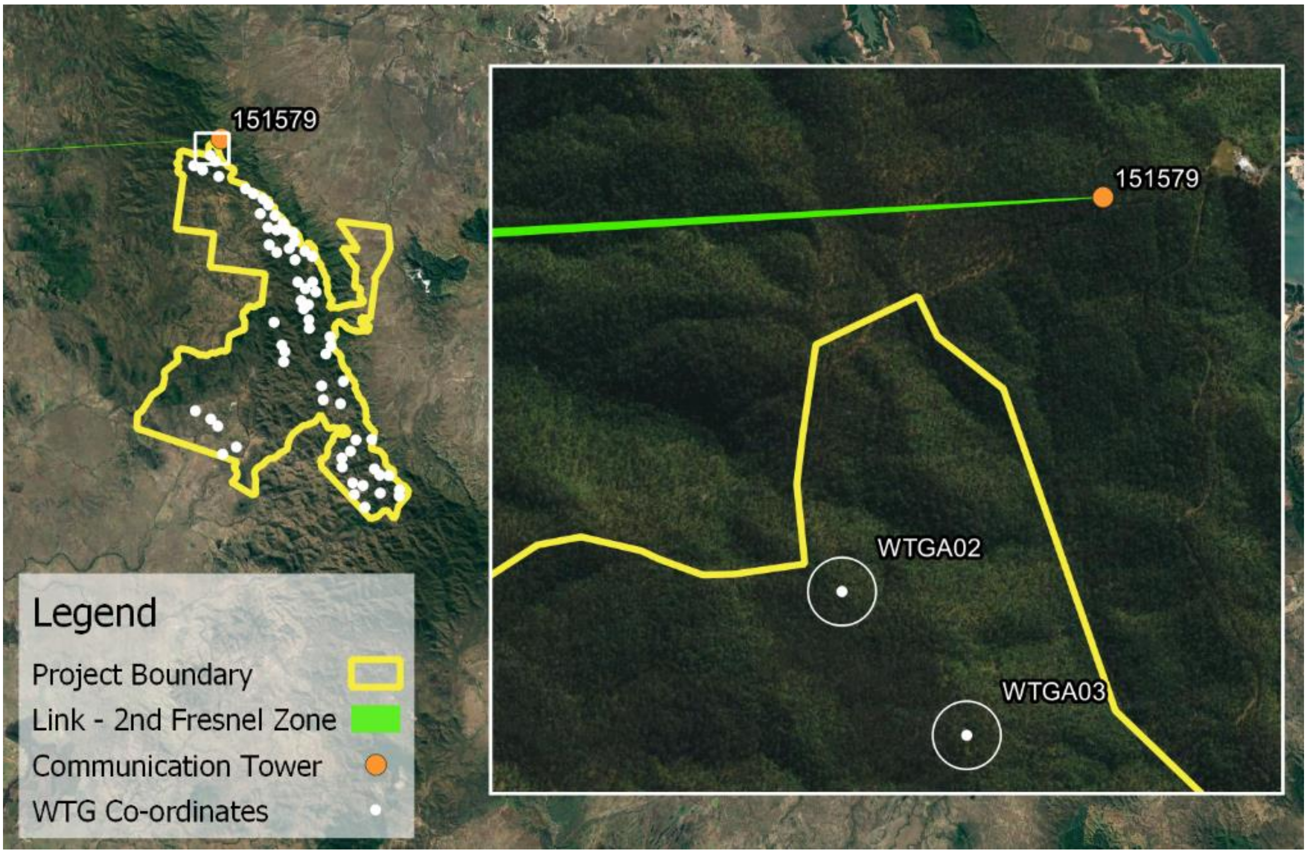

Figure 3.20 Point to point Link 17, calculated 2nd Fresnel zone

It was observed that no WTGs are currently positioned as such to encroach on the 2nd Fresnel zone of Link 17, with the closest WTG being WTGA02. The blade tip of WTGA02 is approximately 890 m south of the 2nd Fresnel zone.

It should be noted that Link 17 was not included in the previous assessment. As such, WSP has not contacted the relevant Licensee yet. However, it is recommended that the licensee is contacted to ensure there are not adverse effects on the communication link.

3.3 POINT-TO-MULTIPOINT LICENCES

Point-to-multipoint links are similarly susceptible to the types of impacts discussed in Sections 3.1.1 and 3.2. There may be point-to-multipoint services with fixed receivers that can be impacted. Any registered services will be present and accounted for in the ACMA database referred to in this assessment [3].

Table 3.20 details the point-to-multipoint services within 30 km of the MHWF project boundary according to the RADCOM database.

Table 3.20 Point-to-multipoint licences within 30 km of the MHWF project

LICENCEE	SITE	SITE ID	FREQUENCY [MHZ]	DISTANCE TO MHWF [km]
Rockhampton Regional Council	Water Treatment Plant Jeannie St MOUNT MORGAN	9010814	472.1250	15.0
Ergon Energy Corporation Limited	QR Site RAGLAN	17127	452.3438, 461.8438	19.4
Aurizon Network Pty Ltd	QR Intermediate Site CALLIOPE RANGE	460377	471.7000	23.4
Telstra Corporation Limited	Telstra Radio Terminal GAYFIELDS	16504	506.7000, 516.7000	24.3

No point-to-multipoint (P2MP) licences were observed to intersect the site boundary. According to the ACMA database [3], the closest P2MP is Site ID 9010814 (Water Treatment Plant Jeannie St) located approximately 15 km away. WSP's previous consultation process only considered organisations within 10 km of the MHWF project. The P2MP links in Table 3.20 were deemed low-risk due to the significant distance from the MHWF site boundary, and therefore these licensees were not further contacted by WSP.

3.4 POINT-TO-AREA AND BROADCASTING LICENCES

Point-to-area services were identified within 30 km of the MHWF project. Table 3.21 lists each licence type and the corresponding number of licences within 30 km of the MHWF project.

Table 3.21 Details of other licences identified within 30 km of the MHWF project

LICENCE TYPE	LICENCE CATEGORY	NUMBER OF LICENCES	MINIMUM DISTANCE TO MHWF [km]
Aeronautical	Aeronautical Assigned System	10	16.8
Amateur	Amateur Repeater	2	19.3
Broadcasting	Commercial Television	3	0.9
	Narrowcasting Service (LPON)	5	13.8
	National Broadcasting	6	0.9
	Retransmission	5	14.9
	Narrowband Area Service stations	1	17.4
Land Mobile	Land Mobile System - > 30MHz	198	0.7
	Land Mobile System 0-30MHz	56	15.5
	Paging System - Exterior	1	14.7
	CBRS Repeater	2	16.8
PTS	PMTS Class B	18	0.9
PTS 900 MHz	PMTS Class B (935-960 MHz)	14	0.9
Radiodetermination	Radiodetermination	10	13.8
Spectrum	1800 MHz Band	20	17.7
	2 GHz	32	17.7
	2.3 GHz Band	560	18.3
	2.5 GHz Band	6	18.4
	3.4 GHz Band	46	17.7
	700 MHz Band	66	0.8
	800 MHz Band	48	0.8
	AWL – FSS Only	15	14.3

In the previous assessment, WSP contacted any organisations with operation licences within 10 km of the MHWF project for comment on potential EMI impacts to their services as a result of the proposed development and operation of the MHWF project. As previously mentioned, WSP have not conducted any further consultation as part of this update, as per the agreement with WSP and the Client. A summary of contacted licensees is shown in Appendix A.

3.4.1 AM AND FM BROADCASTING

The impact on AM and FM radio broadcasting reception is considered to be negligible beyond the boundary of the wind farm. In general, there are no known effects on AM/FM services caused by the wind farm as the wavelengths of these services are relatively large compared to the size of the WTGs.

It is noted that AM signals can propagate around WTGs and as such, WSP does not expect that the MHWF development and operation will adversely impact the AM radio services in the area. FM signals, however, are more susceptible to interference from nearby obstacles, such as WTGs. However, this can only occur when the receiver is in close proximity to the obstacle.

As part of the consultation process in the previous assessment, WSP contacted the Australian Broadcasting Corporation (ABC) seeking feedback regarding any potential EMI impacts on their services arising from the development and operation of MHWF. WSP did not receive a response.

3.4.2 RADIO FREQUENCY NATIONAL SITE ARCHIVE

State code 23 for QLD recommends reviewing the Australian mobile telecommunication association's Radio Frequency National Site Archive (RFNSA) database [22]. WSP notes that there are four (4) Australian Mobile Network base stations in the vicinity of MHWF. Telstra is listed as the contact manager for towers 4714003, 4714005 and 4699003. Tower 4699001 lists Telstra, Optus and Vodafone as contacts.

In the previous assessment, WSP contacted Telstra, Optus and Vodafone. No feedback was received by Telstra or Vodafone but Optus stated that; *"while there may be some impacts on Optus network and services in the area, the impacts is not expected to be unacceptable. Hence, Optus does not have any objection to the proposed Mt Hopeful Wind Farm located near Rockhampton, QLD."* [20]

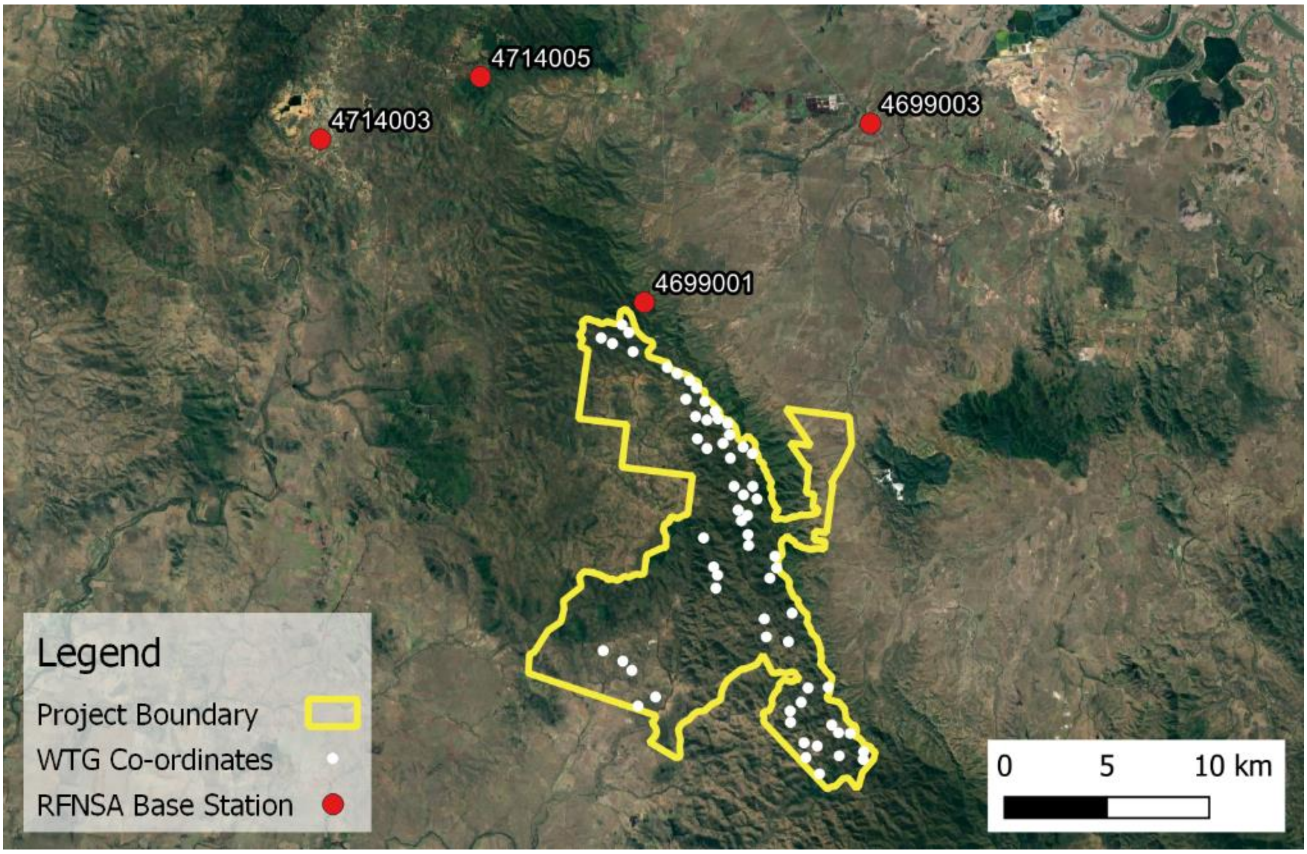

Figure 3.21 Australian Mobile Network base station location with respect to MHWF

3.4.3 DIGITAL RADIO

Based on the Digital Radio Plus's coverage estimator [23], WSP notes that DAB+ digital radio services are currently unavailable in the MHWF area. As such, due to the inexistence of digital radio within the area, MHWF will have negligible impact on digital radio services.

3.4.4 MOBILE RADIO

Mobile radio may be affected by the shadowing effects of MHWF. However, if this is the case, any problems can usually be rectified through a minor adjustment in the position of the receiver.

3.4.5 MOBILE RECEPTION

Mobile reception can be affected by the development and operation of the MHWF project, depending on the level of coverage surrounding the site. WSP has assessed existing mobile coverage from three (3) common service providers in proximity to the MHWF project, including Telstra, Optus and Vodafone.

3.4.5.1 TELSTRA

The mobile reception coverage map for Telstra in the area surrounding the MHWF project is shown in Figure 3.22 for 4G mobile coverage.

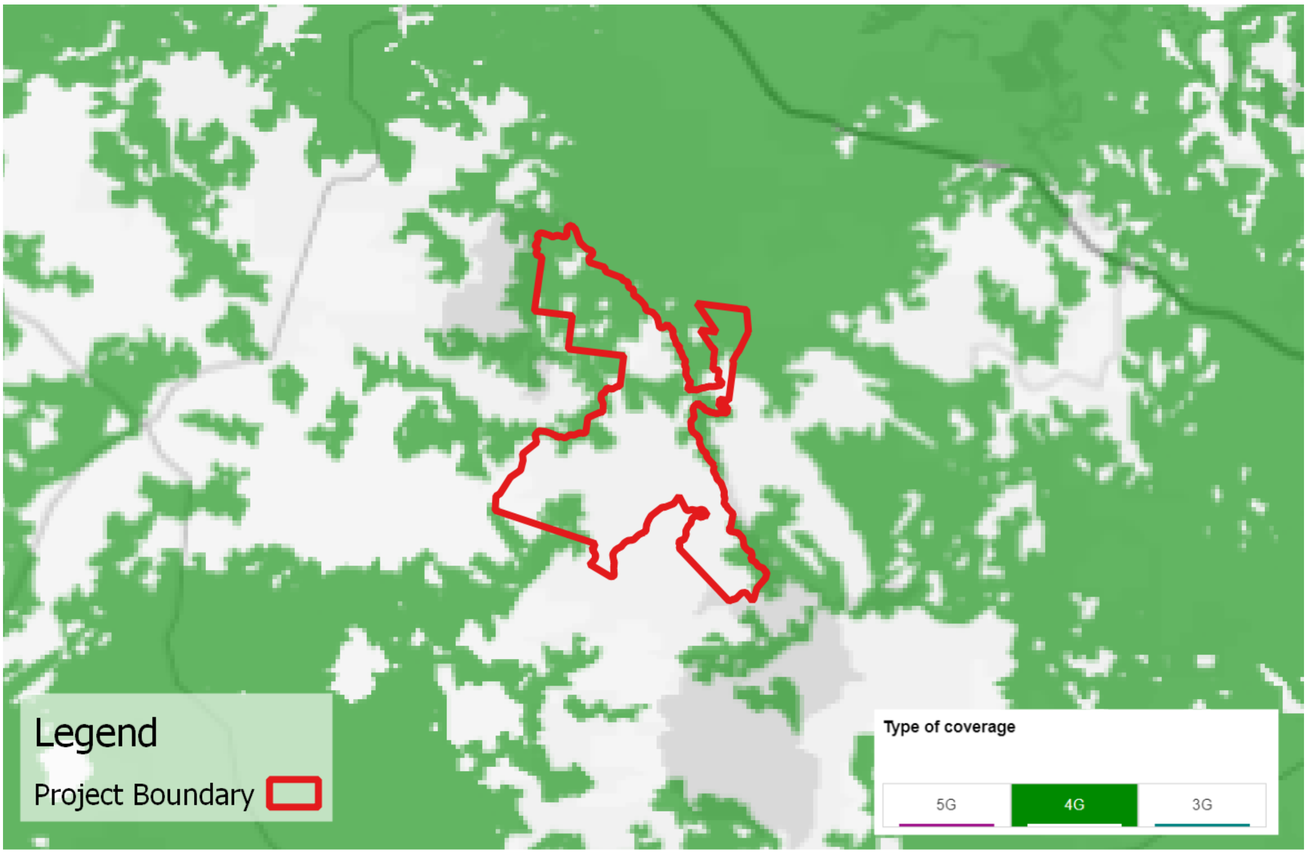

Figure 3.22 Telstra 4G coverage map and the MHWF project site boundary [12]

The strength of Telstra mobile phone reception varies around the MHWF project, with most of the site having little to no coverage. 5G network coverage is currently unavailable for the area. In the previous assessment, WSP contacted the relevant licensees and did not receive any feedback by the end of the consultation period.

3.4.5.2 OPTUS

The mobile reception coverage map for Optus mobile services in the area around the MHWF project is shown in Figure 3.23.

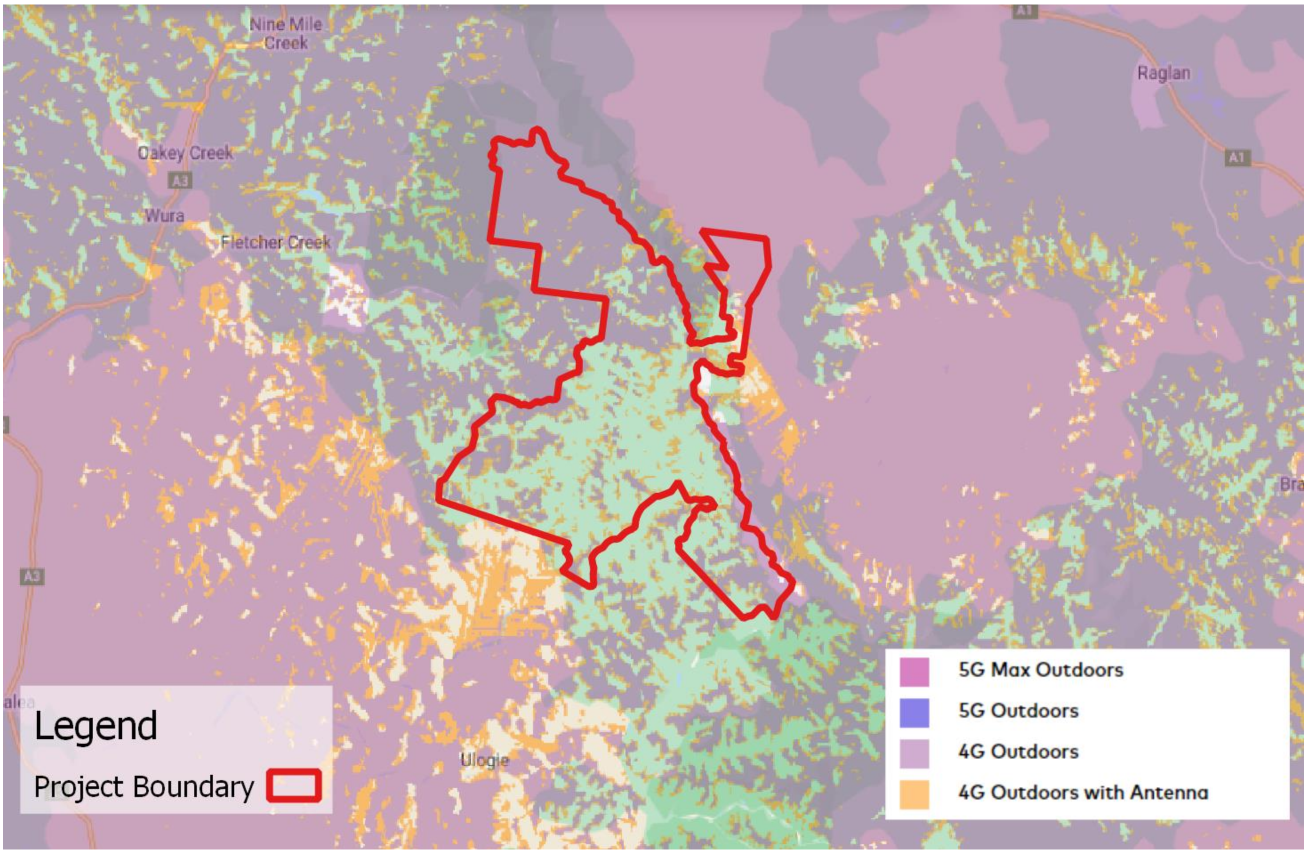

Figure 3.23 Optus network coverage map and the MHWF project site boundary [13]

The strength of Optus mobile phone reception varies around the MHWF project. In areas of currently marginal coverage, it is possible that MHWF will impact the mobile reception for Optus customers. In the previous assessment, WSP has contacted Optus Mobile Pty Limited (Optus) seeking feedback on the potential EMI impact of MHWF on their operations and services. Optus stated that; *"while there may be some impacts on Optus network and services in the area, the impacts is not expected to be unacceptable. Hence, Optus does not have any objection to the proposed Mt Hopeful Wind Farm located near Rockhampton, QLD."* [20]

3.4.5.3 VODAFONE

The mobile reception coverage map for Vodafone in the area around the MHWF project is shown in Figure 3.24.

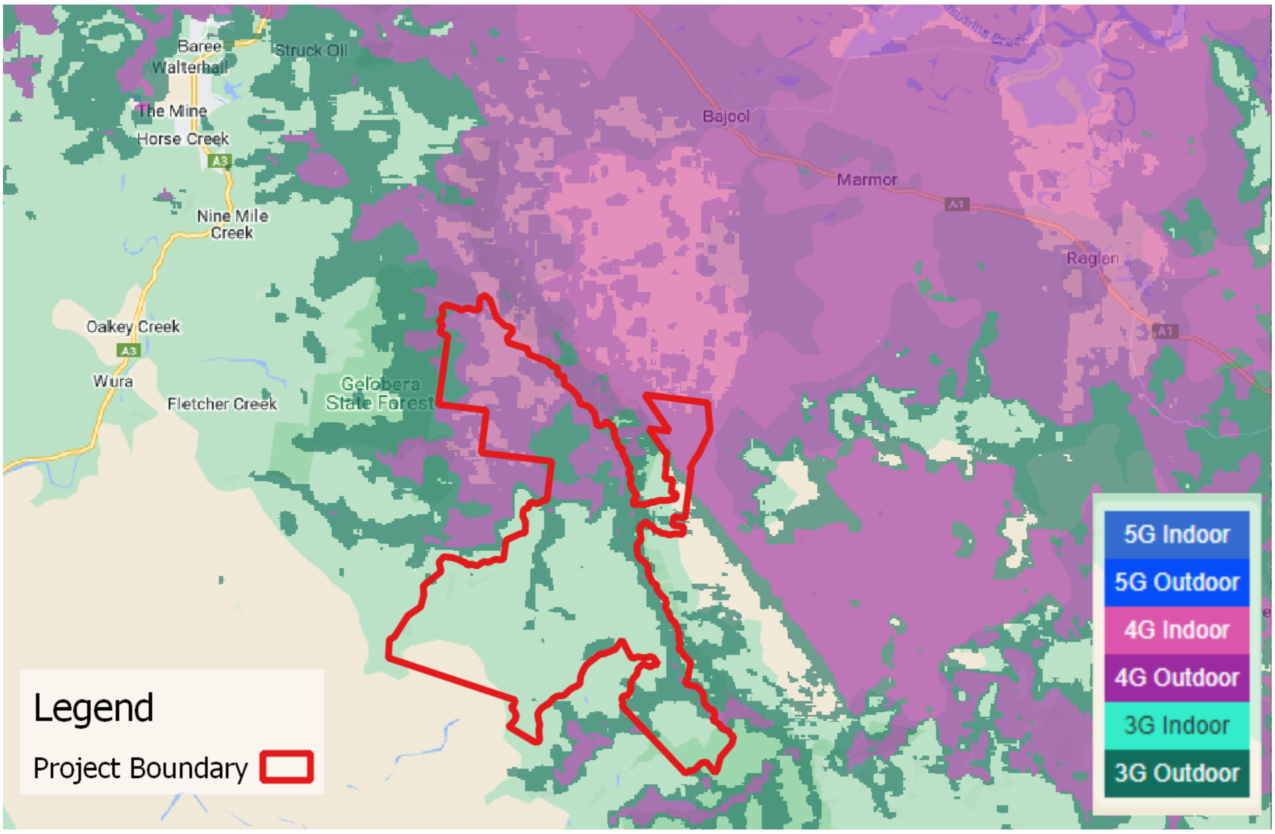

Figure 3.24 Vodafone network coverage map and the MHWF project site boundary [14]

The strength of Vodafone mobile phone reception is limited around the MHWF project, with much of the site not receiving mobile coverage or very limited 3G coverage outdoors. Due to the marginal network coverage from Vodafone in the area, it is unlikely that residents rely on Vodafone for mobile phone services.

WSP has assessed the existing mobile reception in the vicinity of the MHWF project from Vodafone mobile provider. It is observed, based on current coverage, mobile reception is either marginal, or inexistent within and surrounding the MHWF project site. WSP contacted the relevant licensee and did not receive any feedback by the end of the consultation period.

3.4.6 TELEVISION RECEPTION

Analog TV signals are known to be affected by interference from WTGs. Analog TV was gradually phased out in Australia since 2010 and completed nation-wide in 2013. At present, digital TV signals are available across the country and are usually less prone to interference, if the signal is strong enough initially. A search of the digital TV broadcast stations was conducted in proximity of MHWF [11]. Based on the mySwitch website, the coverage within and surrounding the MHWF site, TV reception ranges from good to variable as shown in Figure 3.25.

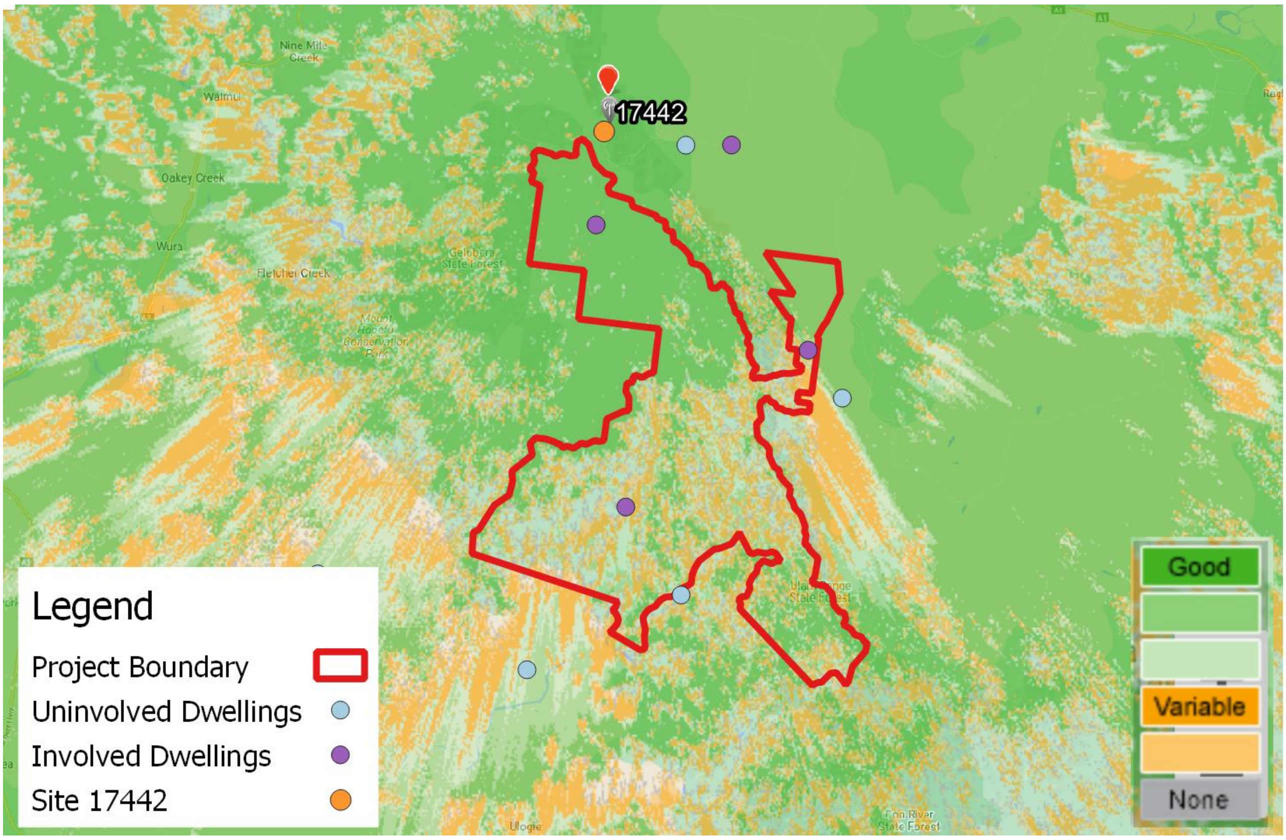

Figure 3.25 Television reception in the proximity of MHWF

There are nine (9) dwellings identified by Neoen in proximity to the MHWF project area [24]. If a WTGs obstructs the line of sight of nearby broadcast stations, residences may experience interference to their existing TV coverage. Residences that are currently experiencing marginal TV coverage, may further experience interference to their TV services due to MHWF.

Should this be the case, there are a number of mitigation measures that can be put in place, as discussed in Section 4.3. According to the mySwitch website [11], the closest broadcasting tower to MHWF is Site 17422, approximately 1 km north east of the site.

As existing TV coverage is considered variable, WSP recommends that a ground survey of TV signal strength is undertaken with the residents surrounding MHWF prior to the construction of the wind farm to confirm the current status of TV signal strength.

In the previous assessment, WSP sought feedback from TV broadcasting licensees identified within 10 km of MHWF as part of the consultation process. Contacted licensees included the Australian Broadcasting Corporation (ABC), the Special Broadcasting Service (SBS), and Prime Television. WSP did not receive any feedback by the end of the consultation period.

3.4.7 INTERNET SERVICES

Organisations operating point-to-area licences within 30 km of the MHWF project were identified in Section 3.4.

Table 3.22 shows the registered Internet Service Providers (ISPs) and telecommunication providers operating within 30 km of the MHWF project.

Table 3.22 Internet service and telecommunications providers holding licences within 30 km of the MHWF project

LICENCEE
Optus Mobile Pty Limited
Telstra Corporation Limited
Vodafone Australia Pty Limited

WSP had previously contacted the licensees in

Table 3.22 that were identified to be within 10 km to comment on any potential impacts to their services as a result of the development and operation of the MHWF project. WSP contacted Telstra, Vodafone and Optus as part of the consultation process and did not receive a response from Telstra and Vodafone but Optus stated that; *"while there may be some impacts on Optus network and services in the area, the impacts is not expected to be unacceptable. Hence, Optus does not have any objection to the proposed Mt Hopeful Wind Farm located near Rockhampton, QLD."* [20]

WSP notes that there are a number of ISPs who are also NBN providers but may not be captured within the ACMA database. WSP recommends that a ground survey is undertaken to identify any other potential ISP providing NBN services at the MHWF project.

3.5 RADAR AND METEOROLOGICAL SERVICES

Radar transmits a signal which is reflected back to the transmitting station (some systems involve communication between a radar station and a transponder). Services that utilise radar technology include aircraft detection and weather services. As per the Draft National Wind Farm Development Guidelines [5], WSP has performed a qualitative assessment to identify radar services within 250 nautical miles of MHWF.

3.5.1 METEOROLOGICAL SERVICES

A search of automatic weather stations (AWS) surrounding the proposed MHWF was conducted using the Australian Bureau of Meteorology (BoM) 'Climate Data Online' database [10]. No weather stations were found within 30 km of the site. The closest AWS was found to be Rockhampton Aero (Station Number 039083) located approximately 39 km from MHWF.

Based on the BoM website [10], five (5) meteorological radars have been identified within 250 nautical miles (approximately 460 km) of MHWF shown in Table 3.23. The closest radar station was observed to be Gladstone located approximately 65 km from MHWF.

Table 3.23 BoM radar stations within 250 nautical miles of MHWF

BOM RADAR SITE	LATITUDE [°]	LONGITUDE [°]	RADAR CATEGORY	APPROXIMATE DISTANCE FROM MHWF [KM]
Gladstone	**-23.86**	**151.26**	**WSR74 S-Band**	**65**
Taroom	-23.70	149.90	Meteor 1700 S-band Doppler	205
Emerald (Central Highlands)	-23.55	148.24	DWSR 8502S 2° S-band	230
Gympie (Mt Kanigan)	-25.96	152.58	DWSR 8502S 2° S-band	300
Mackay (Mt Basset)	-21.12	149.22	TVDR2500C	320

In the previous analysis, WSP contacted the BoM to seek feedback on any potential EMI impacts on their services. The BoM replied and stated that *"Our analysis shows that the proposed wind farm in Mt Hopeful will affect our radar at Gladstone."* The BoM provided several mitigation options to lower the impact of MHWF. As a result WSP understands that Neoen and the BoM are negotiating the exact terms of the operational limits for MHWF to ensure that the Gladstone radar can maintain operational efficiency. [25]

3.5.2 AVIATION

Neoen has informed WSP that an independent Aviation Impact Assessment has been completed for MHWF [26]. Figure 3.26 shows the airports in the vicinity of MHWF.

Figure 3.26 Airports in the vicinity of MHWF

In the previous assessment, WSP contacted both Airservices Australia and the Department of Defence to seek feedback on any impact to their services and operations. WSP received a response from Airservices Australia but not the Department of Defence. Airservies Australia stated *"…the wind farm will affect the 25NM MSA and the RNAV-Z (GNSS) RWY 33 instrument procedures at Rockhampton aerodrome…The wind farm will affect the Rockhampton RTCC" however "this proposal will not adversely impact the performance of any Airservices Precision/Non-Precision Nav Aids, Anemometers, HF/VHF/UHF Comms, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links."* [21]

3.6 EMERGENCY SERVICES

Using the ACMA RADCOM database, a search was conducted of radiocommunication sites within 30 km of MHWF operated by emergency service providers. Table 3.24 shows the identified emergency service providers.

Table 3.24 Emergency Services operating within 30 km of MHWF

LICENCEE	NO OF ASSIGNMENT IDS
Department of Community Safety (Queensland Fire and Rescue Service)	70
Department of Health (Queensland Ambulance Service)	20
Queensland Fire and Emergency Services	71
Queensland Police Service	32

In the previous assessment, WSP contacted the above licensees seeking feedback on the potential EMI impact of MHWF on their operations and services. The Public Safety Agencies (PSAs) comprising of Queensland Police, Fire and Ambulance responded and stated that *"the link paths and radio sites at Banana Range and My Spencer are not obstructed and the wind farm location should not have any impact on nearby PSA radio communication facility services."* [16] [17]

4 MANAGEMENT AND MITIGATION

Generally, mitigation of radiocommunication impacts involves manipulation of the WTG layout so that impacts are acceptably controlled. However, the wind farm proponent's consideration may make other options feasible (providing there is agreement amongst the relevant parties). The Draft National Wind Farm Development Guidelines [5] provides the following hierarchy of mitigation options (in order of most preferable to least preferable):

1. Re-location / removal of WTGs
2. Replacement of existing radio communications service equipment with another less affected type (e.g. replace UHF link with microwave link)
3. Re-location of radio communications services to another existing radio communications site
4. Re-location of radio communications services to a new telecommunications site
5. Substitute radio communication for underground or overhead optical fibre
6. Enhance radar filters

WSP notes that the Draft National Wind Farm Development Guidelines [5] (as well as State Code 23: Wind farm development [7]) includes designing wind turbines to minimise their Radar Cross Section (RCS) as a mitigation strategy for reflection/scattering. As mentioned previously in Sections 2.1.1 and 2.5 , reflection/scattering impacts were not considered within the scope of this assessment. However as part of the Near Field Impact assessment, as per State Code 23, a recommended minimum distance of 1 km radio tower exclusion zones from WTGs has been used as a precautionary measure for any reflection and scattering impacts, and it is found that no proposed WTGs are within 1 km of a communications tower.

It is recommended that the exclusion distances, which are established and applied to the final layout, be respected during construction, maintenance and decommissioning. These exclusion zones should be agreed upon by the licence holders and the wind farm proponent. Crane booms and the raising and lowering of WTG parts may also cause interference. It is recommended that subsequent lifting management plans for these activities include these considerations.

4.1 RECOMMENDATIONS AND MITIGATION FOR NEAR FIELD INTERFERENCE

For the registered assignments identified within 10 km of the MHWF project, WSP had previously contacted the licensees identified seeking feedback regarding potential EMI impacts on their services and operations. The consultation process had spanned over a 4-month period and no licencee has indicated a potential issue with the proposed the MHWF project layout on near field effects.

However, should licensees deem MHWF to cause potential EMI impacts, the first mitigation technique to be considered should be to microsite or relocate WTGs to locations outside of the near field exclusion zones. The specific requirements of near field zones should be discussed with the affected licensees to minimise disruption to the WTG layout and to avoid radio interference.

In the event that relocation of WTGs is not possible or preferable, it may be possible to modify or upgrade affected services to new apparatus or frequencies with smaller near field zones. If this mitigation technique is not possible, the next option will be to re-locate and/or re-direct services to alternative existing sites.

Further mitigation techniques (including commission of new radio towers and fibre optic cabling) are possible beyond the options discussed; however significant cost may be incurred if these options are undertaken.

4.2 RECOMMENDATIONS AND MITIGATION FOR POINT-TO-POINT LINK INTERFERENCE

For the registered point-to-point links identified in the vicinity of the proposed WTGs, WSP had previously contacted the identified licensees to seek feedback regarding potential EMI impacts on their services and operations arising from the development and operation of MHWF. WSP note that no WTG locations currently encroach the identified links, assuming a rotor diameter of 180 m. If this diameter were to increase, then there is a chance one of the WTGs may encroach on a point-to-point link. A summary of consultation responses can be found in Appendix A.

Assuming that each of the links (and corresponding assignments) are currently active and the locations given by the ACMA and organisations are accurate, the first mitigation technique to be considered is to ensure WTG locations, including their blades and towers, do not intrude on the 2nd Fresnel exclusion zone.

However, in the event that relocation of WTGs is required but not possible or preferable, it may be possible to modify or upgrade affected services to new apparatus or frequencies with narrower 2nd Fresnel exclusion zones. If this mitigation technique cannot be performed, then the next option will be to re-locate and/or re-direct services to alternative existing sites.

Further mitigation techniques (including commissioning of new radio towers and fibre optic cabling) are possible beyond the options discussed, however, significant cost may be incurred if these options are undertaken.

4.3 RECOMMENDATIONS AND MITIGATION FOR BROADCASTING SERVICES

TV broadcast services across Australia are now digital broadcast. Digital TV signals are usually less prone to interference from WTGs. However, in areas where the digital TV signals are considered marginal, it is possible that TV signals can be subject to some interference from nearby obstacles, like WTGs.

For such instances, a number of mitigation options are available, such as:

1. Retuning the antenna to another tower, not within the line of sight of the WTGs
2. The use of a higher gain antenna
3. Moving the existing antenna to a less affected position
4. Installation of satellite TV at the affected residence, such as Viewer Access Satellite Television (VAST) [27].

WSP notes that a large portion of the site is subject to varying levels of TV coverage and as such, recommends that a ground survey of TV signal strength is undertaken with the residences surrounding the MHWF project prior to the construction of the wind farm.

5 ELECTROMAGNETIC COMPATIBILITY OF WTGS

A wind farm typically comprises of complex electrical systems which will emit various levels of electromagnetic emissions while in operation. This section briefly details the main components known to emit electromagnetic emissions and describes a qualitative review undertaken by WSP on expected levels of electromagnetic emissions from wind farms.

5.1 WIND TURBINE GENERATORS

Most electrical components in a WTG are located in the nacelle. The generator, converter and transformer are typically located at the top of the WTG, at approximately 100 m or greater, AGL.

All components associated with the generation and/or distribution of electricity will emit electromagnetic fields (EMFs). The strength of the EMFs is proportional to the voltage of the electrical system. Electromagnetic Compatibility (EMC) relates to the ability of an electrical system to operate in the vicinity of other systems with no impact.

In the case of a WTG, generator windings will typically emit EMFs. The windings are located in close proximity and the EMFs emitted will cancel out each other. Additionally, the windings are enclosed in a metal housing which will provide shielding to the EMFs.

Due to adverse impacts of EMFs, the levels of EMF emitted by a WTG are typically regulated by legislative requirements. The Radiocommunications (Electromagnetic Compatibility) Standard 2017 [28] dictates the EMC criteria required for any device manufactured or imported into Australia. The Standard details the requirements pertaining to interference to radiocommunications and has been developed based on a number of Industry Standards including the Industry Electrotechnical Commission (IEC) and the European Committee for Electrotechnical Standardisation.

WTGs are typically designed to satisfy the requirements of several Standards including the IEC 61400-1 “Electromagnetic Compatibility (EMC) - Part6-1: Generic Standards - Immunity for residential, commercial and light-industrial environments” as well as the EU Electromagnetic Compatibility Legislation [29]. The EU legislation ensures that all electrical components do not adversely impact nearby electrical systems [30].

As such, WSP notes that the levels of EMF emitted by any WTG imported into Australia will most likely be within the allowable limits and pose minimal risk to the general public.

5.2 COLLECTOR SYSTEM AND SUBSTATION

The electrical collector network (reticulation network) of a wind farm typically comprises of underground cables which are used to transport electricity from the WTGs to the wind farm substation. These cables are generally shielded/screened, the individual phases bundled together and typically buried at a depth of 800 mm below ground. Due to this, the EMF levels are negligible. In some instances, the cables can be installed overhead instead of underground. It is expected that these overhead cables are still shielded/screened, and ground clearances are maintained according to Australian Standard requirements. Therefore, EMF levels are still expected to be minimal for overhead cables also. As a mitigation measure however, WSP suggests that any overhead sections are constructed away from metallic fences or underground pipes.

The transformer and reactor (if any) located in the substation are other potential sources of EMF. However, this equipment will be enclosed, shielded and typically located well inside a substation. Also, protective fencing is generally installed, meaning that general public exposure to any potential EMF from a substation is negligible.

In addition to the above commentary, WSP would expect that the design of the wind farm should ensure compliance with the EMF exposure limits/requirements specified in the Energy Network Association (ENA) EMF Management Handbook and AS 2067 (Substations and high voltage installations exceeding 1 kV a.c.).

6 CONCLUSIONS

Following the assessment, WSP makes the following observations, recommendations and conclusions;

1. This report is an update on a previous assessment [1] that was issued in June 2021. The update considers the new WTG layout consisting of 63 turbines [4]. The RADCOM ACMA database has been re-accessed on the 25 January 2023 [3], and the distances of communications towers have now been calculated from the proposed MHWF site boundary (rather than a set point within the boundary).
2. WSP has not engaged in any further consultation since the previous assessment.
3. WSP has used the recommendations in 'Fixed-link wind-turbine exclusion zone method' [6] to determine the exclusion zones associated with fixed point-to-point links in the vicinity of the MHWF project.
4. As a result of this EMI assessment, WSP makes the following conclusions and recommendations
   - WTGA02 and WTGA03 were found to be within 2 km of six (6) communication towers to the north of the Project. As a conservative approach WSP generally recommends a 2 km buffer to avoid near-field effects, however State Code 23 recommends a 1 km buffer in respect to near-field effects [7]. None of the proposed WTG locations at MHWF are within 1 km of a communication tower.
   - 17 existing point-to-point links are in the vicinity of the MHWF project boundary. No WTGs are observed to encroach links. This is however based on the assumption that the WTG rotor diameters are fixed at 180 m. If the rotor diameter lengths do become larger, it is recommended an update of this assessment is conducted to ensure no WTG blades are encroaching onto the 2nd Fresnel zones.
   - According to the ACMA database [3], no point-to-multipoint licences were observed within 10 km of the site boundary. The closest P2MP site was found to be at least 15 km from MHWF.
   - Existing mobile reception is observed to be marginal within and surrounding the MHWF project site. In the previous assessment WSP contacted the relevant mobile providers to assess the impact of MHWF on their operations and services. Of the three (3) providers contacted, only Optus Mobile provided a response. No response was received from Telstra nor Vodafone.
   - Existing TV coverage is considered marginal. WSP recommends that a ground survey of TV signal strength is undertaken with the residents surrounding MHWF prior to the construction of the wind farm to confirm the current status of TV signal strength.
   - Radar and meteorological services include but not limited to aviation, weather and defence services. WSP contacted all relevant parties in the previous consultation process and have received feedback from BoM and Airservices Australia.
   - Emergency service providers were contacted as part of the consultation process in the previous assessment and WSP received feedback indicating that MHWF will not affect their services.
   - Details of the consultation process undertaken by WSP in the previous assessment can be found in Appendix A.

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APPENDIX A

CONSULTATION PROCESS

A1 SUMMARY OF LICENCEES

Table A.1 Contacted licensees within 10 km of the MHWF project

LICENCEE	TYPE OF LICENCE	COMMUNICATION	RESPONSE	RESPONSE SUMMARY
Air Services Australia	Radar	Email sent on 01/03/2021 Follow up email on 22/04/2021	Response received 30/03/2021	*"...the wind farm will affect the 25NM MSA and the RNAV-Z (GNSS) RWY 33 instrument procedures at Rockhampton aerodrome...The wind farm will affect the Rockhampton RTCC."*
Australian Broadcasting Corporation	TV and Radio Reception	Email sent on 03/03/2021 Follow up email on 22/04/2021	No response received	-
Aurizon Network Pty Ltd	Point to Multipoint	Email sent on 22/02/2021	Response received 23/03/2021	*"Aurizon Network do not foresee any issues or impacts to our services."*
Bureau of Meteorology (BoM)	Radar	Email sent on 22/02/2021 Follow up email on 22/04/2021	Response received 28/04/2021	*"Our analysis shows that the proposed wind farm in Mt Hopeful will affect our radar at Gladstone."*
Department of Defence	Radar	Email sent on 03/03/2021 Follow up email on 22/04/2021	No response received	-
Department of Health (Queensland Ambulance Service)	Point to Point, Emergency Service	Email sent on 22/02/2021	Response received from the PSBA 25/03/2021	No obstruction or impact to services.
Department of Transport and Main Roads	Point to Point	Email sent on 22/02/2021	No response received	-

LICENCEE	TYPE OF LICENCE	COMMUNICATION	RESPONSE	RESPONSE SUMMARY
Digital Distribution Australia Pty Ltd	Point to Point	Email sent on 22/02/2021 Follow up email on 22/04/2021	Response received 27/04/2021	*"In summary, the proposed windfarm and turbine locations do not appear to have any impacts on the existing DDA infrastructure and point to point links currently in operation."*
Ergon Corporation Limited	Point to Point, Point to Multipoint	Email sent on 22/02/2021	Response received 1/03/2021	No Impact identified with the currently proposed turbine locations.
Nixon Communications Pty Ltd	Point to Point	Email sent on 22/02/2021 Follow up email on 22/04/2021	Response received 23/04/2021	*"We assumed no impact due to the frequencies we use at Mt Hopeful and have noted no impact to date."*
Optus Mobile Pty Limited	Point to Point	Email sent on 22/02/2021	Response received 12/03/2021	*"While there may be some impacts on Optus network and services in the area, the impacts is not expected to be unacceptable. Hence, Optus does not have any objection to the proposed Mt Hopeful Wind Farm located near Rockhampton, QLD."*
Queensland Police Service	Point to Point, Emergency Service	Email sent on 22/02/2021	Response received from the PSBA 25/03/2021	No obstruction or impact to services.
Queensland Fire and Emergency Services	Point to Point, Emergency Service	Email sent on 22/02/2021	Response received from the PSBA 25/03/2021	No obstruction or impact to services.
Special Broadcasting Service Corporation	TV Reception	Email sent on 22/02/2021 Follow up email on 22/04/2021	No response received	-

LICENCEE	TYPE OF LICENCE	COMMUNICATION	RESPONSE	RESPONSE SUMMARY
Telstra Corporation Limited	Point to Point	Email sent on 22/02/2021 Follow up email on 22/04/2021 and 19/05/2021	No response received	-
Vertical Telecoms Pty Ltd	Point to Point	Email sent on 22/04/2021	No response received	
Vodafone Australia Pty Limited	Mobile Coverage	Email sent on 03/03/2021 Follow up email on 22/04/2021	No response received	-
Win Television NSW Pty Limited	TV Reception	Email sent on 22/02/2021 Follow up email on 22/04/2021	No response received	-

APPENDIX B

WIND FARM DETAILS

B1 WTG LOCATIONS

Table B.1 Proposed WTG locations – (UTM South Zone 56, WGS84)

WTG ID	Easting [m]	Northing [m]
WTG 01	247250	7371525
WTG 02	248260	7371125
WTG 03	249930	7370355
WTG 04	250420	7370050
WTG 05	251030	7369720
WTG 06	251360	7369350
WTG 07	250850	7368800
WTG 08	251770	7368690
WTG 09	252280	7368220
WTG 10	251870	7367780
WTG 11	252890	7367610
WTG 12	251408	7366866
WTG 13	251875	7366390
WTG 14	252990	7367060
WTG 15	253640	7366460
WTG 16	253020	7365920
WTG 17	254100	7366140
WTG 18	253200	7364540
WTG 19	253660	7364120
WTG 20	254320	7363920
WTG 21	253400	7363380
WTG 22	253880	7362180
WTG 23	253910	7361650
WTG 24	251710	7362020
WTG 25	252200	7360600
WTG 26	252390	7360200
WTG 27	252310	7359560
WTG 28	255200	7361120
WTG 29	255280	7360550
WTG 30	254950	7360050
WTG 31	254680	7358060
WTG 32	256040	7358340

WTG ID	Easting [m]	Northing [m]
WTG 33	254780	7357180
WTG 34	255860	7356940
WTG 35	246800	7356500
WTG 36	247760	7355990
WTG 37	248200	7355540
WTG 38	249360	7354240
WTG 39	248500	7353800
WTG 40	256820	7354680
WTG 41	257810	7354720
WTG 42	256480	7353980
WTG 43	255940	7353550
WTG 44	255960	7353000
WTG 45	256620	7352000
WTG 46	257270	7351840
WTG 47	256720	7351280
WTG 48	257380	7350480
WTG 49	257980	7352870
WTG 50	258310	7352490
WTG 51	258880	7352460
WTG 52	259540	7351560
WTG 53	259520	7351180
WTG 54	258340	7351360
WTGA01	246700	7371800
WTGA02	247720	7372440
WTGA03	248050	7372060
WTGA04	251320	7367950
WTGA05	252420	7367840
WTGA07	252660	7366640
WTGA08	254120	7364540
WTGA09	253860	7363120
WTGA10	253560	7362860

APPENDIX E

Flora Impact Assessment

umwelt
Environmental & Social Consultants

NEOEN

TERRESTRIAL FLORA ASSESSMENT

Mount Hopeful Wind Farm

FINAL

May 2023

TERRESTRIAL FLORA ASSESSMENT

Mount Hopeful Wind Farm

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

Report No.	7053/R03
Date:	March 2023

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) has prepared this terrestrial flora and vegetation assessment report on behalf of Neoen Australia Pty Ltd (Neoen) in support of a Development Application (DA) for the proposed Mount Hopeful Wind Farm (the Project).

The Project will involve the construction and operation of up to 63 wind turbine generators and ancillary wind farm infrastructure, located approximately 45 kilometres (km) south of Rockhampton and 65 km west of Gladstone within the Central Queensland Region (**Figure 1.1**). The Project is expected to have a maximum generation capacity of approximately 400 megawatts (MW) and will supply energy to the future Queensland Renewable Energy Zone (QREZ).

Subject to conditions, the Project was granted approval by the Queensland State Assessment and Referral Agency (SARA) on 17 June 2022 (SARA Reference 2109-24892 SDA). However, the Project scope and design underwent further refinement in late 2022. This report, which was originally submitted as part of the DA, has been updated to reflect the latest Project design current as of 2023.

The Project is also currently in the process of attaining approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Project was referred to the Commonwealth in 2021 (EPBC Reference 2021/9137) and deemed a controlled action. It is undergoing further assessment via Preliminary Documentation.

1.1 Project Areas

Four distinct areas / boundaries are relevant to the Project and this assessment, described in the subsequent sections.

1.1.1 Study Area

The Project is proposed over 17 land parcels and numerous road reserves, which cover an area of 16,758 hectares (ha), collectively referred to as the Study Area (**Figure 1.1**). **Table 1.1** details the lot plan identifiers for land parcels contained within the Study Area. The Study Area occurs across two local government areas: The Banana Shire Council and the Rockhampton Regional Council (**Figure 1.1**).

Table 1.1 Study Area Land Parcels

Lot and Plan		
100 SP289441	2057 RAG4059	24 RN34
148 DS151	21 RN1345	25 RN25
15 RN1089	21 RN46	30 RN72
1933 RAG4058	2345 DT4077	33 DT40123
2039 RAG4056	23 RN25	38 DT40131
2420 DT4077	50 DT40144	-

1.1.2 Ground-truthed Mapping Extent

The Ground-truthed Mapping Extent covers approximately 12,924 ha and represents the limit of the vegetation mapped within the Study Area. Due to the dynamic nature of the Project, some areas surveyed no longer fall within the Study Area boundary, and within the Study Area, not all areas of each land parcel were entirely surveyed. It should be noted that this boundary does not represent the spatial bounds in which all Project field surveys have been conducted (this area being larger and including areas outside of the Study Area).

1.1.3 Development Corridor

The Development Corridor is a 'buffered' version of the indicative Project layout, covering approximately 1,347 ha. This area represents the maximum spatial extent where disturbance may occur within the Study Area and includes areas required for temporary and permanent Project infrastructure, equipment and materials laydown, installation and access.

1.1.4 Disturbance Footprint

The Disturbance Footprint covers approximately 877.5 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure. It is a 'worst-case' scenario in terms of the extent of clearing works. The impact assessment on flora values refers to clearing areas that are based on the Disturbance Footprint. As infrastructure will be micro-sited within the Development Corridor, the final clearing areas are anticipated to be lower than detailed in this assessment (described further in **Section 5.0**).

1.2 Aim and Scope of Works

The aim of the assessment was to identify and characterise the terrestrial flora and vegetation values within the Study Area and undertake an assessment of potential impacts resulting from the Project on those values. The following scope of work has been completed to identify and assess these values:

- Literature and database review of available resources relating to flora and vegetation values within the Study Area.
- Flora and vegetation surveys to confirm the values identified during the literature review and to:
    - further define the presence and diversity of terrestrial flora
    - determine the presence or likely presence of conservation significant flora species and associated habitat
    - describe and map the vegetation communities across the Study Area, ground-truth the State Regional Ecosystem mapping and identify and map the presence of any threatened ecological communities
    - identify the occurrence of introduced flora species.
- Address the requirements of the State Development Assessment Provisions (SDAP) Code 16 and 23.
- Identify any significant residual impacts on terrestrial flora values in the context of relevant legislation.
- Recommend measures to avoid or mitigate potential impacts on terrestrial flora and vegetation values at the design, construction, and operational phases of the Project.

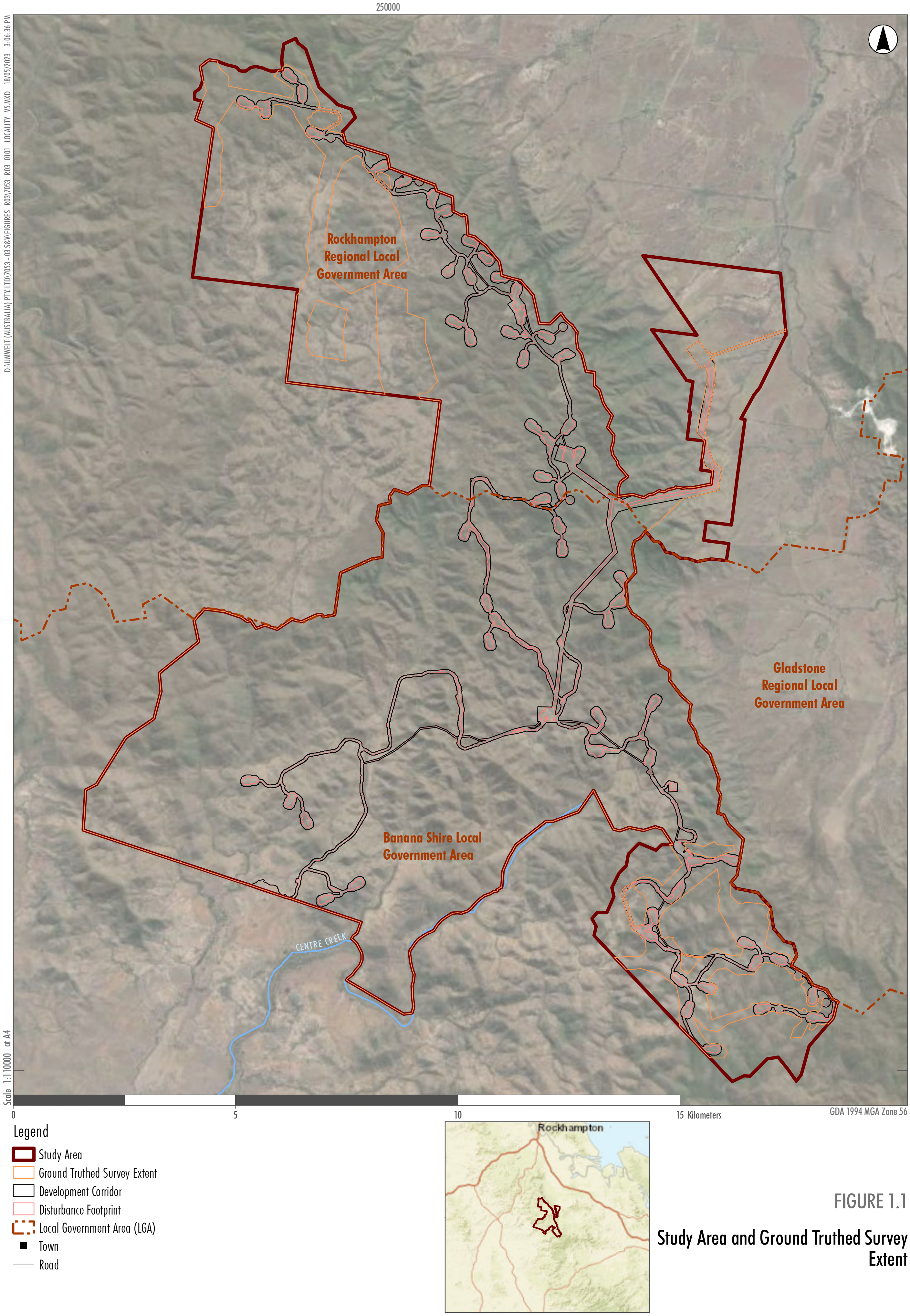


FIGURE 1.1

Study Area and Ground Truthed Survey Extent

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

2.0 Legislation

Table 2.1 Flora Legislation

Relevant Legislation	Governing Agency	Summary	Project Relevance
Commonwealth Legislation			
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Agriculture, Water, and the Environment (DAWE)	The EPBC Act is Australia's key piece of environmental legislation. It outlines nine Matters of National Environmental Significance (MNES). Actions that adversely affect MNES may be deemed to be a controlled action under the EPBC Act.	The following MNES is relevant to the Project: • Threatened Species and Ecological Communities
State Legislation			
Nature Conservation Act 1992 (NC Act)	Department of Environment and Science (DES)	The purpose of the NC Act is to conserve biodiversity by creating and managing protected areas, managing and protecting native wildlife, and managing the spread of non-native wildlife. *Flora survey trigger map* The flora survey trigger map identifies high-risk areas where endangered, vulnerable or near threatened native plants are present or are likely to be present. The map is used to determine requirements to be considered before clearing native plants.	Where a proposed development will result in impacts to flora and or fauna protected under the NC Act, authorisation from the Director General of the DES is required. The following values under the NC Act are relevant to the Project: • Threatened flora species, and • High-risk areas for protected plants.

Relevant Legislation	Governing Agency	Summary	Project Relevance
Vegetation Management Act 1999 (VM Act)	Department of Resources (DoR)	The purpose of the Vegetation Management act is to regulate the clearing of vegetation in a way that conserves Regional Ecosystems (REs), to prevent the loss of biodiversity and maintain ecological processes. REs are vegetation communities in a bioregion that are consistently associated with a combination of geology, landform, and soil (Sattler and Williams, 1999). Under the VM Act, REs are assigned a conservation status based on an assessment of the pre-clearing and remnant extent of each RE.	The Vegetation Management Act will be referred to prior to the development stage to conserve and minimise the impact to remnant and threatened ecosystem. The Project is required to obtain approval under section 22A of the VM Act. The following values under the VM Act are relevant to the Project: • Endangered and Of Concern regional ecosystems. • Remnant vegetation within the defined distance of a watercourse. • Essential Habitat for protected wildlife.
Biosecurity Act 2014	Department of Agriculture and Fisheries	The *Biosecurity Act 2014* lists fauna and flora pest species as either a prohibited or restricted biosecurity matter.	The *Biosecurity Act 2014* defines specific requirements for notification and management actions for all listed biosecurity matters, including specific requirements for the disposal of restricted matters.
Environmental Offsets Act 2014	Department of Environment and Science (DES)	An environmental offset condition may be imposed under certain Queensland legislation that applies to development assessment where the activity is a prescribed activity under the *Environmental Offsets Act 2014.* Activities which have an impact on a Matter of State Environmental Significance (MSES) may require offsetting under the Act.	Consideration of offsetting requirements for the Project will need to be determined once a fixed design for the Project is completed. Requirements will also need to be considered in conjunction with overlapping EPBC Act requirements.
State Development Assessment Provisions	Department of Infrastructure, Local Government and Planning	State code 23 is contained within the State Development Assessment Provisions (SDAP) and applies to a material change of use for a new or expanding wind farm. Development that is a material change of use for a wind farm should demonstrate compliance with 13 performance outcomes (PO) and associated acceptable outcomes within the code.	This Project relates to two matters of interest in SDAP State Code 16 and State Code 23.

3.0 Methods

3.1 Desktop Assessment

Literature and database resources were accessed that related to the flora and vegetation values within the Study Area, with initial reviews conducted in 2019. Subsequent reviews occurred in 2021, 2022 and 2023. These sources included information regarding bioregions, geology, topography, watercourses, connectivity features, vegetation mapping, flora species and conservation significant flora records and habitat. The following key resources were used to prepare this report:

- EPBC Act Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES) (Department of Agriculture Water and the Environment 2022).
- Species Profile and Threats (SPRAT) database for MNES species information (Department of Agriculture Water and the Environment 2023).
- Atlas of Living Australia (ALA) and WildNet database for species records (Australian Government 2021; Queensland Government 2022).
- Queensland Spatial Catalogue (QSpatial) datasets (Queensland Government 2023):
    - Bioregions of Queensland
    - Detailed surface geology of Queensland
    - Vegetation Management Watercourses and Wetlands (Version 6.0 and Version 8.05 respectively)
    - Vegetation Management Regulated Vegetation map (Version 6.05)
    - Vegetation Management Regional Ecosystem map (Version 12.02)
    - Vegetation Management Essential Habitat map (Version 11.05)
    - Matters of State Environmental Significance series
    - Flora Survey Trigger Map for Clearing Protected Plants (Version 9.0).
- Digital imagery (aerial photographs).
- *Methodology for surveying and mapping regional ecosystems and vegetation communities in Queensland* (Version 5.1) (Neldner et al. 2020).
- The Queensland Herbarium Regional Ecosystem Description Database (REDD) for current Regional Ecosystem (RE) descriptions and geological and land zone descriptions.
- *Technical Descriptions of Regional Ecosystems of the Northern Brigalow Belt* (Queensland Herbarium 2018b).

When undertaking the PMST and species database searches, a 10 km search buffer was applied to the Study Area boundary.

The information collected from these sources informed field survey scope and planning, including to determine appropriate survey locations and techniques, as well as the assessment of flora values.

3.2 Field Survey

3.2.1 Timing and Weather Conditions

Field surveys targeting flora values were undertaken across four main survey periods, detailed in **Table 3.1** along with the weather conditions leading up to the surveys. Supplementary floristic data was also collected during an initial site scoping survey between 9–12 June 2019 as well as during fauna surveys undertaken in February, March, and May 2020 (primarily opportunistic observations).

Two additional field surveys were conducted during 2022 relevant to flora. One survey collected BioCondition and habitat quality information to inform Commonwealth offset investigations and the other quantitatively assessed the presence and abundance of *Cycas megacarpa* within the Disturbance Footprint.

Table 3.1 Field Survey Timing and Weather Conditions

Field survey	Survey dates	Survey length (days)	Rainfall in preceding 3 months (mm)*	Temperature (°C) *	
				Min	Max
Flora survey	6-12 August 2019	7	37.3	1.6	26.7
Flora survey	2-7 June 2020	6	144.3	3.9	24.3
Flora survey	7-11 November 2020	5	139.1	14.7	32.4
Flora survey	20-24 January 2021	4	191	18.3	32.5
BioCondition and Habitat Quality Assessment	24 – 28 October 2022	5	37.4	17.1	33.7
Targeted *Cycas megacarpa* Population Survey					

*Data extracted from the DES SILO weather model (Queensland Government, 2021) using the central coordinates of the Study Area (-23.85, 150.55).

3.2.2 Flora and Vegetation

The flora and vegetation surveys were undertaken to identify and record vascular flora species and classify and map vegetation communities. The sampling of flora and vegetation was undertaken using the *Methodology for the Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner et al. 2020). Representative examples of each RE were sampled using twenty 'Secondary' plots and 648 Quaternary plots as defined by Neldner et al. (2020). The locations of the survey plots are shown on **Figure 3.1**. Incidental flora species observed during the survey were also recorded to provide a more comprehensive species list.

Specimens of any plant taxa that could not be identified in the field were collected, pressed and dried in accordance with the requirements of the Queensland Herbarium (Bean 2016). Dried specimens were then identified through reference books and keys and through comparison with named species. Nomenclature used in this report follows that of Brown and Bostock (2019). Introduced species are denoted by an asterisk in the text (*).

3.2.2.1 Threatened Ecological Communities

The field validation of threatened ecological communities (TECs) identified as potentially occurring in the desktop assessment was undertaken via a two-step process. The first step involved the identification of analogous REs. Where an analogous REs was located, the vegetation composition and structure were evaluated against TEC condition thresholds and key diagnostic characteristics to determine if the community meets the TEC requirements. Condition thresholds and key diagnostic criteria used in the assessment reflect those detailed in the TEC's respective Conservation or Listing Advice.

3.2.2.2 Targeted *Cycas megacarpa* Survey

During the initial scoping visit to the Study Area in June 2019, it was discovered that the threatened plant *Cycas megacarpa* was present and abundant in the area. Based on this finding a targeted survey methodology was developed in consultation with the Queensland Herbarium to record and quantify individuals across the Study Area.

The presence and abundance of *Cycas megacarpa* was assessed throughout the flora field survey program detailed in **Table 3.1.** In October 2022, a targeted *Cycas megacarpa* field survey was conducted across the Development Corridor to increase the understanding of presence and abundance in this area. The methodology for the targeted *Cycas megacarpa* assessments included the following methods:

- individual point counts (single individuals were recorded with a GPS unit)
- visual counts within a 25 metre (m) radius (a centre point was marked with a GPS and all individuals within a 25 m radius from that point were recorded)
- visual counts within a 50 x 50 m plot (a centre point was marked with a GPS and all individuals within a 50 x 50 m plot were recorded)
- detailed counts within a 50 x 10 m plot (a 50 x 10 m plot was marked out using a 50 m tape and all individuals within 5 m either side of the tape were recorded).

A plot-based sampling approach was used, with 0.25 ha plots established for actual counts or used to categorise populations as part of visual density estimates. At each of the plot-based sites the age class structure (e.g., development class) was recorded for each individual using the following classification:

- Juvenile (<50 cm)
- Sub-adult (0.5–1 m)
- Adult (>1–5 m)
- Large adult (>5 m).

Using this approach, an actual count of individuals was obtained for each point record.

For all the plot-based sample sites (i.e. 25 m, 50 x 50 m and 50 x 10 m) the age class structure (e.g. development class) was also recorded for each individual using the following classification:

- juvenile (<50 cm)
- sub-adult (0.5–1 m)
- adult (>1–5 m)
- large adult (>5 m).

3.2.3 Survey Limitations

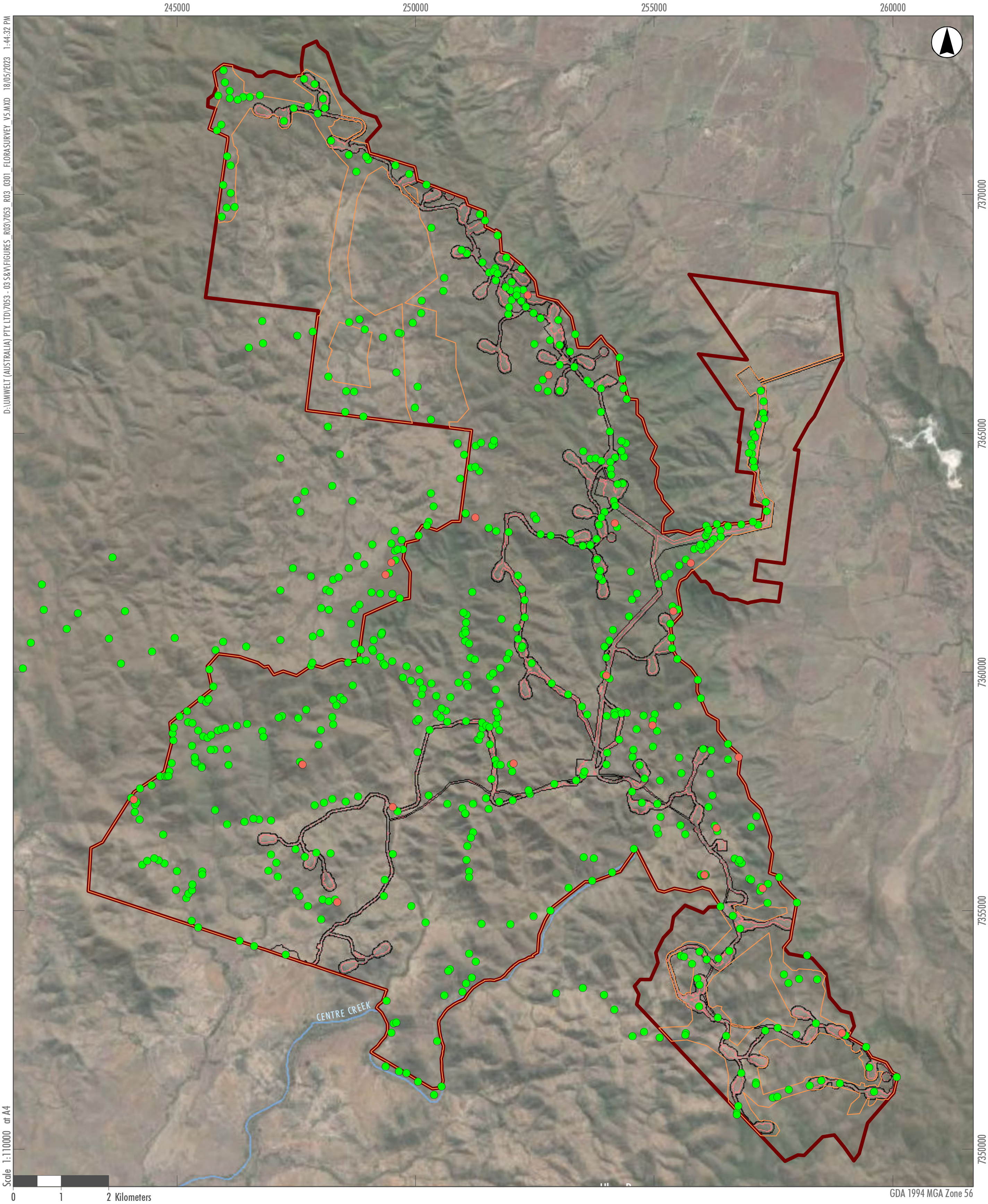
This assessment has been completed using a combination of field-validated data, desktop information and reasonably extrapolated field survey results. As such, the results are subject to the level of accuracy and detail associated with this information.

Land access was a key limitation throughout the field survey program, and particularly affected surveys that required the use of remote locations such as vantage points. Terrain was difficult with tracks generally highly eroded, overgrown, or poorly established, resulting in limited safe access into more remote areas. Potential safety issues as a result of inclement weather also occasionally limited access.

Eucalypt woodland community types were well sampled; however, the semi-evergreen vine thicket communities were less represented due to the thick vegetation and steep slopes. This lack of coverage has been considered when undertaking the likelihood of occurrence assessment (**Section 3.3**).

The flora survey undertaken between 6-12 August 2019 was undertaken in late winter after a long period of extended drought. There was a noticeable lack of species diversity in the ground layer (e.g. grasses and herbs). The following surveys were undertaken in seasons that provided a good representation of grass and herb species.

While the flora field survey method quantitatively measured *Cycas megacarpa* across the Development Corridor, the site coverage was not systematic (i.e. parallel line searches) and whilst extensive, did not cover the full extent of the habitat available. For this reason, the actual numbers recorded from density plots or species record points, represent the lower bound estimate of the population size within the Ground-truthed Mapping Extent. However, the application of density information was used to project the upper limit of *Cycas megacarpa* individuals using a combination of habitat extent mapping (as verified in the field) and spatial interpolation methods.



Legend

- Study Area
- Ground Truthed Survey Extent
- Development Corridor
- Disturbance Footprint
- Quaternary Sites
- Secondary Sites

FIGURE 3.1

Flora Survey Locations

3.3 Likelihood of Occurrence Assessment

A likelihood of occurrence assessment was completed for all threatened flora species identified during the desktop assessment. The likelihood assessment considered the known distribution, preferred habitat and ecological requirements of the threatened species and compared these against the vegetation communities and habitat identified during the field survey. Each species is assessed against the criteria specified in **Table 3.2**.

Table 3.2 Likelihood of Occurrence Assessment Criteria

Likelihood of Occurrence Categories	Definition
Known	All species recorded during the field survey program
High	Species with historical records within the Study Area or have been recorded in the immediate vicinity. The Study Area contains preferred habitat which may support a population of the species.
Moderate	The species is known from the broader area (desktop search extent) and some of the preferred habitat is present within the Study Area.
Low	The Study Area supports some suitable habitat, often marginal.
Unlikely	The Study Area offers limited or no potential habitat and/or is outside their known range.

This process is used as a guide to inform the impact assessment. A conservative approach is adopted when making determinations, noting that field surveys are not exhaustive, and results are subject to limitations. The likelihood of occurrence assessment results do not indicate species presence or absence other than where observed presence is indicated.

3.4 Mapping and Data Analysis

Following the completion of the likelihood of occurrence assessment and the mapping of vegetation communities and habitat, mapping for the known and potentially occurring threatened flora values was completed.

'Modelling criteria' developed for relevant threatened flora values were primarily based on habitat requirements as specified by SPRAT. As required, other publicly available datasets were also reviewed to inform the modelling rules including the DES Species Profile database, relevant species recovery plans (where available), referral guidelines, approved conservation advice and listing advice, management plans and peer-reviewed journal articles. Habitat assessments collected during the field surveys, species records (public and survey records), and Project vegetation mapping were the primary inputs used to map the potential habitat according to the modelling criteria. For some habitats or habitat features (i.e. hilly rocky areas and dense vegetation), mapping delineation was completed manually using additional mapping datasets including watercourse and 10-metre contours in conjunction with high-quality Queensland Globe aerial imagery.

3.4.1 *Cycas megacarpa*

3.4.1.1 Density and Distribution Estimation

Using *Cycas megacarpa* presence/absence and abundance field data, an estimation of the distribution and density of *Cycas megacarpa* within the Study Area was undertaken using a spatial interpolation model. Interpolation models can be used to predict values for cells in a raster from a limited number of sample data points. The underlying assumption that makes interpolation a viable option is that spatially distributed objects are spatially correlated, thereby assuming that things that are close together tend to have similar characteristics.

The interpolation selected for this analysis was the Inverse Distance Weighted method (IDW). IDW is a method of interpolation that estimates cell values by averaging the values of sample data points in the vicinity of each processing cell. The closer a data point is to the centre of the cell being estimated, the more influence, or weight, it has in the averaging process. This method assumes that the variable being mapped decreases in influence with distance from its sampled location.

The interpolation was conducted using ESRI GIS mapping software ArcGIS Pro. To provide a visual aid, the resultant output was categorised and styled into density categories, comprising High (25-50 plants per 0.25 ha), Moderate (10-25 plants per 0.25 ha), Low (0.5 -10 plants per 0.25 ha), Absent (0-0.5 plants per 0.25 ha). The output was analysed against locations of actual counts and habitat extent mapping. To enhance the accuracy of the model, and where available, the IDW outputs were clipped to known habitat (confirmed and suspected) areas.

Noting that a targeted *Cycas megacarpa* field survey was completed across the Development Corridor in October 2022, calculated densities are expected to be most accurate in this area as a result of a greater number of sample data points relative to the surrounding Study Area.

3.4.1.2 Habitat Mapping

Based on feedback from DCCEEW regarding the habitat assessment of *Cycas megacarpa*, habitat for the species has been mapped into the following three categories:

- **Known habitat (confirmed)**; an 80 m buffer on confirmed *Cycas megacarpa* records, to reflect the latest population research which indicates most individuals disperse within 80 m of mature female plants (Etherington et al. 2018; James 2016 PhD thesis). Mapping has not been limited to certain REs noting the species was also recorded within non-remnant vegetation within the Study Area (see **Section 4.2.2.1**).

- **Known habitat (suspected)**; includes areas of the Development Corridor for which known habitat (confirmed) does not overlap, however based on adjacent records and connective habitat, *Cycas megacarpa* presence is presumed or reasonably suspected.

- **Nil detected**; includes areas of the Development Corridor which have been confirmed (via field survey) to not support *Cycas megacarpa*. Nil recorded habitat also includes areas where reasonable extrapolation to edges of the Development Corridor has been applied, based on nearby 'absence' records, absence of connective habitat and field derived opinions of ecologists.

Cycas megacarpa habitat mapping has been limited to the Development Corridor, given the complexity of mapping and large amount of input data requiring interrogation.

3.5 Significant Residual Impact Assessment

An assessment against the *Significant Residual Impact Guideline: For matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (The Department of State Development, Infrastructure and Planning, 2014) has been undertaken to determine whether the Project is likely to have a significant residual impact on a relevant Matter of State Environmental Significance (MSES) (i.e. prescribed environmental matter).

If after all reasonable avoidance and mitigation measures have been taken by the Project, if there is still a significant residual impact on an MSES, an offset may be required.

4.0 Results

4.1 Desktop Assessment

4.1.1 Landform and Geology

The Study Area ranges in elevation from 500 metres (m) Australian Height Datum (AHD), with the lowest elevation occurring in association with the valleys at 190 m AHD (**Figure 4.1**).

The surface geology of the Study Area mostly comprises sedimentary geologies with intrusive volcanics including granitoids and rhyolites as well as a small area in the south eastern corner of the Study Area comprising Quaternary alluvium (**Figure 4.1**). The dominant geologies and their lithographic summaries are provided as follows:

- Raspberry Creek Formation (Dcr): Predominantly basaltic and andesitic volcaniclastic sandstone and conglomerate with minor silicified siltstone and fossiliferous limestone.
- Mount Hoopbound Formation (Dh): Granule to boulder andesitic to dacitic volcaniclastic breccia and conglomerate, locally fossiliferous, lithic to feldspatholithic sandstone, porphyritic andesitea, lapilli to ash tuff, tuffaceous sandstone.
- Ginger Creek Member (Dcrg): Volcanoclastic sandstone and conglomerate, rare fossiliferous limestone and peperite.
- Balaclava Formation (DCb): Rhyolitic volcanoclastic sandstone and conglomerate, minor ignimbrite, rare rhyolite, siltstone and oolitic limestone.
- Alluvium (Qa-QLD): Clay, silt, sand and gravel; floodplain alluvium.

4.1.2 Wetlands and Waterways

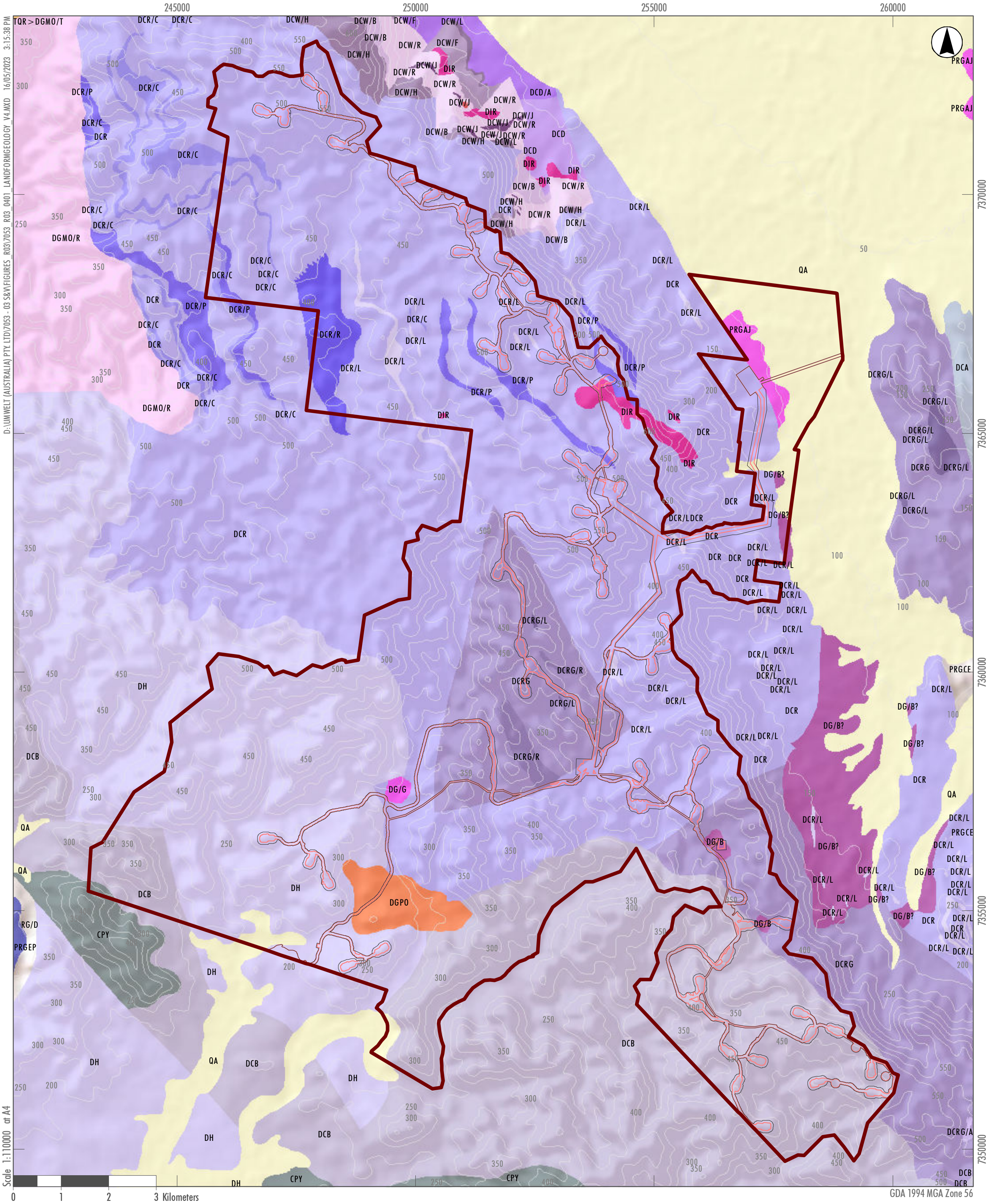
The Study Area does not occur within a DES wetland protection area nor does it contain any wetlands of High Ecological Significance (HES). Wetlands mapped under the *Vegetation Management Act 1999* (VM Act) are also absent from the Study Area.

Watercourses are present across the Study Area as identified from the *Vegetation Management Watercourse and Drainage Feature Map*. Details of these are provided in **Table 4.1** and shown on **Figure 4.2**. However, no watercourses within the Study Area are considered High Ecological Value (HEV).

Table 4.1 VM Act Watercourse Features Within the Study Area

Stream Order	Number of Mapped Watercourse Features
One	153
Two	88
Three	33
Four	8

umwelt



Legend

- Study Area
- Development Corridor
- Disturbance Footprint
- Surface Contours (50m)
- Bajool Quartz Diorite (PRgaj)
- Balaclava Formation (DCb)
- Dg/b-YARROL/SCAG (Dg/b)
- Dg/b?-YARROL/SCAG (Dg/b?)
- Dg/g-YARROL/SCAG (Dg/g)
- Dir-YARROL/SCAG (Dir)
- Eulogie Park Gabbro (PRgep)
- Ginger Creek Member (Dcrg)
- Ginger Creek Member/a (Dcrg/a)
- Ginger Creek Member/l (Dcrg/l)
- Ginger Creek Member/r (Dcrg/r)
- Mount Alma Formation (DCa)
- Mount Dick beds (Dcd)
- Mount Dick beds/a (Dcd/a)
- Mount Hoopbound Formation (Dh)
- Mount Morgan Trondhjemite/r (Dgmo/r)
- Mount Warner Volcanics/b (Dcw/b)
- Mount Warner Volcanics/f (Dcw/f)
- Mount Warner Volcanics/h (Dcw/h)
- Mount Warner Volcanics/j (Dcw/j)
- Mount Warner Volcanics/l (Dcw/l)
- Mount Warner Volcanics/r (Dcw/r)
- Pg/b-YARROL/SCAG (Pg/b)
- Pomegranate Tonalite (Dgpo)
- Qa-QLD (Qa)
- Raspberry Creek Formation (Dcr)
- Raspberry Creek Formation/c (Dcr/c)
- Raspberry Creek Formation/l (Dcr/l)
- Raspberry Creek Formation/p (Dcr/p)
- Raspberry Creek Formation/r (Dcr/r)
- TQr-QLD>Mt Morgan Trondhjemite (TQr>Dgmo/t)
- Youlambie Conglomerate (CPy)

FIGURE 4.1

Landform and Geology

Image Source: ESRI Basemap Data source: QLD DNRM Statewide Detailed Geology (2018)

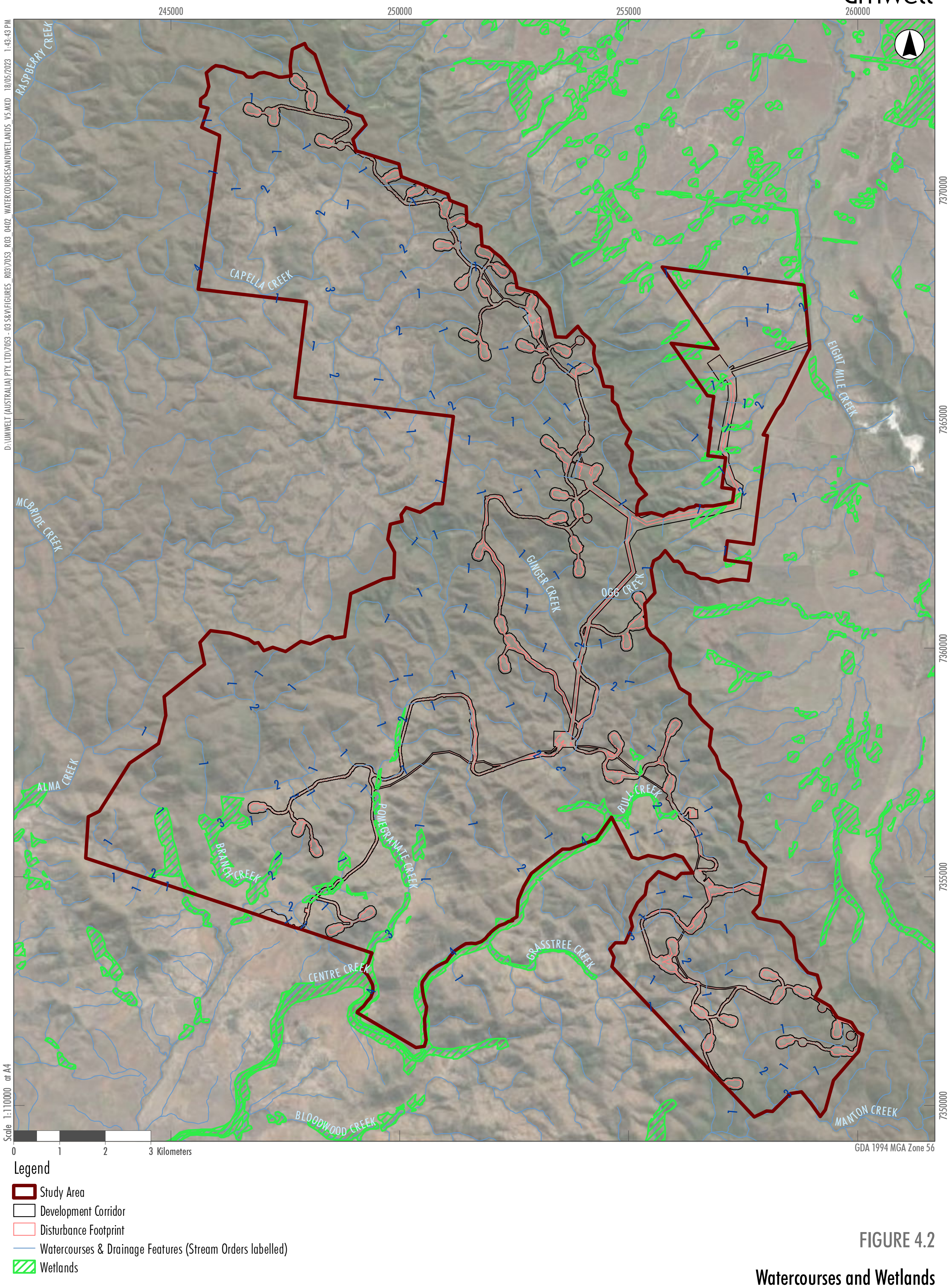


FIGURE 4.2

Watercourses and Wetlands

Image Source: ESRI Basemap Data source: QLD Government (2020)

4.1.3 Bioregional Description

The Study Area is located on the Ulam Range between Mount Hopeful (on the Dee Range) and Mount Alma (on the Mount Alma Range) (**Figure 4.3**).

The Study Area is located within the Brigalow Belt bioregion (**Figure 4.3**), which is characterised by the tree *Acacia harpophylla* (brigalow) which forms forest and woodland on clay soils. Other large areas in the bioregion are characterised by eucalypt forests and woodland, grassland, dry rainforest, cypress pine woodland and riparian communities (Sattler and Williams 1999).

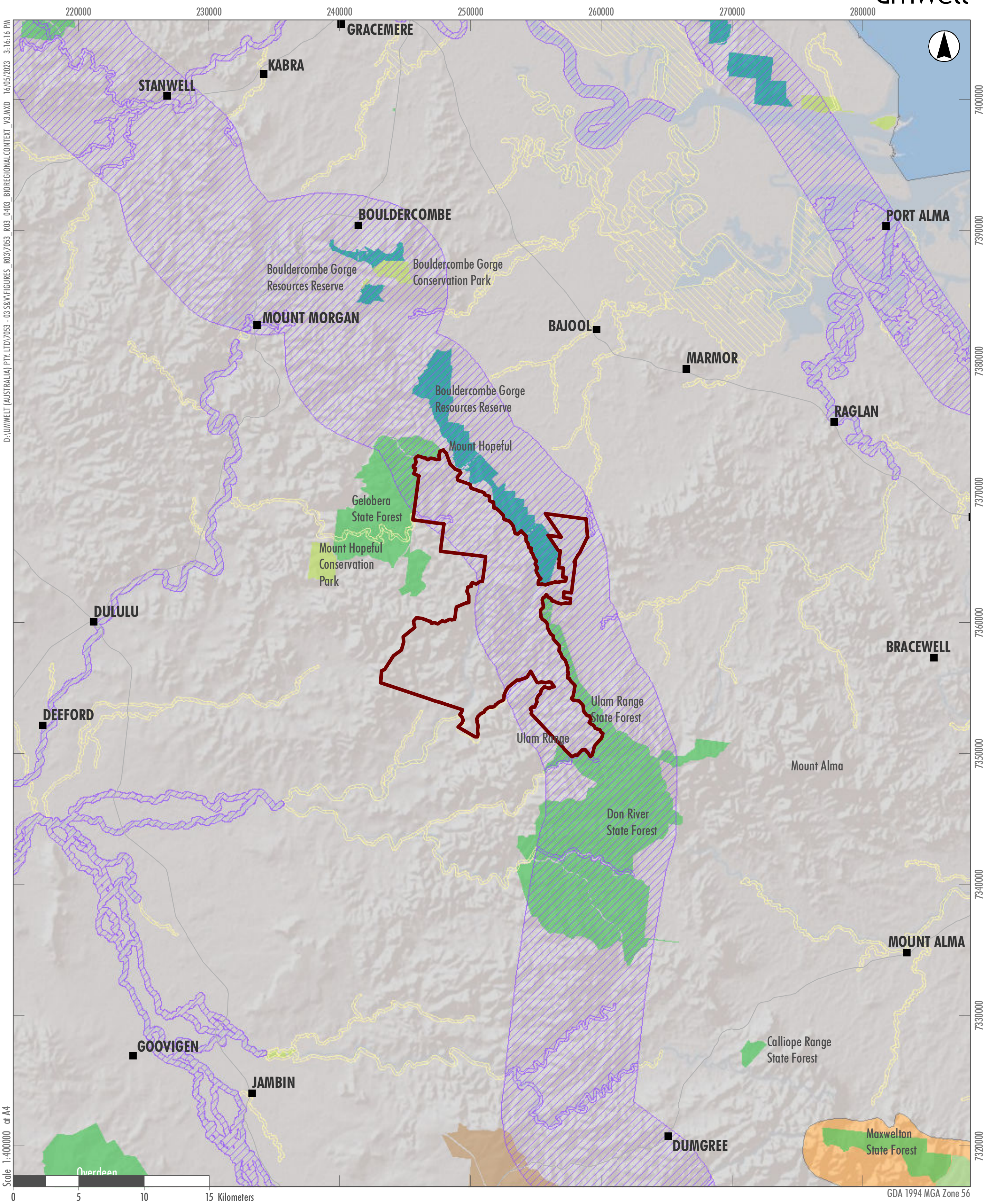
The Study Area is located across two subregions: The Mount Morgan Ranges subregion covers much of the mountainous parts of the Study Area, while the Marlborough Plains subregion covers just the north eastern corner. The Mount Morgan Ranges subregion is a rugged and hilly province formed on the Paleozoic rocks of the coastal ranges. The dominant rock types are volcanics, with areas of igneous rocks and small areas of folded metasediments. The vegetation is dominated by *Eucalyptus crebra* (narrow-leaf ironbark) with *Corymbia erythrophloia* (red bloodwood) and *Corymbia citriodora* (spotted gum) on the rugged slopes and woodlands of *Eucalyptus melanophloia* (silver-leaved ironbark) on erosional lower slopes. On the colluvial slopes *Eucalyptus moluccana* (gum-topped box) forms a woodland. On the alluvial soils *Eucalyptus tereticornis* (forest red gum) and *Corymbia tessellaris* (Moreton Bay ash) can be found (Sattler and Williams 1999).

The Marlborough Plains subregion, covering the north eastern corner of the Study Area is an undulating hilly province with complex geology. The subregion is dominated by alluvial plains and colluvial slopes, usually with a woodland of *Eucalyptus platyphylla* (poplar box), *Corymbia dallachiana* (ghost gum), *Eucalyptus tereticornis* and *Melaleuca* spp. (tea tree). Low rises have *Eucalyptus crebra* and hillier areas with open forest or woodland of *Corymbia citriodora*, *Corymbia* spp. and *Eucalyptus crebra* (Sattler and Williams 1999).

4.1.4 Protected Areas

The Study Area does not occur within any protected areas or reserves. The Ulam Range State Forest borders the south eastern edge of the Study Area, which links within the Don River State Forest to the south. To the north, the Bouldercombe Gorge State Reserve, which includes Mount Hopeful, borders the north eastern side of the Study Area, with the Gelobera State Forest and Mount Hopeful Conservation Park occurring to the north west (**Figure 4.3**).

The eastern half of the Study Area forms part of a Statewide Biodiversity corridor, which incorporates the protected areas and reserves along the eastern side of the Study Area (**Figure 4.3**). For further information about Biodiversity corridors, see the Mount Hopeful Wind Farm Terrestrial Fauna Assessment (Umwelt, 2023).



Legend

Study Area	Brigalow Belt
Conservation Park	Southeast Queensland
National Park	**Statewide Corridors Of Significance**
Resources Reserve	Regional
State Forest	State
Timber Reserve	

FIGURE 4.3

Bioregional Context

Image Source: Data source: QSpatial (2021); QLD DES (2019)

4.1.5 Regulated Vegetation

The Department of Resources (DoR) Regulated Vegetation Management map (Version 6.05) identifies four categories of regulated vegetation present within the Study Area (**Figure 4.4** and **Table 4.2**). Category B vegetation occurs across approximately 41% of the Study Area and generally comprises large, connected patches. In contrast, Category C and Category R vegetation is uncommon with only sporadic, small linear patches mapped, largely associated with mapped watercourses and drainage areas. Category X (non-remnant) vegetation dominates the Study Area, occurring extensively across the northern and southern extents.

Table 4.2 Regulated Vegetation Mapped Within the Study Area

Regulated Vegetation Category	Area (ha) Within the Study Area
Category B - Remnant vegetation	6,890.3
Category C - High-value regrowth	49.6
Category R - Regrowth within 50 m of a watercourse or drainage feature in the Great Barrier Reef catchment	24.1
Category X - Exempt clearing work on Freehold, Indigenous and Leasehold land	9,793.5

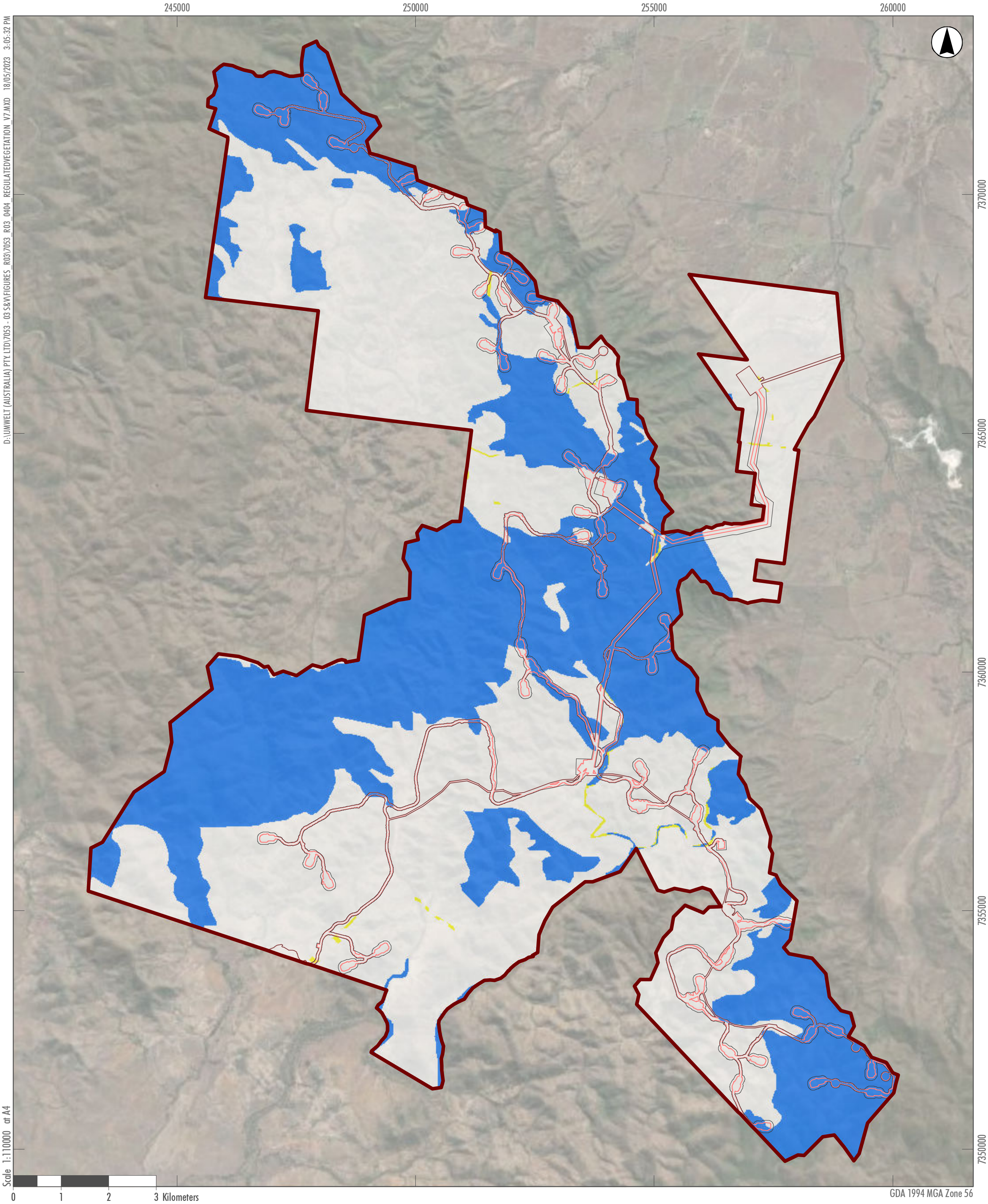
4.1.6 Regional Ecosystems

As per the Department of Environment and Science (DES) Vegetation Management Regional Ecosystem map (Version 12.02), the Study Area contains up to eleven REs, which are listed in **Table 4.3** and illustrated on **Figure 4.5**. Based on classifications under the VM Act, two REs are listed as 'Of Concern' and nine are 'Least Concern'.

Table 4.3 Regional Ecosystems Mapped Within the Study Area

RE	REDD Description[1]	VM Act Class
11.11.15	*Eucalyptus crebra* woodland on deformed and metamorphosed sediments and interbedded volcanics	Least Concern
11.11.3	*Corymbia citriodora, Eucalyptus crebra, E. acmenoides* open forest on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges	Least Concern
11.11.4c	*Eucalyptus moluccana* dominated woodland.	Least Concern
11.11.5	Microphyll vine forest +/- *Araucaria cunninghamii* on old sedimentary rocks with varying degrees of metamorphism and folding	Least Concern
11.12.1	*Eucalyptus crebra* woodland on igneous rocks	Least Concern
11.12.4	Semi-evergreen vine thicket and microphyll vine forest on igneous rocks	Least Concern
11.12.6	*Corymbia citriodora* open forest on igneous rocks (granite)	Least Concern
11.3.2	*Eucalyptus populnea* woodland on alluvial plains	Of Concern
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Least Concern
11.3.26	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains	Least Concern
11.3.4	*Eucalyptus tereticornis* and/or *Eucalyptus* spp. woodland on alluvial plains	Of Concern

[1] Description of REs as contained in the REDD Version 11.1 (Queensland Herbarium 2018a).



Legend

Study Area

Study Area

Development Corridor

Disturbance Footprint

Regulated Vegetation Management Map

Category B area

Category C area

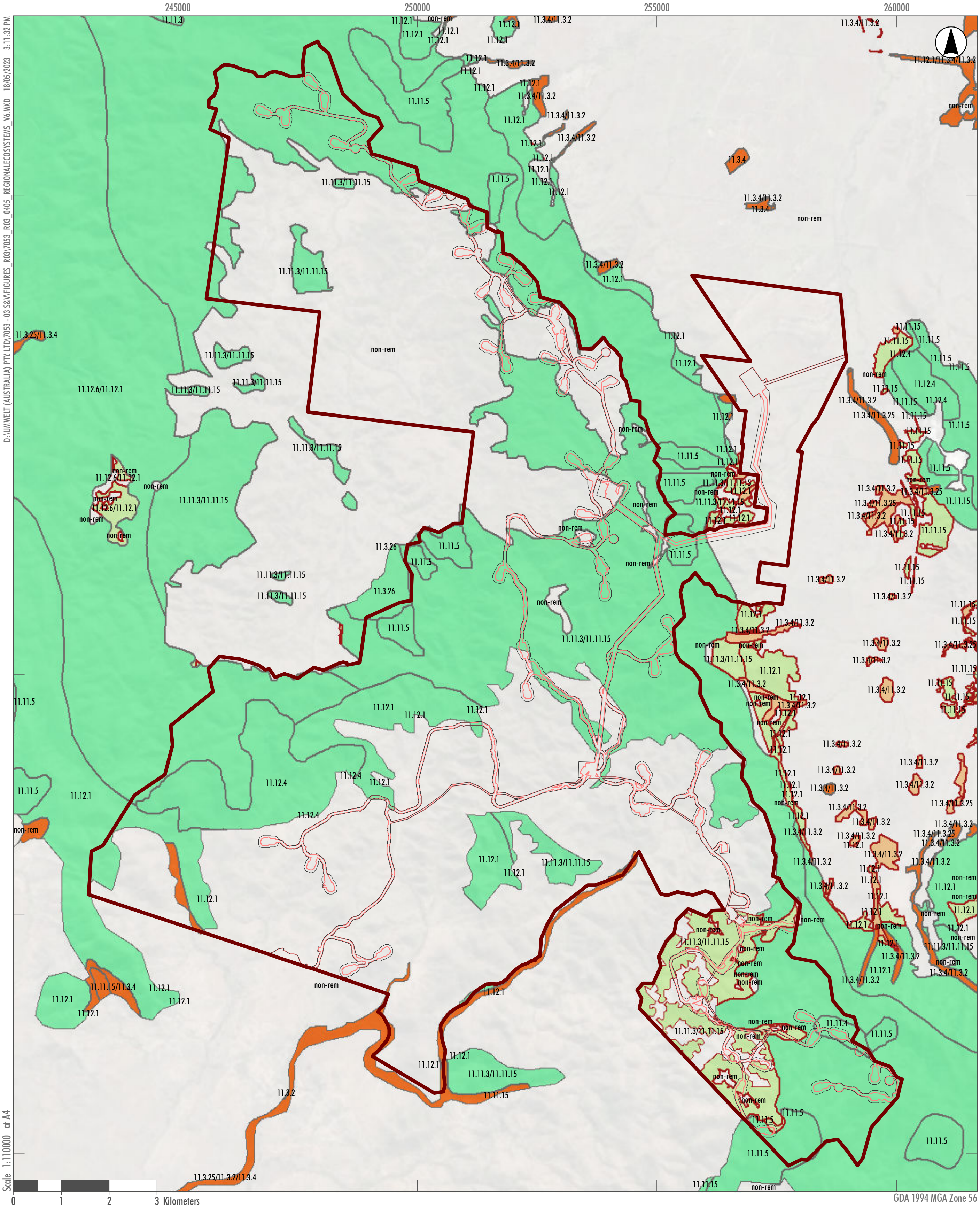
Category R area

Category X area

FIGURE 4.4

Regulated Vegetation

Image Source: ESRI Basemap Data source: QLD Government (2020)



Legend

Study Area

Development Corridor

Disturbance Footprint

Regional Ecosystems - Vegetation Management Supporting Map

Category A or B area containing of concern

Category A or B area that is least concern

Category C area containing of concern

Category C area that is of least concern

Non-remnant

FIGURE 4.5

Regional Ecosystems

Image Source: ESRI Basemap Data source: QLD Government (2020)

4.1.7 Threatened Ecological Communities

Six TECs were identified as potentially occurring within or in proximity to the Study Area based on desktop search results. The TECs are listed in **Table 4.4** as well as the REs which correspond to these communities.

Table 4.4 Potential TECs within the Study Area

TEC	EPBC Act Status	[1]Corresponding REs within the Brigalow Belt Bioregion
Brigalow (*Acacia harpophylla* dominant and codominant)	Endangered	11.3.1, 11.4.3, 11.4.7, 11.4.8, 11.4.9, 11.4.10, 11.5.16, 11.9.1, 11.9.5, 11.11.14, 11.12.21
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community	Endangered	12.1.1, 12.3.20
Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	Endangered	11.3.3, 11.3.15, 11.3.16, 11.3.28, 11.3.37
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	11.3.2, 11.3.17, 11.4.7, 11.4.12
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions	Endangered	11.3.11, 11.4.1, 11.5.15, 11.8.13, 11.9.4, 11.11.18, 11.2.3, 11.8.3, 11.8.6, 11.9.8
Weeping Myall Woodlands	Endangered	11.3.2, 11.3.28

[1] These REs can form part of or align with the TECs if the key diagnostic characteristics and condition thresholds specified as part of the Commonwealth listing advice are also met.

Based on the State RE mapping, there is the potential for two TECs to occur within the Study Area, including:

- Poplar Box Grassy Woodland on Alluvial Plains (represented by RE 11.3.2).
- Weeping Myall Woodlands (represented by 11.3.2).

The Poplar Box Grassy Woodland on Alluvial Plains community is typically a grassy woodland with a canopy dominated by *Eucalyptus populnea* with an understorey of mostly grasses and herbs. The community occurs on a wide range of alluvial soils in gently undulating to flat landscapes. The poplar box grassy woodland may include a low density of shrubs, however this community generally lacks a substantial mid layer, and shrubby forms of the poplar box woodland are not part of the ecological community (Department of the Environment and Energy 2019).

The Weeping Myall Woodlands community occurs on the inland alluvial plains west of the Great Dividing Range and is an open woodland to woodland in which *Acacia pendula* trees are the sole or dominant overstorey species. Other vegetation may also occur in the ecological community, though not as a dominant species. Some examples of other species present include *Eucalyptus populnea*, *Alectryon oleifolius* subsp. *oleifolius* or *Eucalyptus largiflorens*. The understorey of the weeping myall community often includes an open shrub layer over an open ground layer of grasses and herbs (Threatened Species Scientific Committee 2009).

Threatened Flora

A total of 16 threatened flora species were identified from desktop database sources as occurring or having the potential to occur within or in proximity to the Study Area. These species and their respective conservation status under the EPBC Act and NC Act are detailed in **Table 4.5.** Records of threatened species from the ALA database are illustrated on **Figure 4.6**. No desktop records of threatened species were identified within the Study Area; however, two species were identified within the 10 km search radius. These species are *Cycas megacarpa* and *Hernandia bivalvis*.

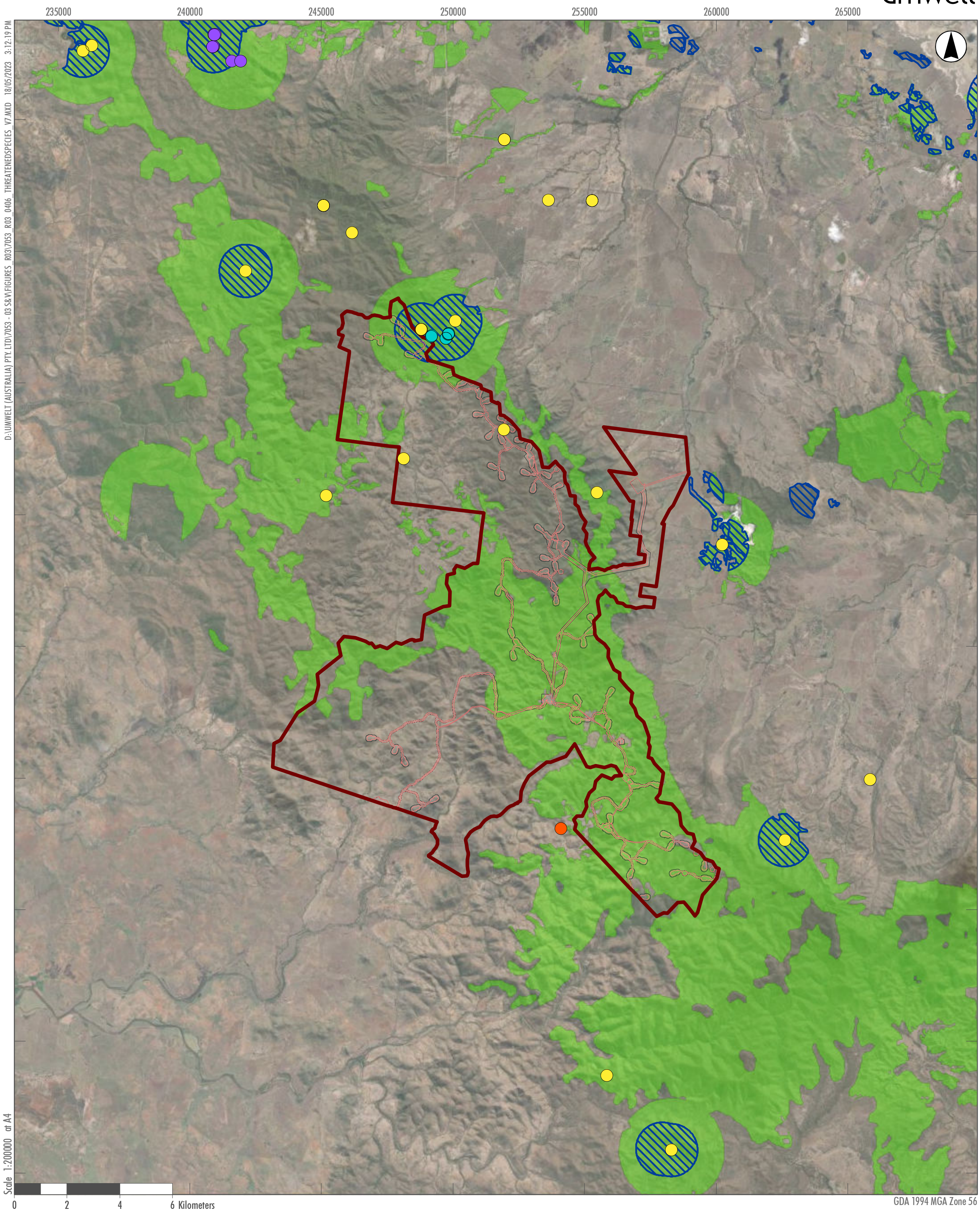
High-risk areas for protected plants have been identified within the north, central and south-eastern portions of the Study Area (**Figure 4.6**). These high-risk areas are likely triggered by records of *Hernandia bivalvis* and *Cycas megacarpa*.

Table 4.5 Database Results for Threatened Species

Family	Species	EPBC Act Status	NC Act Status
Apocynaceae	*Marsdenia brevifolia*	Vulnerable	Vulnerable
Cycadaceae	*Cycas megacarpa*	Endangered	Endangered
	Cycas ophiolitica	Endangered	Endangered
Hernandiaceae	*Hernandia bivalvis*	-	Near Threatened
Myrtaceae	*Decaspermum struckoilicum*	Endangered	Endangered
	Eucalyptus raveretiana	Vulnerable	Least Concern
Orchidaceae	*Bulbophyllum globuliforme*	Vulnerable	Near Threatened
Poaceae	*Arthraxon hispidus*	Vulnerable	Vulnerable
	Dichanthium setosum	Vulnerable	Least Concern
Rutaceae	*Bosistoa transversa*	Vulnerable	Least Concern
Sapindaceae	*Cossinia australiana*	Endangered	Endangered
	Cupaniopsis shirleyana	Vulnerable	Vulnerable
Simaroubaceae	*Samadera bidwillii*	Vulnerable	Vulnerable
Solanaceae	*Solanum dissectum*	Endangered	Endangered
	Solanum johnsonianum	Endangered	Endangered
Surianaceae	*Cadellia pentastylis*	Vulnerable	Vulnerable

4.1.8 Essential Habitat

As per the DoR Vegetation Management Essential Habitat map (Version 11.05), two overlapping areas of Essential Habitat occur within the northern Study Area (**Figure 4.6**). These Essential Habitat areas correspond with desktop records of *Hernandia bivalvis* and *Cycas megacarpa*, which have been recorded within 1 km of the Study Area. Mapped Essential Habitat areas within the Study Area potentially provide habitat for these species.



Legend

- Study Area
- Development Corridor
- Disturbance Footprint
- Protected Plants Trigger Area
- Essential Habitat on the Vegetation Management Map

Threatened Species Records (ALA, 2020)

- *Cossinia australiana*
- *Cycas megacarpa*
- *Decaspermum struckoilicum*
- *Hernandia bivalvis*

FIGURE 4.6

Threatened Species, Protected Plant Trigger Areas and Essential Habitat

Image Source: ESRI Basemap Data source: QLD Government (2020), ALA (2020)

4.2 Flora and Vegetation Survey

4.2.1 Study Area Characteristics

The Study Area occurs within a mountainous area that is sparsely settled and mostly used for light grazing and livestock production (**Plate 4.1**). Large areas of the Study Area have been historically cleared and currently support regrowing eucalypt communities and areas of cleared land. The dominant regrowth and remnant vegetation communities across the Study Area are eucalypt woodland and forest dominated by *Eucalyptus crebra*, *Corymbia citriodora* and *Eucalyptus acmenoides.* On the lower colluvial slopes, *Eucalyptus moluccana* and *Eucalyptus tereticornis* are present with the creek lines supporting *Melaleuca fluviatilis* and *Casuarina cunninghamiana*. Vine thicket communities are also scattered throughout the Study Area, often centred around drainage lines.

Plate 4.1 General view of the Study Area

4.2.2 Flora Diversity

The field survey identified a total of 207 flora species from 56 families and 134 genera. The plant families representing the most taxa were Poaceae (32 taxa), Myrtaceae (24 taxa), Fabaceae (16 taxa), Mimosaceae (10 taxa) and Asteraceae (10 taxa). The survey also identified 32 introduced species, which represents 15.5% of the total flora recorded. The weed species present are further discussed in **Section 4.2.2.2**.
The full list of flora species identified within the Ground-truthed Mapping Extent is provided as **Appendix A**.

4.2.2.1 Threatened Flora

The field surveys recorded one threatened flora species, *Cycas megacarpa* (**Plate 4.2**), which is listed as Endangered under the EPBC Act and NC Act. Four additional threatened flora species, while not recorded during the field survey program, were determined to have a 'Moderate' or 'High' likelihood of occurring within the Study Area (**Section 4.3**).

Cycas megacarpa

This species was recorded extensively across the Study Area and was the subject of targeted surveys in 2022 to ensure population estimates were robust. The number of *Cycas megacarpa* individuals within the Study Area based on data interpolation is 159,915 across an area of 16,757.5 ha. (**Figure 4.7**). Within the Disturbance Footprint, a total of 4,131 individuals are estimated to occur.

During the field survey program, *Cycas megacarpa* was recorded within a variety of vegetation communities, including within regrowth and non-remnant areas. The primary habitat for the species (i.e. where the species was most consistently recorded and abundant) is woodland to open forest on upper slopes and crests consisting of *Corymbia citriodora*, *Eucalyptus crebra*, *Eucalyptus melanophloia, Corymbia intermedia* and *Eucalyptus tereticornis* on metamorphosed sediments and volcanic geologies at altitudes of between 200 and 500 m AHD. Primary habitat for *Cycas megacarpa* corresponds to REs 11.12.1, 11.12.6, 11.11.3 and 11.11.15. A typical example of a primary open forest habitat is shown as **Plate 4.3**.

Other field-verified habitat for *Cycas megacarpa* includes eucalypt communities dominated by *Eucalyptus acmenoides* (RE 11.11.4c), eucalypt communities occurring on lower colluvial slopes (RE 11.11.3c, 11.11.4b), communities on alluvial soils (RE 11.3.25b and 11.3.4), vine thickets (REs 11.11.5, 11.12.4) and areas of regrowth and non-remnant vegetation. The species was recorded within all these communities, although not consistently and in lower numbers.

Based on the *Cycas megacarpa* survey points and recorded densities, a map was created using a spatial interpolation method (**Section 3.2.2.2**) to predict the density distribution of the species across the Study Area (**Figure 4.7**). Predicted densities of *Cycas megacarpa* across the different Project Areas is detailed below (**Table 4.6**).

Table 4.6 Predicted Density and Distribution of *Cycas megacarpa* within the Project Areas

Density of *C. megacarpa* (0.25 ha)	Study Area[1]	Development Corridor[2]	Disturbance Footprint
High (25-50 plants)	74.9 ha	0.9 ha	0.7 ha
Moderate (10-25 plants)	960.8 ha	29.6 ha	16.8 ha
Low (1-10 plants)	5,365.7 ha	301.5 ha	195.7 ha

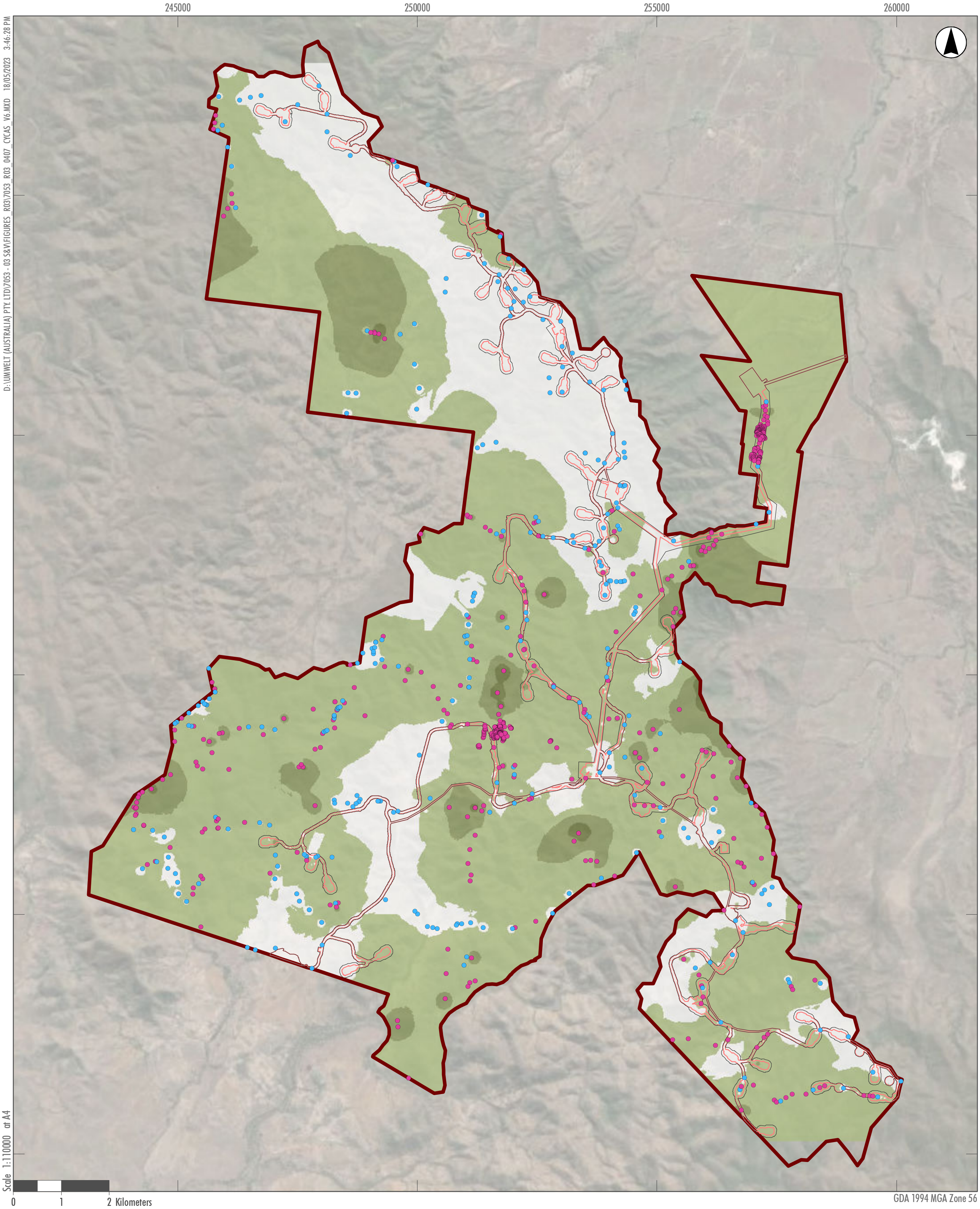
[1] Study Area values have been corrected by a factor of 0.5-0.7 to provide contextual comparison with development corridor, for which IDW outputs have been clipped to the known (confirmed) and known (suspected) habitat area.
[2] IDW outputs clipped to areas of mapped known (confirmed) and known (suspected) habitat area

Based on the species records and habitat mapping rules outlined in **Section 3.4.1.2,** suitable habitat for *Cycas megacarpa* within the Disturbance Footprint is as follows (mapping is provided in **Appendix C**):

- 147.1 ha of Known (confirmed).
- 88.6 ha of Known (suspected).
- 639.0 ha of Nil recorded.

Plate 4.2 The Endangered species *Cycas megacarpa* (Female)

Plate 4.3 Primary habitat for *Cycas megacarpa* consisting of an open forest of *Corymbia citriodora* and *Eucalyptus crebra*



Legend

Study Area
Development Corridor
Disturbance Footprint

Surveyed Locations

Cycas megacarpa Absent
Cycas megacarpa Present

Predicted Distribution and Density of *Cycas megacarpa* (per 50m²)

Absent (0 - 1)
Low (1 - 10)
Moderate (10 - 25)
High (25-50)

FIGURE 4.7

Cycas megacarpa Locations and Predicted Distribution and Density

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

4.2.2.2 Introduced Flora

A total of 32 introduced flora were identified during the survey (**Appendix A**). Of these 32 species, five are identified as Category 3 restricted plants in Queensland under the *Biosecurity Act 2014* as well as Weeds of National Significance (WoNS). WoNS are weed species that have been agreed by Australian governments using an assessment process that prioritised these weeds based on their invasiveness, potential for spread and environmental, social, and economic impacts. These five species are listed as followed:

- Lantana (**Lantana camara*)
- Prickly pear (**Opuntia stricta*)
- Velvety pear (**Opuntia tomentosa*)
- Rubber vine (**Cryptostegia grandiflora*)
- Parthenium (**Parthenium hysterophorus*).

The restricted plant that was most common across the Ground-truthed Mapping Extent was lantana, which was recorded within all vegetation communities including areas of regrowth and non-remnant. Prickly pear (**Plate 4.4**) and velvety pear were recorded as scattered individuals within the eucalypt dominated communities (REs 11.11.3, 11.12.1 and 11.12.6) as well as within creek line communities on alluvial soils (REs 11.3.4 and 11.3.26) and within non-remnant areas. Rubber vine was most common within the creek line communities on alluvial soils (RE 11.3.25b) as well as in the vine thicket communities (REs 11.12.4 and 11.11.5a), however was also recorded as a scattered occurrence within the eucalypt communities (REs 11.12.1, 11.11.3 and 11.11.15) and non-remnant areas. Parthenium was most common in lower lying and disturbed non-remnant areas. Balloon bush (**Gomphocarpus physocarpus*) was a common (non-restricted) introduced flora recorded across the site, particularly within non-remnant areas (**Plate 4.5**).

Plate 4.4 Prickly pear (Opuntia stricta*) within an area of non-remnant paddock**

Plate 4.5 Balloon bush (Gomphocarpus physocarpus*) growing along a fence line**

4.2.3 Vegetation Communities

4.2.3.1 Threatened Ecological Communities

No TECs were identified during the field survey program. The State mapped RE 11.3.2 identified during the database review, which can correspond to the Poplar Box and Weeping Myall TECs was not identified during the field surveys. No additional TECs, or REs that are known to correspond to a TEC, were identified during the field surveys either. As such, no TECs are considered likely to occur within the Ground-truthed Mapping Extent or wider Study Area.

4.2.3.2 Regional Ecosystems

Following the completion of the field survey program, a total of 15 REs were identified and mapped within the Ground-truthed Mapping Extent (**Figure 4.9**). Of the 15 confirmed REs, 11 occur within the Disturbance Footprint and Development Corridor in remnant condition. These REs are described in **Table 4.7**, with areas detailed corresponding only to the extent of the RE in remnant condition.

As per the field-validated vegetation mapping, one confirmed RE does not occur within the Disturbance Footprint or Development Corridor: RE 11.12.4. REs that occur within the Disturbance Footprint and Development Corridor but in regrowth form include REs 11.3.25, 11.11.5 and 11.12.1.

Table 4.7 Remnant Regional Ecosystems Confirmed Within the Disturbance Footprint and Development Corridor

11.3.25b	**Woodland to open forest of *Melaleuca fluviatilis* and *Casuarina cunninghamiana* over low open woodland of *Melaleuca bracteata* over an open shrubland of *Casuarina cunninghamiana* and *Melaleuca viminalis* over a sparse herbland of **Cenchrus ciliaris*, *Brunoniella australis*, **Malvastrum americanum* and **Sida acuta*.**	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	176.4	
Area in Disturbance Footprint (ha)	3.3	
Structure (m)	T1 (14-20) T2 (8-12) S1 (2-5) S2 (<2) G (<0.5)	
Significant species	Habitat for *Cycas megacarpa*	

11.3.4	***Eucalyptus tereticornis* and/or *Corymbia tessellaris* and *Angophora floribunda* woodland to open forest on alluvial plains. Other tree species occur sporadically including *Lophostemon suaveolens*, *Eucalyptus crebra*, *Corymbia clarksoniana* and *Casuarina cunninghamiana*. Where present, the shrub layer is generally dominated by *Lantana camara**.**	
VM Act Status	Of Concern	-
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	19.0	
Area in Disturbance Footprint (ha)	0.4	
Structure (m)	T1 (16-25) S1 (2-5) S2 (<2) G (<0.5)	
Significant species	-	
RE 11.11.3	**Open forest of *Corymbia citriodora*, *Eucalyptus crebra*, *Eucalyptus tereticornis* and *Corymbia intermedia* over a low open woodland of *Corymbia citriodora*, *Eucalyptus crebra*, *Allocasuarina torulosa* and *Angophora floribunda* over an open shrubland of *Macrozamia macleayi*, *Xanthorrhoea johnsonii* and *Cycas megacarpa* over an open tussock grassland of *Themeda triandra*, *Heteropogon contortus*, *Aristida latifolia* and *Lomandra* spp.**	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	1,416.9	
Area in Disturbance Footprint (ha)	160.2	
Structure (m)	T1 (18-27 m) T2 (8-12 m) S1 (1-2 m) G (<0.5 m)	
Significant species	Habitat for *Cycas megacarpa*	

<table>
<tr><th>11.11.3c</th><th colspan="2">Woodland of Eucalyptus moluccana, Eucalyptus acmenoides, Eucalyptus crebra and Corymbia citriodora over a low woodland of Lophostemon suaveolens, Allocasuarina torulosa and Lophostemon confertus over an open shrubland of Xanthorrhoea johnsonii, Macrozamia spp., Jacksonia scoparia and Breynia oblongifolia over an open tussock grassland of Heteropogon contortus, Themeda triandra, Arundinella nepalensis, Gahnia aspera and *Stylosanthes scabra.</th></tr>
<tr><td>VM Act Status</td><td>Least Concern</td><td rowspan="5"></td></tr>
<tr><td>EPBC Act Status</td><td>NA</td></tr>
<tr><td>Area in the Ground-truthed Mapping Extent (ha)</td><td>152.5</td></tr>
<tr><td>Area in Disturbance Footprint (ha)</td><td>23.8</td></tr>
<tr><td>Structure (m)</td><td>T1 (16-19)
T2 (8-12)
S1 (2-5)
S2 (1-2)
G (<0.5)</td></tr>
<tr><td>Significant species</td><td colspan="2">Habitat for Cycas megacarpa</td></tr>
<tr><th>11.11.4a</th><th colspan="2">Open forest of Eucalyptus tereticornis, Eucalyptus acmenoides and Corymbia intermedia over a low woodland of Allocasuarina torulosa and Lophostemon confertus over a shrubland of Lophostemon confertus, Xanthorrhoea johnsonii and *Lantana camara tussock grassland of Heteropogon contortus, Arundinella nepalensis, Lomandra confertifolia, Gahnia aspera, Imperata cylindrica and Dianella caerulea.</th></tr>
<tr><td>VM Act Status</td><td>Least Concern</td><td rowspan="5"></td></tr>
<tr><td>EPBC Act Status</td><td>NA</td></tr>
<tr><td>Area in Ground-truthed Mapping Extent (ha)</td><td>54.6</td></tr>
<tr><td>Area in Disturbance Footprint (ha)</td><td>14.1</td></tr>
<tr><td>Structure (m)</td><td>T1 (12-19)
T2 (5-8)
S1 (1-3)
G (<0.5)</td></tr>
<tr><td>Significant species</td><td colspan="2">Habitat for Cycas megacarpa</td></tr>
</table>

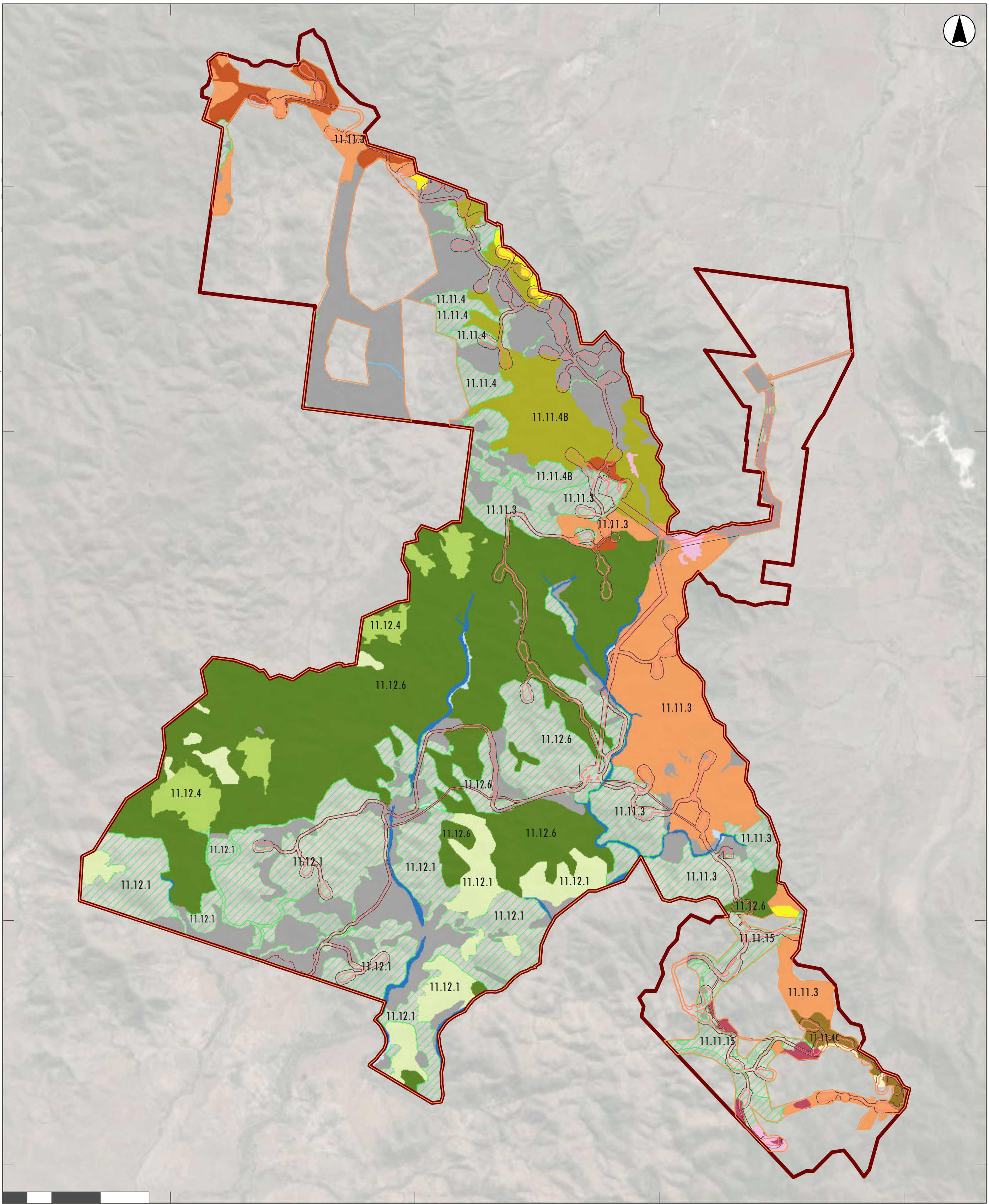
11.11.4b	**Open forest of *Eucalyptus acmenoides*, *Eucalyptus crebra* and *Eucalyptus moluccana* over a low open woodland of *Eucalyptus acmenoides*, *Eucalyptus crebra* and *Allocasuarina torulosa* over an open shrubland of *Acacia leiocalyx* over an open tussock grassland of *Themeda triandra*, *Heteropogon contortus*, *Cymbopogon refractus*, *Aristida latifolia*, *Arundinella nepalensis*, *Lomandra confertifolia* and *Glycine tomentella***	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	642.9	
Area in Disturbance Footprint (ha)	40.4	
Structure (m)	T1 (12-17 m) T2 (5-8 m) S1 (1-2 m) G (<0.5 m)	
Significant species	Habitat for *Cycas megacarpa*	
11.11.4c	**Woodland to open forest of *Eucalyptus moluccana*, *Eucalyptus crebra* and *Corymbia citriodora* over an open woodland of *Eucalyptus moluccana* and *Corymbia citriodora* over an open shrubland of *Macrozamia macleayi* over an open tussock grassland of *Heteropogon contortus*, *Chrysopogon fallax* and *Glycine tomentella***	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	85.2	
Area in Disturbance Footprint (ha)	29.6	
Structure (m)	T1 (12-18) T2 (5-8) S1 (1-2) G (<0.5)	
Significant species	Habitat for *C. megacarpa*	

11.11.5a	**Closed forest of *Euroschinus falcatus* var. *falcatus*, *Dysoxylum gaudichaudianum*, *Polyscias elegans* and *Ficus* spp. over a tall shrubland of *Mallotus mollissimus*, *Polyscias elegans* and *Glochidion lobocarpum* over an open scrub of *Alyxia ruscifolia*, *Pittosporum spinescens*, *Cassinia laevis*, *Jasminum didymum*, *Jasminum simplicifolium*, **Lantana camara*, *Smilax australis*, *Geitonoplesium cymosum*, *Strychnos psilosperma* over an open herbland of *Adiantum atroviride*, **Solanum seaforthianum* and *Gahnia aspera*.**	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	50.7	
Area in Disturbance Footprint (ha)	8.4	
Structure (m)	T1 (10-14) T2 (6-8) S1 (2-4) S2 (0.5-1.5) G (<1)	
Significant species	Habitat for *Cycas megacarpa* Potential habitat for *Hernandia bivalvis, Decaspermum struckoilicum, Cossinia australiana* and *Samadera bidwillii*	

11.12.6	**Woodland of *Corymbia citriodora* and *Eucalyptus crebra* over a low woodland of *Corymbia citriodora*, *Eucalyptus crebra* and *Eucalyptus exserta* over a tall shrubland of *Lophostemon confertus* over an open shrubland of *Acacia leiocalyx*, *Lophostemon confertus*, *Acacia disparrima*, *Jacksonia scoparia* and *Alphitonia excelsa* over an open tussock grassland of *Chrysopogon fallax*, *Heteropogon contortus*, *Aristida latifolia*, *Gahnia aspera* and *Desmodium rhytidophyllum***	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	3,497.3	
Area in Disturbance Footprint (ha)	75.0	
Structure (m)	T1 (14-19) T2 (6-12) S1 (2-5) S2 (0.5-1.5) G (<0.5)	
Significant species	Habitat for *Cycas megacarpa*	

11.11.4	Woodland to open forest of *Eucalyptus crebra* and *Corymbia citriodora* over a low open woodland of *Eucalyptus crebra* over an open shrubland of *Macrozamia macleayii* over a tussock grassland of *Heteropogon contortus*, *Glycine tomentella* and *Indigofera pratensis*.	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	14.9	
Area in Disturbance Footprint (ha)	6.0	
Structure (m)	T1 (12-16) T2 (3-5) S1(1-2) G (<0.5)	
Significant species	Habitat for *Cycas megacarpa*	

11.11.15	Woodland to open woodland of *Eucalyptus crebra* over an open sub-canopy of *Corymbia erythrophloia* and *Euroschinus falcatus* over a sparse shrub layer comprising *Acacia decora, Alphitonia excelsa, Santalum lanceolatum.* Ground layer species include *Chrysopogon fallax, Evolvulus alsinoides, Gahnia aspera, Malvastrum americanum var. americanum** , *Melinis repens* and *Sida hackettiana*	
VM Act Status	Least Concern	
EPBC Act Status	NA	
Area in the Ground-truthed Mapping Extent (ha)	46.6	
Area in Disturbance Footprint (ha)	10.9	
Structure (m)	T1 (8–18) S1 (1-4) G (<0.5)	
Significant species	Habitat for *Cycas megacarpa*	



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Scale 1:110000 at A4

Legend

- Study Area
- Ground Truthed Survey Extent
- Development Corridor
- Disturbance Footprint
- Regrowth

Groud Truthed Regional Ecosystems

- 11.3.4
- 11.3.25
- 11.3.25b
- 11.11.3
- 11.11.3c
- 11.11.4
- 11.11.4a
- 11.11.4b
- 11.11.4c
- 11.11.5a
- 11.11.15
- 12.12.1
- 11.12.4
- 11.12.6
- Regrowth
- Non remnant

FIGURE 4.8

Field Verified Regional Ecosystems

Image Source: ESRI Basemap Data source: Umwelt (2021)

4.3 Likelihood of Occurrence Assessment

The results of the likelihood of occurrence assessment identified one threatened flora species as 'known' to occur (identified during the field surveys), one species as having a 'high' potential for occurrence and four species having a 'moderate' potential for occurrence (**Table 4.8**). No TECs were considered likely to occur within the Study Area. Threatened species and communities assigned an 'unlikely' or 'low' likelihood of occurrence have been excluded from further assessment.

The full likelihood of occurrence assessment is provided in **Appendix B**.

Table 4.8 Key Likelihood of Occurrence Assessment Results

Family	Species	EPBC Act Status	NC Act Status
Known			
Cycadaceae	*Cycas megacarpa*	Endangered	Endangered
High			
Hernandiaceae	*Hernandia bivalvis*	Not Listed	Near Threatened
Moderate			
Myrtaceae	*Decaspermum struckoilicum*	Endangered	Endangered
Sapindaceae	*Cossinia australiana*	Endangered,	Endangered
Simaroubaceae	*Samadera bidwillii*	Vulnerable	Vulnerable
Combretaceae	*Dansiea elliptica*	Not Listed	Near Threatened

4.4 Threatened Flora Habitat Mapping

Habitat mapping was completed for four flora species listed as Endangered or Vulnerable under the EPBC Act or NC Act that are known or have a moderate or high likelihood of occurring within the Study Area. Ground-truthed regional ecosystems mapped within the Study Area were used to characterise threatened species habitat. Particular habitat requirements of each species were used to further refine habitat mapping. **Table 4.9** below details the habitat criteria used for each threatened species occurring and potentially occurring within the Study Area. Habitat mapping for Endangered and Vulnerable species is provided in **Appendix C**.

Table 4.9 Habitat Mapping Rules for Known and Potentially Occurring Threatened Flora Species

Family	Species	Habitat Mapping Criteria
Cycadaceae	*Cycas megacarpa*	Remnant and regrowth REs and non-remnant areas. See Section 3.4.1.2 for description on how known habitat has been mapped, which in places (confirmed) is limited to 80 m buffer on recorded individuals. For the predicted density distribution see **Figure 4.7**.
Myrtaceae	*Decaspermum struckoilicum*	REs 11.11.5a, 11.12.4 in remnant condition, below 300 m AHD.
Sapindaceae	*Cossinia australiana*	REs 11.11.5a, 11.12.4 in remnant condition where they occur at elevations between 20 m and 520 m AHD.
Simaroubaceae	*Samadera bidwillii*	All remnant forest and woodland communities below 510 m AHD.

4.5 Matters of State Environmental Significance

The following MSES, as described in Schedule 2 of the Environmental Offset Regulation 2014, that relate to flora and vegetation are mapped and/or have been identified through the field survey program within the Disturbance Footprint and Development Corridor:

- Regulated vegetation (within a Category B area on the Regulated Vegetation Management map) that is:
  - Remnant vegetation comprising an Of Concern or Endangered RE
  - Remnant vegetation within a defined distance from the defining bank of a watercourse
  - Essential Habitat as identified on the Essential Habitat map (*Cycas megacarpa* and *Hernandia bivalvis*) (**Figure 4.6**).
- Protected wildlife habitat or potential wildlife habitat for a plant that is 'endangered wildlife' or 'vulnerable wildlife':
  - *Cycas megacarpa* (Known to occur)
  - *Decaspermum struckoilicum* (Moderate likelihood of occurrence)
  - *Cossinia australiana* (Moderate likelihood of occurrence)
  - *Samadera bidwillii* (Moderate likelihood of occurrence).

The MSES outlined above are considered the relevant prescribed matters for Projects requiring approval under the State *Planning Act 2016*. An assessment of Project impacts on these MSES values against the *Significant Residual Impact Guidelines* has been undertaken to determine whether a significant residual impact is anticipated (**Appendix C**).

It should be noted that other MSES values also occur within the Disturbance Footprint and Development Corridor (i.e. protected wildlife habitat comprising an area/s that is shown as a high risk area on the flora survey trigger map), however these do not require assessment as per the *Significant Residual Impact Guidelines* (The Department of State Development, Infrastructure and Planning, 2014).

5.0 Potential Impacts

Potential impacts to flora and vegetation values may occur during both the construction and operation/maintenance phases of the Project, and may be either direct impacts (e.g. through direct vegetation loss) or indirect impacts (e.g. through introduction of weeds).

The Disturbance Footprint, which occupies a subset of the Disturbance Footprint, has been used as the assessment unit when undertaking the assessment of direct impacts. The extent of clearing represented by the Disturbance Footprint is considered to be a 'worst-case' scenario. When assessing potential indirect impacts resulting from the Project, the Disturbance Footprint and the wider surrounding area have been considered. This area, along with the Project's Development Corridor and supporting infrastructure layout is provided in **Figure 5.1.**

5.1 Construction Impacts

The construction phase of the Project will involve the installation of the wind turbines, access tracks, underground cables, and other associated infrastructure. It is the phase when the most significant impacts to flora and vegetation values will occur, as it involves the direct removal of individual flora species and habitat.

5.1.1 Direct Impacts

5.1.1.1 Vegetation Clearance

Based on the current Disturbance Footprint and field-validated vegetation mapping, the Project will result in the disturbance of up to 377.7 ha of remnant vegetation. Through a preliminary ecological constraint's analysis (**Section 6.1.1**) the majority of RE 11.3.4 (the only Of Concern RE verified within the Ground-truthed Mapping Extent) was able to be avoided with the remaining remnant 10 REs predicted to be impacted listed Least Concern. **Table 5.1** identifies the potential extent of disturbance to each RE (in remnant condition only). All REs to be directly impacted are Least Concern under the VM Act except one (RE 11.3.4) and none correspond to a TEC under the EPBC Act.

While the clearance of remnant vegetation is unavoidable within the Disturbance Footprint, there are a range of measures that will be implemented to minimise the magnitude of impact from clearing. Clearing will be staged and completed only be completed as strictly necessary. To maximise avoidance and minimisation opportunities, Project infrastructure will be micro-sited within the Development Corridor, guided by the results of pre-clearance surveys and a Project Vegetation Management Plan (**Section 6.2**). For the full range of avoidance, mitigation and management measures, see **Section 6.2.**

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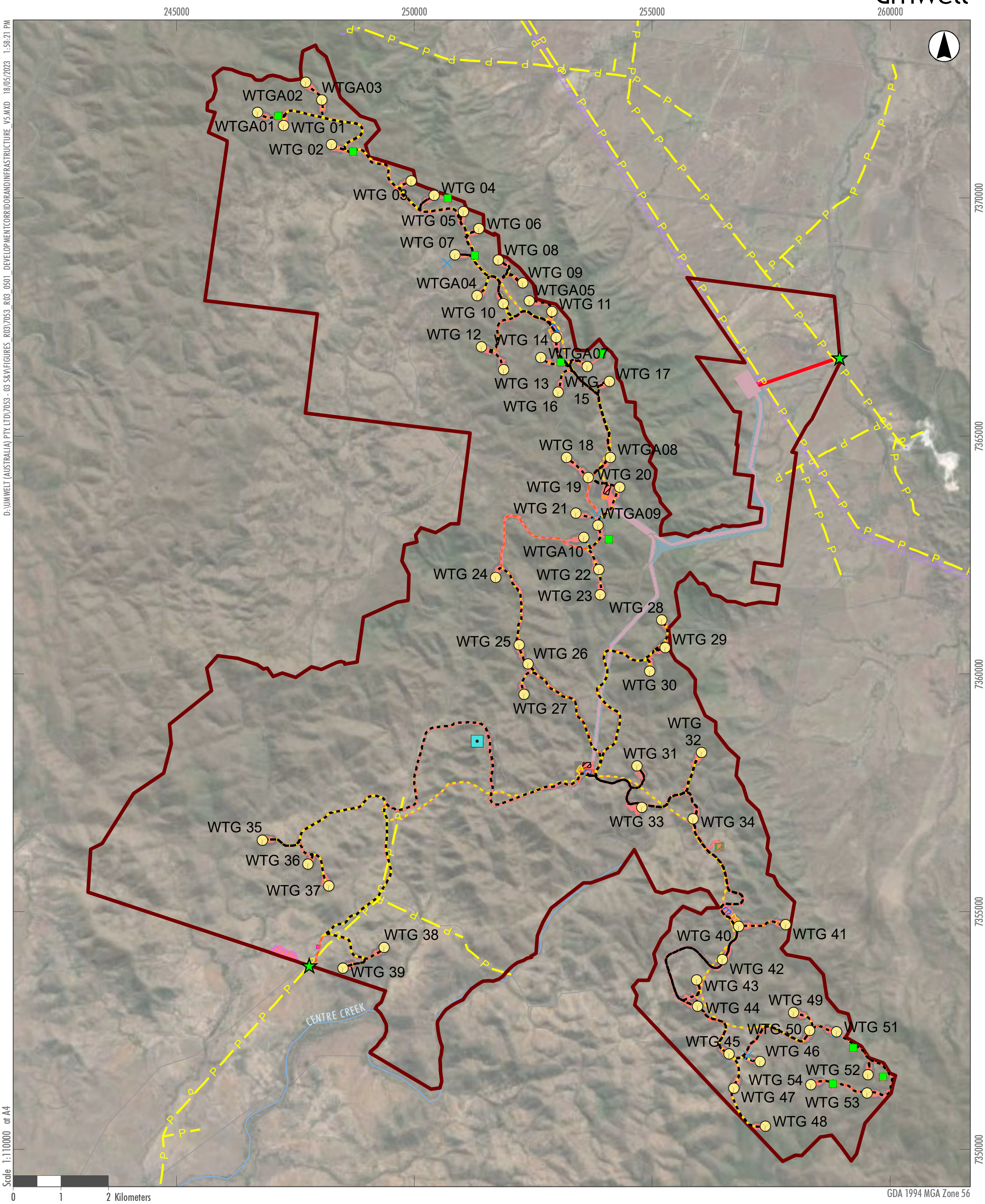

Legend

- Study Area
- Project Site (Development Corridor)
- Disturbance Footprint
- HV Electricity Network
- Easements

Proposed Project Infrastructure

- Site Access
- Access Road
- Overhead Line
- Underground Line
- Compound
- Concrete Batching Plant
- Construction Camp
- Laydown
- Operation and Maintenance Area
- Site Entry
- Substation
- Transmission Infrastructure
- Grid Connection Easement
- Access
- Temporary Met Masts
- Permanent Met Masts
- Turbines

Existing Project Infrastructure

- Existing Met Mast

FIGURE 5.1

Development Corridor and Infrastructure Layout

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

Table 5.1 Potential Impact to REs in Remnant Condition as per Field-validated Vegetation Mapping

Regional Ecosystem	VM Act Status	Area (ha) in Disturbance Footprint	Area (ha) in Development Corridor
11.3.25b	Least Concern	3.3	4.1
11.3.4	Of Concern	0.4	0.6
11.11.3	Least Concern	160.2	249.7
11.11.3c	Least Concern	23.8	38.6
11.11.4	Least Concern	6.0	11.3
11.11.4a	Least Concern	14.1	22.5
11.11.4b	Least Concern	40.4	69.4
11.11.4c	Least Concern	29.6	44.6
11.11.5a	Least Concern	8.4	20.9
11.11.15	Least Concern	10.9	15.7
11.12.6	Least Concern	75.0	116.6
Total Area		**372.0**	**594.0**

5.1.1.2 Regulated Vegetation

The regulated vegetation categories and respective areas within the Disturbance Footprint and Development Corridor as per the Regulated Vegetation Management map (Version 6.05) are provided below in **Table 5.2**.

Table 5.2 Potential Impacts to Regulated Vegetation

Regulated Vegetation Categories	Area (ha) within the Disturbance Footprint	Area (ha) within the Development Corridor
Category B – Remnant vegetation	323.9	519.9
Category C – High value regrowth	3.5	4.1
Category R – Regrowth within 50 m of a watercourse or drainage feature in the Great Barrier Reef catchment	3.6	5.6
Category X - Exempt clearing work on Freehold, Indigenous and Leasehold land	546.5	817.7

5.1.1.3 Threatened Species

Cycas megacarpa

The field surveys targeted habitat for *Cycas megacarpa* and conducted plot-based counts of individuals as well as rapid density visual estimates. Using this approach, an actual count of individuals is obtained (recognised as lower bound) and allows for an estimation of distribution, undertaken spatially using an IDW interpolation algorithm (see **Section 3.4.1**).

The results of this assessment are summarised below in **Table 5.3** and **Table 5.4.**

Table 5.3 *Cycas megacarpa* Individuals

Project Area	Projected Count (Individuals)
Study Area	159,915
Development Corridor	6,709
Disturbance Footprint	4,131

Table 5.4 *Cycas megacarpa* Density Summary

Density Category (per 0.25 ha)	Study Area[1]	Development Corridor[2]	Disturbance Footprint[2]
High (25-50 individuals)	74.9 ha	0.9 ha	0.7 ha
Moderate (10-25 individuals)	960.8 ha	29.6 ha	16.8 ha
Low (1-10 individuals)	5,365.7 ha	301.5 ha	195.7 ha

[1] Study Area values have been corrected by a factor of 0.5-0.7 to provide contextual comparison with development corridor, for with IDW outputs have been clipped to the known (confirmed) and known (suspected) habitat area.
[2] IDW outputs clipped to areas of mapped known (confirmed) and known (suspected) habitat area

The habitat mapping identified a total of 360.7 ha of known habitat within the Disturbance Footprint comprising 213.0 ha of known (confirmed) and 147.7 ha of known (suspected) habitat.

The Disturbance Footprint will require vegetation clearing to allow for construction of the Project. However, a number of mitigation measures for this species specifically including but not limited to, translocation, are proposed to ensure not net loss of individuals (see **Section 6.2**). Nonetheless, it is acknowledged that approximately 360.7 ha of known (confirmed and suspected) habitat for the species will be removed.

The population of *Cycas megacarpa* within the Study Area is considered an 'important population' and the habitat 'critical to the survival of the species'. A Significant Residual Impact (SRI) assessment has been completed (**Appendix C**) and after avoidance, mitigation and management measures have been considered (**Section 6.2.2**) it is considered 'Likely' that the Project will have a SRI on this species.

Species with a High to Moderate Likelihood of Occurring

Four additional threatened species have a High to Moderate likelihood of occurring within the Disturbance Footprint. The potential habitat and extent of disturbance for these species is provided in **Table 5.5**.
It should be noted that habitat mapping criteria have been updated from the original submission due to DCCEEW mapping requirements for the Preliminary Documentation. As such, the extent of potential habitat for these flora species has been updated accordingly.

Significant Residual Impact (SRI) assessments for these species have been completed (**Appendix C**) and after avoidance and mitigation measures have been considered (**Section 6.2.2**) it is considered 'Unlikely' that the Project will have a SRI on these species.

Table 5.5 Potential Impact to Threatened Flora Habitat

Species	Status[1] (EPBC Act, NC Act)	Identified Suitable Habitat	Area (ha) of Habitat Within the Ground Truthed Mapping Extent	Area (ha) of Habitat Within the Development Corridor	Area (ha) of Habitat Within the Disturbance Footprint
High					
Hernandia bivalvis	-, NT	REs 11.11.5a, 11.12.4 in remnant condition	330.3	20.4	8.3
Moderate					
Dansiea elliptica	-, NT	REs 11.11.5a, 11.12.4 in remnant condition	330.3	20.4	8.3
Decaspermum struckoilicum	E, E	REs 11.11.5a, 11.12.4 in remnant condition, below 300 m AHD.	39.1	6.0	2.1
Cossinia australiana	E, E	REs 11.11.5a, 11.12.4 in remnant condition where they occur at elevations between 20 m and 520 m AHD.	330.3	20.4	8.3
Samadera bidwillii	V, V	All remnant forest and woodland communities below 510 m AHD.	6,681.9	462.1	284.0

[1] V = Vulnerable, E = Endangered, NT = Near Threatened (NC Act only)

5.1.2 Indirect Impacts

5.1.2.1 Introduction and/or Spread of Weeds

Introduction and/or spread of weeds is a major indirect impact that can impact the integrity of remaining vegetation, increase the intensity and/or frequency of fires, as well as threaten the long-term survival of threatened flora species.

Within the Study Area weed species are common within the cleared and regrowth areas of the site as well as sporadically throughout the remnant vegetation. The weed species that pose the biggest threat to flora and vegetation values are the Category 3 ‘restricted’ species listed under the Biosecurity Act, WoNS, as well as high-biomass grass species. High-biomass grass species can out-compete native vegetation as well as reduce the germination of native species. The high-biomass of these species also increases the intensity and/or frequency of fires.

The weed species that pose the biggest threat to flora and vegetation values are:

Category 3 restricted weed species:

- Lantana (*Lantana camara*)
- Prickly pear (*Opuntia stricta*)
- Velvety pear (*Opuntia tomentosa*)
- Rubber vine (*Cryptostegia grandiflora*)
- Parthenium (*Parthenium hysterophorus*).

High-biomass grass species:

- Green panic (*Megathyrsus maximus* var. *maximus*)
- Buffel grass (*Cenchrus ciliaris*).

Actively removing and managing these species within the Development Corridor and preventing the introduction of additional weed species may prevent indirect impacts to flora and vegetation values. Weed management measures are discussed in **Section 6.2.3**.

5.1.2.2 Edge Effects

Edge effects in ecology are identified as any difference in environment between the edge and interior of a particular vegetation patch (Murcia 1995). Environmental characteristics which differ across edges cover many components of the environment including atmosphere (e.g. microclimate), vegetation (e.g., structure, composition, functioning), fauna and their habitat and soil (Murcia 1995).

Edges and their effects can be created through clearing of vegetation, such as new edges created by roads. The distance the effect spreads from the edge, known as edge permeability, can be highly variable and depends upon many factors such as vulnerability of the ecosystems, degree of change in land use, intensity of this use and chance events (Murcia 1995).

The main environmental impacts to new edges created by the Project are considered to include:

- Modification of microclimate where new edges are created due to greater penetration of light and wind into the vegetation. Temperature extremes are greater, and humidity of air is generally less at the edge than in the interior of vegetation. This effect is known to increase in size if vegetation is dense or cover is high.
- Physical disturbance to vegetation at the edge. Ongoing damage to the edge of vegetation may occur due to grading and weed control of road edges and vehicle use. Similarly, unsealed tracks can facilitate an increase incident of fire ignitions.
- Changes to soil properties including compaction of the soil, less organic matter and more erodible.
- Introduction of weeds and pathogens through mud and dirt which falls off vehicles.
- Changes to vegetation through the above listed impacts.

Many of these potential environmental impacts including introduction of weeds and physical disturbance to vegetation can be managed through good site practices and vehicle restrictions. Rehabilitation of areas no longer used for construction activities will further reduce potential impacts. Measures to manage potential impacts are provided in **Section 6.2.**

The vine thicket communities are considered particularly sensitive to edge effects due to a dense community structure. For these communities it is recommended that a vegetated buffer of up to 5 m be retained to reduce potential impacts of edge effects.

5.1.2.3 Soil Erosion and Sedimentation

Removal of vegetation and disturbance to the soil profile through clearing and construction activities can lead to soil erosion, which in turn can lead to increased input of sediment into waterways. Increased sediment in waterways can lead to siltation of watercourses and a reduction in water quality of creeks, rivers, and coastal areas.

Through erosion, important topsoil can be lost, leading to exposure of subsoil, which often has poor physical and chemical properties.

5.1.2.4 Dust Impacts

Soil exposed through vegetation clearance can lead to dust generation, which in turn settles on adjacent vegetation. Dust impacts to vegetation are understudies, but are dependent on the type of vegetation, type of dust (chemical properties, grain size) and total dust load settling on the vegetation.

Dust impacts from the Project are expected to be restricted to vegetation directly adjacent to the access tracks where soil is exposed and can be disturbed through vehicle movement. The dust will be chemically inert, and as such, any potential impacts will be physical in nature, such as blocking of plant stomata and reduction in light penetration to the leaf surface, potentially reducing photosynthetic capacity. This may lead to a reduction in the health and vigour of vegetation directly adjacent to the road.

5.2 Operation/Maintenance Impacts

Impacts to flora and vegetation values associated with maintenance and access of the infrastructure during the operation and maintenance phases of the Project are expected to be minimal and relate primarily to the following indirect impacts:

- Weed introduction and spread
- Edge effects
- Erosion and sedimentation
- Dust impacts.

It is expected that these impacts can be managed through the mitigation and management measures provided in **Section 6.20**.

6.0 Avoidance, Mitigation and Management

The hierarchy of avoid, minimise, and mitigate has been applied to the design process for the Project, with the field survey findings incorporated into the Development Corridor design. This section describes the avoidance, mitigation and management measures proposed to reduce the potential Project on flora values. Where significant residual impacts remain following implementation of mitigation measures, these impacts will need to be offset.

6.1 Avoidance

6.1.1 Ecological Constraint Analysis

The Development Corridor as shown within this report, has been subject to an ecological constraint analysis, the purpose of which was to identify flora and fauna values of high ecological significance to be avoided as part of the Development Corridor. The ecological constraints analysis was largely structured around the legislative status of each ecological value.

The main priority flora value that was considered as part of this process was areas of high-density *C. megacarpa*, with the risk rating of all values shown in **Table 6.1**. Through this process, most (96%) of the high-density *C. megacarpa* areas have been avoided and it is considered through the micro-siting process that this impact can be further reduced. Areas of the Of Concern RE 11.3.4 were also avoided through this process.

Table 6.1 Constraint Risk Categories

Constraint	Constraint Value	Constraint Category
Cycas megacarpa	High density	Very High
	Moderate density	High
	Low density	Moderate
Regional Ecosystems (REs)	Of Concern	Moderate
	Least Concern	Low
	Non-remnant	Limited
High Value Regrowth REs	Of Concern	Low
	Least Concern	Limited

Constraint	Constraint Value	Constraint Category
Essential Habitat	Essential habitat	High
Protected Plants	High-risk trigger area	High

6.1.2 Micro-siting

Project infrastructure will be micro-sited within the Development Corridor based on the location of on-ground constraints including threatened species individuals and habitat. Additional field surveys specific to terrestrial ecology (as well as other types of constraints) will be conducted prior to construction, including pre-clearance surveys. This data will allow for increased accuracy and detail in mapped terrestrial ecological values within the Development Corridor. Ground-truthed ecological field data will strongly influence the final design of the Project, with the avoidance hierarchy principles in place. Future refinement of the Project will seek to avoid threatened species individuals and habitat, particularly species where significant impacts may occur.

Infrastructure micro-siting will aim to avoid or further minimise disturbance to:

- Habitat features required by fauna species including hollow bearing trees and stags, trees with diameter at breast height (DBH) >30 cm, large hollow logs and complex boulder piles.
- Large reproductive-age and mature female *Cycas megacarpa* individuals.
- Breeding habitat for threatened and migratory fauna species.
- Vine thicket communities.
- Riparian zones, including avoiding placement of turbines within 50 m of waterways.

Infrastructure micro-siting will prioritise the avoidance of threatened species and other conservation significant values not pre-approved for impact or translocation including, but not limited to, potentially occurring threatened flora. However, where a threatened flora species not previously known to the Study Area is encountered, the pre-clearance surveys constraints protocol will be enacted (see **Section 7.1.3**).

6.1.3 Pre-clearance Survey Constraint Protocol

This section defines an adaptive management response which is to be engaged if a threatened species not already known to occur within the Study Area is encountered during pre-clearance surveys or any other surveys undertaken prior to construction. The trigger to undertake the pre-clearance surveys constraint protocol is the observation of one or more individual of a flora species listed as threatened under the EPBC Act within the Disturbance Footprint during future surveys or construction. If either are to be found, the constraints protocol below will then be followed.

STEP 1: Halt construction/clearing activities in the area (i.e. adjacent areas within the Disturbance Footprint where suitable habitat is present – to be determined by a suitably qualified ecologist).

STEP 2: Undertake investigation into potential impacts on the species. This should include:

- Updating of habitat mapping.
- Updating of Significant Impact Assessment.
- Determination of avoidance and mitigation strategies.

STEP 3: Communicate outcomes with DCCEEW and DES as appropriate to determine next steps.

Where threatened species (NC Act or EPBC Act) and weed species have been identified then the following information will be recorded:

- GPS location.
- Collector, date and time.
- Species (scientific and common name).
- Number or density of individuals.
- Habit.
- Vegetation community in which it was recorded.
- General notes on the feature identified.
- Collect a reference specimen.

It is noted that should a threatened species listed only under the NC Act be encountered, potential impacts to this species will be managed in consultation with DES via the Protected Plants assessment process outlined in the Nature Conservation (Plants) Regulation 2020.

6.2 Mitigation and Management

Throughout the life of the Project, potential impacts on flora and vegetation values will be directly or indirectly managed via Project Management Plans. All mitigation and management measures will be captured in one or multiple of the Project Management Plans, listed below:

- Health, Safety and Environment Management Plan (HSE Plan)
- Construction Environmental Management Plan (CEMP)
- *Cycas megacarpa* Species Management Plan (SMP)
- Vegetation Management Plan (VMP)
- Erosion and Sediment Control Plan (ESCP)
- Decommissioning Management Plan

- *Cycas megacarpa* Translocation Management Plan
- Weed and Pest Management Plan (WPMP)
- Rehabilitation Management Plan (RMP)
- Bushfire Management Plan (BMP).

All plans will be finalised prior to construction commencing.

6.2.1 Vegetation Clearance

To reduce impacts to remnant vegetation as a result of vegetation clearance, the Project will utilise a VMP which will be prepared prior to construction commencing. Vegetation management measures will include:

- Site preparation must include the demarcation of areas to be cleared as well as 'no-go' zones to avoid inadvertent clearing.
- Pre-clearance surveys in areas of potential threatened flora habitat will include targeted searches for these species.
- Micro-siting of Project infrastructure will maximise the use of existing breaks in vegetation and areas of previously cleared land as much as practical.
- Micro-siting of Project infrastructure will aim to retain a vegetated buffer around the vine thicket communities up to 5 m, to limit edge effects. In cases where the final Disturbance Footprint intersects the vine thicket communities, a 5 m buffer will not be possible.
- Where watercourses intersect linear areas of the Project (i.e., access tracks and reticulation cabling) the clearing width will be reduced to 25 m or less wherever it is feasible. The full implementation of this measure is subject to final design and safe transport of Project components.
- To minimise further loss of vegetation, trees will be felled away from areas of retained vegetation where practicable. Where trees unavoidably fall into retained areas, they will be left in-situ to mimic natural tree fall and provide habitat for ground-dwelling fauna.
- Dust suppression measures will be implemented as required i.e., on high wind days during extended dry periods.

6.2.2 Threatened Species

Several measures will be put in place to reduce the impact to threatened species, these include:

- Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for the respective potentially occurring threatened flora species. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated. The pre-clearance survey constraints protocol (see **Section 6.1.3**) will then be followed to ensure any potential impacts on the species (which are also listed under the EPBC Act) are avoided or managed appropriately.

- The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should direct impacts be anticipated as a result of the Project within 100 m of high risk trigger areas or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines, and if necessary an impact management plan will be developed and implemented.
  - A protected plants clearing permit for *Cycas megacarpa* has been acquired for the proposed geo-technical investigations.

For *Cycas megacarpa*, measures include:

- Pre-clearance surveys for *Cycas megacarpa* will occur across the Disturbance Footprint plus a 5 m buffer to confirm the location, extent, numbers, and age class of the population within the clearing extent, with all efforts made to avoid impacts via micro-siting to high-density areas and large reproductive-age individuals.
- A pre-approved *Cycas megacarpa* SMP will be implemented through all Project phases. This plan will provide detailed information regarding:
  - Species information including a description to aid identification.
  - Mitigation and management methods, including corrective actions.
  - Vegetation clearing requirements and methods to reduce impacts to surrounding individuals and their habitat.
  - Specific weed management measures to reduce impacts on the long-term integrity of the remaining habitat and population including high-biomass weeds.
  - Erosion, sedimentation, and dust management requirements specific to the species.
  - A pre-approved translocation plan will be implemented for individuals that would otherwise be removed through clearing for the Project. The plan will specify pre and post monitoring requirements, translocation and propagation methods and protocols and reporting requirements and performance criteria.

6.2.3 Weed Management

Management of the spread or introduction of weeds is a major indirect potential impact of the Project, which can impact the integrity and longevity of vegetation communities and threatened species. It is considered that the risk of these potential impacts can be appropriately mitigated and managed through appropriate site management practices.

A WPMP will be developed and implemented that includes the following measures:

- Identification and location of restricted weeds and high-biomass grasses within the Development Corridor.
- Removal and/or treatment of restricted weeds and high-biomass grasses from the Development Corridor prior to ground disturbance.

- The origin of construction materials, machinery and equipment will be identified to mitigate introduction of weed species.
- Vehicles and machinery must follow hygiene protocols to prevent introduction of new weed species.
- Staff and contractors must be equipped with information on the location of biosecurity threats.
- Management methods to control spread of weeds considered to be Restricted Matters must be in keeping with regional management practice or Queensland Department of Agriculture and Fisheries pest control prescriptions.
- Promote the awareness of weed management, by inclusion of weed issues, pictures, and procedures into the Project's site induction program.
- Appropriate weed monitoring to identify spread of existing weeds and any new incidence of weeds.
- Reporting requirements and performance measures.

6.2.4 Other

- To minimise soil loss, best practice erosion and sediment control measures will be implemented during construction via the Preliminary Erosion and Sediment Control Plan (Attachment H of the Preliminary Documentation):
    - Disturbed areas will be assessed and progressively rehabilitated in accordance with the VMP and / or RMP.
    - Disturbed areas will be assessed and progressively rehabilitated in accordance with the RMP (to be developed in response to the State approval) and/or the Preliminary VMP.
    - Batters and embankments will be stabilised as soon as practical after construction.
- Undertake refuelling and chemical storage in designated containment areas and follow emergency response procedures in the event of a spill. Containment areas will be designed and managed in accordance with relevant regulatory requirements and standard.
- Threat of wildfire caused by Project activities will be minimised through maintenance of firebreaks around ignition sources as appropriate according to the BMP which will be prepared prior to construction.
- Where a watercourse crossing must be established, the crossing site will be the most direct route (i.e., 90 ± 10-degree angle to the watercourse) that maximises the use of existing vegetation breaks and minimises clearing.

6.3 Rehabilitate

The Disturbance Footprint includes a number of linear sections associated with access tracks and supporting ancillary infrastructure such as communication and power cable lines. Linear sections of the Disturbance Footprint vary in width but in some locations span approximately 100 m; these widths have been deemed necessary for the safe transport and installation of turbine infrastructure. Excluding established access tracks and fire safety Asset Protection Zones, which at all times will need to remain free of vegetation, previously cleared, linear areas will be reclaimed and rehabilitated. Further to this, all areas of temporary ancillary infrastructure will also be subject to rehabilitation efforts including:

- Laydown areas
- Concrete batching plants
- Construction compound
- Temporary workers accommodation camp.

Prior to construction commencing, a RMP will be developed and approved which outlines the specific objectives and plan for rehabilitation. With current design details, it is estimated approximately 20% of the total Disturbance Footprint (i.e. the area that will be cleared for the Project) may be able to be rehabilitated following construction. This equates to approximately 180 ha of native vegetation being rehabilitated. Rehabilitation will include the planting of native species known to the region, consistent with the characteristics of surrounding retained vegetation.

7.0 Significant Residual Impact Assessment

SRI assessments were undertaken for the MSES that occur within the Disturbance Footprint (**Appendix C**). This assessment identified that, after avoidance and mitigation measures were considered, the Project is 'Likely' to have a SRI on the following flora / vegetation values:

- Regulated vegetation containing Essential Habitat for *Cycas megacarpa* and *Hernandia bivalvis.*
- Protected wildlife habitat for *Cycas megacarpa*.

It should be noted, that while Essential Habitat is mapped for both *Cycas megacarpa* and *Hernandia bivalvis*, the field survey did not identify any appropriate habitat for *H. bivalvis* within the mapped Essential Habitat extent that covers the Study Area.

7.1 Offset Requirements

To compensate for significant residual impacts on two MSES values (regulated vegetation containing Essential Habitat areas and Protected Wildlife Habitat for *Cycas megacarpa*), offsets are likely to be required.

Cycas megacarpa is listed as Endangered under the Commonwealth EPBC Act and is therefore considered a MNES. The Project, including a description of the potential impacts to *Cycas megacarpa*, has been referred to the Commonwealth for assessment under the EPBC Act and is currently in the final stages of Preliminary Documentation assessment. In this assessment, it was determined that a significant impact on *Cycas megacarpa* was likely to occur as a result of habitat loss and as such Commonwealth offsets are required. Under this scenario, offsets relating to *Cycas megacarpa* protected wildlife habitat will not be required under the State *Environmental Offsets Act 2014*.

Regardless of the Project's determination under the EPBC Act, offset requirements for the State matter of regulated vegetation containing Essential Habitat areas will need to be considered under the State *Environmental Offsets Act 2014*.

7.1.1 Offset Pathways

The provision of offsets under the *Environmental Offsets Act 2014* can take various forms, including financial settlement offsets, proponent driven offsets or a combination of the two. These offset pathways are explained in the context of the Project below.

7.1.1.1 Financial Settlement

To offset the loss of Essential Habitat and *Cycas megacarpa* individuals and its habitat, a payment must be made to the Queensland Government's Offset Account. The financial settlement cost must be calculated using the Financial Settlement Offset Calculator. The following offset delivery forms must be submitted to DES:

- EOD1—Environmental Offsets Delivery Form 1: Notice of Election.
- EOD4—Environmental Offsets Delivery Form 4: Financial Settlement Details.

The Queensland Government is then responsible for delivering a conservation outcome from the financial settlement offset payment.

7.1.1.2 Proponent Driven Offset

A proponent driven offset is undertaken through a land-based offset, direct benefit management plan, or a combination of both. The land-based offset requirement is calculated using a 4x multiplier derived from the DES Land-based Offset Multiplier Calculator.

The suitability of a proposed offset site is measured by undertaking a Habitat Quality Assessment in accordance with the *Guide to Determining Terrestrial Habitat Quality* (version 1.3) (DES 2020) or an alternative approach approved by DES. The proponent driven offset must be undertaken in accordance with an approved Offset Delivery Plan.

The following offset delivery forms must be submitted to DES with the Offset Delivery Plan:

- EOD1—Environmental Offsets Delivery Form 1: Notice of Election.
- EOD2—Environmental Offsets Delivery Form 2: Offset Delivery Plan Details.
- EOD3—Environmental Offsets Delivery Form 3: Offset Area Details.
- EOD5—Environmental Offsets Delivery Form 5: Habitat Quality Details.

8.0 Conclusion

This report documents the findings of a flora and vegetation field survey program undertaken between 2019 and 2022 for the proposed Mount Hopeful Wind Farm Project. Findings from the field survey program identified the following floristic values within the Development Corridor and Disturbance Footprint:

- Fifteen REs including one (RE 11.3.4) which is listed Of Concern under the VM Act.
- One threatened flora species considered 'Known' to occur: the Endangered *Cycas megacarpa*, which was recorded within a variety of vegetation communities including areas of regrowth and non-remnant vegetation.
- Five threatened flora species with a 'High' to 'Moderate' likelihood of occurrence, including:
  - *Hernandia bivalvis* (-, NT)
  - *Dansiea elliptica* (-, NT)
  - *Decaspermum struckoilicum* (E, E)
  - *Cossinia australiana* (E, E)
  - *Samadera bidwillii* (V, V).
- Five 'Category B' restricted weed species under the Biosecurity Act, including:
  - Lantana (**Lantana camara*)
  - Prickly pear (**Opuntia stricta*)
  - Velvety pear (**Opuntia tomentosa*)
  - Rubber vine (**Cryptostegia grandiflora*)
  - Parthenium (**Parthenium hysterophorus*).
- Prescribed environmental matters (MSES) including:
  - Regulated vegetation containing Endangered or Of Concern REs
  - Regulated vegetation within a defined distance of a watercourse
  - Regulated vegetation containing mapped areas of Essential Habitat (*Cycas megacarpa* and *Hernandia bivalvis*)
  - Protected wildlife habitat for *Cycas megacarpa*, *Hernandia bivalvis*, *Decaspermum struckoilicum*, *Cossinia australiana* and *Samadera bidwillii.*

Based on the findings of the impact assessment, the following are considered the main impacts from the Project:

- Removal of up to 372.0 ha of ground-truthed remnant vegetation, of which 0.4 ha comprises Of Concern RE 11.3.4, with the remaining area comprising Least Concern REs as per the field validated vegetation mapping.

- Removal of up to 323.9 ha of remnant vegetation located within a Category B area on the Regulated Vegetation Management map, of which a maximum of 0.1 ha is associated with Of Concern REs (RE 11.3.4 and 11.3.2). The outcome of the SRI for Of Concern or Endangered RE indicates the Project is **Unlikely** to have a SRI on this value.

- Removal of up to 3.5 ha of Category C (high value regrowth) and 3.6 ha of Category R (Riverine) regulated vegetation identified on the Regulated Vegetation Management Map.

- Removal of up to 10.7 ha of remnant vegetation (within a Category B area) within the defined distance of a watercourse as per the Regulated Vegetation Management map. The outcome of the SRI for Remnant Vegetation Within the Defined Distance of a Watercourse indicates the Project is **Unlikely** to have a significant impact on this value.

- Removal of 22.5 ha of regulated vegetation containing mapped Essential Habitat for *Cycas megacarpa* and *Hernandia bivalvis*. The outcome of the SRI indicates the Project is **Likely** to have a SRI on *Cycas megacarpa* Essential Habitat.

- Disturbance to individuals and habitat of the Endangered *Cycas megacarpa.* The outcome of the SRI indicates the Project is **Likely** to have a SRI on this species.

- Disturbance to potential habitat of four threatened species considered to have a High-Moderate likelihood of occurring. The outcome of a SRI for the 'Vulnerable' and 'Endangered' species indicated that the Project is **Unlikely** to have the SRI on these species.

The hierarchy of avoid, minimise, and mitigate has been applied to the design process for the Project. The following avoidance, mitigation and management measures are proposed to further reduce potential impacts from the Project:

Avoid

Infrastructure micro-siting will aim to avoid or further minimise disturbance to:

- Habitat features required by fauna species including hollow bearing trees and stags, trees with diameter at breast height (DBH) >30 cm, large hollow logs and complex boulder piles.

- Large reproductive-age and mature female *Cycas megacarpa* individuals.

- Breeding habitat for threatened and migratory fauna species.

- Vine thicket communities.

- Riparian zones, including avoiding placement of turbines within 50 m of waterways.

Within the Development Footprint, pre-clearance surveys will be undertaken within suitable habitat for potentially occurring threatened species.

Mitigate and Manage

- A Preliminary VMP has been prepared to provide guidance on the requirements of vegetation management and protection.
- Where clearing is proposed in areas of mapped potential habitat, pre-clearance surveys will include searches for the respective potentially occurring threatened flora species. If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence must be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated. The pre-clearance survey constraints protocol (see **Section 6.1.3**) will then be followed to ensure any potential impacts on the species (which are also listed under the EPBC Act) are avoided or managed appropriately.
- The Nature Conservation (Plants) Regulation 2020 outlines the regulatory requirements for managing potential impacts on a protected plant. Should direct impacts as a result of the Project be anticipated within 100 m of high risk trigger areas or protected plant individuals, a protected plants permit will be required. The permit application will need to be supported by a protected plants assessment and survey in accordance with the guidelines, and if necessary an impact management plan will be developed and implemented.
- Pre-clearance surveys for *Cycas megacarpa* will occur across the Disturbance Footprint plus a 5 m buffer to confirm the location, extent, numbers, and age class of the population within the clearing extent, with all efforts made to avoid impacts via micro-siting to high-density areas and large reproductive-age individuals.
- A pre-approved *Cycas megacarpa* SMP will be implemented through all Project phases. This plan will provide detailed information regarding:
  - species information including a description to aid identification
  - mitigation and management methods, including corrective actions
  - vegetation clearing requirements and methods to reduce impacts to surrounding individuals and their habitat
  - specific weed management measures to reduce impacts on the long-term integrity of the remaining habitat and population including high-biomass weeds
  - erosion, sedimentation, and dust management requirements specific to the species.
- A pre-approved *Cycas megacarpa* Translocation Management Plan will be implemented for individuals that would otherwise be removed through clearing for the Project. The plan will specify pre and post monitoring requirements, translocation and propagation methods and protocols and reporting requirements and performance criteria.
- A WPMP will be prepared that documents the weed management requirements and protocols for the Project.
- An ESCP will be developed to prevent erosion and sedimentation from disturbed areas into waterways.

<u>Offsets</u>

For the MSES values that returned a **Likely** SRI, it is anticipated that offsets will be required to compensate for this residual impact. For State matters, offsets can be in the form of either financial offsets or proponent driven offsets. The requirement for offsets will be determined following the detailed design of the Project and will be administered in accordance with the *Environmental Offsets Act 2014*.

Cycas megacarpa is listed as Endangered under the Commonwealth EPBC Act and is therefore considered a MNES. The Preliminary Documentation assessment used to inform the EPBC Act approval, although not yet finalised, states that a significant impact on *Cycas megacarpa* is likely to occur as a result of habitat loss. As such, Commonwealth offsets are likely to be required and a preliminary Offset Strategy has been developed. To avoid duplication of offsets between the two jurisdictions, offsets for impacts relating to *Cycas megacarpa* protected wildlife habitat are unlikely to be required under the State *Environmental Offsets Act 2014*.

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APPENDIX A

Flora Species

Table A.1 Flora species recorded during the field survey program

Family	Species	Common name	1Introduced Status	2NC Act Status	3EPBC Act Status
Acanthaceae	*Brunoniella australis*	blue trumpet		C	-
Amaranthaceae	*Achyranthes aspera*	-		C	-
	Alternanthera nana	hairy joyweed		C	-
Anacardiaceae	*Euroschinus falcatus* var. *falcatus*	-		C	-
	Pleiogynium timorense	Burdekin plum		C	-
Apocynaceae	*Alyxia ruscifolia*	-		C	-
	Cryptostegia grandiflora	rubber vine	*, C3, WoNS	-	-
	Gomphocarpus physocarpus	balloon cottonbush	*	-	-
Araliaceae	*Polyscias elegans*	celery wood		C	-
	Schefflera actinophylla	umbrella tree		C	-
Arecaceae	*Livistona decora*	-		C	-
Asteraceae	*Ageratum conyzoides* subsp. *conyzoides*	-	*	-	-
	Apowollastonia spilanthoides	-		C	-
	Bidens pilosa var. *pilosa*	-	*	-	-
	Cassinia laevis	-		C	-
	Cirsium vulgare	spear thistle	*	-	-
	Emilia sonchifolia	-	*	-	-
	Ozothamnus cassinioides	-		C	-
	Parthenium hysterophorus	parthenium	*, C3, WONS	-	-
	Pterocaulon sphacelatum	applebush		C	-
	Sonchus oleraceus	common sowthistle	*	-	-
	Sonchus sp.	-	*	-	-
Bignoniaceae	*Pandorea jasminoides*	-		C	-
Cactaceae	*Opuntia stricta*	-	*, C3, WoNS	-	-
	Opuntia tomentosa	velvety tree pear	*, C3, WoNS	-	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
Capparaceae	*Capparis* sp.	-		C	-
	Capparis canescens	-		C	-
	Capparis loranthifolia var. *loranthifolia*	-		C	-
Casuarinaceae	*Allocasuarina littoralis*	-		C	-
	Allocasuarina torulosa	-		C	-
	Casuarina cunninghamiana subsp. *cunninghamiana*	-		C	-
Celastraceae	*Denhamia celastroides*	broad-leaved boxwood		C	-
	Denhamia cunninghamii	-		C	-
	Denhamia disperma	-		C	-
Combretaceae	*Terminalia* sp.	-		C	-
Cycadaceae	*Cycas megacarpa*	-		E	E
Cyperaceae	*Fimbristylis dichotoma*	common fringe-rush		C	-
	Gahnia aspera	-		C	-
	Lepidosperma sp.	-		C	-
	Scleria brownii	-		C	-
Ebenaceae	*Diospyros geminata*	scaly ebony		C	-
Euphorbiaceae	*Acalypha eremorum*	soft acalypha		C	-
	Macaranga tanarius	macaranga		C	-
	Mallotus discolor	white kamala		C	-
	Mallotus mollissimus	-		C	-
	Mallotus philippensis	red kamala		C	-
	Phyllanthus virgatus	-		C	-
Fabaceae	*Desmodium gunnii*	-		C	-
	Desmodium macrocarpum	-		C	-
	Desmodium rhytidophyllum	-		C	-
	Desmodium varians	slender tick trefoil		C	-
	Erythrina vespertilio subsp. *vespertilio*	-		C	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
	Flemingia parviflora	flemingia		C	-
	Galactia tenuiflora	-		C	-
	Glycine cyrtoloba	-		C	-
	Glycine sp.	-		C	-
	Glycine tomentella	woolly glycine		C	-
	Hardenbergia violacea	-		C	-
	Indigofera pratensis	-		C	-
	Jacksonia scoparia	-		C	-
	Macroptilium atropurpureum	siratro	*	-	-
	Stylosanthes scabra	-	*	-	-
Goodeniaceae	*Goodenia glabra*	-		C	-
Goodeniaceae	*Goodenia rotundifolia*	-		C	-
Hemerocallidaceae	*Dianella caerulea*	-		C	-
	Dianella revoluta	-		C	-
	Geitonoplesium cymosum forma *album*	-		C	-
Juncaceae	*Juncus usitatus*	-		C	-
Lamiaceae	*Coleus australis*	-		C	-
Lauraceae	*Cryptocarya triplinervis* var. *triplinervis*	-		C	-
Laxmanniaceae	*Eustrephus latifolius* subforma *fimbriatus*	-		C	-
	Lomandra confertifolia subsp. *pallida*	-		C	-
	Lomandra hystrix	-		C	-
	Lomandra longifolia	-		C	-
	Lomandra multiflora subsp. *multiflora*	-		C	-
Lecythidaceae	*Planchonia careya*	cockatoo apple		C	-
Loganiaceae	*Strychnos psilosperma*	strychnine tree		C	-
Malvaceae	*Hibiscus heterophyllus*	-		C	-
	Malvastrum americanum var. *americanum*	-	*	-	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
	Sida acuta	spinyhead sida		-	-
	Sida cordifolia	-	*	-	-
	Sida hackettiana	spiked sida		C	-
Meliaceae	*Dysoxylum gaudichaudianum*	ivory mahogany		C	-
	Melia azedarach	white cedar		C	-
	Turraea pubescens	native honeysuckle		C	-
Mimosaceae	*Acacia decora*	pretty wattle		C	-
	Acacia disparrima subsp. disparrima	-		C	-
	Acacia fasciculifera	scaly bark		C	-
	Acacia implexa	lightwood		C	-
	Acacia leiocalyx subsp. *leiocalyx*	-		C	-
	Acacia penninervis var. *penninervis*	-		C	-
	Acacia salicina	Doolan		C	-
	Acacia sp.	-		C	-
	Archidendropsis basaltica	red lancewood		C	-
	Vachellia bidwillii	-		C	-
Moraceae	*Ficus coronata*	creek sandpaper fig		C	-
	Ficus obliqua	-		C	-
	Ficus opposita	-		C	-
	Ficus racemosa var. *racemosa*	-		C	-
	Ficus rubiginosa forma *glabrescens*	-		C	-
	Ficus virens var. *virens*	-		C	-
Myrsinaceae	*Myrsine variabilis*	-		C	-
Myrtaceae	*Angophora floribunda*	rough-barked apple		C	-
	Corymbia citriodora subsp. *citriodora*	spotted gum		C	-
	Corymbia clarksoniana	-		C	-
	Corymbia dallachiana	-		C	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
	Corymbia erythrophloia	variable-barked bloodwood		C	-
	Corymbia intermedia	pink bloodwood		C	-
	Corymbia sp.	-		C	-
	Corymbia tessellaris	Moreton Bay ash		C	-
	Corymbia trachyphloia subsp. *trachyphloia*	-		C	-
	Eucalyptus acmenoides	-		C	-
	Eucalyptus crebra	narrow-leaved red ironbark		C	-
	Eucalyptus exserta	Queensland peppermint		C	-
	Eucalyptus melanophloia subsp. *melanophloia*	-		C	-
	Eucalyptus moluccana	gum-topped box		C	-
	Eucalyptus portuensis	-		C	-
	Eucalyptus tereticornis subsp. *tereticornis*	-		C	-
	Lophostemon confertus	brush box		C	-
	Lophostemon suaveolens	swamp box		C	-
	Melaleuca bracteata	-		C	-
	Melaleuca fluviatilis	-		C	-
	Melaleuca leucadendra	broad-leaved tea-tree		C	-
	Melaleuca linariifolia	snow-in summer		C	-
	Melaleuca viminalis	-		C	-
	Waterhousea floribunda	Weeping lilly pilly		C	
Oleaceae	*Chionanthus ramiflorus*	northern olive		C	-
	Jasminum didymum subsp. *didymum*	-		C	-
	Jasminum simplicifolium subsp. *australiense*	-		C	-
Orchidaceae	*Cymbidium canaliculatum*	-		C	-
Oxalidaceae	*Oxalis corniculata*	creeping wood sorrel	*	-	-
Passifloraceae	*Passiflora foetida*	-	*	-	-
	Passiflora subpeltata	white passionflower	*	-	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
Phyllanthaceae	*Breynia oblongifolia*	-		C	-
	Bridelia leichhardtii	-		C	-
	Glochidion lobocarpum	-		C	-
Pittosporaceae	*Bursaria incana*	-		C	-
	Pittosporum spinescens	-		C	-
Poaceae	*Alloteropsis semialata*	cockatoo grass		C	-
	Amphibromus sp.	-		C	-
	Aristida calycina var. *calycina*	-		C	-
	Aristida latifolia	feathertop wiregrass		C	-
	Aristida leptopoda	white speargrass		C	-
	Aristida sp.	-		C	-
	Arundinella nepalensis	reedgrass		C	-
	Bothriochloa bladhii subsp. *bladhii*	-		C	-
	Bothriochloa decipiens var. *decipiens*	-		C	-
	Bothriochloa ewartiana	desert bluegrass		C	-
	Bothriochloa pertusa	-	*	-	-
	Cenchrus sp.	-	*	-	-
	Chloris gayana	rhodes grass	*	-	-
	Chrysopogon fallax	-		C	-
	Cymbopogon ambiguus	lemon grass		C	-
	Cymbopogon bombycinus	silky oilgrass		C	-
	Cymbopogon refractus	barbed-wire grass		C	-
	Dichanthium sericeum subsp. *sericeum*	-		C	-
	Eriochloa crebra	spring grass		C	-
	Enneapogon polyphyllus	leafy nineawn		C	-
	Eriachne mucronata	-		C	-
	Heteropogon contortus	black speargrass		C	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
	Hyparrhenia rufa subsp. *rufa*	-	*	-	-
	Imperata cylindrica	blady grass		C	-
	Megathyrsus maximus var. *maximus*	-	*	-	-
	Melinis repens	red natal grass	*	-	-
	Panicum decompositum var. *decompositum*	-		C	-
	Panicum effusum	hairy panic		C	-
	Panicum simile	-		C	-
	Sporobolus creber	-		C	-
	Themeda triandra	kangaroo grass		C	-
Pteridaceae	*Adiantum atroviride*	-		C	-
Putranjivaceae	*Drypetes deplanchei*	grey boxwood		C	-
Rhamnaceae	*Alphitonia excelsa*	soap tree		C	-
	Ventilago viminalis	supplejack		C	-
Rubiaceae	*Psydrax lamprophylla* forma *lamprophylla*	-		C	-
	Psydrax odorata	-		C	-
	Psydrax oleifolia	-		C	-
	Spermacoce brachystema	-		C	-
Rutaceae	*Acronychia laevis* var. *leucocarpa*	-		C	-
	Flindersia australis	crow's ash		C	-
	Geijera salicifolia	brush wilga		C	-
Santalaceae	*Exocarpos cupressiformis*	native cherry		C	-
	Exocarpos latifolius	-		C	-
	Santalum lanceolatum var. *venosum*	-		C	-
Sapindaceae	*Alectryon subdentatus*	-		C	-
	Arytera divaricata	Coogera		C	-
	Cupaniopsis anacardioides	tuckeroo		C	-
	Dodonaea lanceolata var. *lanceolata*	-		C	-

Family	Species	Common name	[1]Introduced Status	[2]NC Act Status	[3]EPBC Act Status
	Harpullia pendula	-		C	-
Scrophulariaceae	*Eremophila debilis*	winter apple		C	-
Smilacaceae	*Smilax australis*	barbed-wire vine		C	-
Solanaceae	*Solanum ellipticum*	potato bush		C	-
	Solanum seaforthianum	Brazilian nightshade	*	-	-
Sparrmanniaceae	*Grewia latifolia*	dysentery plant		C	-
	Grewia retusifolia	-		C	-
Sterculiaceae	*Brachychiton australis*	broad-leaved bottle tree		C	-
	Brachychiton bidwillii	little kurrajong		C	-
	Brachychiton populneus subsp. *populneus*	-		C	-
Ulmaceae	*Trema tomentosa* var. *tomentosa*	-		C	-
Verbenaceae	*Glandularia aristigera*	-	*	-	-
	Lantana camara	lantana	*, C3, WoNS	-	-
Xanthorrhoeaceae	*Xanthorrhoea johnsonii*	-		C	-
Zamiaceae	*Macrozamia douglasii*	-		C	-
	Macrozamia macleayi	-		C	-
Zingiberaceae	*Alpinia arundelliana*	-		C	-

[1] ** - Introduced, C3 - Category 3 Restricted plant under the Biosecurity Act, WoNS - Weed of National Significance.*

[2] *C –Least Concern, E – Endangered under the NC Act.*

[3] *E – Endangered under the EPBC Act.*

APPENDIX B

Likelihood of Occurrence Assessments

Table C.1 Likelihood of Occurrence Assessment – TECs

Community	EPBC Act Status	Description	Likelihood of Occurrence
Coolibah – Black Box Woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions	E	This TEC is associated with floodplains and drainage areas of the Darling Riverine Plains and Brigalow Belt South IBRA bioregion. This community is represented by eucalypt woodland where *Eucalyptus coolabah* subsp. *coolabah* and/or *Eucalyptus largiflorens* are the dominant canopy species and where the understorey tends to be grassy. The following REs form part of, or align with this TEC: RE 11.3.3, 11.3.15, 11.3.16, 11.3.28 and 11.3.37.	**Unlikely to occur** No REs were recorded within the Study Area that align with this TEC.
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	E	This TEC occurs in coastal catchments, mostly at elevations of less than 20 m AHD which are typically found within 30 km of the coast. It is found on Quaternary age unconsolidated sediments, including alluvium. The forest to woodland community is dominated by *Casuarina glauca* (swamp oak) with a lower canopy layer of smaller swamp oak and other species including *Melaleuca* spp. or *Eucalyptus* spp. The following REs form part of, or align with this TEC: RE 12.1.1, 12.3.2	**Unlikely to occur** No REs were recorded within the Study Area that align with this TEC
Poplar Box Grassy Woodland on Alluvial Plains	E	This TEC occurs on alluvial soils and is typically a grassy woodland with a canopy dominated by Eucalyptus populnea with an understorey of mostly grasses and herbs. The following REs correspond to this TEC: 11.3.2, 11.3.17, 11.4.7, 11.4.12, 12.3.10.	**Unlikely to occur** No REs were recorded within the Study Area that align with this TEC
Semi-evergreen vine thickets of the Brigalow Belt (North and South) and the Nandewar Bioregion	E	This TEC is an extreme form of dry seasonal subtropical rainforest and is generally characterised by the prominence of trees with microphyll sized leaves and the frequent presence of bottle trees (*Brachychiton* spp.) as emergents from the vegetation. The following REs correspond to this TEC: 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8, 11.11.18.	**Unlikely to occur** No REs were recorded within the Study Area that align with this TEC
Weeping Myall Woodlands	E	This TEC occurs on the inland alluvial plains west of the Great Dividing Range in NSW and Queensland. This community is an open woodland to woodland in which weeping Myall (*Acacia pendula*) trees are the sole or dominant overstorey species. The following REs correspond to this TEC: 11.3.2 and 11.3.28.	**Unlikely to occur** No REs were recorded within the Study Area that align with this TEC

Table C.2 Likelihood of occurrence assessment – Threatened Flora

Family	Species	Status (EPBC Act, NC Act)	Distribution and Preferred Habitat	Likelihood of Occurrence
Apocynaceae	*Marsdenia brevifolia*	V, V	*Marsdenia brevifolia* occurs in north and central Queensland where it is known from localities near Townsville, Springsure and north of Rockhampton. North of Rockhampton, *Marsdenia brevifolia* grows on serpentine rock outcrops or crumbly black soil derived from serpentine in eucalypt woodland, often with broad-leaf ironbark (*Eucalyptus fibrosa*) and *Corymbia xanthope*. At Hidden Valley near Paluma, plants grow in woodland on granite soils and on Magnetic Island the species occurs in open forest on acid agglomerate soils.	**Low** No records of this species are known from the search area, with the closest records of this species occurring north of Rockhampton. Habitat for this species within the site is considered marginal, as some records of this species have been recorded on granite soils, which are present within the Study Area.
Cycadaceae	*Cycas megacarpa*	E, E	*Cycas megacarpa* is endemic to south-east Queensland and its range extends from Woolooga in the south to Bouldercombe in the north. *Cycas megacarpa* occurs in spotted gum (*Eucalyptus citriodora*) and narrow-leaved ironbark (*Eucalyptus crebra*) woodland and open forest with a grassy understorey. It has also been recorded on rainforest margins. The species usually grows on hill tops and steep slopes. It is found on varying topsoils; commonly sandy loams or shallow clay loams which are often stony. *C. megacarpa* occurs at altitudes of 40-600 m above sea level.	**Known to occur** Previous records of the species occur within and adjacent to the Study Area identified through Wildlife online and ALA, as well as many individuals recorded during the field survey.
	Cycas ophiolitica	E, E	*Cycas ophiolitica* is endemic to Queensland and occurs between Marlborough and Rockhampton in central-eastern Queensland. Cycas ophiolitica inhabits eucalypt open forest and woodland communities with a grassy understorey. They occur on hill tops or steep slopes, at altitudes of 80-620 m above sea level. It grows on shallow, stony, red clay loams or sandy soils.	**Low** No records of this species occur within the search area of the Study Area. While suitable habit exists onsite, extensive targeted surveys did not identify this species within the Study Area.

Family	Species	Status (EPBC Act, NC Act)	Distribution and Preferred Habitat	Likelihood of Occurrence
Combretaceae	*Dansiea elliptica*	-, NT	The species is known to occur in several localities within Queensland including within Dinden National Park, Wooroonooran National Park, Rundle State Forest and Deep Water National Park. The area of occupancy in Queensland is less than 40 square km in total. Habitat for the species includes lowland dry rainforest and vine thicket on substrates derived from rhyolite, basalt and greywacke. Species associated with *Dansiea elliptica* include *Flindersia australis, Casuarina cristata, Gossia bidwillii, Drypetes deplanchei, Planchonella cotinifolia, Pleiogynium timorense, Terminalia porphyrocarpa, Polyscias elegans, Flindersia spp., Elaeocarpus eumundi, Synima, Cryptocarya mackinnoniana* and *Cryptocarya vulgaris.*	**Moderate** Two records of this species occur within 20 km of the Study Area. Some suitable habitat for this species occurs within the Study Area as semi-evergreen vine thicket as species often recorded in association to the species are known to the Study Area.
Hernandiaceae	*Hernandia bivalvis*	-, NT	*Hernandia bivalvis* occurs in Queensland from Brisbane to south of Rockhampton. Records have also been identified from Proserpine. *Hernandia bivalvis* grows in drier rainforest on lowlands or hills.	**High** Records for *Hernandia bivalvis* occur immediately north of the Study Area within microphyll vine forest, a community type which is present within the Study Area.
Myrtaceae	*Decaspermum struckoilicum*	E, E	*Decaspermum struckoilicum* is only known from two populations in Queensland, both about 8 km east of Mount Morgan, in the area known as Struck Oil. The species occurs in semi-evergreen vine thicket on brown or reddish soil. The northern population comprises only a single plant, where the northern population possibly 17. Both populations occur in remnant vegetation.	**Moderate** The two known populations of this species occur approximately 15 km north west of the Study Area. Semi-evergreen vine thicket vegetation (RE 11.12.4 and 11.11.a5) has been mapped within the Study Area, and while the vegetation survey did not identify this species, there is still a Moderate chance that it occurs within the Study Area.

Family	Species	Status (EPBC Act, NC Act)	Distribution and Preferred Habitat	Likelihood of Occurrence
	Eucalyptus raveretiana	V, LC	The species usually grows along watercourses, to a lesser extent river flats or open woodland at 0-300 m asl in sub-tropical climates. Soil varies from sand to heavy clays. The species does not occur in pure stands, but is co-dominant with species including *Melaleuca leucadendra, M. fluviatilis, Eucalyptus tereticornis, Corymbia tessellaris,* and occasionally in semi evergreen vine thicket.	**Low** The species has been recorded from the broader region. Extensive surveys did not record this conspicuous species.
Orchidaceae	*Bulbophyllum globuliforme*	V, NT	*Bulbophyllum globuliforme* occurs in the McPherson Range of north-east NSW, south-east Queensland and in the Calliope Range Inland from Gladstone. The species grows only on hoop pines (*Araucaria cunninghamii*), colonising the upper mature branches in upland rainforest	**Low** No records of this species occur within the search area of the Study Area and no hoop pines were recorded as part of the surveys.
Poaceae	*Arthraxon hispidus*	V, V	*Arthraxon hispidus* occurs in Queensland and NSW. In Queensland it occurs as far north as Port Douglas, and west to disjunct occurrences around mound springs in Carnarvon National Park. However, most occurrences occur south of Noosa. *Arthraxon hispidus* occurs in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps.	**Low** No records of this species occur within the search area of the Study Area and habitat is marginal.
	Dichanthium setosum	V, LC	*Dichanthium setosum* occurs in Queensland and NSW. In Queensland it occurs in the Leichardt, Morton, North Kennedy and Port Curtis regions. It occurs in the Mistake Range, in Main Range National Park and possibly Glen Rock National Park. It occurs on heavy basaltic black soils and stony red-brown hard-setting loam with clay subsoil.	**Low** No records of this species occur within the search area of the Study Area and habitat is marginal.
Rutaceae	*Bosistoa transversa*	V, LC	The species grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude. It is associated with *Argyrodrendon trifoliolatum*, *Syzygium hodgkinsoniae*, *Endiandra pubens*, *Dendrocnide phoinphylla*, *Amena ingens*, *Diploglottis australis* and *Diospyros mabacea*.	**Low** No records of this species occur within the desktop search extent and habitat in the Study Area is marginal.

Family	Species	Status (EPBC Act, NC Act)	Distribution and Preferred Habitat	Likelihood of Occurrence
Sapindaceae	*Cossinia australiana*	E, E	*Cossinia australiana* is known from fragmented relict patches of Araucarian vineforests or vine thickets on fertile soils in central and southern Queensland. It is distributed from Rockhampton in the north Kingaroy in the south-west.	**Moderate** Records of this species have been recorded from the broader Study Area (within 25 km of the Study Area) and suitable vine thicket habitat occurs within the Study Area.
	Cupaniopsis shirleyana	V, V	*Cupaniopsis shirleyana* occurs in south-east Queensland between Brisbane and Curtis Island. It occurs in dry rainforest and scrubby urbanised areas on moderate to very steep slopes, screeslope gullies and rocky stream channels at elevations of 60 to 550 m above sea level.	**Low** No records of this species occur within the vicinity of the Study Area. The closest record occurs approximately 100 km south west at Turkey Beach. Some suitable habitats in the form of vine thickets occur within the Study Area.
Simaroubaceae	*Samadera bidwillii*	V, V	*Samadera bidwillii* is endemic to Queensland and is currently known in several locations between Scawfell Island near Mackay, and Goomboorian, north of Gympie. *Samadera bidwillii* occurs in lowland rainforest or on rainforest margins, but it can be found in other forest types such as open forest and woodland.	**Moderate** There are several records of this species within a 25-50 km radius of the Study Area occurring within the ecotone between vine thicket and eucalypt woodland. Some suitable vine thicket communities occur within the Study Area.
Solanaceae	*Solanum dissectum*	E, E	*Solanum dissectum* is endemic to Queensland and found within a region bounded by the towns of Blackwater to Bauhinia to Thangool to Dululu, which is centred about 150 km west of Gladstone. It is restricted to very small, localised areas where populations exist. It is found in open forest and woodland habitats where brigalow (Acacia harpophylla) and/or lapunyah (Eucalyptus thozetiana) characterise the dominant vegetation types on solodic soils.	**Low** No suitable habitat occurs within the Study Area.

Family	Species	Status (EPBC Act, NC Act)	Distribution and Preferred Habitat	Likelihood of Occurrence
	Solanum johnsonianum	E, E	*Solanum johnsonianum* is endemic to Queensland and found in a region bounded by the town of Rolleston to Theodore to Biloela to Dululu, which is centred about 160 km west of Gladstone. It may be found in very small, localised areas on heavy cracking clays soils where brigalow (Acacia harpophylla) dominates or co-dominates. Other associated species include lapunyah (*Eucalyptus thozetiana*) and an understorey of wilga (*Geijera parviflora*).	**Low** No suitable habitat occurs within the Study Area.
Surianaceae	*Cadellia pentastylis*	V, V	*Cadellia pentastylis* occurs in NSW and Queensland. In Queensland it occurs from the southern border to the Canarvon Range and Callide Valley, south-west of Rockhampton. *Cadellia* grows in dry rainforest, semi evergreen vine thickets and sclerophyll ecological communities, often locally dominant or as an emergent.	**Low** The closest records of *Cadellia pentastylis* occur greater than 50 km from the Study Area and generally occur to the west of the Study Area.

APPENDIX C

Significant Residual Impact Assessment

umwelt
Environmental & Social Consultants

NEOEN

SIGNIFICANT RESIDUAL IMPACT ASSESSMENT

Mount Hopeful Wind Farm

FINAL

May 2023

1.0 Matter of State Environmental Significance (MSES) within the Disturbance Footprint

A Significant Residual Impact (SRI) on a MSES that is also a prescribed environmental matter is defined under the Queensland EO Act, Section 8 and includes:

"an adverse impact, whether direct or indirect, of a prescribed activity on all or part of a prescribed environmental matter that:

a. Remains, or will or is likely to remain, (whether temporarily or permanently) despite on-site avoidance and mitigation measures for the prescribed activity; and

b. Is, or will or is likely to be, significant"."

The following MSES relate to flora and vegetation and occur (or are likely to occur) within the Disturbance Footprint:

- Regulated vegetation:
  - Of Concern Res.
  - Remnant vegetation within the defined distance of a watercourse identified on the vegetation management watercourses map.
  - Essential Habitat (EH) as identified on the essential habitat map.
- Protected wildlife habitat.

After all reasonable avoidance, mitigation and management measures for the Project have been or will be undertaken (**Section 6.0**), the Project may still impact on MSES. Therefore, an assessment in accordance with the *Significant Residual Impact Guideline* (Department of State Development, Infrastructure and Planning, 2014) has been completed to determine if the Project may have a SRI on these values.

1.1 Regulated Vegetation

1.1.1 Endangered and Of Concern REs

As per the DES Regional Ecosystem map (Version 12.02), the Disturbance Footprint contains remnant vegetation in the form of homogeneous and heterogeneous polygons analogous to a maximum of eight REs, within a Category B area. No Endangered REs are identified within this area. However, one polygon to be impacted is a heterogeneous polygon of REs 11.3.25/11.3.4/11.3.2. REs 11.3.4 and 11.3.2 are both listed as Of Concern under the VM Act. The remaining six REs predicted for impact are Least Concern under the VM Act.

Impact areas that correspond to the DES Regional Ecosystem map are detailed in **Table C.1** below.

Based on the assessment detailed in **Table C.2**, it is considered **Unlikely** that a SRI to remnant vegetation comprising an Endangered or Of Concern RE will occur.

Table C.1: Of Concern Regional Ecosystems within Disturbance Footprint

RE	Polygon Percentage	VM Act Status	Direct Impact (ha)
11.3.25	60	Least Concern	0.042
11.3.2	20	Of Concern	0.014
11.3.4	20		0.014
11.3.25 / 11.3.2 / 11.3.4	100	Least Concern / Of Concern	0.07

Table C.2: SRI criteria of regulated vegetation – Endangered and Of Concern REs

Impact Criteria	Assessment
An action is LIKELY to have an SRI on remnant vegetation comprising an Endangered or Of Concern RE if the action will result in:	
Clearing of more than 5 ha of an Endangered or Of Concern RE vegetation.	Approximately 0.03 ha of remnant vegetation comprising an Of Concern RE will be cleared (see **Table C.1**). Based on this criterion, it is considered unlikely that the Project will have a SRI on Regulated Vegetation comprising an OF Concern RE.
Clearing that results in an overall area (not confined to property boundaries) of Endangered or Of Concern RE vegetation of less than 5 ha.	Within the Study Area, RE 11.3.4 and RE 11.3.2 in remnant condition occupy a total of 35.3 ha. Following vegetation clearing required for construction of the Project, 35.27 ha (substantially greater than 5 ha) of remnant vegetation analogous to RE 11.3.4 and RE 11.3.2 will remain within the Study Area. Based on this criterion, it is considered unlikely that the Project will have a SRI on Of Concern RE Regulated Vegetation.
Clearing that results in the physical separation of Endangered or Of Concern RE communities within and on adjoining sites.	Clearing required for the Project is linear and will be limited to the edge of a polygon containing an Of Concern RE. The community occurs as a narrow polygon, connected to Least Concern vegetation (Category B and C) but predominantly surrounded by Category X vegetation. Therefore, clearing will not result in physical separation of relevant communities and a SRI on Of Concern REs is unlikely.

1.1.2 Remnant vegetation within the defined distance of a watercourse

A large number of watercourses mapped under the VM Act intersect the Disturbance Footprint, ranging from Stream Order 1 to 4. The total area of regulated vegetation within the determined distance from the defining bank of each watercourse is provided in **Table C.3**. Impacts to regulated vegetation within these zones are limited to tracks to access the wind farm infrastructure. Under the SRI guidelines, only impacts to remnant vegetation (within a Category B area) are considered.

Based on the assessment detailed in **Table C.4**, it is considered **Unlikely** that a SRI to remnant vegetation with a defined distance to a watercourse will occur.

Table C.3: Regulated vegetation within a defined distance from the defining bank of a watercourse (non-coastal bioregions and subregions) within the Disturbance Footprint

Watercourse Stream Order	Distance from the Defining Bank (m)	[1]Category B Vegetation (ha)
1	25	6.3
2		0.6
3	50	3.9
4		0.0
	Total	**10.7**

[1]based on State regional ecosystem mapping

Table C.4: SRI criteria of regulated vegetation - Remnant vegetation within the define distance of a watercourse

Impact Criteria	Assessment
An action is LIKELY to have an SRI on remnant vegetation within the defined distance of a watercourse if the action will result in:	
Permanent removal of vegetation within the defined distance of a stream order 2 or higher where no rehabilitation is proposed	The permanent removal of 4.5 ha of remnant vegetation within the defined distance of a stream order 2 and 3 watercourse may occur based on the 'worst-case' scenario that all vegetation within the Disturbance Footprint will be cleared. Works within these areas will be confined to access tracks and cabling and no windfarm infrastructure will be located in proximity to a watercourse. Where possible and practical, clearing associated with watercourse crossings will be reduced to 25 m or less and erosion and sediment control measures will be employed. Rehabilitation is proposed to occur primarily within linear areas of the Disturbance Footprint including tracks and reticulation lines. Rehabilitation will include the planting of native species known to the region, consistent with the characteristics of surrounding retained vegetation. With current design details, it is estimated approximately 20% of the total Disturbance Footprint will be rehabilitated. However, the specific locations of rehabilitation will not be determined until detailed design of the Project has been completed. Efforts will be made to complete rehabilitation in cleared areas of remnant regulated vegetation within a defined distance of a watercourse, that are no longer needed for operation and maintenance of the Project. Mitigation and management measures are detailed in **Section 6.2** of the main report. Based on this criterion, it is considered unlikely that the Project will have a SRI on Regulated Vegetation.
Building of an online detention basin greater than 1 ha in size or other similar works that result in the clearing of vegetation which fragments up and downstream remnant areas on any stream order	No detention basins are proposed to be created. Impacts to remnant vegetation associated with streams within the Disturbance Footprint relate to crossing of creeks for access tracks to the turbines only. Based on this criterion, it is considered unlikely that the Project will have an SRI on Regulated Vegetation.
Permanent clearing of more than 0.5 ha of an endangered or of concern RE, within the defined distance of a watercourse	Remnant vegetation within a defined distance of a watercourse (within an category B area) analogous to REs 11.3.25/11.3.4/11.3.2 will be cleared for the Project. REs 11.3.4 and 11.3.2 are listed Of Concern under the VM Act. A total of 0.07 ha is predicted for impact, which is well below the specified threshold of 0.5 ha. Based on this criterion, it is considered unlikely that the Project will have an SRI on Regulated Vegetation.

1.1.3 Essential Habitat

Essential habitat, for protected wildlife, means an area of vegetation shown on the Regulated Vegetation Management map:

1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database. Essential habitat factors are comprised of - regional ecosystem (mandatory for most species), vegetation community, altitude, soils, position in landscape; or

2) in which the protected wildlife, at any stage of its life cycle, is located.

Regulated vegetation containing mapped areas of Essential Habitat for two species (*Hernandia bivalvis* and *Cycas megacarpa*) is mapped within the Study Area and Disturbance Footprint (**Figure 4.6**), covering a total combined area of 140.7 ha and 22.5 ha respectively. Essential Habitat areas are associated with records of two species (a buffer of 1.1 km), as indicated by the Vegetation Management Reports for the relevant lot and plans. However, RE is considered a mandatory Essential Habitat factor for both species. Noting this, the approximate areas of Essential Habitat for each species has been determined Using the DES Regional Ecosystem mapping.

The mapped Essential Habitat area is associated with a heterogeneous polygon (90/10 percentage spilt) of REs 11.11.3 (suitable for *Cycas megacarpa* only) and 11.11.5 (suitable for *Hernandia bivalvis* only). As per REDD, RE 11.11.3 has a mid-dense structure and RE 11.11.5 has a dense structure.

Based on the assessment outlined below in **Table C.5,** it is considered **Likely** that the Project will have a SRI on Essential Habitat for *Cycas megacarpa* and *Hernandia bivalvis*. However, it should be considered that the verified vegetation communities within the mapped Essential Habitat area for *H. bivalvis* did not identify suitable habitat for this species.

Table C.5: SRI criteria for regulated vegetation - Essential habitat for *C. megacarpa* and *H. bivalvis*

Impact Criteria	Assessment
An action is LIKELY to have an SRI on essential habitat if the action will result in:	
Clearing of EH exceeding the thresholds specified in Table 1, SDAP Module 8, and resulting in a greater than 10% permanent reduction in the extent of EH mapped on site	***Cycas megacarpa*** The total area of Essential Habitat mapped for *Cycas megacarpa* within the Study Area is approximately 126.6 ha and the area within the Disturbance Footprint is 20.25 ha. This exceeds the thresholds specified in Table 1, SDAP Module 8, and results in a greater than 10% permanent reduction in the extent of EH mapped within the Study Area. Based on these criteria the Project is likely to have a SRI on Essential Habitat for *C. megacarpa*.
	Hernandia bivalvis The total area of Essential Habitat mapped for *Hernandia bivalvis* within the Study Area is approximately 14.1 ha and the area within the Disturbance Footprint is 2.25 ha. This exceeds the thresholds specified in Table 1, SDAP Module 8, and results in a greater than 10% permanent reduction in the extent of EH mapped within the Study Area. Based on these criteria the Project is likely to have a SRI on Essential Habitat for *H. bivalvis.* It should be noted however, that verified vegetation communities within the EH for *H. bivalvis* within the Study Area, did not identify suitable habitat for this species.

1.2 Protected Wildlife Habitat

1.2.1.1 Threatened Flora – 'Known to Occur'

- *Cycas megacarpa* – Endangered under the NC Act

The field surveys targeted habitat for *Cycas megacarpa* and conducted plot-based counts of individuals as well as rapid density visual estimates. Using this approach, an actual count of individuals is obtained (recognised as lower bound) and allows for an estimation of distribution, undertaken spatially using an inverse distance weighted (IDW) interpolation algorithm. A detailed description of the IDW interpolation algorithm method and how it has been applied is provided in **Section 3.4.1** of the overarching report.

The results of this assessment are summarised below in **Table C.6** and **Table C.7.**

Table C.6 *Cycas megacarpa* Individuals

Item	Study Area	Development Corridor	Disturbance Footprint
Individual records of *Cycas megacarpa*	159,915	6,709	4,131

Table C.7 *Cycas megacarpa* Density Summary

Density Categories	Study Area[1]	Development Corridor[2]	Disturbance Footprint[2]
High (25–50 plants per 0.25 ha)	74.9 ha	0.9 ha	0.7 ha
Moderate (10–25 plants per 0.25 ha)	960.8 ha	29.6 ha	16.8 ha
Low (1–10 plants per 0.25 ha)	5,365.7 ha	301.5 ha	195.7 ha

[1] Study Area values have been corrected by a factor of 0.5-0.7 to provide contextual comparison with development corridor, for with IDW outputs have been clipped to the known (confirmed) and known (suspected) habitat area.
[2] IDW outputs clipped to areas of mapped known (confirmed) and known (suspected) habitat area.

Cycas megacarpa habitat has been categorised as follows:

- Known habitat (confirmed).
- Known habitat (suspected).
- Nil recorded.

The criteria used to define these categories as well as the extent that habitat is mapped throughout the Development Corridor is provided in **Table C.8**.

Cycas megacarpa habitat mapping is provided in **Figure C.1.**

Table C.8 Habitat Extent and Justification for *Cycas megacarpa*

Habitat Criteria	Mapping Justification	Extent within Development Corridor (ha)	Extent within Disturbance Footprint (ha)
Known habitat (confirmed)	An 80 m buffer on confirmed *Cycas megacarpa* records, to reflect the latest population research which indicates most individuals disperse within 80 m of mature female plants (Etherington et al. 2018; James 2016 PhD thesis). Mapping has not been limited to certain REs noting the species was also recorded within non-remnant vegetation within the Study Area.	213.0	147.1
Known habitat (suspected)	Includes areas of the Development Corridor for which known habitat (confirmed) does not overlap, however based on adjacent records and connective habitat, *Cycas megacarpa* presence is presumed or reasonably suspected.	147.7	88.6
Known habitat (total)	**Combined areas of confirmed and suspected habitat**	**360.7**	**235.7**
Nil detected	Includes areas of the Development Corridor which have been confirmed (via field survey) to not support *Cycas megacarpa*. Nil recorded habitat also includes areas where reasonable extrapolation to edges of the Development Corridor has been applied, based on nearby 'absence' records, absence of connective habitat and field derived opinions of ecologists.	984.7	639.0

Based on the assessment in **Table C.9**, it is considered **Likely** that the Project will have a SRI on the habitat and population of *Cycas megacarpa*.

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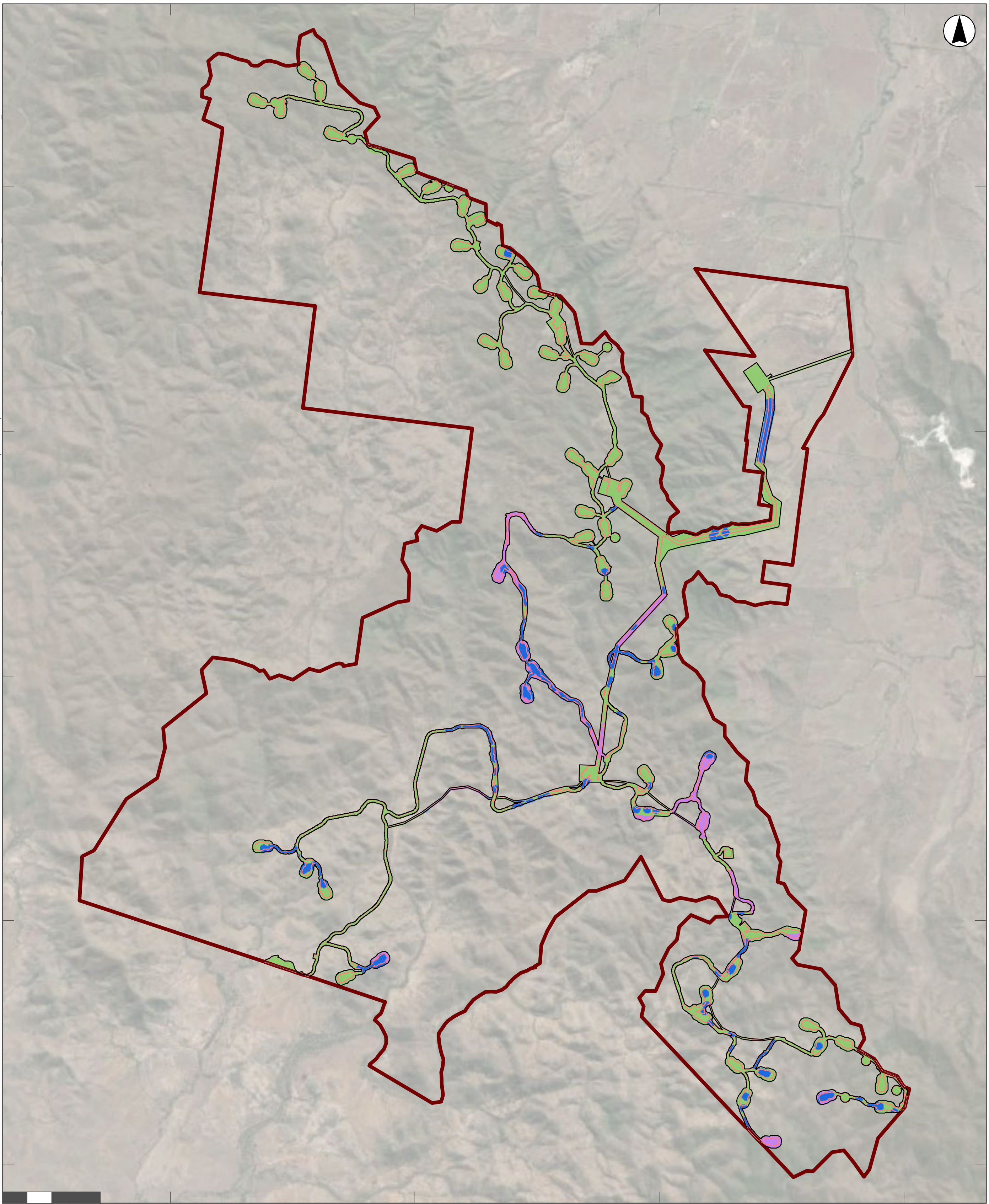


Scale 1:110000 at A4

0 1 2 Kilometers

GDA 1994 MGA Zone 56

Legend

Study Area

Development Corridor

Disturbance Footprint

Known *Cycas megacarpa* Habitat

Known (confirmed)

Known (suspected)

Nil Recorded

FIGURE C1.1

Known Habitat for Cycas megacarpa

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

Table C.9: SRI criteria for Plants - Protected wildlife habitat - *Cycas megacarpa*

Impact Criteria	Assessment
An action is UNLIKELY to have an SRI on a plant that is 'endangered' or 'vulnerable' wildlife if the action will result in:	
Clearing of plants that are threatened wildlife and not located within a natural setting (i.e., does not meet the definition of 'in the wild' under the *Nature Conservation Act 1992*) where the proposal includes translocation	The habitat for *Cycas megacarpa* within the Disturbance Footprint meets the definition of 'in the wild' under the NC Act. Therefore, this criterion does not apply for this species.
Clearing of up to 10% of the total number of plants that are threatened wildlife occurring on a site where the proposal results in 90% of all plants that are threatened wildlife being retained and protected as a reserve or similar	Based on the interpolation of species records collected during the field survey program, the total number of *Cycas megacarpa* individuals within the Study Area is 159,915 plants and within the Disturbance Footprint is 4,131 plants. Based on these figures, direct impacts are anticipated to approximately 3% of the total population recorded within the Study Area (although an extensive translocation program has been proposed). Individuals to be retained within the Study Area are not proposed to be retained in a reserve or similar, as the involved land parcels are active rural properties. Therefore, this criterion does not apply for this species
Clearing of regenerating plants that are threatened wildlife which have previously been cleared within the last 5 years and that are historically maintained through slashing or grazing	Although some *Cycas megacarpa* individuals occur in historically cleared areas, the *Cycas megacarpa* population within the Study Area is not considered to comprise 'regenerating plants which have previously been cleared in the last five years and that are historically maintained through slashing or grazing'. Therefore, this criterion does not apply for this species.
The proposed relocation of an area of plants that are threatened wildlife less than 1000 m^2 not occurring in a relatively natural ecological situation (e.g., bushland), to a permanent retention area via an approved management plan	Although a translocation plan will be developed and enacted for the Project to ensure there is no net loss of *Cycas megacarpa* individuals as a result of Project works, the plants requiring relocation occur in a relatively natural ecological situation. Given the approximately 4,131 individuals occur within the Disturbance Footprint and occupy an area >1000m^2. The area of known habitat (confirmed and suspected) for *Cycas megacarpa* to be cleared within the Disturbance Footprint is 235.7 ha (although it is noted this includes an 80 m buffer on recorded individuals to reflect seed dispersal as per DCCEEW advice). This covers areas of high, medium, and low-density area occurring in remnant, regrowth and non-remnant areas. Therefore, this criterion does not apply for this species.

1.2.1.2 Threatened Flora – Moderate likelihood of Occurring

- *Decaspermum struckoilicum* – Endangered under the NC Act
- *Cossinia australiana* – Endangered under the NC Act
- *Samadera bidwillii* – Vulnerable under the NC Act

These three threatened species have been determined to have a 'Moderate' likelihood of occurring within the Study Area. The assessment of these species is presented in **Table C.11**.

Within the Disturbance Footprint, pre-clearance surveys for these species will be undertaken within suitable habitat prior to construction. If any of the above potentially occurring threatened species are identified within the Disturbance Footprint, the pre-clearance survey constraints protocol outlined below will be enacted.

STEP 1: Halt construction/clearing activities in the area (i.e. adjacent areas within the Disturbance Footprint where suitable habitat is present – to be determined by a suitably qualified ecologist)

STEP 2: Undertake investigation into potential impacts on the species. This should include:

- Updating of habitat mapping
- Updating of Significant Impact Assessment
- Determination of avoidance and mitigation strategies.

STEP 3: Communicate outcomes with DCCEEW and DES to determine next steps.

As all three species are also listed under the EPBC Act, the protocol places emphasis on the Commonwealth approval pathway noting the stricter requirements for offsets (i.e. must be land based). However, all plants are also considered 'protected plants' based on their listings under the NC Act and are therefore regulated under the Nature Conservation Regulation (Plants) 2020. As such, the protected plants assessment process will need to be followed should direct impacts occur within 100 m of an individual.

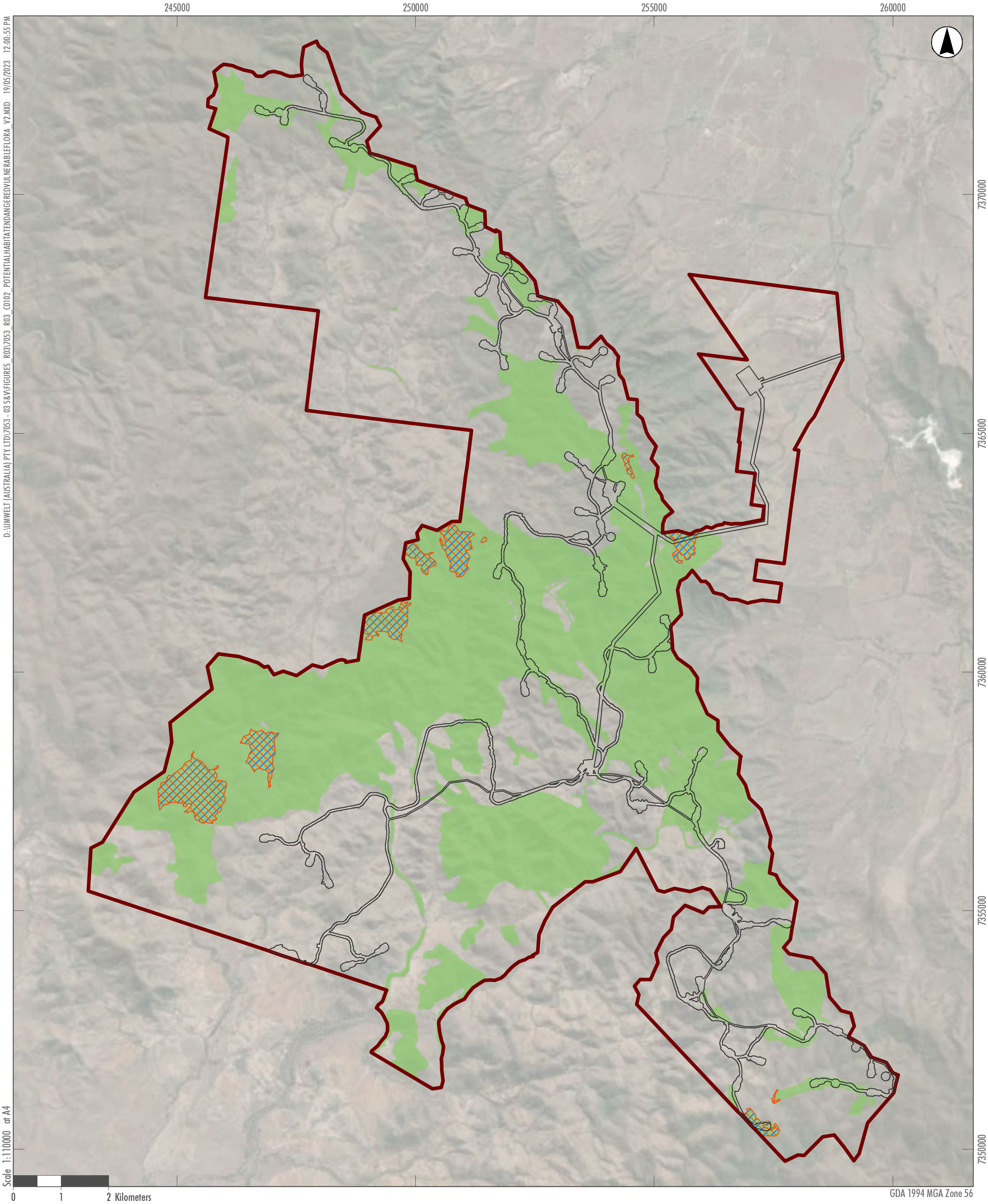
Whilst the occurrence of these species within the Disturbance Footprint is considered unlikely given the large amount of survey effort within this area (albeit subject to some limitations), the protocol allows for an appropriate and adaptive management response to be implemented. By doing so, the intent is that adverse impacts on threatened species not already proposed for translocation and/or offsets are mitigated.

Based on the above, it is considered **Unlikely** that there will be a significant residual impact on these species. Further mitigation and management measures are provided in **Section 6.2** of this report.

The extent and habitat mapping justification for Endangered and Vulnerable flora species with a moderate likelihood of occurrence is provided in **Table C.10** below while potential habitat mapping within the Study Area is provided in **Figure C.2.**

Table C.10: Habitat Extent and Justification for Endangered and Vulnerable Species with a Moderate Likelihood of Occurrence

Species	NC Act Status	Habitat Mapping Justification	Area (ha) of Habitat Within the Disturbance Footprint
Decaspermum struckoilicum	Endangered	REs 11.11.5a, 11.12.4 in remnant condition, below 300 m AHD.	2.1
Cossinia australiana	Endangered	REs 11.11.5a, 11.12.4 in remnant condition where they occur at elevations between 20 m and 520 m AHD.	8.3
Samadera bidwillii	Vulnerable	All remnant forest and woodland communities below 510 m AHD.	284



Legend

- Study Area
- Disturbance Footprint
- *Cossinia australiana* Habitat
- *Decaspermum struckoilicum* Habitat
- *Samadera bidwillii* Habitat

FIGURE C1.2

Potential Habitat for Endangered or Vulnerable Flora – Moderate Likelihood

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

Table C.11 SRI criteria for Plants - Protected wildlife habitat - *Decaspermum struckoilicum, Cossinia australiana* and *Samadera bidwillii*

Impact Criteria	Assessment
An action is UNLIKELY to have an SRI on a plant that is 'endangered' or 'vulnerable' wildlife if the action will result in:	
Clearing of plants that are threatened wildlife and not located within a natural setting (i.e., does not meet the definition of 'in the wild' under the Nature Conservation Act 1992) where the proposal includes translocation.	No individuals have been recorded within the Study Area. However, if they were present, it is likely that they would meet the definition of 'in the wild'. Pre-clearance surveys will be undertaken within suitable habitat prior to any disturbance, and if individual/s are recorded all effort would be made to avoid them. If avoidance is not possible, consultation will first occur with DCCEEW and then DES if required. The protected plants assessment process will be followed if direct impacts are predicted to occur within 100 m of an individual. Mitigation and management measures are provided in **Section 6.2** of this report.
Clearing of up to 10% of the total number of plants that are threatened wildlife occurring on a site where the proposal results in 90% of all plants that are threatened wildlife being retained and protected as a reserve or similar.	No evidence of the three species with a Moderate likelihood of occurrence has been recorded within the Study Area. Pre-clearance surveys will be undertaken within suitable habitat prior to any disturbance, and if individuals were recorded all effort would be made to avoid them. If avoidance is not possible, consultation will first occur with DCCEEW and then DES if required. The protected plants assessment process will be followed if direct impacts are predicted to occur within 100 m of an individual. Consideration would be given to threatened wildlife being retained and protected as a reserve or similar.
Clearing of regenerating plants that are threatened wildlife which have previously been cleared within the last 5 years and that are historically maintained through slashing or grazing.	The individuals of this species, if present, would unlikely be regenerating plants which have previously been cleared in the last five years and that are historically maintained through slashing of grazing.
The proposed relocation of an area of plants that are threatened wildlife less than 1000 m^2 not occurring in a relatively natural ecological situation (e.g., bushland), to a permanent retention area via an approved management plan.	This criterion is unlikely to be the case for these species. However, if individuals are identified as part of the pre-clearance surveys, translocation and/or propagation and planting of individuals would be proposed if required through the protected plants assessment process.

Environmental & Social Consultants

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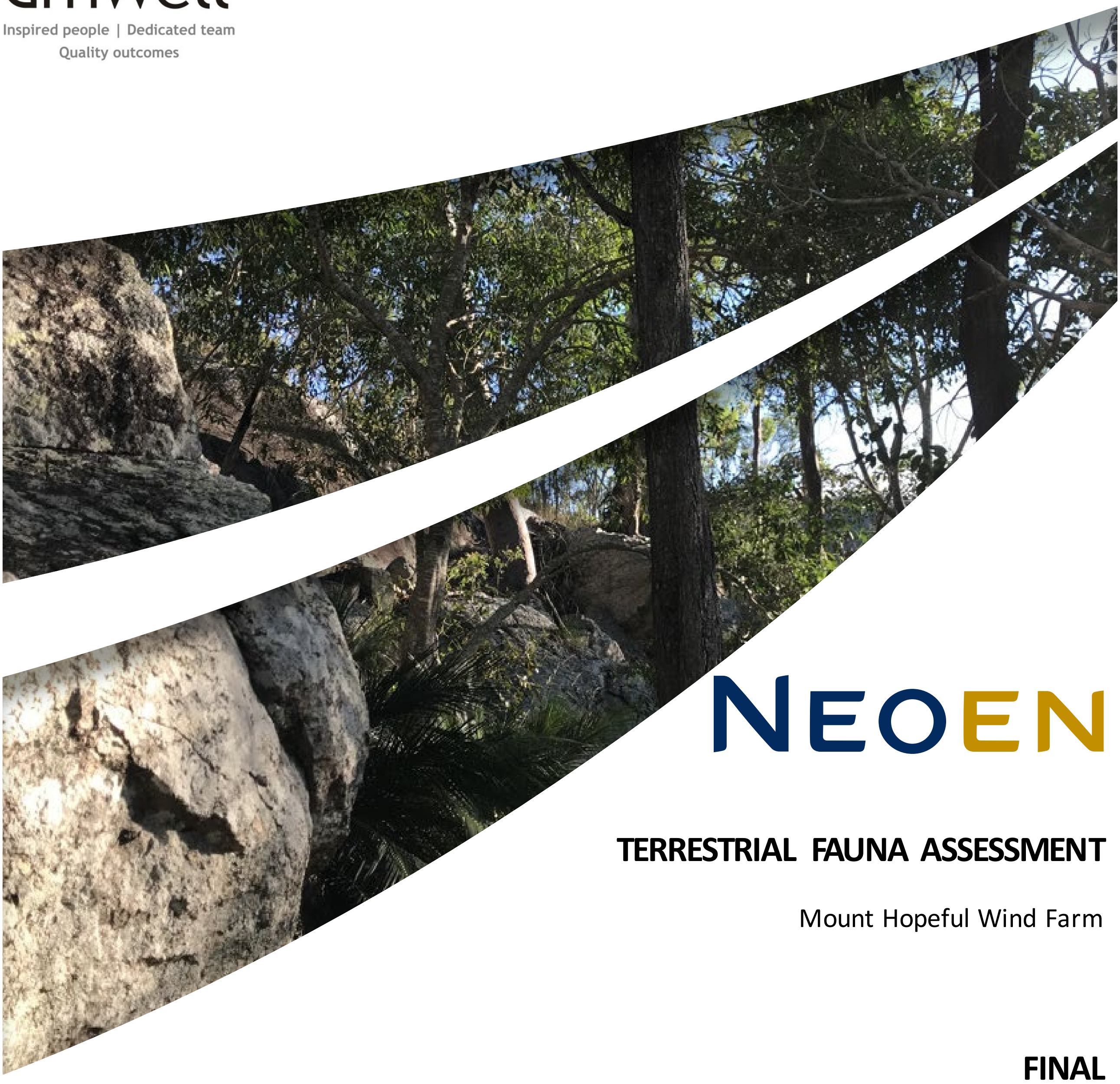
APPENDIX F

Fauna Impact Assessment



TERRESTRIAL FAUNA ASSESSMENT

Mount Hopeful Wind Farm

FINAL

May 2023

Table of Contents

Figures

Plates

Tables

Appendices

Abbreviations

Abbreviation	Description
agl	above ground level
ALA	Atlas of Living Australia
asl	above sea level
BBUS	bird and bat utilisation survey
BBAMP	Bird and Bat Adaptive Management Plan
BPA	Biodiversity Planning Assessment
CEMP	Construction Environment Management Plan
DA	development application
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DEWHA	Department of the Environment, Water, Heritage and the Arts
DoR	Department of Resources
DSEWPaC	Department of Sustainability, Water, Populations and Communities
EO Act	*Environmental Offsets Act 2014* (QLD)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
km	kilometre
m	metre
MSES	Matter of State Environmental Significance
NC Act	*Nature Conservation Act 1992*
Neoen	Neoen Australia Pty Ltd
PO	performance outcomes
Qld	Queensland
RSA	rotor swept area
SDAP	State Development Assessment Provisions
SPRAT	Species Profile and Threats
SRI	Significant Residual Impact
State code 23	*State code 23: Wind farm development*
Umwelt	Umwelt (Australia) Pty Ltd
VM Act	*Vegetation Management Act 1999* (QLD)

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) was commissioned by Neoen Australia Pty Ltd (Neoen) to undertake a terrestrial fauna survey and impact assessment of the proposed Mount Hopeful Wind Farm (the Project). If approved, the Project will involve the construction and operation of up to 63 wind turbine generators (WTGs) and associated infrastructure.

1.1 Project Locality

The Project is situated approximately 45 kilometres (km) south of Rockhampton and 65 km west of Gladstone, Queensland. The Project occurs across two local government areas, being the Banana Shire Council and the Rockhampton Regional Council. The Project is located on the Ulam Range between Mount Hopeful (on the Dee Range) and Mount Alma (on the Mount Alma Range). It is surrounded by mountain ranges and is in a largely rural and sparsely settled landscape mostly used for light grazing and livestock production.

The Project and its position in the region are depicted on **Figure 1.1.**

1.2 Ecology Study Boundaries

For the purposes of this assessment four distinct boundaries are presented, including:

- **Study Area**: represents the boundaries of the involved land parcels where consent has been granted for development (**Section 1.2.1**).
- **Ground-truthed Mapping Extent**: represents the area of interest within the Study Area for which field surveys were conducted, and the extent of coverage within the Study Area for ground-truthed vegetation mapping (**Section 1.2.2**).
- **Development Corridor**: refers to spatial bounds in which all Project infrastructure will be located (**Section 1.2.3**).
- **Disturbance Footprint**: represents the maximum extent of direct impacts and the indicative location of proposed Project infrastructure (**Section 1.2.4**).

These areas are described below and depicted on **Figure 1.1**.

1.2.1 Study Area

The Study Area refers to the boundaries of 17 land parcels where consent has been granted for development. The area covers 16,758hectares (ha) and extends approximately 25 km north to south and up to 16 km east to west at its widest point.

Table 1.1 below details the lot plan code for land parcels contained within the Study Area.

Table 1.1 **Study Area Land Parcels**

Land Parcels		
100 SP289441	2057 RAG4059	24 RN34
148 DS151	21 RN1345	25 RN25
15 RN1089	21 RN46	30 RN72
1933 RAG4058	2345 DT4077	33 DT40123
50 DT40144	23 RN25	38 DT40131
2039 RAG4056	2420 DT4077	

1.2.2 Ground-truthed Mapping Extent

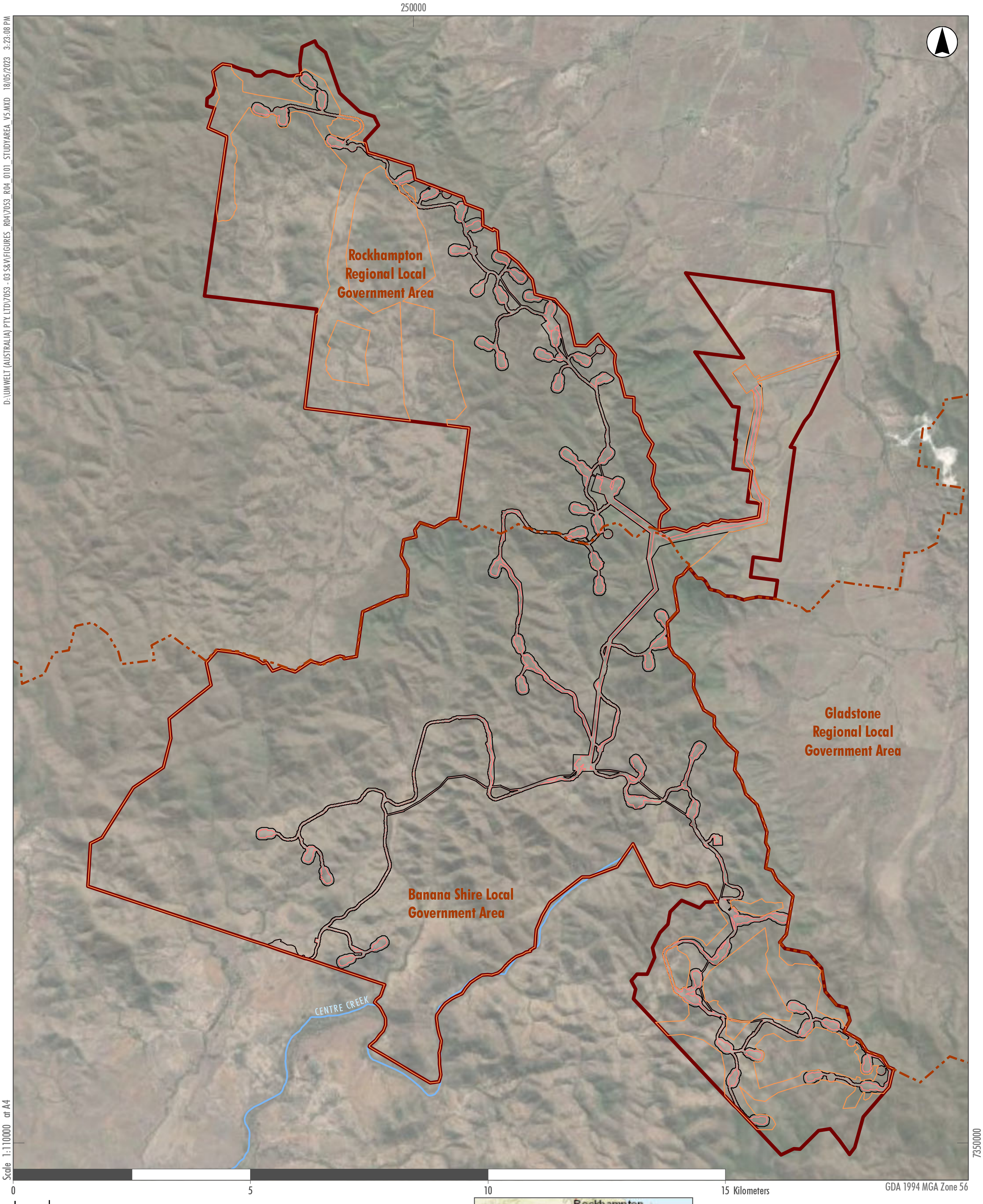
The Ground-truthed Mapping Extent covers approximately 12,924.1 ha and represents the limit of the vegetation mapped within the Study Area. Due to the dynamic nature of the Project's design development, some areas surveyed no longer fall within the Study Area boundary, and not all parcels within the Study Area were surveyed in their entirety. It should be noted that this boundary does not represent the spatial bounds in which all Project field surveys have been conducted (this area being larger and including areas outside of the Study Area).

1.2.3 Development Corridor

For the purposes of this report, the Development Corridor refers to the area within which all Project infrastructure will be located. The Development Corridor includes a variable width buffer around the infrastructure of up to 100 m and covers an area of approximately 1,347.4 ha.

1.2.4 Disturbance Footprint

The Disturbance Footprint covers approximately 877.5 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure. It is a 'worst-case' scenario in terms of the extent of clearing works. The impact assessment on fauna values (see **Section 7.1.1** and **Appendix E**) refers to clearing areas that are based on the Disturbance Footprint. As infrastructure will be micro-sited within the Development Corridor, the final clearing areas are anticipated to be lower than detailed in this assessment (described further in **Section 6.0**).



Legend

- Study Area
- Ground Truthed Survey Extent
- Development Corridor
- Disturbance Footprint
- Local Government Area (LGA)
- Town
- Road

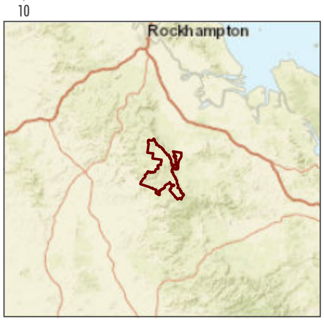


FIGURE 1.1

Study Area and Ground Truthed Survey Extent

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

1.3 Assessment Aim and Scope of Works

The aim of the assessment was to characterise terrestrial fauna values within the Study Area (including threatened fauna and their habitat), assess the impacts of the Project on these values, and present strategies to avoid, minimise or mitigate potential impacts.

- A desktop assessment of relevant database searches and literature to identify threatened fauna species which may be present within the Study Area.
- Field surveys within the Study Area employing standard survey techniques to:
  - Document condition, extent and value of vegetation communities, habitat types and other ecological values within the Study Area.
  - Target potentially occurring threatened fauna listed under the *Nature Conservation Act 1992* (NC Act).
  - Identify habitat resources for known and potentially occurring threatened fauna and Special Least Concern (SLC) fauna species.
- Utilise field-based data in conjunction with aerial imagery and desktop data to determine the likely extent of vegetation communities, habitat types and associated Matters of State Environmental Significance (MSES) values across the Study Area.
- Undertake a likelihood of occurrence assessment to confirm known or potentially present fauna species listed under the NC Act within the Study Area.
- An impact assessment against the *Significant Residual Impact Guideline: For matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (The Department of State Development, Infrastructure and Planning, 2014) to determine whether the Project is likely to have a significant residual impact on a relevant MSES (i.e. prescribed environmental matter). This impact assessment is inclusive of recommended mitigation and management measures.

2.0 Legislative Context

State and Commonwealth legislation relevant to the Project has been summarised in **Table 2.1** below.

Table 2.1 Summary of Relevant Legislation

Relevant Legislation	Governing Agency	Summary	Project Relevance
Commonwealth Legislation			
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	The EPBC Act is Australia's key piece of environmental legislation. It outlines nine Matters of National Environmental Significance (MNES). Actions that adversely affect MNES may be deemed to be a controlled action under the EPBC Act.	Two MNES are relevant to the Project: • Threatened Species and Ecological Communities. • Migratory Species.
State Legislation			
Nature Conservation Act 1992 (NC Act)	Department of Environment and Science (DES)	The purpose of the NC Act is to conserve biodiversity by creating and managing protected areas, managing and protecting native wildlife, and managing the spread of non-native wildlife.	Where a proposed development will result in such impacts to flora and or fauna protected under the NC Act, authorisation from the Director General of the DES is required. The following fauna values under the NC Act are relevant to the Project: • Threatened fauna species. • Connectivity areas. • Waterways for waterway barrier works.
Vegetation Management Act 1999 (VM Act)	Department of Resources (DoR)	The VM Act establishes the vegetation management framework for Queensland which applies to all vegetation with the exception of State forests, National parks, forest reserves and certain other tenures defined under the NC Act and the *Forestry Act 1959*.	Essential habitat is vegetation in which threatened species listed under the NC Act have been known to occur is. Essential habitat is regulated under the VM Act. Where clearing cannot be reasonably avoided or minimised, an offset may occur.
Biosecurity Act 2014	Department of Agriculture and Fisheries	The *Biosecurity Act 2014* lists fauna and flora pest species as either a prohibited or restricted biosecurity matter.	The *Biosecurity Act 2014* defines specific requirements for notification and management actions for all listed biosecurity matters, including specific requirements for the disposal of restricted matters.

Relevant Legislation	Governing Agency	Summary	Project Relevance
Environmental Offsets Act 2014	Department of Environment and Science (DES)	An environmental offset condition may be imposed under certain Queensland legislation that applies to development assessment where the activity is a prescribed activity under the *Environmental Offsets Act 2014* Activities which have an impact on a Matter of State Environmental Significance (MSES) may require offsetting under the Act.	Consideration of offsetting requirements for the Project will need to be determined once a fixed design for the Project is completed. Requirements will also need to be considered in conjunction with overlapping EPBC Act requirements. Environmental offsets are therefore not discussed as part of this report.
State Code 23: Wind Farm Development (State code 23)	Department of State Development, Infrastructure, Local Government and Planning	State code 23 is contained within the State Development Assessment Provisions (SDAP) and applies to a material change of use for a new or expanding wind farm. Development that is a material change of use for a wind farm should demonstrate compliance with 13 performance outcomes (PO) and associated acceptable outcomes within the code.	The PO relevant to this assessment is PO5 – Flora and Fauna: *Development ensures that impacts on flora, fauna and associated ecological processes are avoided, or minimised and mitigated, through effective siting, design and operation of the development.*

3.0 Methods

3.1 Desktop Assessment

A desktop assessment of publicly available data sources was initially completed in 2019 to determine the preliminary status of fauna values within the Study Area. Database searches were re-run in 2021, 2022 and 2023 as the Project progressed. These data sources represent both government and private industry databases and documents relevant to the Study Area. The following sources were interpreted to complete the desktop assessment:

- DCCEEW EPBC Protected Matters Search Tool (PMST) database.
- DCCEEW Species Profile and Threats (SPRAT) database.
- Department of Environment and Science (DES) Wildlife Online database.
- DES WetlandInfo Wetland Summary Information.
- DES Protected Plants Flora Survey Trigger Map.
- Department of Resources (DoR) Regulated Vegetation Management Map.
- DoR Vegetation Management Supporting Map, including Essential Habitat mapping.
- DoR Reservoirs Map.
- DoR Queensland resources web map service.
- Queensland Herbarium Regional Ecosystem Description Database (REDD).
- Atlas of Living Australia (ALA) records database.
- Available published and unpublished reports concerning the ecology of the Study Area, including:
  - eBird and Birdlife Australia databases
  - Published and unpublished ecology reports where available.

For the purposes of the database searches, a 10 km buffer was applied to the Study Area boundary.

3.2 Field Survey

3.2.1 Field Survey Timing and Weather Conditions

The fauna data presented herein has been collected within the Study Area and neighbouring land parcels, across thirteen field surveys from July 2019 to October 2022. Intensive fauna survey trapping effort was focused during two trips in May and June 2020 with a final fauna survey being conducted in September / October 2021. Opportunistic fauna data was collected during all surveys including flora surveys (**Table 3.1**).

Due to the remoteness of the Study Area and the absence of a local weather station, field survey weather conditions have been extracted from the DES SILO weather model (Queensland Government 2022). The data was extracted from the model using the coordinates central to the Study Area (-23.85, 150.55). Variation in weather data results reflect the seasonality of field surveys.

Table 3.1 Field Survey Weather Conditions

Field Survey	Survey Dates	Survey Length (Days)	Rainfall (mm)	Temperature (°C)	
				Min	Max
Initial Site Scoping	9–12 July 2019	4	0.7	6.0	24.4
Flora Survey^	6–12 August 2019	7	0	1.6	26.7
Bird and Bat Utilisation Survey	25 February–5 March 2020	10	57.1	19.5	31.8
Fauna Survey	14–23 May 2020	10	18.1	9.3	25.1
Fauna Survey	1–8 June 2020	8	0	3.9	24.3
Bird and Bat Utilisation Survey	3–11 November 2020	9	0.6	14.7	32.4
Fauna Survey	3–13 November 2020	11	0.6	14.7	32.4
Flora Survey^	7–11 November 2020	5	0	14.7	28.6
Flora Survey^	20–24 January 2021	4	0.6	18.3	32.5
Fauna Survey	30 September–6 October 2021	7	23.5	10.2	32.4
Bird and Bat Utilisation Survey	8–5 October 2021	8	1.8	14.5	31.3
Bird and Bat Utilisation Survey	14–21 February 2022	8	6.1	18.9	32.9
BioCondition and Habitat Quality Assessment	24–28 October 2022	5	37.4	17.1	33.7

^ Opportunistic fauna surveys also undertaken.

3.2.2 Approach and Survey Effort

Threatened fauna species were identified from the desktop assessments and targeted during the field survey within representative habitat types. Fauna surveys were conducted in accordance with the Terrestrial Fauna Survey Guidelines for Queensland (Eyre *et al*. 2018). Fauna survey methods specifically targeting EPBC listed fauna species were developed based on the Commonwealth survey guidelines for Australia's threatened animals, including:

- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a).
- Survey Guidelines for Australia's Threatened Bats (DEWHA 2010a).
- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010b).
- Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011b).
- Survey Guidelines for Australia's Threatened Frogs (DEWHA 2010c).

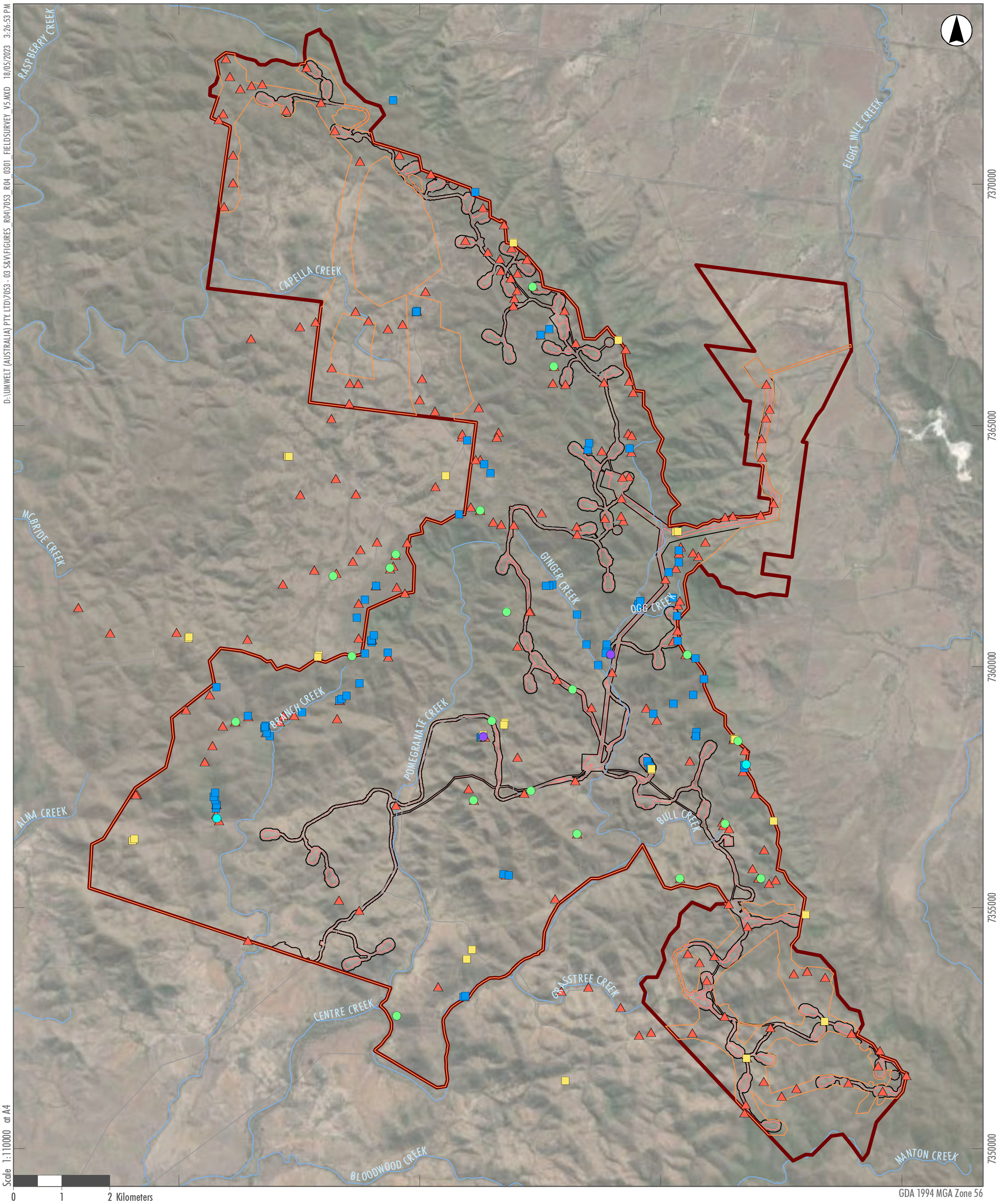
As ecological information was collected, the constraints map for the Project and subsequently the Project boundary has evolved. As a result, significant survey effort has been undertaken within the reported Study Area as well as within adjacent land parcels.

The fauna effort presented below includes ecology surveys completed adjacent to the Study Area boundary. Field survey techniques employed to assess the presence of fauna species within the Study Area, including survey effort, are detailed in **Table 3.2** below. Field survey locations are depicted in **Figure 3.1**.

Table 3.2 Field Survey Techniques and Survey Effort

Technique	Description	Survey Effort
Bird Survey (General)	Diurnal birds were sampled using an area census method, supplemented by broad observational surveys throughout the Study Area. Sampling was also undertaken at each trapping site during early morning trap checks.	99 person-hours
Spotlighting	Spotlighting was undertaken on foot using head torches and hand-held spotlights within areas of suitable and representative habitat. Spotlighting was also undertaken from the passenger window of a slow-moving vehicle while travelling between spotlighting sites.	60 person-hours
Mammal Trapping	Type A aluminium Elliot traps targeting small mammals and reptiles were placed at approximately 10 m intervals along two transects. Traps were baited with a mixture of rolled oats, peanut butter, honey and vanilla essence, and checked each morning to identify and release captured fauna.	320 trap nights
Pitfall Trapping	Pitfall trapping was undertaken using 20 L buckets dug into the ground until the top of the bucket is flush with the surface of the ground. Three buckets are used at each site separated by approximately 10 m. Between each bucket is a drift fence approximately 30 cm high used to direct small animals towards the pitfall traps.	27 trap nights
Call Playback	Call playback for nocturnal bird species was undertaken in conjunction with spotlight surveys and targeted a range of species depending on habitat type present. Calls were played for several minutes, followed by a period of quiet listening for responses, scanning the night sky for silhouettes and spotlighting adjacent to vegetation.	6 hours
Active Searches	Active diurnal searches were undertaken within suitable microhabitat across the broad range of habitat types for reptiles, amphibians and small mammals. This involved searching beneath microhabitat such as rocks and fallen timber, digging through leaf litter and soil at tree bases and identifying tracks and traces such as scats and tree scratches.	58 person-hours
Camera Trapping	Camera traps were deployed in strategic positions including fauna corridors and watering points such as dams and creek lines to record visitation by nocturnal and diurnal animals. Camera traps comprised baited set-ups using honey oat mix and/or sardines as an attractant.	490 trap nights
Acoustic Monitoring	Anabat devices were deployed in strategic positions including in natural flyways and at bird and bat utilisation survey (BBUS) vantage points to record visitation by bats.	111 trap nights
Harp Trapping	Two-bank harp traps were deployed in natural flyways and checked each morning before dawn to identify and release captured fauna.	14 trap nights
Koala SAT	At each site, 30 trees greater than 10 cm diameter at breast height (dbh) were searched at the base for koala scats.	20 sites

Technique	Description	Survey Effort
Fauna Habitat Assessment	Habitat assessments were undertaken within areas of representative habitat, capturing variation in condition and vegetation types. The relative abundance of key habitat attributes was recorded at each location, including hollow bearing trees or stags, coarse woody debris, surface rocks, soil cracks, leaf litter and vegetated cover. Disturbances or threats such as erosion, invasive weeds and pests were also noted. These assessments were used to inform habitat modelling for the impact assessment.	224 sites
Incidental Observations	All fauna observed incidentally throughout the Study Area were recorded. Observations of wildlife recorded outside of the main sampling sites were noted according to the habitat in which they were observed.	NA



Legend

- Study Area
- Ground Truthed Survey Extent
- Development Corridor
- Disturbance Footprint

Field Survey Locations

- Anabat
- Camera
- Elliot Trapping
- Koala SAT
- Pitfall Trapping
- Fauna Habitat Assessment

FIGURE 3.1

Field Survey Locations

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

3.2.3 Bird and Bat Utilisation

Umwelt ecologists conducted an extensive bird and bat utilisation survey program for the Project. Bird utilisation surveys were initially conducted in 2019 during winter (9 to 12 July 2019 and 7 to 12 August 2019) to establish vantage point locations and begin collecting a baseline avifaunal data set. A total of 16 vantage survey points were selected on the ridgelines and peaks of the Study Area based on the degree of visibility of surrounding areas.

Following initial surveys in 2019, four replicate surveys were conducted to capture seasonal variation in birds present within the Study Area. These surveys were conducted during the following periods:

- Autumn 2020 (23 February to 5 March 2020)
- Late spring 2020 (5 to 12 November 2020)
- Spring 2021 (8 to 15 October 2021)
- Summer 2022 (14 to 21 February 2022).

The timing of these surveys coincided with the seasonal migration of listed threatened and/or migratory bird species, including white-throated needletail (*Hirundapus caudacutus*) and fork-tailed swift (*Apus pacificus*).

During each survey event generally 13 of the 16 vantage points were selected for sampling. Each vantage point was surveyed for one hour during three sampling windows per day:

- Morning (between 6.00 am and 10.00 am)
- Midday (between 10.00 am and 2.00 pm)
- Afternoon (between 2.00 pm and 6.00 pm).

Vantage points were surveyed twice during each sampling window such that individual surveys were undertaken on six occasions at each vantage point. At each vantage point, a single observer recorded the following information for each observation:

- Species and abundance.
- Observation type (visual or aural).
- Distance and direction from the observer (to the nearest 10 m and 10° respectively).
- Approximate height AGL of the observed bird/s (to the nearest 10 m).
- Direction of flight (to the nearest 10°).
- Flight pattern (i.e. not flying, local movement, directional flight, circling, swooping, varied, other).
- Behaviour (i.e. flight, foraging, perching, mating, aggressive interactions, hollow inspection, nesting, on station).

Bat utilisation surveys were undertaken in July 2019 (winter), February to March 2020 (autumn), November 2020 (spring), October 2021 (spring) and February 2022(summer). Microchiropteran bat (microbat) echolocation calls were sampled using Anabat Swift recording devices at each vantage point location. Devices were placed approximately 2 m AGL facing a cleared area or flyway and left for between two to five nights. In addition, two Anabat Swift devices were deployed on the meteorological mast at approximately 50 m AGL, for a combined total of three nights.

The likelihood that bat species detected in the Study Area fly at-risk (i.e. at RSA height) was inferred based on calls detected from the elevated Anabat Swift device and on literature relevant to the flight behaviour of recorded species.

3.2.4 Limitations

Patterns of faunal activity and estimates of relative abundance or presence-absence of species, varies temporally in response to the time of day (day versus night), seasonal changes (e.g. spring versus winter) as well as between years (e.g. rainy year versus drought year) (Eyre et al. 2018).

The COVID-19 pandemic caused delays in the survey schedule due to Government regulated travel restrictions and commercial fight availability from March to June 2020. These delays pushed the fauna survey from late in the autumn fauna survey window and into early winter. These surveys were subsequently undertaken during a cooler, drier period.

Restricted access and safety mitigation measures meant that many ecological trapping methods were unable to be deployed (harp traps, Elliot traps and pitfall traps) intensively across the Study Area.

3.3 Likelihood of Occurrence Assessment

The assessed likelihood of occurrence of threatened species was based on a review of previous sighting records, a review of known habitat preferences and the broad habitats provided by verified vegetation communities mapped across the Study Area. Based upon the analysis of habitats, records and known species habitat preferences, species were assigned to one of the following categories:

- **Known to Occur:** this category includes all species previously recorded in the Study Area.
- **High Potential to Occur:** This category includes species previously recorded in the Study Area or in the immediate vicinity and details on presence are reliable. The Study Area contains preferred habitat resources which may support a population of the species.
- **Moderate Potential to Occur:** The species is known from the broader area (desktop search extent) and some of the preferred habitat is present within the Study Area. Aerial foragers and other migratory birds that may overfly the Study Area are also included.
- **Low Potential to Occur:** The Study Area supports some suitable habitat, often marginal. The species may disperse through the Project infrequently and is unlikely to depend on the habitat for their survival.
- **Unlikely to Occur:** This category includes those species for which the Study Area offers limited or no potential habitat, is outside their known range and/or is without broader habitat requirements.

3.4 Significant Residual Impact Assessment

The Project comprises a wind farm development and as such requires approval under the Queensland *Planning Act 2016*. An assessment against the *Significant Residual Impact Guideline: For matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009* (The Department of State Development, Infrastructure and Planning, 2014) has been undertaken to determine whether the Project is likely to have a significant residual impact on a relevant Matter of State Environmental Significance (MSES) (i.e. prescribed environmental matter).

If after all reasonable avoidance and mitigation measures have been taken by the Project, if there is still a significant residual impact on an MSES, an offset may be required.

4.0 Results

4.1 Desktop Assessment

4.1.1 Threatened Species

The desktop search identified 31 threatened fauna species listed under the NC Act and/or EPBC Act as having potential to occur within the Study Area including 16 birds, 9 mammals and 6 reptiles. Identified species are outlined in **Table 4.1**.

Table 4.1 Desktop Search Results: Threatened Species

Common Name	Scientific Name	EPBC Act Status	NC Act Status
Birds			
Australian painted snipe	*Rostratula australis*	Endangered	Vulnerable
black-breasted buttonquail	*Turnix melanogaster*	Vulnerable	Vulnerable
Coxen's fig-parrot	*Cyclopsitta diophthalma coxeni*	Endangered	Endangered
curlew sandpiper	*Calidris ferruginea*	Critically Endangered, Migratory	Endangered
Diamond firetail	*Stagonopleura guttata*	Vulnerable	Vulnerable
eastern curlew	*Numenius madagascariensis*	Critically Endangered, Migratory	Endangered
glossy black-cockatoo	*Calyptorhynchus lathami*	-	Vulnerable
greater sand plover	*Charadrius leschenaultii*	Vulnerable, Migratory	Vulnerable
grey falcon	*Falco hypoleucos*	Vulnerable	Vulnerable
painted honeyeater	*Grantiella picta*	Vulnerable	Vulnerable
red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Endangered
southern black-throated finch	*Poephila cincta cincta*	Endangered	Endangered
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
star finch (eastern, southern)	*Neochmia ruficauda ruficauda*	Endangered	Endangered
white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable
yellow chat (Dawson)	*Epthianura crocea macgregor*	Critically Endangered	Endangered
Mammals			
Corben's long-eared bat	*Nyctophilus corbeni*	Vulnerable	Vulnerable
ghost bat	*Macroderma gigas*	Vulnerable	Endangered
greater glider (southern and central)	*Petauroides volans*	Endangered	Vulnerable
yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable
grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	-

Common Name	Scientific Name	EPBC Act Status	NC Act Status
koala (combined populations of Qld, NSW and the ACT)	*Phascolarctos cinereus*	Endangered	Endangered
large-eared pied bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable
long-nosed potoroo (SE mainland)	*Potorous tridactylus tridactylus*	Vulnerable	Vulnerable
northern quoll	*Dasyurus hallucatus*	Endangered	-
Reptiles			
collared delma	*Delma torquata*	Vulnerable	Vulnerable
Dunmall's snake	*Furina dunmalli*	Vulnerable	Vulnerable
Fitzroy river turtle	*Rheodytes leukops*	Vulnerable	Vulnerable
ornamental snake	*Denisonia maculata*	Vulnerable	Vulnerable
southern snapping turtle	*Elseya albagula*	Critically Endangered	Endangered
yakka skink	*Egernia rugosa*	Vulnerable	Vulnerable

4.1.2 Special Least Concern Species

The desktop search identified 15 fauna species listed Migratory under the EPBC Act and Special Least Concern under the NC Act as having potential to occur within the search extent. Also identified during this search was the short-beaked echidna (*Tachyglossus aculeatus*) which is listed Special Least Concern under the NC Act (but is not Migratory).

Of the 16 species identified, two species, white-throated needletail and greater sand plover, are also listed as Vulnerable under both the EPBC Act and NC Act. These species are herein assessed as Vulnerable being the higher level of classification graded for this species. Identified species are outlined in **Table 4.2**.

Table 4.2 Desktop Search Results: Special Least Concern Species

Common Name	Scientific Name	EPBC Act Status	NC Act Status
Special Least Concern Mammal			
short-beaked echidna	*Tachyglossus aculeatus*	-	Special Least Concern
Marine Birds			
fork-tailed swift	*Apus pacificus*	Migratory	Special Least Concern
greater sand plover	*Charadrius leschenaultia*	Vulnerable, Migratory	Vulnerable
Marine Bird Species			
salt-water crocodile	*Crocodylus porosus*	Migratory	Special Least Concern
Terrestrial Bird Species			
black-faced monarch	*Monarcha melanopsis*	Migratory	Special Least Concern
oriental cuckoo	*Cuculus optatus*	Migratory	Special Least Concern
rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern
satin flycatcher	*Myiagra cyanoleuca*	Migratory	Special Least Concern

Common Name	Scientific Name	EPBC Act Status	NC Act Status
spectacled monarch	*Monarcha trivirgatus*	Migratory	Special Least Concern
white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable
yellow wagtail	*Motacilla flava*	Migratory	Special Least Concern
Wetlands Bird Species			
common sandpiper	*Actitis hypoleucos*	Migratory	Special Least Concern
Latham's snipe	*Gallinago hardwickii*	Migratory	Special Least Concern
osprey	*Pandion haliaetus*	Migratory	Special Least Concern
pectoral sandpiper	*Calidris melanotos*	Migratory	Special Least Concern
sharp-tailed sandpiper	*Calidris acuminata*	Migratory	Special Least Concern

4.1.3 Essential Habitat

The Study Area does not contain any essential habitat areas for listed fauna species, as shown on the DoR (2023) Vegetation Management essential habitat map (version 11.05).

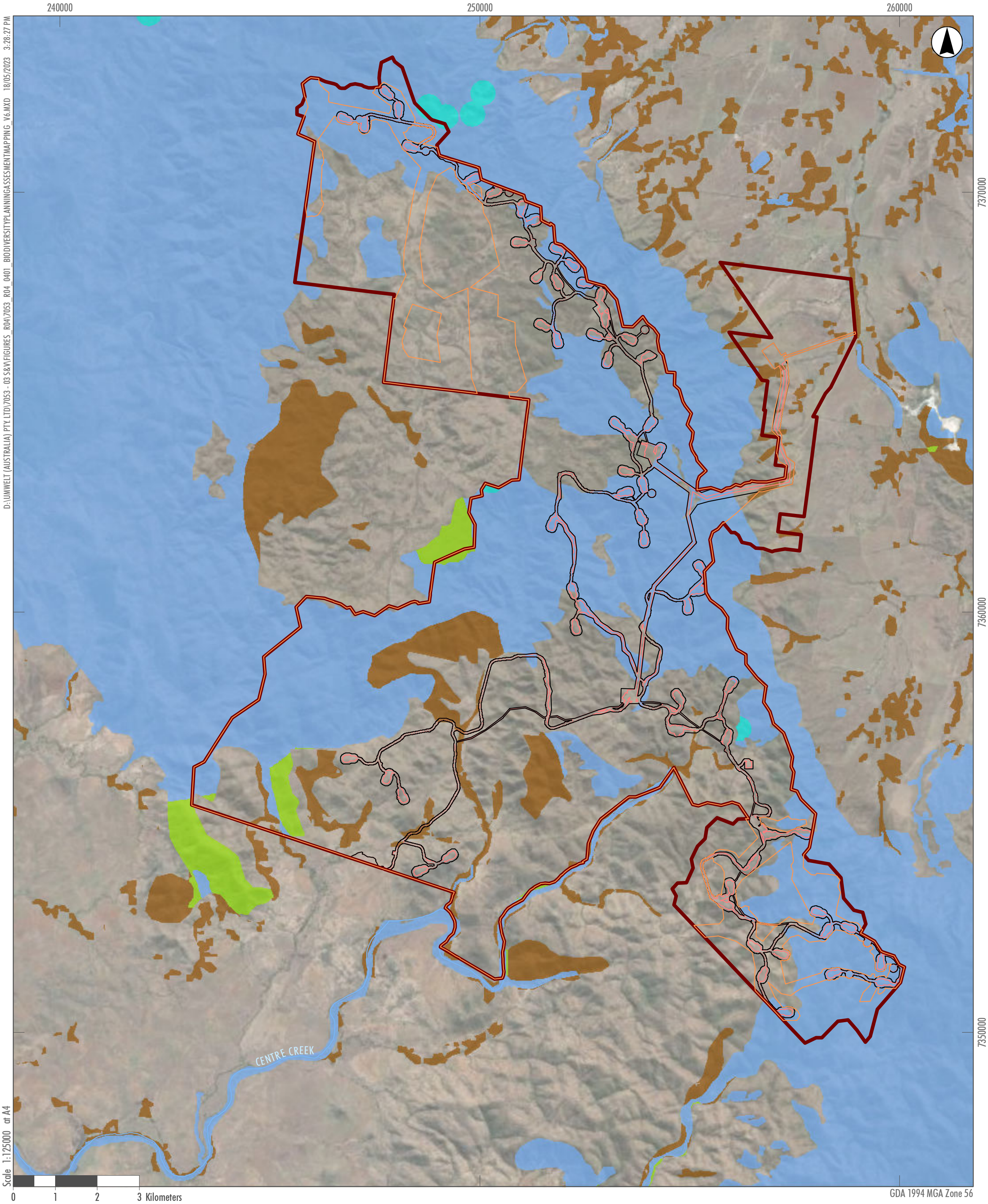
4.1.4 Biodiversity Planning Assessment

Biodiversity significance is attributed by DES on a bioregional scale through a Biodiversity Planning Assessment (BPA). BPAs assign three levels of overall biodiversity significance:

1. **State significance** – areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales.
2. **Regional significance** – areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
3. **Local significance** and/or **other values** – areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

The BPA mapping identifies all three levels within the Study Area, with state significant corridors dominating the eastern range, including northern areas of connected vegetation. The BPA mapping is presented in **Figure 4.1.**

umwelt



Legend

- Study Area
- Ground Truthed Survey Extent
- Development Corridor
- Disturbance Footprint

Biodiversity Significance

- State Habitat for Endangered, Vulnerable or Near Threatened (EVNT) Taxa
- State
- Regional
- Local or Other Values

FIGURE 4.1

Biodiversity Planning Assessment Mapping

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

4.2 Field Results

4.2.1 Study Area Characteristics

The Study Area extends across the Ulam Range surrounded on each side by agricultural properties and local dwellings. East of the Study Area, the Ulam Range ends and the landscape flattens to a plain where the dominant land use is cattle grazing. The southwestern extent of the Study Area also extends to a cleared, flatter landscape with two water courses flowing south-west into Centre Creek.

A large section of the Ulam Range has been cleared for cattle grazing and is localised within the centre of the range. This section exists within the northern section of the Study Area, extending further north. This section is associated with a slightly flatter landscape with various vegetated creeks throughout.

Large stands of remnant vegetation exist within the Study Area separated by partly cleared regrowth areas used primarily for livestock grazing. Due to the steep topography of the Study Area, uncleared riverine vegetation communities are common, often with a dense mid-story of vine thicket or dense shrubs. These areas sprawl through the Study Area connecting various habitat types and providing local connectivity for fauna species. Non-riverine vine thickets are also common on the upper slopes of the steep hills and ridges of the Study Area. These thickets trend along a northern ridgeline in the Study Area and extend down into the creeks and gullies.

4.2.2 Fauna Diversity

A total of 211 fauna species from 156 genera were identified during the field survey program, comprising 148 birds, 37 mammals, 19 reptiles and 7 amphibians. Of the species recorded, 6 are introduced, representing 2.8% of the total fauna assemblage recorded.

The following sections describe the fauna species which are of significance to the Project. The full list of fauna species identified during the field surveys is provided in **Appendix B.**

4.2.2.1 Threatened Species

Field surveys identified six fauna species listed as threatened under the EPBC Act and/or NC Act. A breakdown of these species is provided in **Table 4.3** and record locations are provided in **Figure 4.2**.

Table 4.3 Threatened Fauna Species Recorded within the Study Area

Common Name	Scientific Name	EPBC Act Status	NC Act Status
glossy black-cockatoo	*Calyptorhynchus lathami*	-	Vulnerable
greater glider (southern and central)	*Petauroides volans*	Vulnerable	Vulnerable
northern quoll	*Dasyurus hallucatus*	Endangered	Least Concern
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable
Yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable

Plate 4.1 Northern quoll (*Dasyurus hallucatus*) detected on a camera trap in the central-east portion of the Study Area

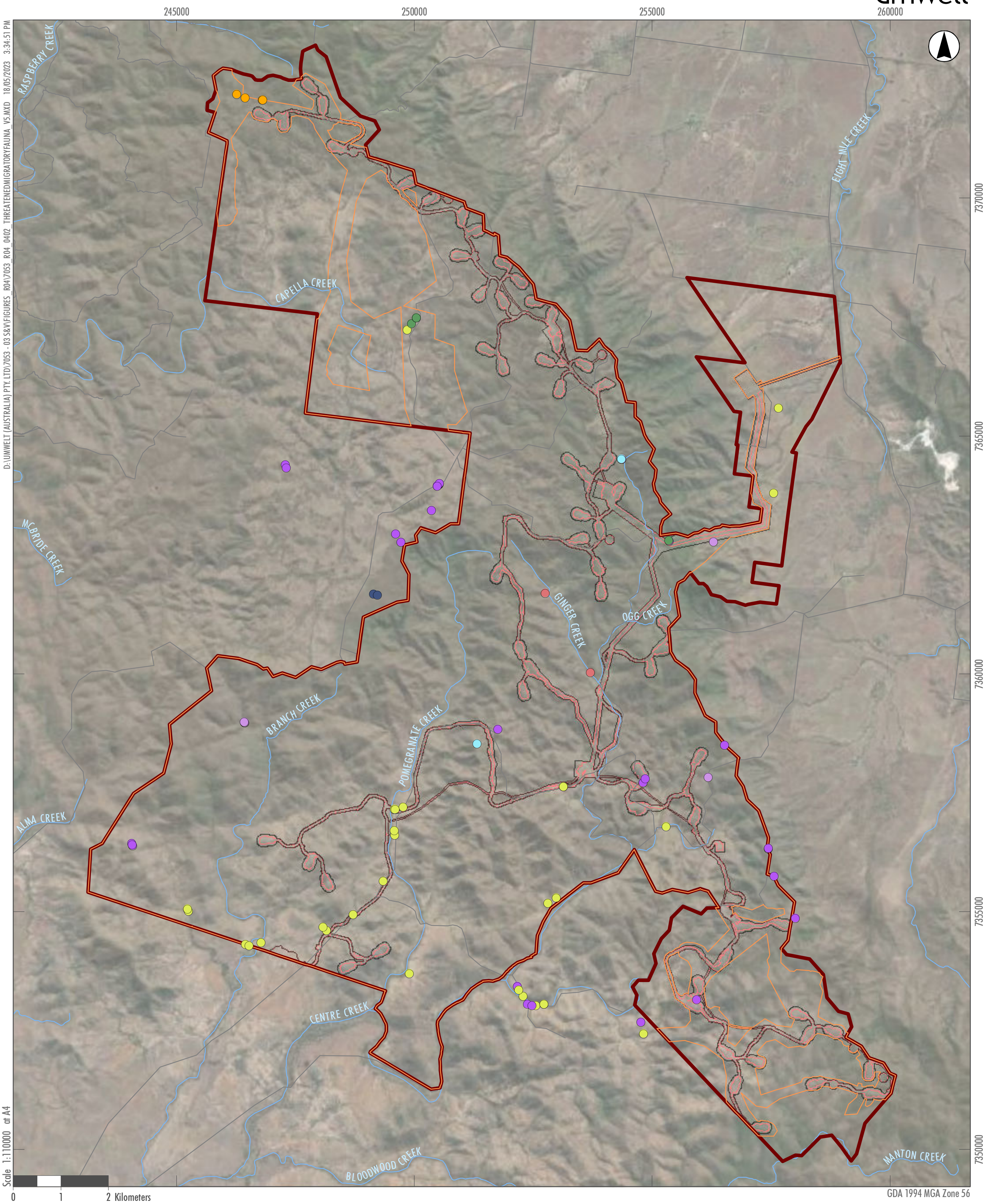
Plate 4.2 Male glossy black-cockatoo (*Calyptorhynchus lathami*) feeding on forest she-oak (*Allocasuarina torulosa*) adjacent to the Study Area

4.2.2.2 Migratory and Species Least Concern Species

Field survey identified four fauna species listed as Migratory under the EPBC Act and/or Special Least Concern under the NC Act. This includes one species, white-throated needletail, which is also listed as Vulnerable under the EPBC Act and NC Act and has also been considered in the section above. A breakdown of these species is provided in **Table 4.4** and record locations are provided in **Figure 4.2**.

Table 4.4 Migratory and Special Least Concern Species Recorded within the Study Area

Common Name	Scientific Name	EPBC Act Status	NC Act Status
rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern
spectacled monarch	*Symposiarchus trivirgatus*	Migratory	Special Least Concern
short-beaked echidna	*Tachyglossus aculeatus*	-	Special Least Concern
White-throated needletail	*Hirundapus caudacutus*	Vulnerable / Migratory	Vulnerable



Legend

- Study Area
- Ground Truthed Survey Extent
- Development Corridor
- Disturbance Footprint

Threatened and Migratory Fauna Record Locations

- Glossy black-cockatoo *(Calyptorhynchus lathami)*
- Greater glider *(Petauroides volans)*
- Northern quoll *(Dasyurus hallucatus)*
- Rufous fantail *(Rhipidura rufifrons)*
- Spectacled monarch *(Symposiachrus trivirgatus)*
- Squatter pigeon (southern) *(Geophaps scripta scripta)*
- White-throated needletail *(Hirundapus caudacutus)*
- Yellow-bellied glider (south-eastern) *(Petaurus australis australis)*

FIGURE 4.2

Threatened and Migratory Fauna Record Locations

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

4.2.2.3 Introduced Species

Field surveys identified six introduced fauna species, four of which are listed as Restricted Invasive biosecurity matters under the *Biosecurity Act 2014*. A breakdown of these species is provided in **Table 4.5**.

Table 4.5 Introduced Species Recorded within the Study Area

Common Name	Scientific Name	*Biosecurity Act 2014* Status
cane toad	*Rhinella marina*	Invasive
horse	*Equus caballus*	Invasive
feral cat	Felis catus	Restricted Invasive
feral pig	Sus scrofa	Restricted Invasive
black rat	*Rattus rattus*	Restricted Invasive
brown hare	*Lepus capensis*	Restricted Invasive

EPBC Act 'key threatening processes' are processes which threaten the survival, abundance or evolutionary development of a native species or ecological community (DAWE 2021). Key threatening processes are linked to three of the above introduced species and include:

- The biological effects, including lethal toxic ingestion, caused by cane toads (*Rhinella marina*).
- Predation by feral cats.
- Predation, habitat degradation, competition and disease transmission by feral pigs.

4.2.3 Bird and Bat Utilisation Survey Results

A total of 148 bird species were recorded within the Study Area; 88 were recorded during vantage point surveys while the remaining 60 were heard or observed incidentally during travel between vantage points or during other surveys within the Study Area.

A total of 18 bat species were recorded within the Study Area across the field survey program, either acoustically recorded by Anabat devices or caught via harp trapping. Nine of the 18 species were recorded during each BBUS. None of the bat species recorded during the field survey program are listed under the NC Act or EPBC Act.

The full list of bird and bat species identified during the field surveys is provided in **Appendix B**.

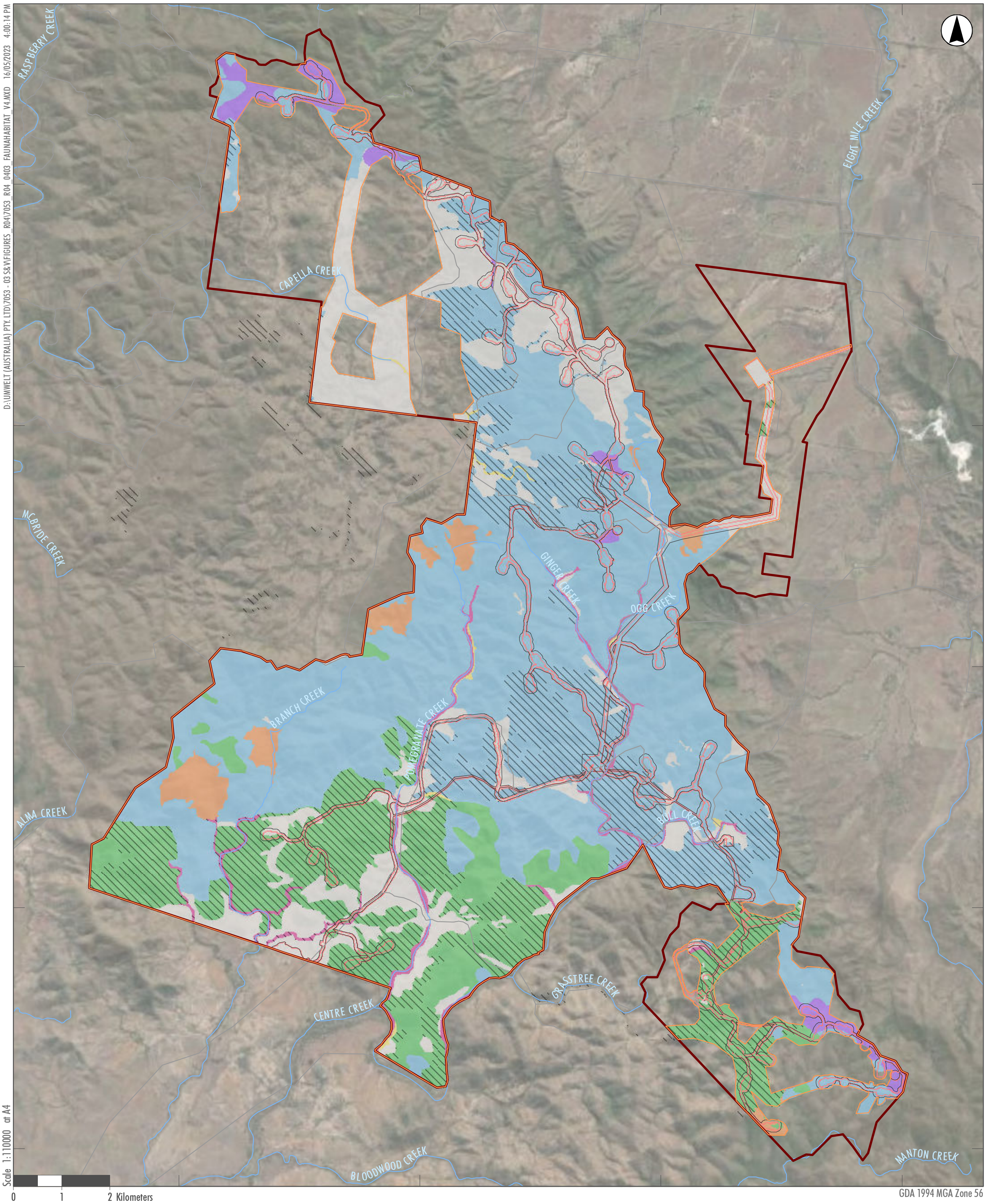
4.2.4 Fauna Habitat Types

The Study Area supports seven broad fauna habitat types, ranging from eucalypt woodland to dense microphyll vine forest (**Table 4.6**). The various habitat types support habitat resources for multiple threatened and migratory fauna species which are known to occur within the Study Area or have a moderate or high likelihood of occurring. A profile for each fauna habitat type is provided in **Appendix C.** These fauna habitat types have been mapped based on ground-truthed RE mapping and are shown on **Figure 4.3**.

Table 4.6 Fauna Habitat Types within the Study Area (Ground-truthed Mapping Extent)

Fauna Habitat Type	Habitat Description	Associated Regional Ecosystems	Ground-truthed Mapping Extent (ha)[1]
Mixed eucalypt woodland on steep slopes	Mixed eucalypt woodland on steep slopes and crests, commonly with *Corymbia citriodora* and/or *Eucalyptus crebra* +\- *E. acmenoides*, *E. tereticornis*	11.11.3, 11.11.4, 11.11.4a, 11.11.4b, 11.12.6	7,264.3
Eucalyptus crebra woodland	*Eucalyptus crebra* +\- *Corymbia erythrophloia* woodland on slopes and crests	11.11.15, 11.12.1	2,575.5
Eucalyptus moluccana woodland	*Eucalyptus moluccana* woodland on slopes and crests	11.11.3c, 11.11.4c	241.8
Semi-evergreen vine thicket	Vine thicket on upper slopes and gullies with various floristics including *Euroschinus falcatus* var. *falcatus*, *Brachychiton australis*, *Flindersia* spp., *Ficus* sp., *Jasminum* sp., *Alyxia* sp., etc.	11.11.5, 11.11.5a, 11.12.4	330.8
Riparian *Melaleuca* woodland	*Melaleuca fluviatilis* woodland +\- *Eucalyptus tereticornis* fringing a watercourse	11.3.25b	240.8
Alluvial eucalypt woodland	*Eucalyptus tereticornis* +\- *Corymbia tessellaris* woodland on alluvial soils sometimes with *Casuarina cunninghamiana* as dominant	11.3.4, 11.3.25	36.9
Non-remnant pasture	Areas containing pasture comprising native and non-native grasses, scattered native trees and various infrastructure including tracks and dams	-	2,234.1

[1]: Areas reported are inclusive of regrowth where present.



Legend

Study Area
Ground Truthed Survey Extent
Development Corridor
Disturbance Footprint

Fauna Habitat Type

Alluvial eucalypt woodland
Eucalyptus crebra woodland
Eucalyptus moluccana woodland
Mixed eucalypt woodland on steep slopes
Non-remnant pasture
Riparian Melaleuca woodland
Semi-evergreen vine thicket
Regrowth Vegetation

FIGURE 4.3

Fauna Habitat Mapping

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

4.2.5 Aquatic Habitat

The aquatic ecological values assessed during the field survey relate to the ephemeral creek systems of the Study Area. These creeks include many watercourses mapped under the VM Act comprising stream order four, three, two and one watercourses. Given the highly ephemeral nature of watercourses in the Study Area, they were generally dry at the time of field surveys with small pools persisting after rain where the channel substrate comprised bedrock. The longest major watercourse within the Study Area is Centre Creek, a stream order four watercourse situated along the central, southern boundary. One mapped high ecological value watercourse associated with the Callide Creek Catchment is mapped approximately 50 m into the north western-most extent of the Study Area. There are no wetlands mapped within the Study Area.

In-stream aquatic habitat included rocky substrates, varying in complexity from pebbles/stones to large boulders upon bedrock. All watercourses supported in-stream snags such as fallen branches, logs, trees and shrubs. Stream banks comprised grasses consistent with the adjacent woodlands, although riparian species such as spiny-head mat-rush (*Lomandra longifolia*) were also present. Watercourses showed evidence of disturbance, often associated with cattle impacts such as the presence of weeds e.g. lantana (*Lantana camara*) and rubber vine (*Cryptostegia grandiflora*), and ground disturbance. No watercourses of high ecological significance exist within the Study Area. However, several mapped watercourses are considered relevant waterways for waterway barrier works. Associated risk levels range from 'Major' to 'Low'. Only small areas of 'Major' watercourses are present in the Study Area where stream bends meander into the edge of the area, however none intersect the Disturbance Footprint or Development Corridor.

Fringing riparian vegetation was generally similar throughout the Study Area, generally dominated by weeping tea-tree (*Melaleuca fluviatilis*) and/or river she-oak (*Casuarina cunninghamiana*), although vine thicket habitat types which formed a dense canopy was also present. Eucalypts also featured along watercourses, predominately on stream order three and stream order four watercourses. Dominant eucalypt species including Queensland blue gum (*Eucalyptus tereticornis*) and Moreton Bay ash (*Corymbia tessellaris*).

During brief periods of inundation, the aquatic environment within the Study Area may support marginal assemblages of aquatic fauna species such as native fish and freshwater crustaceans. No aquatic flora species were recorded within the Study Area due to an absence of water. However, numerous macrophyte species were recorded in and around the watercourses. These species were represented within alluvial woodlands dominated by *Eucalyptus tereticornis*, *Melaleuca fluviatilis* and *Casuarina cunninghamiana*.

Plate 4.3 Stream order 3 waterway with bedrock substrate and fringed by vine thicket

Plate 4.4 Stream order 4 waterway, 'Centre Creek', fringed by *Casuarina cunninghamiana* and *Melaleuca fluviatilis*

4.3 Likelihood of Occurrence Assessment

4.3.1 Threatened Species

The likelihood of occurrence assessment determined that six threatened species are known from the Study Area based on field surveys and two species have a moderate likelihood of occurrence within the Study Area (**Table 4.7**). No species were identified as having a high likelihood of occurrence. Threatened species that have a low likelihood of occurrence or are unlikely to occur were excluded from further assessment. The full likelihood of occurrence assessment, including a habitat assessment and justification of likelihood, is provided in **Appendix A**.

One species, the yellow-bellied glider (south-eastern), was listed after the Project's development application was properly made to the State Assessment and Referral Agency on 6 October 2021 and as such has not been considered further in this assessment. However, this species has been considered in the Commonwealth approval process.

Table 4.7 Likelihood of Occurrence Assessment Results: Threatened Species

Common Name	Scientific Name	EPBC Act Status	NC Act Status
Known			
glossy black-cockatoo	*Calyptorhynchus lathami*	-	Vulnerable
greater glider (southern and central)	*Petauroides volans*	Vulnerable	Vulnerable
northern quoll	*Dasyurus hallucatus*	Endangered	Least Concern
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable
yellow-bellied glider	*Petaurus australis australis*	Vulnerable	Vulnerable
Moderate			
collared delma	*Delma torquata*	Vulnerable	Vulnerable
koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable

4.3.2 Species Least Concern Species

The likelihood of occurrence assessment determined that three Special Least Concern species are known to occur within the Study Area based on field surveys, one species has a high likelihood of occurrence and three species have a moderate likelihood of occurrence (**Table 4.8**). Migratory species that have a low likelihood of occurrence or are unlikely to occur were excluded from further assessment. The full likelihood assessment and justification of likelihood is provided in **Appendix A**.

Table 4.8 Likelihood of Occurrence Assessment Results: Migratory and Species Least Concern Species

Common Name	Scientific Name	EPBC Act Status	NC Act Status
Known			
rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern
spectacled monarch	*Symposiarchus trivirgatus*	Migratory	Special Least Concern
short-beaked echidna	*Tachyglossus aculeatus*	-	Special Least Concern
High			
fork-tailed swift	*Apus pacificus*	Migratory	Special Least Concern
Moderate			
black-faced monarch	*Monarcha melanopsis*	Migratory	Special Least Concern
oriental cuckoo	*Cuculus optatus*	Migratory	Special Least Concern
satin flycatcher	*Myiagra cyanoleuca*	Migratory	Special Least Concern

4.4 Threatened and Migratory Fauna Habitat Modelling

Habitat for threatened and Migratory fauna species known or potentially occurring within the Study Area was mapped based on each species unique habitat requirements, and the occurrence of such features within the Ground-truthed Mapping Extent. Habitat criteria used to inform the mapping of each species is provided in **Table 4.9** along with the area of habitat within the Ground-truthed Mapping Extent**.** Habitat mapping developed for listed threatened fauna is presented in **Appendix E**.

Table 4.9 Habitat Modelling Criteria for Threatened and Migratory Fauna

Species	Habitat Criteria	Area within the Ground-truthed Mapping Extent (ha)	Area Total
Threatened and Special Least Concern Fauna Species			
glossy black-cockatoo (*Calyptorhynchus lathami*)	Breeding: Regional ecosystem 11.11.3c was considered suitable for breeding based on the presence of large hollow-bearing trees.	152.1	2,752.2
	Foraging: Remnant or regrowth regional ecosystem supporting foraging tree species including those from the genera *Casuarina* and *Allocasuarina* (11.3.25, 11.3.25b, 11.11.3, 11.11.4).	2,600. 1	
Greater Glider (southern and central) (*Petauroides volans*)	Breeding and Denning: Select areas of seven REs (RE 11.3.4, 11.3.25b, 11.12.6, 11.11.3, 11.11.3c, 11.11.4a and 11.11.4b) were considered suitable for breeding and denning based on the presence of suitable hollow-bearing trees. Areas of mature regrowth were only included where the hollows were confirmed present and the EDL height was >14m.	2,339.5	9,900.5
	Foraging and Dispersal: Excluding areas found to provide breeding and denning habitat, all relevant REs (as per DES 2022) were considered to comprise foraging and dispersal habitat. Areas of mature regrowth were only included where the EDL height was >14m and canopy cover was not very open.	7,560.9	
northern quoll (*Dasyurus hallucatus*)	Denning and Refuge: Vegetation, watercourse, and 10-metre contour mapping was examined in conjunction with survey data (including floristics and habitat assessments) and high-quality Queensland Globe satellite imagery to manually identify hilly and rocky habitats including gullies, creeklines and structurally diverse woodlands.	1,449.4	8,394.0

Species	Habitat Criteria	Area within the Ground-truthed Mapping Extent (ha)	Area Total
	Foraging and Dispersal: All remnant and regrowth vegetation communities within 1 km of shelter habitat (mapped within and surrounding the Study Area) were identified as foraging and dispersal habitat.	6,944.6	
squatter pigeon (southern) (*Geophaps scripta scripta*)	Breeding: Although no land zone 5 or 7 occurs, woodland communities associated with land zone 3 are present and, in places, are within 1 km of a suitable water source (i.e. farm dams, lacustrine wetlands and watercourses with a stream order of 3 or higher).	184.0	6,925.6
	Foraging: Although no land zone 5 or 7 occurs, woodland communities associated with land zone 3 are present and, in places, are within 3 km of a suitable water source (i.e. farm dams, lacustrine wetlands and watercourses with a stream order of 3 or higher).	57.7	
	Dispersal: Breeding, foraging and suitable water sources within the Study Area and adjacent all largely occur within 1 km of each other. Based on this, all woodlands and areas of cleared land less than 100 m within 1 km of breeding and foraging were included.	6,683.9	
white-throated needletail (*Hirundapus caudacutus*)	Roosting and Foraging: Remnant vegetation occurring within areas above 400 m AHD.	2,866.1	10,690.0
	Foraging and Dispersal: All remaining vegetation communities in remnant or regrowth condition.	7,823.9	
collared delma (*Delma torquata*)	Breeding and Foraging: Open-forest, woodlands and adjacent exposed rocky areas in Queensland on land zones 3 (i.e. REs 11.3.25b and 11.3.4) with some suitable microhabitat. Some patches of above REs excluded based on confirming lack of microhabitat from field data. No land zone 9 or 10 communities present.	249.8	249.8
Koala (*Phascolarctos cinereus*)	Breeding, Foraging and Dispersal: All vegetation communities except SEVT in remnant or regrowth condition included.	11,128.2	11,405.9

Species	Habitat Criteria	Area within the Ground-truthed Mapping Extent (ha)	Area Total
	Climate Refugia: All eucalypt woodlands on land zone 3 are considered potential climate refugia.	277.7	
short-beaked echidna (*Tachyglossus aculeatus*)	Foraging, Breeding and Dispersal: All remnant and non-remnant vegetation communities included	12,924.1	12,924.1
Migratory Fauna Species			
rufous fantail (*Rhipidura rufifrons*)	Breeding: No breeding habitat has been identified as the Study Area is outside of the breeding range and does not support preferred habitat.	-	6,971.2
	Foraging and Dispersal: All vegetation in remnant condition. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	6,971.2	
spectacled monarch (*Symposiarchus trivirgatus*)	Foraging and Dispersal: Dense vegetation as confirmed during the field surveys, associated with gullies and steep slopes. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	1,037.5	1,037.5
fork-tailed swift (*Apus pacificus*)	Foraging and Dispersal: All remnant and non-remnant vegetation communities included.	12,924.1	12,924.1
black-faced monarch (*Monarcha melanopsis*)	Foraging and Marginal Breeding: Dense, semi-evergreen vine thicket vegetation as confirmed during the field surveys, associated with gullies and steep slopes. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	1,037.5	7,021.0
	Foraging and Dispersal: Excluding areas considered foraging and marginal breeding, all vegetation communities in remnant condition. Regrowth and non-remnant vegetation excluded due to unsuitable structure or connectivity.	5,983.5	

Species	Habitat Criteria	Area within the Ground-truthed Mapping Extent (ha)	Area Total
oriental cuckoo (*Cuculus optatus*)	Foraging and Dispersal: All vegetation communities are regarded as suitable, where they exist in remnant condition.	6,971.2	6,971.2
satin flycatcher (*Myiagra cyanoleuca*)	Breeding: No breeding habitat has been mapped for this species as the Study Area is outside of the species' breeding range.	-	6,640.4
	Foraging and Dispersal: All vegetation communities except two (REs 11.11.5a and 11.12.4) in remnant condition included. Regrowth and non-remnant vegetation not found to support suitable structure or connectivity.	6,640.4	

4.5 Matters of State Environmental Significance

The following MSES (i.e. prescribed environmental matters) that relate to fauna are mapped and/or have been identified through the field survey or via desktop assessment within the Study Area:

- Protected wildlife habitat for an animal that is endangered or vulnerable wildlife:
  - glossy black-cockatoo (*Calyptorhynchus lathami*)
  - greater glider (southern and central) (*Petauroides volans*)
  - yellow-bellied glider (south-eastern) (*Petaurus australis australis*)[1]
  - squatter pigeon (southern) (*Geophaps scripta scripta*)
  - white-throated needletail (*Hirundapus caudacutus*)
  - collared delma (*Delma torquata*)
  - koala (*Phascolarctos cinereus*).
- Protected wildlife habitat for a special least concern animal:
  - short-beaked echidna (*Tachyglossus aculeatus*).
- Connectivity areas.

[1] As discussed previously, as this species was not listed under the NC Act prior to the initial assessment of the DA, it has not been considered further in this report. Yellow-bellied glider (south-eastern) will be assessed under the Commonwealth approval process.

5.0 Potential Impacts

This section identifies the potential impacts on fauna that may occur during the Project's construction, operation and maintenance, and decommissioning and rehabilitation. The Disturbance Footprint has been used as the assessment unit when undertaking the impact assessment on ecological values. This area, along with the Project's Development Corridor and supporting infrastructure layout is provided in **Figure 5.1.**

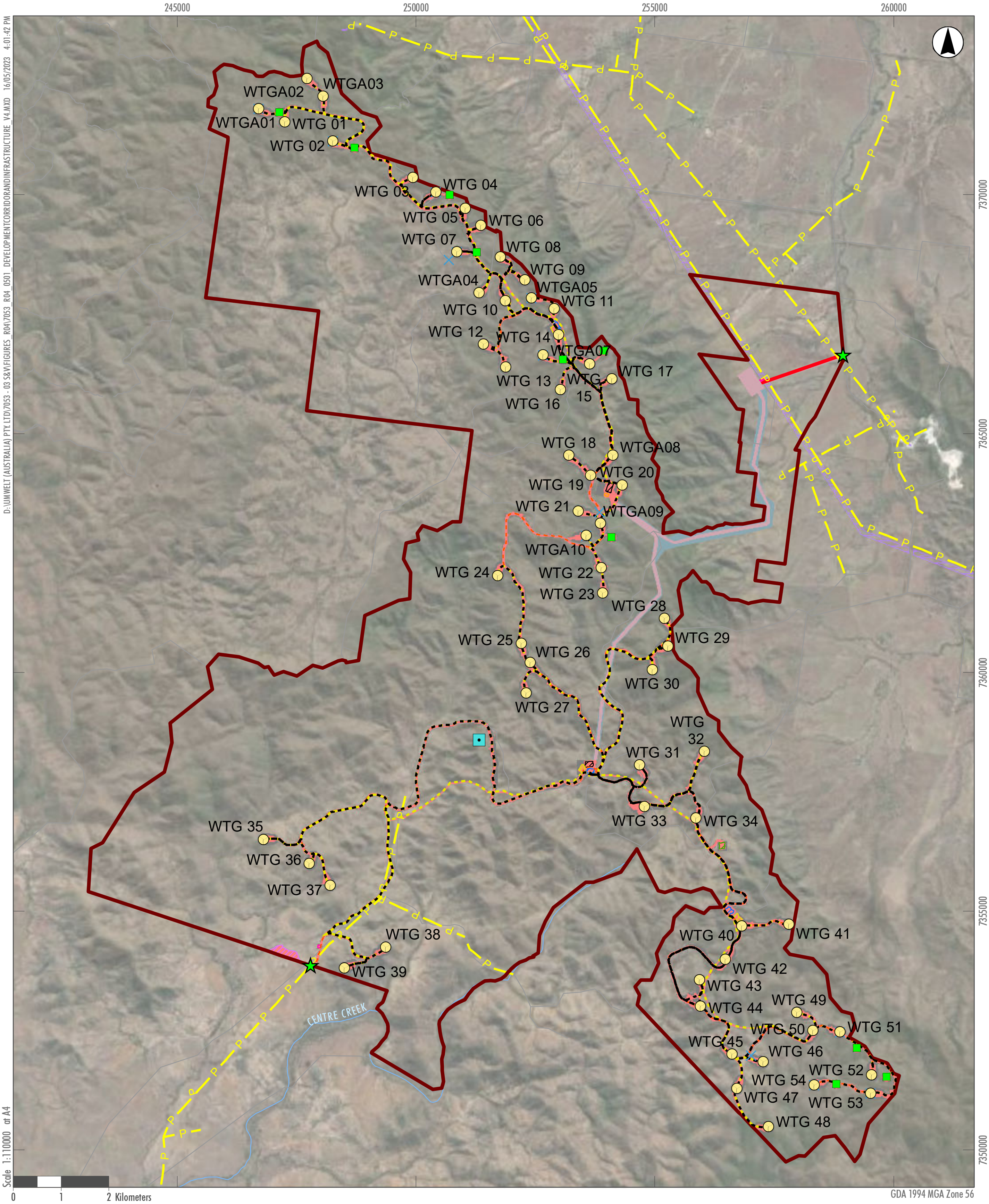
Potential impacts to fauna may occur during all phases of the Project. The potential impacts identified and assessed include:

- Construction impacts:
  - Habitat loss including threatened species habitat.
  - Fauna injury and mortality.
  - Loss of fauna movement opportunities.
  - Indirect impacts such as disturbance from noise, light and dust.
  - Habitat degradation and increased threats from the pests and weeds.
- Operational impacts:
  - Vehicle strikes.

Potential impacts relating to the birds and bats are specifically addressed in the Bird and Bat Utilisation Report (**Appendix D**), however information has also been provided in **Section 5.2.2** to **Section 5.2.4** on the following impacts:

- Collisions with turbine blades and other infrastructure (e.g. guy wires) including barotrauma.
- Barrier effects.

Avoidance, mitigation and management measures for the above potential impacts are presented in **Section 6.0.**



Legend

- Study Area (16,758 Ha)
- Project Site (Development Corridor - 1346 Ha)
- Disturbance Footprint
- HV Electricity Network
- Easements

Proposed Project Infrastructure

- Site Access
- Access Road
- Overhead Line
- Underground Line
- Compound
- Concrete Batching Plant
- Construction Camp
- Laydown
- Operation and Maintenance Area
- Site Entry
- Substation
- Transmission Infrastructure
- Grid Connection Easement
- Access
- Temporary Met Masts
- Permanent Met Masts
- Turbines

Existing Project Infrastructure

- Existing Met Mast

FIGURE 5.1

Development Corridor and Infrastructure Layout

Image Source: ESRI Basemap (2021) Data source: Queensland Spatial (2020)

5.1 Construction Impacts

The greatest risk of adverse impact to threatened fauna species will occur during the construction phase. The Disturbance Footprint, which occupies a subset of the Development Corridor, has been used as the assessment unit when undertaking the assessment of direct impacts. The extent of clearing represented by the Disturbance Footprint is considered to be a 'worst-case' scenario. When assessing potential indirect impacts resulting from the Project, the Disturbance Footprint and the wider surrounding area have been considered.

The construction activities to support the installation of turbines, associated electrical lines, ancillary infrastructure and access tracks will involve vegetation clearing and earth works including excavation and ground reinstatement. Potential direct and indirect impacts on threatened fauna species associated with these activities are described below.

5.1.1 Habitat Loss

The Disturbance Footprint encompasses a total of 877.5 ha. Vegetation clearing is a direct impact that results in the loss of vegetation and associated habitat values, including habitats that support threatened species. Potential impacts resulting from clearing native vegetation can include:

- Reduced patch size of vegetation communities potentially compromising the viability of the community and associated habitat.
- Loss of habitat causing a reduction of biological diversity or loss of local populations and genotypes.
- Loss of or disturbance to microhabitat features such as tree hollows, ground timber including hollow logs, surface rocks, leaf litter and boulder piles.
- Loss of floristic diversity and the food resources this provides such as foliage, flowers, nectar, fruit and seeds.
- Fragmentation of habitats resulting in reduced dispersal opportunities for fauna.
- Destruction of abiotic features necessary to support vegetation communities and habitat types.

Vegetation clearing and construction of the Project will be staged. Although the resulting impact from clearing will be largely permanent (noting some areas to be rehabilitated), staging will allow for impacts resulting from this activity to be limited to a relatively small area within the Disturbance Footprint and wider Study Area at any one time. For some mobile fauna species, this localised impact will allow time for individuals to temporarily relocate away from disturbance. However, for species with small home ranges or reduced dispersal abilities (i.e. skinks, frogs) this may cause localised population depletion.

While the clearance of vegetation for the Project is unavoidable, it will only be completed as strictly necessary. In addition, a range of measures will be implemented to minimise the overall level of impact from clearing. It is acknowledged however that where clearing and habitat loss cannot be avoided, particularly in high constraint areas (i.e. greater glider (breeding and denning habitat) and northern quoll (breeding and shelter habitat)), it is likely to result in permanent impacts to threatened biodiversity values.

5.1.1.1 Fauna Habitat Types

The Disturbance Footprint is primarily linear, distributed across the landscape in a predominately north south fashion. For these reasons, habitat loss is not anticipated to provide barriers to fauna movement, allowing existing populations to disperse and access resources within and beyond the Study Area.

The fauna habitat types and the associated potential impact areas (as well as mapped area within the Ground-truthed Mapping Extent) is provided in **Table 5.1** below.

Table 5.1 Potential Impact Areas to Fauna Habitat Types

Fauna Habitat Type	Ground-truthed Mapping Extent (ha)	Development Corridor (ha)	Disturbance Footprint (ha)
Mixed eucalypt woodland on steep slopes	7,264.3	651.4	420.4
Eucalyptus crebra woodland	2,575.5	209.2	144.3
Eucalyptus moluccana woodland	241.8	85.6	55.5
Semi-evergreen vine thicket	330.8	28.8	8.4
Riparian *Melaleuca* woodland	240.8	5.8	4.7
Alluvial eucalypt woodland	36.9	1.3	0.7
Non-remnant pasture	2,234.1	364.3	243.5
Total	12,924.1	1,346.5	877.3

5.1.1.2 Conservation Significant Fauna

The potential clearance of fauna habitat (**Table 5.1**) includes areas which may be utilised by fauna listed as threatened or Special Least Concern under the NC Act that are known to occur or are considered a moderate or high likelihood of occurring (**Section 4.3**). The potential impacts on conservation significant fauna have been quantified (**Table 5.2**) based on the fauna habitat types mapped within the Disturbance Footprint and modelled habitat areas presented in **Appendix E.** In some instances, a further breakdown in habitat areas has been provided due to the significance of specific habitat types (features that are limiting in the landscape and are essential for the survival of the species). For some species, the impact calculations presented in **Table 5.2** differ from those in the original Terrestrial Fauna Assessment submitted to support the Development Application. This change in numbers is due to footprint refinements as updated species habitat mapping undertaken to meet DCCEEWs requirements for the Preliminary Documentation. Mapped habitat for each species is described in **Appendix E.**

All species listed as migratory under the EPBC Act, have been impact assessed in line with the *Significant Impact Guidelines 1.1 – MNES* (DCCEEW) and are not considered further in this report. As per the *Significant Residual Impact Guideline* (DSDIP), Special Least Concern animals must be assessed. As per the Environmental Offsets Regulation 2014, there are only two Special Least Concern animals – short-beaked echidna and platypus. As such, potential impacts to short-beaked echidna are assessed within this report.

Further, impacts to the yellow-bellied glider (south-eastern) have not been considered in impact assessment as the species was listed under the NC Act after the Project's development application was properly made to the State Assessment and Referral Agency on 6 October 2021. However, this species will be assessed under the Commonwealth approval process.

Table 5.2 Potential Habitat Loss Impacts to Threatened Fauna

Common Name	Scientific Name	Survey Extent (ha)	Development Corridor (ha)	Disturbance Footprint (ha)
Threatened Species				
glossy black-cockatoo	*Calyptorhynchus lathami*	Breeding: 152.5	38.6	23.8
		Foraging: 2,600.1	372.7	242.5
greater glider	*Petauroides volans*	Breeding and Denning: 2,339.5	330.4	206.9
		Foraging and Dispersal: 7,560.9	500.4	331.5
squatter pigeon (southern)	*Geophaps scripta scripta*	Breeding: 184.0	4.5	3.6
		Foraging: 57.7	2.2	1.5
		Dispersal: 6,683.9	470.0	324.4
white-throated needletail	*Hirundapus caudacutus*	Roosting and Foraging: 2,866.1	427.9	365.9
		Foraging and Dispersal: 7,823.9	554.2	267.9
collared delma	*Delma torquata*	Breeding, foraging and dispersal: 249.8	6.1	5.0
koala	*Phascolarctos cinereus*	Breeding, Foraging and Dispersal: 11,128.2	1,111.3	721.1
		Climate Refugia: 277.7	7.1	5.3
Special Least Concern (Non-Migratory)				
short-beaked echidna	*Tachyglossus aculeatus*	Breeding, foraging and dispersal: 12,924.1	1,346.5	877.3

5.1.2 Habitat Fragmentation and Loss of Movement Opportunities

Clearing may result in reduced fauna movement opportunities, leading to reduced species recruitment, genetic flow and ultimately affect the long-term viability and persistence of fauna populations within the landscape.

Habitat within the Disturbance Footprint and the wider Study Area has been historically subjected to low level fragmentation impacts as a result of ongoing agricultural works, including the creation of farm dams and installation of tracks, firebreaks and fences. Further vegetation clearing will be required for the construction of the Project, which may exacerbate existing fragmentation impacts.

Threatened fauna species that are considered most susceptible to fragmentation impacts as a result of the construction of the Project include greater glider (southern and central) (*Petauroides volans*) and koala (*Phascolarctos cinereus*). Although the koala (*Phascolarctos cinereus*) is considered highly mobile and is known to disperse through cleared areas, it is while making these movements that they are most susceptible to vehicle collision and attack by dogs and other predators. In contrast, the greater glider (southern and central) (*Petauroides volans*) is known to have a low dispersal ability. Vegetation clearing may create gaps or expand existing gaps between areas of suitable habitat and potentially restrict the movement of individuals and access to required habitat resources.

The Project is situated on the Great Dividing Range and remnant vegetation within the Study Area provides connectivity through biodiversity corridors that facilitate north-south movement of fauna at a regional scale. Internal fauna movement is likely afforded by waterways, ridgelines and gullies. The clearance of habitat within the Disturbance Footprint may temporarily disrupt fauna movement internally, as well as to adjacent high-quality areas outside of the Study Area. Although the Project is primarily linear in nature and will have few hard dispersal barriers (i.e. fencing), clearing widths for up to 100 m for linear infrastructure (i.e. 275 Kv transmission lines) and up to 165 m for turbines will reduce functional connectivity for a number of species (i.e. greater glider (*Petauroides volans*)). Siting of the Development Corridor and Disturbance Footprint has considered the location of threatened fauna species habitat in the landscape and the use of existing disturbed or cleared areas has been maximised.

5.1.3 Fauna Injuries and Mortality

Physical trauma to fauna has the potential to occur during all phases of the Project, however the highest likelihood will be during construction activities that involve vegetation clearing, earthworks and trenching. Fauna may be injured or killed during construction principally through:

- Strike from moving vehicles/machinery – key issue for ground dwelling species, particularly those with poor mobility.
- Entrapment in habitat during removal – key issue during tree felling for species that use tree hollows or hollow logs for roosting and denning.
- Entrapment in trenches/holes – key issue for ground dwelling species (reptiles and small mammals), particularly those that are active at night and cannot detect trenches to avoid.

The species which are most at risk of injuries and mortality are those that are cryptic, difficult to detect (i.e. harder to be observed and moved by spotter-catchers) and/or have poorly developed dispersal mechanisms. Larger species with defined territories and movement patterns (i.e. koala) are less likely to be at risk of direct mortality where appropriate mitigation measures are applied (i.e. spotter-catchers undertaking pre-clearance surveys).

Some mobile species, such as birds, may move away from areas being disturbed and may not be adversely impacted in terms of direct physical trauma unless fauna are nesting or are killed by vehicle strike. However, other species that are less mobile (i.e. ground-dwelling reptile and mammal species, or those that are nocturnal and nest or roost in trees or tree hollows during the day (i.e. arboreal mammals such as gliders), may find it difficult to move away from roosts or active breeding places.

There is the potential for fauna injury or mortality during all phases of the Project through vehicle collision, but particularly when high volumes of vehicle activity occur during the construction phase of the Project. The construction of the Project infrastructure, as well as the general use of access tracks and roads across the Disturbance Footprint will result in increased vehicle movements that may cause injury or death to fauna by vehicle strike. During the operation and maintenance phase, vehicle movements will be dramatically reduced, however some risk of collision does remain. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike, particularly common species (e.g. macropods) that are tolerant of disturbance and/or those species that can utilise roads for movement pathways or as foraging habitat.

In addition, entrapment of wildlife in trenches or other excavations associated with the Project may also cause physical trauma to fauna. For example, open trenches for underground utilities, or other pits are known to be effective at trapping a wide variety of wildlife and often result in mortality. Species most likely to become trapped in pits or other excavations during construction of the Project are ground dwelling species that are capable of moving across modified environments and arboreal species which ascend to the ground to disperse.

Threatened fauna species that are most susceptible to mortality as a result of construction of the Project include greater glider (*Petauroides volans*), koala (*Phascolarctos cinereus*), squatter pigeon (southern) (*Geophaps scripta scripta*) and collared delma (*Delma torquata*). As described above, clearing and construction will be staged so only a subset of the Disturbance Footprint and overall Study Area will be impacted at one time.

Mitigation measures for fauna injury and mortality are presented in **Section 6.3.**

5.1.4 Indirect Impacts

Indirect impacts from the Project construction phase such as noise, light and dust caused by heavy machinery, increased vehicle movement and wind farm construction may impact sensitive fauna species occupying the Study Area.

It is expected that noise from excavation, construction and earthmoving associated with the Project will potentially cause disturbance to all groups of fauna. This may result in the short-term avoidance of the area for the duration of these activities. As alternative habitats are available elsewhere, an overall loss of fauna diversity as a result of construction is considered low, with many, if not all species are likely to resume normal activities. The long-term impacts from construction noise or other indirect impacts are not anticipated to occur.

The loss of vegetation and habitat, as well as the construction activities required to be undertaken to clear vegetation or complete construction, can potentially result in indirect or secondary impacts to the associated fauna and flora values. This includes:

- Increased edge effects reducing the condition of quality of remaining vegetation communities and habitat types.
- The establishment and spread of exotic species that may displace native species, native habitat resources and alter fire regimes.
- Soil exposure resulting in an increased risk of erosion and sedimentation of water bodies, reducing water quality and degrading aquatic habitats.

- Increased risk of contamination associated with activities such as refueling or storage of chemicals.
- Temporary changes in hydrology from installation of infrastructure creating a barrier to surface flow and increasing stormwater run-off.
- Generation of dust emissions leading to excessive deposition of dust on leaves of plants suppressing photosynthesis and growth.
- Increased noise and light levels affecting foraging and breeding behaviour for some fauna species or resulting in complete avoidance and displacement from habitats.
- Periodic burst of elevated noise levels may startle and disorientate fauna species within proximity.
- Although unlikely, increased anthropogenic activity may lead to temporary increased pest levels.

It is important to note that during the construction phase these potential impacts are likely to be short-term and concentrated in specific areas before moving progressively through the Disturbance Footprint. However, it is acknowledged that some of these indirect impacts such as increased edge effects are longer term.

Further information about potential indirect impacts relating to weeds, edge effects, soil erosion and sedimentation and dust are provided in the subsequent sections.

5.1.5 Exacerbation of Pest Fauna and Weeds

The Study Area was found to support introduced fauna including, feral pig, (*Sus scrofa*), feral cat (*Felis catus*), cane toad (*Rhinella marina*), black rat (*Rattus rattus*) and feral horse (*Equus caballus*). These species, left unchecked, may flourish in newly disturbed areas, disperse into higher quality habitat areas and further contribute toward the degradation of fauna habitat within the Study Area. Given the prevalence of these species within the existing landscape, it is unlikely that the proposed works will result in further introductions of feral vertebrate species. However, habitat modification may facilitate larger populations of certain introduced species such as European rabbit (*Oryctolagus cuniculus*) and house mouse (*Mus musculus*) where some native species will not be able to persist as well as movement opportunities for exotic predators (i.e. wild dog (*Canis lupus*) and feral cat (*Felis catus*)). Weed and pest management measures are discussed in **Section 6.3.**

The introduction and/or spread of weeds is an indirect impact that can impact the integrity of remaining vegetation, increase the intensity and/or frequency of fires, as well as threaten the long-term survival of threatened fauna species. Within the Study Area weed species are common within cleared and regrowth vegetation, as well as sporadically throughout the remnant vegetation. The weed species that pose the biggest threat to fauna and associated habitat values are the Category 3 ‘restricted’ species listed under the Biosecurity Act, Weeds of National Significance, as well as high-biomass grass species. High-biomass grass species can out-compete native vegetation as well as reduce the germination of native species. The high biomass of these species also increases the intensity and/or frequency of fires.

5.2 Operational and Maintenance Impacts

Potential impacts to fauna during the operation and maintenance phase include:

- Vehicle strike (Vehicle usage during the operational phase of the Project is expected to be significantly lower than during construction due to the decrease in site personnel).
- Mortality to birds and bats through collision with infrastructure.
- Barotrauma suffered by bats flying in close proximity to turbine blades.
- Barrier effects to avifauna from project infrastructure.

Vegetation clearing is unlikely to be required as part of the operation and maintenance of the Project. The exception to this is areas directly adjacent to certain infrastructure (i.e. substation) and in areas required for use throughout the life of the Project such as access tracks. In these locations, clearing works will predominantly comprise grass slashing and pruning and will be conducted as required for safe access and operation of infrastructure.

5.2.1 Vehicle Strikes

During operation, it is expected that temporary periods of increased vehicle activity, including light vehicles, large trucks and maintenance equipment will occur on the access tracks within the Disturbance Footprint. Although the frequency of vehicle movements during operations is expected to be minor, there is some risk of vehicle strike to fauna species including medium to large mammals, woodland birds which forage on the ground and reptiles. Of the known and potentially occurring species listed under the NC Act, two are considered vulnerable to vehicle strike: koala (*Phascolarctos cinereus*) and squatter pigeon (southern) (*Geophaps scripta scripta*).

5.2.2 Infrastructure Collisions

Certain bird and bat species are known to collide with wind turbine blades, towers, nacelles, guy cable, power lines and meteorological masts resulting in injury or death. The majority of fatalities appear to result from turbine collisions (Grodsky et al. 2011). Drewitt & Langston (2008) identify a range of factors that influence risk of collisions with such infrastructure, including:

- Physical attributes of a wind turbine generator (i.e. turbine dimensions, lighting).
- Species-specific variables (i.e. abundance, flight behaviour, turbine avoidance capacity).
- Biophysical attributes (i.e. landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable. Proximity to roost locations, migratory flight pathways and wetlands appear to be particularly important factors that influence bird and bat utilisation.

Data from Australia, Europe and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e. migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

Of the known and potentially occurring threatened species, one species (the white-throated needletail) has been identified as being at very high overall risk of collision-based impacts from the Project due to a high likelihood and high consequence of collisions. Several non-listed microbat species are also at moderate to high overall risk of impacts from the Project due to the probability that they may fly at RSA height, noting the very high level of uncertainty inherently associated with any estimate relating to whether each species rarely, occasionally or regularly flies at RSA height.

A potential secondary impact associated with bird and bat collisions is the increased presence of both native and exotic ground-dwelling predators who may feed on carrion. The increased use of cleared areas by native predators to forage may result in greater levels of direct predation and competition with exotic predators including the feral cat (*Felis catus*) and fox (*Vulpes vulpes*).

5.2.3 Barotrauma

Barotrauma is a phenomenon in which rapid air pressure changes cause tissue damage to air-containing structures, most notably the lungs (Baerwald et al. 2008). Barotrauma can also result in non-lethal injuries such as hearing impairments and other internal injuries that may result in bats succumbing to their injuries at a later time.

There is currently no published information on barotrauma in Australia. One study undertaken in Canada found that 90% of bat fatalities involved internal haemorrhaging consistent with barotrauma, and that collision with turbine blades accounted for about 50% of the fatalities (Baerwald et al. 2008). However, another study found that only 6% of bats collected at a wind farm in Illinois had lesions possibly consistent with barotrauma, leading to the conclusion that traumatic injury (i.e. collisions) is the major cause of bat mortality at wind farms (Rollins et al. 2012).

Due to the difficulty in diagnosing barotrauma unless the carcass is examined immediately after death, it is possible that cases attributed to barotrauma have been confused with traumatic injury associated with direct collisions.

Of the microbat species detected during field surveys, it is considered probable that seven species may fly at RSA, none of which are listed under the NC Act. In the absence of data from RSA height in the Study Area a very high level of uncertainty is inherently associated with any estimate relating to whether each species rarely, occasionally or regularly flies at RSA. However, the risk of barotrauma is relevant to all microbat individuals when flying within RSA.

5.2.4 Barrier Effects

Barrier effects can be caused by wind turbines disrupting links between feeding, roosting and/or nesting areas, or diverting flights (including migratory flights) around a wind farm. Species that pass wind farms frequently on migration appear to be of higher concern than other species (Hötker, Thomsen & Köster 2006). However, these effects on birds, possibly resulting in higher energy consumption or injuries as a result of collision, are not yet well known (Schuster, Bulling & Köppel 2015). There is currently no published information on barrier effects from wind farms in Australia.

5.3 Decommissioning and Rehabilitation Phase

The Project will be decommissioned in accordance with the Decommissioning Management Plan and in compliance with any planning conditions at the time of the decision. This plan follows the current best practice approach for removal of infrastructure including the removal of all above ground structures; the removal of all underground structures to at least 1 m below ground level with structures beneath this level to remain in situ. This approach is considered less environmentally damaging than the complete removal of all above and below ground structures from the Disturbance Footprint. Areas of disturbed land will be reinstated to the original condition prior to the construction of the Project or to the condition just prior to the commencement of the decommissioning activities.

Overall, impacts on threatened fauna values associated with the decommissioning and rehabilitation phase are expected to be minor. However, there is some potential for impacts to occur on threatened fauna species and their habitat in both a direct and indirect capacity. Direct impacts may include:

- Slashing and pruning of recolonised vegetation in specific locations, that may support threatened species habitat.
- Vehicle and other operational equipment strike.

Indirect impacts associated with decommissioning and rehabilitation are expected to be similar (although less severe) to construction phase impacts including:

- Elevated noise and light.
- Soil erosion and sedimentation.
- Edge effects.
- Increased dust generation as a result of increased vehicles and machinery.

6.0 Avoidance, Mitigation and Management

Neoen is committed to ensuring the Project follows the principles of ecologically sustainable development. In planning for and developing the Project, Neoen have implemented the hierarchy of management principles. These principles and the order in which they have been applied is as follows.

1. Avoid: locating activities to avoid direct and indirect impacts on threatened fauna species.
2. Minimise: minimising direct and indirect impacts where they cannot be completely avoided.
3. Mitigate: implementing mitigation and management measures to reduce direct, indirect and cumulative impacts.
4. Remediate and rehabilitate: actively remediate and rehabilitate impacted areas to promote long-term recovery.
5. Offset (where necessary): provide suitable offsets for activities that result in significant residual impacts to MSES even with the implementation of the above principles.

6.1 Avoidance

The avoidance of threatened fauna values has been demonstrated through both selection of the Study Area and the design and siting of the Development Corridor. Revisions to both have occurred throughout the life of the Project as a result of community and landholder consultation, wind resource data, grid connectivity options and an understanding of on-ground constraints.

The Development Corridor size and configuration in particular has undergone several revisions and has been informed by an ecological constraints analysis, which is described in **Section 6.1.1** below.

6.1.1 Ecological Constraint Analysis

The Development Corridor shown within this report has been subject to an ecological constraint analysis. The purpose of the constraint analysis was to determine priority avoidance areas based on the presence (potential and known) of flora and fauna values with varying sensitivity levels and environmental significance. The analysis utilised habitat mapping informed by field validated data and incorporated a traffic light system with values ranging from a very high constraint value to a limited constraint value.

A key initial input in the constraints analysis was the delineation of remnant and regrowth habitat types from non-remnant cleared areas, as well as the identification of suitability for threatened fauna species including the presence of habitat features which may be limited in the environment. Two threatened species considered known or potentially occurring within the Study Area may inhabit select non-remnant areas: the squatter pigeon (southern) (*Geophaps scripta scripta*) and koala (*Phascolarctos cinereus*). However, both these species have broad habitat requirements and are not overly sensitive to disturbance. Non-remnant areas are unlikely to be relied upon for any stage of the species lifecycle. The majority of remaining known or potentially occurring threatened species are highly unlikely to inhabit these areas due to the absence of necessary habitat features and / or ecological functionality.

Siting Project infrastructure within areas that have already been previously cleared allows for threatened fauna values to be largely avoided in these areas. Unnecessary vegetation clearing for some Project elements such as access tracks and laydown areas is also avoided and as the areas affected are already impacted by historical clearing and edge effects, the severity of new habitat fragmentation impacts is minimised.

The main priority fauna value that was considered in the constraints analysis was habitat features considered unique or uncommon in the landscape (e.g. breeding and denning habitat for greater glider (*Petauroides volans*)). This process directed infrastructure towards pre-disturbed areas, avoiding fauna habitat areas to the greatest extent possible.

6.2 Minimise

Where impacts on threatened fauna cannot be avoided, all efforts will be made to minimise Project impacts. Vegetation clearing and the subsequent construction of the Project will occur progressively and in stages. By doing this, only a small subset of the Disturbance Footprint will be impacted at one time. Indirect impacts resulting from the construction of the Project will be localised, short-term, and actively managed as detailed below. Furthermore, clearing extents detailed in **Section 5.1** represent a worst-case scenario.

Since the original development application was submitted for the Project, predicted direct impacts to threatened fauna species across the Study Area have been minimised via a significant redesign of the Project, as described below in **Section 6.2.1**.

Micro-siting of Project infrastructure will also provide opportunities to further minimise direct impacts on fauna values (see **Section 6.2.2** below).

6.2.1 Design Changes

The Project originally proposed the construction, operation and decommissioning of 118 turbine generators and supporting ancillary infrastructure within a Development Corridor covering 1,973.3 ha. Influenced by a range of factors including MNES values, the Project scope and Development Corridor configuration were recently reassessed and adjusted by Neoen. This process resulted in significant changes to the Project including a decrease in the number of turbines (118 to 63) and the Development Corridor size (reduced by >400 ha). A primary benefit of these changes is the minimisation of impacts to threatened species habitat.

6.2.2 Micro-siting

Project infrastructure will be sited within the Development Corridor based on the location of on-ground constraints including habitat for threated fauna species. Additional field surveys specific to terrestrial ecology (as well as other types of constraints) will be conducted prior to construction, including pre-clearance surveys. This data will allow for increased accuracy and detail in mapped terrestrial ecological values within the Development Corridor including threatened fauna habitat values. Ground-truthed ecological field data will strongly influence the final design of the Project, with the avoidance hierarchy principles in place. Future refinement of the Project will seek to avoid threatened species individuals and habitat, particularly species where significant residual impacts may occur.

Infrastructure micro-siting will aim to avoid or further minimise disturbance to:

- Habitat features required by threatened fauna species including hollow bearing trees and stags, trees with diameter at breast height (DBH) >30 cm, large hollow logs and complex boulder piles.
- Breeding habitat for threatened and migratory fauna species.
- Vine thicket communities.
- Riparian zones, including avoiding placement of turbines within 50 m of waterways.

6.3 Mitigate and Manage

Throughout the life of the Project, potential impacts to threatened fauna species and associated habitats will be directly or indirectly managed via Project Management Plans. All mitigation and management measures relevant to threatened fauna species will be captured in one or multiple of the Project Management Plans, listed below:

- Preliminary Construction Environmental Management Plan (CEMP).
- Preliminary Bird and Bat Adaptive Management Plan (BBAMP).
- Preliminary *Cycas megacarpa* Translocation Management Plan (CTMP).
- Offset Area Management Plan (OAMP).
- Preliminary Vegetation Management Plan (VMP).
- Preliminary Fauna Management Plan (FMP).
- Preliminary Weed and Pest Management Plan.
- Preliminary Rehabilitation Management Plan.
- Preliminary Bushfire Management Plan.

Most of the Project Management Plans above are required to support Project approvals under both Commonwealth and State legislation. As such, it is noted that they may include requirements specific to either legislative framework.

6.3.1 General Management Measures

All measures captured in this section will be documented in an appropriate Project management plan, which will also include objectives relevant to the theme, timing details and specific metrics to measure progress relative to the objectives. Measures are listed under their associated themes below.

6.3.1.1 Fauna

Project mitigation and management measures related to fauna include:

- A qualified fauna spotter will be present at all times during clearing.
- A qualified fauna spotter will be present at all times during clearing and pre-clearance surveys. The fauna-spotter will inspect habitat features (including but not limited to: hollowing-bearing trees and stags, caves and rocky boulder piles) for MNES prior to felling, using work platforms, inspection cameras or other methods deemed safe and suitable. Fauna spotters will also be present during earthworks where exposed trenches and holes will be left for periods greater than 24 hours
- In areas of threatened fauna habitat planned to be cleared, qualified spotter-catchers will scout the area immediately prior to the commencement of disturbance for the presence of habitat trees and other features (i.e. coarse woody debris, hollow logs, large stones and boulder piles), as well as listed species. This will include an inspection of terrestrial habitat features (hollows, potential dens, surface rocks and fallen logs) prior to disturbance using work platforms, inspection cameras, or other methods deemed safe and suitable. Habitat features/trees will be marked using appropriate paint or flagging tape. Located fauna (excluding koalas, see **Section 6.3.2**) will be moved to a nearby and suitable undisturbed location by the spotter-catcher.
- Exclusion zones will be established around identified active and potentially active breeding places, such as nests, burrows, dens etc. Where there is the potential an active breeding place will be tampered with, this will only be done in accordance with an approved and appropriate (low or high risk) DES Species Management Program (SMP) as per the Nature Conservation (Animals) Regulation 2020.
- Micro-siting of Project infrastructure will aim to retain habitat trees (including hollow-bearing trees or stags, trees with DBH >30 cm, and trees containing potential animal breeding places) and terrestrial habitat features (including complex boulder piles, hollow logs). Habitat trees and features that can be avoided will be demarcated. If construction is planned to occur in proximity to a habitat tree/s to be retained, a tree protection zone (TPZ) may be established if deemed necessary by the spotter-catcher. The TPZ will be calculated using Australian Standard (AS) 4970-2009.
- Where they cannot be retained, hollow bearing trees and stags will be ‘slow felled’ to minimise the chances of injury or death and will be inspected after felling by a qualified fauna spotter to confirm no injured wildlife are present.
- Where they cannot be retained in situ, habitat features (i.e. ground timber including hollow logs, large stones and boulders) will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance)
- Movement within the Study Area will be via approved access tracks only with speed limits enforced. The requirement to enter and traverse the Study Area will be minimised and limited to those required for essential Project activities.
- Night works within or adjacent to areas of threatened fauna habitat will be avoided where possible to reduce impacts from construction light and noise on threatened fauna species (i.e., by interrupting male koala mating calls during breeding season). Where night works are required, lights will be directed to minimise light spill into adjacent habitats and the use of alternative, low-noise construction equipment considered.

- Fauna exclusion fencing will be installed around infrastructure that may pose a hazard such as the substation and laydown areas. Elsewhere, fencing will only be installed as required and will be 'fauna-friendly' (i.e. not barbed wire).

- Any open excavations will be checked for trapped fauna in the morning and at the end of the day by a suitably qualified spotter-catcher. Trench ladders, ramps, sticks, ropes and moist hessian sacks at regular intervals (or similar) will be utilised where trenches or excavations are anticipated to remain open for extended periods. This will help trapped fauna escape and/or survive until removed by a fauna spotter-catcher.

6.3.1.2 Weeds and Pests

A number of mitigation and management measures have been developed to minimise the proliferation and/or introduction of introduced weeds and pests. These measures will be implemented via several Project management plans, but primarily the Weed and Pest Management Plan.

Measures outlined in the Weed and Pest Management Plan will be relevant to the Disturbance Footprint with a 5 m buffer either side to account for potential GPS inaccuracies. The following points outline the management objectives of the plan:

- Maintain (or improve) the condition of retained habitat compared against baseline condition in terms of disturbance from weeds and pests.

- No introduction or proliferation of invasive weed species or pest fauna species.

- Successful removal invasive weeds for all areas subject to disturbance.

Table 6.1 below outlines the overarching performance criteria and management actions which will be implemented to minimise the risk of introduction or proliferation of weeds/pests throughout the Project. The timing, monitoring and reporting requirements will be detailed in the final Weed and Pest Management Plan, which will be developed and approved prior to construction.

Table 6.1 Weed and Pest Management Measures for the Disturbance Footprint (plus a 5 m buffer)

Project Phase	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
Pre-construction	Pest species presence and abundance identified within relevant Project areas	• Pre-clearance surveys will be undertaken within the applicable areas to record the presence and abundance of pest fauna. • Baseline conditions will need to be established prior to construction such that impacts from the Project can be monitored throughout the Project lifecycle.	0–6 months prior to site disturbance during suitable seasonal conditions	Pre-clearance survey report Baseline condition assessment
	Invasive weed species presence and abundance identified within relevant Project areas	• Pre-clearance surveys will be undertaken within the applicable areas to record the presence and abundance of introduced flora and those classified as Category 3 Restricted Matters and/or WoNS or species defined as weeds in the Preliminary Vegetation Management Plan. • Baseline conditions will need to be established prior to construction such that impacts from the Project can be monitored throughout the Project lifecycle.		Pre-clearance survey report Baseline condition assessment
	Successful removal of invasive weeds within all Project areas subject to disturbance	• Areas containing infestations will be treated prior to the commencement of site disturbance and any construction activities. Refer to Appendix A of the Vegetation Management Plan for species specific control methods. Chemical treatment adjacent to sensitive areas should be avoided, where possible. If chemical treatment is required, spot spraying methods will be undertaken.		Pre-clearance survey report
Construction, operation and maintenance, decommissioning and rehabilitation	No increase in pest fauna presence and abundance within the applicable areas	• Implement a species-specific control program for pest fauna in consultation with landowner(s). This is only to be implemented if incidence of any feral species has increased during construction or operation as reasonably attributable to the Project. The species-specific control program will be detailed in the Weed and Pest Management Plan.	Throughout construction, operation and maintenance, decommissioning and rehabilitation	Construction audits (monthly) Compliance audits (annually for life of the Project approval)

Project Phase	Indicative Performance Criteria	Management Actions	Timing	Monitoring Activity
		• Avoid inclusion of any water retaining voids or pits in the design where these are not otherwise required for the control of stormwater run-off erosion and sediment control measures or dams required to supply water for construction activities. Where pits and voids are required, include appropriate cover to prevent extended water retention and subsequent breeding opportunities for cane toads • For pits and voids where long-term presence of retained water is reasonably anticipated and covering is not practicable, fencing to exclude access by cane toads will be incorporated in the design. Sediment fencing, free standing or attached to the base of other fencing material has proven to be effective • Wash down and laydown areas will be designed to include cane toad traps where exclusion from areas of potential water retention is not practicable and where cane toad activity is locally detected • No alteration, or refuse left exposed, which will specifically assist breeding opportunities for cane toad, red fox, feral cat, dog, house mouse or rat on site • To reduce the presence of pest fauna on site, all food scaps must be placed into designated waste bins, and their lids securely closed • Train workforce in the identification of pest fauna species present in the area.		

6.3.2 Species Specific Measures

Mitigation and management measures specific to the known and potentially occurring threatened fauna species and the short-beaked echidna (*Tachyglossus aculeatus*) within the Study Area are detailed in **Table 6.2** below. Greater consideration has been given to threatened species that may be particularly sensitive to potential Project impacts including the endangered greater glider (*Petauroides volans*) and koala (*Phascolarctos cinereus*).

Sections 6.3.3 provides detail regarding the Preliminary BBAMP, which largely includes measures relevant to potential operational impacts on threatened birds and bats, as well as migratory birds.

Table 6.2 Threatened Species Specific Management Measures

Fauna Species	Measures
glossy black-cockatoo (*Calyptorhynchus lathami*)	• Any active breeding places will be managed under an approved DES High Risk SMP. • As detailed in the Preliminary BBAMP, a single glossy black-cockatoo (*Calyptorhynchus lathami*) death will be a reportable incident to DES/DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to glossy black-cockatoo (*Calyptorhynchus lathami*) are detailed in the Preliminary BBAMP.
greater glider (southern and central)(*Petauroides volans*)	• Where clearing is proposed for areas of greater glider breeding and denning habitat, pre-clearance surveys must include canopy searches and inspections of suitably sized hollows (>8 cm diameter). • Every effort will be made to retain suitable hollow bearing trees (those containing hollows >8 cm diameter) within areas identified as breeding and denning habitat including *Eucalyptus moluccana* woodlands. The retention of trees >30 cm DBH on patch edges will be prioritised next in areas of potential greater glider habitat. Trees to be retained within the Disturbance Footprint must be clearly demarcated and avoided. If deemed necessary, a TPZ may be established. • Glider poles are proposed to be installed at 12 locations within the Disturbance Footprint to provide movement opportunities between areas of suitable habitat in the landscape. The proposed glider pole locations represent areas important for dispersal and where ongoing connectivity is required to avoid isolation of patches and retention of possible high use areas (i.e. riparian corridors). Glider pole locations will be finalised during the detailed design phase of the Project. • Five 'pinch points' are proposed within the Disturbance Footprint associated with areas of greater glider modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species. Pinch points describe locations of the Disturbance Footprint which are reduced in width to the extent that individuals can easily disperse across (i.e., based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). Pinch points locations will be finalised during the detailed design phase of the Project. • In areas of habitat where greater gliders are known to occur (i.e. the far northern Study Area), cleared suitable hollows (>8 cm diameter) will be replaced at a 1:2 ratio with a suitable nest box, to be installed in adjacent suitable habitat (i.e. two nest boxes for every hollow removed). A nest box is considered suitable if it is a design known to be used by the greater glider. • In the unlikely event that a greater glider (southern and central) is killed as a result of Project activities, DES/DCCEEW will be notified within a maximum period of 2 business days.

Fauna Species	Measures
squatter pigeon (southern) (*Geophaps scripta scripta*)	• Where clearing is proposed for areas of squatter pigeon (southern) breeding, foraging or dispersal habitat, pre-clearance surveys must include flushing to encourage the movement of individuals out of the clearing area. • As squatter pigeon (southern) nests on the ground and is at high risk of direct mortality, nests should be identified and clearly demarcated by a spotter-catcher during pre-clearance surveys. If the spotter-catcher determines a nest to be active, it will be managed in accordance with an approved High-risk SMP. • To reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks in squatter pigeon breeding habitat. • To minimise the chances of a collision, in known squatter pigeon (southern) occurrence areas speed limits (in private areas) will be reduced to 40 km/hr or less and signage will be installed that indicates subspecies' presence. • The construction contractor will not conduct water extraction activities at any location that provide suitable resources for squatter pigeon (southern) (i.e. suitable watercourses and reservoirs) • As outlined in the Preliminary BBAMP, a single squatter pigeon (southern) death will be a reportable incident to DES/DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to squatter pigeon (southern) are detailed in the Preliminary BBAMP.
white-throated needletail (*Hirundapus caudacutus*)	• As detailed in the Preliminary BBAMP the single death of a white-throated needletail will be a reportable incident to DES/DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to this species are detailed in the Preliminary BBAMP.
collared delma (*Delma torquata*)	• Micro-siting of Project infrastructure will aim to retain terrestrial habitat features including large stones, boulders and coarse woody debris. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e., the relocation of habitat features must not cause unnecessary disturbance). • Where clearing is proposed for areas of potential collared delma habitat, pre-clearance surveys must include active searches targeting areas with common surface rocks. Should an individual or eggs of the species be located, the pre-clearance survey constraints protocol (see **Section 6.3.4**) will be enacted to ensure any potential impacts on the species are avoided or managed appropriately. In the unlikely event that a collared delma is killed as a result of Project activities, DES/DCCEEW will be notified within a maximum period of 2 business days.
koala (*Phascolarctos cinereus*)	• Pre-clearance surveys will include canopy searches for koalas. If a koala is located during pre-clearance surveys or during clearing activities: o the individual must not be forcibly relocated o any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition

Fauna Species	Measures
	○ allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter-catcher ○ any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer ○ requirements for koalas subject to handling to be examined and if suspected of Chlamydia infection will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release. • Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention. • In the unlikely event that a koala is killed as a result of Project activities, DES/DCCEEW will be notified within a maximum period of 2 business days.
short-beaked echidna (*Tachyglossus aculeatus*)	• Pre-clearance surveys will include on-ground searches for short-beaked echidna. If an echidna is located during pre-clearance surveys or during clearing activities: ○ the individual will be relocated to a nearby area of suitable habitat ○ any injured echidna should be transported to a vet or recognised wildlife carer.

6.3.3 Bird and Bat Adaptive Management Plan

Monitoring and management actions relating to threatened birds and bats will be undertaken in accordance with a pre-approved BBAMP. The strategy of the BBAMP is to monitor and mitigate the potential impacts of turbine strike on birds and bats via trigger based, adaptive management.
The implementation of a trigger will be the primary mechanism for monitoring and managing impacts on the white-throated needletail.

Pre- and post-commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan. The monitoring will inform a risk profile for each turbine. This strategy leads to direct and tailored management actions, applied at the appropriate locations and times.

6.3.4 Pre-clearance Survey Constraint Protocol

This section defines an adaptive management response which is to be engaged if a collared delma (*Delma torquata*) is encountered during pre-clearance surveys or any other surveys undertaken prior to construction. Excluding potentially occurring threatened flora species, this species is the focus of the protocol as it is highly sensitive to disturbance, reported to potentially be sedentary and restricted to very small areas of suitable habitat (Department of the Environment, Water, Heritage and the Arts, 2008). Remaining conservation significant fauna species are generally highly mobile and therefore able to temporarily relocate, or have broad habitat preferences making them less sensitive to disturbance.

The trigger to undertake the pre-clearance surveys constraint protocol is the observation of one or more individual collared delma (*Delma torquata*) within the Disturbance Footprint during future surveys or construction. If either are to be found, the constraints protocol below will then be followed.

STEP 1: Halt construction/clearing activities in the area (i.e. adjacent areas within the Disturbance Footprint where suitable habitat is present – to be determined by a suitably qualified ecologist).

STEP 2: Undertake investigation into potential impacts on the species. This should include:

- Updating of habitat mapping.
- Updating of Significant Impact Assessment.
- Determination of avoidance and mitigation strategies.

STEP 3: Communicate outcomes with DCCEEW and DES as appropriate to determine next steps.

It is noted that the above process is focused towards Commonwealth requirements. This is due to the fact that Commonwealth offset requirements have stricter delivery requirements (i.e. must be land based) and require additional time to acquire and seek approval for. As the species is also protected under State legislation, any potential impacts on the species will also be communicated with DES.

6.4 Rehabilitate

The Disturbance Footprint includes a number of linear sections associated with access tracks and supporting ancillary infrastructure such as communication and power cable lines. Linear sections of the Disturbance Footprint vary in width but in some locations span approximately 100 m; these widths have been deemed necessary for the safe transport and installation of turbine infrastructure. Excluding established access tracks and fire safety Asset Protection Zones, which at all times will need to remain free of vegetation, previously cleared areas will be reclaimed and rehabilitated. Further to this, all areas of temporary ancillary infrastructure will also be subject to rehabilitation efforts including:

- Laydown areas.
- Concrete batching plants.
- Construction compound.
- Temporary workers accommodation camp.

With current design details, it is estimated approximately 20% of the total Disturbance Footprint (i.e. the area that will be cleared for the Project) may be able to be rehabilitated following construction. This equates to approximately 180 ha of native vegetation being rehabilitated.

Rehabilitation will include the planting of native species known to the region, consistent with the characteristics of surrounding retained vegetation. In locations where the integrity of infrastructure will not be compromised, opportunities to create supplementary habitat for threatened species such as the greater glider (*Petauroides volans*), koala (*Phascolarctos cinereus*) and squatter pigeon (southern) (*Geophaps scripta scripta*) will be investigated. For example, in addition to native grasses and shrubs which will provide ground cover for dispersing koalas and squatter pigeons (southern), trees likely to form hollows in the future will also be planted as appropriate (e.g. *Corymbia citriodora* or *Eucalyptus moluccana*).

7.0 Environmental Offset Requirements

Where a Project is deemed to have a significant residual impact (SRI) on a Matter of State Environmental Significance (MSES), an environmental offset is required in accordance with the *Environmental Offsets Act 2014*. Environmental offsets can take various forms, including financial settlement offsets, proponent driven offsets or a combination of the two.

MSES within the Disturbance Footprint relevant to fauna include:

- Protected wildlife habitat, comprising NC Act listed, threatened fauna and special least concern animals known to occur or deemed a high or moderate likelihood of occurrence.
- Connectivity areas.
- Waterways for waterway barrier works.

Potential impacts on the above MSES (excluding waterways for waterway barrier works) have been assessed against the SRI guidelines. Although potential direct impacts may occur to 'at risk' waterways for barrier works as a result of the Project, works will preferentially be designed and constructed in accordance with the relevant accepted development requirements and would therefore not require a development approval. As such, this MSES has not been further assessed. If necessary, a full SRI assessment for impacts to waterways for waterway barrier works may be completed during the detailed design of the Project.

Potential impacts on the relevant MSES above were assessed against SRI guidelines (**Appendix E**) and are discussed below.

7.1.1 Significant Residual Impact Assessment

The assessment of impacts on MSES concluded that the Project will result in an SRI on MSES, namely protected wildlife habitat for greater glider (southern and central).

Based on the findings above and under the provisions of the *Environmental Offsets Act 2014* an environmental offset will be required for the Project. The requirement for an offset, size (area) and offset pathway will be determined following the completion of final design and as part of further pre-clearance surveys for the Project.

8.0 Conclusion

This report has outlined the findings of the terrestrial fauna assessment for the Project. Terrestrial fauna values have been identified via desktop review and field assessments conducted across a three-year period. Key findings of the terrestrial fauna assessment include:

- A total of 211 fauna species from 156 genera were also identified during the field survey program, comprising 148 birds, 37 mammals, 19 reptiles and 7 amphibians. This includes:
  - Threatened fauna species listed under the NC Act confirmed during field surveys:
    - Glossy black-cockatoo (*Calyptorhynchus lathami*) (Vulnerable under NC Act).
    - Greater glider (southern and central) (*Petauroides volans*) (Endangered under EPBC Act and NC Act).
    - Yellow-bellied glider (south-eastern (*Petaurus australis australis*) (Vulnerable under EPBC Act and NC Act).
    - Squatter pigeon (southern) (*Geophaps scripta scripta*) (Vulnerable under EPBC Act and NC Act).
    - White-throated needletail (*Hirundapus caudacutus*) (Vulnerable under NC Act and Vulnerable/Migratory under EPBC Act).
  - Migratory fauna confirmed during the field survey included:
    - Rufous fantail (*Rhipidura rufifrons*) (Special Least Concern under the NC Act).
    - Spectacled monarch (*Symposiarchus trivirgatus*) (Special Least Concern under the NC Act).
- Six broad habitat types were defined, comprising habitat for threatened fauna species above.
- The bird and bat utilisation study concluded that the white-throated needletail has a Very High overall collision risk ranking, whereas all other identified, at-risk birds have a Moderate or Minor collision risk ranking. Microbat species vary in risk from Moderate to High.
- MSES include protected wildlife habitat and connectivity.

Having regard to the above, the potential impacts and mitigation measures associated with the Project were presented. The assessment identifies numerous sources of potential impact, with the greatest risk to terrestrial fauna occurring during the construction phase, due of habitat loss. Other potential impacts include wind turbine collision-based impacts, exacerbation of biosecurity risks and disturbance from indirect impacts such as noise, light and dust.

The Project has employed avoidance controls as part of the existing Development Corridor design and will continue to consider ecological constraints as the clearing footprint is further refined. Where avoidance is not possible, the Project will be governed by a CEMP, FMP and a BBAMP. These management plans will outline procedures to limit and reduce impacts on fauna, as well as define the operational response as it relates to bird and bat risk/mortality.

With consideration of Project mitigation measures and that the final clearing footprint will be considerably smaller than the Development Corridor, an SRI assessment was conducted for MSES (excluding the yellow-bellied glider (south-eastern) given its' listing date was after the development application was properly made to the State Assessment and Referral Agency on 6 October 2021). The assessment identified that the Project will have a SRI on greater glider (southern and central). This impact will require offsets under the *Environmental Offset Act 2014*. The requirement for an offset, size (area) and offset pathway will be determined following the completion of final design and as part of further pre-clearance surveys for the Project.

9.0 References

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APPENDIX A

Likelihood of Occurrence Assessment

Table A1 Likelihood of Occurrence Assessment

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Threatened Species					
Birds					
Calidris ferruginea	curlew sandpiper	Critically Endangered, Migratory	Endangered	The species mainly occurs on intertidal mudflats in sheltered coastal areas such as estuaries, bays, inlets and lagoons, and around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded less often inland, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand, occurring in both fresh and brackish waters.	**Unlikely** – No proximal records for this species exist, and the inland location of the Study Area is unlikely to provide suitable habitat.
Calyptorhynchus lathami	glossy black-cockatoo	-	Vulnerable	Prefers habitat dominated by *Allocasuarina*, or open sclerophyll forests and woodlands with a stratum of *Allocasuarina* beneath a canopy of myrtaceous species. They are known to feed in belah (*Casuarina cristata*) and bull oak (*Allocasuarina luehmannii*) forests. This species feeds almost exclusively on *Casuarina* and *Allocasuarina* seeds. Requires tree hollows, usually mature *Eucalyptus* for breeding.	**Known –** This species was recorded in *Allocasuarina torulosa* adjacent to the Study Area boundary in the north and observed once in-flight during vantage point surveys in the central east portion of the Study Area.
Charadrius leschenaultia	greater sand plover	Vulnerable, Migratory	Vulnerable	The species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt-marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast.	**Low** – Suitable habitat does not occur within the Study Area. Records for this species occur within the wider Project region though are further east towards the coast.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	Endangered	Endangered	The species occurs in rainforest habitats including subtropical, dry, littoral and vine forest types. Within these habitats, the species is likely to favour alluvial areas that support figs and other trees with fleshy fruits. The species has also been recorded in sub-littoral mixed scrub; corridors of riparian vegetation in woodland, open woodland or other types of cleared habitat; and isolated stands of fig or other trees on urban, agricultural or cleared land.	**Low** – The Study Area is located north of the historic range of the species. The Study Area may provide suitable habitat within vine forest and riparian woodland habitats.
Epthianura crocea macgregor	yellow chat (Dawson)	Critically Endangered	Endangered	The species is restricted to coastal areas of central Queensland (Qld), known to occur in breeding populations on the Torilla Plain and Fitzroy River Delta. The species inhabits marine plain wetlands that are subject to extensive seasonal inundation and varying degrees of both fresh and saltwater (tidal) influence.	**Low** – Suitable marine plain and wetland habitat does not occur within the Study Area. Records for this species occur within the wider Project region though are further east towards the coast.
Erythrotriorchis radiatus	red goshawk	Vulnerable	Endangered	The species occurs in coastal and sub-coastal tall open forests and woodlands, preferring areas with a mosaic of vegetation types, permanent water and abundant small birds. Associated with gorge and escarpment country in partially cleared country in eastern Qld. In eastern Australia, populations seem to move from inland nest sites to coastal plains in winter, thus occupying home ranges of 50-220 km^2.	**Low** – No recent records for this species exist in the region and the species is thought to be locally extinct. The Study Area may provide habitat within remnant eucalypt woodland associated with permanent water sources.
Falco hypoleucos	grey falcon	Vulnerable	Vulnerable	Occupies woodlands, shrublands, and grasslands of arid to semi-arid landscapes often in association with watercourses. Occasionally found in coastal woodlands. Uses nests of other birds of prey usually in tall eucalypts near water.	**Low –** Records of this species are rare within the Project region as this species rarely occupies coastal woodland. Limited habitat for this species exists within the Study Area.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Geophaps scripta scripta	squatter pigeon (southern)	Vulnerable	Vulnerable	The species occurs in open, dry woodland with a grassy understorey in proximity to permanent water. Prefers areas of sandy soil with sparser cover of low grasses; and less common on heavier soils with dense grass cover.	**Known** – This species was recorded frequently on site, commonly along tracks in proximity to water sources.
Grantiella picta	painted honeyeater	Vulnerable	Vulnerable	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box (*Eucalyptus largiflorens*) and river red gum (*E. camaldulensis*), box-ironbark-yellow gum woodlands, *Acacia*-dominated woodlands, *Melaleuca*, *Casuarina* or *Callitris* woodlands, and trees on farmland or in gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes.	**Low** – Some suitable habitat for this species may exist within eucalypt woodland in the Study Area, however, there are no records proximal to the Project.
Hirundapus caudacutus	white-throated needletail	Vulnerable, Migratory	Vulnerable	The species is found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial, though it roosts in tree hollows and the foliage canopy. It forages for insects aerially, flying anywhere between “cloud level” and “ground level”, often forming mixed feeding flocks with other species. The species roosts in tall trees at night, mainly in forests.	**Known** – This species was recorded commonly during field surveys, often flocking in high numbers above ridges and peaks within the Study Area.
Neochmia ruficauda ruficauda	star finch (eastern, southern)	Endangered	Endangered	The species inhabits tall grass and reed beds associated with swamps and watercourses. It may also be found in grassy woodlands, open forests and mangroves. The condition of preferred habitat varies according to season, grazing pressure and fire.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Numenius madagascariensis	eastern curlew	Critically Endangered / MIgratory	Endangered	The species occurs in sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. The species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. They are often recorded among saltmarsh and on mudflats fringed by mangroves, sometimes within the mangroves. They are also found in coastal saltworks and sewage farms.	**Unlikely** – No proximal records for this species exist, and the inland location of the Study Area is unlikely to provide suitable habitat.
Poephila cincta cincta	southern black-throated finch	Endangered	Endangered	The species inhabits grassy, open woodlands and forests, typically dominated by *Eucalyptus* spp. including narrow-leaved ironbark (*E. crebra*), river red gum (*E. camaldulensis*) and silver-leaved ironbark (*E. melanophloia*), *Corymbia* spp. and *Melaleuca* spp, and occasionally in tussock grasslands or other habitats often along or near watercourses, or in the vicinity of water.	**Low –** This location of the Study Area is outside of this species current known distribution. Some available tussock grasslands may be present but it is unlikely that they would exist in a large enough patch to support this species.
Rostratula australis	Australian painted-snipe	Endangered	Vulnerable	The species occurs in shallow freshwater wetlands or saltmarshes, including inundated grasslands, dams and bore drains, generally with good cover of grasses or low scrub.	**Low** – Suitable habitat for this species is unlikely to occur within the Study Area. Records for this species occur within the wider Project region but are found on low lying marsh and swamp land which is not present within the Study Area.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Stagonopleura guttata	diamond firetail	Vulnerable	Vulnerable	This species is distributed from south-east Queensland to Eyre peninsula, South Australia and to approximately 300 km inland from coastal regions. The species utilizes eucalypt, acacia and casuarina woodlands, open forests and other lightly timbered environments. The species prefers habitat with a low tree density, few large logs, low litter cover and high grass cover for foraging, roosting and breeding.	**Low –** Some suitable habitat for this species may exist within eucalypt woodlands within the Study Area, however, there are no records proximal to the Project.
Turnix melanogaster	black-breasted button-quail	Vulnerable	Vulnerable	The species is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum. They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, araucarian microphyll vine forest and araucarian notophyll vine forest. They may also be found in low, dense acacia thickets and, in littoral areas, in vegetation behind sand dunes.	**Low** – Some suitable habitat for this species may exist within vine forest in the Study Area, however, there are no records proximal to the Project.
Mammals					
Chalinolobus dwyer	large-eared pied bat	Vulnerable	Vulnerable	In south-east Qld, the species has primarily been recorded from higher altitude moist tall open forest adjacent to rainforest. Most records are from canopied habitat, although narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used. Rainforest and moist eucalypt forest habitats on rhyolite, trachyte and basalt at high elevation are important roosting habitat for the species.	**Low** – Some suitable habitat for this species may exist within vine forest in the Study Area, however, there are no records proximal to the Project.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Dasyurus hallucatus	northern quoll	Endangered	-	The species occupies a diversity of habitats including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. The species is also known to occupy non-rocky lowland habitats such as beach scrub communities in central Qld. The species generally encompasses some form of rocky area for denning purposes, with surrounding vegetated habitats used for foraging and dispersal. Rocky habitats are usually of high relief, often rugged and dissected.	**Known –** This species was recorded twice on camera traps in the central-east portion Study Area from riparian *Melaleuca* woodland adjacent to remnant eucalypt woodland.
Macroderma gigas	ghost bat	Vulnerable	Endangered	The species occurs throughout 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. Ghost bats move between a number of roosts seasonally or as dictated by weather conditions and/or foraging opportunities, as such they require a range of roost sites. Roost sites can include caves, rock crevices and disused mine adits.	**Low** – The species is known historically from the wider region, however, fauna habitat surveys completed during the field survey did not identify any suitable caves for this species within the Study Area. Habitat assessments completed during the field survey program did not identify any suitable roosting habitat including caves or abandoned mines. However, habitat within the Study Area may be suitable for foraging and dispersal.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Nyctophilus corbeni	Corben's long-eared bat	Vulnerable	Vulnerable	The species inhabits a range of inland dry forest habitats including river red gum (*Eucalyptus camaldulensis*), mallee, brigalow (*Acacia harpophylla*) and other arid and semi-arid habitats; in southern Qld it is more common in box, ironbark and cypress pine forests on sandy soils. The species is most abundant in vegetation with a distinct canopy and a dense, cluttered shrub layer, and in large, continuous remnants. Roosts solitarily in tree hollows, crevices, and under loose bark (particularly on dead bull oak (*Allocasuarina luehmannii*) or belah (*Casuarina cristata*).	**Unlikely** – Suitable habitat is not present within the Study Area, and the Study Area is located north of the known range of the species.
Petauroides volans	greater glider (southern and central)	Endangered	Endangered	The species is largely restricted to eucalypt forests and woodlands; it is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows.	**Known –** This species was recorded within gum-topped box (*Eucalyptus moluccana*) woodland during spotlight surveys within the Study Area.
Petaurus australis australis	yellow-bellied glider (south-eastern)	Vulnerable	Vulnerable	The species occurs in eucalypt-dominated woodlands and forests, including both wet and dry sclerophyll forests. Abundance is highly dependent on habitat suitability, which is in turn determined by forest age and floristics. The subspecies shows a preference for large patches of mature old growth forest that provide suitable trees for foraging and shelter.	**Known** – Species was recorded on four occasions during the field survey program while completing spotlighting surveys in *Eucalyptus moluccana* woodlands in the north of the Study Area.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Phascolarctos cinereus	koala (combined populations of Qld, NSW and the ACT)	Vulnerable	Vulnerable	The species inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by eucalypt species. The species is limited by habitat (restricted to below 800 m above sea level (asl)), temperature and, at the western and northern ends of the range, leaf moisture.	**Moderate** – The species is known from the wider region, albeit in low densities. The extensive eucalypt woodlands and forests within the Study Area may provide suitable habitat for the species.
Potorous tridactylus tridactylus	long-nosed potoroo (SE mainland)	Vulnerable	Vulnerable	The species is sparsely distributed along the coast and Great Dividing Range of south-east Qld. There is limited information about the species' habitat in Qld, it can be found in wet eucalypt forests to coastal heaths and scrubs. The main factors appear to be access to some form of dense vegetation for shelter and the presence of an abundant supply of fungi for food.	**Low** – Some suitable habitat for this species may exist within the Study Area, however, there are no records proximal to the Project.
Pteropus poliocephalus	grey-headed flying-fox	Vulnerable	-	The species occurs in rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. Roosting camps are usually in dense riparian vegetation.	**Low** – Some suitable foraging habitat for this species may exist within vine forest in the Study Area, however, there are no records proximal to the Project.
Reptiles					
Delma torquata	collared delma	Vulnerable	Vulnerable	The species normally inhabits eucalypt-dominated woodlands and open-forests in the following land zones: alluvium, undulating country on fine-grained sedimentary rocks, and sandstone ranges. The presence of rocks, logs, coarse woody debris and leaf litter are essential characteristics of the species' microhabitat.	**Moderate** – Suitable eucalypt habitat is present within the Study Area and two historic records exist within the search extent.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Denisonia maculata	ornamental snake	Vulnerable	Vulnerable	The species inhabits lower-lying subtropical areas with deep-cracking clay soils and adjacent slightly elevated ground of clayey and sandy loams. The species is also found in vegetation of woodland and shrub land, including brigalow (*Acacia harpophylla*), riverside woodland and open forest, particularly on natural levees.	**Low** – This species has been historically recorded in the region, however, suitable habitat for this species does not exist within the Study Area.
Egernia rugosa	yakka skink	Vulnerable	Vulnerable	The species occurs in a variety of drier forests and woodlands, usually on well-drained, gritty soils, including poplar box (*Eucalyptus populnea*) on alluvial soils, white cyrpus pine (*Callitris glaucophylla*) on sands, bull oak (*Allocasuarina luehmannii*), brigalow (*Acacia harpophylla*), bendee (*A. catenulata*) and mulga (*A. aneura*). The species inhabits burrows, abandoned rabbit warrens, and hollow logs or in deep rock crevices.	**Low**– Suitable eucalypt woodland habitat is present within the Study Area; however, this species has not been recorded in the search extent.
Elseya albagula	southern snapping turtle	Critically endangered	Endangered	The species is only found in the Burnett, Fitzroy, Raglan and Mary river drainages of south-east Qld. It prefers permanent flowing water habitats where there are suitable shelters and refuges.	**Low** – This species has been recorded from creeks in the wider region. The Study Area lacks suitable watercourses to support this species.
Furina dunmalli	Dunmall's snake	Vulnerable	Vulnerable	The species has been found in a broad range of habitats, including forests and woodlands on black alluvial cracking clay/ clay loams dominated by including brigalow (*Acacia harpophylla*) and other *Acacia* spp., *Callitris* spp. or bull oak (*Allocasuarina luehmannii*), and various spotted gum (*Corymbia citriodora*), ironbark (*Eucalyptus crebra* and *E. melanophloia*) and white cyprus pine (*Callitris glaucophylla*) open forest and woodland associations on sandstone derived soils.	**Low** – The species is not known from the search extent. Eucalypt woodland and forest may provide suitable habitat for the species.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Rheodytes leukops	Fitzroy river turtle	Vulnerable	Vulnerable	The species is a benthic feeder that occurs in flowing rivers with large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles. Preferred areas have high water clarity and are often associated with ribbonweed (*Vallisneria* sp.) beds. Commonly associated riparian vegetation includes forest red gum (*Eucalyptus tereticornis*), river she-oak (*Casuarina cunninghamiana*), weeping bottlebrush (*Melaleuca viminalis*) and snow-in summer (*M. linariifolia*).	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.
Migratory Species					
Marine Birds					
Apus pacificus	fork-tailed swift	Migratory	Special Least Concern	The species is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	**High** -Likely to occur overhead throughout the Study Area, as this species frequently visits the region on migration and utilises updrafts from hills and ridges to maintain flight.
Marine Species					
Crocodylus porosus	salt-water crocodile	Migratory	Special Least Concern	The species mostly occurs in tidal rivers, coastal floodplains and channels, billabongs and swamps up to 150 km inland from the coast. It usually inhabits the estuarine reaches of rivers. In Qld, the species is usually restricted to coastal waterways and floodplain wetlands. Floating rafts of vegetation provide important nesting habitat.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Terrestrial Species					
Cuculus optatus	oriental cuckoo	Migratory	Special Least Concern	The species uses a range of vegetated habitats such as monsoon rainforest, wet sclerophyll forest, open woodlands and often along edges of forests, or ecotones between forest types.	**Moderate** – This species has been recorded within 25 km of the Study Area and some suitable habitat may exist on site, such as open eucalypt forest and woodland.
Monarcha melanopsis	black-faced monarch	Migratory	Special Least Concern	The species is a wet forest specialist, occurring mainly in rainforests and riparian vegetation. In wet sclerophyll forest, the species mostly frequents sheltered gullies and slopes with a dense understorey of ferns and/or shrubs. They forage from trees and shrubs or by taking insect prey from the air (sallying).	**Moderate** – This species has been recorded within 25 km of the Study Area and some suitable habitat, such as riparian woodland, exists on site.
Monarcha trivirgatus	spectacled monarch	Migratory	Special Least Concern	The species occurs in thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	**Known** – This species was recorded twice within the Study Area, once from vine thicket and once from eucalypt woodland.
Motacilla flava	yellow wagtail	Migratory	Special Least Concern	Habitat requirements for the species are highly variable, but typically include open grassy flats near water. Habitats include open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves.	**Unlikely** – Suitable habitat for this species does not exist within the Study Area. The closest record of this species to the Study Area has been identified over 70 km to the west.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Myiagra cyanoleuca	satin flycatcher	Migratory	Special Least Concern	The species inhabits heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	**Moderate** – This species has been historically recorded within 15 km of the Study Area. Suitable habitat for this species exists within the Study Area in the form of vegetated gullies.
Rhipidura rufifrons	rufous fantail	Migratory	Special Least Concern	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns.	**Known** – This species was recorded three times within the Study Area, once from vine thicket and twice from eucalypt woodland.
Wetlands Species					
Actitis hypoleucos	common sandpiper	Migratory	Special Least Concern	The species utilises a wide range of coastal wetlands and some inland wetlands with varying levels of salinity. The species is mostly found around muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, as well as on banks further upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present. Records from the region occur along the coast away from the site.
Calidris acuminata	sharp-tailed sandpiper	Migratory	Special Least Concern	The species prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland. They also occur in salt works and sewage farms.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present. Records from the region occur along the coast away from the site.

Scientific Name	Common Name	EPBC Act Status	NC Act Status	Preferred Habitat	Likelihood of Occurrence
Calidris melanotos	pectoral sandpiper	Migratory	Special Least Concern	The species prefers shallow fresh to saline wetlands. It is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present. Records from the region occur along the coast away from the site.
Gallinago hardwickii	Latham's snipe	Migratory	Special Least Concern	In Australia, the species occurs in permanent and ephemeral wetlands up to 2000 m asl. They usually inhabit open, freshwater wetlands with low, dense vegetation such as swamps, flooded grasslands or heathlands, around bogs and other water bodies.	**Low** – Although freshwater systems exist within the Study Area, suitable wetland habitat is not present.
Pandion haliaetus	osprey	Migratory	Special Least Concern	In east and south-east Australia, the species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts; usually with a dense shrubby understorey often including ferns.	**Unlikely** – No proximal records for this species exist, and the Study Area is unlikely to provide suitable habitat.

APPENDIX B

Fauna Species List

Table B1 Fauna Species List

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Fauna				
Amphibians				
Bufonidae	cane toad	*Bufo marinus**	-	-
Hylidae	common green treefrog	*Litoria caerulea*	-	Least Concern
Hylidae	broad palmed rocketfrog	*Litoria latopalmata*	-	Least Concern
Hylidae	striped rocketfrog	*Litoria nasuta*	-	Least Concern
Limnodynastidae	scarlet sided pobblebonk	*Limnodynastes terraereginae*	-	Least Concern
Limnodynastidae	ornate burrowing frog	*Platyplectrum ornatum*	-	Least Concern
Birds				
Acanthizidae	yellow-rumped thornbill	*Acanthiza chrysorrhoa*	-	Least Concern
Acanthizidae	white-throated gerygone	*Gerygone olivacea*	-	Least Concern
Acanthizidae	fairy gerygone	*Gerygone palpebrosa*	-	Least Concern
Acanthizidae	white-browed scrubwren	*Sericornis frontalis*	-	Least Concern
Acanthizidae	weebill	*Smicrornis brevirostris*	-	Least Concern
Accipitridae	collared sparrowhawk	*Accipiter cirrocephalus*	-	Least Concern
Accipitridae	brown goshawk	*Accipiter fasciatus*	-	Least Concern
Accipitridae	grey goshawk	*Accipiter novaehollandiae*	-	Least Concern
Accipitridae	wedge-tailed eagle	*Aquila audax*	-	Least Concern
Accipitridae	pacific baza	*Aviceda subcristata*	-	Least Concern
Accipitridae	whistling kite	*Haliastur sphenurus*	-	Least Concern
Accipitridae	black kite	*Milvus migrans*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Aegothelidae	Australian owlet-nightjar	*Aegotheles cristatus*	-	Least Concern
Anatidae	pacific black duck	*Anas superciliosa*	-	Least Concern
Anatidae	Australian wood duck	*Chenonetta jubata*	-	Least Concern
Apodidae	white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable
Ardeidae	white-necked heron	*Ardea pacifica*	-	Least Concern
Ardeidae	white-faced heron	*Egretta novaehollandiae*	-	Least Concern
Artamidae	black-faced woodswallow	*Artamus cinereus*	-	Least Concern
Artamidae	dusky woodswallow	*Artamus cyanopterus*	-	Least Concern
Artamidae	white-breasted woodswallow	*Artamus leucorynchus*	-	Least Concern
Artamidae	pied butcherbird	*Cracticus nigrogularis*	-	Least Concern
Artamidae	grey butcherbird	*Cracticus torquatus*	-	Least Concern
Artamidae	Australian magpie	*Gymnorhina tibicen*	-	Least Concern
Artamidae	pied currawong	*Strepera graculina*	-	Least Concern
Burhinidae	bush stone-curlew	*Burhinus grallarius*	-	Least Concern
Cacatuidae	sulphur-crested cockatoo	*Cacatua galerita*	-	Least Concern
Cacatuidae	little corella	*Cacatua sanguinea*	-	Least Concern
Cacatuidae	red-tailed black-cockatoo	*Calyptorhynchus banksii*	-	Least Concern
Cacatuidae	yellow-tailed black-cockatoo	*Calyptorhynchus funereus*	-	Least Concern
Cacatuidae	glossy black-cockatoo	*Calyptorhynchus lathami*	-	Vulnerable
Cacatuidae	galah	*Eolophus roseicapilla*	-	Least Concern
Cacatuidae	cockatiel	*Nymphicus hollandicus*	-	Least Concern
Campephagidae	ground cuckoo-shrike	*Coracina maxima*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Campephagidae	black-faced cuckoo-shrike	*Coracina novaehollandiae*	-	Least Concern
Campephagidae	white-bellied cuckoo-shrike	*Coracina papuensis*	-	Least Concern
Campephagidae	cicadabird	*Coracina tenuirostris*	-	Least Concern
Campephagidae	varied triller	*Lalage leucomela*	-	Least Concern
Casuariidae	emu	*Dromaius novaehollandiae*	-	Least Concern
Charadriidae	masked lapwing	*Vanellus miles*	-	Least Concern
Climacteridae	white-browed treecreeper	*Climacteris affinis*	-	Least Concern
Climacteridae	white-throated treecreeper	*Cormobates leucophaea*	-	Least Concern
Columbidae	emerald dove	*Chalcophaps indica*	-	Least Concern
Columbidae	peaceful dove	*Geopelia striata*	-	Least Concern
Columbidae	squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
Columbidae	wonga pigeon	*Leucosarcia melanoleuca*	-	Least Concern
Columbidae	topknot pigeon	*Lopholaimus antarcticus*	-	Least Concern
Columbidae	brown cuckoo-dove	*Macropygia amboinensis*	-	Least Concern
Columbidae	crested pigeon	*Ocyphaps lophotes*	-	Least Concern
Columbidae	common bronzewing	*Phaps chalcoptera*	-	Least Concern
Columbidae	rose-crowned fruit-dove	*Ptilinopus regina*	-	Least Concern
Coraciidae	dollarbird	*Eurystomus orientalis*	-	Least Concern
Corcoracidae	white-winged chough	*Corcorax melanorhamphos*	-	Least Concern
Corcoracidae	apostlebird	*Struthidea cinerea*	-	Least Concern
Corvidae	Torresian crow	*Corvus orru*	-	Least Concern
Cuculidae	fan-tailed cuckoo	*Cacomantis flabelliformis*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Cuculidae	pallid cuckoo	*Cacomantis pallidus*	-	Least Concern
Cuculidae	pheasant coucal	*Centropus phasianinus*	-	Least Concern
Cuculidae	Horsfield's bronze-cuckoo	*Chalcites basalis*	-	Least Concern
Cuculidae	eastern koel	*Eudynamys orientalis*	-	Least Concern
Cuculidae	channel-billed cuckoo	*Scythrops novaehollandiae*	-	Least Concern
Dicruridae	spangled drongo	*Dicrurus bracteatus*	-	Least Concern
Dicruridae	willie wagtail	*Rhipidura leucophrys*	-	Least Concern
Estrildidae	plum-headed finch	*Neochmia modesta*	-	Least Concern
Estrildidae	red-browed finch	*Neochmia temporalis*	-	Least Concern
Estrildidae	double-barred finch	*Taeniopygia bichenovii*	-	Least Concern
Estrildidae	zebra finch	*Taeniopygia guttata*	-	Least Concern
Eurostopodidae	white-throated nightjar	*Eurostopodus mystacalis*	-	Least Concern
Falconidae	brown falcon	*Falco berigora*	-	Least Concern
Falconidae	nankeen kestrel	*Falco cenchroides*	-	Least Concern
Falconidae	peregrine falcon	*Falco peregrinus*	-	Least Concern
Gruidae	brolga	*Antigone rubicunda*	-	Least Concern
Halcyonidae	blue-winged kookaburra	*Dacelo leachii*	-	Least Concern
Halcyonidae	laughing kookaburra	*Dacelo novaeguineae*	-	Least Concern
Halcyonidae	forest kingfisher	*Todiramphus macleayii*	-	Least Concern
Hirundinidae	welcome swallow	*Hirundo neoxena*	-	Least Concern
Hirundinidae	tree martin	*Petrochelidon nigricans*	-	Least Concern
Maluridae	red-winged fairy-wren	*Malurus elegans*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Maluridae	red-backed fairy-wren	*Malurus melanocephalus*	-	Least Concern
Megaluridae	brown songlark	*Cincloramphus cruralis*	-	Least Concern
Megaluridae	rufous songlark	*Cincloramphus mathewsi*	-	Least Concern
Megapodiidae	Australian brush-turkey	*Alectura lathami*	-	Least Concern
Meliphagidae	blue-faced honeyeater	*Entomyzon cyanotis*	-	Least Concern
Meliphagidae	brown honeyeater	*Lichmera indistincta*	-	Least Concern
Meliphagidae	noisy miner	*Manorina melanocephala*	-	Least Concern
Meliphagidae	Lewin's honeyeater	*Meliphaga lewinii*	-	Least Concern
Meliphagidae	white-throated honeyeater	*Melithreptus albogularis*	-	Least Concern
Meliphagidae	black-chinned honeyeater	*Melithreptus gularis*	-	Least Concern
Meliphagidae	scarlet honeyeater	*Myzomela sanguinolenta*	-	Least Concern
Meliphagidae	white-eared honeyeater	*Nesoptilotis leucotis*	-	Least Concern
Meliphagidae	little friarbird	*Philemon citreogularis*	-	Least Concern
Meliphagidae	noisy friarbird	*Philemon corniculatus*	-	Least Concern
Meropidae	rainbow bee-eater	*Merops ornatus*	-	Least Concern
Monarchidae	magpie-lark	*Grallina cyanoleuca*	-	Least Concern
Monarchidae	leaden flycatcher	*Myiagra rubecula*	-	Least Concern
Monarchidae	broad-billed flycatcher	*Myiagra ruficollis*	-	Least Concern
Monarchidae	spectacled monarch	*Symposiachrus trivirgatus*	Migratory	Special Least Concern
Motacillidae	Australasian pipit	*Anthus novaeseelandiae*	-	Least Concern
Nectariniidae	mistletoebird	*Dicaeum hirundinaceum*	-	Least Concern
Neosittidae	varied sittella	*Daphoenositta chrysoptera*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Oriolidae	olive-backed oriole	*Oriolus sagittatus*	-	Least Concern
Oriolidae	Australasian figbird	*Sphecotheres vieilloti*	-	Least Concern
Otididae	Australian bustard	*Ardeotis australis*	-	Least Concern
Pachycephalidae	grey shrike-thrush	*Colluricincla harmonica*	-	Least Concern
Pachycephalidae	little shrike-thrush	*Colluricincla megarhyncha*	-	Least Concern
Pachycephalidae	golden whistler	*Pachycephala pectoralis*	-	Least Concern
Pachycephalidae	rufous whistler	*Pachycephala rufiventris*	-	Least Concern
Pardalotidae	striated pardalote	*Pardalotus striatus*	-	Least Concern
Pelecanidae	Australian pelican	*Pelecanus conspicillatus*	-	Least Concern
Petroicidae	eastern yellow robin	*Eopsaltria australis*	-	Least Concern
Petroicidae	red-capped robin	*Petroica goodenovii*	-	Least Concern
Petroicidae	rose robin	*Petroica rosea*	-	Least Concern
Phasianidae	brown quail	*Coturnix ypsilophora*	-	Least Concern
Podargidae	tawny frogmouth	*Podargus strigoides*	-	Least Concern
Podicipedidae	Australasian grebe	*Tachybaptus novaehollandiae*	-	Least Concern
Pomatostomidae	grey-crowned babbler	*Pomatostomus temporalis*	-	Least Concern
Psittacidae	Australian king-parrot	*Alisterus scapularis*	-	Least Concern
Psittacidae	red-winged parrot	*Aprosmictus erythropterus*	-	Least Concern
Psittacidae	budgerigar	*Melopsittacus undulatus*	-	Least Concern
Psittacidae	little lorikeet	*Parvipsitta pusilla*	-	Least Concern
Psittacidae	scaly-breasted lorikeet	*Trichoglossus chlorolepidotus*	-	Least Concern
Psittaculidae	pale-headed rosella	*Platycercus adscitus*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Psittaculidae	rainbow lorikeet	*Trichoglossus moluccanus*	-	Least Concern
Psophodidae	spotted quail-thrush	*Cinclosoma punctatum*	-	Least Concern
Ptilonorhynchidae	green catbird	*Ailuroedus crassirostris*	-	Least Concern
Ptilonorhynchidae	spotted bowerbird	*Ptilonorhynchus maculatus*	-	Least Concern
Rhipiduridae	grey fantail	*Rhipidura albiscapa*	-	Least Concern
Rhipiduridae	rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern
Strigidae	southern boobook	*Ninox boobook*	-	Least Concern
Strigidae	barking owl	*Ninox connivens*	-	Least Concern
Threskiornithidae	straw-necked ibis	*Threskiornis spinicollis*	-	Least Concern
Turnicidae	painted button-quail	*Turnix varius*	-	Least Concern
Tytonidae	eastern barn owl	*Tyto delicatula*	-	Least Concern
Zosteropidae	silvereye	*Zosterops lateralis*	-	Least Concern
Mammals				
Canidae	dingo	*Canis familiaris dingo*	-	-
Dasyuridae	northern quoll	*Dasyurus hallucatus*	Endangered	Least Concern
Emballonuridae	yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	-	Least Concern
Emballonuridae	Troughton's sheathtail bat	*Taphozous troughtoni*	-	Least Concern
Equidae	wild horse	*Equus caballus**	-	-
Felidae	cat	*Felis catus**	-	-
Leporidae	European brown hare	*Lepus europaeus**	-	-
Macropodidae	black-striped wallaby	*Macropus dorsalis*	-	Least Concern
Macropodidae	eastern grey kangaroo	*Macropus giganteus*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Macropodidae	whiptail wallaby	*Macropus parryi*	-	Least Concern
Macropodidae	Herbert's rock-wallaby	*Petrogale herberti*	-	Least Concern
Macropodidae	unadorned rock-wallaby	*Petrogale inornata*	-	Least Concern
Macropodidae	swamp wallaby	*Wallabia bicolor*	-	Least Concern
Miniopteridae	little bent-wing bat	*Miniopterus australis*	-	Least Concern
Miniopteridae	eastern bent-wing bat	*Miniopterus orianae*	-	Least Concern
Molossidae	northern freetail bat	*Chaerephon jobensis*	-	Least Concern
Molossidae	northern free-tailed bat	*Ozimops lumsdenae*	-	Least Concern
Molossidae	eastern free-tailed bat	*Ozimops ridei*	-	Least Concern
Molossidae	bristle-faced free-tailed bat	*Setirostris eleryi*	-	Least Concern
Muridae	black rat	*Rattus rattus**	-	-
Petauridae	yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable
Petauridae	sugar glider	*Petaurus breviceps*	-	Least Concern
Petauridae	squirrel glider	*Petaurus norfolcensis*	-	Least Concern
Phalangeridae	common brushtail possum	*Trichosurus vulpecula*	-	Least Concern
Potoroidae	rufous bettong	*Aepyprymnus rufescens*	-	Least Concern
Pseudocheiridae	greater glider (southern and central)	*Petauroides volans*	Vulnerable	Vulnerable
Pteropodidae	black flying-fox	*Pteropus alecto*	-	Least Concern
Pteropodidae	little red flying-fox	*Pteropus scapulatus*	-	-
Rhinolophidae	eastern horseshoe bat	*Rhinolophus megaphyllus*	-	Least Concern
Suidae	pig	*Sus scrofa**	-	-
Tachyglossidae	short-beaked echidna	*Tachyglossus aculeatus*	-	Special Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Vespertilionidae	Gould's wattled bat	*Chalinolobus gouldii*	-	Least Concern
Vespertilionidae	chocolate wattled bat	*Chalinolobus morio*	-	Least Concern
Vespertilionidae	hoary wattled bat	*Chalinolobus nigrogriseus*	-	Least Concern
Vespertilionidae	little pied bat	*Chalinolobus picatus*	-	Least Concern
Vespertilionidae	inland broad-nosed bat	*Scotorepens balstoni*	-	Least Concern
Vespertilionidae	little broad-nosed bat	*Scotorepens greyii*	-	Least Concern
Vespertilionidae	south-eastern broad-nosed bat	*Scotorepens orion*		Least Concern
Vespertilionidae	northern broad-nosed bat	*Scotorepens sanborni*	-	Least Concern
Reptiles				
Agamidae	eastern bearded dragon	*Pogona barbata*	-	Least Concern
Colubridae	green tree snake	*Dendrelaphis punctulatus*	-	Least Concern
Diplodactylidae	wood gecko	*Diplodactylus vittatus*	-	Least Concern
Diplodactylidae	robust velvet gecko	*Nebulifera robusta*	-	Least Concern
Diplodactylidae	ocellated velvet gecko	*Oedura monilis*	-	Least Concern
Diplodactylidae	southern spotted velvet gecko	*Oedura tryoni*	-	Least Concern
Elapidae	eastern small-eyed snake	*Cryptophis nigrescens*	-	Least Concern
Gekkonidae	Bynoe's gecko	*Heteronotia binoei*	-	Least Concern
Pygopodidae	Burton's legless lizard	*Lialis burtonis*	-	Least Concern
Scincidae	open-litter rainbow skink	*Carlia pectoralis*	-	Least Concern
Scincidae	orange-flanked rainbow skink	*Carlia rubigo*	-	Least Concern
Scincidae	tree-base litter-skink	*Lygisaurus foliorum*	-	Least Concern
Scincidae	eastern blue-tongued lizard	*Tiliqua scincoides*	-	Least Concern

Family	Common Name	Scientific Name	EPBC Status	NC Act Status
Varanidae	sand monitor	*Varanus gouldii*	-	Least Concern
Varanidae	black-tailed monitor	*Varanus tristis*	-	Least Concern
Varanidae	lace monitor	*Varanus varius*	-	Least Concern

APPENDIX C

Fauna Habitat Types

Fauna Habitat Types	Mixed eucalypt woodland on steep slopes	*Eucalyptus crebra* woodland
Habitat Description	Mixed eucalypt woodland on steep slopes and ridges, commonly with *Corymbia citriodora* and/or *Eucalyptus crebra* +\- *E. acmenoides*, *E. tereticornis*	*Eucalyptus crebra* +\- *Corymbia erythrophloia*, *C. citriodora* woodland on slopes and ridges
Associated Regional Ecosystems	11.11.3, 11.11.4, 11.11.4a, 11.11.4b, 11.12.6	11.11.15, 11.12.1
Habitat Features	Commonly recorded habitat features include rocky outcrops and fallen logs of various sizes, while in some instances there is a denser cover of shrubs and grasses. Permanent water is rare in these areas, generally only existing in standing pools in creek beds or dams.	This habitat type generally has a grassier understorey with boulders and fallen logs occasionally present. Permanent water is rare in these areas, generally only existing in standing pools in creek beds or dams.
Disturbance Present	Grazing, erosion, weeds including common prickly pear (*Opuntia stricta*) and lantana (*Lantana camara*)	Grazing, erosion, weeds including velvet tree pear (*Opuntia tomentosa*) and lantana (*Lantana camara*)
Ground-truthed Mapping Extent (ha)	7,544.3	2,575.4
Representative Photograph		

Fauna Habitat Types	*Eucalyptus moluccana* woodland	Semi-evergreen vine thicket
Habitat Description	*Eucalyptus moluccana* woodland on slopes and ridges	Vine thicket on upper slopes and gullies with various floristics including *Euroschinus falcatus* var. *falcatus*, *Brachychiton australis*, *Flindersia* spp., *Ficus* sp., *Jasminum* sp., *Alyxia* sp., etc.
Associated Regional Ecosystems	11.11.3c, 11.11.4c	11.11.5a, 11.12.4
Habitat Features	This habitat type supports a variable assemblage of hollows suitable for nesting/roosting by arboreal mammals and birds. A sparse ground layer is often present with scattered fallen logs of various sizes.	The dense, complex structure of this habitat type make it suitable for smaller birds, reptiles and mammals which are capable of navigating the thick shrubs, vines and rocky outcrops.
Disturbance Present	Grazing, weeds including velvet tree pear (*Opuntia tomentosa*) and common prickly pear (*Opuntia stricta*)	Weeds including lantana (*Lantana camara*), velvet tree pear (*Opuntia tomentosa*) and common prickly pear (*Opuntia stricta*)
Ground-truthed Mapping Extent (ha)	241.7	50.7
Representative Photograph		

Fauna Habitat Types	Riparian *Melaleuca* woodland	Alluvial eucalypt woodland
Habitat Description	*Melaleuca fluviatilis* woodland +\- Eucalyptus tereticornis fringing a watercourse	*Eucalyptus tereticornis* +\- *Corymbia tessellaris* woodland on alluvial soils sometimes with *Casuarina cunninghamiana* as dominant.
Associated Regional Ecosystems	11.3.25b	11.3.4, 11.3.25
Habitat Features	This habitat type fringes rocky creek beds with an abundance of fine litter. Vegetation is often sparsely distributed and adjacent to non-remnant pasture, resulting in incursions from exotic species.	This habitat type generally has a grassy understorey with a sparse shrub layer. The large, older growth eucalypt species in the canopy supports a variable assemblage of hollows suitable for nesting/roosting by arboreal mammals and birds. Termitaria were also observed regularly within this habitat type.
Disturbance Present	Weeds including rubber vine (*Cryptostegia grandiflora*) and lantana (*Lantana camara*)	grazing, weeds including rubber vine (*Cryptostegia grandiflora*) and lantana (*Lantana camara*)
Ground-truthed Mapping Extent (ha)	240.8	36.8
Representative Photograph		

Fauna Habitat Types	Non-remnant pasture
Habitat Description	Non-remnant areas containing pasture comprising native and non-native grasses, scattered native trees and various infrastructure including tracks and dams.
Associated Regional Ecosystems	N/A
Habitat Features	This habitat type contains naturalised pasture grasses including buffel grass (*Cenchrus ciliaris*) and guinea grass (*Megathyrsus maximus*) providing little suitable habitat for native fauna species. Trees and shrubs are sparsely distributed.
Disturbance Present	Grazing, clearing, tracks, infrastructure, weeds including rubber vine (*Cryptostegia grandiflora*) and lantana (*Lantana camara*)
Ground-truthed Mapping Extent (ha))	2,234.3
Representative Photograph	

APPENDIX D

Bird and Bat Utilisation Assessment

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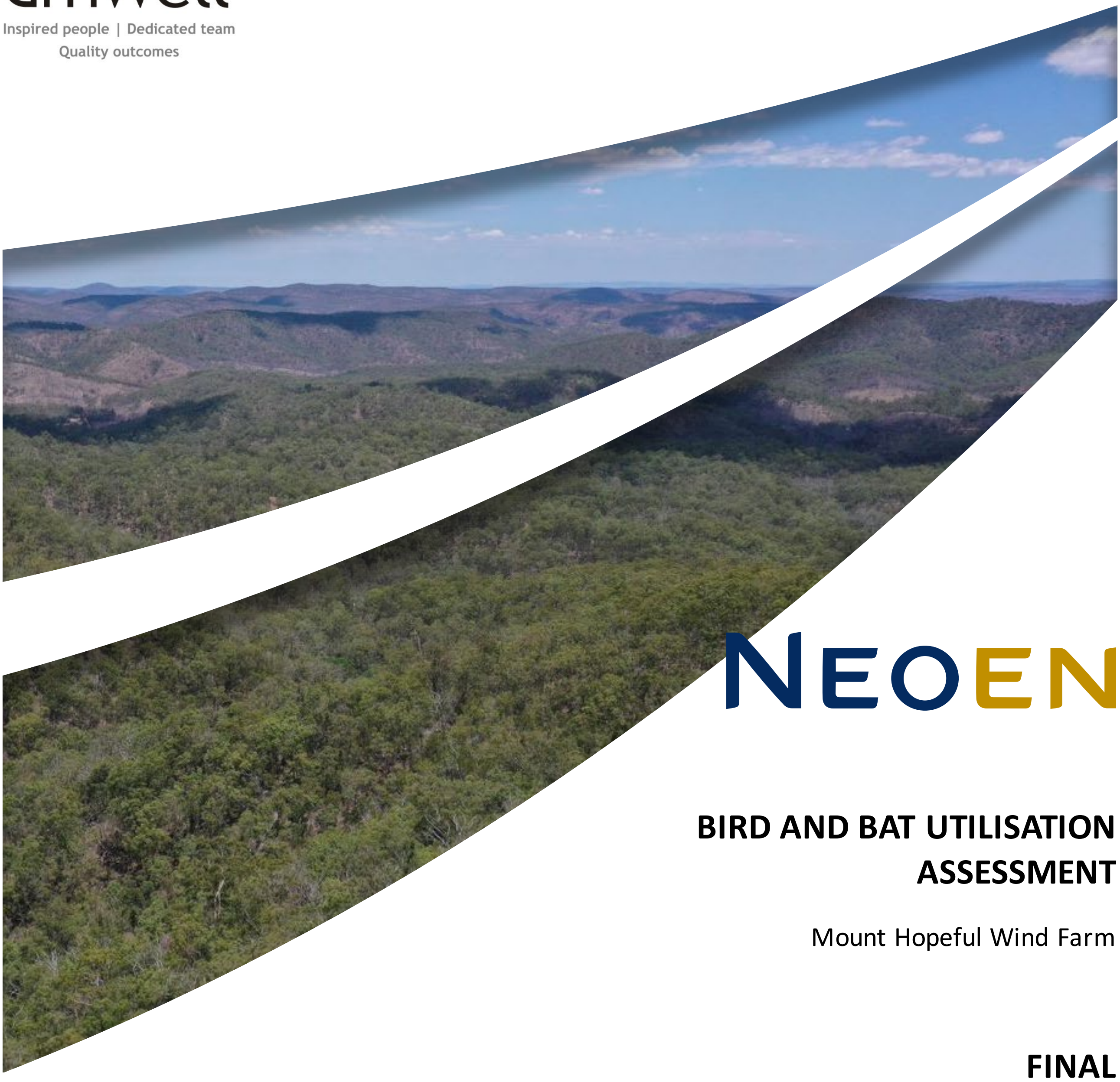
Inspired people | Dedicated team
Quality outcomes



NEOEN

BIRD AND BAT UTILISATION ASSESSMENT

Mount Hopeful Wind Farm

FINAL

May 2023

BIRD AND BAT UTILISATION ASSESSMENT

Mount Hopeful Wind Farm

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

Report No. 22753/R07/Appendix A
Date: December 2022

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Table of Contents

Figures

Graphs

Tables

Appendices

Abbreviations and Glossary

Abbreviations

Abbreviation	Description
AHD	Australian height datum
AGL	above ground level
BACI	before-after control-impact
BBAMP	Bird and bat adaptive management plan
BBUS	Bird and bat utilisation survey
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ha	hectares
km	kilometres
LGA	Local government area
m	metres
NC Act	*Nature Conservation Act 1992* (QLD)
Neoen	Neoen Australia Pty Ltd
Qld	Queensland
RSA	rotor swept area
Umwelt	Umwelt (Australia) Pty Ltd
WTG	Wind turbine generator

Glossary

Term	Meaning
Barotrauma	A phenomenon in which rapid air pressure changes cause tissue damage to air-containing structures, most notably the lungs of bats (Baerwald et al. 2008)
Biophysical	The biotic and abiotic surrounding of an organism or population
Blade Strike	A collision between bird or bat and wind turbine blade
Fecundity	The ability to produce an abundance of offspring
Interrelated	Related or connected to one another
Riparian	Relating to wetlands adjacent to rivers and streams.
Plateau	An area of fairly level high ground
Volant	Able to fly

1.0 Introduction

Umwelt was engaged by Neoen Australia Pty Ltd (Neoen) to undertake ecological surveys to support a development application for the proposed Mount Hopeful Wind Farm (the Project). This bird and bat utilisation assessment presents the methods and results of six dedicated bird and bat utilisation surveys, as well as bird and bat observations made during other flora and fauna field surveys, and an analysis of the findings with respect to potential impacts from the Project.

1.1 Scope of Works

The aims of this assessment are to document the bird and bat species that are present or likely to occur in the Study Area, and to assess the risk of impacts for species flying at rotor swept area (RSA), particularly those that are of conservation concern.

Specific objectives for the scope of work include:

- Determining the status of bird and bat species in the Study Area through review of existing data and field survey.
- Identifying which bird and bat species are susceptible to blade strike from wind turbines in the Study Area through analysis of flight behaviour recorded on site and assessment of external information.
- Assessing potential impacts of the Project on bird and bat species and estimating the relative level of risk associated with potential impacts on species that are considered most at risk.
- Outlining available measures that have been employed at wind farms to avoid or mitigate impacts of blade strike on birds and bats.

1.2 Project Description

The Mount Hopeful Wind Farm is located on the Ulam Range approximately 45 km south of Rockhampton, Queensland (Qld) and 65 km west of Gladstone, Qld (**Figure 1.1**). The Project involves the development of a wind farm that contains 63 wind turbine generators (WTGs, referred to herein as turbines), ancillary infrastructure including up to ten temporary and ten permanent wind monitoring masts, six substations, battery energy storage systems (BESS), temporary construction compound/laydown areas, a concrete batching plant, high voltage (275 kV) overhead powerlines, as well as underground power and communication cables. The Project is expected to have a maximum generation capacity of approximately 400 megawatts (MW).

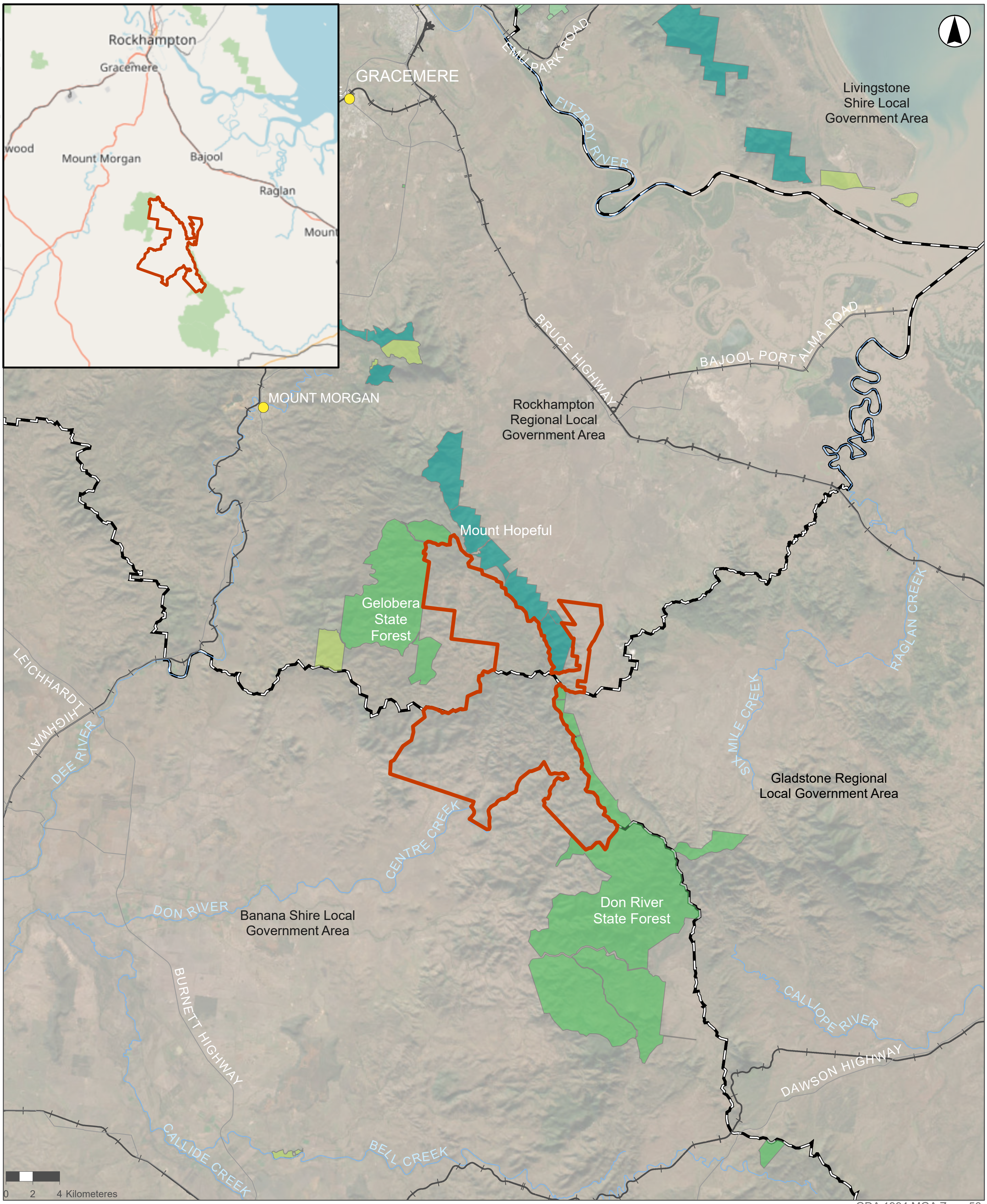
At this stage in the Project, turbine specifications have not been confirmed by Neoen.

1.2.1 Study Area

The Project is proposed over 18 land parcels and will utilise a number of local road reserves, which will be collectively referred to as the 'Study Area'. The Study Area is within the Rockhampton Regional Council and Banana Shire Council Local Government Areas (LGA) and covers approximately 16,976 ha of land.

Elevation within the Study Area ranges from approximately 500 m Australian Height Datum (AHD) to 120 m AHD, characterised by hilly terrain that comprises peaks and valleys, with areas of lower, generally flatter topography surrounding the Study Area to the east and west.

Major highways in proximity to the Study Area include the Bruce Highway to the east, Burnett Highway to the west, and the Dawson Highway to the south. These major transport corridors link to the cities of Rockhampton and Gladstone, as well as the Port of Gladstone from which the proposed turbine components will be transported.



Legend

- Town
- Roads
- Railway
- Watercourses
- Local Government Area (LGA)
- Study Area
- Conservation Park
- National Park
- Resources Reserve
- State Forest

FIGURE 1.1

Study Area Mount Hopeful Wind Farm

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.2.2 Wind Turbine Dimensions

The Project proposes up to 63 turbines, with a maximum overall height (tip height) of 260 m above ground level (AGL). The turbines will have a horizontal axis, with a rotor consisting of three blades with a maximum blade length of up to 90 m and a maximum hub height of up to 180 m. The selected blade length and wind turbine hub height will be configured so that the tip height does not exceed 260 m. These maximum specifications are summarised in **Table 1.1.**

Table 1.1 Turbine Specifications

Feature	Maximum Specification
Project generation capacity	Approximately 400 MW
Turbine electrical output	Approximately 6.5 MW
Maximum number of turbines	63
Tip height	Up to 260 m
Blade length	Up to 90 m

** The specifications listed in the table are considered to be an upper limit and are intended to provide flexibility for any innovation in turbine design between now and the time of detailed design and construction.*

The rotor swept area (RSA) refers to the physical area swept by the rotating blades during operation. For a hub height of 145 m and blade length of 90 m, the RSA would be located at a height of between 55 m to 235 m AGL (**Figure 1.2a**), and for a hub height of 170 m and blade length of 90 m, the RSA would be between 80 m to 260 m AGL (**Figure 1.2b**).

For the purposes of data analysis for this report, an inclusive RSA of 55 to 260 m was considered.

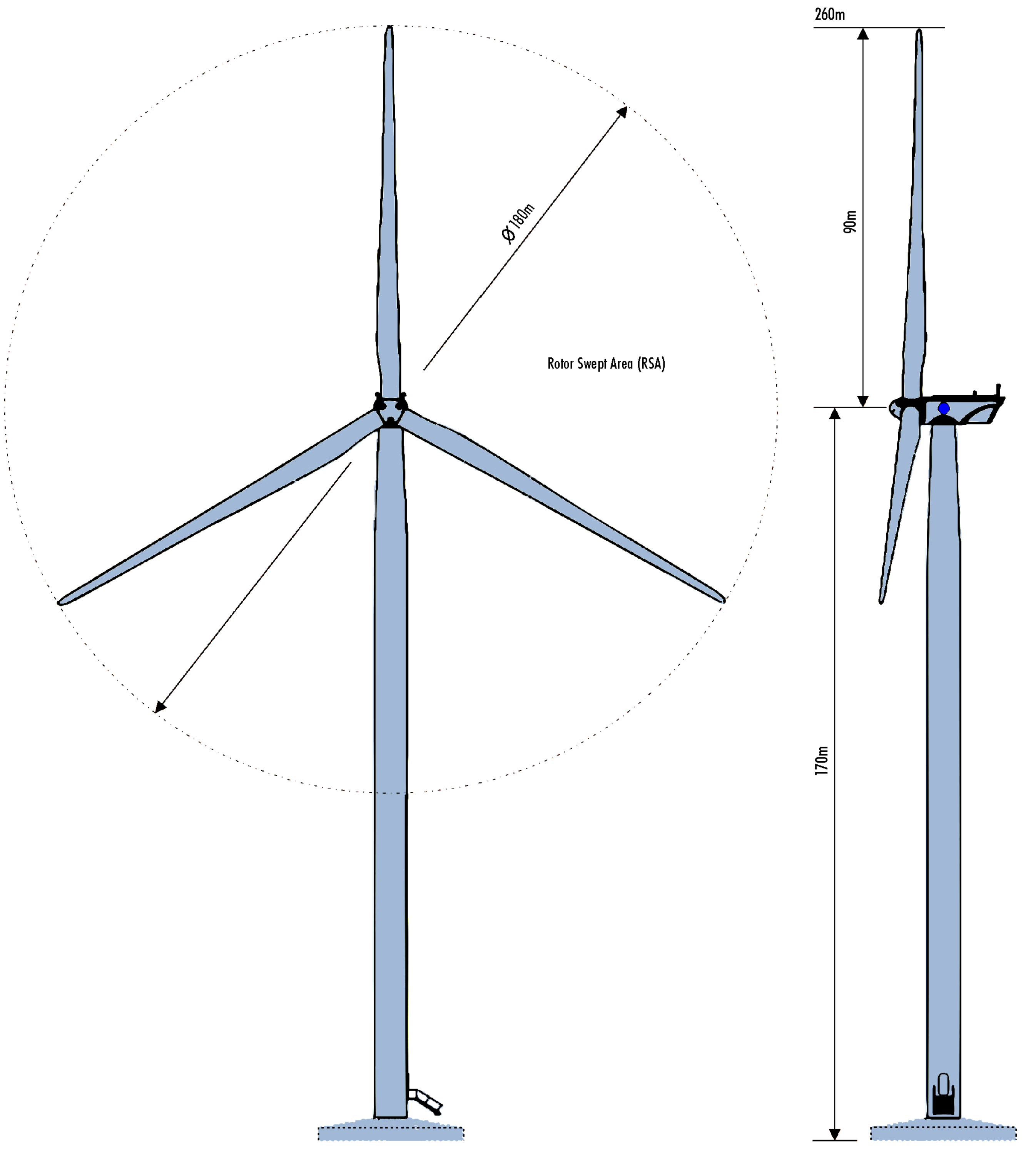


FIGURE 1.2A

Indicative Turbine Rotor Swept Area

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

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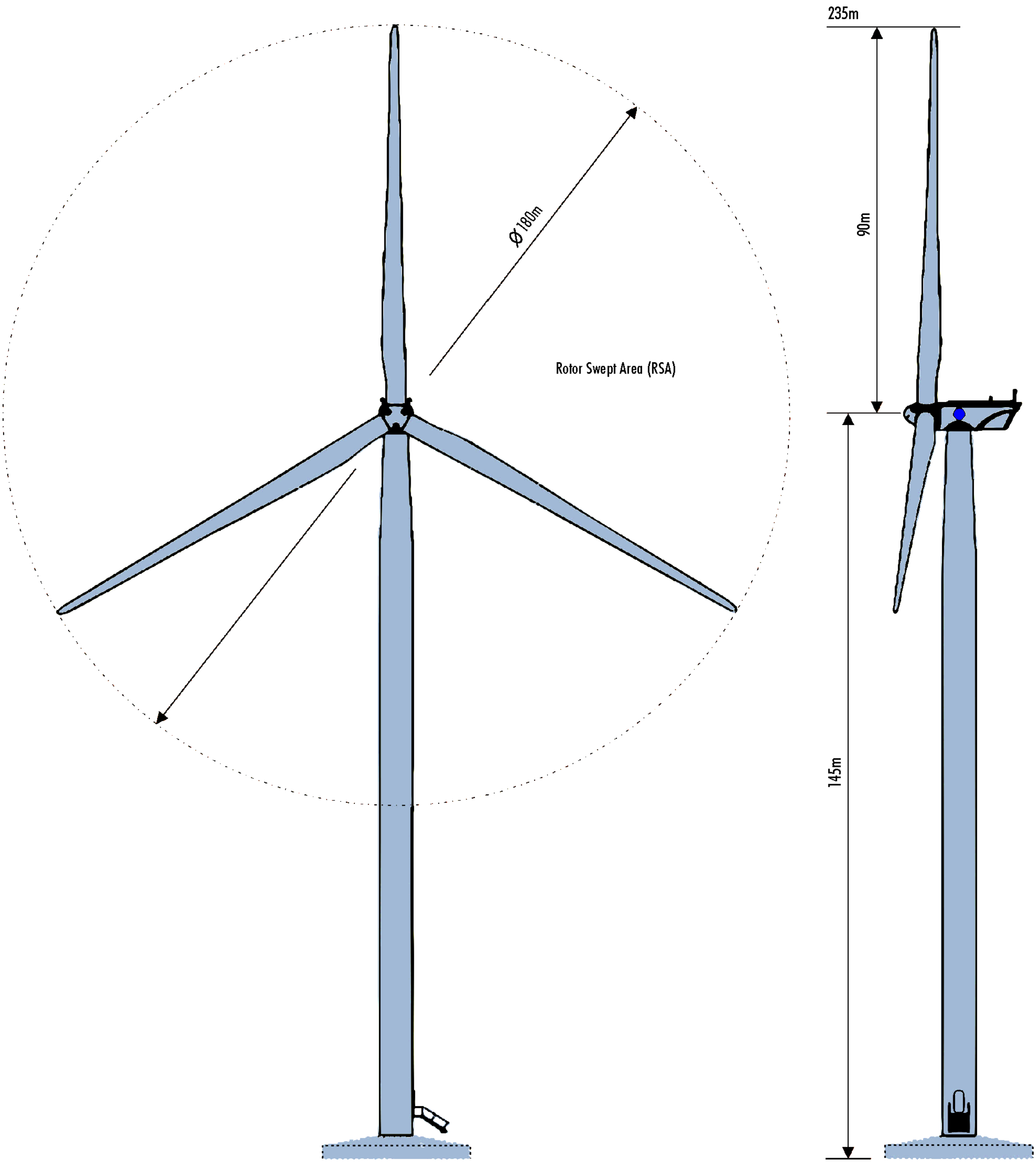


FIGURE 1.2A

Indicative Turbine Rotor Swept Area

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

2.0 Methods

2.1 Desktop Assessment

Tools used to investigate the potential occurrence of bird and bat species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *Nature Conservation Act 1992* (NC Act) (using a 10 km buffer around the Project boundary) included:

- EPBC Act Protected Matters Search Tool (PMST) (Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022).
- Wildlife Online search tool (Department of Environment and Science (DES) 2022).
- Spatial Portal (Atlas of Living Australia (ALA) 2022).
- Atlas and Birdata (BirdLife Australia 2022).

2.2 Field Survey

2.2.1 Survey Timing

Umwelt ecologists initially conducted bird utilisation surveys in 2019 during Winter (9 to 12 July 2019 and 7 to 12 August 2019) to establish vantage point locations and begin collecting a baseline avifaunal data set. The next surveys were conducted during 2020 in Autumn (23 February to 5 March 2020) and late Spring (5 to 12 November 2020). The timing of these surveys coincided with the seasonal migration of EPBC Act listed birds, including white-throated needletail (*Hirundapus caudacutus*) and fork-tailed swift (*Apus pacificus*).

Ecologists conducted additional bird utilisation survey in 2021 during Spring (8 to 15 October 2021) and 2022 during Summer (14 to 21 February 2022) to capture seasonal variation in birds present within the Project site and airspace. Additional Project associated surveys have been undertaken throughout this period recording bird species incidentally to capture threatened species records and contribute towards the broader understanding of avifaunal biodiversity across the Study Area.

Bird and bat utilisation surveys occurred in various months and seasons to best record species presence within the Study Area. The survey timing is as follows:

- July 2019 (Winter)
- February to March 2020 (Autumn)
- November 2020 (Spring)
- October 2021 (Spring)
- February 2022 (Summer).

Vantage point surveys were not undertaken during the July 2019 (Winter) survey. Bird and bat data collected during this survey was limited to the use of bat call detectors and incidental observations (recording flight data). The vantage point methodology as described in **Section 2.2.2** and **Section 2.2.3** was undertaken during the remaining four surveys.

A summary of the survey effort and timing of surveys has been outlined in **Appendix B**.

2.2.2 Bird Utilisation Survey

2.2.2.1 Vantage Point Surveys

Sixteen vantage survey points were selected on the ridgelines and peaks of the Study Area based on the degree of visibility of surrounding areas. The vantage survey points were configured such that representativeness and coverage of the Study Area was maximised. Four control sites (North 1, North 2, North 3 and North 4) were selected outside of the Study Area to inform the before-after control-impact (BACI) model. A further 12 vantage point locations were selected throughout the Study Area. The position of each vantage survey point is depicted in **Figure 2.1**. Photographs taken from each vantage survey point are presented in **Appendix A**.

Vantage point surveys were conducted to assess site utilisation and flight behaviour of bird species in the Study Area. Each site was surveyed for one hour during three sampling windows per day to minimise sampling bias. On each field trip, vantage points were surveyed twice during each sampling window such that individual surveys were undertaken on six occasions at each vantage point. The sampling windows are outlined below and tables detailing survey effort at each vantage point are presented in **Appendix B**.

- Morning (between 6.00 am and 10.00 am).
- Midday (between 10.00 am and 2.00 pm).
- Afternoon (between 2.00 pm and 6.00 pm).

During each vantage point survey, a single observer recorded the following information for each observation:

- Species and abundance.
- Observation type (visual or aural).
- Distance and direction from the observer (to the nearest 10 m and 10° respectively).
- Approximate height AGL of the observed bird/s (to the nearest 10 m).
- Direction of flight (to the nearest 10°).
- Flight pattern (i.e. not flying, local movement, directional flight, circling, swooping, varied, other).
- Behaviour (i.e. flight, foraging, perching, mating, aggressive interactions, hollow inspection, nesting, on station).

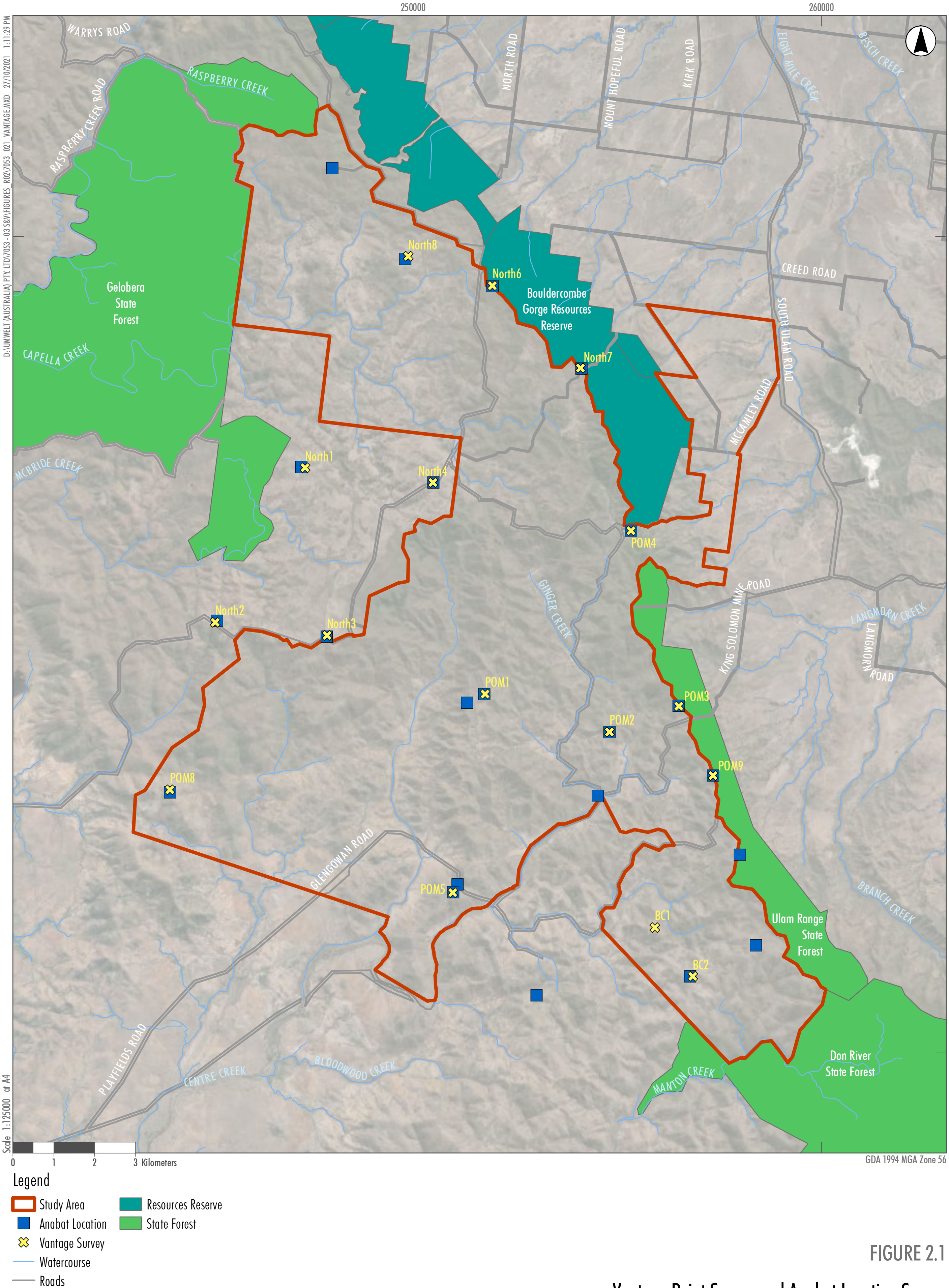


FIGURE 2.1

Vantage Point Survey and Anabat Location Survey

Image Source: ESRI Basemap (2020) Data source: QLD Government (2020)

2.2.2.2 Incidental Observations

Incidental bird observations were recorded at various locations throughout the Study Area during travel between vantage point sites. For each record the following were noted; species, location of the observation recorded, abundance, flight behaviour, flight height and flight direction. Additional incidental observations were recorded during other ecology field surveys conducted in July 2019, May to June 2020, October to November 2020, January 2021, October 2021 and October 2022. Incidental records of threatened species within 1.5 km of the Study Area buffer have been included in this assessment given the aerial nature of some species and the ability to traverse habitat across the Study Area.

2.2.3 Bat Utilisation Survey

Microchiropteran (microbat) echolocation calls were sampled using Anabat Swift recording devices at each vantage point location (**Figure 2.1**). Devices were placed approximately two metres AGL facing a cleared area or flyway and left for between two to five nights, and one Anabat Swift device was deployed at approximately 50 m AGL for three nights. Call data collected from each device was sent to Balance! Environmental for identification. Across all surveys, the total number of detector nights was 104 The number of sampling nights for each detector location is provided in **Appendix C**.

The likelihood that bat species detected in the Study Area fly at RSA height was based on literature relevant to the flight behaviour of recorded species. Where possible height information was inferred from calls detected from the elevated Anabat Swift device (approximately 50 m AGL upon met mast).

2.2.4 Field Survey Limitations

Ecologists aimed to survey all sites twice during each survey window which was largely achieved except for periods when inclement weather disrupted surveys. Vehicle incidents during February 2022 BBUS meant two vantage point could only be surveyed five times at the northern half of the Study Area and survey effort was largely concentrated within the midday and afternoon survey windows. Efforts were made to randomise the order of surveys across the whole Study Area, however the restricted access between the northern and southern halves of the Study Area meant that field surveys comprised two sampling efforts (north and south). Double counting of birds was managed by avoiding surveying the nearest vantage survey points concurrently such that observers were approximately three kilometres apart.

Ecologists were unable to determine exact numbers of birds present for aural observations, so for the purposes of this report and data analyses all aural observations will be assigned a count of one individual.

2.3 Likelihood of Occurrence Assessment

Given the rarity and/or potentially infrequent habitation of the Study Area by threatened or migratory species, it was necessary to complete a likelihood of occurrence assessment. The likelihood of occurrence of bird and bat species listed under the EPBC Act and/or the NC Act was determined through review of existing records, assessment of the suitability of vegetation in the Study Area for species known from the region, and observations made during field surveys. Species were assigned to one of the following categories:

- **Known to Occur:** this category includes all species recorded in the Study Area in previous datasets or during Umwelt field survey.
- **High Potential to Occur:** This category includes species previously recorded in the immediate vicinity. The Study Area contains preferred habitat resources which may support a population of the species.
- **Moderate Potential to Occur:** The species is known from the broader area (desktop search extent) and some of the preferred habitat is present within the Study Area. Aerial foragers and other migratory birds that may overfly the Study Area are also included.
- **Low Potential to Occur:** The Study Area supports some suitable habitat, often marginal. The species may disperse through the Study Area infrequently and is unlikely to depend on the habitat for survival.
- **Unlikely to Occur:** This category includes those species for which the Study Area offers limited or no potential habitat, is outside their known range and/or is lacking broader habitat requirements.

Threatened bird and bat species listed under the EPBC Act which have a Moderate or High likelihood of occurrence within the Study Area were included in the risk assessment.

2.4 Risk Assessment

2.4.1 Approach

The risk assessment considered the likelihood of species presence and conservation status of species observed or indicated to be present in the Study Area, as well as risk to observed species based on flight characteristics. Species that met any of the following criteria were included in the risk assessment:

- Bird and bat species listed as threatened and/or migratory under the EPBC Act recorded in the Study Area or deemed to have a Moderate or High likelihood of occurrence in the Study Area.
- Bird and bat species listed as threatened under the NC Act recorded in the Study Area or deemed to have a Moderate or High likelihood of occurrence in the Study Area.
- Bird species recorded flying at RSA height in the Study Area.
- bat species recorded in the Study Area that have Moderate to High potential to occur at RSA height.

2.4.2 Criteria for Estimating the Relative Risk of Blade Strike

The relative risk for assessed species was estimated using two criteria to ascribe likelihood of risk, and four criteria to ascribe consequence of risk (**Table 2.1** and **Table 2.2**). This method was employed in a recent study that aimed to develop a science-based approach to aid decision-making regarding turbine collision risk for birds and bats in Victoria (Lumsden *et al.* 2019).

Each criterion was either adopted unchanged or adjusted for the purposes of this assessment to ensure each was relevant to specific aspects of the Project, for example geographic location. For the purposes of this assessment, Criteria A, C and F were slightly altered, Criterion B was substantially altered, and the thresholds and spatial scale for Criterion E were adjusted.

Each species was ranked either low, moderate or high for each criterion depending on which was most appropriate in consideration of the assessed species' ecology and observed or predicted utilisation of the Study Area. Descriptions for each ranking are outlined in **Table 2.1** and **Table 2.2**. The approach used to assess each species against each criterion is described in **Appendix D**.

Table 2.1 **Criteria Used to Ascribe Likelihood of Risk**

A	B
Known or likely frequency of flights within RSA height	Status or frequency of occurrence in the Study Area.

Table 2.2 **Criteria Used to Ascribe Consequence of Risk**

C	D	E	F
Highly localised or concentrated population (for whole or part of lifecycle), such that siting of wind farm could have significant consequence to Queensland, national or international population	Impact on population relative to demographic capacity to replace fatalities (i.e., generalised combination of dispersal capacity of potential replacements, fecundity and generation time)	Known or estimated size of national or global population	Listed conservation status under the EPBC Act and/or the NC Act.

Each species was ranked either Low, Moderate or High for each criterion depending on which is most appropriate in consideration of the assessed species' ecology and observed or predicted utilisation of the Study Area. Descriptions for each ranking are outlined in (**Table 2.3**).

Criterion A (flight height) was assessed by identifying the frequency of flights observed between 55 m and 260 m in the Study Area and assessing this with consideration of observed and reported flight behaviour from elsewhere in Australia. Given that flight height data for bird and bat species in Australia is scant and observation data from pre-construction surveys at wind farms sites is largely unavailable, estimates of flight height require an adequate number of observations from the assessed site coupled with consideration of expert opinion on known flight behaviour for each species assessed. This Criterion is important as flight height is the primary variable through which a relative estimate of collision risk can be reached.

Criterion B (status in Study Area) was assessed by determining the status or estimating the frequency of occurrence in the Study Area. This Criterion is included as it is an essential component for estimating overall blade strike risk. Data from field surveys conducted by NGH in 2012, 2013, 2015 and 2016, and by Umwelt in 2020 were primarily used to establish the ranking for this criterion. In the absence of species observations, likelihood of occurrence was predicted based on historical and local observations, known ranges and/or presence of suitable foraging or nesting habitat.

Criterion C (geographic population concentration) was assessed by estimating the degree to which a species' population may be concentrated due to site related factors such as geographic location, habitat type, proximity to important habitat or roost locations (i.e., significant wetlands, roost caves) and how this relates to the specific landscape in which the Study Area is located. Lumsden *et al.* (2019) noted that this criterion is intended to account for situations where the degree to which a taxon is geographically concentrated may influence the risk posed by the particular location of a wind farm. Where large flocks or aggregations are involved the concentration of individuals may be for short seasonal periods but may nonetheless substantially heighten risk to a large portion of a species' total population. This is particularly important if a large proportion of a species' population passes through a localised area, such as a migratory corridor, over the course of each seasonal passage.

Criterion D (demographic resilience) was assessed through consideration of known aspects of each assessed species breeding biology and, most specifically, the nature of species' life-history traits. This criterion is included in the risk assessment as it is necessary to estimate the capacity to which a species may replace individuals lost to mortality resulting from blade strike.

Criterion E (population size) is included to account for the variation in the significance of mortality of a given number of individuals between species as a result of the large variation in assessed species' national or global populations. This, when assessed in combination with Criterion D provides a measure through which the relative vulnerability of a species to loss of individuals can be estimated.

Criterion F (listed conservation status) refers to the status of bird and bat species listed under the EPBC Act or the NC Act. In instances where a species listing differs between Acts, for example one that is listed vulnerable under the EPBC Act and endangered under the BC Act the most threatened listing category is selected for the purposes of this assessment. The order being critically endangered, endangered and vulnerable. Species listed as migratory and/or marine under the EPBC Act are not assigned a rank for this criterion.

Table 2.3 Descriptions of Each Ranking for Criterion A-F

Rank	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
	Likelihood of Risk		Consequence of Risk			
Low	Species that do not or rarely fly at RSA height	Species that rarely occur in the Study Area	Species that are widely distributed within areas of suitable habitat and the habitat itself is relatively widely dispersed	Species that form breeding territories and that have a reasonable proportion of the population as nonbreeding 'floaters' that can rapidly replace breeding territorial adults if lost; species that may or may not form breeding territories and that are short-lived and have high fecundity; species that have capacity for long range or widespread juvenile or sub-adult dispersal	Total population (i.e. whether that corresponds to the national population of Australian endemics or a migrant's global population) is estimated to number more than 20,000 individuals	Species not listed or listed as near threatened or data deficient under the EPBC Act or the NC Act
Moderate	Species which regularly fly below RSA height and occasionally fly at RSA height	Species that occasionally occur in, or occasionally move through the Study Area	Species that may be more widespread or have greater flexibility in the range of suitable habitat availability, but where a high proportion of their population is likely to be concentrated at sites where they do occur	Species with life-history characteristics that sit between the low and high descriptions here	Total population is estimated to number between 5,000 and 20,000 individuals	Species listed as vulnerable under the EPBC Act or the NC Act
High	Species in which a high proportion of flight activity is at RSA height	Species that regularly occur in, or regularly move through the Study Area	Bat species that have major aggregations at a few caves, or bird or bat species that have either very restricted distributions or those where a substantial proportion of a population may move through certain areas (i.e. migratory pathways)	Species that form breeding territories but where there is limited capacity for a lost breeding adult to be readily replaced; species that do not form breeding territories and that are long-lived and/or have low fecundity; species that may have short-distance juvenile or sub-adult dispersal capacity only	Total population is estimated to number less than 5,000 individuals	Species listed as endangered or critically endangered under the EPBC Act or the NC Act

2.4.3 Estimating Overall Risk

Estimates of overall risk for each assessed species were determined by following an approach similar to that employed by Lumsden *et al.* (2019) with the most notable exception being the difference in spatial scale for which resulting estimates of risk are intended to be relevant to (i.e. state-wide vs site-specific). Elements of the likelihood and consequence of collision were combined to form an overall qualitative risk category (Low/Moderate/High) specific to the Project for the likelihood of collision and the consequence of collision. Likelihood of collision questions (Criterion A and B) and consequence of collision questions (Criterion C to F) were combined in a generally additive process to determine whether the overall likelihood and consequence of collisions was Low, Moderate or High. The following describes how the **likelihood of collision** was determined:

- **High**: Either criteria A or B is High and neither can be Low.
- **Moderate**: All other combinations not described in High or Low.
- **Low**: Both criteria A and B are Low, or:
  - In cases where criterion A is Low because the likelihood of flight at RSA is deemed highly unlikely based on knowledge of the species' flight behaviour and/or observations from the Study Area.
  - In cases where criterion B is Low because the likelihood of occurrence is deemed very unlikely based on the distribution of the species, expert advice and / or supported by literature or records.

The following describes how the **consequence of collision** was determined:

- **High:** The majority of criteria C through F are High, or the risk associated with criterion C for localised concentration is High. It was considered that the consequences of high mortality due to wind turbine collisions for species that have a limited distribution and/or have the capacity to be highly concentrated is sufficiently large such that, if a species' risk associated with this element was High, the consequences of collision should also be set to High, irrespective of the risks of the other criteria.
- **Moderate**: The majority of criteria C through F were Moderate.
- **Low:** The majority of criteria C through F were Low.

In cases where risk achieved two of two criteria, the higher risk rating was designated, e.g., two Moderate and two High criteria would result in a High rating.

Once the overall risk levels for the likelihood and consequence of collision specific to the Project had been assigned for a species, the results were then placed into a risk matrix to determine the level of concern (**Table 2.4**). Five categories of risk were used, namely Negligible, Low, Moderate, High, and Very High, based on the combination of the scores for likelihood and consequence.

Table 2.4 Risk matrix

		Consequence of Collisions		
		Low	Moderate	High
Likelihood of Collisions	Low	Negligible	Minor	Moderate
	Moderate	Minor	Moderate	High
	High	Moderate	High	Very High

2.4.4 Collision Risk Modelling for White-throated Needletail

Collision risk modelling for white-throated needletail was assessed by Biosis Pty Ltd (Biosis) using their Deterministic Collision Risk Model (refer to Appendix B of Attachment G (Bird and Bat Adaptive Management Plan) of the Preliminary Documentation). The collision risk model accounts for the bird flight data that occurs within the heigh area occupied by wind turbines. Flight data collected during BBUS (**Section 2.2.2**) was used as an empirical sample for the model to extrapolate the number of flights that may occur over a 12-month period.

2.4.4.1 Overview of the Model

As per the collision risk modelling (Appendix B of Attachment G (Bird and Bat Adaptive Management Plan) of the Preliminary Documentation) the model categorises turbines into a static and dynamic components. The entire turbine (including the tower, nacelle and the rotor when stationary) represents the static component. The dynamic component is the volume swept by the leading edge of the rotor blades in the time it takes the species of interest to pass through the airspace in which the rotor sweeps.

Since the turbine tower below rotor swept height is always a static component and poses minimal collision risk, the model takes this into account by dividing flights into those below turbine rotor height, and those within the height zone swept by turbine rotors and allocates different risk rates to these height zones.

The risk assessment accounts for a combination of variables that are specific to the proposed wind farm and to data for birds from the site. They include the following:

- The numbers of flights of the species below rotor height, and for which just the lower portion of turbine towers may present a collision risk.
- The numbers of flights at heights within the zone swept by turbine rotors, and for which the upper portion of towers, nacelles and rotors present a collision risk.
- The numbers of bird movements-at-risk, as recorded during timed point counts, extrapolated to determine an estimated number of movements-at-risk the species makes in an entire year. Account is taken of the portion of the year that birds may be present in Australia, and they may thus be at risk. The mean area (m^2 per turbine), of tower, nacelle and stationary rotor blades of a wind generator that present a risk to birds. Thus, the mean area presented by a turbine is between the maximum (where the direction of the bird is perpendicular to the plane of the rotor sweep) and the minimum (where the direction of the bird is parallel to the plane of the rotor sweep). The mean presented area is determined from turbine specifications supplied to Biosis for the specific make and model of turbine. It represents the average area presented to an incoming flight from any direction.

- The additional area (m^2 per turbine) presented by the movement of rotors during the potential flight of a bird through a turbine. This information is determined via a calculation involving species-specific, independent parameters of flight speed and body length and supplied turbine specifications.
- The model assumes that all turbines at the site represent equal risk.
- A calculation of the average number of turbines a bird is likely to encounter in a given flight through the site. This is based on the scattered configuration of turbines in the landscape and the total number of turbines proposed for the project.

2.4.4.2 Avoidance Rate

Results are provided based on various avoidance rates for white-throated needletail. The avoidance rate is the capacity for a bird to avoid a collision, whether that occurs due to a cognitive response on the part of a bird or not. An avoidance rate of 0.95 would equate to one flight in 20 in which a bird takes no action to avoid a turbine and a 0.999 avoidance rate equates to one flight in 1000 in which it would not avoid a turbine.

It should be noted that internationally there is very little empirical evidence for the actual avoidance rate for any bird species and for this reason it is prudent to provide a range of estimates that are considered to be reasonable. The evidence that is available suggests that avoidance capacity is species-specific, and that the great majority of birds have avoidance capability that is higher than 0.98. Overseas avoidance rates of greater than 0.99 have been demonstrated to be applicable to a variety of seabirds (Cook et al. 2014).

Based on experience with a wide range of bird species, it is certain that virtually all species have high capacity to avoid collision with the static components of turbines. White-throated needletails are highly agile, aerial birds and it is not considered likely that they would collide with stationary turbines. For this reason, an avoidance rate of 0.999 has been applied to static turbine components in the modelling regardless of the different dynamic avoidance rates applied. Various avoidance rates are modelled for the dynamic turbine components because, while it is reasonable to assume that White-throated Needletails can avoid a moving rotor most of the time, the actual rate at which they can do so is not certain. For this reason, results are provided for 0.990, 0.995 and 0.999 avoidance rates for the dynamic components (moving rotor) of turbines.

2.4.4.3 Result Metrics

Bird movement data was measured by the number of flights recorded at the site. Only when a reasonable estimate can be made for the number of individuals that might occur at the site can the model incorporate that to provide results expressed as an annual estimate of the number of individuals that might collide (otherwise the results remain expressed as the simple number of flights at risk). In order to provide results in terms of an annual estimate of bird collisions, a site-population estimate for white-throated needletails has been applied for the present modelling.

The model cannot forecast the frequency of collisions around the predicted annual average, and it is important to recognise that the number of any actual collisions that might occur can be expected to vary from year to year in a distribution around the average.

All results are provided to three significant figures simply to permit differences between them to be apparent. This should not be taken to indicate a measure of precision in result values. Output values represent annual 'average' results and, of course actual bird fatalities will always be measured in numbers of individuals and that may vary from year-to-year in a distribution around the mean.

3.0 Results

3.1 Desktop Assessment

Review of database searches identified 30 threatened and/or migratory bird species and 4 threatened bat species that have the potential to occur within the Study Area. These results were combined with field observations to develop the Likelihood of Occurrence Assessment (**Section 3.3**) and Risk Assessment (**Section 3.4**).

3.2 Field Survey

3.2.1 Site Conditions

Weather conditions recorded at the nearest weather station (Rockhampton Aero (039083)) during the surveys are presented in **Appendix E**.

3.2.2 Bird Utilisation Survey

3.2.2.1 Species Diversity

A total of 137 bird species were recorded within the Study Area during the BBUS field program. A further 18 bird species have been recorded within the Study Area during other Project associated fauna surveys. A list of all species recorded at each location is presented in **Appendix F**.

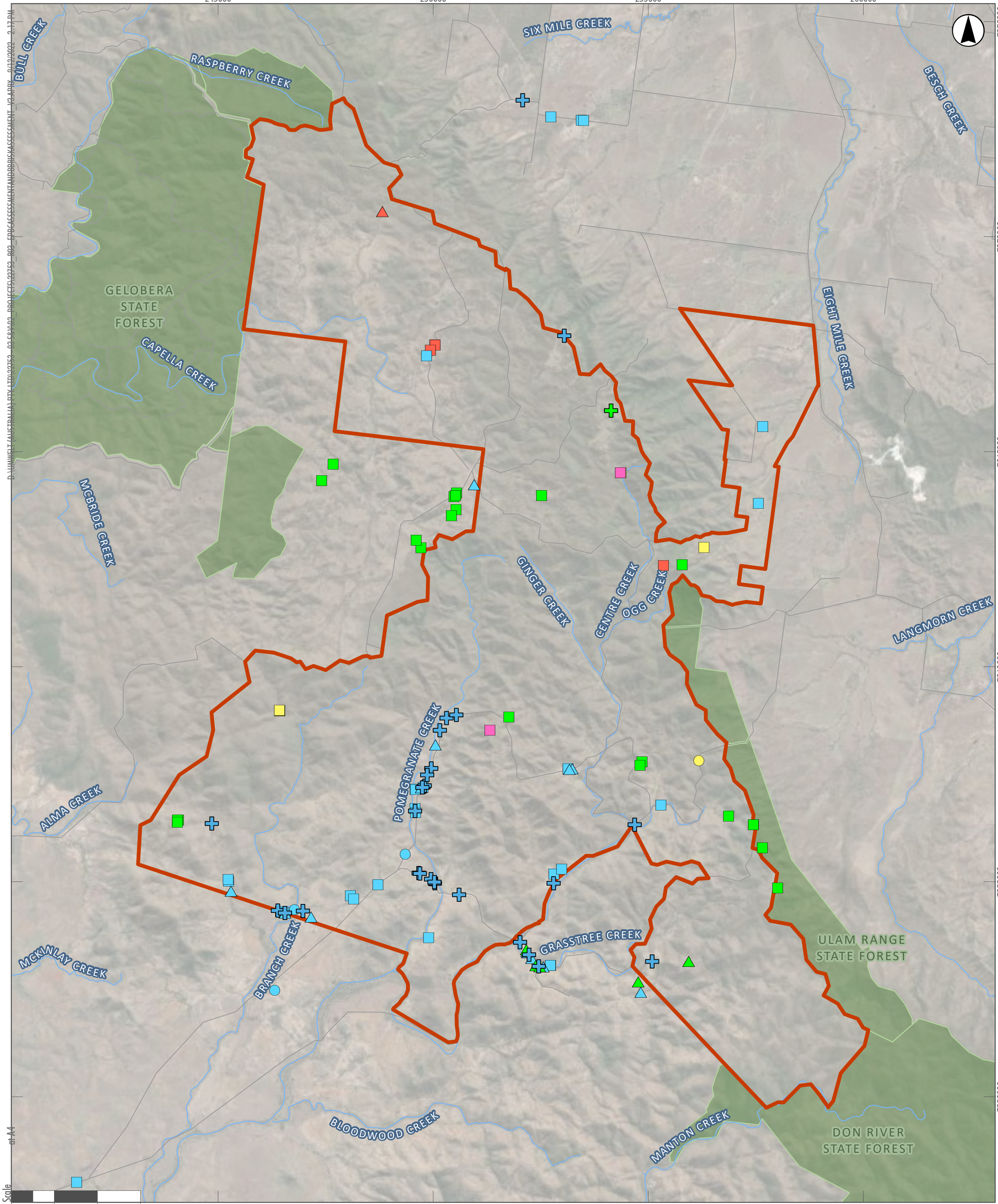
Of the bird and bat species identified within the Study Area, five are listed as threatened or migratory under the NC Act and/or the EPBC Act. These are detailed in **Table 3.1** and illustrated in **Figure 3.1**.

Table 3.1 Listed Threatened and Migratory Species Recorded During All Surveys

Common Name	Scientific Name	NC Act Listing	EPBC Act Listing
glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable	-
rufous fantail	*Rhipidura rufifrons*	Special Least Concern	Migratory
spectacled monarch	*Symposiachrus trivirgatus*	Special Least Concern	Migratory
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
white-throated needletail	*Hirundapus caudacutus*	Vulnerable	Vulnerable; Migratory

Glossy Black-cockatoo

Glossy black-cockatoo was recorded on five occasions, once during the bird utilisation survey where a flock of 22 were observed transiting south from the POM4 vantage point along the eastern ridge of the Study Area between 60 to 90 m AGL. The remaining four observations were of small flocks (two–three individuals), with one group foraging within a stand of *Allocasuarina torulosa*.



Legend

Watercourse
Roads
Study Area
State Forest

Threatened Bird Species

2019

- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- Rufous fantail (*Rhipidura rufifrons*)

2020

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- White-throated Needletail (*Hirundapus caudacutus*)
- Spectacled monarch (*Symposiachrus trivirgatus*)
- Rufous fantail (*Rhipidura rufifrons*)

2021

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- White-throated Needletail (*Hirundapus caudacutus*)

2022

- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- White-throated Needletail (*Hirundapus caudacutus*)

FIGURE 3.1

Location of Records of Bird Species Listed under the EPBC Act and/or the NC Act in the Study Area

Image Source: ESRI Basemap (2020) Data source: QLD Government (2020)

Rufous Fantail

Rufous fantail was only recorded incidentally and not during vantage point surveys, as such no flight data were recorded. Of four observations, three were made on the western edge of the Study Area, while the remaining observations occurred along the eastern boundary of the Study Area.

- One individual observed actively foraging within a narrow gully, comprising a structurally complex lower tree and shrub layer. The gully was situated adjacent to steep sloping Eucalypt woodland.
- One individual observed within vine thicket vegetation, comprising structurally complex shrub layer over ground microhabitat of fallen logs and course litter.
- Two individuals were recorded on separate occasions on steep slopes, dispersing through eucalypt woodland in close proximity to vine thicket vegetation and in areas invaded by *Lantana camara*.

On all occasions, the rufous fantail was using lower portions of habitat, occupying the ground and mid-stratum vegetation layers (i.e., below RSA).

Spectacled Monarch

Spectacled monarch was observed only twice incidentally during June 2020 in other ecological surveys, however the observations were made over 6 km apart, once in the central portion and once in the north-eastern portion of the Study Area. On both occasions the species was observed in the mid-statum vegetation layers.

Habitat suitable for foraging and dispersal was present within the Study Area and included the following:

- semi-evergreen vine thicket
- gullies in eucalypt woodlands where dense vegetation occurs.

The species utilises this region on its' migration and does not reside or breed in the region. As such habitat within the Study Area has been identified as foraging and dispersal only (i.e., below RSA).

Squatter Pigeon (Southern)

Squatter pigeon was observed on 78 occasions, throughout the field survey program, although this is likely to include multiple observations of the same individuals. It was commonly recorded along access tracks in non-remnant areas of the Study Area and was observed using a range of habitat types. All observations were made incidentally with 55.1% of observations based on one individual, however groups of up to 11 individuals were observed, often within close proximity to water sources.

Water sources suitable for the foraging of the squatter pigeon (southern) do not occur commonly within the Study Area. Stream order 1 and 2 watercourses occur extensively, however are associated with rugged and steep terrain areas generally at elevation. Farm dams identified using the Department of Resources (DoR) Reservoirs dataset were all considered suitable and are likely to be the primary resource utilised by the species due to their permanency.

On all occasions the species was observed on the ground or perched upon infrastructure (farm gates). When flushed, squatter pigeon was infrequently observed flying onto a nearby tree perch, no taller than 6 m (below RSA).

White-throated Needletail

White-throated needletail were observed on 30 occasions, 21 of which were incidental. Observations were variable in abundance and behaviour, with some individuals transiting through the airspace, however the majority of observations were of larger flocks (1 to 180) circling between 5 to 400 m AGL. White-throated needletail are further discussed in **Section 3.2.2.3**.

3.2.2.2 Species by Record and Count

Fifty-four species were recorded frequently (i.e., >10 times) throughout all field surveys, both during vantage point surveys and incidentally. **Table 3.2** outlines the 10 most recorded (visually and aurally) bird species. Pied currawong, rainbow lorikeet and Torresian crow were all recorded at every vantage point and incidentally, often observed in-flight or heard calling from a distance.

Table 3.2 Top 10 Species by Record

Rank	Common Name	Scientific Name	Total Observations
1	pied currawong	*Strepera graculina*	228
2	rainbow lorikeet	*Trichoglossus moluccanus*	161
3	Torresian crow	*Corvus orru*	161
4	white-throated honeyeater	*Melithreptus albogularis*	128
5	wedge-tailed eagle	*Aquila audax*	125
6	Australian magpie	*Gymnorhina tibicen*	109
7	noisy friarbird	*Philemon corniculatus*	108
8	laughing kookaburra	*Dacelo novaeguineae*	107
9	striated pardalote	*Pardalotus striatus*	91
10	squatter pigeon (southern)	*Geophaps scripta scripta*	78

Table 3.3 outlines the top 10 species by count, calculated using visual observations made both during vantage point surveys and incidentally. White-throated needletail was commonly observed in large flocks of up to 180, topknot pigeon was observed on only three occasions in flocks of 60 to 100, while rainbow lorikeet was observed frequently as individuals or pairs, with occasional observations of flocks (up to 39 individuals).

Table 3.3 Top 12 Species Observed Visually by Count

Rank	Common Name	Scientific Name	Total Count (Visual)
1	Torresian crow	*Corvus orru*	864
2	white-throated needletail	*Hirundapus caudacutus*	698
3	rainbow lorikeet	*Trichoglossus moluccanus*	337
4	pied currawong	*Strepera graculina*	261
5	topknot pigeon	*Lopholaimus antarcticus*	222
6	wedge-tailed eagle	*Aquila audax*	170
7	white-throated honeyeater	*Merops ornatus*	164

Rank	Common Name	Scientific Name	Total Count (Visual)
8	rainbow bee-eater	*Trichoglossus moluccanus*	163
9	noisy friarbird	*Philemon corniculatus*	160
10	squatter pigeon	*Geophaps scripta scripta*	143

3.2.2.3 At-risk Species

Twenty-four bird species were observed flying within the RSA, placing them at risk of turbine blade strike. A summary of these species and their minimum and maximum flight heights are presented in **Table 3.4**.

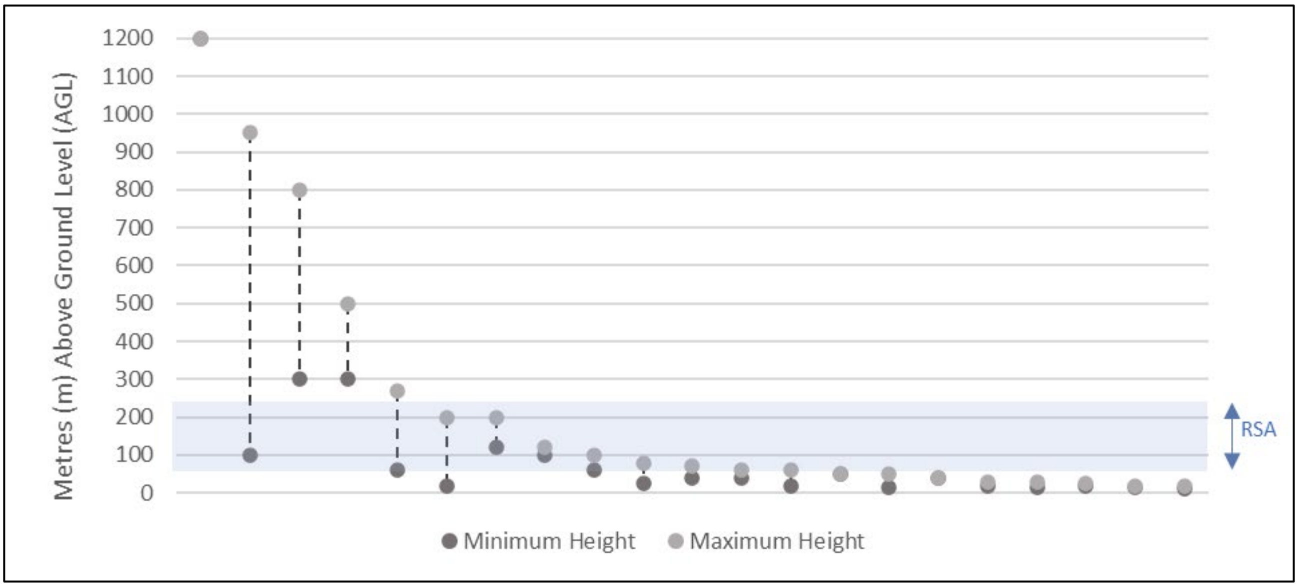
Table 3.4 At-risk Species

Common Name	Scientific Name	Observed Flight Height	
		Minimum	Maximum
Australian magpie	*Gymnorhina tibicen*	0	700
black kite	*Milvus migrans*	200	300
blue-faced honeyeater	*Entomyzon cyanotis*	10	120
brown falcon	*Falco berigora*	10	1200
brown goshawk	*Accipiter fasciatus*	14	200
channel-billed cuckoo	*Scythrops novaehollandiae*	6	1000
galah	*Eolophus roseicapilla*	80	80
glossy black-cockatoo	*Calyptorhynchus lathami*	20	90
nankeen kestrel	*Falco cenchroides*	0	300
noisy friarbird	*Philemon corniculatus*	0	80
pacific baza	*Aviceda subcristata*	10	190
peregrine falcon	*Falco peregrinus*	10	700
pied currawong	*Strepera graculina*	0	130
rainbow bee-eater	*Merops ornatus*	5	120
rainbow lorikeet	*Trichoglossus moluccanus*	1	300
red-tailed black-cockatoo	*Calyptorhynchus banksii*	20	100
scaly-breasted lorikeet	*Trichoglossus chlorolepidotus*	30	60
sulphur-crested cockatoo	*Cacatua galerita*	10	1200
topknot pigeon	*Lopholaimus antarcticus*	80	500
Torresian crow	*Corvus orru*	0	800
tree martin	*Petrochelidon nigricans*	10	250
wedge-tailed eagle	*Aquila audax*	10	1500
whistling kite	*Haliastur sphenurus*	200	300
white-throated needletail	*Hirundapus caudacutus*	1	1100

Six at-risk species are highlighted due to the frequency of observed flights within the RSA, total count, and/or their status as a listed threatened or migratory species, including brown falcon, rainbow lorikeet, sulphur-crested cockatoo, Torresian crow, wedge-tailed eagle and white-throated needletail. A summary of observations for these species are discussed below.

Brown Falcon

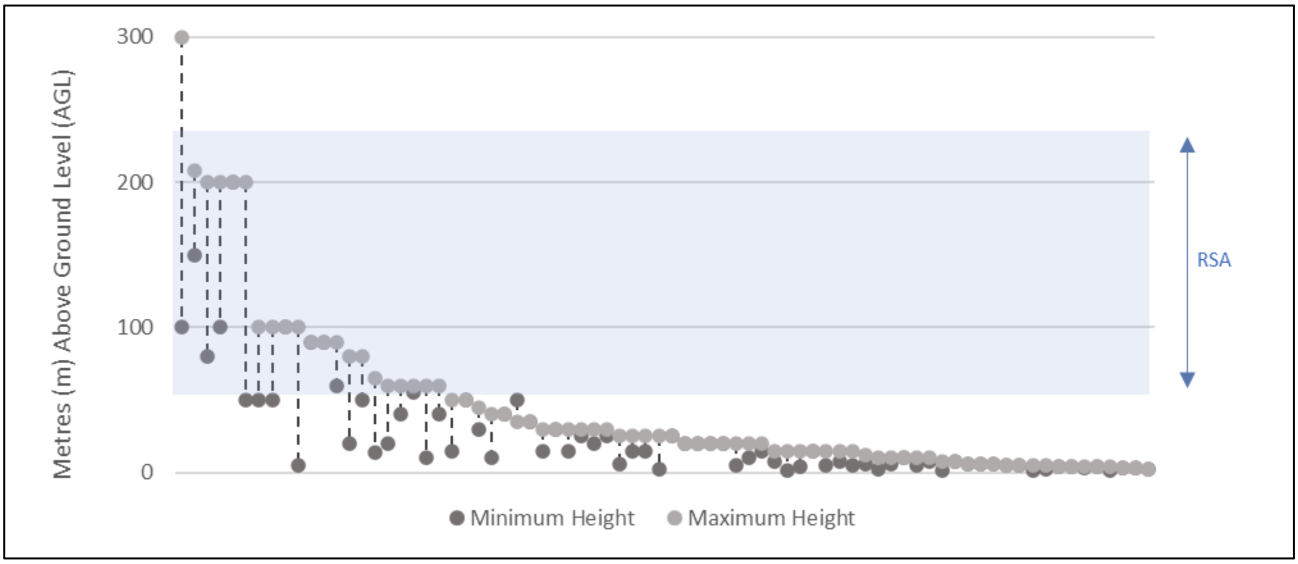
Brown falcon were recorded on 34 occasions (most commonly solitarily) of which 21 records were made across all surveys where flight data was recorded (**Graph 3.1**). 42.9% of flights observed were within the RSA.



Graph 3.1 Brown Falcon minimum and maximum heights recorded during the BBUS program

Rainbow Lorikeet

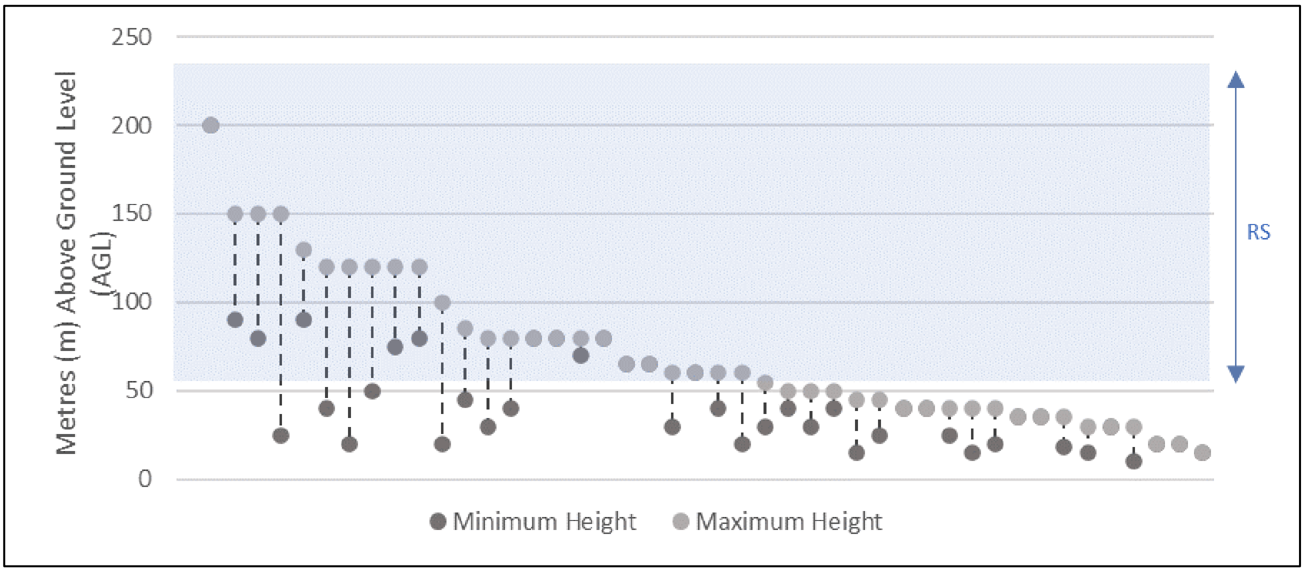
Rainbow lorikeet were recorded on 161 occasions; 76 instances during all surveys of which 47.2% were visual observation of rainbow lorikeets transiting through the Study Area airspace; 27.6% of these observed flights were within the RSA (**Graph 3.2**). Most observations were of indivuals, pairs and small flocks (up to seven lorikeets), though one flock of 39 was recorded.



Graph 3.2 Rainbow Lorikeet minimum and maximum heights recorded during the BBUS program

Sulphur-crested Cockatoo

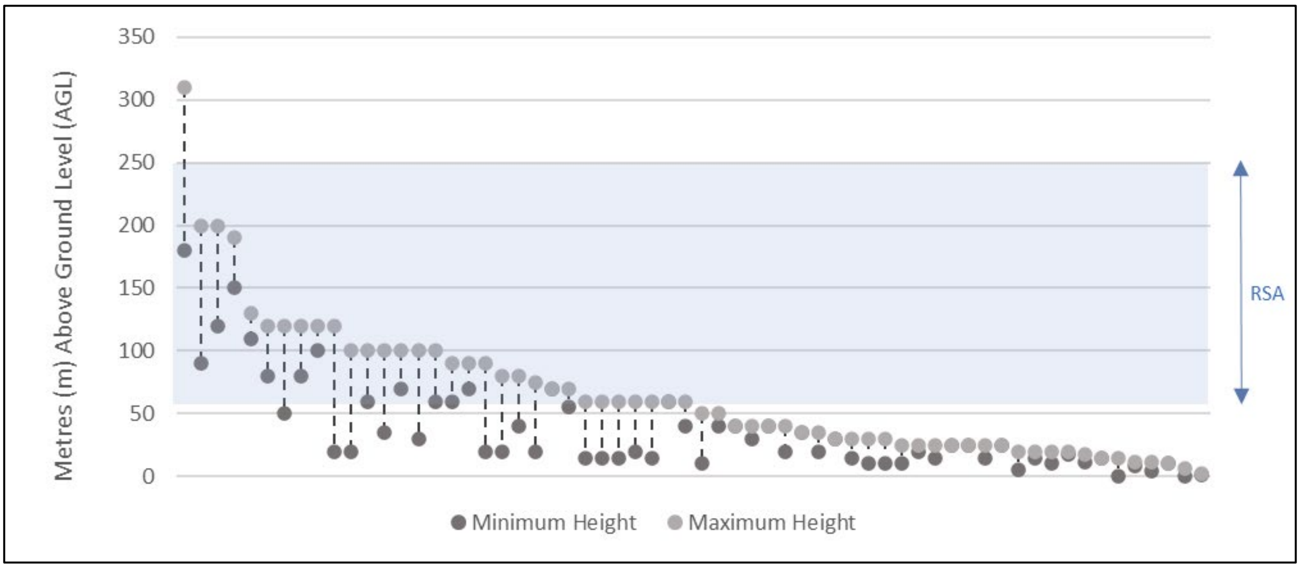
Sulphur-crested cockatoo were recorded on 78 occasions, 45 instances during all surveys of which 57.7% were visual records across all surveys where birds were observed transiting through the Study Area airspace; 55.6% of those flights were in the RSA (**Graph 3.3**). Most records were of individuals, though pairs and flocks of up to eight cockatoos were recorded. Sulphur-crested cockatoo were recorded at a height of 600 m to 1200 m, this flight height is not included in **Graph 3.3** to better display flight heights within the RSA.



Graph 3.3 Sulphur-crested cockatoo minimum and maximum heights recorded during the BBUS program

Torresian Crow

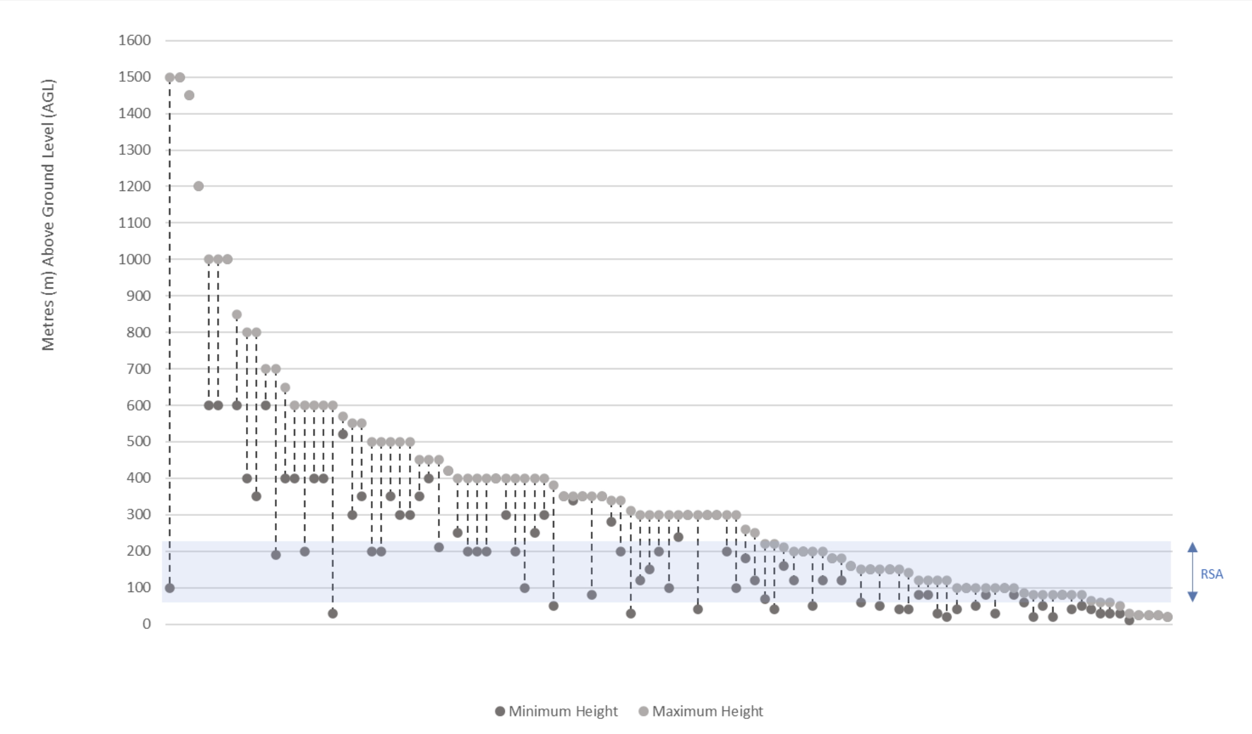
Torresian crow were observed on 161 occasions, 63 instances during all surveys of which 31.9% were visual records across all surveys where most commonly as individuals with some observations of pairs and small flocks (up to 16 individuals). 49.2% of visual observations made during all surveys were of crows transiting the Study Area air space through the RSA (**Graph 3.4**). Torresian crow were recorded at a height of 800 m, this flight height is not included in **Graph 3.4** to better display flight heights within the RSA.



Graph 3.4 Torresian crow minimum and maximum heights recorded during the BBUS program

Wedge-tailed Eagle

Wedge-tailed eagle were observed on 125 occasions across all surveys, usually solitarily or in pairs, with two observations of small flocks (three and four eagles). 64.5% of wedge-tailed eagles of observations involved birds circling through the Study Area air space, with the remaining 35.5% transiting overhead. 63% of these observations involved flight within the RSA (**Graph 3.5**).



Graph 3.5 Wedge-tailed eagle minimum and maximum heights recorded during the BBUS program

White-throated Needletail

White-throated needletail was recorded on 30 occasions flying over a diversity of habitat types, both incidentally and during BBUS. A total of 698 individuals have been recorded during surveys with a total of 324 individuals recorded at vantage points during BBUS and a total of 374 individuals recorded incidentally across all survey events. The number of individuals observed in aggregations ranged from one to 180. During the morning BBUS survey period (6 am to 10 am) a total of 413 individuals were recorded. During the midday BBUS survey period (10 am to 2 pm) a total of 236 individuals were recorded. During the afternoon BBUS survey period (2 pm to 6 pm) a total of 49 individuals were recorded.

A summary of the white-throated needletail records made throughout the field survey program is provided in **Table 3.5.**

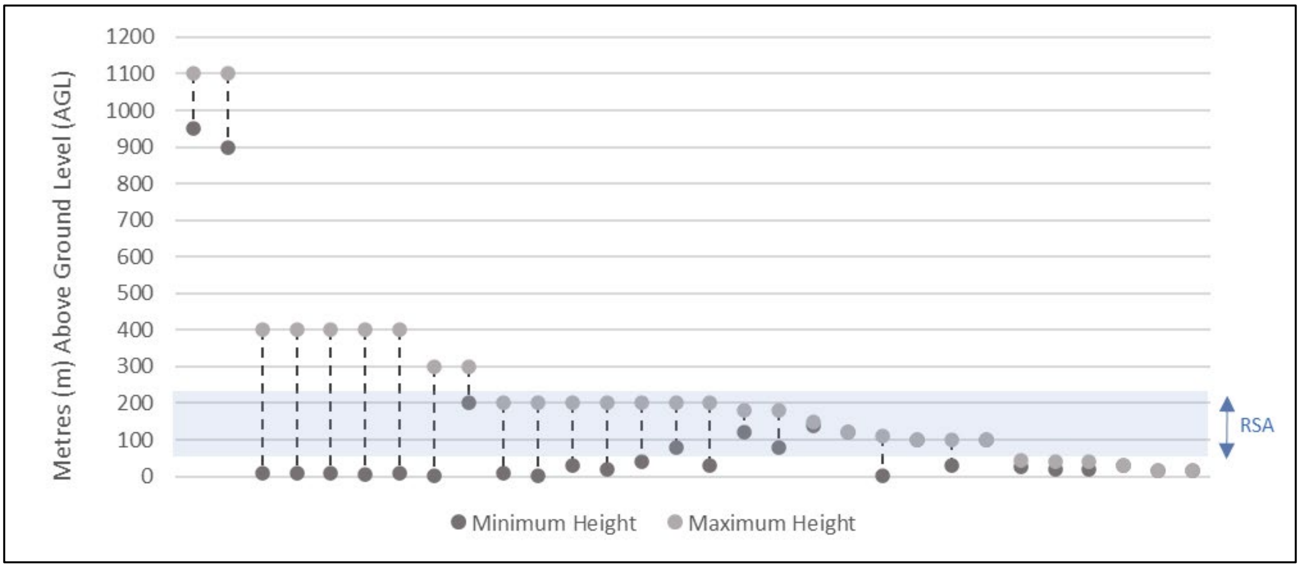
Table 3.5 White-throated Needletail Records

Date	Survey Period	Latitude (GDA94)	Longitude (GDA 94)	Count
28/02/2020	Morning (6 am–10 am)	-23.883207	150.486404	70
29/02/2020	Morning (6 am–10 am)	-23.88362202	150.4866362	29
29/02/2020	Morning (6 am–10 am)	-23.88349405	150.4865347	1
29/02/2020	Morning (6 am–10 am)	-23.827547	150.59845	6
3/03/2020	Morning (6 am–10 am)	-23.81588274	150.5512635	10
3/03/2020	Morning (6 am–10 am)	-23.816328	150.550781	25
3/03/2020	Morning (6 am–10 am)	-23.81638452	150.550749	2

Date	Survey Period	Latitude (GDA94)	Longitude (GDA 94)	Count
3/03/2020	Morning (6 am–10 am)	-23.81248477	150.5196786	1
4/03/2020	Morning (6 am–10 am)	-23.816097	150.551132	16
4/03/2020	Morning (6 am–10 am)	-23.826971	150.543045	10
4/03/2020	Morning (6 am–10 am)	-23.811903	150.519531	7
4/03/2020	Morning (6 am–10 am)	-23.816105	150.551132	1
4/03/2020	Morning (6 am–10 am)	-23.816105	150.551147	6
4/03/2020	Morning (6 am–10 am)	-23.821007	150.549469	4
12/11/2020	Midday (6 am–10 am)	-27.7006771	152.9148582	4
23/01/2021	Morning (6 am–10 am)	-23.91164328	150.5654752	180
23/01/2021	Morning (6 am–10 am)	-23.91502085	150.567564	45
29/02/2020	Midday (10 am–2 pm	-23.866512	150.6091	15
4/03/2020	Midday (10 am–2 pm	-23.886278	150.617828	25
4/03/2020	Midday (10 am–2 pm	-23.886259	150.617813	25
4/03/2020	Midday (10 am–2 pm	-23.899616	150.623108	4
4/03/2020	Midday (10 am–2 pm	-23.891569	150.618912	5
8/11/2020	Midday (10 am–2 pm	-23.8726454	150.5926574	5
23/01/2021	Midday (10 am–2 pm	-23.91468987	150.6024838	120
11/11/2020	Midday (10 am–2 pm	-23.82534656	150.5420071	10
22/1/2021	Midday (10 am–2 pm	-23.91879832	150.5908907	20
22/1/2021	Midday (10 am–2 pm	-23.9152745	150.5684851	3
14/02/2020	Afternoon (2 pm–6 pm)	-23.79161437	150.5870644	5
25/02/2020	Afternoon (2 pm–6 pm)	-23.862768	150.562439	43
8/11/2020	Afternoon (2 pm–6 pm)	-23.873354	150.5921572	1

While only nine of these records were made during the bird utilisation survey, minimum and maximum flight height was often recorded during other ecological surveys, allowing for analysis of 76.7% of all records (**Graph 3.6**). Needletails were observed transiting through and foraging in circular movements through the Study Area airspace. Approximately 50% of observations involved flocks of 10 or more individuals, with two large flocks of 120 and 180 needletails recorded during an ecological survey in January 2021. A total of 73.3% of observations involved flight within the RSA.

Records throughout a migration event generally began during spring when the species arrives in Australia and ended in autumn when the species is leaving Australia. Data has been collected across two migration events recording 310 individuals during the 2019-2020 migration and 384 individuals during the 2020–2021 migration.



Graph 3.6 White-throated needletail minimum and maximum heights

3.2.3 Bat Utilisation Survey

Call data from the anabat swift units from all bat utilisation surveys found 18 microbats to be present in the Study Area, nine of which were found during every season surveyed (**Table 3.6**). None of the microbat species identified are listed under the EPBC Act or NC Act. Total calls from each species and mixed groups are presented in **Appendix C**.

Table 3.6 Microbat species detected during all call detection nights

Common Name	Scientific Name	Jul 2019	Feb-Mar 2020	Nov 2020	Jan 2021	Feb 2022
bristle-faced free-tailed bat	*Setirostris eleryi*		X			
chocolate wattled bat	*Chalinolobus morio*	X	X	X	X	X
eastern bent-winged bat	*Miniopterus orianae*	X	X	X	X	
eastern free-tailed bat	*Ozimops ridei*	X	X	X	X	X
eastern horseshoe-bat	*Rhinolophus megaphyllus*	X	X		X	X
Gould's wattled bat	*Chalinolobus gouldii*	X	X	X	X	X
hoary wattled bat	*Chalinolobus nigrogriseus*		X	X	X	X
inland broad-nosed bat	*Scotorepens balstoni*		X			X
lesser long-eared bat or Gould's long-eared bat	*Nyctophilus sp* (*N. geoffroyi* or *N. gouldi*)		X			X
little bent-wing bat	*Miniopterus australis*	X	X	X	X	X
little broad-nosed bat	*Scotorepens greyii*	X	X	X	X	X
little pied bat	*Chalinolobus picatus*		X			X
northern broad-nosed bat	*Scotorepens sanborni*	X	X	X	X	X
northern freetail bat	*Chaerephon jobensis*	X	X	X	X	X
northern free-tailed bat	*Ozimops lumsdenae*	X	X	X	X	X
south-eastern broad-nosed bat	*Scotorepens orion*				X	X

Common Name	Scientific Name	Jul 2019	Feb-Mar 2020	Nov 2020	Jan 2021	Feb 2022
Troughton's sheathtail bat	*Taphozous troughtoni*		X			X
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	X	X		X	X

3.3 Likelihood of Occurrence

The likelihood of occurrence assessment includes the five recorded listed species, and an additional five species with a High or Moderate potential of occurring in the Study Area (**Table 3.7**).

Table 3.7 Likelihood of Occurrence

Common Name	Scientific Name	NC Act Status	EPBC Act Status
Known			
glossy black-cockatoo	*Calyptorhynchus lathami erebus*	Vulnerable	-
rufous fantail	*Rhipidura rufifrons*	Special Least Concern	Migratory
spectacled monarch	*Monarcha trivirgatus*	Special Least Concern	Migratory
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable
white-throated needletail	*Hirundapus caudacutus*	Vulnerable	Vulnerable; Migratory
High			
black-faced monarch	*Monarcha melanopsis*	Special Least Concern	Migratory
oriental cuckoo	*Cuculus optatus*	Special Least Concern	Migratory
fork-tailed swift	*Apus pacificus*	Special Least Concern	Migratory
satin flycatcher	*Myiagra cyanoleuca*	Special Least Concern	Migratory
Moderate			
Latham's snipe	*Gallinago hardwickii*	Special Least Concern	Migratory

3.4 Risk Assessment

Based on the risk rating criteria outlined in **Section 2.4.2** and **2.4.3**, 35 bird species and 21 bat species were included in the risk assessment. The risk rating for each bird and bat species considered in the risk assessment is presented in **Table 3.8**.

An additional three species have been assessed despite their low likelihood of occurrence within the Study Area including red goshawk, ghost bat and grey-headed flying fox. The inclusion of these species in the risk assessment is resultant of the Project's Request for Information (RFI) as requested by DCCEEW. These species have been addressed in **Section 3.4.1**, **Section 3.4.2** and **Section 3.4.3**.

The rationale for species ranked Very High and Moderate-High is also listed in this section, and the remaining species' risks are discussed in **Appendix D**.

Table 3.8 Risk Assessment Ratings

Common Name	Scientific Name	Likelihood	Consequence	Risk Rating
white-throated needletail	*Hirundapus caudacutus*	High	High	Very High
microbat species	microchiroptera	High	Low - Moderate	Moderate-High
red goshawk	*Erythrotriorchis radiatus*	Low	High	Moderate
ghost bat	*Macroderma gigas*	Low	High	Moderate
grey-headed flying-fox	*Pteropus poliocephalus*	Moderate	Moderate	Moderate
Australian magpie	*Gymnorhina tibicen*	High	Low	Moderate
black flying fox	*Pteropus alecto*	High	Low	Moderate
black kite	*Milvus migrans*	High	Low	Moderate
brown falcon	*Falco berigora*	High	Low	Moderate
brown goshawk	*Accipiter fasciatus*	High	Low	Moderate
channel-billed cuckoo	*Scythrops novaehollandiae*	High	Low	Moderate
collared sparrowhawk	*Accipiter cirrocephalus*	Moderate	Moderate	Moderate
glossy black-cockatoo	*Calyptorhynchus lathami*	Moderate	Moderate	Moderate
grey goshawk	*Accipiter novaehollandiae*	Moderate	Moderate	Moderate
nankeen kestrel	*Falco cenchroides*	High	Low	Moderate
noisy friarbird	*Philemon corniculatus*	High	Low	Moderate
peregrine falcon	*Falco peregrinus*	High	Low	Moderate
pacific baza	*Aviceda subcristata*	High	Low	Moderate
fork-tailed swift	*Apus pacificus*	High	Low	Moderate
pied currawong	*Strepera graculina*	High	Low	Moderate
rainbow bee-eater	*Merops ornatus*	High	Low	Moderate
squatter pigeon	*Geophaps scripta scripta*	Moderate	Moderate	Moderate
topknot pigeon	*Lopholaimus antarcticus*	High	Low	Moderate
Torresian crow	*Corvus orru*	High	Low	Moderate
tree martin	*Petrochelidon nigricans*	High	Low	Moderate
wedge-tailed eagle	*Aquila audax*	High	Low	Moderate
whistling kite	*Haliastur sphenurus*	High	Low	Moderate
black-faced monarch	*Monarcha melanopsis*	Moderate	Low	Minor
blue-faced honeyeater	*Entomyzon cyanotis*	Moderate	Low	Minor
galah	*Eolophus roseicapilla*	Moderate	Low	Minor
Latham's snipe	*Gallinago hardwickii*	Moderate	Low	Minor
oriental cuckoo	*Cuculus optatus*	Moderate	Low	Minor
rainbow lorikeet	*Trichoglossus moluccanus*	Moderate	Low	Minor
red-tailed black-cockatoo	*Calyptorhynchus banksii*	Moderate	Low	Minor
rufous fantail	*Rhipidura rufifrons*	Moderate	Low	Minor

Common Name	Scientific Name	Likelihood	Consequence	Risk Rating
satin flycatcher	*Myiagra cyanoleuca*	Moderate	Low	Minor
spectacled monarch	*Symposiachrus trivirgatus*	Moderate	Low	Minor
scaly-breasted lorikeet	*Trichoglossus chlorolepidotus*	Moderate	Low	Minor
sulphur-crested cockatoo	*Cacatua galerita*	Moderate	Low	Minor

3.4.1 Red Goshawk

3.4.1.1 Information on red goshawk from Australian wind farms

There is no publicly available information on blade strike from wind farms located within this species' Australian range. Raptors and other large birds of prey are particularly susceptible to collision risk at wind farms. The placement of wind turbines coincides with areas where raptors soar on ridge-lift (Debus 2019).

3.4.1.2 Likelihood and Consequence of Impacts

The overall risk rating for red goshawk is Moderate, based on a Low likelihood and High consequence of collisions. The rationale for responses to each criterion is as follows:

- Red goshawk was not recorded during Project associated surveys as such, it is difficult to determine whether red goshawk flight activity occurs at RSA height. One study indicated the species is capable of flying up to 150 m AGL (Hertog 1986). Another study describing behaviour of what was potentially a pair of red goshawks described the species flying approximately 25-30 m above tree height (Smith 1991). Given the lack of flight data and observations of the species during Project associated surveys it can be assumed based on the above information that a portion of red goshawk flight activity could occur at RSA height.
- Despite extensive survey through bird utilisation surveys over four seasons and diurnal bird survey throughout the field survey program, red goshawk was not recorded within the Study Area. The species is considered to be extinct in the Rockhampton region (Noske 2021).
- Red goshawk is sparsely disbursed across coastal and sub-coastal regions of northern and eastern Australia from the Kimberley Division to north-eastern New South Wales (Marchant & Higgins 1993). The species and its habitat are widely distributed.
- The life-history characteristic of red goshawk overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Marchant & Higgins 1993).
- The total red goshawk Australian population is estimated to be 900 to 1400 mature individuals (BirdLife International 2022).
- The listing status of red goshawk is Vulnerable under the EPBC Act and Endangered under the NC Act.

The red goshawk's risk rating of Moderate reflects the low likelihood of collision in the Study Area if the species were to occur and the potentially high consequence. This assessment has been made based on assumptions relevant to red goshawk flight heights and the associated risk of collision if the species were to occur within the Study Area. The likelihood of occurrence assessment has identified red goshawk as having a low likelihood of occurring within the Study Area.

Table 3.9 Red goshawk risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low		X	X			
Moderate				X		
High	X				X	X
Risk Rating						
Likelihood	Low	Consequence	High	Risk Rating	Moderate	

3.4.2 Ghost Bat

3.4.2.1 Information on ghost bat from Australian wind farms

There is no publicly available information on blade strike from the majority of wind farms located in this species' Australian range.

3.4.2.2 Likelihood and Consequence of Impacts

The overall risk rating for ghost bat is Moderate, based on a Low likelihood and High consequence of collisions. The rationale for responses to each criterion is as follows:

- Ghost bat was not recorded during Project associated surveys however, it is unlikely to regularly fly at RSA height.
- Ghost bat was not recorded during project associated surveys. Database records (ALA 2022b) indicate the species has the potential to occur within the general location of the Study Area indicating a moderate likelihood of occurrence based on an anticipated low presence within the Study Area.
- Ghost bat distribution is largely discontinuous, and species aggregate and rely on caves (Threatened Species Scientific Committee (TSSC) 2016).
- The life-history characteristic of ghost bat overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (TSSC 2016).
- The total population of ghost bat is estimated at between 4,000 and 6,000 individuals (Armstrong *et al.* 2021).
- The listing status of ghost bat is listed as Vulnerable under the EPBC Act and Endangered under the NC Act.

Ghost bat's Moderate risk rating largely reflects the high consequence of blade strike and low likelihood of collision in the Study Area is likely to have on this species overall.

Table 3.10 Ghost Bat Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X	X				
Moderate				X	X	
High			X			X
Risk Rating						
Likelihood	Low	**Consequence**	High	**Risk Rating**	**Moderate**	

3.4.3 Grey-headed Flying-Fox

3.4.3.1 Information on ghost bat from Australian wind farms

There is no publicly available information on blade strike from the majority of wind farms located in this species' Australian range.

3.4.3.2 Likelihood and Consequence of Impacts

The overall risk rating for grey-headed flying-fox is Moderate, based on a Moderate likelihood of collision and Moderate consequence of collisions. The rationale for responses to each criterion is as follows:

- Grey-headed flying-fox was not recorded during Project associated surveys. They regularly fly below RSA height and are capable of flying at RSA height.
- Grey-headed flying-fox was not recorded during project associated surveys. Database records indicate the species irregularly occurs in low numbers in the region and the nearest camps where occupation has been observed are at the maximum nightly foraging extent of the species. As such this species has been assessed as having a low likelihood of occurrence.
- Grey-headed flying-fox is nomadic and widely dispersed within areas of suitable habitat, and the habitat itself is widely dispersed.
- The life-history characteristic of grey-headed flying fox overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D.
- The total population of grey-headed flying-fox is estimated at 25,000 individuals.
- The listing status of grey-headed flying-fox is Vulnerable under the EPBC Act and the NC Act.

Table 3.11 Grey-headed Flying-fox Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low		X			X	
Moderate	X		X	X		X
High						
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	**Moderate**	

3.4.4 White-throated Needletail

3.4.4.1 Information on white-throated needletail from Australian wind farms

White-throated needletail has been assigned an overall risk rating of Very High. This species is particularly vulnerable to blade strike (Hull *et al.* 2013). Five birds have been found during post-construction mortality monitoring conducted at 15 wind farms in Victoria from 2003 to 2018 (Moloney, Lumsden & Smales 2019). There are 11 records of blade strike of white-throated needletail at both Bluff Point Wind Farm and at Studland Bay Wind Farm in north-west Tasmania (Hull *et al.* 2013). White-throated needletail are known to have collided with wind turbines in south-east New South Wales, with much of the data collected in this region being not publicly available (BCD unpublished data). Despite this, there are six records of deceased white-throated needletail at Capital Wind Farm from 2012/13 on the Atlas of Living Australia.

3.4.4.2 Likelihood and Consequence of Impacts

The overall risk rating for white-throated needletail is Very High, based on a High likelihood and High consequence of collisions. The rationale for responses to each criterion is as follows:

- A high proportion of the white-throated needletail's flight activity is at RSA height.
- White-throated needletail regularly occurs in or moves through the Study Area between October and April.
- An ecologically significant proportion of the white-throated needletail's population is likely to occur in and migrate through the Study Area each year due to the Study Area's location and position in the landscape spanning the forested eastern escarpment of the Great Dividing Range. Observations from the Study Area indicate that an internationally significant proportion of its population occurs in the Study Area annually (Department of the Environment 2015). The Study Area spans the main north – south corridor of forested mountainous habitat in the greater region and is hence likely to comprise important foraging and roosting habitat and constitute the most frequently used migratory pathway in the region. Hence, criterion C is assigned 'high'.
- The life-history characteristics of the white-throated needletail overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Higgins 1999).
- The total population for the species is estimated to be approximately 41,000 birds (Garnett and Baker 2021) and has undergone a 30 to 50% decline in recent decades (Tarburton 2014; TSSC 2019).
- White-throated needletail is listed as Vulnerable and migratory under the EPBC Act.

The white-throated needletail's risk rating of Very High reflects the high likelihood of collision in the Study Area and the potentially high consequence of such given a substantial proportion of the white-throated needletail's declining population is likely to occur in and move through the Study Area each year.

Table 3.12 White-throated Needletail Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low						
Moderate				X	X	X
High	X	X	X			
Risk Rating						
Likelihood	High	Consequence	High	Risk Rating	Very High	

3.4.4.3 Collision Risk Modelling

Species that received a Very High overall risk rating from the risk assessment in **Section 3.4** were subject to collision risk modelling to determine the actual predicted impacts to the species from the Project.

Collision risk modelling was provided by Biosis for white-throated needletail for the Mount Hopeful Wind Farm based on the BBUS data that has been collected for the Project (**Section 2.4;** Appendix B of Attachment G (Bird and Bat Adaptive Management Plan) of the Preliminary Documentation). The assessment was based on the two different turbine dimensions outlined in **Section 1.2.2**. The results are presented as the projected annual number of potential collisions and are presented in **Table 3.13**.

Table 3.13 Annual Collision Risk Model Results for White-throated Needletail

Turbine Option	Estimated Annual Number of Collisions for Three Dynamic Avoidance Rate Scenarios		
	0.990	0.995	0.999
Vestas V162	0.172	0.089	0.022
General Electric GE 164	0.166	0.083	0.017

At the time of writing this report no empirical data was available to determine the avoidance capacity of white-throated needletails at wind energy facilities. Given the agility of the species it is probable that their capacity to avoid collisions is within the range of modelled avoidance rates set out in **Table 3.13**. At a lower, conservative extreme, the results at 0.99 dynamic avoidance rate are about 0.17 collisions per annum for white-throated needletails for either of the two turbine specifications modelled. This would equate to an approximate average of one white-throated needletail collision in 5.9 years. Results for the highest avoidance rate of 0.999 (estimated annual collision of approximately 0.02) would equate to an approximate average of one white-throated needletail collision in 50 years.

Results of the collision risk modelling undertaken by Biosis (Appendix B of Attachment G of the Preliminary Documentation) indicate little difference in risk to white-throated needletails between the two turbine options. As noted above, the differences in flight heights below and within RSA as they relate to the two turbine specifications are due to a single observation of 29 birds recorded at 70 metres height. Thus, the small difference between modelled results cannot be considered to be a reliable indicator of different risks due to the different rotor heights of the two turbines.

Rather than rotor-height, the primary factor influencing the slightly different results for the two turbines is the higher rotor speed of the Vestas turbine, with an average of 12.1 revolutions per minute, compared to an average rotor speed of 9.7 revolutions per minute for the General Electric turbine. As the average flight speed of the species is held as a constant in the risk model, greater rotor speed exposes a bird interacting with a turbine to a heightened level of collision risk.

3.4.5 Non-listed Microbats

A total of 18 non-listed microbats were detected in the Study Area during bat call detection nights, with four species recorded from the Anabat Swift device placed at 50 m AGL (Gould's wattled bat, little bent-wing bat, northern freetail bat, yellow-bellied sheathtail bat), noting that calls may be detected from approximately 20 m below the device.

Of the species detected in the Study Area it is considered probable that seven species may fly above 55 to 80 m AGL, namely Gould's wattled bat, large bent-winged bat, northern freetail bat, northern free-tailed bat, eastern free-tailed bat, yellow-bellied sheathtail bat, Troughton's sheathtail bat. In the absence of data from RSA height in the Study Area a very high level of uncertainty is inherently associated with any estimate relating to whether each species rarely, occasionally or regularly flies at RSA height (a crucial component of the risk assessment method followed in this report).

Given the height of the RSA proposed to be installed in the Study Area it is unlikely that any of these species match a High rating for Criterion A, that is a species in which a high proportion of flight activity is at RSA height. Rather a Moderate rating is most accurate for the seven aforementioned species identified as being most likely to fly at RSA height. Thus, either an overall risk rating of Moderate may be most accurate for those of the aforementioned seven species that are assigned an overall Low rating for consequence and an overall risk rating of High for species assigned an overall Moderate rating for consequence.

Table 3.14 Microbat Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate	X			X	X	
High		X				
Risk Rating						
Likelihood	High	**Consequence**	Low - Moderate	**Risk Rating**	**Moderate - High**	

4.0 Potential Impacts

This section provides a high-level overview of common impacts to volant wildlife from wind turbine projects. A final BBAMP that addresses these impacts along with site-specific and regional considerations of wind farm-species interactions will be prepared prior to the operation of the wind farm.

Additionally, Appendix E of Attachment B (Assessment of Matters of National Environmental Significance) of the Preliminary Documentation includes a significant impact assessment, which considers impacts to threatened species based on the area of relevant habitat to be impacted by the Project.

4.1 Collisions

Mortality at wind farms can result from birds or bats colliding with wind turbine blades, towers, nacelles, guy cable, power lines and meteorological masts. There are a range of factors that influence risk of collisions with such infrastructure including (Drewitt & Langston 2008):

- Physical attributes of a wind turbine generator (i.e., turbine dimensions, lighting).
- Species-specific variables (i.e., abundance, flight behaviour, turbine avoidance capacity).
- Biophysical attributes (i.e., landscape position, topography, vegetation type).

Factors falling under the latter two points are often interrelated and generally highly spatially and temporally variable by nature. Proximity to roost locations, migratory flight pathways and wetlands appear to be particularly important factors that influence bird and bat utilisation. A range of other factors not necessarily related to a site's biophysical state such as weather conditions (inc. wind speed, temperature and relative humidity) can also affect utilisation and therefore collision risk (e.g., Amorim 2012).

Data from Australia, Europe and North America indicate that the risk of collision is likely to be highest in any given area or landscape where species most susceptible to collision (i.e., migratory species, raptors, swifts, waterbirds, high flying microbats) most frequently occur and lowest in areas where activity of such species is comparatively low. The consequence of mortality resulting from collision for any given species is largely influenced by the species' population size and life history traits such as longevity and fecundity which combine to determine a species' capacity to replace individuals lost.

4.2 Barotrauma

Barotrauma is a phenomenon in which rapid air pressure changes cause tissue damage to air-containing structures, most notably the lungs (Baerwald *et al.* 2009). It is thought that barotrauma can also result in non-lethal injuries, such as hearing impairments and other internal injuries that may result in bats succumbing to their injuries away from turbines (US Fish and Wildlife Service 2012).

Research conducted in North America on the relative risk of barotrauma compared with direct collisions has resulted in mixed findings regarding the proportion of deaths that have been attributed to each factor (Ellison 2012) though it appears the majority of fatalities are due to collisions (Grodsky *et al.* 2011; Rollins *et al.* 2012).Baerwald *et al.* (2009) found that barotrauma to the lungs and possibly other organs accounted for 46% of bats killed at turbines with 92% of bats having haemorrhaging in the thoracic and/or abdominal cavities. Rollins *et al.* (2012) found that only 6% (5/81) of bats collected at a wind farm in Illinois had lesions possibly consistent with barotrauma etiology leading the authors to conclude that 'traumatic injury is the major cause of bat mortality at wind farms, and, at best, barotrauma is a minor etiology'.

Due to the difficulty in diagnosing barotrauma unless the carcass is examined immediately after death, it is possible that cases attributed to barotrauma have been confused with traumatic injury associated with direct collisions.

There is currently no published information on barotrauma in Australia.

4.3 Barrier Effects

Barrier effects can be caused by wind turbines disrupting links between feeding, roosting and/or nesting areas, or diverting flights, including migratory flights, around a wind farm (Hötker, Thomsen & Köster 2006; Schuster, Bulling & Köppel 2015). Migrating species that pass wind farms frequently such as swifts appear to be of higher concern than other species (Hötker, Thomsen & Köster 2006). However, these effects on birds, possibly resulting in higher energy consumption or injuries as a result of collision, are not yet well known (Schuster, Bulling & Köppel 2015).

There is currently no published information on barrier effects from wind farms in Australia.

5.0 Management Actions

Neoen propose an adaptive management approach to turbine strike impacts, informed by seasonal surveys. This section outlines the adaptive management approach and presents mitigation measures which are considered in the Preliminary Bird and Bat Adaptive Management Plan (BBAMP) (Attachment G of the Preliminary Documentation).

5.1 Adaptive Management Plan

Neoen will undertake monitoring and management actions in accordance with the BBAMP for the Project (Attachment G of the Preliminary Documentation). The strategy of the management plan is to monitor and mitigate the potential impacts of turbine strike on birds and bats via trigger based, adaptive management. Pre and post commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan. The monitoring will inform a risk profile of each turbine to direct tailored management actions as when, and where required.

The specific objectives of the BBAMP include:

- Provide an overview of pre-commissioning survey results for the Project.
- Present the outcomes of the collision risk assessment, focussing on species which were deemed a high or very high risk of collision impacts.
- Present an overview of post-commissioning survey requirements including further bird and bat utilisation survey, as well as a carcass detection program.
- Provide proposed impact trigger thresholds for EPBC Act listed threatened and migratory species.
- Present the adaptive management framework to be initiated in the event that a trigger threshold is reached or exceeded.
- Outline ongoing and preventative mitigation and management measures, as well as reporting requirements.

5.2 Mitigation Measures

There are a range of mitigation measures employed at wind farms globally to reduce the impact of operating turbines on birds and bats. These include measures designed to deter birds and bats from turbines, measures employed to minimise the attractiveness of turbines and measures used to lure birds and bats away from turbines. Other measures include altering the operation of turbines such that the risk of birds and/or bats that do fly through a turbine's RSA may be at lower risk of impact. Despite the widespread implementation of several mitigation measures there has been relatively little empirical research conducted on the efficacy of the majority of those that have been employed (Gartman *et al.* 2016). Only a few mitigation measures specifically employed to reduce bird and bat collision risk overseas are regularly implemented in Australia and to date there has been no empirical research published on the effectiveness of mitigation measures employed here.

This section outlines the main mitigation measures that have been employed in Australia and/or overseas with a focus on cases where measures appear to be effective in reducing direct impacts, noting that the aforementioned BBAMP will provide a more detailed plan for adaptive management actions to reduce impacts.

5.2.1 Carrion Removal

Removal of carrion from near turbines is undertaken at wind farms (particularly in Australia) to mitigate the risk of carrion feeders such as raptors and other scavengers colliding with turbines. Carrion removal programs typically involve regular searches of target areas for any animal. Regular searches and removal limit the amount of time carcasses are present to attract scavengers and can be complemented by opportunistic identification by personnel undertaking unrelated work at a given wind farm.

Despite carrion removal programs being a key component of most bird and bat adaptive management plans prepared for wind farms in Australia, there is currently no publicly available information based on empirical research on their effectiveness. However, regular carrion removal is an established technique to reduce the presence of aerial scavengers employed in aviation to reduce the risk of aircraft bird strike (Australian Airports Association 2016).

5.2.2 Lighting

There is inconsistency amongst recommended use of (or avoidance of) lighting on wind turbines to specifically reduce impacts on birds and bats. This is probably partly due to variability in the way in which different species appear to respond (or not) to different lighting arrangements or configurations (i.e., according to colour, constant vs flashing etc) and the overall poor understanding of bird and bat interactions with turbines at night.

In instances where lighting is required on wind turbines it appears that the use of synchronised, flashing red lights is the best option for mitigating bird and bat collisions at night. There are evidence that steady-burning lights on communication towers increase the risk of collision for nocturnal migrants (Longcore, Rich & Gauthreaux 2008). Gehring, Kerlinger & Manville (2009) found that communication towers with red strobe, red flashing, and white strobe lights result in less mortality than towers with steady-burning lights. The use of synchronised, flashing red aviation lights on wind turbines was recommended by Kerlinger *et al.* (2010) to mitigate risk of blade strike for birds as it was found that their use does not attract birds. A study conducted by Bennett & Hale (2014) found that use of flashing red aviation lights does not appear to be one of the potential causes of bat fatalities at wind farms leading the authors to recommend red aviation lights on turbines over other options to manage impacts on bats.

There is currently no information on the influence of lighting on wind turbines on bird and bat collision risk in Australia.

5.2.3 Painting Turbines

May *et al.* (2020) demonstrated that painting one wind turbine blade black reduced the annual bird fatalities across a range of bird species by 70%, compared to a non-painted turbine. Painting a turbine blade increased rotor visibility by reducing 'motion smear', the phenomenon where fast-moving objects appear to blend together.

It is noted that painting turbine blades would conflict with standard conditions of wind farm project approval, and this measure would require additional authorisation from regulators and special consideration from all stakeholders.

5.2.4 Temporary Shutdown Periods

Employing temporary shutdown of turbines has been shown to be an effective measure for reducing fatalities of certain birds and bats (de Lucas et al. 2012; Gartman et al. 2016; Smallwood & Bell 2020). For example, de Lucas et al. (2012) investigated mortality rates for Griffon vulture (*Gyps fulvus*) at 10 out of 13 wind facilities in Spain by conducting turbine shutdown programs from 2008 to 2009 and compared rates from a non-stop program in 2006 to 2007. The researchers found that selectively stopping a few turbines during a few months of the year can significantly reduce mortality rates by more than 50% (de Lucas *et al.* 2012; Gallego *et al.* 2011). This mortality reduction was achieved through short shutdown periods between the first two hours after sunrise until the last two hours before sunset, resulting in only a negligible reduction (0.07%) in energy production (de Lucas et al. 2012). In another study, Smallwood & Bell (2020) found that employing turbine shutdown periods significantly reduced fatalities of bats but not of birds in the United States.

Temporary turbine shutdowns specifically designed to reduce the risk of strike of a threatened bird species (Tasmanian wedge-tailed eagle (*Aquila audax fleayi*)) are employed at the Cattle Hill Wind Farm in Tasmania, however the effectiveness of this measure on reducing collision risk has not been reported.

5.2.5 Altering Cut-In Speed of Turbines (Curtailment)

Increasing the cut-in speed of wind turbines (the velocity at which turbines start producing electricity) appears to be the most effective mitigation measure for reducing microbat mortality partly because bat mortality rates are generally higher during nights with low wind speeds (Kerns, Erickson & Arnett 2005; Rydell et al. 2010; Amorim, Rebelo & Rodrigues 2012). Investigations conducted in North America indicate that bat mortality can be reduced by increasing the cut-in speed with reductions from 30% to 90% being reported (Arnett et al. 2008; Baerwald et al. 2009; Arnett et al. 2010). Similarly, Wellig *et al.* (2018) found that collision risk could be drastically reduced if nocturnal operation of wind turbines would be restricted to wind speeds above 5 ms^{-1} at a site in Switzerland.

A curtailment study was undertaken at the Cape Nelson North wind farm in southwest Victoria which reported similar results to international studies showing a significant decrease in bat mortality of 54% when curtailment measures were applied to the site (Bennett *et al.* 2022). This mitigation measure appears to be most effective at locations where there is a high frequency of flights undertaken at RSA such as in migratory pathways.

6.0 Significant Impact Assessment

The potential for residual impacts on birds and bats as a result of wind turbine collisions, barotrauma and barrier effects was considered for significance against the Commonwealth Significant Impact Assessment (SIA) guidelines. Given the Project may also result in other impacts on fauna, such as habitat loss, SIAs were addressed in Attachment B of the Preliminary Documentation. A summary of this assessment, as it relates to this report are presented below.

The SIA assessment considered the potential impacts on threatened and migratory fauna, including threatened birds and bats identified as having a Moderate to Very High collision risk profile (**Section 3.4**). Disregarding habitat clearance impacts, the assessment identified no SIA to birds or bats as a result of turbine collision, barotrauma or barrier effects, noting the following reasons:

- Collision Risk Modelling:
  - Modelling for the white-throated needletail determined at a lower, conservative extreme, the results at 0.99 dynamic avoidance rate are 0.17 collisions per annum for white-throated needletails for either of the two turbine specifications modelled.
- Adaptive management:
  - The Project will be governed by a BBAMP, which identifies the operational response to bird and bat collisions in the event that mortalities are recorded and exceed trigger thresholds (the Preliminary BBAMP is provided as Attachment G of the Preliminary Documentation).
  - The BBAMP outlines a dynamic monitoring approach, with individual turbine risk profiles informing the frequency and timing of monitoring events, including carcass searches.
- Flight behaviours/infrequent visitation:
  - As documented in this report, numerous threatened and migratory species present a moderate collision due to the infrequency of flights at RSA or the infrequency of occurrence with the Study Area.
  - The predicted size of migratory bird populations, coupled with operational response measures as governed by the BBAMP reduce the likelihood of significant impacts on populations as a result of mortality from wind turbine collisions.
- Habitat availability/fauna movement corridors:
  - The Project is situated within and adjacent to a large, vegetated corridor associated with Ulam Range.
  - The Study Area does not support regionally unique habitat features (i.e., wetlands or other important foraging/roosting locations) that the Project would be otherwise restricting access to (e.g., flight barriers).
  - The Study Area does not support habitat features such as wetlands that may attract large groups of threatened or migratory water birds.
  - The Study Area does not support any known flying fox camps and is not positioned near mapped nationally important camp locations.

7.0 Conclusion

A total of 137 bird species were recorded within the Study Area during the field surveys; five of which are threatened and listed under state and/or federal legislation:

- Glossy black cockatoo.
- Rufous fantail.
- Spectacled monarch.
- Squatter pigeon (southern).
- White-throated needletail.

An additional four species were found to have a High likelihood of occurring in the Study Area, and one species with a Moderate likelihood of occurring.

The risk assessment found white-throated needletail to have a Very High risk of impact by the Project and for seven identified microbat species to have a Moderate to High-risk potential. An additional three species were included in the assessment based on the Project's RFI including red goshawk, grey-headed flying-fox and ghost bat. Despite these species Low likelihood of occurrence within the Study Area, they each received a Moderate overall risk rating. These species, along with other species with a Moderate and Minor risk potential, have been considered in the preliminary BBAMP.

In conjunction with the collision risk modelling undertaken by Biosis, the findings of this document have been used to develop the preliminary BBAMP which uses an adaptive management process to mitigate the risk of turbine strike and barotrauma on threatened and migratory bird and bat species listed under the EPBC Act. A Project BBAMP will be developed based on conditions of the Project approval which will seek to mitigate and manage Project risks on both EPBC Act and NC Act listed threatened species and non-threatened species. The preliminary BBAMP details mitigation and management procedures to be undertaken during the operational phase of the Project including:

- A carcass detection program as well as a detailed carcass persistence trial.
- A carrion removal program.
- The use of lighting and deterrents.
- Shutdown or curtailment processes based on unacceptable risks to white-throated needletail.
- Pre-clearance nest surveys for red goshawk.
- An adaptive management process based on the identification of unacceptable risks (trigger levels) to all threatened and migratory species.

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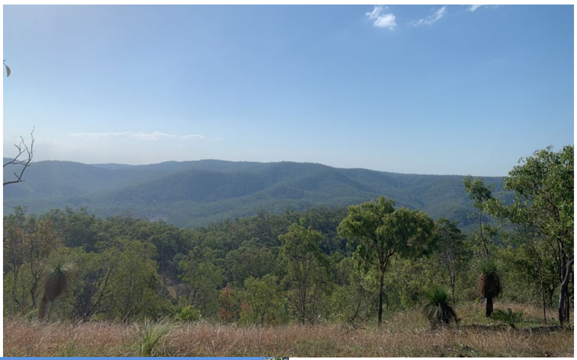
APPENDIX A

Vantage Point Photos

POM1


POM2



POM3

POM4

POM5

POM8



POM9

No photographs available

NORTH1

No photographs available

NORTH2


NORTH3

NORTH4

NORTH6


NORTH7





BC1




BC2




APPENDIX B

Survey Effort

Bird Utilisation Surveys

February – March 2020Vantage Point Survey Schedule (Autumn)

Survey Period	26 Feb	28 Feb	29 Feb	1 Mar	2 Mar	3 Mar	4 Mar
Morning **(6:00 – 10:00)**		POM2 POM3 POM9	POM3 POM5 POM8	POM3 POM4 POM9		NORTH1 NORTH4	NORTH2 NORTH3
Midday **(10:00 -14:00)**	POM9	POM4	POM1 POM8	POM2 POM3	NORTH2 NORTH3	NORTH1 NORTH4	
Afternoon **(14:00 – 18:00)**	POM2	POM3	POM1 POM5	POM4 POM9	NORTH2 NORTH3	NORTH1 NORTH4	

November 2020 Vantage Point Survey Schedule (Spring)

Survey Period	5 Nov	6 Nov	7 Nov	8 Nov	9 NOV	10 Nov	11 Nov
Morning **(6:00 – 10:00)**	NORTH1 NORTH2 NORTH6 NORTH7	POM2 POM3 POM4 POM5	POM1 POM2 POM3 POM8	POM1 POM4 POM5 POM8	NORTH3 NORTH4	NORTH1 NORTH3 NORTH4 NORTH6	NORTH2 NORTH7
Midday **(10:00 -14:00)**	NORTH1 NORTH3 NORTH4 NORTH6	POM1 POM3 POM4 POM8	POM2 POM4 POM5 POM8	POM1 POM2 POM3 POM5	NORTH2 NORTH6 NORTH7 POM1	NORTH2 NORTH3 NORTH4 NORTH7	
Afternoon **(14:00 – 18:00)**	NORTH2 NORTH3 NORTH4 NORTH7	POM1 POM3 POM4 POM5	POM1 POM3 POM4 POM5	POM2 POM3 POM8	NORTH1 NORTH3 NORTH4 NORTH6	NORTH2 NORTH6 NORTH7	

October 2021 Vantage Point Survey Schedule (Spring)

Survey Period	8 Oct	9 Oct	10 Oct	11 Oct	12 Oct	13 Oct	14 Oct	15 Oct
Morning **(6:00 – 10:00)**	NORTH7 NORTH8 NORTH6 NORTH4		NORTH6 NORTH4 NORTH7 NORTH8	POM1	POM4 POM8 POM3 POM1	POM5 POM4	BC1 BC2	POM3 POM8
Midday **(10:00 -14:00)**	NORTH4 NORTH6 NORTH8 NORTH7	NORTH7 NORTH4 NORTH6 NORHT8		POM4 POM8 POM5 POM4	POM1 POM4 POM8 POM3	POM8 POM3 POM1 POM5	BC1 BC2	
Afternoon **(14:00 – 18:00)**	NORTH6 NORTH4 NORTH7 NORTH8	NORTH8 NORTH7 NORTH4 NORTH8		POM8 POM3	POM1 POM4	POM4 POM8 POM3 POM1	BC1 BC2	

February 2022 Vantage Point Survey Schedule (Summer)

Survey Period	14 Feb	15 Feb	16 Feb	17 Feb	18 Feb	19 Feb	20 Feb	21 Feb
Morning (6:00 – 10:00)		NORTH4 NORTH6			POM4 POM8	POM1 POM3 POM4 POM5	POM1 POM3 POM5 POM8	BC1 BC2 BC1 BC2
Midday (10:00 -14:00)		NORTH4 NORTH6 NORTH7 NORTH8	NORTH4 NORTH6 NORTH7 NORTH8	NORTH4 NORTH7 NORTH8	POM1 POM3 POM4 POM5	POM3 POM4 POM5 POM8	POM1 POM3 POM4 POM8	BC1 BC2 BC1 BC2
Afternoon (14:00 – 18:00)	NORTH7 NORTH8	NORTH4 NORTH6 NORTH7 NORTH8	NORTH4 NORTH6	NORTH7	POM1 POM3 POM5 POM8	POM1 POM8	POM1 POM5	BC1 BC2

Bat Utilisation Surveys

July 2019 Survey Bat Call Detection Nights (Winter)

Site ID	Deployment Date	Retrieval Date	Total Nights
POM4	9/07/2019	11/07/2019	2
N/A (-23.8861, 150.5892)	9/07/2019	11/07/2019	2

February – March 2020 Survey Bat Call Detection Nights (Autumn)

Site ID	Deployment Date	Retrieval Date	Total Nights
North1	2/03/2020	4/03/2020	2
North2	2/03/2020	4/03/2020	2
North3	2/03/2020	4/03/2020	2
North4	2/03/2020	4/03/2020	2
POM1	25/02/2020	1/03/2020	5
POM2	25/02/2020	1/03/2020	5
POM3	29/02/2020	4/03/2020	4
POM4	26/02/2020	1/03/2020	4
POM5	26/02/2020	2/03/2020	5
POM8	1/03/2020	4/03/2020	3
POM9	26/02/2020	1/03/2020	4
Other (-23.92998, 150.57360)	26/02/2020	2/03/2020	5
Other (-23.89965, 150.62312	1/03/2020	4/03/2020	3

November 2020 Survey Bat Call Detection Nights (Spring)

Site ID	Deployment Date	Retrieval Date	Total Nights
North1	9/11/2020	11/11/2020	2
North2	9/11/2020	11/11/2020	2
North3	10/11/2020	12/11/2020	2
North4	9/11/2020	11/11/2020	2
North6	9/11/2020	11/11/2020	2
North7	9/11/2020	11/11/2020	2
Pom1	6/11/2020	7/11/2020	1
Pom2	6/11/2020	12/11/2020	6
Pom3	6/11/2020	9/11/2020	3
Pom4	6/11/2020	8/11/2020	2
Pom5	6/11/2020	8/11/2020	2
Pom8	6/11/2020	8/11/2020	2

January 2021 Survey Bat Call Detection Nights (Summer)

Site ID	Deployment Date	Retrieval Date	Total Nights
Other (-23.92635, 150.61061)	22/01/21	24/01/21	2
Other (-23.91968, 150.62659)	22/01/21	24/01/21	2

October 2021 Survey Bat Call Detection Nights (Spring)

Site ID	Deployment Date	Retrieval Date	Total Nights
North4	08/10/2021	10/10/2021	2
North6	08/10/2021	10/10/2021	2
North7	08/10/2021	10/10/2021	2
North8	08/10/2021	10/10/2021	2
POM1	11/10/2021	13/10/2021	2
POM3	11/10/2021	13/10/2021	2
POM4	11/10/2021	13/10/2021	2
POM5	11/10/2021	13/10/2021	2
POM8	11/10/2021	13/10/2021	2
Other (-23.7463,150.5279)	08/10/2021	10/10/2021	2
Other (-23.8649, 150.5582)	11/10/2021	13/10/2021	2

February 2022 Survey Bat Call Detection Nights (Summer)

Site ID	Deployment Date	Retrieval Date	Total Nights
North4	15/02/2022	17/02/2022	2
North6	15/02/2022	17/02/2022	2
North7	14/02/2022	17/02/2022	3
North8	14/02/2022	17/02/2022	3
POM1	18/02/2022	20/02/2022	2
POM3	18/02/2022	20/02/2022	2
POM4	18/02/2022	20/02/2022	2
POM5	18/02/2022	20/02/2022	2
POM8	18/02/2022	20/02/2022	2
Other (-23.8648, 150.5577)	18/02/2022	20/02/2022	2

APPENDIX C

Microbat Data

Microbat species and calls detected July 2019 (Winter)

Common Name	Scientific Name	Calls Detected
Individual Species		
eastern horseshoe-bat	*Rhinolophus megaphyllus*	188
northern freetail bat	*Chaerephon jobensis*	107
little bent-wing bat	*Miniopterus australis*	84
hoary wattled bat	*Chalinolobus nigrogriseus*	71
eastern free-tailed bat	*Ozimops ridei*	42
eastern bent-winged bat	*Miniopterus orianae*	5
northern free-tailed bat	*Ozimops lumsdenae*	4
northern broad-nosed bat	*Scotorepens sanborni*	3
chocolate wattled bat	*Chalinolobus morio*	2
Gould's wattled bat	*Chalinolobus gouldii*	2
little broad-nosed bat	*Scotorepens greyii*	1
Mixed Species Groups		
S. greyii / C. nigrogriseus		8

Microbat species and calls detected February – March 2020 (Autumn)

Common Name	Scientific Name	Calls Detected
Individual Species		
Gould's wattled bat	*Chalinolobus gouldii*	949
northern freetail bat	*Chaerephon jobensis*	844
northern free-tailed bat	*Ozimops lumsdenae*	327
northern broad-nosed bat	*Scotorepens sanborni*	298
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	264
little bent-wing bat	*Miniopterus australis*	209
eastern free-tailed bat	*Ozimops ridei*	187
large bent-winged bat	*Miniopterus orianae oceanensis*	160
chocolate wattled bat	*Chalinolobus morio*	62
long eared bat sp.	*Nyctophilus sp.*(*N. geoffroyi* or *N. gouldi*)	45
little broad-nosed bat	*Scotorepens greyii*	30
hoary wattled bat	*Chalinolobus nigrogriseus*	20
inland broad-nosed bat	*Scotorepens balstoni*	19
eastern horseshoe-bat	*Rhinolophus megaphyllus*	15
Troughton's sheathtail bat	*Taphozous troughtoni*	3
bristle-faced free-tailed bat	*Setirostris eleryi*	1

Common Name	Scientific Name	Calls Detected
Mixed Species Groups		
C. gouldii / S. balstoni / O. ridei		6051
C. jobensis / O. lumsdenae / S. flaviventris		1190
C. nigrogriseus / Scotorepens sp.		842
S. greyii / S. sanborni		653
S. greyii / S. sanborni / Chalinolobus picatus		63
M. o. oceanensis / S. sanborni		21
S. eleryi / S. greyii		6

Microbat species and calls detected November 2020 (Spring)

Common Name	Scientific Name	Calls Detected
Individual Species		
northern freetail bat	*Chaerephon jobensis*	2987
Gould's wattled bat	*Chalinolobus gouldii*	1661
eastern free-tailed bat	*Ozimops ridei*	397
northern broad-nosed bat	*Scotorepens sanborni*	382
little bent-wing bat	*Miniopterus australis*	355
little broad-nosed bat	*Scotorepens greyii*	65
hoary wattled bat	*Chalinolobus nigrogriseus*	21
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	20
eastern bent-wing bat	*Miniopterus orianae*	13
northern free-tailed bat	*Ozimops lumsdenae*	11
chocolate wattled bat	*Chalinolobus morio*	8
eastern horseshoe-bat	*Rhinolophus megaphyllus*	2
south-eastern broad-nosed bat	*Scotorepens orion*	1
Mixed Species Groups		
C. gouldii / O. ridei		1196
S. greyii / C. nigrogriseus		95
S. sanborni / C. picatus		74
S. flaviventris / C. jobensis		3

Microbat species and calls detected January 2021 (Summer)

Common Name	Scientific Name	Calls Detected
Individual Species		
Gould's wattled bat	*Chalinolobus gouldii*	80
little broad-nosed bat	*Scotorepens greyii*	63
northern freetail bat	*Chaerephon jobensis*	20
northern broad-nosed bat	*Scotorepens sanborni*	11
eastern horseshoe-bat	*Rhinolophus megaphyllus*	8
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	6
eastern free-tailed bat	*Ozimops ridei*	4
little bent-wing bat	*Miniopterus australis*	2
eastern bent-wing bat	*Miniopterus orianae*	2
northern free-tailed bat	*Ozimops lumsdenae*	1
chocolate wattled bat	*Chalinolobus morio*	1
Mixed Species Groups		
S. sanborni / C. picatus		17
C. gouldii / O. ridei		10
S. greyii / C. nigrogriseus		2

Microbat species and calls detected October 2021 (Spring)

Common Name	Scientific Name	Calls Detected
Individual Species		
Gould's wattled bat	*Chalinolobus gouldii*	1272
hoary wattled bat	*Chalinolobus nigrogriseus*	146
little broad-nosed bat	*Scotorepens greyii*	976
northern freetail bat	*Chaerephon jobensis*	365
northern broad-nosed bat	*Scotorepens sanborni*	248
eastern horseshoe-bat	*Rhinolophus megaphyllus*	4
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	164
eastern free-tailed bat	*Ozimops ridei*	4
little bent-wing bat	*Miniopterus australis*	308
eastern bent-wing bat	*Miniopterus orianae*	96
northern free-tailed bat	*Ozimops lumsdenae*	76
chocolate wattled bat	*Chalinolobus morio*	2
Mixed Species Groups		
C. gouldii / O. ridei		1882
C. nigrogriseus / S. greyii		765

Common Name	Scientific Name	Calls Detected
S. greyii / S. sanborni		123
S. sanborni / Chalinolobus picatus		11

Microbat species and calls detected February 2022 (Summer)

Common Name	Scientific Name	Calls Detected
Individual Species		
Gould's wattled bat	*Chalinolobus gouldii*	212
northern freetail bat	*Chaerephon jobensis*	380
northern free-tailed bat	*Ozimops lumsdenae*	37
northern broad-nosed bat	*Scotorepens sanborni*	39
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	46
little bent-wing bat	*Miniopterus australis*	79
eastern free-tailed bat	*Ozimops ridei*	15
chocolate wattled bat	*Chalinolobus morio*	1
long eared bat sp.	*Nyctophilus sp.*(*N. geoffroyi* or *N. gouldi*)	1
little broad-nosed bat	*Scotorepens greyii*	9
hoary wattled bat	*Chalinolobus nigrogriseus*	8
inland broad-nosed bat	*Scotorepens balstoni*	4
eastern broad-nosed bat	*Scotorepens orion*	2
eastern horseshoe-bat	*Rhinolophus megaphyllus*	4
Troughton's sheathtail bat	*Taphozous troughtoni*	1
little pied bat	*Chalinolobus picatus*	38
Mixed Species Groups		
C. gouldii / O. ridei		22
C. nigrogriseus / S. greyii		4
C. pictatus / S. sanborni		96

APPENDIX D

Risk Assessment

Risk Assessment

A total of 23 bird and eight bat species that met the criteria for inclusion in the risk assessment were assessed.

Non-listed bird and bat species (barring wedge-tailed eagle) were subject to a briefer risk assessment than species listed under the EPBC Act and/or the NC Act.

D1 Threatened Birds

D1.1 Squatter pigeon

Information on squatter pigeon from Australian wind farms

There is no publicly available literature on blade strike at wind farms in the squatter pigeon's range.

Likelihood and Consequence of Impacts

The overall risk rating for squatter pigeon is Moderate, based on Moderate likelihood and Moderate consequence of collisions. The rationale for responses to each criterion is as follows:

- As the squatter pigeon is highly unlikely to fly at RSA height in the Study Area the overall rating for the likelihood of collision is deemed Low regardless of the response to criterion B.
- The squatter pigeon is a common resident in the Study Area.
- The southern subspecies of squatter pigeon (*Geophaps scripta scripta*) is widely dispersed within areas of suitable habitat and its habitat is relatively scattered.
- The life-history characteristics of the squatter pigeon match the description for a 'low' rating for Criterion D (Higgins and Davies 1996)
- Garnett & Crowley (2000) estimated the number of mature individuals to be approximately 40,000, although this estimate was considered to be of low reliability. The total squatter pigeon population is likely to exceed 20,000 however the southern subspecies' population may number between 5,000 – 20,000 individuals. Hence, criterion E is conservatively assigned Moderate.
- The southern subspecies of squatter pigeon is listed as vulnerable under the EPBC Act and the NC Act.

Squatter pigeon's Moderate ranking reflects the species' vulnerable listing and frequency of occurrence within the Study Area, despite the Low ranking for Criteria A, C and D.

Squatter Pigeon Risk Assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X		X	X		
Moderate					X	X
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	**Moderate**	

D1.2 Glossy black-cockatoo

Information on glossy black-cockatoo from Australian wind farms

There are no publicly available information on blade strike from wind farms in the glossy black-cockatoo's range.

Likelihood and Consequence of Impacts

The overall risk rating for glossy black-cockatoo is Moderate, based on a Moderate likelihood and Moderate consequence of collisions. The rationale for responses to each criterion is as follows:

- Glossy black-cockatoo is an uncommon resident or visitor in the Study Area.
- Glossy black-cockatoo 's habitat is widely dispersed, and individuals do not typically congregate in large numbers in particular areas.
- The life-history characteristics of the glossy black-cockatoo overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Higgins 1999).
- Garnett and Crowley (2000) estimated the total population size of glossy black-cockatoo to comprise 17,140 individuals and the population occurring in the Study Area to comprise 5,000 individuals. Hence, criterion E is assigned 'moderate' based on total population size though it is noted that the population size may be less than 5,000.
- Glossy black-cockatoo is listed as vulnerable under the NC Act.

The glossy black-cockatoo's Moderate risk rating reflects the risk of collisions based on their presence in the Study Area and potential to fly at RSA height and the Moderate rating for consequence based on population size, their low reproduction rate and their status under the EPBC Act and the NC Act.

Glossy black-cockatoo risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X		X			
Moderate		X		X	X	X
High						
Risk Rating						
Likelihood	Moderate	**Consequence**	Moderate	**Risk Rating**	**Moderate**	

D2 Migratory Listed Birds

D2.1 Latham's snipe

Information on Latham's snipe from Australian wind farms

There are no records of blade strike of Latham's snipe in the available literature from Victoria (Moloney *et al.* 2019) or Tasmania (Hull *et al.* 2013). Latham's snipe was identified by Smales (2006) as being one of three of the highest priority species (in regard to collision risk) in the Gippsland region of Victoria based on risk posed by species' flight behaviour and conservations status.

Likelihood and Consequence of Impacts

The overall risk rating for Latham's snipe is Minor, based on a Moderate likelihood and Low consequence of collisions. The rationale for responses to each criterion is as follows:

- Latham's snipe regularly flies below RSA height and occasionally flies at RSA height though the height at which Latham's snipe tend to fly during migration is unknown.
- Latham's snipe is likely to be an infrequent visitor in the Study Area particularly during southward (July-September) and northward passage (February to April).
- Latham's snipe can congregate in relatively large numbers at certain wetland sites. Sites considered to support important habitat for Latham's snipe are those that regularly support at least 18 individuals (Department of the Environment 2015a). As no such sites are present in or near the Study Area, Criterion C is assigned 'low'.
- The life-history characteristics of the Latham's snipe overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Higgins and Davies 1996).
- Hansen *et al.* (2016) estimated that the total population of Latham's snipe which visits Australia is 30,000 individuals. Hence, criterion E is assigned 'low' though it is noted that recent population monitoring conducted in Hokkaido, Japan indicated a steep decline between 2018 (35,000 birds) to 2020 (20,000) (Wild Bird Society of Japan 2020).
- Latham's snipe is listed as migratory under the EPBC Act.

Latham's snipe was not recorded in the Study Area during the bird utilisation survey or incidentally during 2019/20. Latham's snipe may occasionally migrate through the Study Area during southward (July-September) or northward passage (February to April) (Higgins and Davies 1996). Dams in the Study Area comprise suitable stopover habitat though due to their limited habitat value (i.e., small size and lack of suitable vegetation cover) occurrences would be infrequent. No waterbodies in the Study Area constitute important habitat for Latham's snipe as per the important habitat guidelines for this species (Department of the Environment 2015a).

The Latham's snipe's Minor risk rating reflects the risk of blade strike of individuals migrating through the Study Area coupled with the minor consequence that the potential collision rate may have on their population.

Latham's snipe risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate	X	X		X		
High						
Risk Rating						
Likelihood	Moderate	**Consequence**	Low	**Risk Rating**	**Minor**	

D2.2 Oriental cuckoo

Information on oriental cuckoo from Australian wind farms

There is no publicly available information on blade strike at wind farms within the oriental cuckoo's range in Australia.

Likelihood and Consequence of Impacts

The overall risk rating for oriental cuckoo is Minor, based on a Moderate likelihood and Low consequence of collisions. The rationale for responses to each criterion is as follows:

- Little is known about the height range in which oriental cuckoo fly whilst migrating, though the majority of movements are likely to occur below 55 m AGL.
- Oriental cuckoo is likely to regularly occur in or move through the Study Area between November – March.
- Though oriental cuckoo does not congregate in high numbers, a large proportion of the population that migrates south of the Study Area annually is likely to migrate through a relatively restricted area along the coast and eastern escarpment of the Great Dividing Range where the majority of suitable habitat is present. Hence, Criterion C is assigned Moderate.
- The life-history characteristics of oriental cuckoo matches the description for a Low rating for-Criterion D (Higgins 1999).
- The total population size has not been quantified though it is estimated to exceed 1 million (BirdLife International 2015).
- Oriental cuckoo is listed as migratory under the EPBC Act.

Oriental cuckoo are likely to regularly occur in or move through the Study Area between November to March but may be present as early as August (Higgins 1999). Oriental cuckoo typically arrive in Qld from their breeding grounds in the Northern Hemisphere during November/December and return north during February/March (Higgins 1999).

Oriental cuckoo's Minor overall risk rating reflects the anticipated regular occurrence within the Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their very large population size, capability to replace lost individuals and non-threatened status at the state and national scale.

Oriental cuckoo risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X			X	X	X
Moderate			X			
High		X				
Risk Rating						
Likelihood	Moderate	Consequence	Low	Risk Rating	Minor	

D2.3 Fork-tailed swift

Information on fork-tailed swift from Australian wind farms

There is one record of blade strike of fork-tailed swift in the available literature from Victoria (Moloney *et al.* 2019). There is no publicly available information on blade strike from the majority of wind farms located in this species' Australian range.

Likelihood and Consequence of Impacts

The overall risk rating for fork-tailed swift is Moderate, based on a High likelihood and Low consequence of collisions. The rationale for responses to each criterion is as follows:

- A high proportion of the fork-tailed swift's flight activity is at RSA height.
- Fork-tailed swift regularly occurs in or moves through the Study Area between October to April.
- Fork-tailed swift is widely dispersed throughout Australia and although it occasionally congregates in very high numbers it may do so anywhere in its range over a vast range of landforms and vegetation types.
- The life-history characteristics of fork-tailed swift overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for Criterion D (Higgins 1999).
- The global population size has not been quantified, but the species is reported to be generally common throughout most of its breeding range (del Hoyo *et al.* 1999) and it is highly likely to exceed 20,000 individuals given national population estimates for China, Japan, Taiwan, South Korea and Russia (Birdlife Australia 2022).
- Fork-tailed swift is listed as migratory under the EPBC Act.

Fork-tailed swift are likely to regularly occur in or move through the Study Area between October to April in small to very large flocks (Higgins 1999).

Fork-tailed swift's Moderate risk rating largely reflects the relatively low consequence that blade strike in the Study Area is likely to have on this species overall.

Fork-tailed swift risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

D2.4 Rufous fantail

Information on rufous fantail from Australian wind farms

There are no records of blade strike of rufous fantail in the available literature from Victoria (Moloney *et al.* 2019) though there are only few records of rufous fantail in parts of western Victoria where post-construction monitoring has been conducted.

Likelihood and Consequence of Impacts

The overall risk rating for rufous fantail is Minor, based on a Moderate likelihood and Minor consequence of collisions. The rationale for responses to each criterion is as follows:

- Little is known about the height range in which rufous fantail fly whilst migrating though the majority of movements are likely to occur below 55 m AGL.
- Rufous fantail regularly occurs in or moves through the Study Area.
- Though the rufous fantail does not congregate in high numbers a large proportion of the population that migrates south of the Study Area annually is likely to migrate through a relatively restricted area along the coast and eastern escarpment of the Great Dividing Range where the majority of suitable habitat is present. Hence, Criterion C is assigned 'moderate'.
- The life-history characteristics of rufous fantail matches the description for a Low rating for Criterion D (Higgins et al. 2006).
- The total population of rufous fantail is estimated to exceed 20,000 individuals (Department of the Environment 2015b).
- Rufous fantail is listed as Migratory under the EPBC Act.

Rufous fantail are likely to regularly occur in or move through the Study Area. The number of birds migrating through the Study Area is likely to peak during southward passage which usually occurs in QLD from October to November (Higgins *et al.* 2006). Rufous fantail movement patterns are poorly understood in Central QLD though this species has been recorded during each month of the year in the Rockhampton region.

Rufous fantail's Minor overall risk rating reflects the anticipated regular occurrence within the Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their very large population size, capability to replace lost individuals and non-threatened status at the state and national scale.

Rufous fantail risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X			X	X	X
Moderate			X			
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Low	**Risk Rating**	**Minor**	

D2.5 Satin flycatcher

Information on satin flycatcher from Australian wind farms

There are no records of blade strike of satin flycatcher in the available literature from Victoria (Moloney *et al.* 2019) or Tasmania (Hull *et al.* 2013).

Likelihood and Consequence of Impacts

The overall risk rating for satin flycatcher is Minor, based on a Moderate likelihood and Minor consequence of collisions. The rationale for responses to each criterion is as follows:

- Little is known about the height range in which satin flycatcher fly whilst migrating, though the majority of movements are likely to occur below 55 m AGL.
- Satin flycatcher is likely to regularly occur in or move through the Study Area particularly between August to November and February to May.
- Though the satin flycatcher does not congregate in high numbers a large proportion of the population that migrates south of the Study Area annually is likely to migrate through a relatively restricted area along the coast and eastern escarpment of the Great Dividing Range where the majority of suitable habitat is present. Hence, Criterion C is assigned 'moderate'.
- The life-history characteristics of satin flycatcher matches the description for a Low rating for Criterion D (Higgins et al. 2006).
- The total population of satin flycatcher is estimated to exceed 20,000 individuals (Department of the Environment 2015b).
- Satin flycatcher is listed as migratory under the EPBC Act.

Satin flycatcher are likely to regularly occur in or move through the Study Area during their migration south through Queensland between August to November and during northward passage between February to early May (Higgins *et al.* 2006). Satin flycatcher have been recorded in the Rockhampton region during all months though the majority of records are between August to November.

Satin flycatcher's Minor overall risk rating reflects the anticipated regular occurrence within the Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale.

Satin flycatcher risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X			X	X	X
Moderate			X			
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Low	**Risk Rating**	**Minor**	

D2.6 Black-faced monarch

Information on black-faced monarch from Australian wind farms

There is no publicly available information on blade strike at wind farms within the black-faced monarch's range in Australia.

Likelihood and Consequence of Impacts

The overall risk rating for black-faced monarch is Minor, based on a Moderate likelihood and Minor consequence of collisions. The rationale for responses to each criterion is as follows:

- Little is known about the height range in which black-faced monarch fly whilst migrating though the majority of movements are likely to occur below 55 m AGL.
- The black-faced monarch is likely to regularly occur in or move through the Study Area particularly between September to November and February to April.
- Though the black-faced monarch does not congregate in high numbers a large proportion of the population that migrates south of the Study Area annually is likely to migrate through a relatively restricted area along the coast and eastern escarpment of the Great Dividing Range where the majority of suitable habitat is present. Hence, Criterion C is assigned 'moderate'.
- The life-history characteristics of the black-faced monarch matches the description for a 'low' rating for Criterion D (Higgins *et al.* 2006).
- The total population of black-faced monarch is estimated to exceed 20,000 individuals (Department of the Environment 2015b).
- Black-faced monarch is listed as migratory under the EPBC Act.

Black-faced monarch are likely to regularly occur in or move through the Study Area particularly during southward passage from September to November and northward passage between February to April (Higgins *et al.* 2006). Black -faced monarch have been recorded during all months in the Rockhampton region barring June and July. The majority of records in the region fall within migratory periods during September to October and March to April.

The black-faced monarch's Minor overall risk rating reflects the anticipated regular occurrence within the Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale.

Black-faced monarch risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X			X	X	X
Moderate			X			
High		X				
Risk Rating						
Likelihood	Moderate	Consequence	Low	Risk Rating	Minor	

D2.7 Spectacled monarch

Information on spectacled monarch from Australian wind farms

There is no publicly available information on blade strike at wind farms within the spectacled monarch's range in Australia.

Status in the Study Area

Likelihood and Consequence of Impacts

The overall risk rating for spectacled monarch is Minor, based on a Moderate likelihood and Minor consequence of collisions. The rationale for responses to each criterion is as follows:

- Little is known about the height range in which spectacled monarch fly whilst migrating though the majority of movements are likely to occur below 55 m AGL.
- Spectacled monarch is likely to regularly occur in or move through the Study Area.
- Though the spectacled monarch does not congregate in high numbers a large proportion of the population that migrates south of the Study Area annually is likely to migrate through a relatively restricted area along the coast and eastern escarpment of the Great Dividing Range where the majority of suitable habitat is present. Hence, Criterion C is assigned Moderate.
- The life-history characteristics of spectacled monarch matches the description for a Low rating for-Criterion D (Higgins et al. 2006).
- The total population of spectacled monarch is estimated to exceed 20,000 individuals (Department of the Environment 2015).
- Spectacled monarch is listed as migratory under the EPBC Act.

Spectacled monarch movement patterns are not well known though observations in eastern Australia indicate that a proportion of their population undertakes migratory movements (Higgins *et al.* 2006). Birds on southward passage are likely to pass through the Study Area during September to October and those migrating north are likely to move through the Study Area during March to April (Higgins *et al.* 2006).

Individuals that are largely sedentary or those that do not migrate further south or north than Central QLD may be present in the Study Area at any time of year. Spectacled monarch have been recorded during all months in the Rockhampton/Gladstone region.

Spectacled monarch's Minor overall risk rating reflects the anticipated regular occurrence within the Study Area, predicted low flight behaviour (below RSA) and minor rating for consequence based on their large population size, capability to replace lost individuals and non-threatened status at the state and national scale.

Spectacled monarch risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	X			X	X	X
Moderate			X			
High		X				
Risk Rating						
Likelihood	Moderate	**Consequence**	Low	**Risk Rating**	**Minor**	

D3 Non-listed Birds

Non-listed birds were included in the risk assessment due to observed flights within the RSA.

D3.1 Wedge-tailed eagle

Information on wedge-tailed eagle from Australian wind farms

The wedge-tailed eagle is commonly reported during mortality monitoring events at wind farms in Australia. Moloney *et al.* (2019) report wedge-tailed eagle as the second most frequently recorded bird species found dead during monitoring from 2003 to 2018 across 15 wind farms in Victoria, with 58 carcasses detected and equating to 10% of all birds found. Using this data, Moloney *et al.* (2019) calculated mortality estimates of 0.06 (95% CI: 0.02 – 0.41) and 0.1 (95% CI: 0 - 0.2) individuals per turbine per year at 2 Victorian wind farms.

At 2 wind farms in north-western Tasmania, 18 wedge-tailed eagle carcasses were recorded during monitoring conducted for 3 and 6 years at Bluff Point Wind Farm and Studland Bay Wind Farm respectively (Hull *et al.* 2013). This particular monitoring program modelled a mortality estimate of 1.5 and 1.1 collisions per annum at Bluff Point (37 turbines) and Studland Bay (25 turbines). A 95% turbine avoidance rate closely approximated the observed mean annual mortality rate of 1.6 and 1.1 individuals per annum at each wind farm respectively (Smales *et al.* 2013).

Wedge-tailed eagle occur at the majority of wind farms in Australia however publicly available information on blade strike is restricted to that collected from select Victoria and Tasmania wind farms discussed above.

Likelihood and Consequence of Impacts

The overall risk rating for wedge-tailed eagle is Moderate, based on a High likelihood and Low consequence of collisions. The rationale for responses to each criterion is as follows:

- A high proportion of the wedge-tailed eagle's flight activity is at RSA height.
- Wedge-tailed eagle is a common resident in the Study Area.
- Wedge-tailed eagle is largely sedentary, is widely dispersed within areas of suitable habitat and the habitat itself is widely dispersed.
- The life-history characteristics of the wedge-tailed eagle overlap with certain aspects of both the descriptions for a 'low' and 'high' rating for criterion D (Marchant and Higgins 1993).
- The total population of wedge-tailed eagle is described as very large by Birdlife International (2020) and given its very large distribution (c. 10.6 Mkm^2) its total population is very likely to exceed 20,000 individuals.
- The subspecies of wedge-tailed eagle that occurs in the Study Area is not listed as threatened under the EPBC Act or the NC Act.

Wedge-tailed eagle's Moderate risk rating largely reflects the relatively low consequence that a potentially high frequency of blade strike in the Study Area is likely to have on this species overall.

Wedge-tailed eagle risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate				X		
High	X	X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

D3.2 Other diurnal raptors

Black kite, brown falcon, brown goshawk, nankeen kestrel, pacific baza, peregrine falcon and whistling kite have been recorded flying at RSA height in the Study Area. Grey goshawk and collared sparrowhawk have been recorded in the Study Area below RSA height though each species is likely to occur at RSA height.

Other raptor species that have not been recorded in the Study Area but may occasionally move through the area such as white-bellied sea-eagle, little eagle, square-tailed kite, swamp harrier, spotted harrier, black falcon and Australian hobby are not included in this assessment though are noted to be at risk of blade strike wherever they occur given their flight behaviour.

The Moderate risk rating for these eight raptors reflects the relatively low consequence that blade strike in the Study Area is likely to have on these species overall given their large populations and secure status at State and National level. Variability between species in terms of the potential impact of a set number of collisions on local populations is likely (for example the loss of five grey goshawk would have a greater impact than the loss of five black kite on both species' respective local populations) though overall a low rating for consequence is appropriate for all eight species at the broader scale.

Diurnal raptor risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			All		All barring GG	All
Moderate	GG, CS	BG, CS, PB, PF, GG, WK		All	GG	
High	BF, BG, BK, NK, PB, PF, WK	BF, BK, NK				
Risk Rating						

BF, BG, BK PB, PF, NK, WK	**Likelihood**	High	**Consequence**	Low	**Risk Rating**	**Moderate**
CS, GG	**Likelihood**	Moderate	**Consequence**	Moderate	**Risk Rating**	**Moderate**

LEGEND: PB: Pacific baza, BK: black kite, BG: brown goshawk, GG: grey goshawk, CS: collared sparrowhawk, BF: brown falcon, PF: peregrine falcon, NK: nankeen kestrel, WK: whistling kite.

D3.3 Rainbow bee-eater

There is no publicly available information on blade strike at wind farms within the rainbow bee-eater's range in Australia.

The overall risk rank for rainbow bee-eater is Moderate, based on a Moderate likelihood and a Low consequence of collisions. The rationale for responses to each criterion is as follows:

Rainbow bee-eater risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X	X	X	X
Moderate	X					
High		X				
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

D3.4 Channel-billed Cuckoo

Channel-billed cuckoo are included in the risk assessment as they were observed flying within the RSA. The overall risk rating for channel-billed cuckoo is moderate, based on a high likelihood and low consequence collisions.

Channel-billed cuckoo risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate		X		X		
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

D3.5 Topknot pigeon

Topknot pigeon are included in the risk assessment as they were observed flying within the RSA. The overall risk rating for topknot pigeon is moderate, based on a high likelihood and low consequence of collisions.

Topknot pigeon risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate		X		X		
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

D3.6 Other Parrots

Rainbow lorikeet, red-tailed black cockatoo, galah and sulphur-crested cockatoo are common residents in the Study Area which were occasionally recorded flying at RSA height during the bird utilisation survey. Additionally, scaly-breasted lorikeet was observed flying through the RSA.

The overall risk rating for these four species is Minor, based on a Moderate likelihood and Low consequence of collisions.

Parrots risk assessment (rainbow lorikeet, galah, red-tailed black-cockatoo, scaly-breasted lorikeet and sulphur-crested cockatoo)

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate	X	X		X		
High						
Risk Rating						
Likelihood	Moderate	Consequence	Low	Risk Rating	Minor	

D3.7 Common passerines

These five common passerines were regularly recorded in the Study Area during the bird utilisation survey and are included in the risk assessment as they were observed flying at RSA height on at least one occasion.

The overall risk rating for blue-faced honeyeater is Minor, based on a Moderate likelihood and Low consequence of collisions. The overall risk rating for Australian magpie, noisy friarbird, pied currawong, Torresian crow and tree martin is Moderate, based on a High likelihood and Low consequence of collisions.

Common resident passerine risk assessment (blue-faced honeyeater, striated pardalote, pied currawong, Torresian crow, tree martin)

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low	BFH		All	All	All	All
Moderate	AM, NF, PC, TC, TM					
High		All				

Risk Rating						
BFH	Likelihood	Moderate	Consequence	Low	Risk Rating	Minor
AM, NF, PC, TC, TM	Likelihood	High	Consequence	Low	Risk Rating	Moderate

AM: Australian Magpie, BFH: blue-faced honeyeater, NF: Noisy Friarbird, PC: pied currawong, TC: Torresian Crow, TM: tree martin

D4 Bats

No bats listed under the EPBC Act and/or the NC Act were detected in the Study Area during bird and bat utilisation surveys or other Project associated surveys and none are considered likely to occur in the Study Area. An additional two species, grey-headed flying fox and ghost bat have been included in the risk assessment (**Section 3.4**) despite their Low likelihood of occurrence within the Study Area.

D4.1 Black flying-fox

Black flying-fox were recorded on two occasions in the Study Area. One was observed on 25 May 2020 flying along a creek line at a height of 25 m AGL after foraging in a fig tree. The second observation was of an individual flying at 50 m AGL on 31 May 2020.

The overall risk rating for black flying-fox is Moderate, based on a High likelihood and Low consequence of collisions.

Black flying-fox risk assessment

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion E	Criterion F
Low			X		X	X
Moderate		X		X		
High	X					
Risk Rating						
Likelihood	High	**Consequence**	Low	**Risk Rating**	**Moderate**	

D5 References

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APPENDIX E

Weather Data from Surveys

Table E.1 Weather Conditions at Rockhampton Aero Weather Station (039083) during the summer survey (BoM (a) 2021; BoM (b) 2021).

Date	Temperature (°C)		Wind Direction		Wind Speed (km/h)	
	Minimum	Maximum	9 am	3 pm	9 am	3 pm
26/2/20	24.0	32.8	ESE	E	11	11
27/2/20	24.8	33.7	N	NNE	9	15
28/2/20	23.6	33.7	SE	E	7	11
29/2/20	24.3	32.3	ESE	E	13	20
1/3/20	23.0	32.3	ESE	ESE	20	15
2/3/20	23.2	33.5	SE	E	13	15
3/3/20	23.8	32.4	SE	ENE	11	17
4/3/20	24.8	30.4	SE	ESE	19	13

Table E.2 Weather Conditions at Rockhampton Aero Weather Station (039083) during the spring survey (BoM (c) 2021).

Date	Temperature (°C)		Wind Direction		Wind Speed (km/h)	
	Minimum	Maximum	9 am	3 pm	9 am	3 pm
5/11/20	18.2	34.0	N	N	19	20
6/11/20	19.8	35.2	SSE	NNW	11	11
7/11/20	20.3	30.6	E	ENE	19	17
8/11/20	23.6	28.8	E	ENE	26	20
9/11/20	19.6	27.9	ESE	ENE	24	22
10/11/20	17.9	28.8	ESE	E	17	22
11/11/20	17.7	29.1	E	E	11	17

Table E.3 Weather Conditions at Rockhampton Aero Weather Station (039083) during the spring survey (BoM (c) 2021).

Date	Temperature (°C)		Wind Direction		Wind Speed (km/h)	
	Minimum	Maximum	9 am	3 pm	9 am	3 pm
8/10/21	17.7	32.4	NE	SE	9	13
9/10/21	19.2	30.8	E	NE	11	15
10/10/21	17.5	31.4	NNE	NNE	13	20
11/10/21	15.4	32.9	N	NNE	11	24
12/10/21	21.4	33.2	E	NNE	2	20
13/10/21	20.9	32.4	NNE	ENE	7	17
14/10/21	22.5	33.4	NNE	ENE	19	20
15/10/21	20.8	35.1	NNW	W	20	26

Table E.4 Weather Conditions at Rockhampton Aero Weather Station (039083) during the summer survey (BoM (c) 2022).

Date	Temperature (°C)		Wind Direction		Wind Speed (km/h)	
	Minimum	Maximum	9 am	3 pm	9 am	3 pm
14/02/22	20.8	31.5	ESE	E	24	26
15/02/22	21.5	31.3	ESE	ESE	26	22
16/02/22	21.7	31.2	ESE	ENE	20	19
17/02/22	22.1	32.6	E	NE	19	17
18/02/22	22.3	33.8	ESE	ENE	11	11
19/02/22	22.4	32.7	ESE	ENE	13	20
20/02/22	22.0	32.4	ESE	ENE	17	19
21/02/22	21.9	33.8	E	ENE	13	13

APPENDIX F

Species List

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
Birds																				
apostlebird	*Struthidea cinerea*	Least Concern	-												X					X
Australasian figbird	*Sphecotheres vieilloti*	Least Concern	-			X	X													X
Australasian grebe	*Tachybaptus novaehollandiae*	Least Concern	-																	X
Australasian pipit	*Anthus novaeseelandiae*	Least Concern	-	X		X	X													X
Australian brush-turkey	*Alectura lathami*	Least Concern	-											X						X
Australian bustard	*Ardeotis australis*	Least Concern	-																	X
Australian king-parrot	*Alisterus scapularis*	Least Concern	-					X			X	X	X	X						X
Australian magpie	*Gymnorhina tibicen*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Australian owlet-nightjar	*Aegotheles cristatus*	Least Concern	-																	X
Australian wood duck	*Chenonetta jubata*	Least Concern	-																	X
barking owl	*Ninox connivens*	Least Concern	-																	X
bar-shouldered dove	*Geopelia humeralis*	Least Concern	-								X			X						
black kite	*Milvus migrans*	Least Concern	-														X			X
black-chinned honeyeater	*Melithreptus gularis*	Least Concern	-																	X
black-faced cuckoo-shrike	*Coracina novaehollandiae*	Least Concern	-	X		X		X	X		X		X	X	X	X		X	X	X
black-faced woodswallow	*Artamus cinereus*	Least Concern	-																	X
blue-faced honeyeater	*Entomyzon cyanotis*	Least Concern	-				X		X		X			X	X	X			X	X
blue-winged kookaburra	*Dacelo leachii*	Least Concern	-										X		X					X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
brolga	*Antigone rubicunda*	Least Concern	-																	X
brown cuckoo-dove	*Macropygia phasianella*	Least Concern	-											X						X
brown falcon	*Falco berigora*	Least Concern	-		X		X	X	X			X			X		X		X	X
brown goshawk	*Accipiter fasciatus*	Least Concern	-									X	X							X
brown honeyeater	*Lichmera indistincta*	Least Concern	-				X		X											X
brown quail	*Coturnix ypsilophora*	Least Concern	-			X							X		X					X
brown songlark	*Cincloramphus cruralis*	Least Concern	-				X													
brown treecreeper	*Climacteris picumnus*	Least Concern	-											X						
budgerigar	*Melopsittacus undulatus*	Least Concern	-																	X
buff-rumped thornbill	*Acanthiza reguloides*	Least Concern	-																X	
bush stone-curlew	*Burhinus grallarius*	Least Concern	-																	X
cattle egret	*Bubulcus ibis*	Least Concern	-																	X
channel-billed cuckoo	*Scythrops novaehollandiae*	Least Concern	-	X	X		X		X		X		X	X	X	X				X
cicadabird	*Coracina tenuirostris*	Least Concern	-		X		X	X	X		X		X	X			X		X	X
collared sparrowhawk	*Accipiter cirrocephalus*	Least Concern	-								X				X					X
common bronzewing	*Phaps chalcoptera*	Least Concern	-											X						X
crested pigeon	*Ocyphaps lophotes*	Least Concern	-	X																X
dollarbird	*Eurystomus orientalis*	Least Concern	-	X				X						X	X					X
double-barred finch	*Taeniopygia bichenovii*	Least Concern	-												X					X
dusky woodswallow	*Artamus cyanopterus*	Least Concern	-																	X
eastern barn owl	*Tyto delicatula*	Least Concern	-																	X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																	
				NORTH							POM								BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
eastern koel	*Eudynamys orientalis*	Least Concern	-	X	X	X	X				X	X	X	X	X		X			X
eastern yellow robin	*Eopsaltria australis*	Least Concern	-																	X
emerald dove	*Chalcophaps indica*	Least Concern	-																	X
emu	*Dromaius novaehollandiae*	Least Concern	-		X															X
fairy gerygone	*Gerygone palpebrosa*	Least Concern	-																	X
fan-tailed cuckoo	*Cacomantis flabelliformis*	Least Concern	-	X			X	X	X		X		X	X	X	X	X	X	X	X
forest kingfisher	*Todiramphus macleayii*	Least Concern	-	X			X	X	X		X		X	X	X	X		X	X	X
galah	*Eolophus roseicapilla*	Least Concern	-										X		X	X				X
glossy black-cockatoo	*Calyptorhynchus lathami erebus*	Vulnerable	-											X						X
golden whistler	*Pachycephala pectoralis*	Least Concern	-																	X
green catbird	*Ailuroedus crassirostris*	Least Concern	-																	X
grey butcherbird	*Cracticus torquatus*	Least Concern	-												X					X
grey fantail	*Rhipidura albiscapa*	Least Concern	-																	X
grey goshawk	*Accipiter novaehollandiae*	Least Concern	-					X												X
grey shrike-thrush	*Colluricincla harmonica*	Least Concern	-				X		X		X		X	X						X
grey-crowned babbler	*Pomatostomus temporalis*	Least Concern	-	X																
ground cuckoo-shrike	*Coracina maxima*	Least Concern	-			X													X	
Horsfield's bronze-cuckoo	*Chalcites basalis*	Least Concern	-																	X
laughing kookaburra	*Dacelo novaeguineae*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
leaden flycatcher	*Myiagra rubecula*	Least Concern	-	X				X	X			X	X	X		X				X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
Lewin's honeyeater	*Meliphaga lewinii*	Least Concern	-				X	X	X		X	X	X	X	X		X			X
little corella	*Cacatua sanguinea*	Least Concern	-																	X
little friarbird	*Philemon citreogularis*	Least Concern	-								X									X
little lorikeet	*Glossopsitta pusilla*	Least Concern	-																	X
little shrike-thrush	*Colluricincla megarhyncha*	Least Concern	-										X	X						X
magpie-lark	*Grallina cyanoleuca*	Least Concern	-												X					X
masked lapwing	*Vanellus miles*	Least Concern	-												X					X
masked woodswallow	*Artamus personatus*	Least Concern	-																	X
mistletoebird	*Dicaeum hirundinaceum*	Least Concern	-	X	X	X	X	X	X		X	X		X	X	X		X	X	X
nankeen kestrel	*Falco cenchroides*	Least Concern	-	X		X	X				X		X		X	X		X	X	X
noisy friarbird	*Philemon corniculatus*	Least Concern	-	X	X		X				X	X	X	X	X	X	X		X	X
noisy miner	*Manorina melanocephala*	Least Concern	-	X	X	X	X				X	X	X		X	X		X	X	X
olive-backed oriole	*Oriolus sagittatus*	Least Concern	-																	X
Pacific baza	*Aviceda subcristata*	Least Concern	-				X	X												X
Pacific black duck	*Anas superciliosa*	Least Concern	-																	X
painted button-quail	*Turnix varius*	Least Concern	-		X															X
pale-headed rosella	*Platycercus adscitus*	Least Concern	-			X		X			X	X	X	X	X			X	X	X
pallid cuckoo	*Cacomantis pallidus*	Least Concern	-																	X
peaceful dove	*Geopelia striata*	Least Concern	-		X	X					X			X						X
peregrine falcon	*Falco peregrinus*	Least Concern	-								X		X	X						X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
pheasant coucal	*Centropus phasianinus*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
pied butcherbird	*Cracticus nigrogularis*	Least Concern	-	X	X	X	X	X			X		X	X	X	X	X	X	X	X
pied currawong	*Strepera graculina*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
plumed whistling-duck	*Dendrocygna eytoni*	Least Concern	-																	X
plum-headed finch	*Neochmia modesta*	Least Concern	-																	X
rainbow bee-eater	*Merops ornatus*	Least Concern	-			X			X		X		X	X	X	X		X		X
rainbow lorikeet	*Trichoglossus moluccanus*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
red-backed fairy-wren	*Malurus melanocephalus*	Least Concern	-				X	X	X				X	X	X			X	X	X
red-browed finch	*Neochmia temporalis*	Least Concern	-					X					X							X
red-capped robin	*Petroica goodenovii*	Least Concern	-																	X
red-tailed black-cockatoo	*Calyptorhynchus banksii*	Least Concern	-						X					X		X		X		X
red-winged parrot	*Aprosmictus erythropterus*	Least Concern	-													X				
restless flycatcher	*Myiagra inquieta*	Least Concern	-								X		X							
rose robin	*Petroica rosea*	Least Concern	-											X						X
rose-crowned fruit-dove	*Ptilinopus regina*	Least Concern	-																	X
rufous fantail	*Rhipidura rufifrons*	Special Least Concern	Migratory																	X
rufous songlark	*Cincloramphus mathewsi*	Least Concern	-																	X
rufous whistler	*Pachycephala rufiventris*	Least Concern	-						X		X			X						X
scaly-breasted lorikeet	*Trichoglossus chlorolepidotus*	Least Concern	-				X													X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
scarlet honeyeater	*Myzomela sanguinolenta*	Least Concern	-						X				X	X						X
silvereye	*Zosterops lateralis*	Least Concern	-					X												X
southern boobook	*Ninox boobook*	Least Concern	-																	X
spangled drongo	*Dicrurus bracteatus*	Least Concern	-			X		X	X		X	X	X	X	X	X		X		X
spectacled monarch	*Symposiachrus trivirgatus*	Special Least Concern	Migratory																	X
spotted bowerbird	*Ptilonorhynchus maculatus*	Least Concern	-																	X
spotted quail-thrush	*Cinclosoma punctatum*	Least Concern	-																	X
squatter pigeon	*Geophaps scripta scripta*	Vulnerable	Vulnerable																	X
straw-necked ibis	*Threskiornis spinicollis*	Least Concern	-																	X
striated pardalote	*Pardalotus striatus*	Least Concern	-	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
sulphur-crested cockatoo	*Cacatua galerita*	Least Concern	-	X		X	X	X			X	X	X	X	X	X				X
tawny frogmouth	*Podargus strigoides*	Least Concern	-									X				X	X			X
topknot pigeon	*Lopholaimus antarcticus*	Least Concern	-											X						X
Torresian crow	*Corvus orru*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
tree martin	*Petrochelidon nigricans*	Least Concern	-						X											X
varied sittella	*Daphoenositta chrysoptera*	Least Concern	-					X					X		X	X				X
varied triller	*Lalage leucomela*	Least Concern	-				X							X						
wedge-tailed eagle	*Aquila audax*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
weebill	*Smicrornis brevirostris*	Least Concern	-						X						X	X				
welcome swallow	*Hirundo neoxena*	Least Concern	-																	X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
whistling kite	*Haliastur sphenurus*	Least Concern	-												X		X			X
white-bellied cuckoo-shrike	*Coracina papuensis*	Least Concern	-																	X
white-breasted woodswallow	*Artamus leucorynchus*	Least Concern	-																	X
white-browed scrubwren	*Sericornis frontalis*	Least Concern	-					X						X						X
white-browed treecreeper	*Climacteris affinis*	Least Concern	-											X						
white-cheeked honeyeater	*Phylidonyris niger*	Least Concern	-								X		X		X				X	
white-eared honeyeater	*Nesoptilotis leucotis*	Least Concern	-								X		X	X	X				X	X
white-faced heron	*Egretta novaehollandiae*	Least Concern	-																	X
white-throated gerygone	*Gerygone olivacea*	Least Concern	-													X				X
white-throated honeyeater	*Melithreptus albogularis*	Least Concern	-	X	X		X	X	X		X	X	X	X	X	X		X	X	X
white-throated needletail	*Hirundapus caudacutus*	Vulnerable	Vulnerable, Migratory	X			X		X			X				X				X
white-throated nightjar	*Eurostopodus mystacalis*	Least Concern	-																	X
white-throated treecreeper	*Cormobates leucophaea*	Least Concern	-				X	X	X		X		X	X	X	X		X	X	X
white-winged chough	*Corcorax melanorhamphos*	Least Concern	-																	X
willie wagtail	*Rhipidura leucophrys*	Least Concern	-																	X
wonga pigeon	*Leucosarcia melanoleuca*	Least Concern	-											X						X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
yellow-rumped thornbill	*Acanthiza chrysorrhoa*	Least Concern	-																	X
yellow-tailed black-cockatoo	*Calyptorhynchus funereus*	Least Concern	-																	X
zebra finch	*Taeniopygia guttata*	Least Concern	-																	X
Microbats																				
bristle-faced free-tailed bat	*Mormopterus eleryi*	Least Concern	-								X	X				X				X
chocolate wattled bat	*Chalinolobus morio*	Least Concern	-		X	X			X			X	X	X	X	X	X			X
eastern bent-wing bat	*Miniopterus orianae*	Least Concern	-		X	X		X	X			X	X	X	X	X	X			X
eastern cave bat	*Vespadelus troughtoni*							X	X				X		X					
eastern free-tailed bat	*Mormopterus ridei*	Least Concern	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
eastern horseshoe-bat	*Rhinolophus megaphyllus*	Least Concern	-						X		X	X	X	X			X			X
Gould's wattled bat	*Chalinolobus gouldii*	Least Concern	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
hoary wattled bat	*Chalinolobus nigrogriseus*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X			X
inland broad-nosed bat	*Scotorepens balstoni*	Least Concern	-			X		X	X		X	X	X	X	X	X	X			X
little bent-wing bat	*Miniopterus australis*	Least Concern	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
little broad-nosed bat	*Scotorepens greyii*	Least Concern	-	X	X	X	X	X	X		X	X	X	X	X	X	X			X
little pied bat	*Chalinolobus picatus*	Least Concern	-		X			X	X		X	X	X	X	X	X	X			X
northern broad-nosed bat	*Scotorepens sanborni*	Least Concern	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
northern freetail bat	*Chaerephon jobensis*	Least Concern	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X
northern free-tailed bat	*Mormopterus lumsdenae*	Least Concern	-	X	X	X	X				X	X	X	X	X	X	X			X

Common Name	Scientific Name	NC Act Status	EPBC Act Status	Observation Location																
				NORTH							POM							BC		Incidental/ Other
				1	2	3	4	6	7	8	1	2	3	4	5	8	9	1	2	
-	*Nyctophilus sp. (N. geoffroyi* or *N. gouldi*)	Least Concern	-		X	X					X	X	X	X	X	X	X			X
south-eastern broad-nosed bat	*Scotorepens orion*	Least Concern	-					X	X		X		X		X					
southern horseshoe bat	*Rhinolophus megaphyllus megaphyllus*	Least Concern	-											X						
Troughton's sheathtail bat	*Taphozous troughtoni*	Least Concern	-									X			X					
yellow-bellied sheathtail bat	*Saccolaimus flaviventris*	Least Concern	-	X	X	X			X		X	X	X	X	X	X	X			X

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APPENDIX E

Significant Residual Impact Assessment

SIGNIFICANT RESIDUAL IMPACT ASSESSMENT

Mount Hopeful Wind Farm

FINAL

May 2023

SIGNIFICANT RESIDUAL IMPACT ASSESSMENT

Mount Hopeful Wind Farm

FINAL

Prepared by
Umwelt (Australia) Pty Ltd
on behalf of
Neoen Australia Pty Ltd

Report No. 7053/R04 Appendix F
Date: June 2021

Environmental & Social Consultants

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This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

1.0 Protected Wildlife Habitat

With regards to fauna, protected wildlife habitat prescribed in the *Environmental Offsets Regulation 2014* includes:

- An area of essential habitat on the essential habitat map for an animal that is endangered or vulnerable wildlife.
- An area of habitat (e.g. foraging, roosting, nesting or breeding habitat) for an animal that is a critically endangered, endangered, vulnerable or a special least concern animal.

With regards to the Study Area, the following Matter of State Environmental Significance (MSES) pertaining to the terrestrial fauna assessment include:

- Protected wildlife habitat (fauna).
- Connectivity.

A significant residual impact test was performed for each species, as detailed in **Section 1.1** and **Section 1.2** and for connectivity in **Section 2.0** below.

1.1 Threatened Species

1.1.1 Collared Delma (*Delma torquata*)

The collared delma is endemic to Queensland and inhabits open-forest and woodlands that are typically adjacent to rocky terrain. The species distribution extends from the western edges of Brisbane in southeast Queensland, northwest to the Blackdown Tablelands and west to the Roma region of inland Queensland (Steve K Wilson 2015). The population is heavily fragmented with records occurring at the Bunya Mountains, Blackdown Tablelands National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP Expedition NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran and the Toowoomba Range (Davidson 1993; Ryan 2006).

Potential habitat across the Ground-truthed Mapping Extent was generally found to have low levels of required microhabitat. Eucalypt woodlands associated with REs 11.3.25b and 11.3.4 generally occur adjacent to steep hillslopes with exposed rocky boulders and other microhabitat features. In select patches of these communities, ground timber and woody debris was recorded as being common to abundant across a range of sizes from less than 10 cm to greater than 30 cm. Leaf litter was also abundant in places but generally comprised a single thin layer and did not form 'mats'. Outcrops of stones consisted of sizes that were generally less than 20 cm in diameter. Rocky outcrop areas were typically associated with ephemeral creek lines and banks. Native grass cover was largely absent in these areas. Whilst some habitat features may provide micro habitat for collared delma, the absence of key ground cover species limits the suitability of the habitat overall.

The collared delma was not recorded during the field survey program but is conservatively considered to have a moderate likelihood of occurrence. Within the Study Area, collared delma may be found in alluvial eucalypt woodland where some suitable microhabitat (exposed rocky outcrops) is present (**Table 1.1** and **Figure 1.1**).

The SRI assessment for the species is presented in **Table 1.2.** In summary, an SRI was **not triggered** for this species.

Table 1.1 Potential Area of Impact to Habitat: Collared Delma

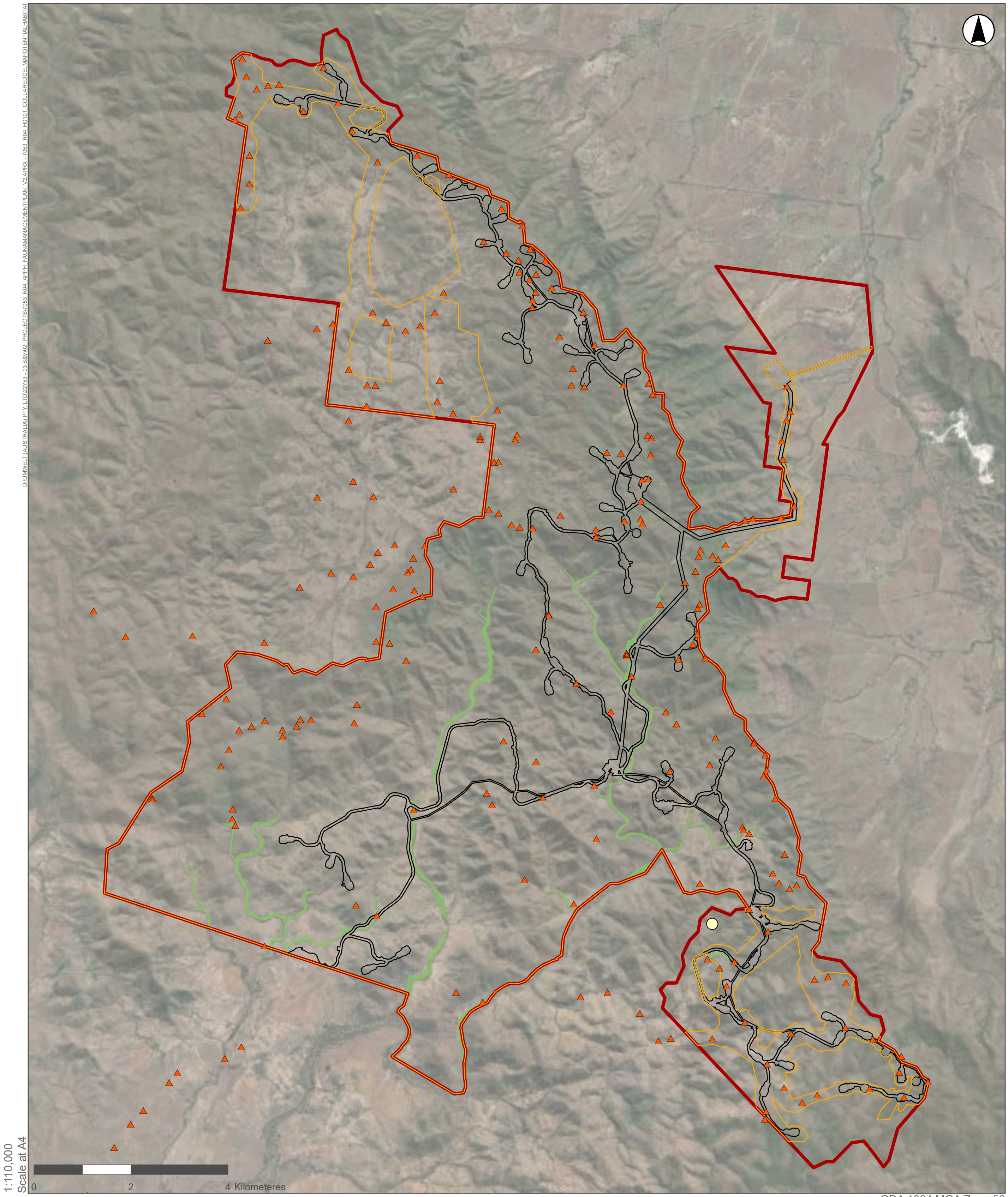
Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Breeding and Foraging	249.8	5.0
Total	**249.8**	**5.0**

Table 1.2 Significant Residual Impact Assessment: Collared Delma

Evaluation Criteria	Response
Lead to a long-term decrease in the size of local population	**No**. The species was not detected during field survey. Potentially suitable habitat is present within the Study Area although is restricted to alluvial eucalypt woodlands. Potential impacts of the Project on the species includes habitat loss and degradation. Under worst-case scenario, a maximum of 5.0 ha of potential habitat will be cleared for construction of the Project. Potential habitat is considered to be of low to moderate quality due to the presence of cattle, weeds and pests. Nonetheless, direct impacts to potential habitat will be minimised via micro-siting wherever possible including at watercourse crossings. As the species is sedentary, there is a risk of mortality during clearing works. To manage this risk, pre-clearance surveys will include targeted searches for the species in areas of potential habitat to be cleared. Although it is considered unlikely, should the species be encountered during pre-clearance surveys, work will stop and the pre-clearance survey protocol will be enacted (see **Section 6.3.4** of the body of this report). Potential indirect impacts on the species include habitat degradation via weed incursion and altered fire regimes; all of which will be actively managed via the Project management plans. For these reasons, a long-term decrease in the size of a local population of the species is unlikely to result from the Project.
Reduce the extent of occurrence of the species	**No**. The extent of occurrence of the species has not been estimated. However, the species has previously been reported to be relatively common in occupied areas. The species is known from a small number of localities across south-eastern Queensland and northern NSW, across an area that extends from Middlemount in the north to Deepwater in NSW. The Study Area does not occur near the limit of the species range nor does it occur near a known location of the species. Modelled potential habitat for the species is limited, generally of low to moderate condition and unlikely to be important for connectivity in the wider local area. Although a maximum of 5.0 ha may be cleared for construction of the Project, large areas of potential habitat will remain which should be of sufficient size to support any population that may occur.

Evaluation Criteria	Response
	Refinement of the Project's design may further reduce the area of impact from what is currently represented within the Disturbance Footprint. Impacts to modelled habitat may be further minimised and potentially avoidable as a result of the micro-siting process. Project works are therefore unlikely to lead to a material change to the availability or quality of habitat for the species to the point where the species' extent of occurrence would be reduced.
Fragment an existing population	**No**. No populations of the species are known to occur within the Study Area. Little is known about the movement patterns of the species, though it is thought to be relatively sedentary; one study by Porter (1998) found that individuals occupy a small (<20 m) home range. As populations are likely to be contained within a small geographical area, they may be susceptible to fragmentation. Although some direct impacts to potential habitat are anticipated, remaining habitat would be sufficiently connected/functional for the species, given its' low dispersal capacity. However, potential habitat is largely associated with a riparian vegetation community (RE 11.3.25b) and clearing within these areas will be minimised as a priority due to the association with watercourses and other habitat features limited in the landscape (i.e. hollow bearing trees). The potential impact to modelled habitat within the Study Area is low and may be reduced following the ongoing refinement of the Project's design and micrositing. Based on the extent of modelled habitat , the Project is unlikely to present a significant barrier to the species or fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	**No**. No populations of the species are known to occur within the Study Area. The sedentary nature of the species means populations are susceptible to isolation as a result of habitat fragmentation. The potential impact to modelled habitat within the Study Area is low and may be reduced following the ongoing refinement of the Project's design. Based on the extent of modelled habitat the Project is unlikely to isolate habitat to the extent where genetically distinct populations would form.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**No**. Invasive species, particularly weeds including lantana (*Lantana camara**) were recorded throughout the field survey program. The feral cat, a recognised threat to the species, was also recorded multiple times. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.
Introduce disease that may cause the population to decline	**No**. There are no known diseases affecting the species. Nonetheless, the Project will employ best practice biosecurity protocols; therefore, introduction of a disease that may cause the species to decline is unlikely.
Interfere with the recovery of the species	**No**. A recovery plan for the Queensland Brigalow Belt Reptiles including the collared delma has been drafted by WWF-Australia in 2006 (Richardson 2006). Several recovery objectives are outlined in the plan and on the species SPRAT profile and broadly cover a range of topics including identification of threats and key habitat, research priorities, conservation and the establishment of reserves, monitoring programs and the development of management guidelines. The Project is unlikely to hinder the success of any of the recovery actions. Furthermore, the Project will not exacerbate any known threats to the species including cattle grazing, weed and pest levels and altered fire regimes. Potential indirect impacts on the species as a result of the Project will be actively managed via one or multiple Management Plans. Given the above and that the species was not recorded during the field survey program, the Project is unlikely to interfere with the recovery of the species.

Evaluation Criteria	Response
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**No**. No populations of the species are known to occur within the Study Area. The Project may involve the loss of modelled habitat, however the impact to habitat is low and may be reduced from what is currently represented within the Development Corridor or avoided entirely. Given the above and that the species was not recorded from the Study Area, the Project is unlikely to cause disruption to ecologically significant locations for the species.



GDA 1994 MGA Zone 56

Legend

- Active Diurnal Search Sites
- Collared Delma Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Collared Delma Habitat

- Breeding and Foraging

FIGURE 1.1

COLLARED DELMA POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.1.2 Glossy Black-cockatoo (*Calyptorhynchus lathami*)

The glossy black-cockatoo prefers woodland areas dominated by she-oak (*Allocasuarina*), or open sclerophyll forests (i.e. *Eucalyptus, Corymbia* or *Angophora*) and woodlands with a stratum of *Allocasuarina* beneath.

Glossy black-cockatoos were recorded during the field survey program on three occasions. One observation was made during the bird utilisation survey, where a flock of 22 individuals were observed transiting south from the POM4 vantage point along the eastern ridge of the Study Area between 60 – 90 m above ground level (AGL). The remaining two observations were of small flocks (three individuals), with one group foraging within a stand of forest she-oak (*Allocasuarina torulosa*), and the other group transiting north at 40 m AGL. The location of these records are shown on Figure 4.2 of the Mount Hopeful Fauna Assessment (Umwelt 2023).

Within the Study Area, glossy black-cockatoos may be found in eucalypt woodlands on alluvium and steep slopes, as well as in riparian *Melaleuca* woodlands (**Table 1.3** and **Figure 1.2**). The predicted habitat areas are considered an over-representation of potential foraging habitat within the Study Area, with the primary food source, *Allocasuarina torulosa*, distributed unevenly throughout. Potential breeding habitat within the Study Area is uncommon, limited to a single vegetation community (RE 11.11.3c). This community was the only that was found during the field survey program to support occasional large, hollow bearing trees. It should be noted that no evidence of nesting glossy black-cockatoos was recorded during the field survey program.

The SRI assessment for the species is presented in **Table 1.4**. In summary, an SRI was **not triggered** for this species.

Table 1.3 Potential Area of Impact to Habitat: Glossy Black-Cockatoo

Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Breeding	152.1	23.8
Foraging and dispersal	2,600.1	242.5
Total	**2,752.2**	**266.2**

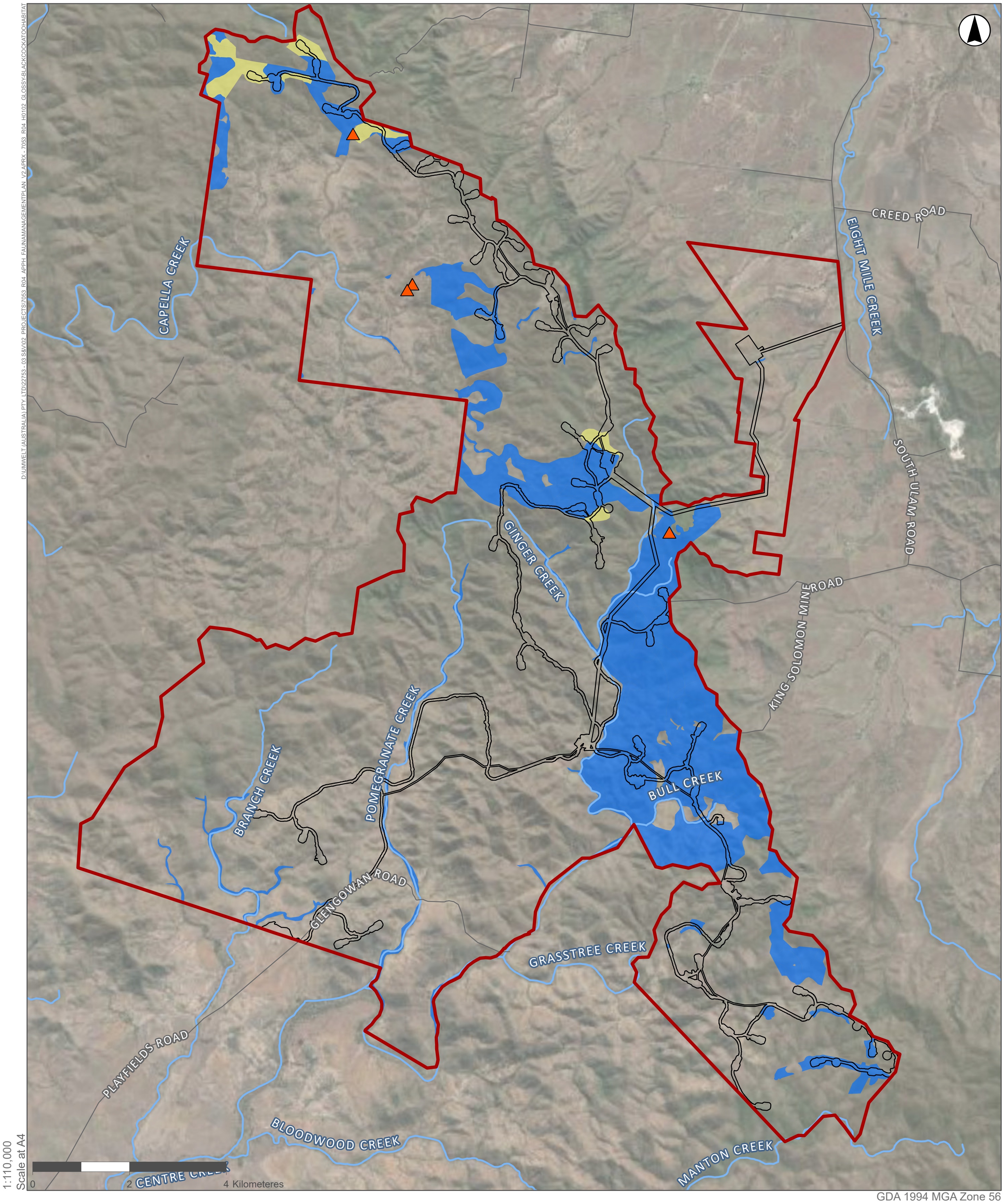
Table 1.4 Significant Residual Impact Assessment: Glossy Black-Cockatoo

Evaluation Criteria	Response
Lead to a long-term decrease in the size of local population	**No**. The collision risk assessment conducted for the species resulted in a moderate risk ranking (Umwelt 2021). Based on this assessment, potential exists for infrequent, individual mortality at turbines near/or between potential habitat areas. The Project will operate under a BBAMP which will govern operational requirements to further minimise impacts on this species, as impacts or potential impacts are detected. Given the infrequency of visits to the Study Area and low numbers recorded, coupled with an adaptive management approach, it is unlikely that the Project will lead to a long-term decrease in the size of a local population as a result of collision with turbine blades or other infrastructure (e.g. masts and guy wires).

Evaluation Criteria	Response
	The majority of habitat predicted for direct impact from the Project is suitable only for foraging and the occurrence of foraging opportunities within areas mapped as foraging habitat is rare. Given the infrequent / transient use of the Study Area by the species, and the availability of similar foraging habitat beyond the Disturbance Footprint, it is unlikely that the Project will lead to a long-term decrease in the size of a local population. The refinement of the Project's design has further reduced the area of impact from what was previously represented within the Development Corridor.
Reduce the extent of occurrence of the species	**No**. The glossy black-cockatoo has a large distribution extending across a significant portion of the Queensland coast. The distribution ranges from the Dawson-Mackenzie-Isaac Rivers basin, north to the Connors-Clarke Ranges south to Dawes and Many Peaks Ranges, and inland to the Expedition, Peak and Denham Ranges, including the Blackdown Tableland. The Study Area is not located near the limit of the species range. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges, avoiding potential nesting sites. Species-specific management includes the halting of vegetation clearing in areas where active nesting hollows are located. Active animal breeding places may only be tampered with under an approved high-risk SMP. Suitable habitat supported within the Study Area includes habitat types which are dominant in the broader landscape, covering large areas of land. Given the linear nature of the Project and high mobility of the species, vegetation clearing required for the construction of the Project is unlikely to materially reduce the extent of occurrence for this species. The Project is unlikely to create significant barriers to movement or alienate large portions of habitat.
Fragment an existing population	**No**. Given the linear nature of the Disturbance Footprint and high mobility of the species, habitat clearance associated with the Project is unlikely to present significant barriers to any existing population to the extent where it would become fragmented. The presence of wind turbine generators may act as a barrier to movement, although little is understood regarding the avoidance strategies employed by the species on wind farms. Given the high mobility of the species, it is unlikely the Project will fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	**No**. Given the linear nature of the Project and high mobility of the species, vegetation clearance or built infrastructure associated with the Project is unlikely to isolate habitat to the extent where genetically distinct populations would form.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**No.** No invasive species are considered a recognised threat to the species, however, the Conservation Advice for *Calyptorhynchus lathami lathami* (south-eastern glossy black cockatoo), a subspecies of the glossy black cockatoo (*Calyptorhynchus lathami*), documents that invasive weeds are currently a minor threat to this species habitat. Feral cats were recorded within the Study Area and may be harmful to this species. Although potential habitat is generally moderately to highly connected, existing conduits for movement do occur comprising cleared areas for tracks, fence lines and cattle grazing areas. Based on this, it is considered unlikely that clearing required for construction of the Project will significantly exacerbate the movement of exotic predators, including feral cats. Regardless, baseline weed and pest surveys will be undertaken prior to construction with monitoring undertaken to determine if any increase occurs as a result of the Project. If the presence or abundance of weeds and/or pests increases, this will be addressed via corrective actions stipulated in the Weed and Pest Management Plan.

Evaluation Criteria	Response
	It is unlikely the Project will result in harmful invasive species becoming established in glossy-black cockatoo habitat. Nonetheless, the Project will employ best practice control methods for weeds and pests.
Introduce disease that may cause the population to decline	**No**. There are no known diseases affecting the species. The Project follows best practice construction and operational methods; therefore, introduction of a disease is unlikely.
Interfere with the recovery of the species	**No**. There is no recovery plan in place for the species. A key threat to the recovery of the species is the loss of habitat, particularly the loss of feeding trees, nesting sites and roosting areas. The majority of habitat predicted for direct impact from the Project is suitable only for foraging and the occurrence of foraging opportunities within areas mapped as foraging habitat is rare. The refinement of the Project's design has further reduced the area of impact from what was previously represented within the Development Corridor. Given the infrequent use of the Study Area and the area of habitat disturbance comparative to the amount of habitat in the broader region, vegetation clearance associated with the Project is unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**No**. A maximum of 266.2 ha of habitat including 23.8 ha of potential breeding habitat and 242.5 ha of potential foraging habitat has been identified within the Disturbance Footprint. Glossy black-cockatoo is an obligate nester, relying on large trees (live or dead), usually eucalypts for breeding. Most nest hollows have an entrance diameter of 20 to 25cm and are in vertical or near vertical spouts, or trunk cavities exposed by the loss of a large branch (Glossy Black Conservancy, n.d.). Presence of hollows of 20 cm or greater has been used as an microhabitat parameter when assigning suitable breeding habitat to mapped fauna habitat within the Disturbance Footprint. Within areas mapped as potential breeding habitat, the occurrence of hollows of suitable diameter for this species is rare to occasional and mapping is considered to be conservative. The Project may disrupt foraging habitat, although the foraging potential (based on the occurrence and density of *Casuarina* and *Allocasuarina* species) varies within the mapped foraging habitat area. Three foraging tree species including black sheoak (*Allocasuarina littoralis*), forest sheoak (*Allocasuarina torulosa*) and river oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) occur within the Disturbance Footprint. *Casuarina cunninghamiana subsp. cunninghamiana* is recognised as being used as a foraging resource to a lesser extent than *Allocasuarina torulosa* and *Allocasuarina littoralis* for the south-eastern subspecies (*Calyptorhynchus lathami lathami*) (DAWE 2021). The occurrence of *Allocasuarina torulosa* and *Allocasuarina littoralis* as a potential foraging resource within the Disturbance Footprint is not likely to be heavily relied upon given the low density of occurrence of these species and their availability in the wider landscape. The majority of habitat predicted for direct impact from the Project is suitable only for foraging and the occurrence of foraging opportunities within areas mapped as foraging habitat is rare.

Evaluation Criteria	Response
	Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges, avoiding potential nesting sites. Active animal breeding places will not be tampered with without an approved DES High Risk SMP. Species specific management includes the halting of vegetation clearing in areas where active nesting hollows are located. In addition, clearing will not be permitted to resume until the nesting cockatoos leave the area on their own accord. As detailed in the Preliminary BBAMP, a single glossy black-cockatoo death will be a reportable incident to DES and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. Based on the low density of breeding and foraging opportunities within mapped habitat in the Disturbance Footprint, and the species-specific management applied to the Project, it is considered unlikely that the Project would cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) for the species.



Legend

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Roads
- Watercourse
- Study Area
- Disturbance Footprint

Glossy-black Cockatoo Habitat

- Foraging and Dispersal
- Nesting

FIGURE 1.2

GLOSSY BLACK-COCKATOO HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.1.3 Greater Glider (Southern and Central) (*Petauroides volans*)

Greater gliders are typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. During the day, this species spends most of its time denning in hollowed trees, with each animal inhabiting up to twenty different dens within its home range. Hollows are therefore an important and limiting habitat resource. As described in the species' Conservation Advice (DCCEEW 2022b), the species' probability of occurrence is positively correlated with the availability of tree hollows.

The greater glider is known to occur within the Study Area, recorded three times during spotlighting surveys. In June 2020, one individual was recorded in a *Eucalyptus moluccana* tree 18 m above ground level (AGL) within RE 11.3.26 in an area directly adjacent to the Study Area. In November 2020, another individual was recorded near the June 2020 record within the same patch of *Eucalyptus moluccana* woodland. Targeted nocturnal surveys undertaken in October 2021 resulted in the identification of one further individual within *Eucalyptus moluccana* woodland (RE 11.11.3c) in the north-western portion of the Study Area. The location of these records are provided in Figure 4.2 of the Mount Hopeful Fauna Assessment (Umwelt 2023).

Eucalypt woodlands and forests dominate the Ground-truthed Mapping Extent and comprise a number of REs identified as 'habitat' or 'potential habitat' consistent with DES (2022). The relevant REs and their habitat categorisation as per the guidelines are:

- 11.3.4 (Habitat)
- 11.3.25 (Habitat)
- 11.11.3 (Habitat)
- 11.11.3c (Habitat)
- 11.11.4 (Habitat)
- 11.11.4a (Potential habitat)
- 11.11.4b (Potential habitat)
- 11.11.4c (Habitat)
- 11.12.6 (Habitat)
- 11.11.15 (Habitat)
- 11.12.1 (Habitat).

Hollow-bearing trees and stags however did not occur consistently across these communities. Based on the findings of the field survey program, the greatest abundance of hollows and occurrence of medium or large sized hollows was limited to select patches of REs 11.3.4, 11.3.25b, 11.12.6, 11.11.3, 11.11.3c, 11.11.4a and 11.11.4b. It is these areas exclusively that are considered suitable for breeding and denning, with remaining areas of connected eucalypt forest and woodland considered suitable for foraging and dispersal. However, excluding the *Eucalyptus moluccana* woodland communities, hollows were generally uncommon reflecting the steep terrain, shallow soils and low water availability in the area. Although not included in DES, 2022, select areas of RE 11.3.25b have also been mapped as greater glider (southern and central) habitat based on the presence of habitat resources, confirmed during the field survey program.

The extent of greater glider (southern and central) habitat within the Ground-truthed Mapping Extent and Disturbance Footprint is provided in **Table 1.5** and **Figure 1.3**.

The SRI assessment for the species is presented in **Table 1.6**. In summary, an SRI was **triggered** for this species.

Table 1.5 Potential Area of Impact to Habitat: Greater Glider

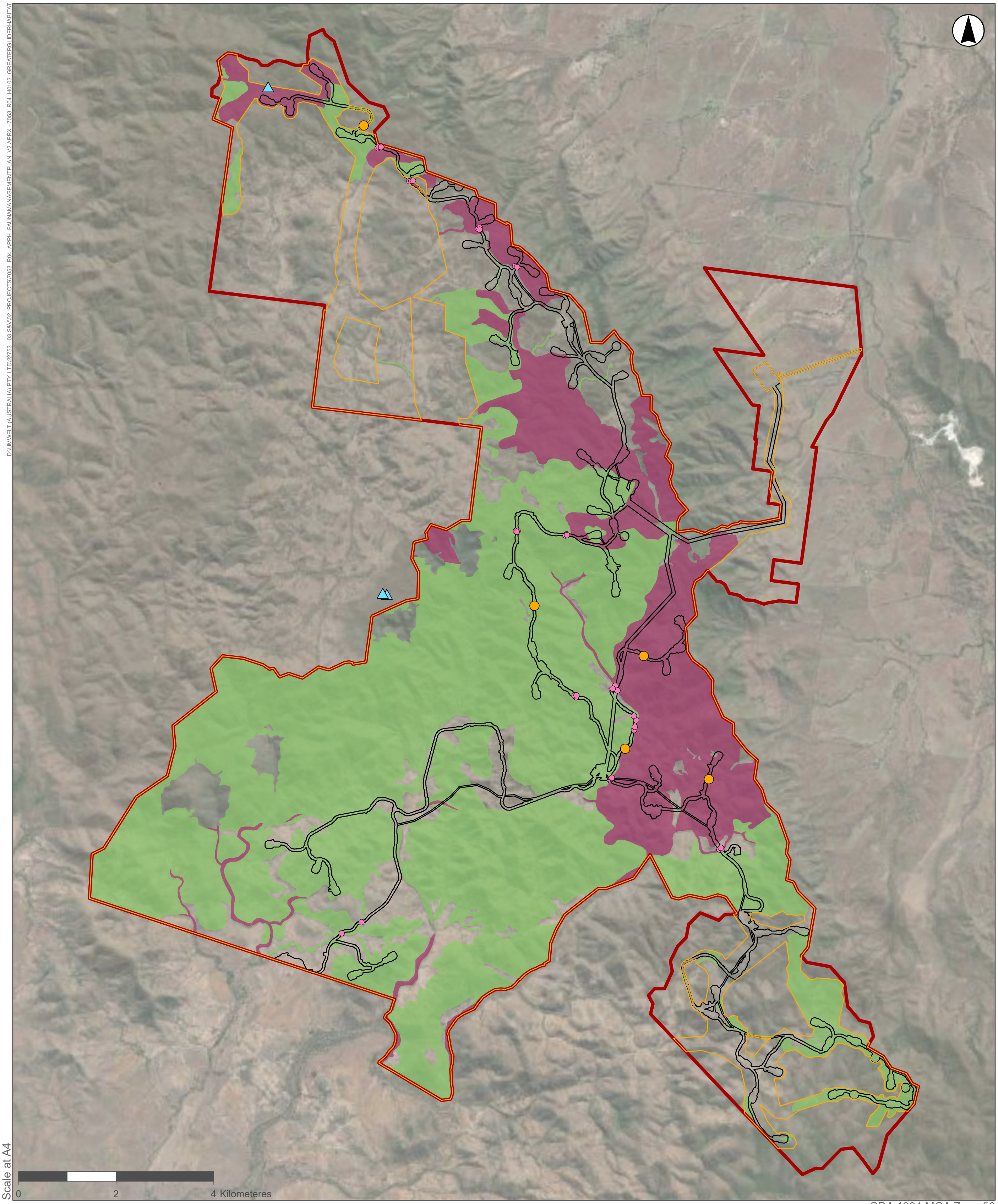
Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Breeding and Denning	2,339.5	206.9
Foraging and Dispersal	7,560.9	331.5
Total	**9,900.5**	**538.4**

Table 1.6 Significant Residual Impact Assessment: Greater Glider (Southern and Central)

Evaluation Criteria	Response
Lead to a long-term decrease in the size of local population	**No.** Greater glider (southern and central) was recorded twice during the field survey program; once in the far north adjacent to the Disturbance Footprint and twice at a location immediately west of the Study Area. Several REs identified to comprise greater glider 'habitat' or 'potential habitat' as per DES (2022) occur within the Disturbance Footprint and wider Ground-truthed Mapping Extent. Apart from the *Eucalyptus moluccana* woodland community however, findings from the field surveys determined that suitable hollow-bearing trees are generally absent or in low abundance. Where hollows occur, potential habitat is considered suitable for breeding and denning. However, the low abundance of this habitat feature indicates the modelled extent of breeding and denning habitat may be overstated. Potential habitat for the greater glider dominates the Ground-truthed Mapping Extent and is not considered unique or high quality due to the rocky substrate and low water availability (resulting in stunted tree growth and low hollow abundance), historical clearing for agricultural works and ongoing disturbance from weeds and pests. Habitat fragmentation impacts have been considered in the design and siting of the Disturbance Footprint. Through the use of pinch points (5) and the installation of glider poles (13) at select locations, movement opportunities for the species will be provided within the Disturbance Footprint. Furthermore, habitat availability is expected to be high in the wider local area. There are several protected areas adjacent to the Study Area including Gelobera State Forest and Don River State Forest which are likely to provide a greater abundance of important habitat resources including hollow bearing trees or stags. Modelled habitat has a relatively high degree of connectivity both internally and to external areas including the State Forests, and this connectivity will be largely maintained following the construction of the Project. The refinement of the Project's design has further reduced the area of impact from what was previously represented within the Development Corridor. Potential indirect impacts on the species as a result of the Project are expected to be limited but will be actively managed via the Project management plans which will include specific measures for the greater glider including pre-clearance survey requirements. Based on the above, a long-term decrease in the size of a local population is unlikely to result from the Project.

Evaluation Criteria	Response
Reduce the extent of occurrence of the species	**No.** The greater glider has a large distribution extending across the majority of the east coast of Australia. The species area of occupancy is estimated at 15,316 km^2, however this may be overstated given the low resolution in the mapping methodology used by the Commonwealth (2km x 2km grid). Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges. Through the installation of glider poles and the inclusion of pinch points within the Disturbance Footprint, movement within and to adjacent areas will be facilitated. Large tracts of connected habitat will remain following the construction of the Project and no significant patch isolation will occur. Furthermore, the Study Area does not occur near the limit of the species distribution. Based on this, Project works are considered unlikely to materially reduce the availability or quality of habitat for the species to the point where the occurrence of a population of this species would be reduced.
Fragment an existing population	**No.** The species is known to have limited dispersal abilities and is sensitive to habitat fragmentation. Modelled habitat within the Disturbance Footprint (and wider Ground-truthed Mapping Extent) generally has moderate levels of existing fragmentation as a result of historical clearing and ongoing agricultural practices. Nonetheless, connectivity to adjacent protected areas is high. Through considered design and siting of the Disturbance Footprint, internal connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and no significant patch isolation will occur. Five pinch points will also be maintained within the Disturbance Footprint to facilitate ongoing movement. To ensure suitability for the dispersal of the greater glider, the clearing width at pinch points will be determined based on the canopy height at those locations and the usual greater glider volplane distances. As a priority, clearing will be minimised at watercourse crossings noting that riparian vegetation may be an important movement corridor for the species. This includes design measures which have sought to cross watercourses at as close as possible to 90 degrees. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges. Once constructed, the Project itself will only create localised barriers to movement, however these barriers will not to be of the extent that they would fragment an existing population into two or more populations.
Result in genetically distinct populations forming as a result of habitat isolation	**No.** Through considered design and siting of the Disturbance Footprint, internal connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and no significant patch isolation will occur. As a priority, clearing will be minimised at watercourse crossings noting that riparian vegetation may be an important movement corridor for the species. This includes design measures which have sought to cross watercourses at as close as possible to 90 degrees. Micro-siting efforts will aim to retain hollow-bearing trees and large trees on patch edges. The Project will create localised barriers to movement, however these barriers will not to be of the extent they could result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**No.** European red fox and feral cats are invasive species that are known to predate upon the greater glider (southern and central). While feral cat was recorded during the field survey program, European red fox was not, however, this species is likely to occur within the Study Area and wider region. It is unlikely the Project will result in invasive species that are harmful to an endangered or vulnerable species becoming established in the species' habitat. Nonetheless, the Project will employ best practice control methods for weeds and pests.

Evaluation Criteria	Response
Introduce disease that may cause the population to decline	**No.** The species is not known to be vulnerable to disease directly. Phytophthora root fungus (*Phytophthora cinnamomic*) has the potential to indirectly impact the species via the infection of eucalyptus trees. The Project will implement best practice biosecurity protocols therefore, introduction of a disease that may cause the species to decline is unlikely.
Interfere with the recovery of the species	**Likely.** There is no recognised recovery plan for the species, however one is required to stop decline and abate threats. The recently published Conservation Advice (DCCEEW, 2022) includes conservation and management priorities which are grouped into four key themes including habitat loss, disturbance and modification (including fire), climate change, invasive species (including threats from predation, grazing, trampling) and ex-situ recovery actions. Habitat loss, disturbance and modification is a recognised threat to the species. Whilst the final impact area to suitable habitat will be smaller than the area currently represented in the Disturbance Footprint, the loss of hollow-bearing trees will still occur and the Project will impact known habitat types where the species was recorded during field surveys (i.e. *Eucalyptus moluccana* woodland). Modelled habitat may also be of regional significance to the species due to its role in providing connectivity and dispersal opportunities for the species along the Ulam Range. The Project may interfere with the recovery of the species by reducing the availability of habitat in the regional context, albeit to a limited extent.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**Likely.** The species is reliant on hollow-bearing trees for breeding and has a low reproductive rate. Females give birth to a single young between March – June (McKay 2008). Clearing may occur within areas of potential breeding and denning habitat during the species' breeding season. Pre-clearance surveys will be conducted in areas of habitat to be cleared and include searches for denning individuals. Active animal breeding places will not be tampered with without an approved DES High Risk SMP. Micro-siting will aim to retain hollow-bearing trees where possible. However as stated above, it is anticipated that some suitable hollow-bearing trees will require removal. In areas of known greater glider habitat (i.e. the far northern Study Area), for every suitable hollow that is removed two suitable nest boxes will be installed. While this measure is anticipated to limit the chances of a net loss of suitable hollows, it is noted that this habitat resource is already limited in the landscape and individuals may not inhabit nest boxes for unknown reasons. Based on this, it is considered likely the Project may cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) for the species.



GDA 1994 MGA Zone 56

Legend

- Towns
- Greater Glider (Southern and Central) Record (ALA)
- Greater Glider (Southern and Central) Record (Umwelt)
- Proposed Glider Poles
- Pinch Points
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Greater Glider (Southern and Central) Habitat

- Foraging and Dispersal
- Breeding and Denning

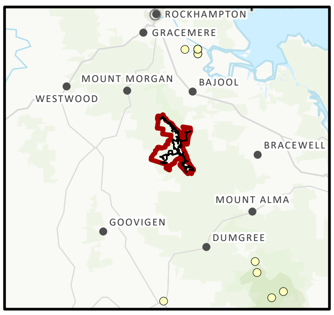


FIGURE 1.3

GREATER GLIDER (CENTRAL AND SOUTHERN) HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.1.4 Koala (*Phascolarctos cinereus*)

The koala is an arboreal, folivorous mammal found across eastern Australia, including Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia. The koala inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by *Eucalyptus* species. Along the Great Dividing Range, they inhabit moist forests and woodlands mostly dominated by *Eucalyptus* species. They are also known to occur in modified or regenerating native vegetation communities.

Habitat for the koala within the Study Area comprises eucalypt woodlands (**Table 1.7** and **Figure 1.4**). Habitat searches, incidental observations, spotlighting and SAT sites did not identify the presence of koala within the Study Area. A total of 20 koala SAT searches were completed in May-June 2020 and November 2020 within five vegetation communities containing koala food trees. The results of the assessment are provided in **Table 1.8**. The SAT methodology (Phillips & Callaghan 2011) uses activity levels to quantify the use of an area by koalas by calculating the percentage of scat trees relative to the total number of trees searched per site. Due to the absence of any scat trees, activity levels for all sites in the assessment was 0%.

The koala is considered to have a moderate likelihood of occurrence based on the presence of suitable eucalypt woodland and forest habitat and scattered desktop records from the wider region. The closest desktop records are both from 1940 and occur east of the Study Area within 14 km. Undated desktop records also occur west (approximately 28 km away) near Wowan, and south (approximately 21 km away) near Round Mountain.

Historical accounts indicate that in the early 1900s, widespread pelt hunting practices within the Rockhampton electorate severely reduced and fragmented the regional koala population. Since then, there have been very few sightings in the area suggesting population numbers are likely low and still recovering. Based on the lack of evidence of koala in the Study Area and recent activity in the surrounding region, the likelihood of occurrence assessment is considered conservative as the koala is likely to occur in very low densities, if at all.

Despite this, suitable habitat for the species is widely available across the Ground-truthed Mapping Extent. The Ground-truthed Mapping Extent is dominated by large tracts of Eucalyptus and/or Corymbia forest, which are functionally connected to tracts of suitably habitat outside of the Study Area at a landscape scale. This habitat is suitable to support the ecological requirements of the species including breeding, foraging and dispersal. Riparian forests and woodlands are also present in low-lying, alluvial areas and may provide climate refugia during extreme weather conditions. However, it is noted that water availability within the Ground-truthed Mapping Extent and wider Study Area is generally limited due to the absence of perennial watercourses and large watercourses (i.e. stream order 4 or higher). Based on this, more valuable areas of refugia are likely to occur outside of the Study Area associated with riverine and floodplain communities to the east. The SRI assessment for the species is presented in **Table 1.9**. In summary, an SRI was **not triggered** for this species.

It should be noted that the Commonwealth Significant Impact Assessment undertaken in line with *Significant Impact Guidelines 1.1 – MNES* (Department of the Environment, 2013), concluded a significant outcome. This is due to the specific requirements of assessment against Habitat Critical to the Survival of the Species. As per the *Conservation Advice for Phascolarctos cinereus (koala)* (Department of Agriculture, Water and the Environment, 2022) habitat critical to the survival of the species includes habitat occupied and habitat currently unoccupied by the species, and as such this part of the test was triggered and a significant result determined. The concept of habitat critical to the survival of the species is not relevant to the SRI process.

Table 1.7 Potential Area of Impact to Habitat: Koala

Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Breeding, Foraging and Dispersal	11,128.2	721.1
Climate Refugia	277.7	5.3
Total	**11,405.9**	**726.5**

Table 1.8 Koala SAT Results

RE ID	Short Description	Sites	Scat Trees
11.3.25b	*Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest	1	0
11.3.26	*Eucalyptus moluccana* or *E. microcarpa* woodland to open forest on margins of alluvial plains	1	0
11.11.3	*Corymbia citriodora*, *Eucalyptus crebra*, *E. acmenoides* open forest on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges	3	0
11.11.4b	*Corymbia trachyphloia* or *Eucalyptus acmenoides*, *E. crebra* woodland +/- *Acacia leiocalyx*	2	0
11.12.1	*Eucalyptus crebra* woodland on igneous rocks	1	0
11.12.6	*Corymbia citriodora* open forest on igneous rocks (granite)	12	0
	Total	**20**	**0**

Table 1.9 Significant Residual Impact Assessment: Koala

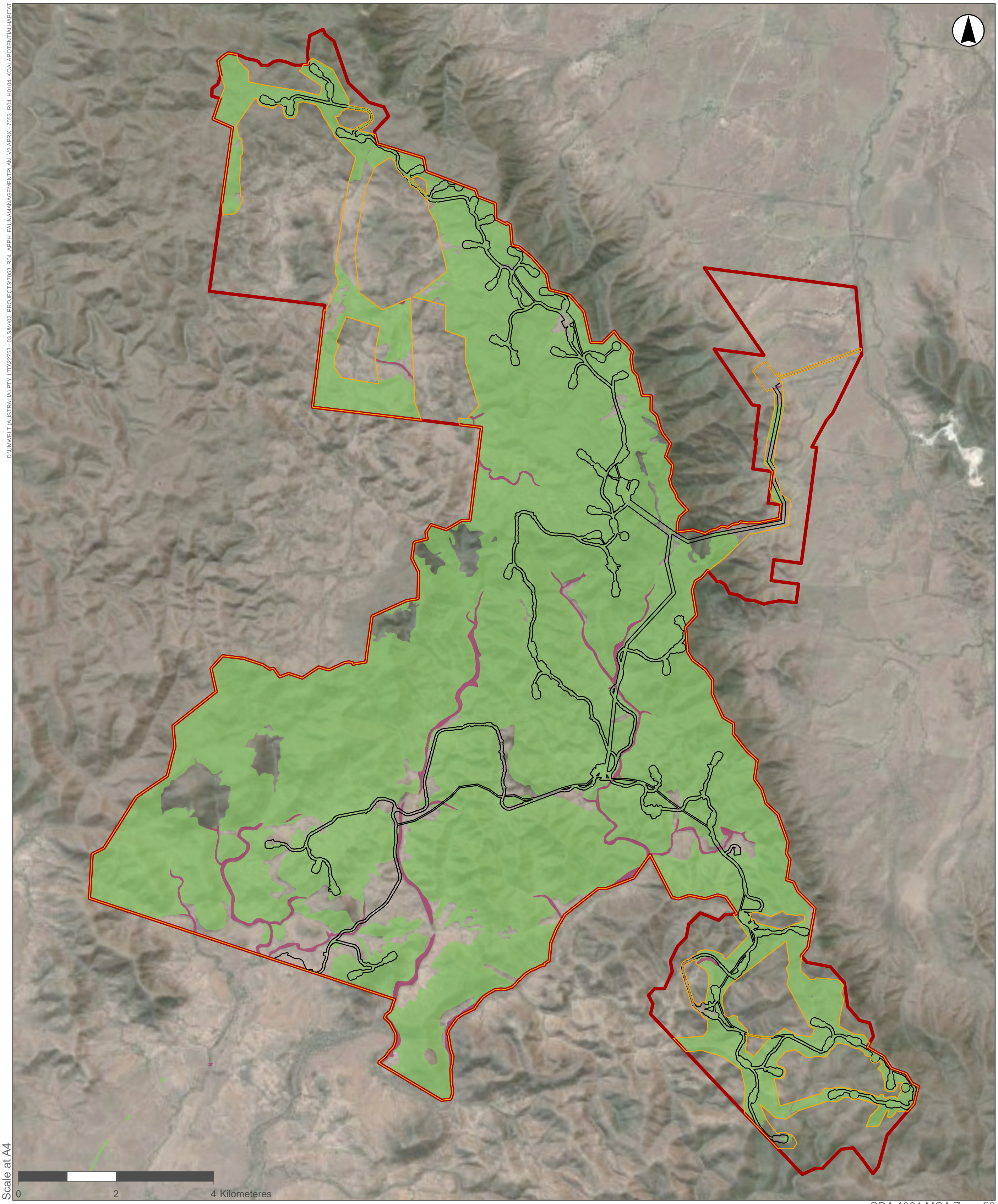
Evaluation Criteria	Response
Lead to a long-term decrease in the size of local population	**No.** This species was not recorded during the field survey program despite the use of recommended survey methods and extensive field effort. Desktop records in the region are scarce and generally >50 years old. Hunting practices within and surrounding Rockhampton in the early 1900s are known to have severely reduced the regional population and recovery has been very slow. Only a small number of transient individuals are likely to utilise the Ground-truthed Mapping Extent and wider Study Area at one time. A maximum of 726.45 ha of potential koala habitat will be directly impacted for construction of the Project, including 721.14 ha suitable for breeding, foraging and dispersal and 5.31 of potential climate refugia. Potential habitat for koala dominates the Ground-truthed Mapping Extent and is not considered unique or high quality due to the ongoing disturbance from cattle grazing, weeds and pests.

Evaluation Criteria	Response
	Potential habitat associated with the non-remnant vegetation communities especially is highly disturbed and in places contains a low abundance of koala food trees. Within the wider region potential habitat is likely to occur extensively and include areas of higher quality particularly in protected areas such as the adjacent State Forests. The extent of habitat that will remain following the construction of the Project is of the magnitude and quality to support a much larger population than is currently expected to occur. Noting this, any important population present is expected to continue to persist within the region regardless of the Project. Indirect impacts on the species as a result of the Project are expected to be limited, as the Project is highly unlikely to increase pests or vehicle strikes with the suite of general mitigation measures proposed including speed limits and pest monitoring. Nonetheless, koala specific measures including pre-clearance survey requirements are also proposed and will be captured in the Fauna Management Plan. Given the potential absence or infrequent use of the modelled habitat by this species as well as the implementation of Project management plans, a long-term decrease in the size of a population is unlikely to result from the Project.
Reduce the extent of occurrence of the species	**No.** As stated in the species' Conservation Advice, the area of occupancy for the koala is estimated at 19,428 km^2 and is contracting. It is noted that the area of occupancy may be potentially overstated given the low resolution in the mapping methodology used by the Commonwealth (2 km x 2 km grid). The koala is widespread across Queensland and the Study Area is not located near the limit of the species distribution. Although the Project will result in the removal of up to 726.5 ha of potential habitat, only a very small number of individuals are expected to be utilising such habitat. The quantum of potential habitat that will remain is sufficient to continue to maintain any potentially occurring population. Furthermore, habitat of similar and better quality is widely available in the local area and connectivity to these areas will be maintained. Based on this, Project works are considered unlikely to materially reduce the availability or quality of habitat for the species to the extent that the area of occurrence of a population would be reduced.
Fragment an existing population	**No.** The species is considered highly mobile and known to readily disperse large distances including across cleared areas. Modelled potential habitat generally has low to moderate levels of fragmentation as a result of historical clearing and ongoing agricultural practices. Where potential habitat is associated with non-remnant vegetation, existing fragmentation impacts are more pronounced, and the canopy cover overall is notably lower. Modelled habitat does however have a relatively high degree of connectivity to adjacent protected areas. Through considered design and siting of the Development Corridor and Disturbance Footprint, connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and five pinch points will be maintained.

Evaluation Criteria	Response
	During construction, increased vehicle activity and ground excavations may become temporary barriers to dispersing individuals. However, the risk of mortality as a result of entrapment and collision will be actively managed via Project management plans. Vehicle traffic will be localised to the construction site and speed limits will be enforced. Any open excavations will contain materials to aid evacuation (i.e. ramps, sticks, hessian sacks) and be checked at set times by a spotter catcher. Once constructed, the Project itself will not create a barrier to movement as ground surfaces will be reinstated and turbines will occur in discrete locations. Furthermore, it is expected 20% of the Disturbance Footprint will be revegetated post construction with native species including eucalypt trees where practical. Based on the above, the Project is considered unlikely to present significant barriers to the species local movement to the extent that it fragments a population into two or more populations.
Result in genetically distinct populations forming as a result of habitat isolation	**No.** The species is considered highly mobile and known to readily disperse large distances including across cleared areas. Modelled potential habitat generally has low to moderate levels of fragmentation as a result of historical clearing and ongoing agricultural practices. Where potential habitat is associated with non-remnant vegetation, existing fragmentation impacts are more pronounced, and the canopy cover overall is notably lower. Modelled habitat does however have a relatively high degree of connectivity to adjacent protected areas. Through considered design and siting of the Development Corridor and Disturbance Footprint, connectivity within and to adjacent protected areas will be largely maintained. The use of existing cleared areas has been maximised and five pinch points will be maintained. During construction, increased vehicle activity and ground excavations may become temporary barriers to dispersing individuals. However, the risk of mortality as a result of entrapment and collision will be actively managed via Project management plans. Vehicle traffic will be localised to the construction site and speed limits will be enforced. Any open excavations will contain materials to aid evacuation (i.e. ramps, sticks, hessian sacks) and be checked at set times by a spotter catcher. Once constructed, the Project itself will not create a barrier to movement as ground surfaces will be reinstated and turbines will occur in discrete locations. Furthermore, it is expected 20% of the Disturbance Footprint will be revegetated post construction with native species including eucalypt trees where practical. Based on the above, the Project is considered unlikely result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**No.** Several exotic fauna species were identified during the field survey program. Wild dogs were recorded commonly and are expected to occur throughout the wider Study Area and surrounding region. Although potential habitat is generally moderately to highly connected, existing conduits for movement do occur comprising cleared areas for tracks, fence lines and cattle grazing areas. Based on this, it is considered unlikely that clearing required for construction of the Project will significantly exacerbate the movement of exotic predators. Regardless, baseline pest surveys (including wild dogs) will be undertaken prior to construction with monitoring undertaken to determine if any increase occurs as a result of the Project. If the presence or abundance of pests increases, a species-specific control program with be designed and implemented. The Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.

Evaluation Criteria	Response
Introduce disease that may cause the population to decline	**No.** Chlamydia and Koala Retrovirus (KoRV) are known threats to the species. Project works are unlikely to spread disease; nonetheless, best practice biosecurity measures will be implemented through the Project management plans. Should an unwell koala be identified during clearing works, it will be handled appropriately by a qualified spotter catcher and taken to a predesignated veterinarian/wildlife care facility for treatment prior to release. Based on the above, it is unlikely the Project will introduce disease that may cause the species to decline.
Interfere with the recovery of the species	**No.**. There is limited information available about the koala population viability and trend within the Rockhampton region. However, historical hunting practices are known to have reduced numbers severely in the 1900s. Despite the availability of suitable habitat, there is no evidence to suggest that koalas are currently occupying the modelled habitat within the Study Area. Given the low density of the population in the region, if koalas were to utilise the area, only a small number of transient individuals are likely to be present within the Ground-truthed Mapping Extent and wider Study Area at one time. Potential habitat for koala dominates the Ground-truthed Mapping Extent and is not considered unique or high quality due to the ongoing disturbance from cattle grazing, weeds and pests. Potential habitat associated with the non-remnant vegetation communities especially is highly disturbed and in places contains a low abundance of koala food trees. Within the wider region potential habitat is likely to occur extensively and include areas of higher quality particularly in protected areas such as the adjacent State Forests. The extent of habitat that would remain following the construction of the Project is of the magnitude and quality to support a much larger population than is currently expected to occur. Noting this, any population present in the region is expected to continue to persist and the quantum and quality of habitat which would be removed as a result of the Project would not be sufficient to interfere with the species' recovery.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**No.** As described above, a small number of individuals may utilise modelled habitat and comprise a population. Male koalas are known to disperse large distances during the breeding season in search of a mate, and dispersal will not be hindered by the Project, as described earlier. Koalas are nocturnal and mating calls generally occur at night when Project-related noise will be minimal. As the species does not have specific breeding requirements, all potential habitat may be suitable for breeding and large areas will be retained following construction of the Project. Potential habitat degradation will be actively managed through the Project management plans. Given the potential absence or infrequent use of the modelled habitat by this species, the Project is unlikely to cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of the species.

umwelt



GDA 1994 MGA Zone 56

Legend

- Towns
- Koala Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Koala Habitat

- Breeding, Foraging and Dispersal
- Climate Refugia

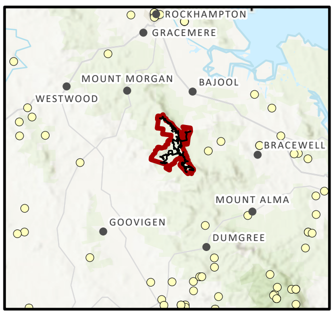


FIGURE 1.4

KOALA POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.1.5 Squatter Pigeon (Southern) (*Geophaps scripta scripta*)

The squatter pigeon occurs in open-forests to sparse, open-woodlands and scrub. Foraging habitat comprises remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus, Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils, within 3 km of a suitable, permanent or seasonal waterbody. Breeding habitat occurs on stony rises occurring on sandy or gravelly soils, within 1 km of a suitable, permanent waterbody.

The subspecies is known to access suitable waterbodies to drink on a daily basis, including permanent or seasonal rivers, creeks, lakes, ponds and waterholes, and artificial dams. The subspecies prefers to drink where there is gently sloping, bare ground on which to approach and stand at the water's edge.

Although breeding can occur throughout the year if conditions are suitable, breeding generally coincides with the dry season (April to October) when their primary food source (grass seed) is most abundant. The nest is a depression scraped into the ground beneath a tussock of grass, bush, fallen tree or log and is sparsely lined with grass.

The squatter pigeon (southern) is known to occur within the Study Area, recorded on 78 occasions throughout the field survey program, although this is likely to include multiple observations of the same individuals. It was commonly recorded along access tracks in non-remnant areas of the Study Area. The location of these records are provided in Figure 4.2 of the Mount Hopeful Fauna Assessment (Umwelt 2023).

Suitable habitat within the Ground-truthed Mapping Extent includes areas that may provide breeding, foraging and dispersal opportunities. Breeding and foraging habitat is generally limited, reflecting the dominant surface geology types (metamorphic and igneous rocks) and steep terrain associated with mapped watercourses. Breeding, foraging and suitable water sources within the Study Area and adjacent were found to all largely occur within 1 km of each other. The local movements of the subspecies will largely be driven by the presence of these resources, and given their tendency to utilise cleared, low-lying areas it is considered likely that the shortest and most direct route to adjacent habitat will be utilised. Based on this, the extent of dispersal habitat was limited to a 1 km distance from breeding and foraging habitat.

Modelled habitat for the species within the Ground-truthed Survey Extent and the Disturbance Footprint is provided in **Table 1.10** and **Figure 1.5**.

The SRI assessment for the species is presented in **Table 1.11**. In summary, an SRI was **not triggered** for this species.

Table 1.10 Potential Area of Impact to Habitat: Squatter Pigeon

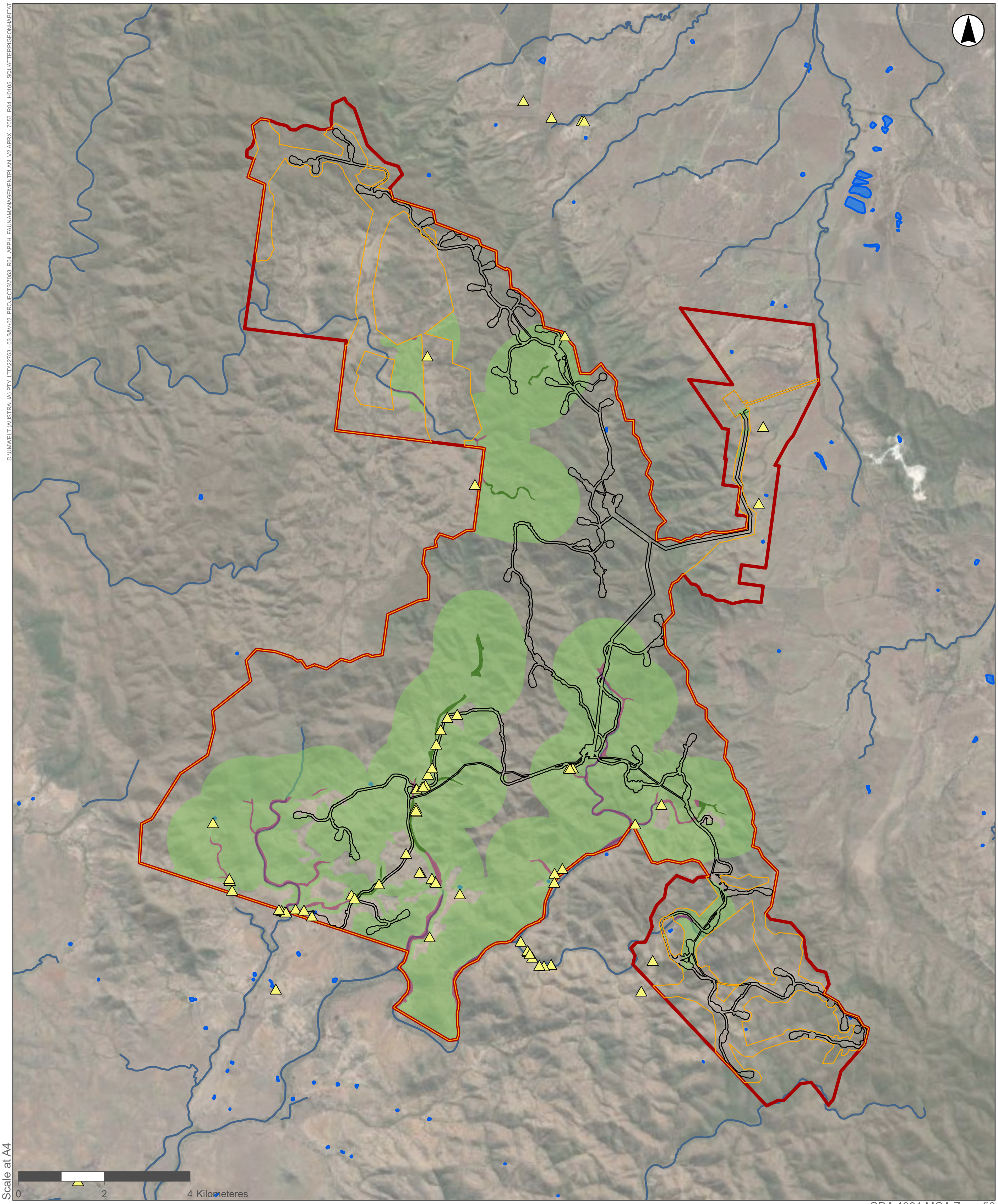
Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Breeding	184.0	3.6
Foraging	57.7	1.5
Dispersal	6,683.9	324.2
Total	**6,925.7**	**329.2**

Table 1.11 Significant Residual Impact Assessment: Squatter Pigeon

Evaluation Criteria	Response
Lead to a long-term decrease in the size of local population	**No.** The squatter pigeon (southern) is known from the Study Area and surrounds, primarily recorded in cleared non-remnant vegetation. Under worst-case scenario, a maximum of 329.23 ha of suitable habitat including 3.59 ha of breeding habitat, 1.47 ha of foraging habitat and 324.17 ha of dispersal habitat will be directly impacted via vegetation clearing required for construction of the Project. Habitat is considered to be of moderate quality due to the presence of cattle, weeds and pests including feral cat which was recorded during the field survey program. Nonetheless, direct impacts to habitat will be minimised wherever possible via micro-siting and the final clearing areas are expected to be lower. Farm dams will be maintained to ensure the availability of suitable water sources required by the species is not affected. The quantum of habitat that will remain following construction of the Project, particularly breeding and foraging habitat, will be sufficient to maintain the population present. As the subspecies is predominantly ground-dwelling and known to frequent tracks, there is a risk of mortality during construction as a result of vehicle/plant strike. To manage this risk, speed limits will be strictly enforced and pre-clearance surveys will include flushing for the subspecies in areas of habitat to be cleared. Potential indirect impacts on the species including habitat degradation via weed and pest incursion will be actively managed via the Project management plans. The turbine collision risk assessment identified the species as being of Moderate risk for impacts from the Project, reflecting the species' vulnerable listing and frequency of occurrence within the Study Area. However it is noted that the species is highly unlikely to fly at RSA height. Any potential operational impacts on this subspecies will be managed by the Project BBAMP. Given the implementation of the Project management plans including the BBAMP, it is considered unlikely that the Project will lead to a long-term decrease in the size of a local population.
Reduce the extent of occurrence of the species	**No.** The squatter pigeon (southern) occurs across a large portion of eastern Queensland. It's area of occupancy was estimated to be 10,000 km^2 (1,000,000 ha) in 2000. However, it is noted that this estimate may be potentially overstated given the low resolution in the mapping methodology used by the Commonwealth (2 km x 2 km grid).

Evaluation Criteria	Response
	During the field survey program the subspecies was commonly recorded in low-lying land both within the Study Area and in areas adjacent. These areas were generally highly disturbed from historical clearing and ongoing cattle grazing activities. The Project is linear in nature and infrastructure has been sited to maximise wind patterns in the landscape i.e. along ridgelines and hill tops. As a result, direct impacts to breeding and foraging habitat are particularly limited and clearing in these areas will be further minimised via micro-siting. Therefore, the Project is unlikely to reduce the area of occurrence of a population.
Fragment an existing population	**No.** The squatter pigeon (southern) is considered highly mobile and was frequently recorded in highly disturbed and cleared areas, highlighting the subspecies' ability to utilise fragmented landscapes. The Project has been strategically sited to maximise the use of cleared areas, minimising additional habitat fragmentation including within breeding and foraging habitat, which are likely important for the population's persistence in the area. Clearing will be completed only as strictly necessary and final impact areas are likely to be lower. The turbine collision risk assessment identified the species as being of Moderate risk for impacts from the Project. However, the species is highly unlikely to fly at RSA height and as such it is unlikely the wind turbines will create a barrier to movement. Potential operational impacts on squatter pigeon (southern) will be managed by the Project BBAMP. As such, it is unlikely the Project will fragment an existing.
Result in genetically distinct populations forming as a result of habitat isolation	**No.** The squatter pigeon (southern) is considered highly mobile and was frequently recorded in highly disturbed and cleared areas, highlighting the subspecies' ability to utilise fragmented landscapes. The Project has been strategically sited to maximise the use of cleared areas, minimising additional habitat fragmentation including within breeding and foraging habitat, which are likely important for the population's persistence in the area. Clearing will be completed only as strictly necessary and final impact areas are likely to be lower. As such, it is unlikely the Project will result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**No.** Invasive species including weeds and predators such as the feral cat were recorded throughout the field survey program. Historical clearing has occurred in discrete locations across the Study Area primarily for cattle grazing purposes. It is considered likely that these areas already act as conduits for pest movement in the landscape. Regardless, baseline weed and pest surveys will be undertaken prior to construction with monitoring undertaken to determine if any increase occurs as a result of the Project. If the presence or abundance of weeds and/or pests increases, a species-specific control program with be designed and implemented. The Project will employ a range of best practice control methods for weeds and pests. Based on this, it is unlikely the Project will result in invasive species that are harmful to the squatter pigeon (southern) becoming established.
Introduce disease that may cause the population to decline	**No.** There are no known diseases affecting the subspecies. Nonetheless, the Project will follow best practice biosecurity protocols during both construction and operation; therefore, introduction of a disease is unlikely.

Evaluation Criteria	Response
Interfere with the recovery of the species	**No.** There is no recovery plan currently in place for the subspecies nor is one considered required. As per SPRAT, the following recovery actions have been recommended (EPA 2006; Garnett & Crowley 2000): • Determine the population size and distribution of the Squatter Pigeon (southern) in southern Queensland and New South Wales, and assess the pigeon's conservation status and requirements. • Undertake studies in North and Central Queensland to determine the relationship between pigeon abundance, tree density and stocking rates. • Establish sites for sub-population monitoring. If possible, these sites should be established with the cooperation of local land-owners and/or conservation organisations. • Develop and implement public education programs and community based tree planting schemes to revegetate favoured habitat types. • Establish control measures for predators (especially cats and foxes) at important sites. • Establish conservation measures to protect grassy woodlands and forests. The Project is highly unlikely to impede any of the above actions and populations within central Queensland are likely to be stable. Although clearing will occur within areas of suitable habitat, the majority of the area to be impacted comprises habitat suitable for dispersal only. Construction of the Project is unlikely to change the subspecies utilisation of the Study Area or limit its success in the region. Implementation of the Project's BBAMP will assist in minimising potential impacts to the subspecies during operation. Therefore, the Project is unlikely to interfere with the recovery of the subspecies.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**No.** Squatter pigeon (southern) may breed throughout the year if conditions are suitable. Within the Ground-truthed Mapping Extent, breeding habitat for the subspecies is of average quality and limited. Although under worst case scenario a maximum of 3.6 ha of breeding habitat will be impacted via vegetation clearing, micro-siting efforts are anticipated to reduce this extent significantly as many areas will also be associated with watercourse crossings. Specific mitigation measures are also proposed to ensure no squatter pigeon (southern) nests are impacted during construction, including nest searches during pre-clearance surveys and demarcating any located. Active animal breeding places will only be tampered with under an approved DES High Risk SMP. Additionally, to reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks. The Project is therefore unlikely to disrupt the breeding cycle of a population.



GDA 1994 MGA Zone 56

Legend

- Squatter Pigeon (Southern) Record (ALA)
- Squatter Pigeon (Southern) Record (Umwelt)
- Suitable Watercourses
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- Reservoirs (DoR)

Squatter Pigeon (Southern) Habitat

- Breeding
- Dispersal
- Foraging

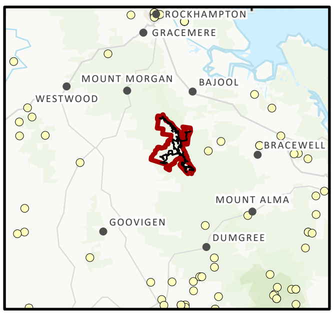


FIGURE 1.5

SQUATTER PIGEON (SOUTHERN) HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.1.6 White-throated Needletail (*Hirundapus caudacutus*)

White-throated needletails are an almost exclusively aerial, large-bodied swift that are insectivorous feeding on a variety of insect prey items during their migration in Australia across a range of habitat types and landscapes. Whilst in Australia the species is gregarious observed flying in flocks of hundreds and even thousands of birds.

They are regularly recorded above wooded areas including open forest and rainforest, though may also fly below the canopy between trees or in clearings. When flying above farmland, they are more often recorded above partly cleared pasture, plantations, or remnant vegetation at the edge of paddocks.

During non-breeding migrations to Australia the white-throated needletail feeds on a variety of insects including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers. The species feeds up to the height of clouds over a variety of foraging habitats including heavily treed forests. Open foraging habitats include farmland, heathland or mudflats, although the species has been observed feeding at lower altitudes closer to the ground as low as 15 cm at a coastal saltworks.

White-throated needletail was recorded on 30 occasions flying over a diversity of habitat types, both incidentally and during the BBUS. Six hundred and ninety-eight individuals have been recorded during surveys with a total of 320 individuals recorded at vantage points during BBUS and a total of 378 individuals recorded incidentally across all survey events. The number of individuals observed in aggregations ranged from 1 to 180. During the morning BBUS survey period (6 am to 10 am) a total of 318 individuals were recorded. During the midday BBUS survey period (10 am to 2 pm) a total of 236 individuals were recorded. During the afternoon BBUS survey period (2 pm to 6 pm) a total of 144 individuals were recorded. The location of these records are provided in Figure 4.2 of the Mount Hopeful Fauna Assessment (Umwelt 2023).

Potential habitat for white-throated needletail within the Study Area consists of roosting, foraging and dispersal habitat. Given the species is a non-breeding migrant to Australia, no breeding habitat exists and will not be considered further. The Study Area is dominated by woodland communities dominated by *Eucalyptus* species, semi-evergreen vine thicket and non-remnant pasture which provide foraging habitat for the species. The Project is located at the Ulam Range, which forms a part of the Great Dividing Range. South-easterly trade winds generated by warm Pacific and Tasman maritime air create the potential for convection along the Great Dividing Range which is aided by orographic lift, the movement of air masses from lower to higher elevations over rising terrain (Spassiani 2020). During the summer months, easterly troughs along the inland side of the Great Dividing Range form a boundary between moist coastal air and the drier air that occurs inland producing a ridge of high pressure along the coast (Bureau of Meteorology 2010). The combination of montane topography and pressure systems along the Great Dividing Range produce updrafts and with it, foraging opportunities for white-throated needletail.
Given the preference for roosting on tall and /or hollow bearing trees at the top of ridges, as well as vertical tree trunks, rock faces and dense canopy foliage, white-throated needletail roosting habitat is limited to remnant vegetation with mature stands of trees confined to ridgelines and mountains throughout the Study Area. As per the Queensland DoR Mountain peaks and capes dataset, the North Pimple is the landscape feature with the lowest elevation (454 m) in the local area. To ensure a conservative approach, all areas with an elevation of 400 m or higher were therefore considered the limit of potential roosting and foraging habitat. Due to the species broad habitat requirements and aerial nature, all remaining areas of regrowth and remnant vegetation are considered potential foraging and dispersal habitat. Habitat for the white-throated needletail is quantified in **Table 1.12** and shown on **Figure 1.6.**

The SRI assessment for the species is presented in **Table 1.13**. In summary, an SRI was **not triggered** for this species.

Table 1.12 Potential Area of Impact to Habitat: White-throated Needletail

Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Roosting and Foraging	7,823.9	267.9
Foraging and Dispersal	2,866.1	365.9
Total	**10,690.0**	**633.8**

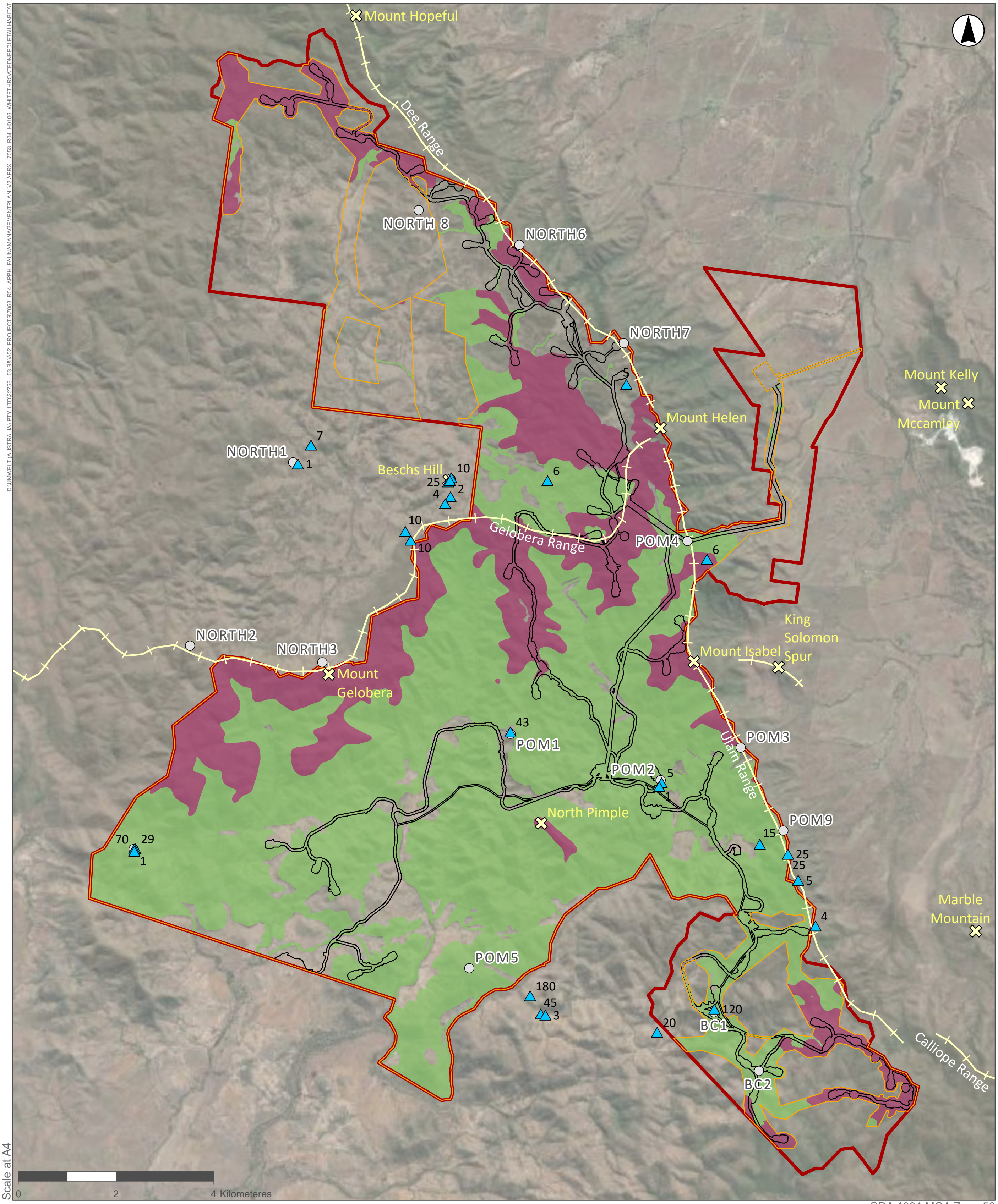
Table 1.13 Significant Residual Impact Assessment: White-throated Needletail

Evaluation Criteria	Response
Lead to a long-term decrease in the size of local population	**No.** The white-throated needletail is known to the Study Area, recorded on 30 occasions during the field survey program, totalling 698 individuals. It is a non-breeding migrant to eastern Australia where it occurs as transient populations, often influenced by prevailing weather conditions. The species generally arrives in Australia during spring and migrates along both sides of the Great Diving Range in Queensland and NSW to the southern parts of their range. The journey is reversed as the species leaves Australia in autumn. While migrating, it is likely the species will inhabit the airspace above all remnant and regrowth habitat types within the Study Area. Under worst-case scenario, up to 267.9 ha of roosting and foraging habitat and 365.9 ha of foraging and dispersal habitat will be directly impacted via vegetation clearing for construction of the Project. Relative to the area that will be cleared, large areas of suitable habitat will remain. Given the species aerial nature and broad requirements for roosting and foraging, it is unlikely this loss of habitat will result in a material change to the species' utilisation of the area. The turbine collision risk assessment identified the species as being of Very High risk for impacts from the Project, reflecting the Vulnerable status of the species and the frequency at which the species occurs at RSA. Given the flight behaviours of the species and known occurrence within the Study Area, the mortality of individual birds may occur during the lifetime of the Project, particularly whilst the species is present in Australia (October - March). However, collision risk modelling completed for the Project indicates overall mortality numbers will be very low (i.e. 1 individual every 5.9 years). The potential impact on this species would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. As the plan is adaptive, the death of a single white-throated needletail would result in notification to DCCEEW, an investigation and additional monitoring. Given the implementation of a BBAMP, it is considered unlikely that the Project will lead to a long-term decrease in the size of a population.
Reduce the extent of occurrence of the species	**No.** While in Australia the species has a large distribution that extends across eastern Australia. As per the species' Conservation Advice, the estimated area of occupancy within Australia is >18,000 km^2 however this may be overstated given the mapping methodology used by the Commonwealth (2 km x 2 km grid).

Evaluation Criteria	Response
	Although the Project will result in a maximum loss of up to 267.9 ha of roosting and foraging habitat and 365.9 ha of foraging and dispersal habitat, habitat is likely to only be utilised temporarily while on migration. The quantum of habitat that will remain is likely to be sufficient to support the ecological requirements of populations of the size observed during field surveys. Furthermore, areas of suitable habitat are likely to occur extensively within the wider region. Given the aerial nature and high mobility of the species, as well as the broad habitat requirements and habitat availability in the broader region, the Project is unlikely to reduce the area of occurrence of a population.
Fragment an existing population	**No.** The species is highly mobile, flying for thousands of kilometres during migration. It is known to occur within fragmented landscapes as well as over a range of habitat types. The Project has been strategically sited to maximise the use of cleared areas, minimising additional habitat fragmentation including within roosting and foraging habitat, which may be preferred habitat while a population is present in the area. Given the aerial nature of the species, vegetation clearance associated with the Project is unlikely to reduce the mobility of the species and will not result in the fragmentation of a population. Once operational, wind turbines may present a barrier to movement. The turbine collision risk assessment identified the species as being of Very High risk for impacts. Predicted mortality rates determined through Collision Risk Modelling based on existing BBUS data and turbine specifications indicates collision events will be rare (i.e. 1 mortality every 5.9 years). The potential impact on this species would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. As such, it is unlikely the Project will fragment an existing population into two or more populations.
Result in genetically distinct populations forming as a result of habitat isolation	**No.** The species is highly mobile, flying for thousands of kilometres during migration. It is known to occur within fragmented landscapes as well as over a range of habitat types. The Project has been strategically sited to maximise the use of cleared areas, minimising additional habitat fragmentation including within roosting and foraging habitat, which may be preferred habitat while a population is present in the area. Given the aerial nature of the species, vegetation clearance associated with the Project is unlikely to reduce the mobility of the species and is unlikely to separate a population into genetically distinct populations as a result of habitat isolation. Once operational, wind turbines may present a barrier to movement. The turbine collision risk assessment identified the species as being of Very High risk for impacts. Predicted mortality rates determined through Collision Risk Modelling based on existing BBUS data and turbine specifications indicates collision events will be rare (i.e. 1 mortality every 5.9 years). The potential impact on this species would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. As such, it is unlikely the Project will result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**No.** Invasive species are not known to be a threat to the white-throated needletail. Nonetheless, the Project will employ best practice control methods for weeds and pests and is unlikely to introduce or exacerbate weeds or pests beyond existing levels.

Evaluation Criteria	Response
Introduce disease that may cause the population to decline	**No.** There are no known diseases affecting the species. The Project will employ best practice biosecurity protocols during construction and operation; therefore, introduction of a disease that may cause the species to decline is unlikely.
Interfere with the recovery of the species	**No.** As identified on SPRAT, a recovery plan for the white-throated needletail is not required as the necessary information is provided in the species' Conservation Advice. This document identifies the primary conservation actions for the species as the protection of breeding habitat in East Asia and the protection of important habitat in Australia. There is currently no evidence to suggest that the species relies on the habitat of the Ground-truthed Mapping Extent or wider Study Area while in Australia or on migration. No roosting locations were identified during the field survey program, however potential roosting habitat has been identified based on the topography of the site and presence of hollow-bearing trees. Following construction of the Project, large and extensive areas of potential roosting and foraging habitat will remain which are of sufficient scale to support any individuals that may occur. Infrastructure including wind turbines are recognised as potential collision threats to the species, and the improvement of knowledge surrounding the species and wind farms is identified as an information and research priority. Monitoring will be completed as part of the BBAMP as required and allow additional data on the white-throated needletail to be collected. Given the above, it is unlikely that Project will interfere with recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species	**No.** The species is a non-breeding migrant to Australia. The species uses the aerial space above vegetated habitat and forages predominantly on insects. Foraging resources are widely available and are not a limitation to building sufficient energy reserves required for their return migration to breeding grounds. Once operational, wind turbines may present a barrier to movement. The turbine collision risk assessment identified the species as being of Very High risk for impacts. Predicted mortality rates determined through Collision Risk Modelling based on existing BBUS data and turbine specifications indicates collision events will be rare (i.e. 1 mortality every 5.9 years). The potential impact on this species would be managed by the Project BBAMP, which governs the operational and compliance reporting response following any confirmed mortality event. Therefore, the Project is unlikely to cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.

umwelt



GDA 1994 MGA Zone 56

Legend

- Towns
- White-throated Needletail Record (ALA)
- White-throated Needletail Record (Umwelt)
- Mountains, Peaks and Capes (DoR)
- Vantage Point Sites
- Mountain Range (DoR)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

White-throated Needletail Habitat

- Foraging and dispersal
- Roosting and foraging

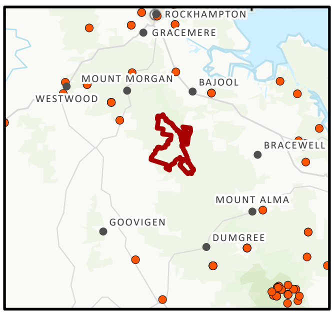


FIGURE 1.6

WHITE-THROATED NEEDLETAIL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.2 Special Least Concern (Non-Migratory) Species

1.2.1 Short-beaked Echidna (*Tachyglossus aculeatus*)

The short-beaked echidna is found in almost all terrestrial habitats in Australia. This species relies on a substrate of leaf litter and course woody debris for foraging. It shelters in fallen logs, rock crevices, dense leaf litter and abandoned burrows.

The short-beaked echidna was recorded twice on camera traps within the Study Area, one from vine forest in the southwest corner and the other from eucalypt woodland in the central-east portion. The location of these records are provided in Figure 4.2 of the Mount Hopeful Fauna Assessment (Umwelt 2023). The generalist nature of the species is reflected by its potential to occur within all habitat types in the Study Area (**Table 1.14** and **Figure 1.7**).

The SRI assessment for the species is presented in **Table 1.15**. In summary, an SRI was **not triggered** for this species.

Table 1.14 Potential Area of Impact to Habitat: Short-beaked Echidna

Fauna Habitat Type	Area (ha)	
	Ground-truthed Mapping Extent	Disturbance Footprint
Foraging, Breeding and Dispersal	12,924.1	877.3
Total	**12,924.1**	**877.3**

Table 1.15 Significant Residual Impact Assessment: Short-beaked Echidna

Evaluation Criteria	Response
Lead to a long-term decrease in the size of a local population	**No.** Extensive survey effort recorded the species only twice in the Study Area. Due to the broad habitat requirements of the species, there are large areas of potential habitat for the species in the Study Area and wider region. The refinement of the Project's design has further reduced the area of impact from what was previously represented within the Development Corridor. Given the linear nature of the Project, ability of the species to disperse between habitat patches and area of habitat disturbance comparative to habitat in the broader region, a long-term decrease in the size of a local population of this species is unlikely to result from the Project.
Reduce the extent of occurrence of the species	**No.** Due to the broad habitat requirements of the species, there are large areas of potential habitat for the species in the Study Area and region. The linear nature of the Project and the ability for the species to disperse between habitat patches means the Project is unlikely to reduce the species' extent of occurrence.
Fragment an existing population	**No.** Given the linear nature of the Project and the ability for the species to disperse between vegetated patches, the potential habitat loss associated with the Project is unlikely to present significant barriers to any existing population to the extent where it would become fragmented.
Reduce gene flow among populations	**No.** Given the linear nature of the Project and the ability for the species to disperse between vegetated patches, the potential habitat loss associated with the Project is unlikely to isolate habitat to the extent where genetically distinct populations would form.

Evaluation Criteria	Response
Disrupt ecologically significant locations (breeding, feeding or nesting sites)	**No.** The generalist nature of the species means it has broad habitat requirements and a lack of limiting habitat features (such as hollow-bearing trees or rocky relief) needed for its survival. Additionally, there are large areas of potential habitat for the species in the Study Area and region. Therefore, habitat within the Disturbance Footprint is not regarded as ecologically significant.

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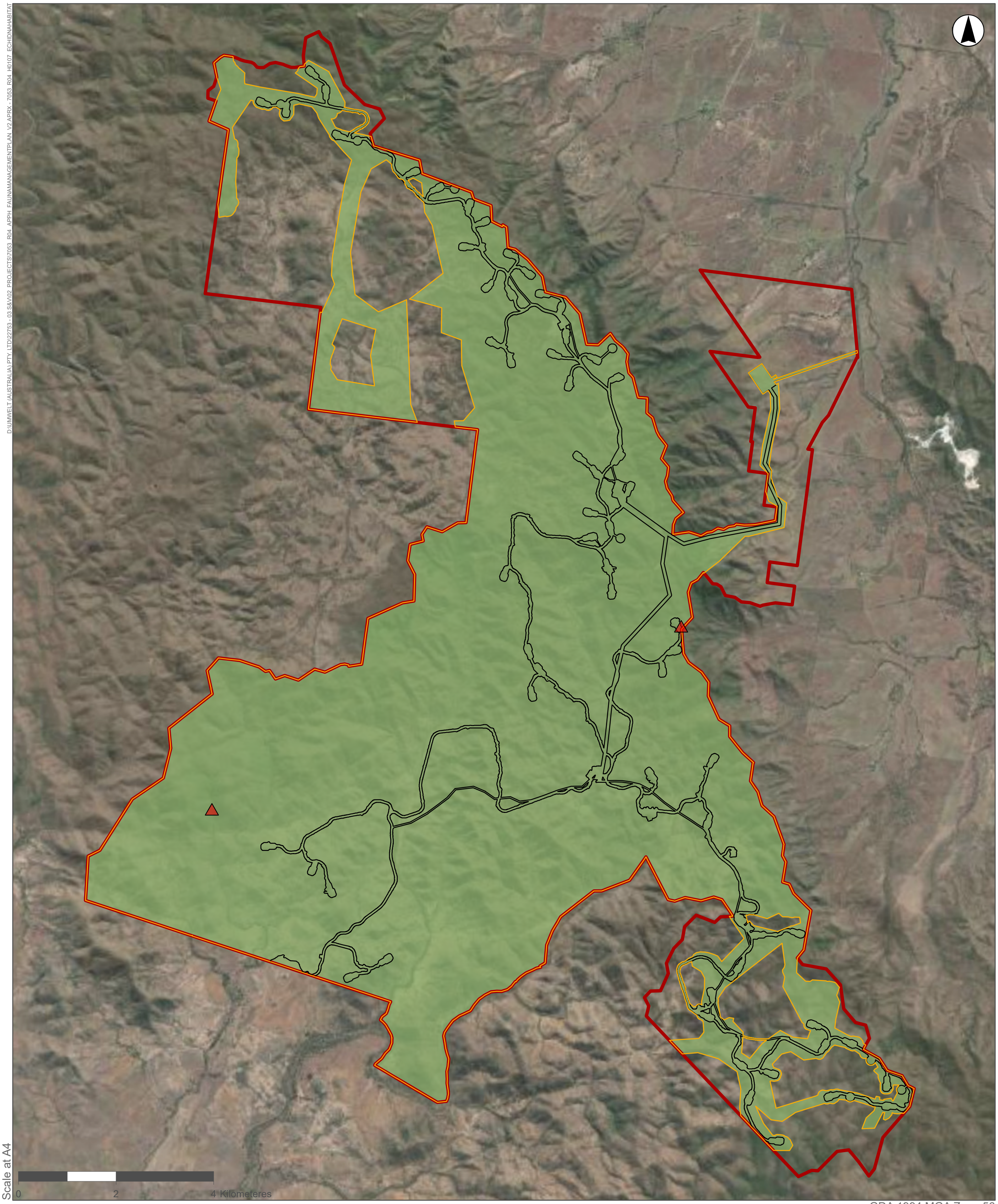

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GDA 1994 MGA Zone 56

Legend

- short-beaked echidna(*Tachyglossus aculeatus*)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- Short-beakd Echidna Habitat

FIGURE 1.7

SHORT-BEAKED ECHIDNA HABITAT

2.0 Connectivity

Connectivity areas are areas of remnant vegetation outside urban areas that are required for ecosystem functioning (including facilitating fauna movement). In deciding if a significant residual impact is likely to occur on a connectivity area, an administering agency (that is the State) must consider the significance of the vegetation in the context of the local and the regional landscape. As described in the Queensland Environmental Offsets Policy (version 1.13) (Department of Environment and Science, 2022), the local and regional fragmentation needs to be quantified.

DES have developed the Landscape Fragmentation and Connectivity (LFC) tool to be used as a decision support tool to quantify any significant impact on connectivity. Consistent with the original Development Application material, the LFC tool has been employed as the primary method in assessing whether or not the Project may have an SRI on connectivity areas. However, habitat and landscape connectivity more broadly, as well as the fauna values that are known or likely to occur on site have also been considered in the context of the Project impacts. This reflects recent advice from the Department of Resources (DoR).

2.1 LFC Tool

The LFC tool determines the significance of a proposed impact on connectivity areas by assessing:

1. Whether the change in the core ecosystem extent at the local scale (post impacts) is greater than a threshold determined by the level of fragmentation at the regional scale; OR

2. If any core area (greater than or equal to one hectare) is lost or reduced to patch fragments (core to non-core).

The LFC tool was run using default values for test parameters and the most recently published version of the DoR Regulated Vegetation Management map (version 6.06).

As per the LFC tool output log file, the Project will result in direct impacts to 323.67 ha of vegetation within a Category B area on the Regulated Vegetation Management map (i.e. connectivity areas). The specific results as they pertain to each of the above tests is provided in Table 2.1 below. In summary, the analysis determined any impact on connectivity areas is not significant.

Table 2.1 Significant Residual Impact Assessment Criteria for Connectivity Areas

Impact Criteria	SRI Outcome
An action is likely to have a significant residual impact on connectivity areas if the action will result in:	
1. The change in the core remnant ecosystem extent at the local scale (post impact) is greater than a threshold determined by the level of fragmentation at the regional scale	**No**. The tool determined that the regional extent of core remnant is 87,990.46 ha or 32.80%. Based on this, the fragmentation local impact threshold of 10% applies. Clearing required for the Project will result in a 2.88% reduction of core areas at the local scale. As this is below 10%, test one does not indicate a significant impact on connectivity.
2. Any core area that is greater than or equal to 1 ha is lost or reduced to patch fragments (core to not-core)	**No.** The tool determined that there is one core remnant area occurring on site (i.e. intersecting the Disturbance Footprint). This core area is predicted to remain on site post impact. Therefore, test two does not indicate a significant impact on connectivity.

2.2 Other Considerations

The Study Area comprises relatively large areas of both cleared non-remnant vegetation (Category X) and intact remnant vegetation (Category B) as shown on the DoR Regulated Vegetation Management map. Category B areas are common within the central Study Area (occurring across the entire width), in the far north and in the far south-east. Remnant vegetation is generally well connected, predominantly occurring as a continuous patch that extends beyond the Study Area largely in a north-west to south-east direction. Remnant vegetation directly adjacent to the Study Area includes several parks or protected areas including Bouldercombe Gorge Resources Reserve, Ulam Range State Forest, Gelobera State Forest, Don River State Forest and Mount Hopeful Conservation Park. This potential north-west/south-east biodiversity corridor is recognised as a State significant biodiversity corridor as per the DES Biodiversity Planning Assessment (BPA) corridor mapping.

As described in Section 6.1.1, the Project design has been subject to an ecological constraint analysis and as a result has undergone several revisions since initial concept designs in 2021. A key initial input in the constraints analysis was the delineation of remnant and regrowth habitat types from non-remnant cleared areas, as well as the identification of suitability for threatened fauna species. This process directed infrastructure towards pre-disturbed areas, avoiding fauna habitat and connectivity areas to the greatest extent possible.

Since the original Development Application, the Project size and scope has been significantly reduced. Initially comprising 116 turbines and covering the majority of the Study Area, the Project now involves up to 63 turbines and will be contained in a smaller and more compact footprint that avoids areas of intact remnant vegetation in the south west as well as portions of the Ulam Range ridgeline in the east. Despite these positive changes, it is acknowledged that the Project will still result in the loss of approximately 324 ha of State-mapped remnant vegetation, which also provides habitat for several threatened species. Habitat within the Disturbance Footprint and the wider Study Area has been historically subjected to low level fragmentation impacts as a result of ongoing agricultural works, including the creation of farm dams, tracks, firebreaks and installation of fences. Vegetation clearing required for the construction of the Project may exacerbate existing fragmentation impacts.

Threatened fauna species relevant to the Study Area that are considered most susceptible to fragmentation impacts include koala (*Phascolarctos cinereus*) and greater glider (*Petauroides volans*). To ensure fauna movement opportunities are maintained for these species, the Project has committed to the installation of glider poles at a thirteen key locations as well as five 'pinch points'. Pinch points describe locations of the Disturbance Footprint which are reduced in width to the extent that individuals can easily disperse across (i.e. based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). For more detail on these measures see Section 6.3.2 of the main body of this report.

The Disturbance Footprint (i.e. maximum clearing extent for the Project) is primarily linear and narrow. Notwithstanding the above, the threatened species known or considered likely to occur within the Study Area are highly mobile and/or are known to utilise cleared areas to disperse. Project infrastructure is not anticipated to create barriers to fauna movement within the Study Area or to adjacent areas as cleared areas will be reinstated to a safe and stable surface, and in select locations, rehabilitated. Based on this, and the large availability of remnant vegetation in the immediate surrounding area that will be retained, it is considered likely that existing populations will continue to disperse and access resources within and beyond the Study Area following the Project. The north-west/south-east biodiversity corridor will be maintained. Based on the above considerations, it is considered unlikely that the Project would result in a significant residual impact to connectivity.

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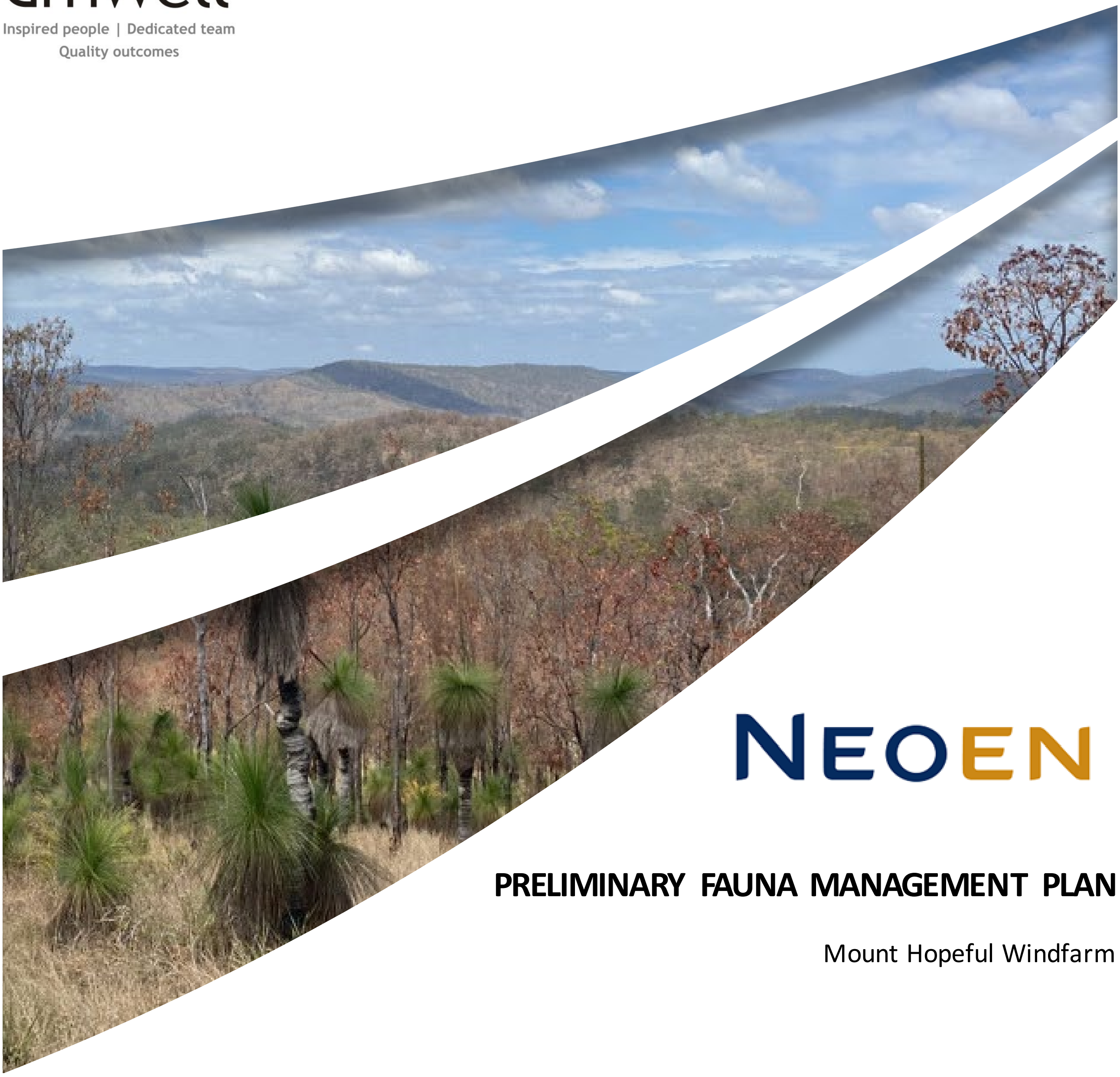
APPENDIX G

Preliminary Fauna Management Plan



Inspired people | Dedicated team
Quality outcomes

PRELIMINARY FAUNA MANAGEMENT PLAN

Mount Hopeful Windfarm

FINAL

May 2023

PRELIMINARY FAUNA MANAGEMENT PLAN

Mount Hopeful Windfarm

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Neoen Australia Pty Ltd

Report No. R27
Project Number 7053
Date: May 2023

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Abbreviations

Abbreviations	Description
AEMO	Australian Energy Market Operator
AHD	Australian Height Datum
BBAMP	Bird and Bat Adaptive Management Plan
BESS	battery energy storage systems
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DoR	Department of Resources
DSDILGP	Department of State Development, Infrastructure, Local Government and Planning
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPMs	Exploration Permits for Minerals
PFMP	Preliminary Fauna Management Plan
ha	hectare
km	kilometres
LGA	Local Government Areas
MCU	Material Change of Use
MNES	Matters of National Environmental Significance
MSES	Matter of State Environmental Significance
MW	megawatts
NC Act	*Nature Conservation Act 1992* (Qld)
Neoen	Neoen Australia Pty Ltd
PO	Performance Outcome
QREZ	Queensland Renewable Energy Zones
RE	Regional Ecosystem
SIS	State Infrastructure Strategy
TEC	Threatened Ecological Communities
the Project	Mount Hopeful Wind Farm
Umwelt	Umwelt (Australia) Pty Ltd
WoNS	Weeds of National Significance
WTG	wind turbine generator

Table of Contents

Figures

Tables

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) is supporting Neoen Australia Pty Ltd (Neoen) in obtaining planning and environmental approvals for the Mount Hopeful Wind Farm (the Project). The Project is located approximately 45 kilometres (km) south of Rockhampton and 65 km west of Gladstone, within the Central Queensland Region.

The Project involves the development of a wind farm containing up to 63 wind turbine generators (WTGs) and ancillary infrastructure including up to ten temporary and ten permanent wind monitoring masts, six substations, battery energy storage system (BESS), temporary construction compound/laydown areas, a concrete batching plant, high voltage (275 kilovolt (kV)) overhead powerlines, as well as underground power and communication cables. The Project is expected to have a maximum generation capacity of approximately 400 megawatts (MW).

The purpose of this Preliminary Fauna Management Plan (PFMP) is to provide an overview of how fauna, including threatened species will be managed for the Project. This PFMP has also been prepared to comply with the conditions of the initial development approval (2109-24892 SDA) dated 17 June 2022 from the State Assessment and Referral Agency (SARA), and has been prepared in consideration of the amended design that is presently being considered by SARA as a Minor Change.

1.1 Ecology Study Boundaries

Information contained within the Mt Hopeful EPBC Act Assessment (Umwelt (Australia) Pty Limited, 2022), has been used to inform and develop this PFMP. Four distinct boundaries are presented that are relevant to the Project and this PFMP including:

- Study Area: refer to **Section 1.1.1**.
- Ground-truthed Mapping Extent: refer to **Section 1.1.2**.
- Development Corridor: refer to **Section 1.1.3**.
- Disturbance Footprint: refer to **Section 1.1.4**.

Figure 1.1 displays the above boundaries.

1.1.1 Study Area

The Study Area refers to the 17 land parcels and local road reserves proposed to host the Project within the Rockhampton Regional Council and Banana Shire Council Local Government Areas (LGA), where development consent is being applied for. The total area of the Study Area is 16,757.5 hectares (ha).

The predominant land use in the Study Area is agriculture, comprising mostly beef cattle grazing. Elevations within the Study Area ranges from approximately 190 metres (m) Australian Height Datum (AHD) to 500 m AHD, characterised by varying landform within the Study Area that comprises of peaks and valleys, with areas of lower, generally flatter topography surrounding the Study Area to the east and west.

Major highways in proximity to the Study Area include the Bruce Highway to the east, Burnett Highway to the west, and the Dawson Highway to the south. These major transport corridors link to the cities of Rockhampton and Gladstone, as well as the Port of Gladstone from which the proposed turbine components will be transported. Access to the Study Area is primarily via local government roads managed by Banana Shire Council including McDonalds Road and Playfields Road to the south-west. Details of all land parcels within the Study Area are provided in **Table 1.1**.

Table 1.1 Study Area Land Parcels

Lot and Plan	Address	Tenure	Local Government Area	Area (ha)
Lot 21 RN1345	Glengowan Road, Ulogie QLD	Freehold	Banana	5,196.6
Lot 24 RN34	Glengowan Road, Ulogie QLD	Freehold	Banana	2,752.5
Lot 23 RN25	Glengowan Road, Ulogie QLD	Freehold	Banana	976.2
Lot 30 RN72	Glengowan Road, Ulogie QLD	Freehold	Banana	1,723.7
Lot 21 RN46	1682A South Ulam Road, Bajool QLD	Freehold	Rockhampton	1,470.6
Lot 25 RN25	1682A South Ulam Road, Bajool QLD	Freehold	Rockhampton	183.5
Lot 2039 RAG4056	1682A South Ulam Road, Bajool QLD	Freehold	Rockhampton	801.0
Lot 1933 RAG4058	1682A South Ulam Road, Bajool QLD	Freehold	Rockhampton	826.3
Lot 2057 RAG4059	1682A South Ulam Road, Bajool QLD	Freehold	Rockhampton	845.9
Lot 15 RN1089	1682A South Ulam Road, Bajool QLD	Freehold	Rockhampton	585.9
Lot 148 DS151	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	235.4
Lot 2420 DT4077	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	64.8
Lot 2345 DT4077	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	105.3
Lot 50 DT40144	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	24.3
Lot 33 DT40123	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	66.5
Lot 38 DT40131	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	71.5
Lot 100 SP28944	1682 South Ulam Road, Bajool QLD	Freehold	Rockhampton	595.0
Local road reserves	Not Applicable	Road reserve	Banana and Rockhampton	232.6
			Total Area	**16,757.5 ha**

1.1.2 Ground-truthed Mapping Extent

The Ground-truthed Mapping Extent covers 12,924.1 ha and represents the limit of the vegetation mapped within the Study Area. Due to the dynamic nature of the Project, some areas surveyed no longer fall within the Study Area boundary, and within the Study Area, not all areas of each land parcel were entirely surveyed.

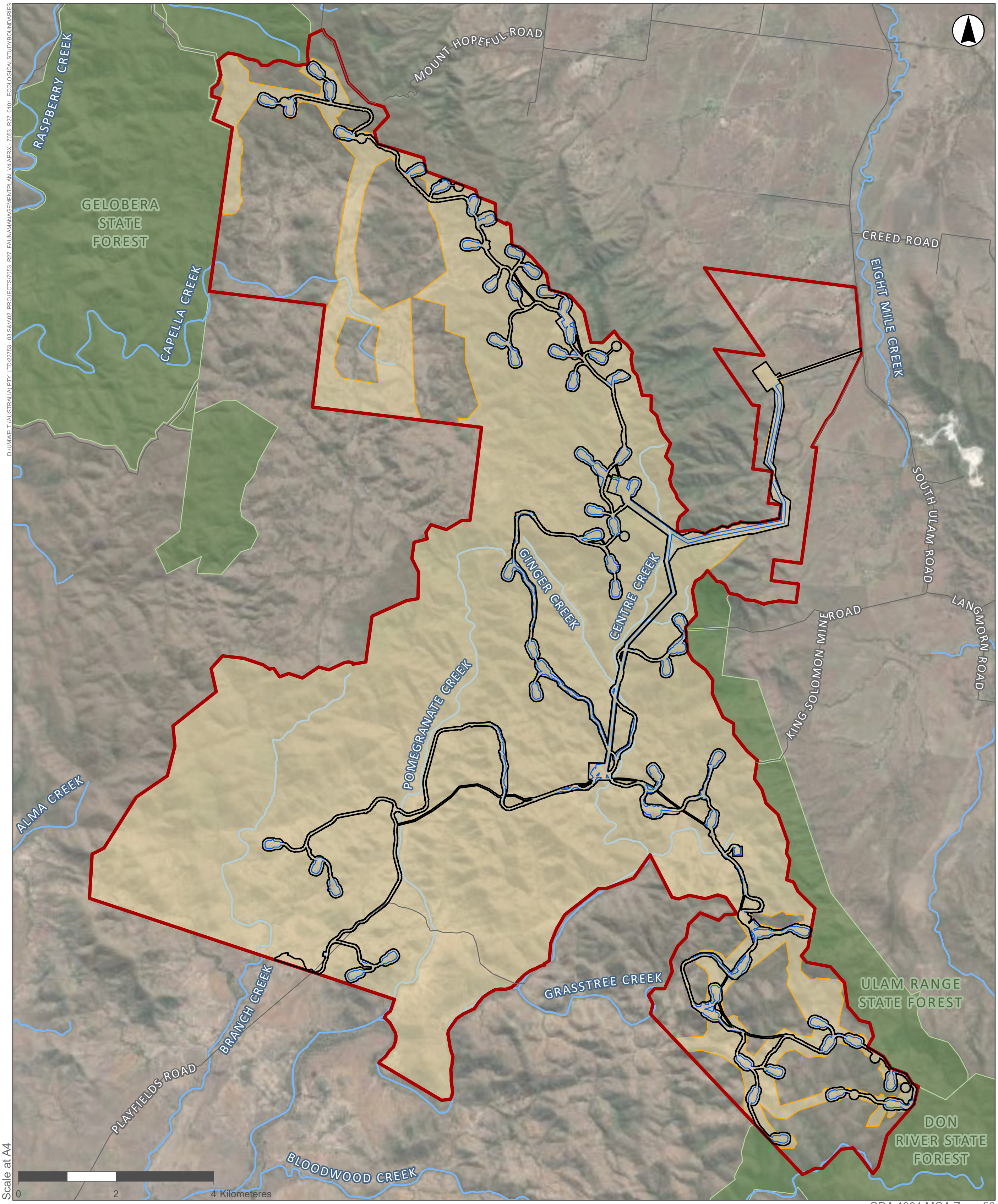
It should be noted that this boundary does not represent the spatial bounds in which all Project field surveys have been conducted (this area being larger and including areas outside of the Study Area). This area will not be referred to within this report.

1.1.3 Development Corridor

The Development Corridor is a 'buffered' version of the indicative Project layout, covering approximately 1,347.4 ha. This area represents the maximum spatial extent where disturbance may occur within the Study Area and includes areas required for temporary and permanent Project infrastructure, equipment and materials laydown, installation and access.

1.1.4 Disturbance Footprint

The Disturbance Footprint covers approximately 877.5 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure.



GDA 1994 MGA Zone 56

Legend

- Roads
- Watercourse
- Study Area
- Development Corridor
- Disturbance Footprint
- Ground-truthed Mapping Extent
- State Forest

FIGURE 1.1

Ecological Study Boundaries

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.2 Project Description

1.2.1 Project Infrastructure

The Project will utilise existing infrastructure as well as construct new Project infrastructure, refer **Section 1.2.1.1** and **Section 1.2.1.2** below.

1.2.1.1 Existing Infrastructure

Powerlink electricity towers and associated overhead electricity transmission lines adjoin the Study Area to the east. An existing telecommunication tower is located approximately 2 km north of the Study Area. A 120 m guyed lattice meteorological mast was erected over the Study Area in August 2020, as well as a 140 m and 110 m guyed lattice meteorological mast in November 2022.

Other rights and encumbrances of note include:

- An easement (A RP612717) for high voltage electricity transmission line intersecting the eastern portion of the Study Area on Lot 100 SP289441.
- A strata for a Profit à Prendre (030 RN72) over Lot 30 RN72 for a Forest Consent Area to the State of Queensland (represented by the Department of Agriculture and Fisheries).
- Three Exploration Permits for Minerals (EPMs) overlap the Study Area, comprising EPM 15810 held by Mount Morgan Exploration Pty Ltd, EPM 27098 held by GBM Resources Limited, and EMP Application area 27105 held by Prophet Resources Pty Ltd.

1.2.1.2 Proposed Infrastructure

The Project will construct 63 WTGs with the turbine specifications used for the assessment shown in **Table 1.2**. These specifications are an upper limit and are intended to provide flexibility for any innovation in turbine design between now and the time of detailed design and construction.

Table 1.2 Turbine Specifications

Feature	Maximum Specifications
Project generation capacity	Approximately 400 MW
Turbine electrical output	Approximately 6.5 MW
Maximum number of turbines	63
Tip height	Up to 260 m
Blade length	Up to 90 m

The Project will also require the provision of ancillary infrastructure, including the following:

- Up to 10 temporary wind monitoring towers.
- Up to 10 permanent wind monitoring towers.
- Up to six substations, a BESS and ancillary electrical infrastructure.

- Up to 13 km of high voltage (275 kV) overhead powerlines.
- Site operational, maintenance and storage areas containing permanent site offices, workshops, warehouses, mobile offices, lunchroom, amenities and ablutions.
- Overhead and/or underground power and communication cables.
- Up to 175 km of gravel capped roads.
- Two permanent site access points.
- A range of temporary infrastructure to facilitate the construction of the Project, including:
    - One construction compound.
    - A temporary worker's accommodation camp to provide for a peak construction workforce of up to approximately 450 staff and including a water treatment plant, sewage treatment plant and sprayfield.
    - Three concrete batching plants.
    - Two laydown areas.

1.2.2 Anticipated Project Timeline

A summary of the anticipated construction works associated with the Project are provided in **Table 1.3**.

Table 1.3 Anticipated Construction Works

Project Stage/Component	Description
Construction Commencement, Completion and Commissioning of Project	• Commencement of construction works: Quarter 4, 2023. • Completion of construction works: Quarter 3, 2025. • Commissioning of the Project: Scheduled in Quarter 4, 2025.
Duration of Construction Works	• Between 22 and 28 months.
Planned Construction Activities	• Site establishment (temporary site facilities, lay down areas, equipment and materials). • Earthworks for access roads and wind turbine hardstands. • Excavations for the foundations. • Construction of wind turbine foundations. • Installation of electrical and communications cabling and equipment. • Installation of wind turbine transformers, in parallel with electrical reticulation works. • Arrival of wind turbine components to the Project Site. • Installation of wind turbines. • Commissioning of wind turbines. • Reliability testing.

1.3 Aim and Objectives

The aim of this PFMP is to reduce the potential impact on fauna species and their habitat within the Study Area by outlining mitigation and management measures to be implemented throughout the duration of the Project. The specific objectives of the PFMP are to:

- Provide a description of the nature and location of Project activities including approximate timing where possible.
- Provide a description of the occurrence and extent of fauna species and their habitat across the Study Area and Disturbance Footprint, including threatened fauna habitat and known threatened species records.
- Provide a description of the location and extent of works required, including how Project activities have been designed to minimise impacts on fauna and fauna habitat.
- Provide information on the roles, responsibilities, and training requirements in relation to fauna management.
- Outline mitigation and management measure to be implemented throughout the duration of the Project to reduce impacts on fauna and fauna habitat.
- Outline the pre-clearance survey methodology.
- Detail the monitoring and reporting requirements for pre-construction, construction, post-construction, and operation phases of the Project, including:
    - Threatened fauna monitoring.
    - Pest fauna monitoring.
    - Bird and bat monitoring as detailed in the Bird and Bat Adaptive Management Plan (BBAMP).

In addition to this PFMP, a Construction Environmental Management Plan (CEMP) will be developed for the Project to address management of environmental values. This plan will include, but not be limited to, the management of noise and vibration, sediment and erosion control, air quality and weed and pest management.

Potential impacts on fauna and fauna habitat values detailed in this document have been determined based on the Disturbance Footprint, which represents worst-case scenario direct impacts (see **Section 1.1.3** above).

2.0 Legislative Context

The legislation relevant to the PFMP is summarised in **Table 2.1**.

Table 2.1 Legislation Relevant to the Project

Relevant Legislation	Governing Agency	Summary	Project Relevance
Commonwealth Legislation			
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	The EPBC Act is Australia's key piece of environmental legislation. It outlines nine Matters of National Environmental Significance (MNES). Actions that adversely affect MNES may be deemed to be a controlled action under the EPBC Act.	The following MNES are relevant to the Project: • Threatened Species • Migratory Species
EPBC Act Environmental Offsets Policy	DCCEEW	The EPBC Act Environmental Offsets Policy outlines the use of environmental offsets under the EPBC Act and are considered during the assessment phase of an environmental impact assessment. Specifically, this policy applies to project assessments and approvals under Parts 8 and 9 of the EPBC Act, in addition to strategic assessments under Part 10.	Pending the outcomes of the EPBC Act referral decision, offsets may be required.
State Legislation			
Planning Act 2016 (Planning Act)	Department of State Development, Infrastructure, Local Government and Planning (DSDILGP)	Applications for a Material Change of Use MCU for a new or expanding wind farm and Operational Works for Native Vegetation Clearing must be assessed against the benchmarks included in State Code 23 and State Code 16 of the State Development Assessment Provisions 16. Development that is a Material Change of Use (MCU) for a wind farm should demonstrate compliance with 13 performance outcomes (PO) and associated acceptable outcomes within the code.	State Code 23 requires assessment against PO5 – Flora and Fauna: *Development is designed, sited and operated to ensure that flora, fauna and associated ecological processes are protected from adverse impacts.* State Code 16 requires assessment against benchmarks relating to offset areas, minimisation of clearing, and clearing associated with wetlands, watercourses and drainage features, connectivity areas, Endangered and Of Concern Regional Ecosystems (REs), and Essential Habitat.

Relevant Legislation	Governing Agency	Summary	Project Relevance
Nature Conservation Act 1992 (NC Act)	Department of Environment and Science (DES)	The purpose of the NC Act is to conserve biodiversity by creating and managing protected areas, managing and protecting native wildlife, and managing the spread of non-native wildlife.	Where a proposed development will result in impacts to fauna protected under the NC Act, authorisation from the Director General of the DES is required. The following fauna values under the NC Act are relevant to the Project: • Threatened fauna species. • Connectivity.
Biosecurity Act 2014	Department of Agriculture and Fisheries	The *Biosecurity Act 2014* lists fauna pest species as either a Prohibited or Restricted biosecurity matter.	The *Biosecurity Act 2014* defines specific requirements for notification and management actions for all listed biosecurity matters, including specific requirements for the disposal of Restricted Matters.
Environmental Offsets Act 2014 (EO Act)	DES	An environmental offset condition may be imposed under certain Queensland legislation that applies to development assessment where the activity is a prescribed activity under the EO Act. Activities which have an impact on a Matter of State Environmental Significance (MSES) may require offsetting under the Act.	Consideration of offsetting requirements for the Project will need to be determined once a fixed design for the Project is completed. Requirements will also need to be considered in conjunction with overlapping EPBC Act requirements. Environmental offsets are therefore not discussed as part of this report.

3.0 Fauna Values

Fauna surveys were conducted within representative locations of all fauna habitat types. The adopted methodology followed recommendations outlined in Queensland survey guidelines, *Terrestrial Fauna Survey Guidelines for Queensland, Version 3* (Eyre et al., 2018). Specific methods employed are detailed in **Table 3.1** below.

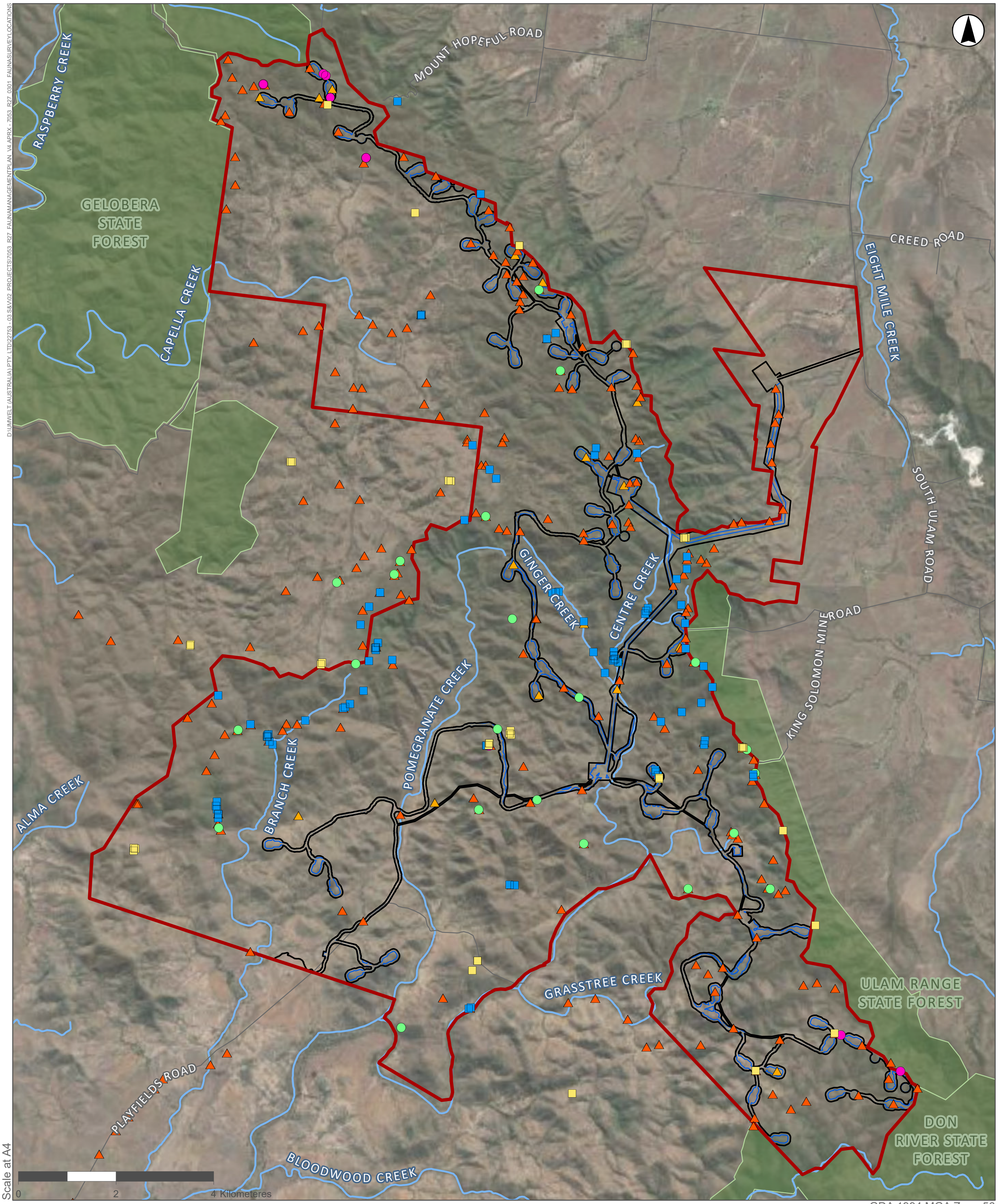
Due to the location of the Study Area, terrain difficulties, ethical requirements and remote access, intensive trapping methodologies were limited to a few locations and remote sampling techniques were instead adopted, including the use of cameras and acoustic monitoring devices.

Survey effort outlined in **Table 3.1** covers the full field survey program which was conducted across an area larger than the Study Area, including areas directly adjacent as well as land parcels to the west. Fauna survey locations are displayed on **Figure 3.1**.

Table 3.1 Fauna Survey Techniques

Technique	Description	Survey Effort
Bird Survey (General)	Roaming/meandering bird surveys using both visual and auditory identification was conducted within all habitat types. Active birding was also completed at farm dams and watercourses where accessible.	99 person-hours
Bird Survey (Vantage Point)	High points within the landscape with clear vantage of proposed turbines and adjacent valleys were surveyed for birds. All birds heard and observed were recorded along with flight heights and behaviours. Vantage point surveys were undertaken to characterise bird assemblages within the Study Area. The presence of threatened and migratory bird species was a key focus, including the white-throated needletail, fork-tailed swift, red goshawk and squatter pigeon (southern).	225 person-hours
Spotlighting and Call Playback	Spotlighting was undertaken on foot targeting grey-headed flying fox, ghost bat, greater and koala habitat, including areas of vine thicket and eucalypt woodland. Spotlighting was also undertaken from the passenger window of a slow-moving vehicle. Call playback surveys were also undertaken targeting nocturnal bird species as well as koala within eucalypt woodland on hills and slopes.	60 person-hours 6 hours
Elliott Trapping	Type A aluminium Elliot traps targeting small mammals and reptiles were placed at approximately 10 m intervals along two transects. Traps were baited with a mixture of rolled oats, peanut butter, honey and vanilla essence, and checked each morning to identify and release captured fauna.	320 trap nights
Pitfall Trapping	Pitfall trapping was undertaken using 20 litre (L) buckets dug into the ground until the top of the bucket was flush with the surface of the ground. Three buckets were used at each site separated by approximately 10 m. A drift fence, approximately 30 cm high, was erected between each bucket to direct small animals towards the pitfall traps.	27 trap nights

Technique	Description	Survey Effort
Active Searches	Active diurnal searches were conducted within all habitat types to identify the present of fauna or signs of fauna activity including scats and scratches. Searches included scanning the trees and ground, searching beneath microhabitat such as rocks, fallen timber and peeling bark, digging through leaf litter and soil at tree bases and flushing birds from areas with a dense or grassy ground cover. Grass tussocks were gently disturbed to potentially flush ground-dwelling birds such as the threatened squatter pigeon (southern). Disturbance to microhabitat features and reptiles was kept to a minimum. Active searches were also completed opportunistically at Habitat Assessment and SAT sites.	58 person-hours
Camera Trapping	Camera traps were deployed in strategic positions including fauna corridors and watering points such as dams and creek lines to record visitation by nocturnal and diurnal animals. Camera traps comprised baited set-ups using honey oat mix and/or sardines as an attractant.	490 trap nights
Acoustic Bat Call Detection	Anabat Swift devices were deployed in representative microbat foraging and dispersal habitat including natural flyways, along watercourses and at BBUS vantage locations to record the presence of microbats. Data recorded on the bat recorders were analysed by a qualified specialist, Greg Ford of Balance! Environmental. The format and content of the analysis summary reports comply with nationally accepted standards for the interpretation and reporting of Anabat data. Anabat Swift devices were used in surveying for ghost bat.	111 nights
Harp Trapping	Single and double-bank harp traps were positioned in natural flyways associated with a creek line in locations of eucalypt woodlands to target microbat species. This method was used to target various microbat species including ghost bat.	14 trap nights
Koala SAT	Targeted searches for koala presence through identification of scats and scratched within all accessible broad habitat types (Phillips and Callaghan, 2011).	20 sites
Fauna Habitat Assessment	Fauna habitat values were characterised using a comprehensive habitat assessment methodology within all accessible broad habitat types capturing variation in condition, vegetation types and disturbances. The presence and abundance of specific habitat resources was also assessed, including but not limited to: • Koala food and shelter trees. • Hollow bearing trees and stags. • Fallen logs, woody debris and leaf litter. • Rocky features such as surface rocks, boulders, crevices, overhangs and caves. • Proximity to water. These assessments were used to inform habitat modelling for each of the potentially occurring or known MNES.	224 sites
Incidental Observations	All fauna observed incidentally throughout the Study Area were recorded, including while traveling to and between vantage point sites. For each record the following were noted; species, location of the observation recorded, abundance, flight behaviour, flight height and flight direction.	-



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Legend

Fauna Survey Locations

- Anabat
- Camera
- Harp Trapping
- Koala SAT
- Fauna Habitat Assessment
- Fauna Habitat Quality Assessment
- Study Area
- Disturbance Footprint
- Development Corridor
- Roads
- Watercourse

State Forest

FIGURE 3.1

FAUNA SURVEY LOCATIONS

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

3.1 Study Area Characteristics

The Study Area is characterised by a variety of vegetated environments, including cleared agricultural land as well as regrowth and remnant Eucalypt woodlands and vine thicket across an undulating terrain. The dominant vegetation communities across the Study Area are woodlands and forests dominated by narrow-leaved ironbark (*Eucalyptus crebra*), spotted gum (*Corymbia citriodora*) and white mahogany (*Eucalyptus acmenoides*).

The Bouldercombe Gorge Resources Reserve, Gelobera State Forest, Don River State Forest and Ulam Range State Forest are Protected Areas located adjacent to the Study Area, providing connectivity to the broader region.

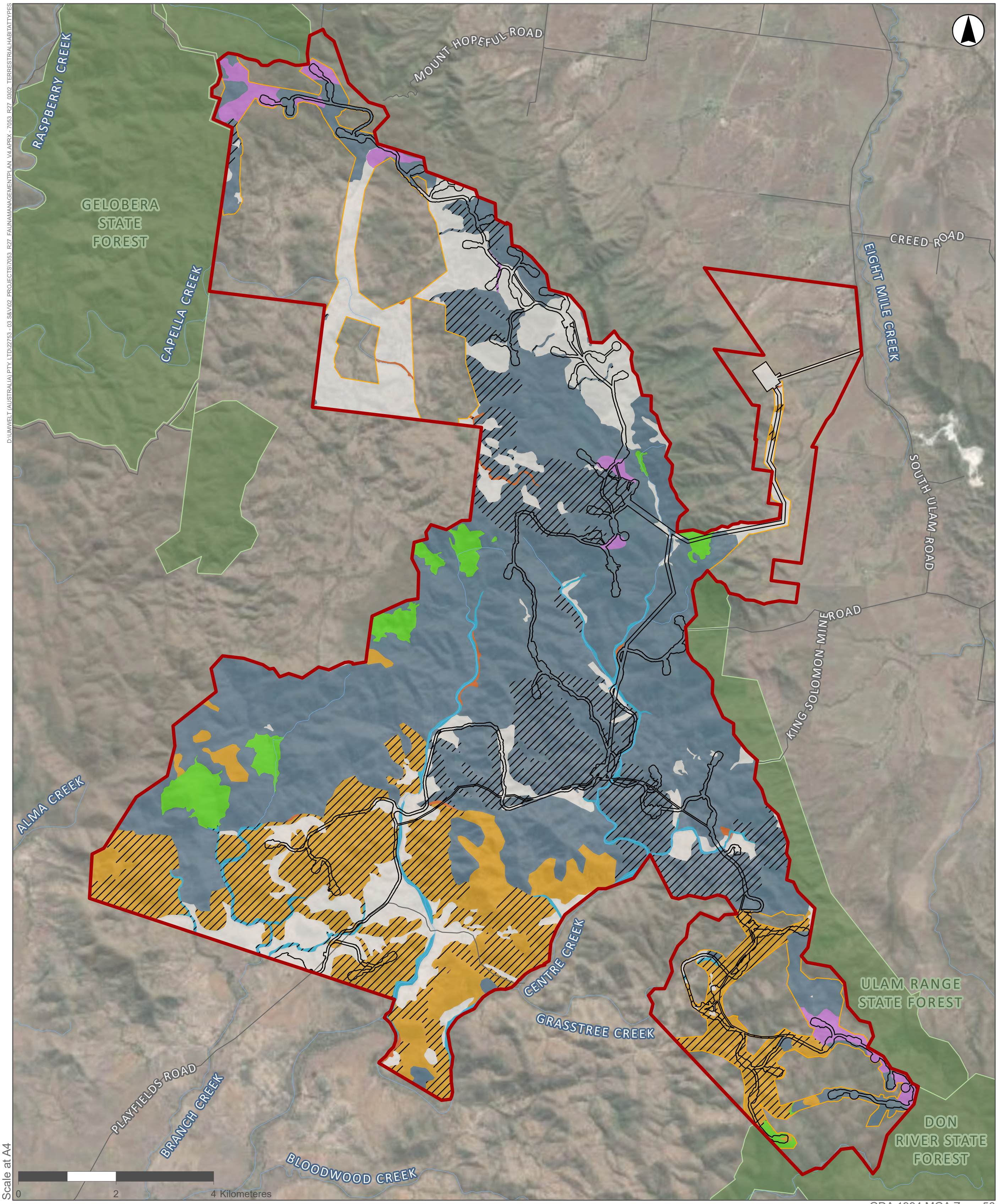
3.2 Terrestrial Habitat Values

Terrestrial habitat assessed during the field survey program can be broadly grouped into seven types, as summarised in **Table 3.2** and shown on **Figure 3.2**.

Table 3.2 Terrestrial Habitat Types within the Ground-truthed Mapping Extent

Habitat Type	Habitat Description	Associated REs	Area (ha)[1] within Ground-truthed Mapping Extent
Mixed eucalypt woodland on steep slopes	Mixed eucalypt woodland on steep slopes and crests, commonly with *Corymbia citriodora* and/or *Eucalyptus crebra* +\- *E. acmenoides*, *E. tereticornis*	11.11.3, 11.11.4, 11.11.4a, 11.11.4b, 11.12.6	7,264.3
Eucalyptus crebra woodland	Eucalyptus crebra +\- Corymbia erythrophloia woodland on slopes and crests	11.11.15, 11.12.1	2,575.5
Eucalyptus moluccana woodland	*Eucalyptus moluccana* woodland on slopes and crests	11.11.3c, 11.11.4c	241.8
Semi-evergreen vine thicket	Vine thicket on upper slopes and gullies with various floristics including *Euroschinus falcatus* var. *falcatus*, *Brachychiton australis*, *Flindersia* spp., *Ficus* sp., *Jasminum* sp., *Alyxia* sp., etc.	11.11.5a 11.12.4	330.8
Riparian *Melaleuca* woodland	*Melaleuca fluviatilis* woodland +\- Eucalyptus tereticornis fringing a watercourse	11.3.25b	240.8
Alluvial eucalypt woodland	Eucalyptus tereticornis +\- Corymbia tessellaris woodland on alluvial soils sometimes with Casuarina cunninghamiana as dominant	11.3.4, 11.3.25	36.9
Non-remnant pasture	Areas containing pasture comprising native and non-native grasses, scattered native trees and various infrastructure including tracks and dams	-	2,234.1

[1]: Areas presented are inclusive of regrowth communities where present.



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Legend

- Roads
- Watercourse
- Study Area
- Disturbance Footprint
- Ground-truthed Mapping Extent
- State Forest
- Regrowth Vegetation

Terrestrial Habitat Types

- Alluvial eucalypt woodland
- Eucalyptus crebra woodland
- Eucalyptus moluccana woodland
- Mixed eucalypt woodland on steep slopes
- Riparian Melaleuca woodland
- Semi-evergreen vine thicket
- Non-remnant

FIGURE 3.2

TERRESTRIAL HABITAT TYPES

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

3.3 Fauna Species Diversity

A total of 211 fauna species from 156 genera were identified during the field survey program, comprising 148 birds, 37 mammals, 19 reptiles and 7 amphibians. Of the species recorded, 6 are introduced, representing 2.8% of the total fauna assemblage recorded. The field surveys also identified 6 introduced species which represents 3.1% of the total fauna species recorded, described further in **Section 3.3.3** below.

3.3.1 Threatened Fauna

Seven threatened fauna species are known from the Study Area, confirmed during the field survey program (**Table 3.3**). Records for threatened species are shown on **Table 3.3**.

The likelihood of occurrence assessment determined that a further two threatened fauna species have a moderate likelihood of occurrence within the Study Area (**Table 3.3**). No species were identified as having a high likelihood of occurrence.

Table 3.3 Likelihood of Occurrence Assessment Results: Threatened Fauna

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Likelihood of Occurrence Outcome
glossy-black cockatoo	Calyptorhynchus lathami	Not Listed	Vulnerable	Known
greater glider (southern and central)	Petauroides volans	Vulnerable	Vulnerable	Known
yellow-bellied glider (south-eastern)	Petaurus australis australis	Vulnerable	Vulnerable	Known
northern quoll	Dasyurus hallucatus	Endangered	Least Concern	Known
squatter pigeon (southern)	Geophaps scripta scripta	Vulnerable	Vulnerable	Known
white-throated needletail	Hirundapus caudacutus	Vulnerable, Migratory	Vulnerable	Known
short-beaked echidna	Tachyglossus aculeatus	-	Special Least Concern	Known
collared delma	Delma torquata	Vulnerable	Vulnerable	Moderate
koala	Phascolarctos cinereus	Vulnerable	Vulnerable	Moderate

In addition to the species outlined in **Table 3.3** three species have been considered relevant to the Project due to the potential presence of habitat within the Study Area. These species, their listing status and justification for assessment has been outlined below in **Table 3.4**.

Table 3.4 Additional Threatened Fauna Considered Relevant to the Project

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Justification for Assessment
red goshawk	Erythrotriorchis radiatus	Vulnerable	Endangered	Habitat within the Study Area may be marginally suitable for foraging and dispersal.
ghost bat	Macroderma gigas	Vulnerable	Endangered	Habitat within the Study Area may be suitable for foraging and dispersal.
grey-headed flying-fox	Pteropus poliocephalus	Vulnerable	Least Concern	Foraging habitat has been identified in the Study Area and includes any vegetation community (remnant or regrowth) which contains important winter/spring flowering species within 40 km of known camps within the Study Area.

Profiles of known and potentially occurring threatened species listed under the NC Act or EPBC Act with the potential to be impacted by Project activities are described in **Table 3.7** and modelled habitat within the Ground-truthed Mapping Extent is shown on **Figure 3.4** to **Figure 3.15**.

3.3.2 Migratory Fauna

Excluding the white-throated needletail (*Hirundapus caudacutus*) which is also listed threatened, two migratory fauna species are known from the Study Area, confirmed during field surveys. Records for these species are shown on **Figure 3.3**. The likelihood of occurrence assessment determined that one species has a high likelihood of occurrence, and three species have a moderate likelihood of occurrence (**Table 3.5**).

Table 3.5 Likelihood of Occurrence Assessment Results: Migratory Fauna

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Likelihood of Occurrence Outcome
rufous fantail	Rhipidura rufifrons	Migratory	Special Least Concern	Known
spectacled monarch	Symposiarchus trivirgatus	Migratory	Special Least Concern	Known
fork-tailed swift	Apus pacificus	Migratory	Special Least Concern	High
black-faced monarch	Monarcha melanopsis	Migratory	Special Least Concern	Moderate
oriental cuckoo	Cuculus optatus	Migratory	Special Least Concern	Moderate
satin flycatcher	Myiagra cyanoleuca	Migratory	Special Least Concern	Moderate

Profiles of known and potentially occurring migratory species listed under the NC Act or EPBC Act with the potential to be impacted by Project activities are described in **Table 3.8** and Ground-truthed Mapping Extent in **Figure 3.16** to **Figure 3.21**.

3.3.3 Introduced Fauna

Field surveys identified six introduced fauna species, four of which are listed as Restricted Invasive biosecurity matters under the *Biosecurity Act 2014*. A breakdown of these species is provided in **Table 3.6**.

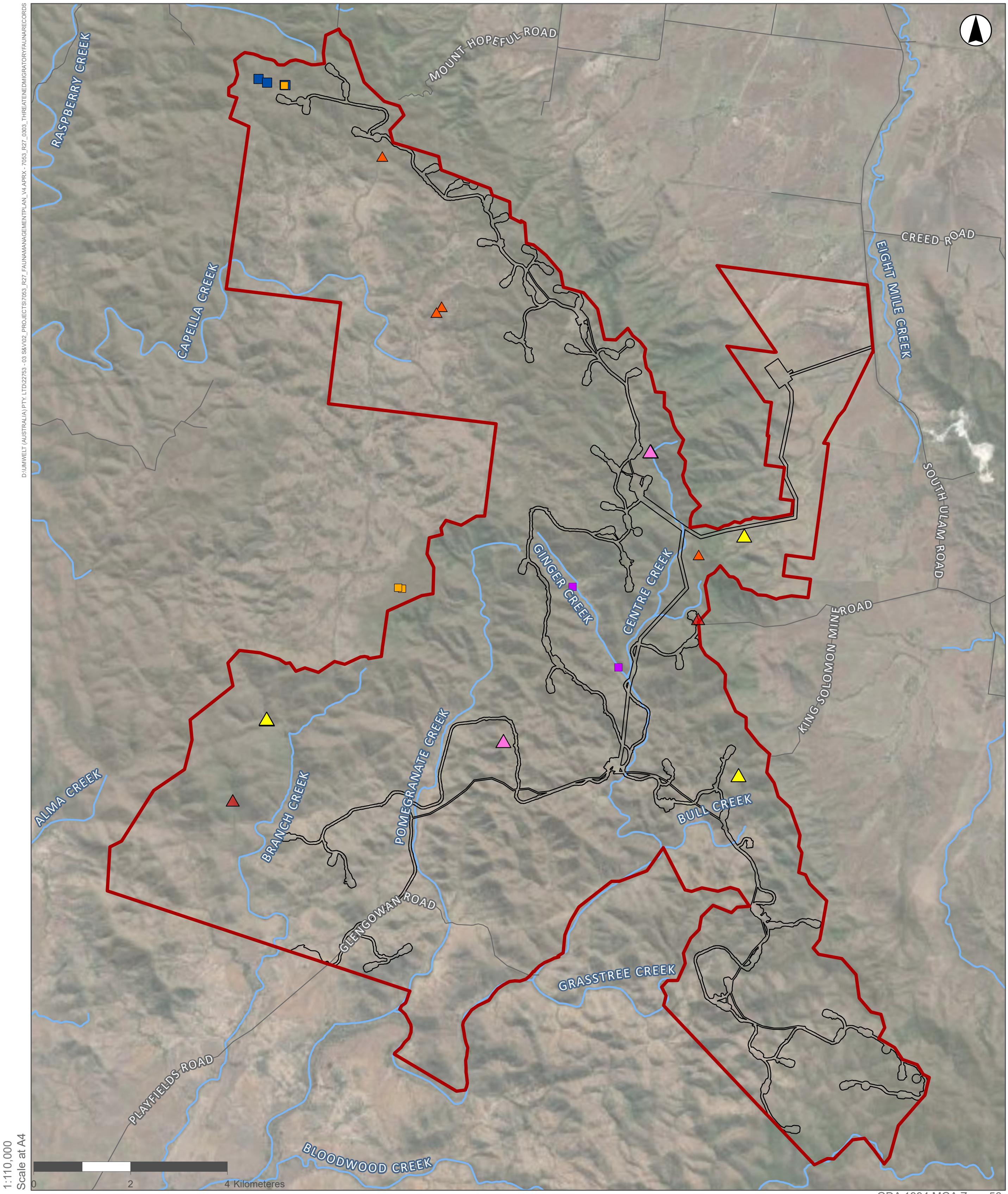
Table 3.6 Introduced Species Recorded within the Study Area

Common Name	Scientific Name	Biosecurity Act 2014 Status
cane toad	Rhinella marina	Invasive
horse	Equus caballus	Invasive
feral cat	Felis catus	Restricted Invasive
feral pig	Sus scrofa	Restricted Invasive
black rat	Rattus rattus	Restricted Invasive
brown hare	Lepus capensis	Restricted Invasive

EPBC Act 'key threatening processes' are processes which threaten the survival, abundance or evolutionary development of a native species or ecological community (Department of Climate Change Energy the Environment and Water, 2022a). Key threatening processes are linked to three of the above introduced species and include:

- The biological effects, including lethal toxic ingestion, caused by cane toads (*Rhinella marina*).
- Predation by feral cats.
- Predation, habitat degradation, competition and disease transmission by feral pigs.

These species are herein referred to as 'pest fauna'.



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Legend

Threatened Fauna Records (Umwelt)

- Northern quoll (*Dasyurus hallucatus*)
- Greater glider (*Petauroides volans*)
- Yellow-bellied glider (*Petaurus australis australis*)

Migratory Fauna Records (Umwelt)

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Squatter pigeon (southern) (*Geophaps scripta scripta*)
- White-throated needletail (*Hirundapus caudacutus*)
- Spectacled monarch (*Symposiachrus trivirgatus*)
- Rufous fantail (*Rhipidura rufifrons*)
- short-beaked echidna(*Tachyglossus aculeatus*)

- Study Area
- Disturbance Footprint
- Roads
- Watercourse

FIGURE 3.3

THREATENED AND MIGRATORY FAUNA RECORD LOCATIONS

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

Table 3.7 Threatened Fauna Species Profiles

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Glossy black-Cockatoo (*Petauroides volans*) – Vulnerable under the NC Act			
	The glossy black-cockatoo prefers woodland areas dominated by she-oak (*Allocasuarina*), or open sclerophyll forests (i.e. *Eucalyptus, Corymbia* or *Angophora*) and woodlands with a stratum of *Allocasuarina* beneath. Glossy black-cockatoos were recorded during the field survey program on three occasions. One observation was made during the bird utilisation survey, where a flock of 22 individuals were observed transiting south from the eastern ridge of the Study Area between 60–90 m above ground level (AGL). The remaining two observations were of small flocks (three individuals), with one group foraging within a stand of forest she-oak (*Allocasuarina torulosa*), and the other group transiting north at 40 m AGL. The location of these records are shown on **Figure 3.3**.	Within the Study Area, glossy black-cockatoos may be found foraging in remnant of regrowth eucalypt woodlands associated with regional ecosystem supporting foraging tree species including those from the genera *Casuarina* and *Allocasuarina* (11.3.25, 11.3.25b, 11.11.3, 11.11.4). The predicted habitat areas are considered an over-representation of potential foraging habitat within the Study Area, with the primary food source, *Allocasuarina torulosa*, distributed unevenly throughout. Potential breeding habitat within the Study Area is uncommon, limited to a single vegetation community (RE 11.11.4c). This community was the only that was found during the field survey program to regularly support rare to occasional large, hollow bearing trees. However, breeding habitat is considered to be marginal, given the lack of large trunk hollows preferred by the species. It should be noted that no evidence of nesting glossy black-cockatoos was recorded during the field survey program. Clearing within the Disturbance Footprint will result in the loss of 23.8 ha of marginal breeding habitat and 242.5 ha of foraging habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Loss of trees with nesting hollows. • Competition for hollows. • Loss of food resources. • Predation. • Inappropriate fire regimes. • Climate change. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Greater glider (southern and central) (*Petauroides volans*) – Endangered under the EPBC Act and NC Act			
	At least two species of greater glider are recognised to occur within Queensland: *Petauroides volans* (southern and central) and *Petauroides minor* (northern). As suggested by the common name, *Petauroides minor* is restricted to a relatively small area of northern Queensland from Townsville to the Windsor Tablelands and has a highly disjunct distribution. Relative to the northern species, the southern and central species (*Petauroides volans*) has a broad and mostly continuous distribution from Proserpine in Queensland, south through NSW and the ACT, to Wombat State Forest in central Victoria. Greater gliders (southern and central) are typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. During the day, this species spends most of its time denning in hollowed trees, with each animal inhabiting up to twenty different dens within its home range. Hollows are therefore an important and limiting habitat resource. As described in the species' Conservation Advice (DAWE, 2022d), the species' probability of occurrence is positively correlated with the availability of tree hollows.	The greater glider (southern and central) is known to occur within the Study Area, recorded three times during spotlighting surveys. In June 2020, one individual was recorded in a grey box (*Eucalyptus moluccana*) tree 18 m above ground level (AGL) within RE 11.3.26 in an area directly adjacent to the Study Area. In November 2020, another individual was recorded near the June 2020 record within the same patch of *Eucalyptus moluccana* woodland. Targeted nocturnal surveys undertaken in October 2021 resulted in the identification of one further individual within *Eucalyptus moluccana* woodland (RE 11.11.3c) in the north-western portion of the Study Area. The location of these records are provided in **Figure 3.3**. Eucalypt woodlands and forests dominate the Ground-truthed Mapping Extent and comprise 11 REs identified as 'habitat' or 'potential habitat' consistent with DES. The extent of habitat for greater glider (central and southern) has been mapped in **Figure 3.5**. Clearing within the Disturbance Footprint will result in the loss of 206.9 ha of breeding and denning habitat and 331.5 ha of foraging and dispersal habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Habitat loss. • Fragmentation and modification. • Barbed wire fencing. • Climate change. • Hyper-predation by owls. • Predation by introduced species. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	Greater gliders (southern and central) are primarily folivorous, with a diet mostly comprising the leaves and flowers of Myrtaceae (e.g. eucalypt) trees. It favours forests with a diversity of eucalypt species due to seasonal variation in its preferred tree species. Home ranges of this species are typically relatively small (1–4 ha) but are larger in lower productivity forests and more open woodlands (up to 16 ha) (DAWE, 2022d). They are larger for males than for females, with male home ranges being largely non-overlapping. The species can cover distances up to 100 m however they usually glider approximately 30 m and have a steeper trajectory than other species of glider.		

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Yellow-bellied glider (*Petaurus australis australis*) – Vulnerable under the EPBC Act and NC Act			
	In Queensland, the sub-species is distributed along the coast and eastern seaboard, from the north of Mackay extending southward through the NSW-QLD border. There are also some isolated smaller populations found inland within the Carnarvon Ranges and Blackdown in central Queensland. The yellow-bellied glider (south-eastern) shows preference for large patches of mature old growth forest, particularly with winter-flowering and smooth-barked eucalypt, that provide suitable foraging habitat and shelter (DAWE 2022e). The sub-species relies on hollows for shelter and denning purposes during the day; suitable hollows are generally found in large living trees usually >1 m in diameter. They live in family groups of two to six individuals within exclusive home ranges of approximately 50–65 ha. Because the trees used for foraging and shelter are dispersed and use may vary over time and space, large home ranges are needed (DAWE 2022e). As detailed in the subspecies' Conservation Advice, yellow-bellied gliders (south-eastern) also require some level of floristic diversity to provide a year-round food supply, and they are unlikely to persist in forests dominated by only one or two tree species. Sap feed trees are a critical habitat feature and form an important component of the diet of the yellow-bellied glider (south-eastern), especially when alternative food sources are limited (DAWE 2022e).	The yellow-bellied glider (south-eastern) is known to the Study Area, having been recorded on four occasions, during nocturnal surveys in Autumn, 2021. One record was confirmed via vocalisation, during a call playback survey in October 2021, while the remaining individuals were observed visually during spotlight searches. All records occur in the far-northern extent of the Study Area where the sub-species was recorded utilising *Eucalyptus moluccana* woodland, ground-truthed as RE 11.11.3c. The location of these records are provided in **Figure 3.3**. The extent of habitat for yellow-bellied glider (south-eastern) has been mapped in **Figure 3.6**. Clearing within the Disturbance Footprint will result in the loss of 170.6 ha of breeding and denning habitat and 181.1 ha of foraging and dispersal habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Habitat loss and degradation. • Fragmentation. • Fire disturbance. • Invasive species predation. • Barbed wire fencing. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	Smooth-barked eucalypts are important due to the range of foraging substrates (and therefore food resources) they provide, as loose bark hanging in strips from these trees provides shelter for insect prey. A study from 2005 identified 13 sap tree species in southern Queensland including *Corymbia citriodora*, *Eucalyptus biturbinata*, *E. longirostrata*, *E. major*, *E. melliodora*, *E. moluccana*, *E. tereticornis*, *E. racemosa*, *E. resinifera*, *E. laevopinea*, *E. sphaerocarpa*, *C. intermedia* and *Angophora leiocarpa*.		
northern quoll (*Dasyurus hallucatus*) – Endangered under the EPBC Act and Least Concern under the NC Act			
	The distribution of the northern quoll is discontinuous across northern Australia with core populations in rocky and/or high rainfall areas (Hill and Ward, 2010). In Queensland, the species is known to occur as far south as Brisbane and Toowoomba in the south, as far north as Cape York and extends as far west into central Queensland to the Carnarvon Range National Park. The species' distribution is highly fragmented in Queensland and surveys indicate severe reductions from the species' former distribution.	The northern quoll was detected on camera traps on two occasions. Records were made within fringing riparian *Casuarina cunninghamiana* and *Melaleuca* spp. woodland (RE 11.3.25b) with a rocky stream bed, and in an adjacent rocky gully with large boulders fringed by *Corymbia citriodora* and *Eucalyptus crebra* woodland (RE 11.12.6). The location of these records are provided in **Figure 3.3**. Vegetation, particularly the shrub layer, was structurally complex in these locations. These areas provided denning opportunities, as did similar habitats with rocky relief, predominantly on drainage lines in steep gullies.	The primary threats identified for the species are: • Introduction of invasive species leading to increased competition, direct predation and habitat degradation. • Direct mortality as a result of vegetation clearing and traffic. • Pastoralism, leading to altered fuel loads and fire regimes. • Disease e.g. toxoplasmosis.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The northern quoll occupies a diversity of habitats including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Habitat generally encompasses some form of rocky area for denning purposes with surrounding vegetated habitats used for foraging and dispersal. Eucalypt forest or woodland habitats usually have a high structural diversity containing large diameter trees, termite mounds or hollow logs for denning purposes. A study of northern quolls in Queensland found that the species is "more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and were closer to permanent water". The *EPBC Act referral guidelines for the northern quoll* states that, "on current knowledge, foraging or dispersal habitat is recognised to be any land comprising predominantly native vegetation in the immediate area (i.e. within 1 km) of shelter habitat, quoll records or land comprising predominately native vegetation that is connected to shelter habitat within the range of the species". Northern quolls are opportunistic omnivores, which consume a wide range of pretty items including invertebrates, carrion, fruit nectar, mammals, birds, reptiles and frogs. Cane toads are a food item of particular concern because ingestion of their toxins is a major cause of decline in northern quoll populations.	Extensive foraging and dispersal habitat occurs throughout the Ground-truthed Mapping Extent and likely wider Study Area, generally represented by large, continuous tracts of open eucalypt woodland within 1 km of breeding and refuge habitat. Areas of potential habitat generally contain prey microhabitat including fallen logs, ground timber and small- to medium-sized rocks in varying abundance. Clearing within the Disturbance Footprint will result in the loss of 22.1 ha of denning habitat and 551.4 ha of foraging and dispersal habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined and micrositing is employed to reduce impact to microhabitat features.	The *National Recovery Plan for the Northern Quoll (Dasyurus hallucatus)* aims to reduce the rate of decline for the species within Australia ensuring viable populations persist across the major regions of the species' distribution.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
squatter pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable under the EPBC Act and NC Act			
	The squatter pigeon (southern) occurs on the inland slopes of the Great Dividing Range, from the Burdekin-Lynd Divide in central Queensland, south to West Wyalong in northern NSW. As per the species SPRAT, the known distribution is estimated to occur within the latitudes, 17° to 30° S, and the longitudes, 141° to 153° 30' E. As per the distribution map on SPRAT, the Study Area occurs in the central part of the sub-species range, in the 'likely to occur' extent. North of the Carnarvon Ranges in Central Queensland and possibly in the area between Injune and the Carnarvon Ranges, the species is relatively common and likely to comprise a single, continuous sub-population. Populations in the southern parts of the subspecies' distribution however (i.e. south of Injune and Tin Can Bay, Queensland and NSW) are largely fragmented and isolated; in these areas there have also been noticeable disappearances. The southern boundary of the known distribution of the squatter pigeon (southern) is contracting northwards. The subspecies is known to access suitable waterbodies to drink on a daily basis, including permanent or seasonal rivers, creeks, lakes, ponds and waterholes, and artificial dams. The subspecies prefers to drink where there is gently sloping, bare ground on which to approach and stand at the water's edge.	The squatter pigeon (southern) is known to occur within the Study Area, recorded on 78 occasions throughout the field survey program, although this is likely to include multiple observations of the same individuals. It was commonly recorded along access tracks in non-remnant areas of the Study Area. The location of these records are provided in **Figure 3.3**. Clearing within the Disturbance Footprint will result in the loss of 3.6 ha of breeding habitat, 1.5 ha of foraging and 324.2 ha of dispersal habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Loss and fragmentation of habitat. • Degradation of habitat by overgrazing by domesticated herbivores. • Habitat degradation by invasive weeds such as buffel grass. • Predation by invasive fauna. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The requirements for breeding and foraging habitat are well defined. Breeding habitat comprises remnant or regrowth open-forest to sparse, open-woodland or scrub dominated by *Eucalyptus*, *Corymbia*, *Acacia* or *Callitris* species, on sandy or gravelly soils (predominantly areas mapped as Queensland land zones 3, 5 or 7) within 1 km of a suitable waterbody. Foraging habitat is almost identical, however occurring within 3 km of a suitable waterbody. As described on SPRAT, the ground layer vegetation in foraging and breeding habitat is typically considerably patchy consisting of native, perennial tussock grasses or a mix of perennial tussock grasses and low shrubs or forbs. This patchy, ground layer of vegetation rarely exceeds 33% of the ground area. The remaining ground surface consisting of bare patches of gravelly or dusty soil and areas lightly covered in leaf litter and coarse, woody debris (e.g. fallen trees, logs and smaller debris). Although breeding can occur throughout the year if conditions are good, breeding generally coincides with the dry season (April to October) when their primary food source (grass seed) is most abundant. The nest is a depression scraped into the ground beneath a tussock of grass, bush, fallen tree or log and is sparsely lined with grass.		

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	Squatter pigeon (southern) dispersal habitat is any forest or woodland occurring between patches of foraging or breeding habitat, and suitable waterbodies. Such patches facilitate the local movement of the subspecies between patches of foraging habitat, breeding habitat and/or waterbodies, or the wider dispersal of individuals in search of reliable water sources during the dry season or droughts.		
white-throated needletail (*Hirundapus caudacutus*) – Vulnerable under the EPBC Act and NC Act			
	The white-throated needletail is a large species of swift which is a non-breeding migrant to Australia typically arriving in September and October. They most commonly migrate to Australia via the Torres Strait and disperse in a southerly direction along the eastern and western sides of the Great Divide in Queensland and New South Wales. By November the species reaches the southern extent of its range in Australia dispersing throughout parts of Victoria, south-eastern South Australia and Tasmania. In the Northern Territory and Western Australia, they occur as vagrants. Estimates place the white-throated needletail's range in Australia at 126,200 km^2. White-throated needletails are an almost exclusively aerial, large-bodied swift that are insectivorous feeding on a variety of insect prey items during their migration in Australia across a range of habitat types and landscapes. Whilst in Australia the species is gregarious observed flying in flocks of hundreds and even thousands of birds.	White-throated needletail was recorded on 30 occasions flying over a diversity of habitat types, both incidentally and during the Bird and Bat Utilisation Surveys (BBUS). Six hundred and ninety-eight individuals have been recorded during surveys with a total of 320 individuals recorded at vantage points during BBUS and a total of 378 individuals recorded incidentally across all survey events. The location of these records are provided in **Figure 3.3**. Clearing within the Disturbance Footprint will result in the loss of 267.9 ha of roosting and foraging habitat and 365.9 ha of foraging and dispersal habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species within Australia are: • Wind turbine collision, overhead wires, windows and lighthouses. • Declines due to a reduction of prey abundance or secondary poisoning. • The loss of roosting habitat and invertebrate prey due to clearing of woodland and forest ecosystems. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	They are occasionally observed individually or in smaller groups and can sometimes be found in mixed flocks with other insectivorous aerial species such as fork-tailed swift (*Apus pacificus*) and fairy martins (*Hirundo ariel*). They are regularly recorded above wooded areas including open forest and rainforest, though may also fly below the canopy between trees or in clearings. When flying above farmland, they are more often recorded above partly cleared pasture, plantations, or remnant vegetation at the edge of paddocks. According to the *Referral guideline for 14 birds listed as migratory species under the EPBC Act* (Department of the Environment, 2015a) trees with dense canopy foliage and tree hollows are considered to provide roosting habitat for white-throated needletail, although the degree to which the species roosts in trees in potentially over-emphasised. A radiotracking study on white-throated needletails was able to track an individual to a roosting site in open sclerophyll forest. Although the study was unable to detect the exact roosting tree the dominant tree species included *Eucalyptus crebra*, *Eucalyptus muelleriana, Eucalyptus gummifera* and *Lophostemon confertus*. It is thought the species will return to roost sites over consecutive nights (Tarburton, 1993). Home ranges and territories are not maintained while the birds are in Australia.		

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	During non-breeding migrations to Australia the white-throated needletail feeds on a variety of insects including beetles, cicadas, flying ants, bees, wasps, flies, termites, moths, locusts and grasshoppers. The species feeds up to the height of clouds over a variety of foraging habitats including heavily treed forests. Open foraging habitats include farmland, heathland or mudflats, although the species has been observed feeding at lower altitudes closer to the ground as low as 15 cm at a coastal saltworks. They occasionally forage above recently disturbed habitats, such as recently burned or cleared forest, or above paddocks being ploughed or cut. The species is also known to hunt in updraught locations like ridges, cliffs, or sand dunes. Low pressure systems both lift food sources and provide assistance with flight and needletails often forage at the edge of these systems (Boehm, 1939).		
collared delma (*Delma torquata*) – Vulnerable under the EPBC Act and the NC Act			
	The collared delma is endemic to Queensland and inhabits open-forest and woodlands that are typically adjacent to rocky terrain. The species distribution extends from the western edges of Brisbane in southeast Queensland, northwest to the Blackdown Tablelands and west to the Roma region of inland Queensland (Steve K Wilson, 2015).	The collared delma was not recorded during the field survey program Of the three land zones collared delma habitat is associated with, only land zone 3 occurs within the Ground-truthed Mapping Extent. Recorded micro-habitat features relevant to collared delma include: • Coarse woody debris and ground timber. • fine and coarse litter.	The primary threats identified for the species are: • Habitat loss through clearing for agriculture. • Habitat degradation by overgrazing of stock.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The population is heavily fragmented with records occurring at the Bunya Mountains, Blackdown Tablelands National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP Expedition NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran and the Toowoomba Range. As per the *Draft Referral Guidelines for the nationally listed Brigalow Belt reptiles*, suitable habitat includes: open-forest, woodlands and adjacent exposed rocky areas in Queensland RE Land Zones 3, 9 and 10. Known important habitat is described as suitable habitat within the known or likely to occur distribution mapping for collared delma. DCCEEW's RFI to referral EPBC 2021/9137 provides further detail on specific habitat requirements for collared delma as: 'Eucalypt dominated woodland to open forest where it is associated with suitable micro-habitats (exposed rocky outcrops) where ground cover is predominantly native grasses, such as *Themeda triandra*, *Cymbopogon refractus*, *Aristida* sp. and *Lomandra* sp.'. The species is also known from two locations featuring woodlands of *Eucalyptus tereticornis* or *Acacia harpophylla* where significant rock components were absent (Steve K Wilson, 2015). As per SPRAT, the presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30–100 mm thick) appears to be an essential characteristic of the microhabitat and is always present where the species occurs.	• native grasses including *Aristida sp.* and *Lomandra sp.* • Stones <20 cm in diameter adjacent to rocky outcrops consisting of boulders. Potential habitat across the Ground-truthed Mapping Extent was generally found to have low levels of required microhabitat. Eucalypt woodlands associated with RE 11.3.25b and 11.3.4 generally occur adjacent to steep hillslopes with exposed rocky boulders and other microhabitat features. In select patches of these communities, ground timber and woody debris was recorded as being common to abundant across a range of sizes from less than 10 cm to greater than 30 cm. Leaf litter was also abundant in places but generally comprised a single thin layer and did not form 'mats'. Outcrops of stones consisted of sizes that were generally less than 20 cm in diameter. Rocky outcrop areas were typically associated with ephemeral creek lines and banks. Native grass cover was largely absent in these areas. Whilst some habitat features may provide micro habitat for collared delma, the absence of key ground cover species limits the suitability of the habitat overall. Clearing within the Disturbance Footprint will result in the loss of 5.0 ha of breeding and foraging habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	• Removal of rocks, course woody debris and ground litter. • Use of agricultural chemicals. • Predation by feral cats and foxes. • Weed invasion (particularly *Lantana montevidensis**). No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Koala (*Phascolarctos cinereus*) – Vulnerable under the EPBC Act and NC Act			
	Koalas are reported to be widespread across Queensland, occurring in patchy and often low-density populations across the different bioregions (Department of Agriculture Water and the Environment, 2022a). As per the modelled species distribution in the Conservation Advice, koala is 'known or likely' to occur in the wider Rockhampton region. Koalas occur in coastal and inland locations and inhabit eucalypt forests and woodlands. The koala's diet is defined by the availability and palatability of a limited variety of *Eucalyptus*, *Corymbia* and *Angophora* species (Department of Agriculture Water and the Environment, 2022a). They are nocturnal and spend significant periods of time moving across the ground between food and shelter trees. Movement increases in the breeding season (typically September to February). Home ranges across the species' distribution are highly variable; in Queensland and New South Wales individual home ranges are reported to vary between 3 and 500 ha (Department of Agriculture Water and the Environment, 2022a). As described in the *National Recovery Plan for the Koala* (Department of Agriculture Water and the Environment, 2022b), the species uses shelter trees to thermoregulate, especially during hot days and to avoid predators. Koalas appear to prefer larger and more shady trees and use a wide range of tree species for shelter. Based on known use, recorded shelter tree species	No evidence of koala was recorded across the field survey program. A range of recommended field survey methods were employed to increase the chances of detecting the species. The koala is considered to have a moderate likelihood of occurrence based on the presence of suitable eucalypt woodland and forest habitat and scattered desktop records from the wider region. The closest desktop records are both from 1940 and occur east of the Study Area within 14 km. Undated desktop records also occur west (approximately 28 km away) near Wowan, and south (approximately 21 km away) near Round Mountain. Clearing within the Disturbance Footprint will result in the loss of 721.1 ha of breeding, foraging and dispersal habitat and 5.3 ha of climate refugia habitat for the species. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Clearing and degradation of habitat. • Vehicle strike. • Disease. • Predation by dogs. Koala populations across parts of Queensland and NSW were significantly impacted by the 2019–2020 bushfires. Drought and extreme heat are also known to cause very significant mortality, and population recovery post-event may be substantially impaired by the range of other threatening factors.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	in Queensland include rainforest trees, *Callitris columellaris*, *Acacia harpophylla* and *Melaleuca bracteata*.		
Red Goshawk (*Phascolarctos cinereus*) – Vulnerable under the EPBC Act and Endangered under the NC Act			
	The red goshawk is found in coastal and subcoastal, tall, open forest and woodlands and tropical savannas traversed by rivers lined with timber, and along the edges of rainforest (Threatened Species Scientific Committee, 2015). Forests of intermediate density are favoured, or ecotones between habitats of differing densities. The species is sparsely distributed across 15 % of coastal and near coastal Australia, from the Kimberley in Western Australia to north-eastern New South Wales. It occurs at low densities across eastern Queensland, to the western slopes of the Great Dividing Range (Czechura et al., 2011). Historically (1970–1975), the species was recorded rarely (11–50 records) in the Rockhampton region, and as of 2020 it is considered to be regionally extinct (Noske and Briggs, 2021). Red goshawks are currently known to breed from the Kimberley east to Cape York Peninsula and on the Tiwi Islands. They may still breed at very low densities in the Wet Tropics and Einasleigh Uplands, though record data are scarce. It is suggested that since European settlement, development and habitat alteration have rendered about 20% of the species' predicted range, especially in coastal Queensland, unsuitable for breeding. Given the species wide ranging habits,	Despite extensive survey effort through bird utilisation surveys (BUS) over four seasons and diurnal bird survey throughout the field survey program, the red goshawk was not recorded. The species is considered to be extinct in the Rockhampton region (Noske and Briggs, 2021), and therefore has a low likelihood of occurrence. No potential breeding habitat was identified in the Ground-truthed Mapping Extent. The majority of woodlands and forests within the Ground-truthed Mapping Extent contain trees that are <20 m in height. However, some patches of woodland were noted as containing trees 20–25 m in height that may be suitable for nesting, including: • Trees up to 24 m tall in *Eucalyptus moluccana* woodland (RE 11.11.3c) in the northernmost section of the Study Area. • Trees 20–25 m tall in sections of riparian woodland containing *Casuarina cunninghamiana*, *Melaleuca* spp. and *Corymbia tessellaris* (RE 11.3.25). • Trees approximately 20 m tall in eucalypt woodland along the eastern boundary of the Study Area (REs 11.11.3, 11.11.4, 11.11.4b). Despite some areas of tall trees being present,	The primary threats identified for the species are: • Extensive habitat loss, degradation and fragmentation. • Inappropriate fire regimes. • Draining of wetlands. • Rural and residential development. • Domestic livestock grazing. • Climate change. The *Draft Conservation Advice and Listing Assessment – Erythrotriorchis radiatus* (Department of Agriculture Water and the Environment, 2022c) also identifies Psittacine Beak and Feather Disease as a potential threat to the species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	inconspicuous nature, and difficulties with reliable field identification, its status in many regions outside northern Australia can be considered uncertain. Red goshawks are probably monogamous and may occupy the same breeding territories year after year (Threatened Species Scientific Committee, 2015). Red goshawks typically breed in trees >20 m tall (range 18.5–40.5 m) with an open limb and canopy structure, though there is anecdotal evidence of birds using trees 14 m in height. Nests are located above 20 m in tall trees (>30 m) that are usually within groups of the tallest trees (>25 m) in a given region of sub-coastal woodlands (Department of Environment and Resource Management, 2012)","noteIndex":0},"citationItems":[{"id":1041,"uris":["http://zotero.org/groups/4916801/items/BEW4XVX9"],"itemData":{"id":1041,"type":"report","abstract":"Heritage facilitate the publication of recovery plans to detail the actions needed for the conservation of threatened native wildlife. The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved, and may also be constrained by the need to address other conservation priorities. Approved recovery plans may be subject to modification due to changes in knowledge and changes in conservation status (Department of Environment and Resource Management, 2012). Further inland, trees tall enough for nesting are restricted to alongside	there are no large or perennial watercourses within proximity to the Study Area. The closest major perennial watercourses are the Don River (5 km south of the Study Area), Calliope River (7 km southeast) and Dee River (15 km west). The closest major watercourse is Centre Creek (stream order 4, non-perennial), which meanders along the southern boundary of the Study Area before flowing into the Don River 12 km south of the Study Area. Reflecting their highly ephemeral nature, watercourses within the Study Area were generally observed during the field survey program to be dry or containing rare pools of water. Suitable foraging and dispersal habitat may occur within the Ground-truthed Mapping Extent and wider Study Area, comprising open woodlands and ecotones between habitats including woodlands and vine forests. However, the absence of nearby permanent water greatly limits the overall suitability of potential habitat, given the presence of permanent freshwater is an essential habitat component. Clearing within the Disturbance Footprint will result in the loss of 578.3 ha of foraging and dispersal habitat. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	major rivers' banks. All identified nest trees having been within 1 km of permanent water, often adjacent to rivers or clearings, and usually the tallest and largest trees (Department of Environment and Resource Management, 2012). When foraging, the red goshawk shows a preference for intact, extensive woodlands and forests with a mosaic of vegetation types that are open enough for fast maneuvering flight (Department of Environment and Resource Management, 2012). These favoured areas contain permanent water, are relatively fertile and biologically rich with large populations of birds. The species generally avoids very densely vegetated or very open habitats but will hunt along ecotones between such habitats and woodlands or forests. In northern Queensland, the species is mainly associated with extensive, uncleared, mosaics of native vegetation, especially riparian vegetation, open forest and woodland that contain a mix of eucalypt, ironbark and bloodwood species (Department of Environment and Resource Management, 2012). The species have large home ranges, estimated at 120 km² for females and 200 km² for males.		

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Ghost Bat (*Macroderma gigas*) – Vulnerable under the EPBC Act and Endangered under the NC Act			
	The ghost bat is endemic to northern Australia. It has a disjunct distribution, comprising isolated populations extant in the semi-desert Pilbara region of Western Australia, the mesic Kimberley and Top End of the Northern Territory, north-western Queensland south of the Gulf of Carpentaria, Cape York peninsular, wet and dry tropics and the central Queensland coastal and hinterland regions. As per SPRAT, within Queensland their estimated range extends from Cape York to the Queensland – New South Wales border. The Rockhampton region falls within the species 'likely' distribution, with known breeding sites occurring at Mount Etna and the surrounding area. The Study Area is situated approximately 64 km south of Mount Etna. The species occupies a wide range of habitats from rainforest, monsoon and vine scrub to open woodlands in arid areas. Recent studies have also indicated the use of cleared agricultural land (Bat Call WA Pty Ltd, 2022). These habitats are used for foraging, while roost habitat is more specific. Ghost bats move between a number of roosts seasonally or as dictated by weather conditions and/or foraging opportunities, as such they require a range of roost sites (Van Dyck and Strahan, 2008). Roost sites can include caves, rock crevices and disused mine adits.	The ghost bat is considered a low likelihood of occurrence within the Study Area. Although the species is known from Mount Etna also located within the Rockhampton region, this site occurs >60 km north of the Study Area. Desktop records of the species in the wider local area are scarce and generally pre-1990; the nearest is located at Stanwell approximately 34 km north-west and has a 20 km spatial uncertainty. No evidence of the species was recorded despite extensive field survey effort, which included several recommended ghost bat survey methods including roost searches and characterisation, habitat assessments, spotlighting and use of passive call detectors (Anabat Swifts). Harp trapping has also been completed in natural flyways. No potential roost sites including caves, rock overhangs or crevices were recorded during the field survey program. A total of five mineral occurrences (gold) are mapped within the Study Area by the Queensland DoR and three of these sites are associated with abandoned mines including the King Solomon mine, Queen of Sheba mine and an unnamed mine (ID 569551). Based on the information associated with these sites including dimensions, work extent and general location (i.e. gully), only one of the three mines (Queen of Sheba) was determined to potentially contain a mine adit.	The primary threats identified for the species are: • Habitat loss and degradation due to mining activities. • The species' slow reproductive rate, and the lack of suitable habitat which restricts its movement, renders it vulnerable to threats and localised extinctions. • Habitat loss (destruction of, or disturbance to, roost sites and nearby areas) due to mining. • Disturbance of (human visitation at) breeding sites. • Loss and modification to foraging habitat. • Collision with fences, especially those with barbed wire. • Collapse or reworking of old mine adits.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	Based on recently published species-specific guidance on the species, roost habitat can be categorised based on utilisation (maternity/diurnal roost or nocturnal roost) and occupancy rates (permanent, regular, occasional or opportunistic) (Bat Call WA Pty Ltd, 2022). Diurnal roost sites are generally deep natural caves or disused mines with a relatively stable temperature of 23°–28°C and a moderate to high relative humidity of 50–100 percent. Most breeding sites appear to require multiple entranced or chambered caves. In contrast, shallow caves, shelters and deep overhangs are likely to be used opportunistically by transient individuals as nocturnal roosts (Bat Call WA Pty Ltd, 2022). The nightly foraging range is 10 to 15 km (Bat Call WA Pty Ltd, 2022). In the cooler months (non-breeding season) individuals may disperse up to 150 km from their permanent roost locations in small groups or pairs (Hoyle et al., 2001).	The Queen of Sheba historical mine was investigated by an ecologist in November 2022 and found to comprise an open cut excavation with a narrow vertical shaft, likely similar to what is reported at the nearby sites. Based on this finding and the known information about historical workings in the wider area, no abandoned mines within or directly adjacent to the Study Area were considered potentially suitable for the roosting of ghost bat. Due to the absence of potential roost sites within the Study Area and the known nightly foraging distances up to 15 km, no foraging habitat is considered present. While a known maternity roost occurs at Mount Etna, as described above this site occurs a significant distance from the Study Area (>60 km) and is not within foraging range. As the species disperses up to 150 km during the non-breeding season, potential habitat within the Ground-truthed Mapping Extent is restricted to seasonal foraging and dispersal habitat. Clearing within the Disturbance Footprint will result in the loss of 877.3 ha of seasonal foraging and dispersal habitat. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	• Contamination by mining residue at roost sites. • Disease. • Poisoning by cane toads. • Competition for prey with foxes and feral cats. As per Bat Call WA (2022), other indirect sources potentially causing impacts to colonies include: • Sound, vibration, airborne dust and pollutants. • Increased light. • Changed fire regimes.

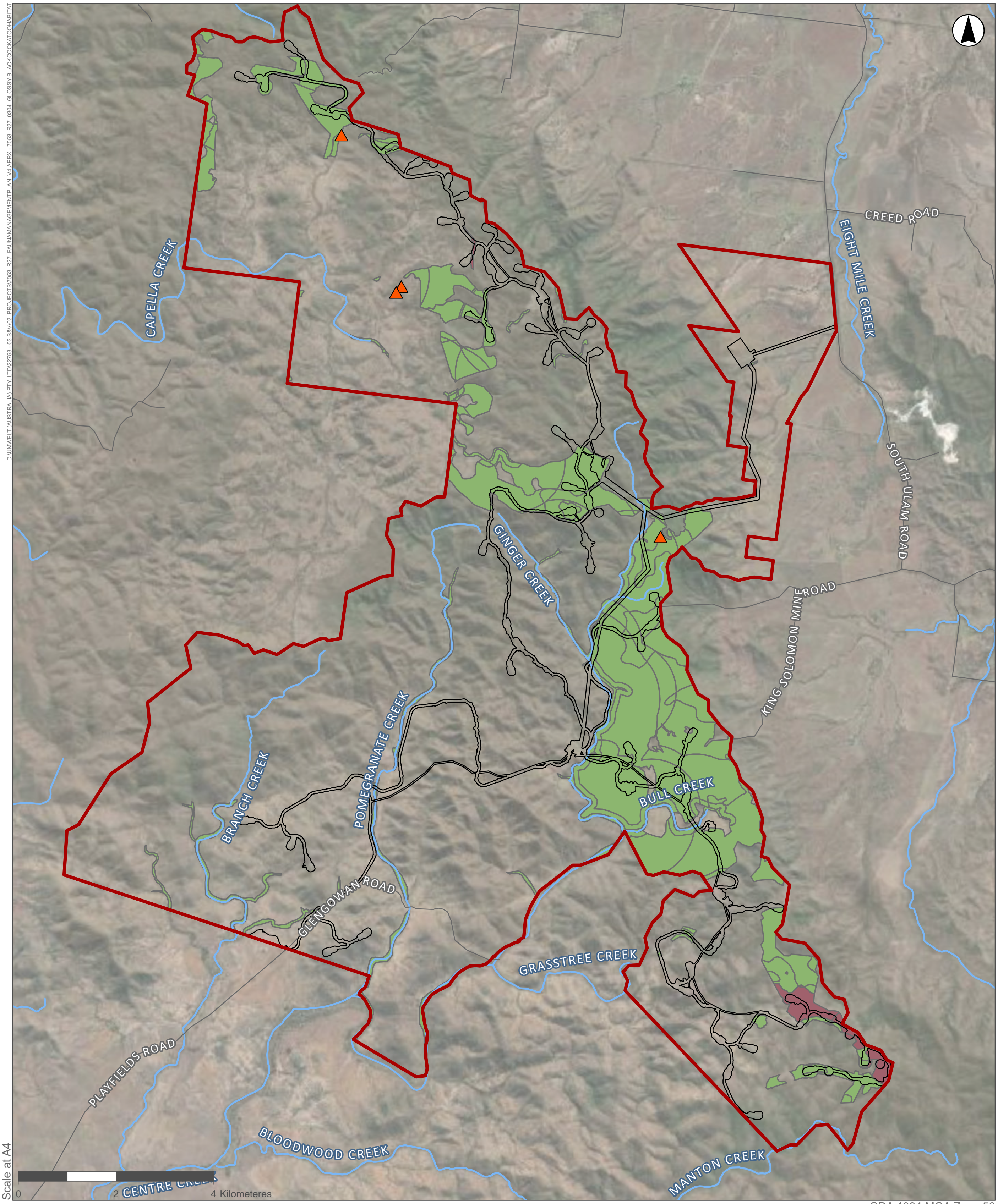
Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable under the EPBC Act and Least Concern under the NC Act			
	The grey-headed flying-fox is endemic to Australia and occurs from Ingham in Queensland to Adelaide in South Australia. They are usually found on the coastal lowlands and slopes of eastern Australia below altitudes of 200 m (Department of Environment and Water, 2021). The species is widespread throughout their range in summer, whilst in autumn it occupies coastal lowlands and is uncommon inland. The grey-headed flying-fox is highly mobile and considered 'highly adaptable' given its proclivity to occupy urbanised environments. The grey-headed flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, *Melaleuca* swamps and *Banksia* woodlands. It also feeds on commercial fruit crops and on introduced tree species in urban areas. The primary food source is blossom from *Eucalyptus* and related genera but in some areas it also utilises a wide range of rainforest fruits. None of the vegetation communities used by the grey-headed flying-fox produce continuous foraging resources throughout the year. As a result, the species has adopted complex migration traits in response to ephemeral and patchy food resources and only a small proportion of its' wide range is used at any one time.	No records of the species were observed during the field survey program which included 60 person hours of spotlighting. Database records indicate that several historical records occur surrounding Rockhampton, the most recent of which (1995) occurs approximately 42 km from the northern boundary of the Study Area. Other records in the wider local area include a number of observations surrounding Gladstone (including records from 2002, 2007 and 2019), approximately 60 km east of the Study Area. Although potential habitat is identified within the Ground-truthed Mapping Extent (as described further below), the species was determined to have a low likelihood of occurrence within the Study Area due to the lack of nearby records. Based on the quarterly data from the National Flying-fox Monitoring Program (contained within the National Flying-fox Monitoring Viewer), the nearest regularly occupied camps are in Bundaberg, approximately 200 km southeast of the Study Area. However, grey-headed flying-fox have been observed roosting in Wowan (approximately 29 km west of the Study Area), Kabra, near Rockhampton (approximately 32 km northeast of the Study Area) and Keppel Sands (approximately 49 km northeast of the Study Area).	The primary threats identified for the species are: • Habitat loss via clearing of winter foraging resources and loss of roosting habitat. • Camp disturbance via conflict with humans. • Mortality in commercial fruit crops – animals being killed from crop management practices. • Heat stress. • Entanglement in netting and barbed wire fencing – animals can become entangled in netting over fruit trees and thousands of animals die or face permanent injury from entanglement in barbed wire.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The grey-headed flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. Roost vegetation includes rainforest patches, stands of *Melaleuca*, mangroves and riparian vegetation. Grey-headed flying-foxes commute daily to foraging areas, usually within 15 km of the day roost site. They are capable of nightly flights of up to 50 km from their roost to different feeding areas as food resources change. At most times of the year there is a complete exodus from the colony site at dusk.	The most recent observations of grey-headed flying-foxes roosting in these camps are from 2019 in Keppel Sands (1–499 individuals – camp #367) and Wowan (1–499 individuals – camp #755) and 2017 in Kabra (1–499 individuals – camp #362). Individuals have been identified in all camps on only one occasion since the beginning of the National Flying-fox Monitoring Program. None of these camps constitute 'Nationally important camps' (Department of Environment and Water, 2021) as they have not contained ≥ 10,000 individuals in more than one year in the last 10 years, or have been occupied by more than 2,500 grey-headed flying-foxes permanently or seasonally every year for the last 10 years. The locations of flying-fox camps are generally stable through time, although pattens of camp occupation vary. Given the paucity of grey-headed flying-fox camps within proximity to the Study Area, and no camps being observed during field surveys despite extensive effort, it is considered that roosting habitat is absent from the Study Area.	• Climate change – has the potential to affect food availability and heat-related mortality. • Bushfires – resulting in the loss of foraging habitat and resources leading to mortalities. • Electrocution on powerlines. • Zoonotic diseases.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
		The Study Area falls outside of the typical nightly foraging commute (20 km) for the species and is outside of the indicative extent of foraging habitat as per Map 1 of the *National Recovery Plan for the Grey-headed Flying-fox* (Department of Environment and Water, 2021). However, two camps (Wowan and Kabra) do occur within the maximum distance grey-headed flying-foxes have been known to fly to forage (40 km). Although movements of these distances are rare, it is considered possible that the species could sporadically forage in *Eucalyptus* woodlands in the Study Area which contain known important foraging species (RE 11.12.1, 11.12.6, 11.11.3. 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.3.4, 11.3.25 and 11.3.25b). Known important foraging species in these vegetation communities include *Eucalyptus crebra*, *Eucalyptus tereticornis* and *Corymbia citriodora*. If used by grey-headed flying-fox, it is likely to be infrequent, given the distance from known camps and the sporadic occupation of these camps. Clearing within the Disturbance Footprint will result in the loss of 243.7 ha of foraging habitat. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
Short-beaked Echidna (*Tachyglossus aculeatus*) – Special Least Concern under the NC Act			
	The short-beaked echidna is found in almost all terrestrial habitats in Australia. This species relies on a substrate of leaf litter and course woody debris for foraging. It shelters in fallen logs, rock crevices, dense leaf litter and abandoned burrows.	The short-beaked echidna was recorded twice on camera traps within the Study Area, one from vine forest in the southwest corner and the other from eucalypt woodland in the central-east portion. The location of these records are provided in **Figure 3.3**. Clearing within the Disturbance Footprint will result in the loss of 877.3 ha of foraging, breeding and dispersal habitat. It should be noted that the disturbance areas are a maximum and subject to potential reduction as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Predation by native and introduced predators. No recovery plan exists for this species.

[1] Species descriptions including key threats, distribution, habitat and ecology have been derived from information within DES Species Profiles (Department of Environment and Science, 2023) and within the Species Profile and Threats Database (Department of Climate Change Energy the Environment and Water, 2022b) or publicly available google images (2022).



Legend

- Glossy black-cockatoo (*Calyptorhynchus lathami*)
- Roads
- Watercourse
- Study Area
- Disturbance Footprint

Glossy-black Cockatoo Habitat

- Foraging and Dispersal
- Breeding and Denning

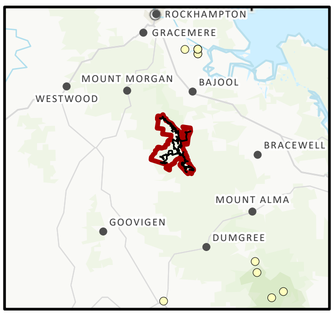
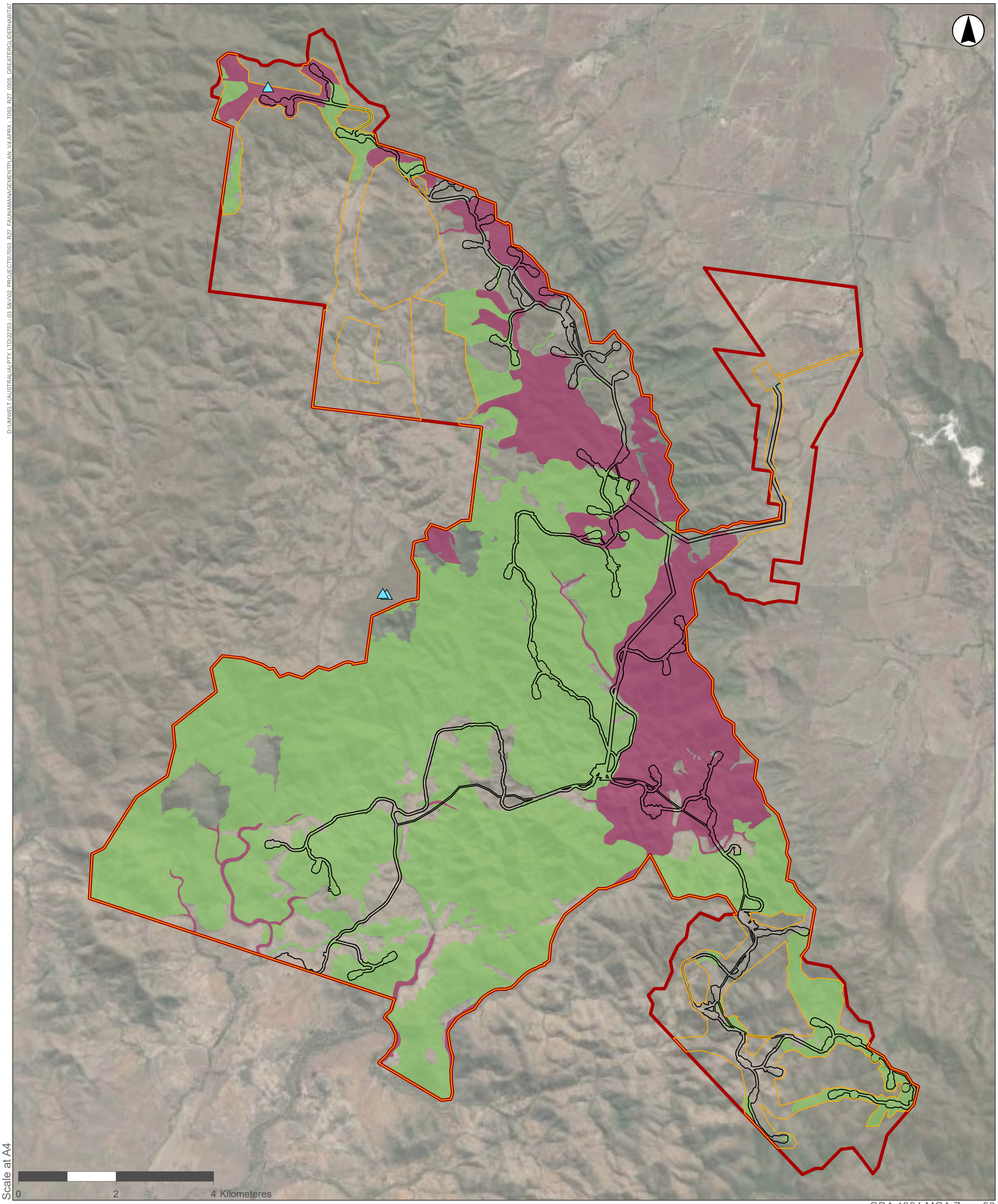


FIGURE 3.4

GLOSSY BLACK-COCKATOO HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



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Scale at A4

GDA 1994 MGA Zone 56

Legend

- Towns
- Greater Glider (Southern and Central) Record (ALA)
- Greater Glider (Southern and Central) Record (Umwelt)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Greater Glider (Southern and Central) Habitat

- Foraging and Dispersal
- Breeding and Denning

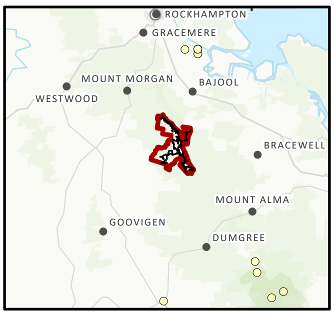
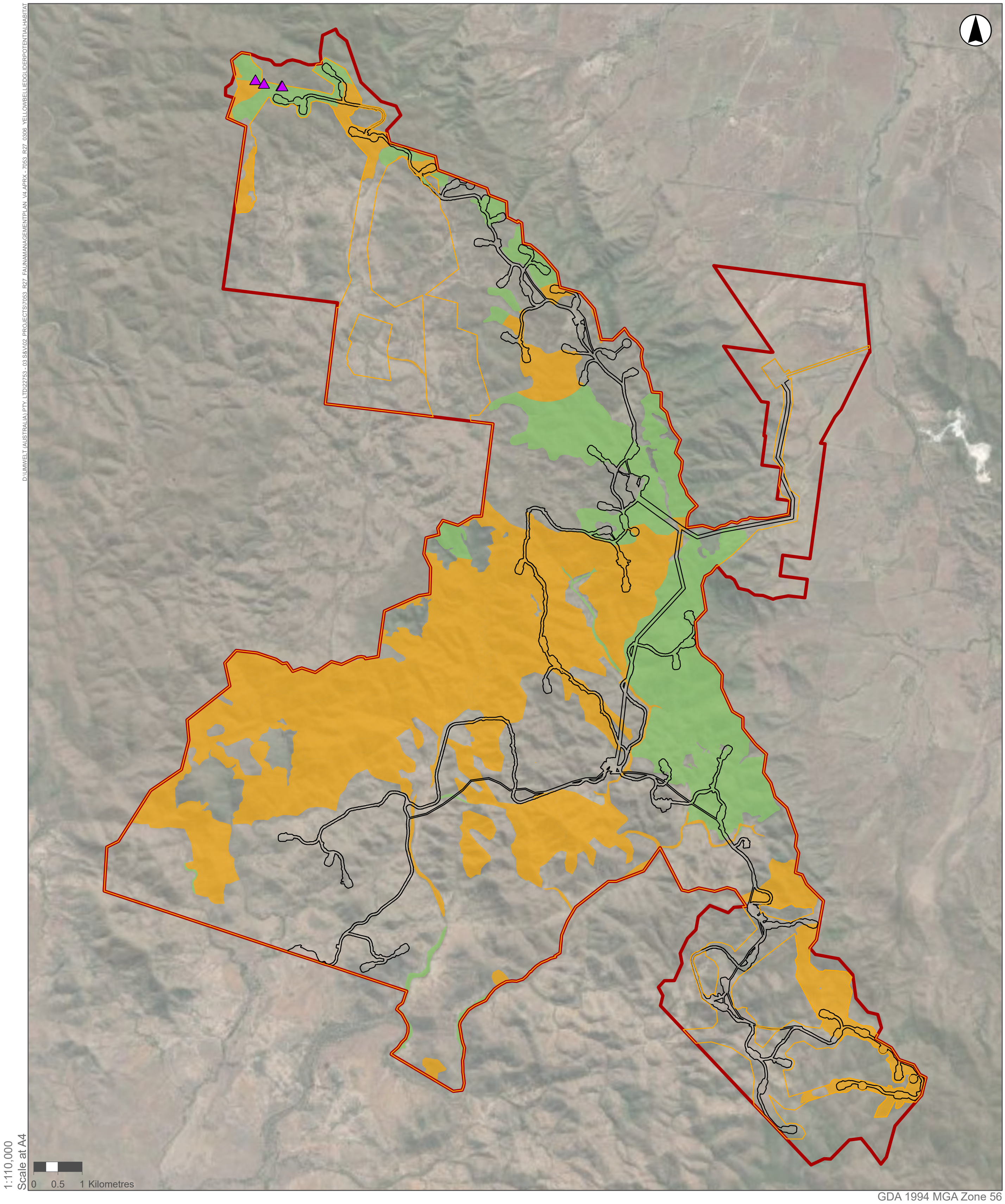


FIGURE 3.5

GREATER GLIDER (CENTRAL AND SOUTHERN) HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- Yellow-bellied Glider (south-eastern)

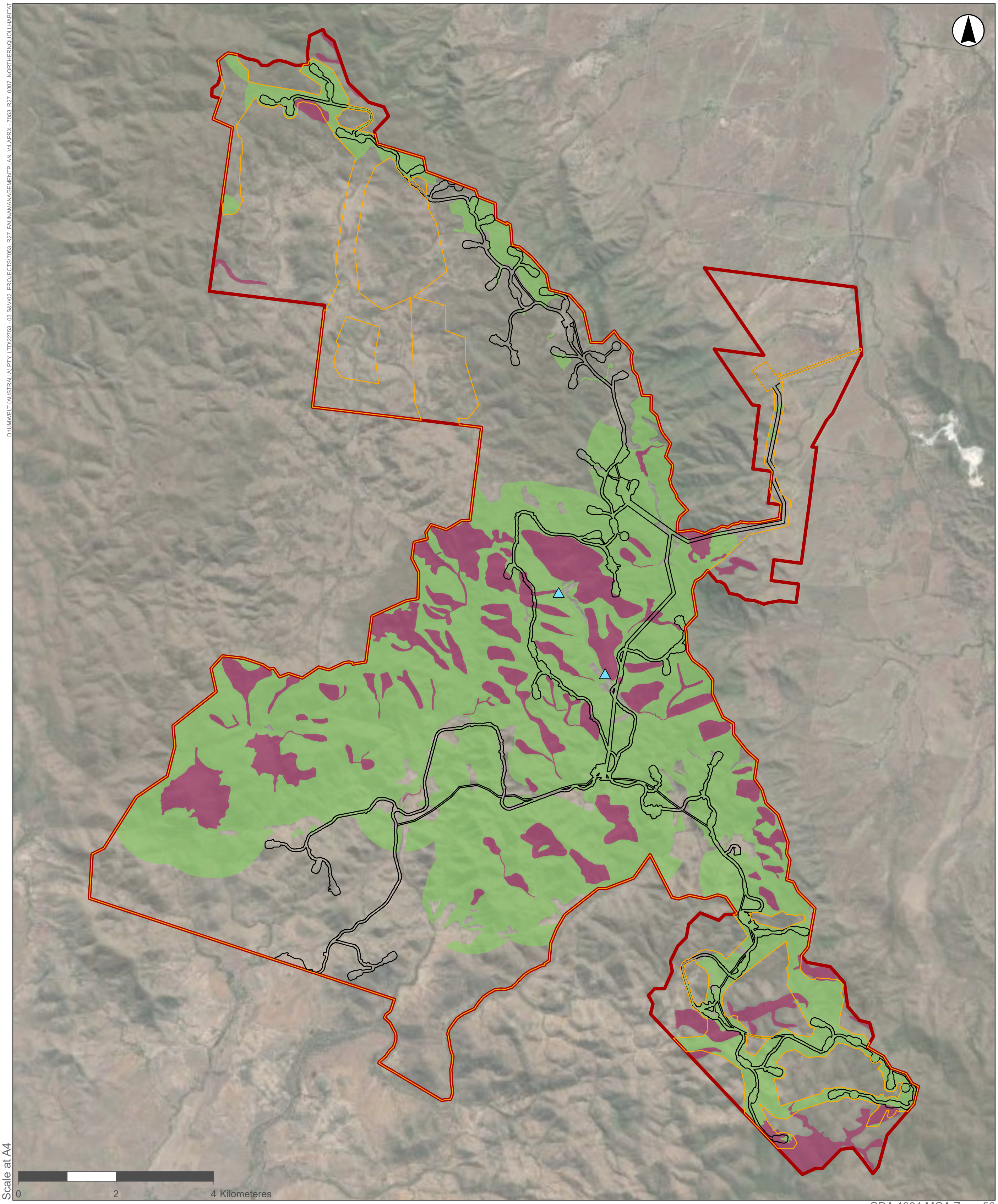
Yellow-bellied Glider (south-eastern) Potential Habitat

- Breeding and Denning
- Foraging and Dispersal

FIGURE 3.6

YELLOW-BELLIED GLIDER (SOUTH-EASTERN) POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Towns
- Northern Quoll Records (Umwelt)
- Northern Quoll Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- Foraging and Disperal
- Breeding and Shelter

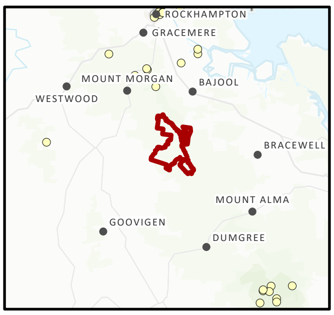
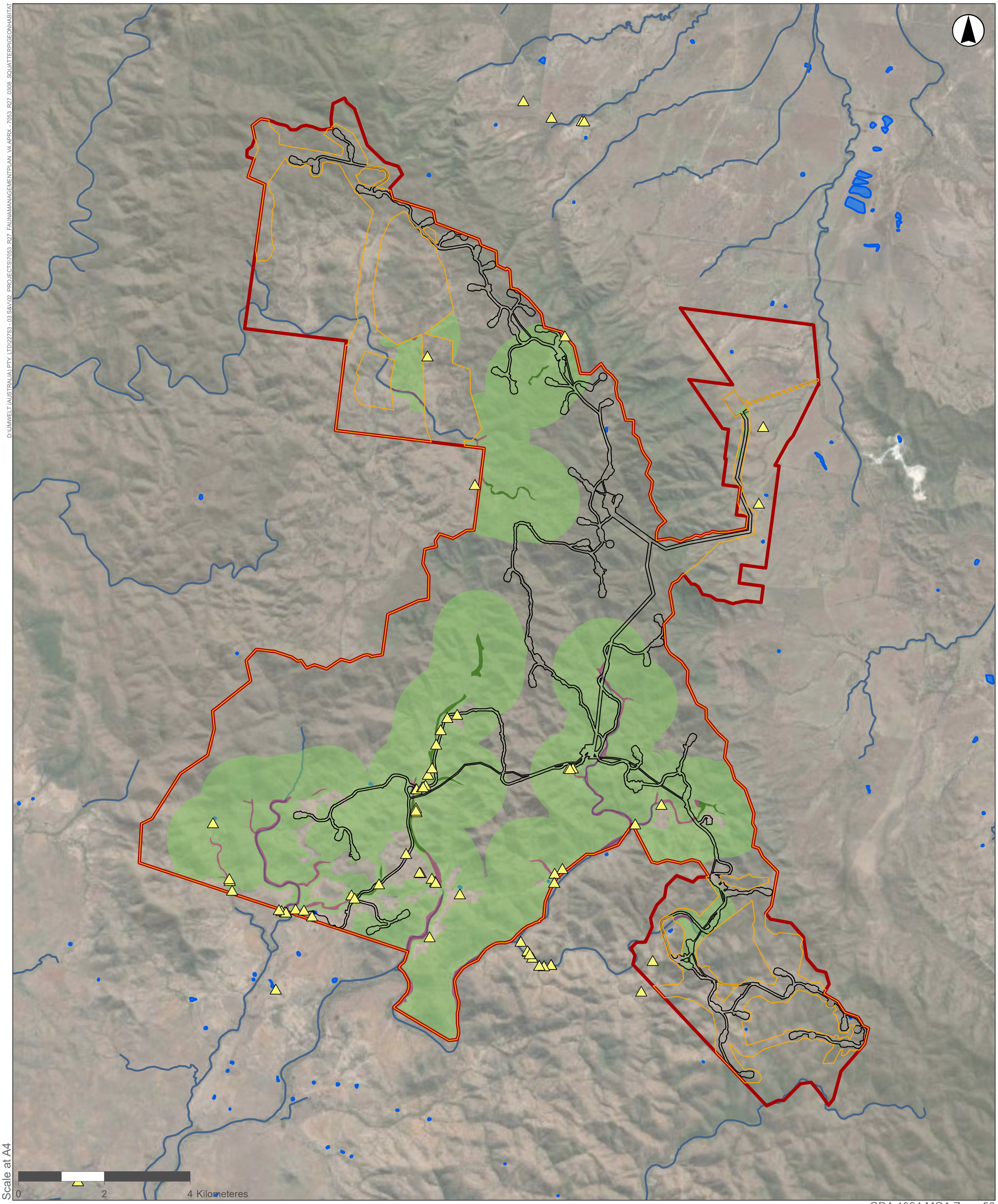


FIGURE 3.7

NORTHERN QUOLL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Scale at A4
1:125,000

GDA 1994 MGA Zone 56

Legend

- Squatter Pigeon (Southern) Record (ALA)
- Squatter Pigeon (Southern) Record (Umwelt)
- Suitable Watercourses
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- Reservoirs (DoR)

Squatter Pigeon (Southern) Habitat

- Breeding
- Dispersal
- Foraging

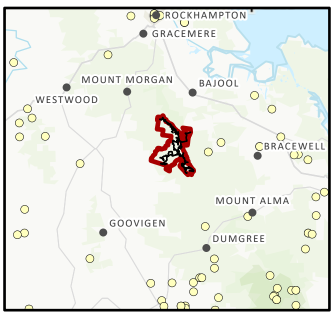
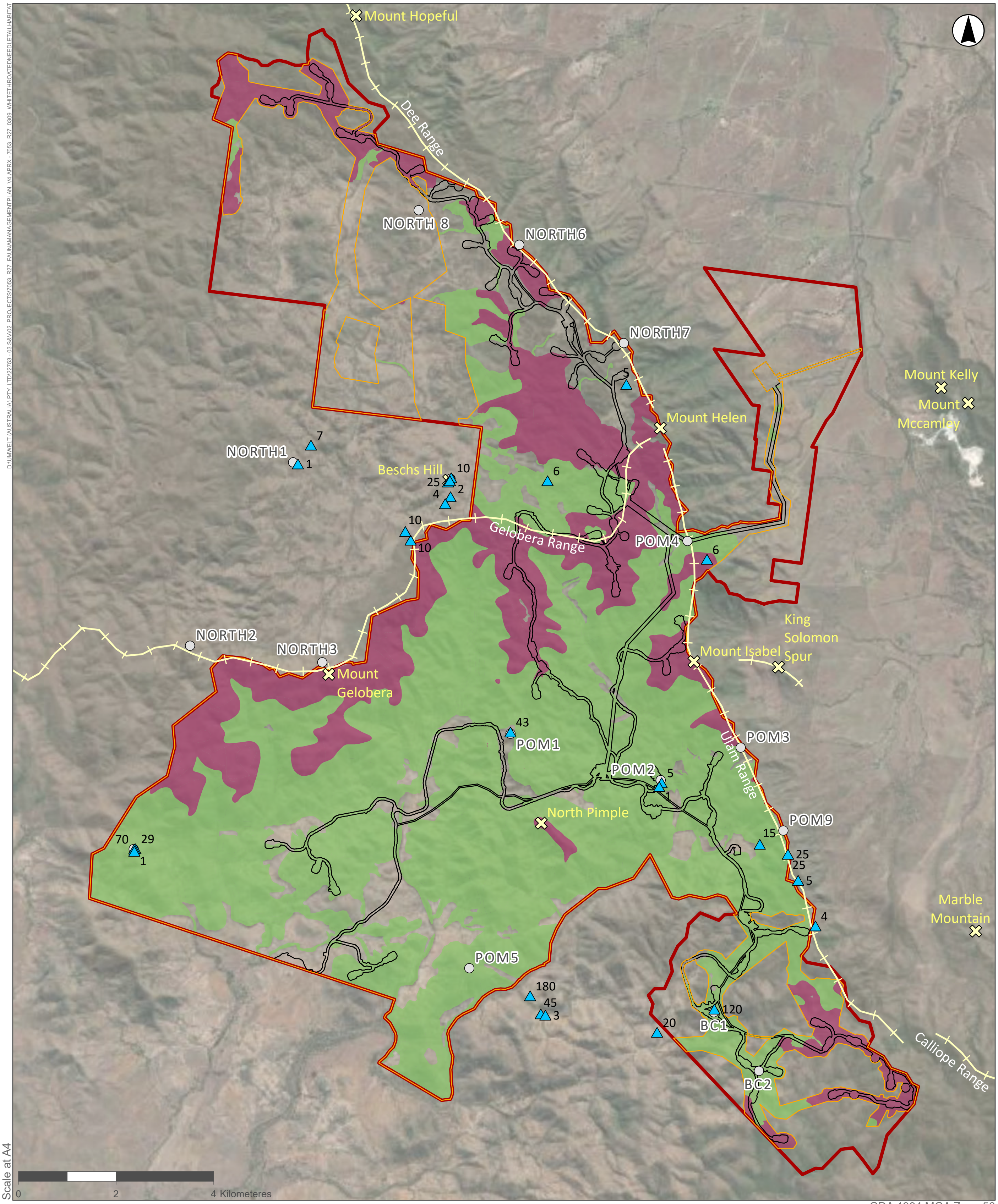


FIGURE 3.8

SQUATTER PIGEON (SOUTHERN) HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Towns
- White-throated Needletail Record (ALA)
- White-throated Needletail Record (Umwelt)
- Mountains, Peaks and Capes (DoR)
- Vantage Point Sites
- Mountain Range (DoR)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

White-throated Needletail Habitat

- Foraging and dispersal
- Roosting and foraging

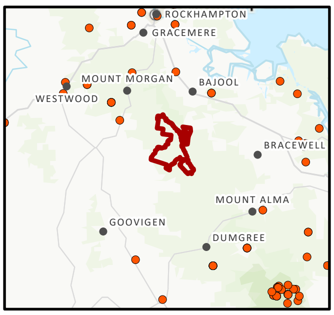
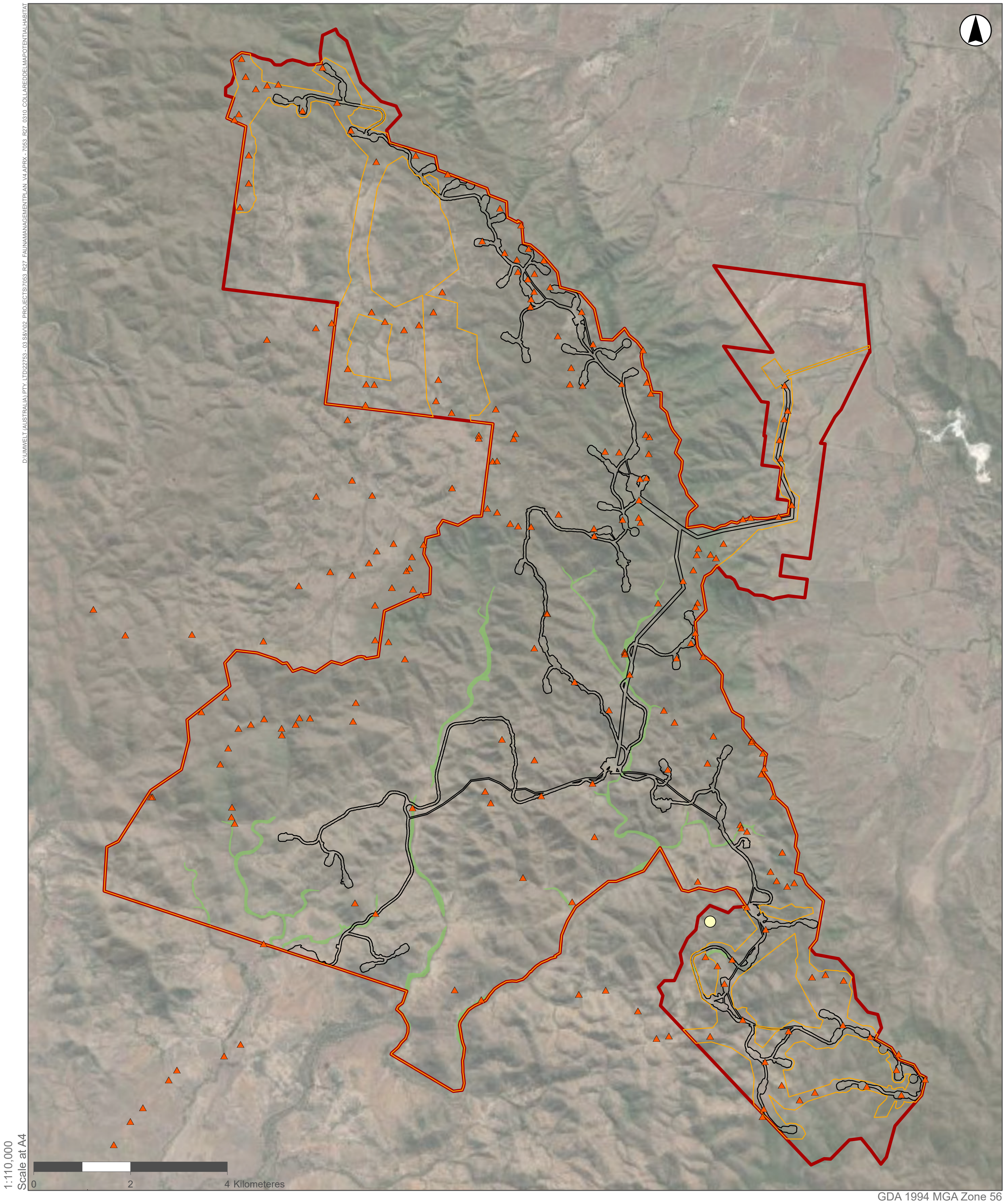


FIGURE 3.9

WHITE-THROATED NEEDLETAIL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Active Diurnal Search Sites
- Collared Delma Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

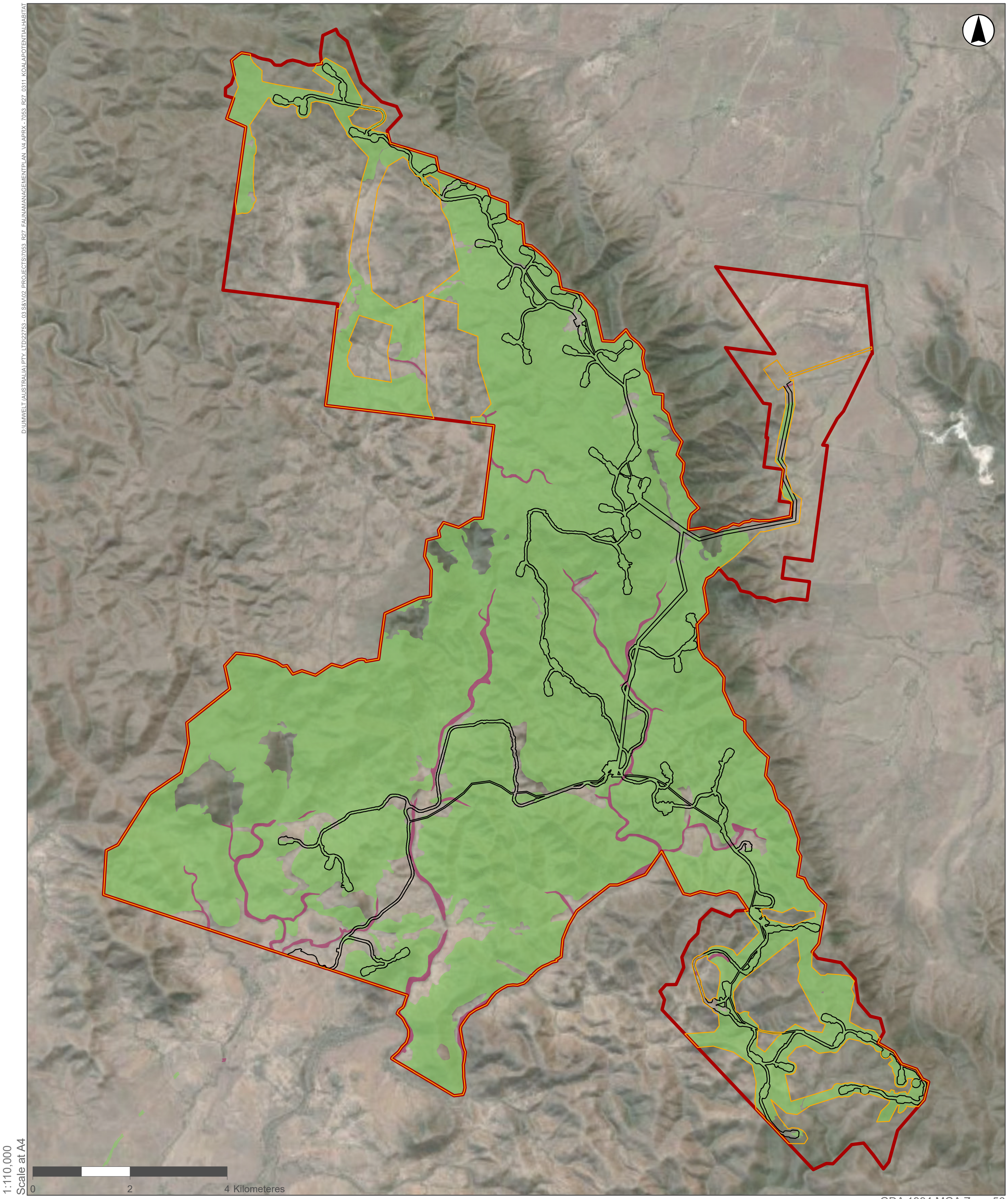
Potential Collared Delma Habitat

- Breeding and Foraging

FIGURE 3.10

COLLARED DELMA POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Towns
- Koala Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Koala Habitat

- Breeding, Foraging and Dispersal
- Climate Refugia

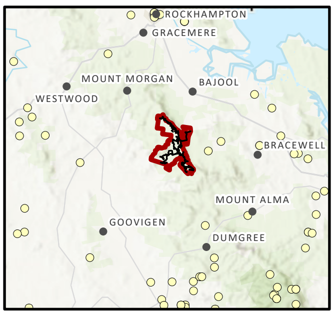
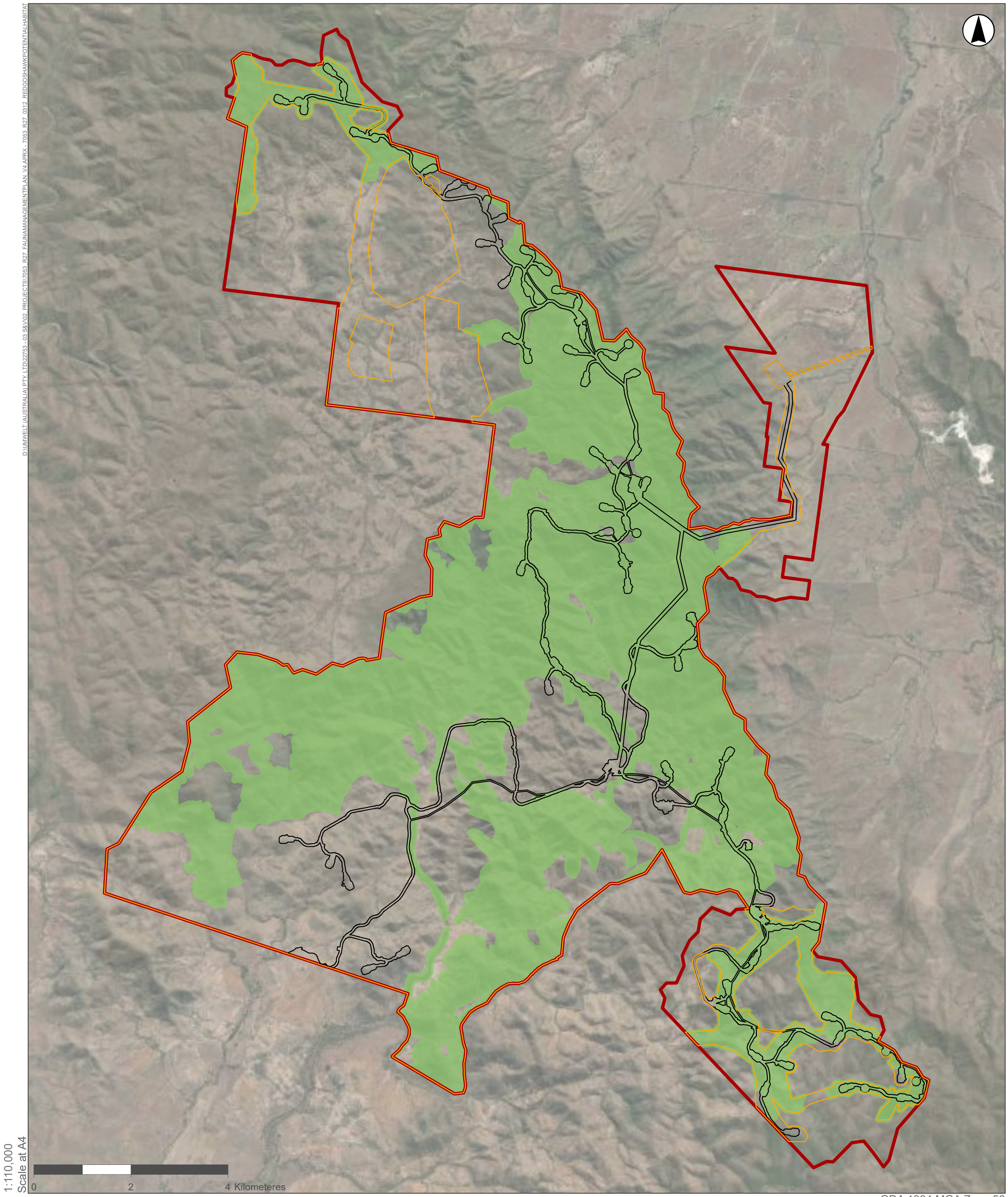


FIGURE 3.11

KOALA POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Red Goshawk Record (ALA)
- Towns
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Red Goshawk Habitat

- Marginal Foraging and Dispersal

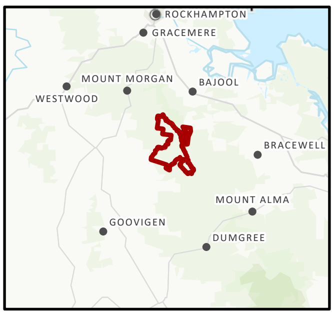
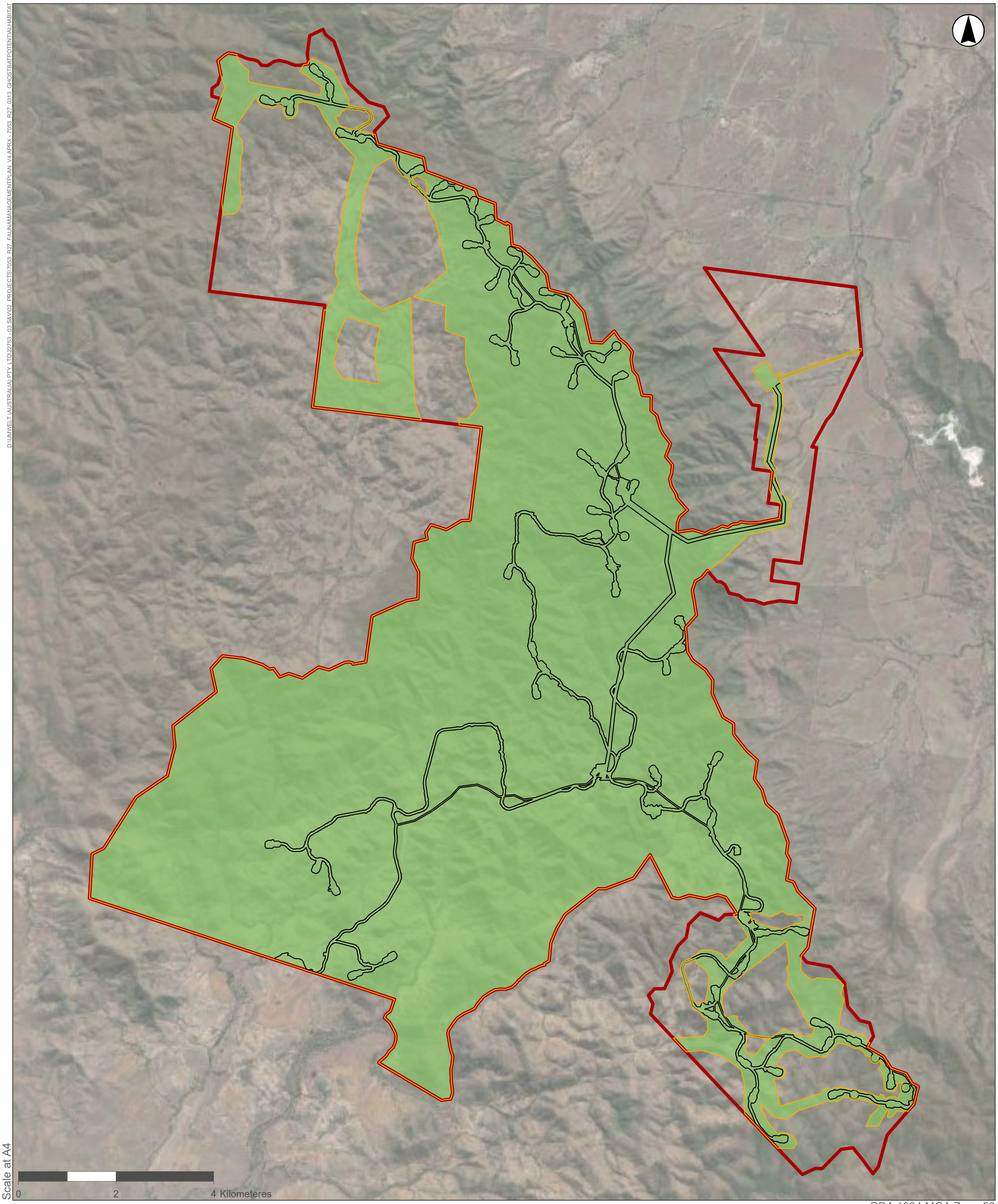


FIGURE 3.12

RED GOSHAWK POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Ghost Bat Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Ghost Bat Habitat

- Seasonal Foraging and Dispersal

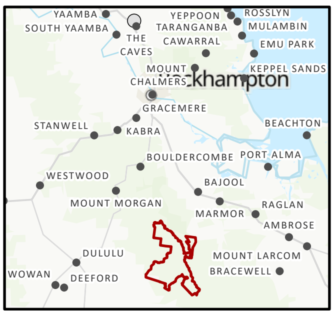
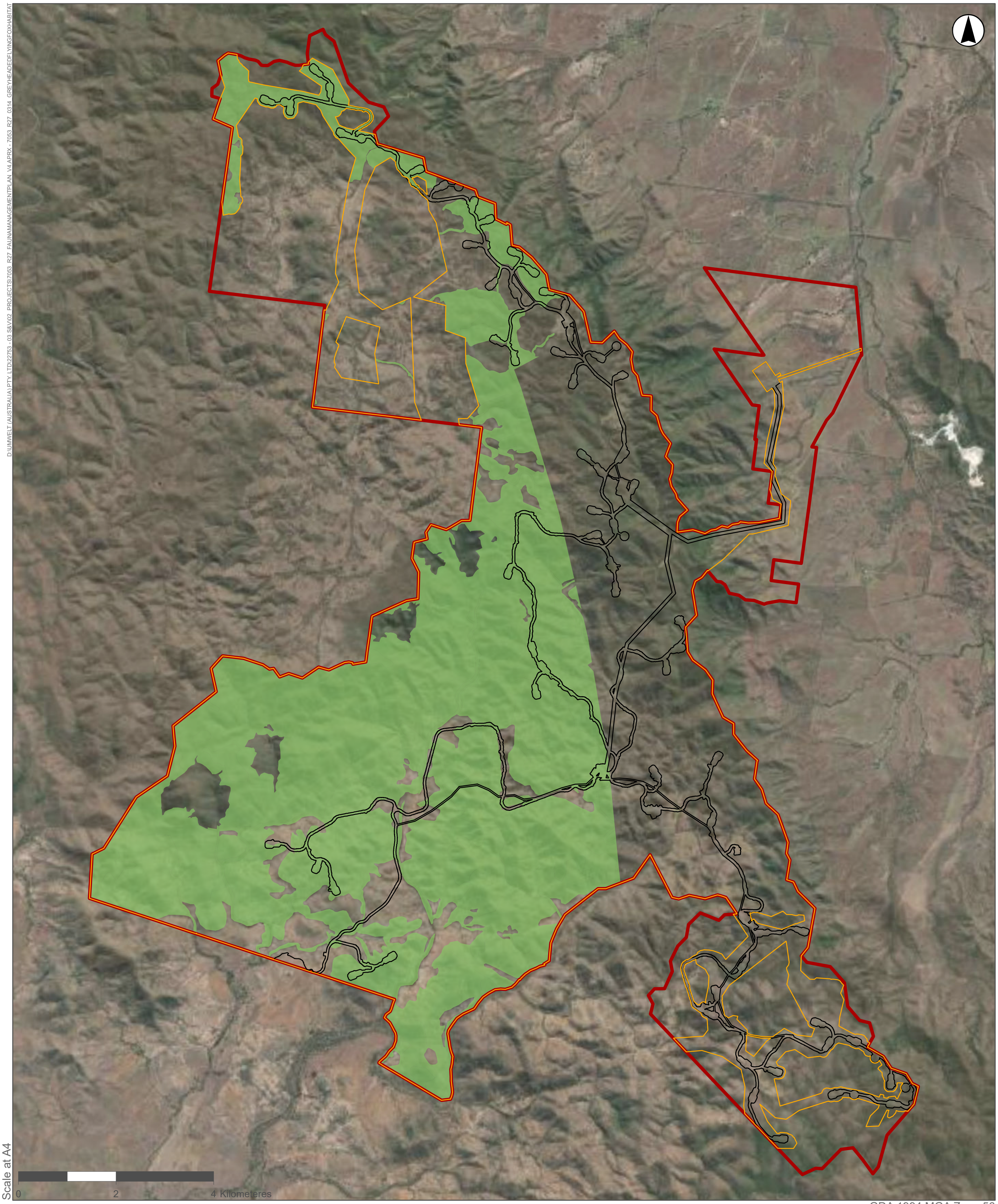


FIGURE 3.13

GHOST BAT POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



1:110,000
Scale at A4

GDA 1994 MGA Zone 56

Legend

- Grey-headed Flying-fox Record (ALA)
- Roost (National Flying-fox Monitoring Program)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Grey-headed Flying-fox Habitat

- Foraging and Dispersal

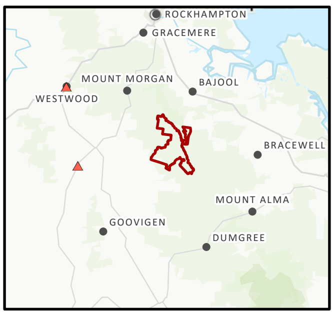
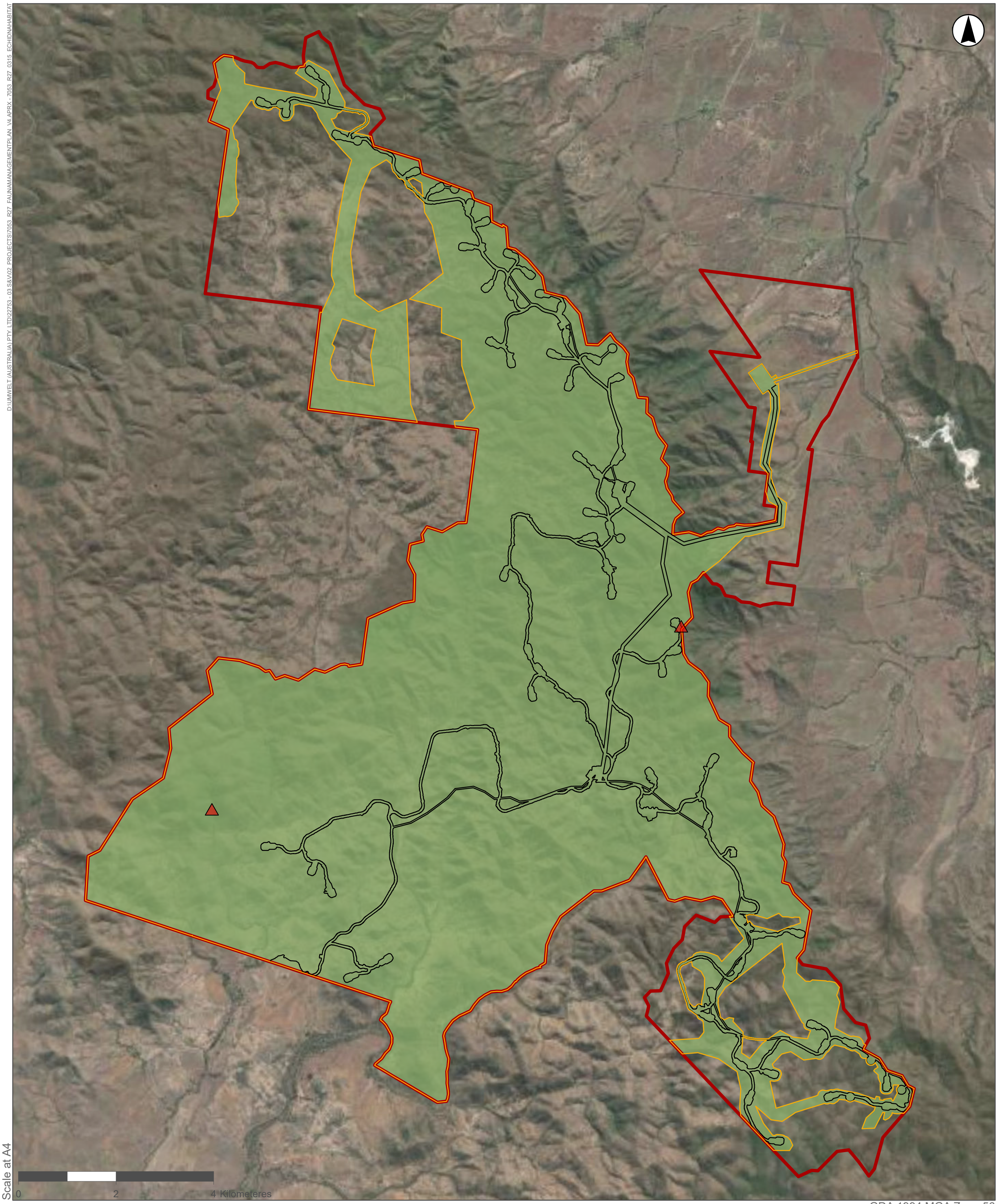


FIGURE 3.14

GREY-HEADED FLYING-FOX POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



1:110,000
Scale at A4

GDA 1994 MGA Zone 56

Legend

- short-beaked echidna(*Tachyglossus aculeatus*)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- Echidna Habitat

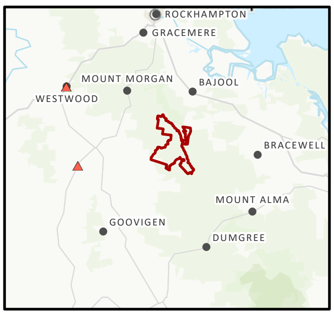


FIGURE 3.15

ECHIDNA HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

Table 3.8 Migratory Fauna Species Profiles

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
rufous fantail (*Rhipidura rufifrons*) – Migratory under the EPBC Act and Special Least Concern under the NC Act			
	In east and south-east Australia, the rufous fantail mainly inhabits wet sclerophyll forests, usually with a dense shrubby understorey often including ferns. They are found in rainforest, dense wet eucalypt and monsoon forest, paperbark and mangrove swamp and riparian vegetation (Morcombe, 2004). When on passage, a wider range of habitats are used including dry eucalypt forests and woodlands and brigalow shrublands. Breeding habitat occurs in dense wet forests – rainforests, mangroves, the wet fern gullies in eucalypt forests and other dense vegetation (Morcombe, 2004). This species occurs as solitary birds or in pairs or small parties. The rufous fantail is found in northern and eastern coastal Australia, being more common in the north. This species migrates to south-east Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range (Department of the Environment, 2015b).	The rufous fantail was recorded within the Study Area on four occasions: • One individual observed actively foraging within a narrow gully, comprising a structurally complex lower tree and shrub layer. The gully was situated adjacent to steep sloping Eucalypt woodland. • One individual observed within vine thicket vegetation, comprising structurally complex shrub layer over ground microhabitat of fallen logs and course litter. • Two individuals were recorded on separate occasions on steep slopes, dispersing through eucalypt woodland in close proximity to vine thicket vegetation and in areas invaded by Lantana camara. The location of these records are provided in **Figure 3.3**. On all occasions, the rufous fantail was using lower portions of habitat, occupying the ground and mid-stratum vegetation layers.	The likely threats identified for the species are: • Introduction of invasive species including black rat (*Rattus rattus*) and incursion of invasive vine species in riparian habitat. • Loss and fragmentation of core moist forest breeding habitat resulting from land clearing and urbanization, particularly where remnant and corridor habitat occurs along the species' migration routes. No recovery plan exists for this species.

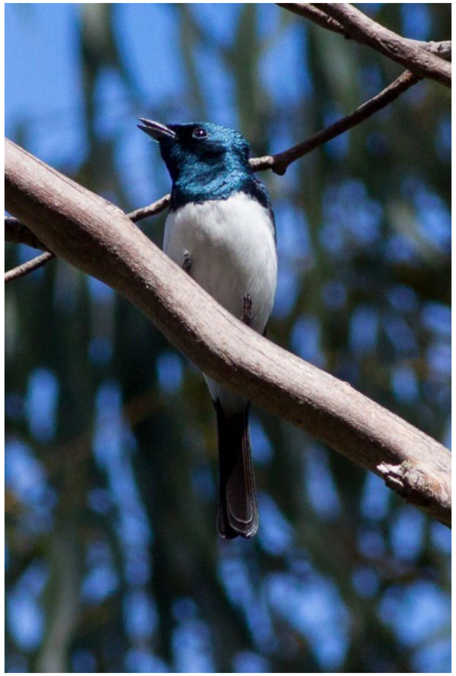
Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
		Semi-evergreen vine-thicket and eucalypt woodlands throughout the Study Area may be utilised for foraging and dispersal when on passage to breeding habitat in south-eastern Australia. It is unlikely that the species breeds in the area due to the geographical location and the lack of wet forest and rainforest. Clearing within the Disturbance Footprint will result in the loss of 372.0 ha of foraging and dispersal habitat for the species. The Disturbance Footprint is outside of the species' breeding range. It should be noted that these areas are subject to change as the Disturbance Footprint is refined.	
spectacled monarch (*Symposiarchus trivirgatus*) – Migratory under the EPBC Act and Special Least Concern under the NC Act			
	The spectacled monarch is found in dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation such as mangroves, drier forest and woodlands. These habitats are considered important habitats (Department of the Environment, 2015a). The spectacled monarch is distributed across eastern Australia along the coastal regions where it is a resident in the north of its distribution and a summer breeding migrant to coastal south-eastern Australia. This species begins its southern	The spectacled monarch was recorded within the Study Area twice in June 2020, once in the central portion and once in the north-eastern portion. Numerous records, including recent records, exist for this species in the surrounding region (Atlas of Living Australia, 2022). Habitat suitable for foraging and dispersal was present within the Study Area and included the following: • Semi-evergreen vine thicket. • Gullies in eucalypt woodlands where dense vegetation occurs.	The primary threat identified for the species is: • Introduction of invasive species including black rat (*Rattus rattus*) and incursion of invasive vine species in riparian habitat. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	migration in September and returns north in March. Spectacled monarch also occupies coastal islands from Cape York in Queensland to Port Stephens in New South Wales (BirdLife Australia, 2022a). This species is also thought to migrate to Papua New Guinea, the Moluccas and Timor during the autumn and winter months (BirdLife Australia, 2022a; Museum Australian, 2022). The spectacled monarch is insectivorous, foraging primarily in the foliage beneath the canopy and on tree trunks or vines. The spectacled monarch constructs a tiny cup nest of fine bark, plant fibres, moss, and spider web 1 m to 6 m above the ground, frequently close to water, in a tree fork or in hanging vines (BirdLife Australia, 2022a).	The location of these records are provided in **Figure 3.3**. The species utilises this region on its' migration and does not reside or breed in the region. As such habitat within the Study Area has been identified as foraging and dispersal only. Clearing within the Disturbance Footprint will result in the loss of 17.5 ha of foraging and dispersal habitat for the species. The Disturbance Footprint is outside of the species' breeding range. It should be noted that these areas are subject to change as the Disturbance Footprint is refined.	
fork-tailed swift (*Apus pacificus*) – Migratory under the EPBC Act and Special Least Concern under the NC Act			
	The fork-tailed swift is found across a range of habitats in Australia, from inland open plains to wooded areas, where it is exclusively aerial (Department of the Environment, 2015b). It spends most of the year at high altitudes, feeding on invertebrates carried aloft in the air column known as aerial plankton. The fork-tailed swift comes down, near to the ground during bad weather.	Despite the high likelihood of occurrence rating for this species, the fork-tailed swift was not identified during the field survey program. The air space above remnant and regrowth woodlands, open pasture grassland and non-remnant vegetation communities all have the potential to be used by this species for foraging and dispersal within the Study Area.	No significant threats to this species in Australia. The potential threats identified for this species are: • Habitat destruction. • Predation by introduced species. No recovery plan exists for this species.

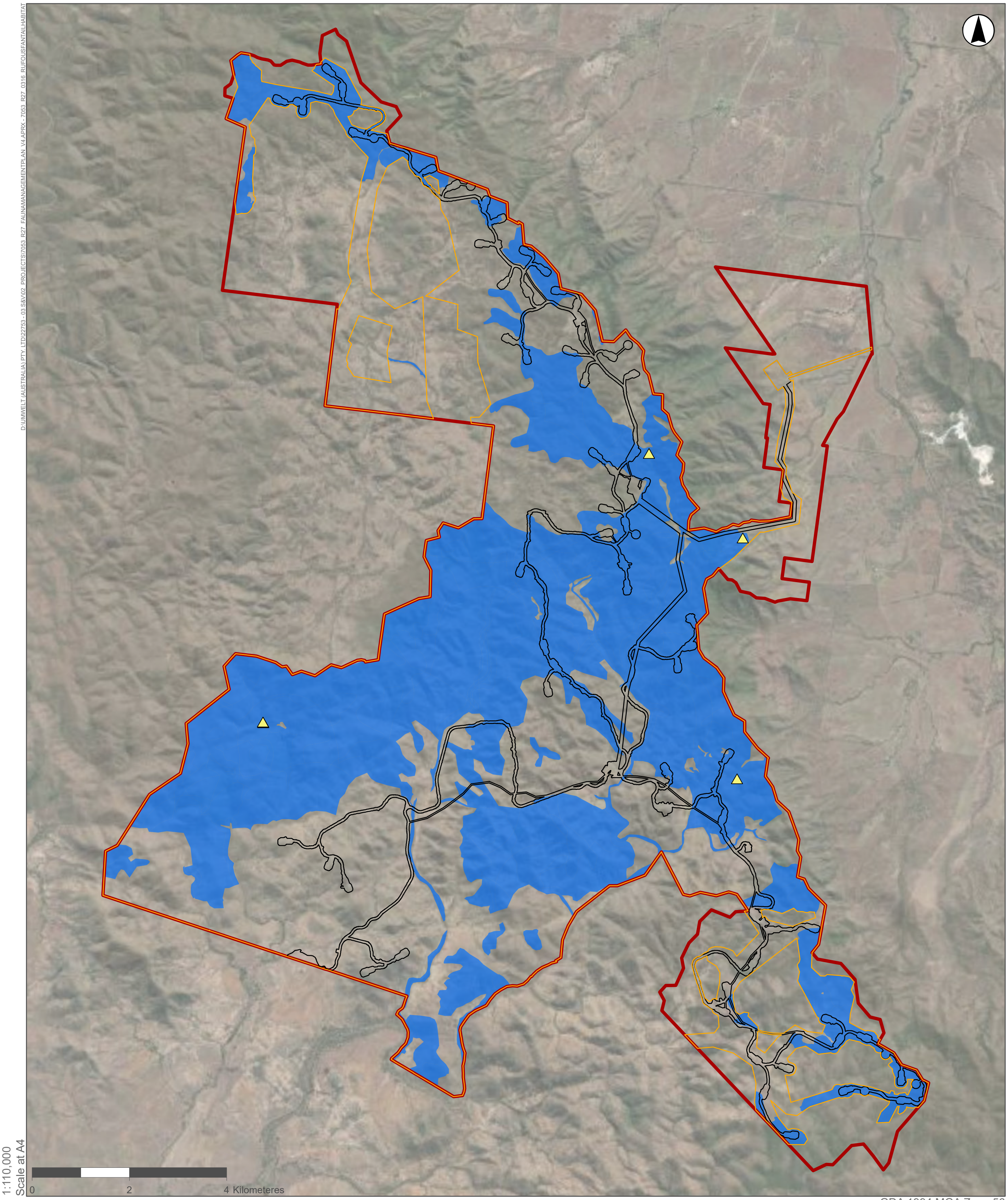
Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The species migrates to Australia during the warmer months of the year from breeding habitat in South-east Asia, where it nests in colonies on cliffs. No breeding habitat is known in Australia.	Desktop records occur in scattered locations in the wider area. The nearest record is from 2019 and is located approximately 20 km north of the Study Area near the Bouldercombe Forge Conservation Park. Clearing within the Disturbance Footprint will result in the loss of 877.3 ha of foraging and dispersal habitat for the species. The Disturbance Footprint is outside of the species' breeding range. It should be noted that these areas are subject to change as the Disturbance Footprint is refined.	
black-faced monarch (*Monarcha melanopsis*) – Migratory under the EPBC Act and Special Least Concern under the NC Act			
	The black-faced monarch inhabits humid gullies, coastal scrub, eucalyptus woodlands, and rainforests. When migrating, it can occur in more open forest across its range (BirdLife Australia, 2022b). This species is mainly associated with wet forests, primarily wet sclerophyll forests and rainforests, particularly in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs (Department of the Environment, 2015a).	Black-faced monarch was not observed within the Study Area during the field survey program. It is conservatively considered to have a moderate likelihood of occurrence due to the presence of suitable habitat and scattered desktop records in the wider local area. The nearest desktop record is located approximately 21 km north near Bouldercombe Gorge Conservation Park and is undated.	The primary threats identified for the species are: • Introduction of invasive species including black rat (*Rattus rattus*) and incursion of invasive vine species in riparian habitat. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The black-faced monarch is distributed across eastern Australia along the coastal regions becoming less common towards the southern extent of its range. This species flies between their breeding grounds in eastern Australia and their wintering habitats in southern New Guinea across the Torres Strait. Individual birds can occur outside of their typical range with vagrants being observed in Western Australia and New Zealand. Individuals have also been recorded in northern and western Victoria and in southern South Australia (BirdLife Australia, 2022b). The black-faced monarch feeds on insects foraging amongst foliage catching prey on the wing. Their nest consists of a deep cup that is typically made from casuarina needles, bark, roots, moss and spider web and placed in the fork of a tree between 3 and 6 m above the ground. Females build the nest and both sexes incubate the eggs (BirdLife Australia, 2022b).	The Project is located within an area mapped as core breeding range for the species however, given that no rainforest or wet sclerophyll habitat types exist within the Study Area suitable habitat is predominantly limited to foraging and dispersal habitat. Semi-evergreen vine thicket associated with gullies and slopes may represent marginal breeding habitat and has been conservatively included. Habitat suitable for foraging and dispersal was present within three habitat types for the species including: • Semi-evergreen vine thicket. • Remnant alluvial eucalypt woodland. • Eucalypt woodland with open understory and grassy ground layer. The species utilises the region on its' migration and breeds in select parts of Queensland. As such, habitat within the Study Area may provide foraging, dispersal and marginal breeding opportunities. Sheltered gullies with dense vegetation and semi-evergreen vine thicket communities may be suitable for foraging and potentially breeding constituting an important habitat.	

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
		Clearing within the Disturbance Footprint will result in the loss of 17.5 h of foraging and marginal breeding habitat and 354.6 ha of foraging and dispersal habitat for the species. It should be noted that these areas are subject to change as the Disturbance Footprint is refined.	
oriental cuckoo (*Cuculus optatus*) – Migratory under the EPBC Act and Special Least Concern under the NC Act			
	Oriental cuckoo is found in a range of vegetation types including rainforest, vine-thicket and wet sclerophyll forests. It also inhabits open communities such as *Casuarina*, *Acacia* and *Eucalyptus* woodland, favouring edges or ecotones between forest types. While on passage, this species has been recorded occupying plantations, cleared areas and gardens, typically at lower. A non-breeding migrant to Australia, oriental cuckoo transits to northern and eastern Australia in summer reaching as far south on the east coast as Bega, NSW.	Oriental cuckoo was not recorded within the Study Area during the field survey program despite the extensive targeted fauna and bird utilisation surveys. This species was conservatively assessed as having a moderate likelihood of occurring within the Study Area due to the presence of scattered records in the wider local area and suitable habitat. The nearest desktop record is located approximately 20 km north of the Study Area near the Bouldercombe Forge Conservation Park and is undated with 9000 m spatial uncertainty. While no breeding habitat occurs within the Australia, large tracts of eucalypts woodlands and vine-thickets throughout the Study Area may be suitable for foraging and dispersal purposes. Habitat suitable for foraging and dispersal was identified as: • Semi-evergreen vine thicket. • Remnant alluvial eucalypt woodland.	Threats to this species are not known. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
		• Eucalypt woodland with open understory and grassy ground layer. Clearing within the Disturbance Footprint will result in the loss of 372.0 ha of foraging and dispersal habitat for the species. The Disturbance Footprint is outside of the species' breeding range. It should be noted that these areas are subject to change as the Disturbance Footprint is refined.	
satin flycatcher (*Myigra cyanoleuca*) – Migratory under the EPBC Act and Special Least Concern under the NC Act			
	The satin flycatcher inhabits heavily vegetated gullies in eucalypt forests and taller woodlands, often near wetlands or watercourses. They are mostly recorded in wet sclerophyll forests, however they also occur in eucalypt woodlands with open understorey and grassy ground cover (Department of the Environment, 2019). This species migrates to northern Australia and Papua New Guinea in autumn and returns to south-eastern Australia in spring however their movements are described as erratic. Their migration route appears to follow the Great Dividing Range but reported sightings have occurred in coastal NSW.	The satin flycatcher was not observed within the Study Area during the field survey program. It is conservatively considered to have a moderate likelihood of occurrence due to the presence of suitable habitat and scattered desktop records in the wider local area. The nearest desktop record is from 1994 and is located approximately 12 km north near Bouldercombe Gorge Conservation Park although has a 20 km spatial uncertainty. Habitat suitable for foraging and dispersal was present within two habitat types for the species: • Remnant alluvial eucalypt woodland. • Eucalypt woodland with open understory and grassy ground layer.	The primary threats identified for the species are: • Introduction of invasive species including black rat (*Rattus rattus*) and incursion of invasive vine species in riparian habitat. • Clearing and logging of mature forest in south-eastern Australia. No recovery plan exists for this species.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	Departure times vary dependent on location, but it is generally between February and early May. Timing for returning to south-eastern Australia to breed also varies dependent on location but ranges between August to November. The satin flycatcher is primarily insectivorous, preying on arthropods, mostly insects, although very occasionally they will also eat seeds. They are arboreal foragers, feeding high in the canopy and subcanopy of trees, usually sallying for prey in the air or picking prey from foliage and branches of trees, flitting from one perch to another (Department of the Environment, 2019).	• The species utilises this region on its' migration and does not reside or breed in the area. As such habitat within the Study Area has been identified as suitable for foraging and dispersal only. Clearing within the Disturbance Footprint will result in the loss of 363.7 ha of foraging and dispersal habitat for the species. The Disturbance Footprint is outside of the species' breeding range. It should be noted that these areas are subject to change as the Disturbance Footprint is refined.	



Legend

- Rufous Fantail Record (ALA)
- Towns
- Rufous Fantail Record (Umwelt)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Rufous Fantail Habitat

- Foraging and Dispersal (Important Habitat)

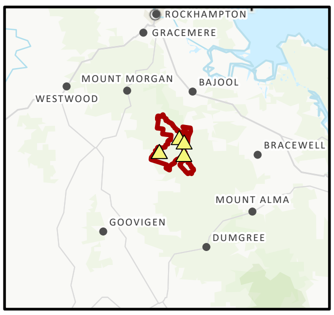
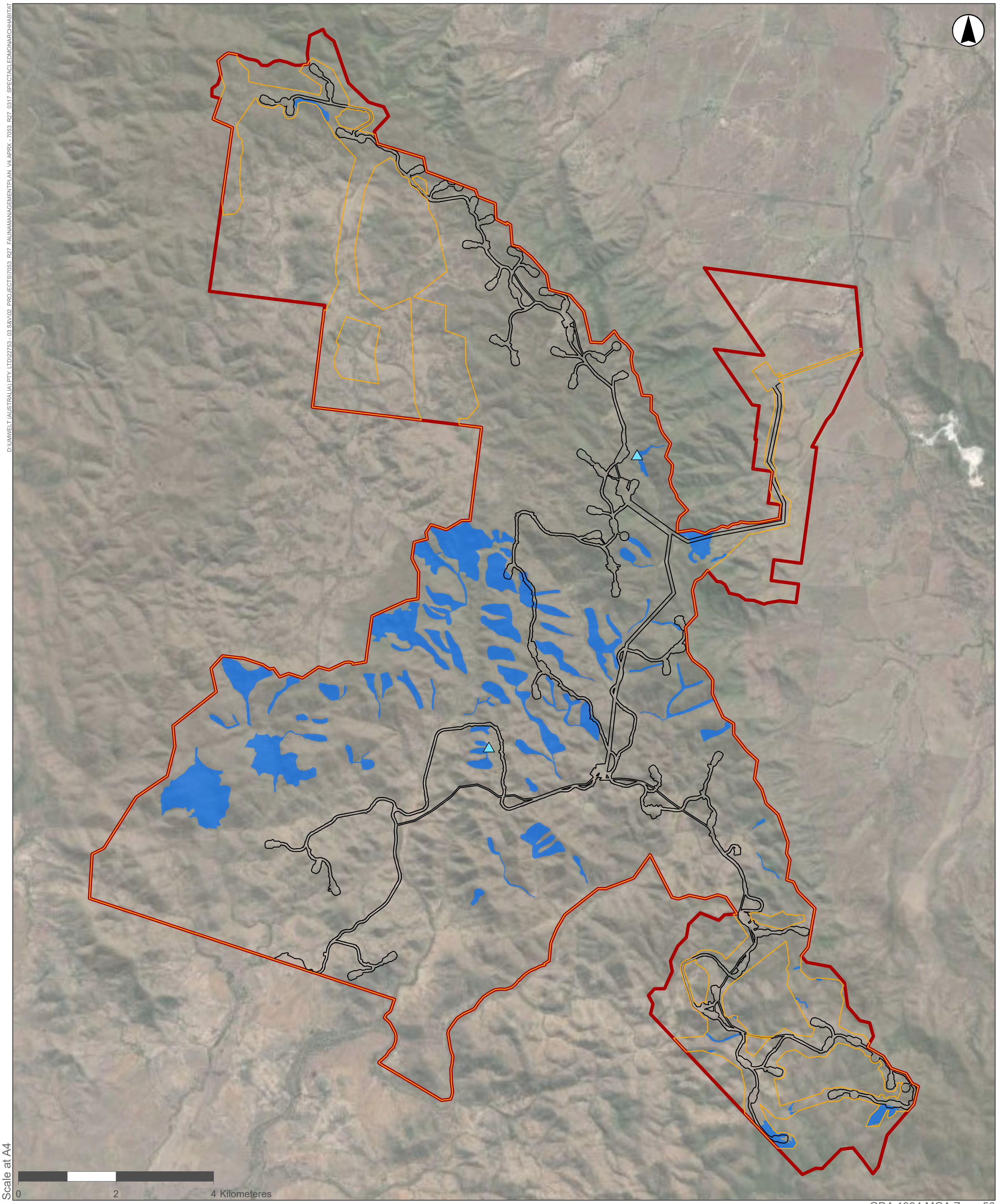


FIGURE 3.16

RUFOUS FANTAIL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Spectacled monarch Record (ALA)
- Spectacled monarch Record (Umwelt)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Spectacled Monarch Habitat

- Foraging and Dispersal (Important Habitat)

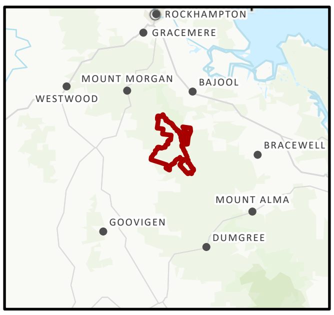
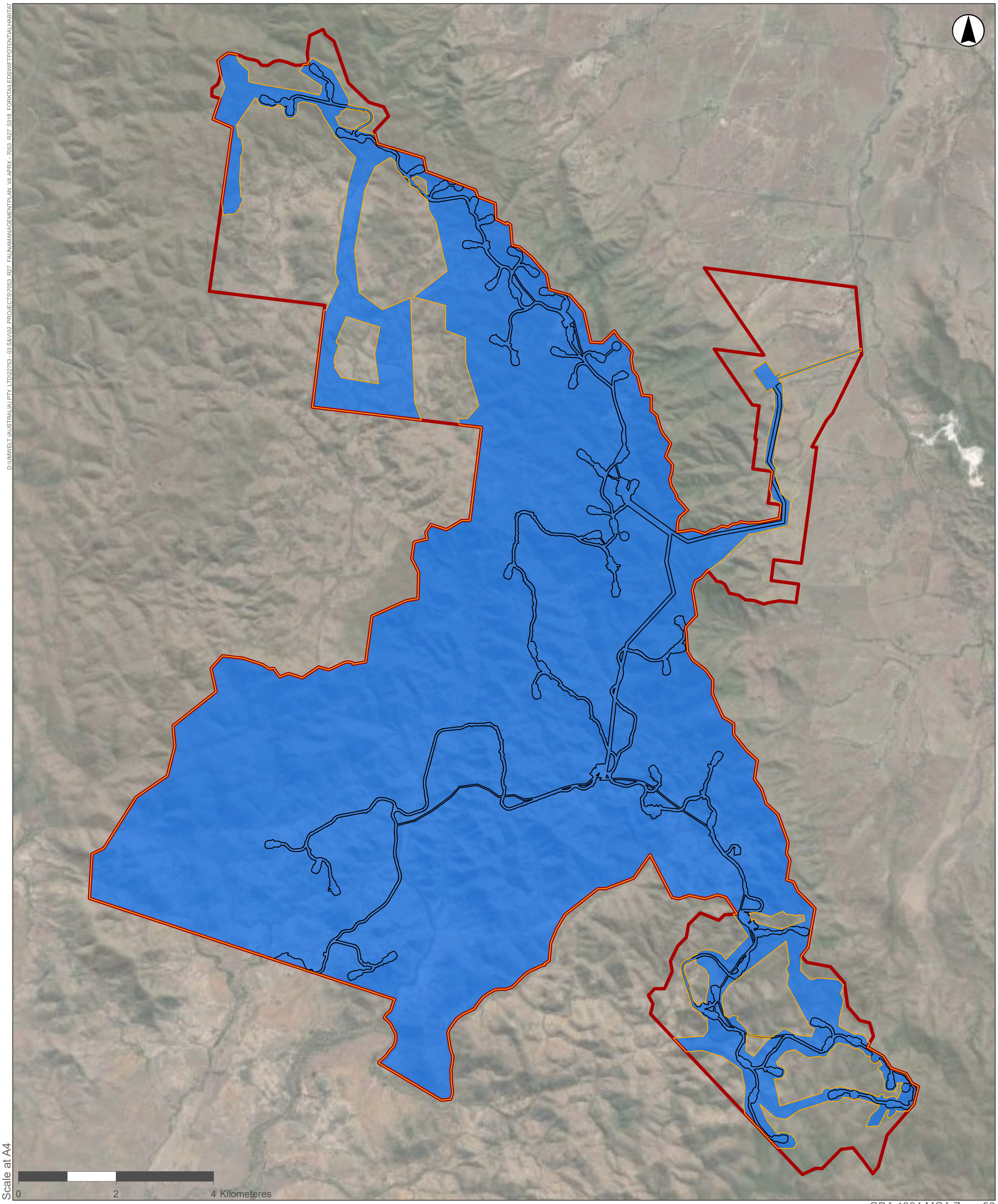


FIGURE 3.17

SPECTACLED MONARCH HABITAT



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GDA 1994 MGA Zone 56

D:\UMWELT (AUSTRALIA) PTY. LTD\22753 - 03 S&V\02 PROJECTS\7053 R27 FAUNAMANAGEMENTPLAN V4.APRX - 7053 R27 0318 FORKTAILEDSWIFTPOTENTIALHABITAT

Legend

- Fork-tailed Swift Record (ALA)
- Towns
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Fork-tailed Swift Habitat

- Foraging and dispersal (exclusively aerial species) (Important Habitat)

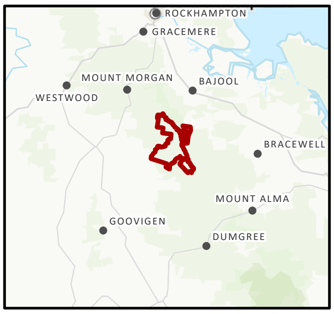
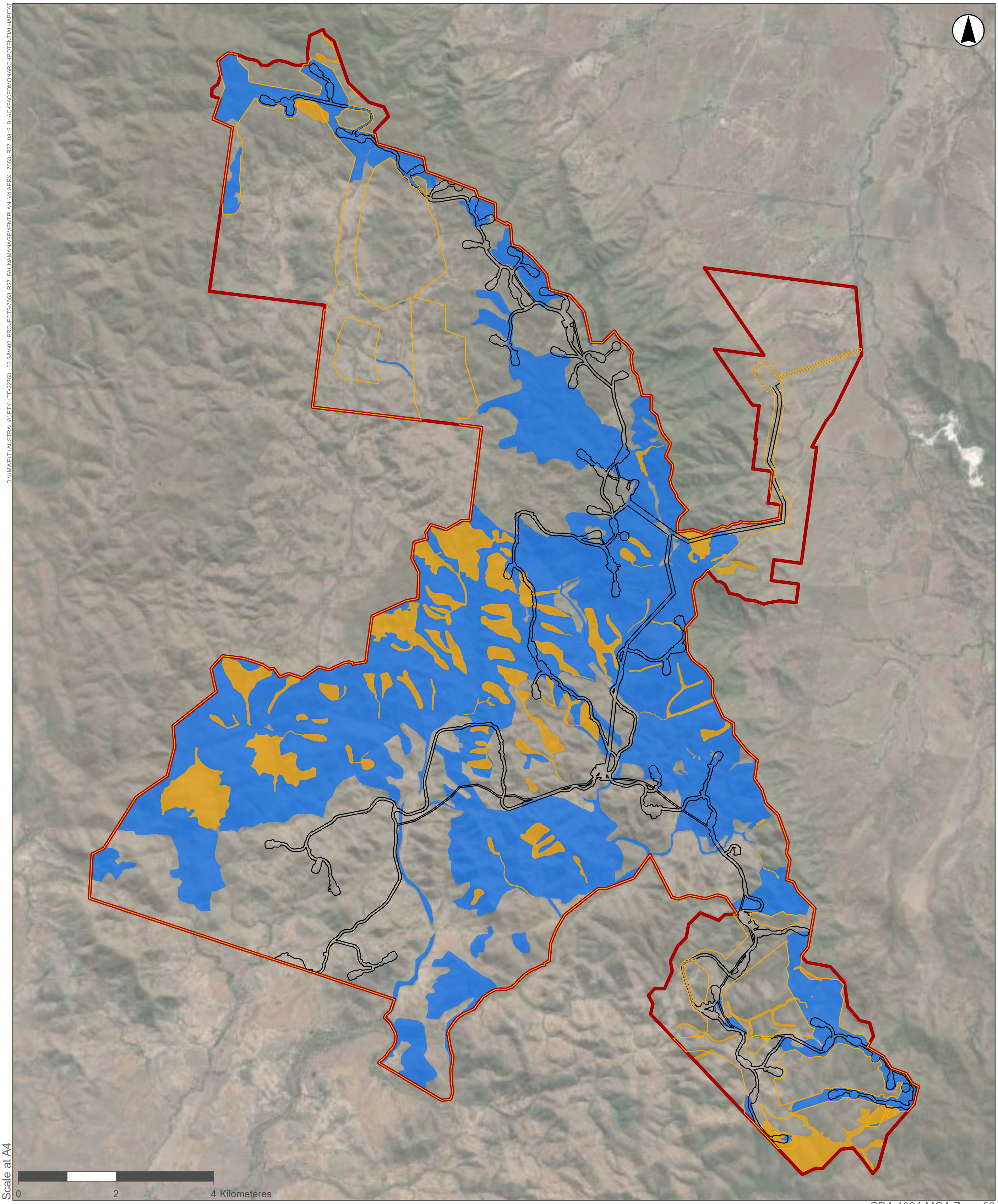


FIGURE 3.18

FORK-TAILED SWIFT POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Towns
- Black-faced Monarch Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Black-faced Monarch Habitat

- Foraging and Dispersal
- Foraging and Marginal Breeding

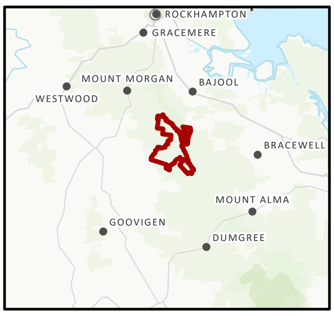
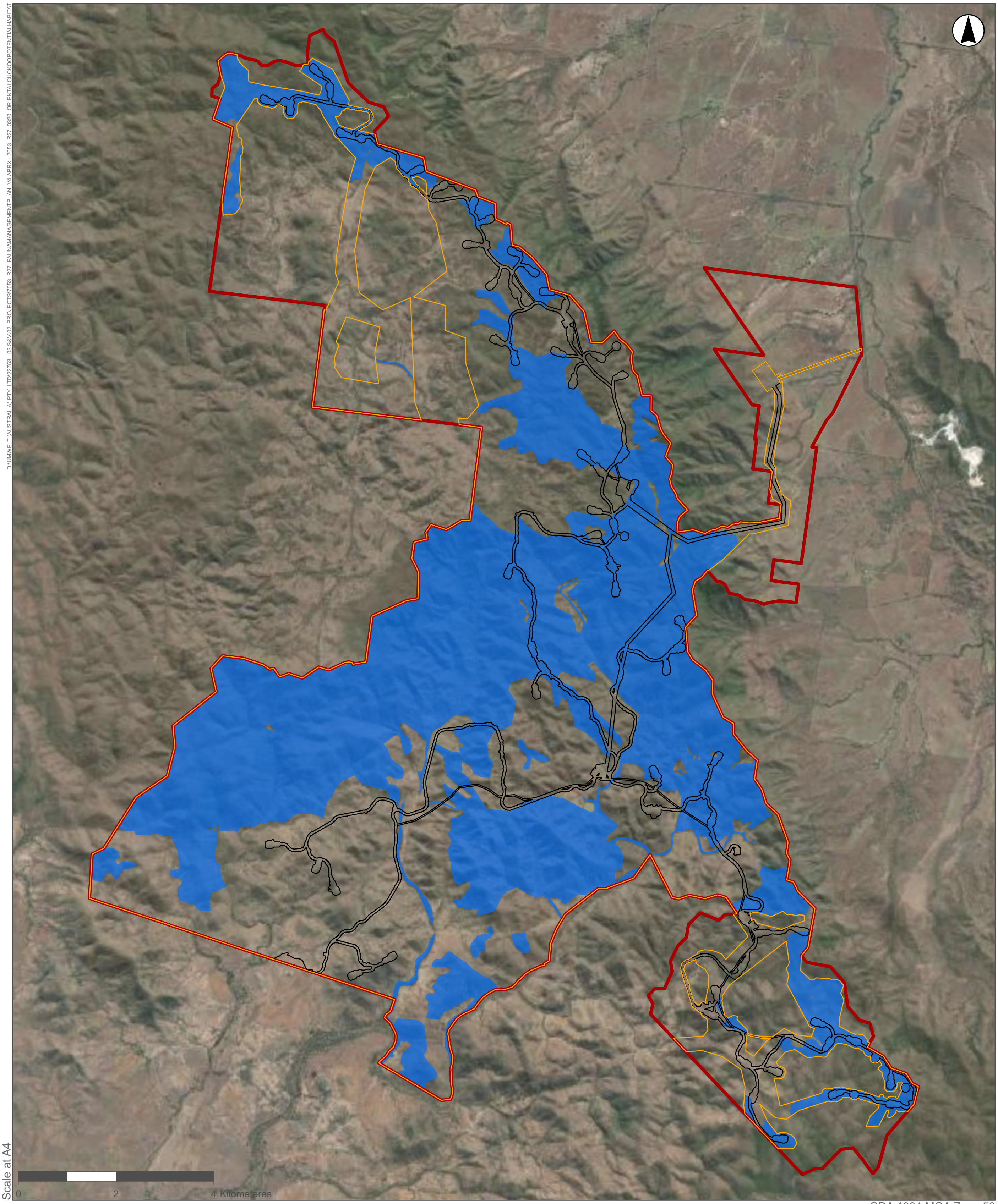


FIGURE 3.19

BLACK-FACED MONARCH POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



GDA 1994 MGA Zone 56

Legend

- Oriental Cuckoo Record (ALA)
- Towns
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Oriental Cuckoo Habitat

- Foraging and dispersal (Important Habitat)

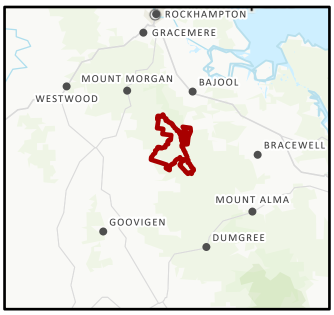
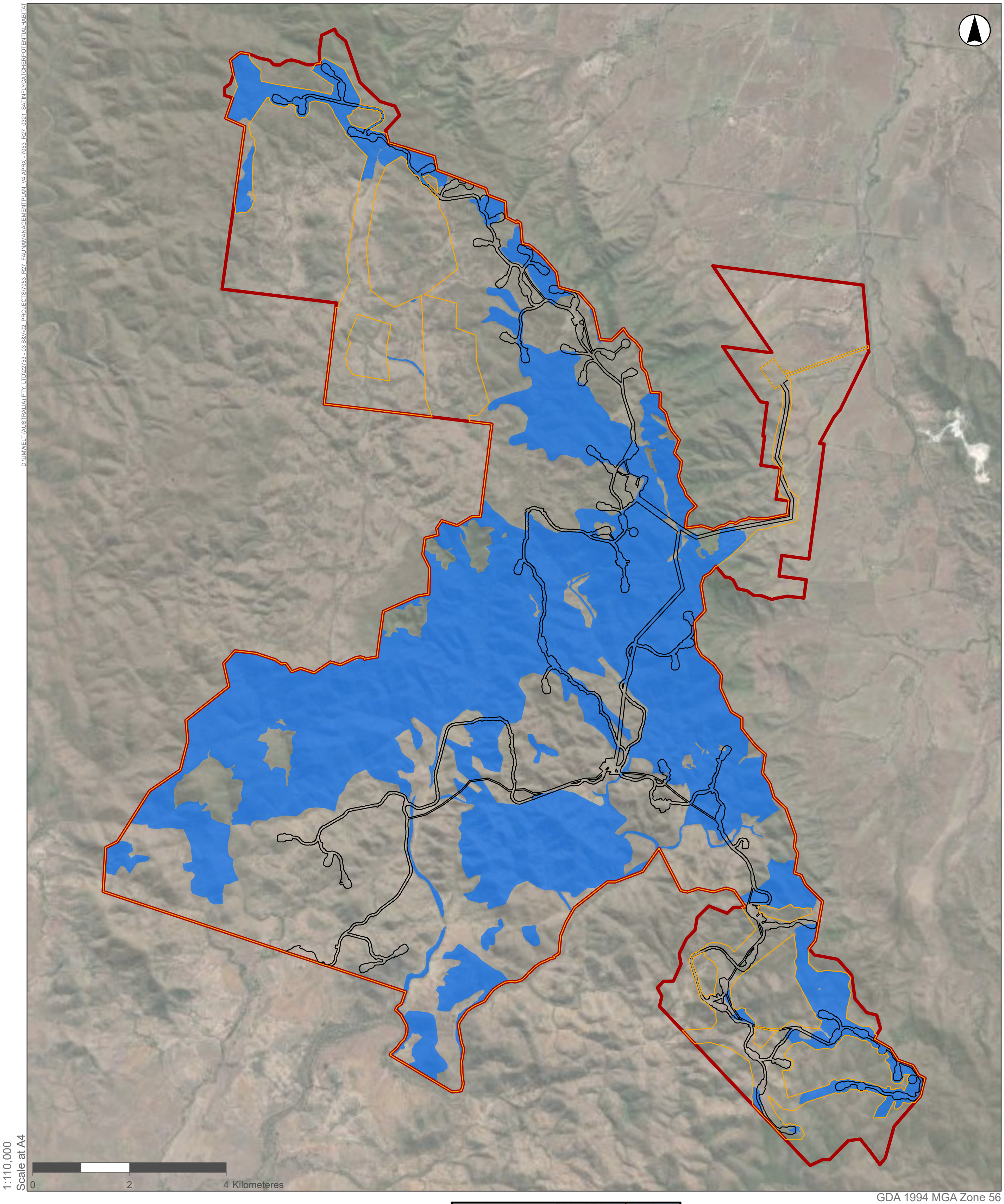


FIGURE 3.20

ORIENTAL CUCKOO POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Towns
- Satin Flycatcher Record (ALA)
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area

Potential Satin Flycatcher Habitat

- Foraging and Dispersal (Important Habitat)

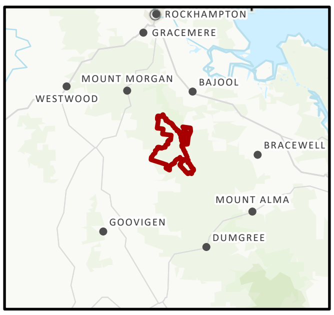


FIGURE 3.21

SATIN FLYCATCHER POTENTIAL HABITAT

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

4.0 Potential Impacts

4.1 Overview

The Project has the potential to impact on fauna and fauna habitat values within the Study Area during the construction, operation and maintenance and decommissioning and rehabilitation phases of the Project. The key potential impacts associated with the different Project phases have been summarised below in **Table 4.1**.

The greatest potential impact on ecological values will be from direct impacts associated with the clearing of vegetation during the construction phase of the Project. Within the Study Area, a maximum area of approximately 877.5 ha will be directly impacted as determined by the Disturbance Footprint (**Figure 1.1**). Approximate impacts on fauna habitat have been provided below in **Table 4.2**.

Mitigation and management measures to reduce Project impacts are discussed in **Section 5.0**.

Table 4.1 Project Activities, Risks and Potential Impacts

Project Phase	Project Activity	Risk/ Threat	Potential Impacts
Construction	Site establishment, vegetation and habitat clearing	Habitat loss, fragmentation, and degradation	• Increase or the introduction of edge effects. • Removal of habitat features necessary to support threatened and migratory fauna species. • Reduction in the extent and condition of suitable habitat. • Reduction in population size and number of individuals within a community.
		Introduction and exacerbation of weeds and pest fauna species	
	Construction activities including vehicular movement	Dust generation	
		Soil erosion and sedimentation	
Operation and Maintenance	Project activities	Introduction and exacerbation of weeds and pest fauna species	
Decommissioning	Project conclusion and rehabilitation works	Dust generation	
		Introduction and exacerbation of weeds and pest fauna species	

4.2 Potential Impacts to Fauna Habitat

The Project will result in the removal of up to 372.0 ha of remnant vegetation, 261.8 ha of regrowth vegetation and 241.2 ha of non-remnant cleared vegetation within the Disturbance Footprint (**Figure 1.1**). **Table 4.2** below provides a breakdown of direct impacts to threatened and migratory fauna species and details the mapped extent of each habitat type within the Development Corridor and within the Disturbance Footprint.

Table 4.2 Impacts to Threatened and Migratory Fauna Habitat/Potential Habitat the Development Corridor and Disturbance Footprint

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Habitat Type	Area (ha) within the Development Corridor	Area (ha) within Disturbance Footprint
Threatened Fauna Habitat/Potential Habitat						
glossy black-cockatoo	*Calyptorhynchus lathami*	Vulnerable	Vulnerable	Marginal breeding	38.6	23.8
				Foraging	372.7	242.5
greater glider (southern and central)	*Petauroides volans*	Endangered	Endangered	Breeding and denning	330.4	206.9
				Foraging and dispersal	500.4	331.5
yellow-bellied glider (south-eastern)	*Petaurus australis australis*	Vulnerable	Vulnerable	Breeding and denning	275.4	170.6
				Foraging and dispersal	280.7	181.1
northern quoll	*Dasyurus hallucatus*	Endangered	Least Concern	Denning and refuge	49.1	22.1
				Foraging and dispersal	834.0	551.4
squatter pigeon (southern)	*Geophaps scripta scripta*	Vulnerable	Vulnerable	Breeding	4.4	3.6
				Foraging	2.2	1.5
				Dispersal	470.0	324.2
white-throated needletail	*Hirundapus caudacutus*	Vulnerable, Migratory	Vulnerable	Roosting and foraging	427.9	267.9
				Foraging and dispersal	554.2	365.9
collared delma	*Delma torquata*	Vulnerable	Vulnerable	Breeding and foraging	6.1	5.0
koala	*Phascolarctos cinereus*	Vulnerable	Vulnerable	Breeding, foraging and dispersal	1,111.3	721.1
				Climate refugia	7.1	5.3
red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Endangered	Foraging and dispersal	883.9	578.3
ghost bat	*Macroderma gigas*	Vulnerable	Endangered	Seasonal foraging and dispersal	1,346.5	877.3

Common Name	Scientific Name	EPBC Act Status	NC Act Status	Habitat Type	Area (ha) within the Development Corridor	Area (ha) within Disturbance Footprint
grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	Least Concern	Foraging and dispersal	374.6	243.7
short-beaked echidna	*Tachyglossus aculeatus*	-	Special Least Concern	Foraging, breeding and dispersal	1,346.5	877.3
Migratory Fauna Habitat/Potential Habitat						
rufous fantail	*Rhipidura rufifrons*	Migratory	Special Least Concern	Foraging and dispersal	594.0	372.0
spectacled monarch	*Symposiarchus trivirgatus*	Migratory	Special Least Concern	Foraging and dispersal	40.0	17.5
fork-tailed swift	*Apus pacificus*	Migratory	Special Least Concern	Foraging and dispersal	1,346.5	877.3
black-faced monarch	*Monarcha melanopsis*	Migratory	Special Least Concern	Foraging and marginal breeding	40.0	17.5
				Foraging and dispersal	554.5	354.6
oriental cuckoo	*Cuculus optatus*	Migratory	Special Least Concern	Foraging and dispersal	594.0	372.0
satin flycatcher	*Myiagra cyanoleuca*	Migratory	Special Least Concern	Foraging and dispersal	573.1	363.7

4.2.1 Threatened Fauna

The Project will result in the removal of suitable habitat for both known and potentially occurring threatened and migratory fauna species, as outlined in **Section 3.3.1** and **Section 3.3.2.** Several threatened and migratory species or species habitat with a likelihood of occurrence of Known, High or Moderate (**Section 3.3.1** and **Section 3.3.2**) may also require offsetting under the EPBC Act or EO Act.

Significant impact assessments were undertaken in accordance with the MNES Guidelines (Department of the Environment, 2013) for the species outlined in **Table 3.5** within the Assessment of Matters of National Environmental Significance (Attachment B of the Preliminary Documentation), as these species have a listing status recognised under the EPBC Act (refer **Section 2.0**). In summary, this assessment identified that after avoidance and mitigation measures were considered, the Project is likely to have a significant impact on the following species:

- Greater glider (southern and central).
- Yellow-bellied glider (south-eastern).
- Northern quoll.
- Koala.

An assessment against the Significant Residual Impact Guideline: For Matters Of State Environmental Significance and prescribed activities under the Sustainable Planning Act 2009 (Department of State Development Infrastructure and Planning, 2014) was also undertaken to determine whether the Project is likely to have a Significant Residual Impact on a MSES (refer **Section 2.0**). As per the Significant Residual Impact assessments detailed in Appendix F – Terrestrial Fauna Assessment (Umwelt (Australia) Pty Limited, 2023), related impacts on greater glider, may result in a Significant Residual Impact and require offsetting under the EO Act (Queensland). It should be noted the Study Area does not contain any essential habitat areas for listed fauna species, as shown on the DoR (of Natural Resources and Mines, 2016) Vegetation Management essential habitat map (version 11.05).

5.0 Mitigation and Management

5.1 Objectives

To reduce impacts to fauna habitat and threatened fauna species due to vegetation clearance, the management and mitigation measures outlined in the following sections have been developed with the aim to achieve the following objectives:

- Persistence and maintenance of known threatened fauna populations within the Study Area.
- Approved clearing limits will not be exceeded, as outlined in the Project's Development Approval and/or EPBC Act approval (if obtained).
- Management of pest fauna and weeds, to ensure there are no new introductions of pest fauna species and weeds within the Disturbance Footprint and that existing pest species are not exacerbated by Project activities.
- Retention of important habitat features and facilitation of fauna movement during vegetation removal.
- Bank stability and water quality to be maintained during disturbance of watercourses and drainage features.
- Implementation of erosion and sediment control measures to avoid degradation of fauna habitat.
- Micro-siting does not result in additional disturbance to threatened fauna or fauna habitat above the approved limits.

5.2 Mitigation and Management Measures

The mitigation and management measures presented in this PFMP have been developed with the aim to achieve the objectives outlined in **Section 5.1**. Mitigation and management measures are based on information within the following supporting documents:

- *Mitigating Biodiversity Impacts Associated with Solar and Wind Energy Development* (Bennun et al., 2021).
- Rockhampton Region Planning Scheme (Rockhampton Regional Council, 2015).
- Banana Shire Planning Scheme 2021 (Banana Shire Council, 2021).
- *Environmental Management Plan Guidelines* (Department of Environment, 2014).
- Information contained within Conservation Advice and Recovery plans for relevant species (Department of Climate Change Energy the Environment and Water, 2022b).

5.2.1 General Mitigation Measures

Table 5.1 contains the general mitigation and management measures that relate to fauna and fauna habitat identified within and adjacent to the Disturbance Footprint. Measures have been provided for the following key risks:

- Vegetation clearing, habitat loss, fragmentation and degradation.
- Soil erosion and sedimentation.
- Introduction and exacerbation of introduced weed and pest fauna species.

Table 5.1 Management and Mitigation Measures for the Avoidance of Impacts to Fauna and Fauna Habitat

Risk / Threat	Objective	Mitigation Measures and Management Action(s)	Timing
Vegetation clearing, habitat loss, fragmentation and degradation	Approved clearing limits will not be exceeded, as outlined in the Project's Development Approval and/or EPBC Act approval (if obtained)	• All Project activities including site access, laydown of plant and equipment and construction activities must be within the finalised Disturbance Footprint. • To ensure all Project activities are within the finalised Disturbance Footprint the following measures will be implemented: ○ Final clearing extents within the Disturbance Footprint will be demarcated with flagging tape and where relevant, fencing. ○ Spatial files (shapefile format) will be provided detailing the Disturbance Footprint and clearing extents. ○ The Environment Officer will inspect this area on a weekly basis to ensure work is being undertaken within the final clearing extents within the Disturbance Footprint, and that the fencing/ flagging tape is still within the correct location. ○ Where possible, locate access tracks and electrical connections adjacent to existing access or farm tracks to minimise clearing. ○ Where possible, reduce clearing to the minimum extent required to facilitate construction activities within the Disturbance Footprint in areas surrounding creek lines and watercourses. ○ Stockpile locations to be identified within previously cleared areas and utilised to retain topsoil and cleared vegetation material. These areas are to be identified during pre-clearance surveys and demarcated with appropriate signage and flagging tape.	Prior to commencement of site disturbance and any construction activities
	Micro-siting does not result in additional disturbance to threatened fauna or fauna habitat above the approved limits	Pre-clearance habitat surveys will be undertaken by a suitably qualified person within suitable habitat in the Disturbance Footprint for the threatened species which are known or likely to occur. (inclusive of a 5 m buffer). These surveys will identify important microhabitat features (i.e. hollow bearing trees; boulder piles) to inform the micro-siting process. Where possible, optimise the placement of infrastructure within the Disturbance Footprint to further minimise impacts to: • Potential threatened or migratory fauna species habitat features. • Potentially active breeding places. • Known locations of threatened or migratory fauna species. Refer to **Section 5.2.3** for details pertaining to pre-clearance survey.	Within 3 months prior to commencement of site disturbance and any construction activities.

Risk / Threat	Objective	Mitigation Measures and Management Action(s)	Timing
	Persistence and maintenance of known threatened fauna populations within the Study Area	• Personnel will be informed of the sensitive areas[1] within the Disturbance Footprint as well as the procedures for minimising ecological impacts through site inductions, training, and toolbox talks. • Exclusion zones will be established around active and potentially active breeding places, such as nests, burrows, dens etc., identified during pre-clearance surveys. Where there is the potential an active breeding place will be tampered with, this will only be done in accordance with an approved and appropriate (low or high risk) DES Species Management Program (SMP) as per the Nature Conservation (Animals) Regulation 2020. • Pre-clearance surveys within the Disturbance Footprint will include opportunistic searches for threatened and migratory species (Refer to **Section 3.3.1** and **Section 3.3.2**). If any individuals, populations or high-value microhabitat features are located during the targeted surveys, these will be recorded as per **Section 5.3.** In the event collared delma is detected during the pre-clearance survey the constraint identification protocol will be followed (**Section 5.3.1**). • A fauna spotter catcher will be present to conduct pre-clearance inspections prior to vegetation clearing activities and monitoring for the presence of fauna during vegetation clearing. In the event collared delma is detected during the clearing process it is the fauna spotter catcher's responsibility to enact Step 1 of the constraint identification protocol (**Section 5.3.1**).	Prior to personnel entering and working on the Project site
	Persistence and maintenance of known threatened fauna populations within the Study Area	• Daily toolbox talks to identify vegetation clearing boundary and presence of high-value microhabitat for threatened fauna identified during pre-clearance survey with vegetation clearing contractor and fauna spotter catcher. • Inspection to be undertaken by a fauna spotter catcher prior to the commencement of any vegetation clearing activities to identify and communicate the presence of potential fauna habitat.	During vegetation clearing activities

Risk / Threat	Objective	Mitigation Measures and Management Action(s)	Timing
		• A fauna spotter catcher will be present at all times during clearing activities. The fauna spotter catcher will inspect habitat features (including but not limited to: hollowing-bearing trees and stags, caves and rocky boulder piles) for threatened and migratory fauna prior to felling, using work platforms, inspection cameras or other methods deemed safe and suitable. Fauna spotters will also be present during earthworks where exposed trenches and holes will be left for periods greater than 24 hours. • A fauna spotter catcher will be present during all vegetation clearing and mulching activities to ensure harm to threatened, migratory and least concern fauna is reduced. Under no circumstances is vegetation clearing or mulching to occur without a fauna spotter catcher present. • Fauna handling avoided in the first instance and limited to a fauna spotter catcher where fauna species are required to be relocated outside of the Disturbance Footprint. Release of fauna to occur in nearest adjacent retained vegetation in areas that provide suitable dispersal capacity for the species. Release of fauna must consider the behaviors of the animals (i.e. nocturnal animals are not to be released prior to dusk and diurnal animals not be released later than 2 hours prior to sunset to ensure they have time to seek refuge).	
	Retention of important habitat features and facilitation of fauna movement during vegetation removal	• Habitat features such as fallen logs, ground timber and large rocks to be salvaged prior to vegetation clearing and relocated to vegetation that will be retained outside of the Disturbance Footprint or reinstated as part of rehabilitation works. Movement of this microhabitat must be completed in such a way as not to disturb the recipient habitat. • Where fauna habitat trees occur at the edge of the Disturbance Footprint, they should be avoided in the first instance and pruned back where avoidance is not possible. • Glider poles are proposed to be installed at 13 locations within the Disturbance Footprint to provide movement opportunities between areas of suitable habitat in the landscape. The proposed glider pole locations represent areas important for dispersal and where ongoing connectivity is required to avoid isolation of patches and retention of possible high use areas (i.e. riparian corridors). Glider pole locations will be finalised during the detailed design phase of the Project. • Five 'pinch points' are proposed within the Disturbance Footprint to maintain movement opportunities and minimise fragmentation impacts. Pinch points describe locations of the Disturbance Footprint which are reduced in width. Although pinch points will be designed to facilitate movement of greater gliders and yellow-bellied gliders, they will also limit the dispersal distance required for other fauna to cross cleared areas. Pinch points locations will be finalised during the detailed design phase of the Project.	During vegetation clearing activities

Risk / Threat	Objective	Mitigation Measures and Management Action(s)	Timing
		• Vegetation clearing undertaken in a staged approach clearing directionally towards retained vegetation outside of the Disturbance Footprint to avoid isolation of displaced fauna and maintain connectivity with retained vegetation. • Where clearing of habitat trees cannot be avoided, understory clearing is to be undertaking around individual trees and left for 24 hours to allow fauna to disperse on their own accord. Nearby large trees to be retained for the 24 hour period to maintain dispersal capacity of arboreal mammals.	
Soil erosion and sedimentation	Bank stability and water quality to be maintained during disturbance of watercourses and drainage features	• Vegetation clearing within a watercourse, drainage feature or riparian vegetation to be kept to the minimum extent practical. • Installation of appropriate stabilisation and sediment control measure where vegetation clearing occurs at a watercourse or drainage feature including rock checks, pipes or culverts. • The potential impacts of erosion and sedimentation will be mitigated and managed through the development and implementation of an Erosion and Sediment Control Plan (ESCP) to ensure water quality is maintained during construction activities.	Prior to commencement of site disturbance and any construction activities
	Implementation of erosion and sediment control measures to avoid degradation of fauna habitat	• The potential impacts of erosion and sedimentation will be mitigated and managed through the Project's Preliminary Erosion and Sediment Control Plan (to be finalised and approved prior to construction). This will include the establishment of temporary erosion and sediment control until construction is complete or exposed areas have been rehabilitated to prevent the sedimentation of waterways within the Disturbance Footprint.	Prior to commencement of site disturbance and any construction activities.
Introduction and exacerbation of introduced weed and pest fauna species	Management of pest fauna and weeds, to ensure there are no new introductions of pest fauna species and weeds within the Disturbance Footprint and that existing pest species are not	**Pre-construction** • Baseline pest fauna conditions will need to be established prior to construction such that impacts from the Project can be monitored throughout the Project lifecycle. A baseline pest fauna survey will be conducted prior to construction of the Project. • Pre-construction management and mitigation of weeds will be undertaken in accordance with the Project's Vegetation Management Plan. **Construction, Operation and Maintenance, Decommissioning and Rehabilitation** • Mitigation and management of weed species during the construction and post-construction phases of the Project will be undertaken in accordance with the Project's Vegetation Management Plan.	Pre-construction: 0–6 months prior to commencement of site disturbance and any construction activities.

Risk / Threat	Objective	Mitigation Measures and Management Action(s)	Timing
	exacerbated by Project activities	• Ongoing monitoring of pest species within the Project footprint to establish a trend in pest species occurrence. A weed and pest monitoring report will be prepared 2 years after construction has ceased to compare baseline weed and pest fauna abundance and site usage. • Implement a species-specific control program for pest fauna in consultation with landowner(s). This is only to be implemented if incidence of any feral fauna species has increased during construction or operation as reasonably attributable to the Project. The species-specific control program will be detailed in the Weed and Pest Management Plan. • Avoid inclusion of any water retaining voids or pits in the design where these are not otherwise required for the control of stormwater run-off erosion and sediment control measures or dams required to supply water for construction activities. Where pits and voids are required, include appropriate cover to prevent extended water retention and subsequent breeding opportunities for cane toads. • For pits and voids where long-term presence of retained water is reasonably anticipated and covering is not practicable, fencing to exclude access by cane toads will be incorporated in the design. Sediment fencing, free standing or attached to the base of other fencing material has proven to be effective. • Wash down and laydown areas will be designed to include cane toad traps where exclusion from areas of potential water retention is not practicable and where cane toad activity is locally detected. • No refuse left exposed, which will specifically assist breeding opportunities for cane toad, red fox, feral cat, dog, house mouse or rat on site. • To reduce the presence of pest fauna on site, all food waste must be placed into designated waste bins, and their lids securely closed. • Train workforce in the identification of pest fauna species present in the area.	Construction, Operation and Maintenance, Decommissioning and Rehabilitation: At all times throughout the life of the Project.

[1] *Sensitive areas are defined as locations outside the Disturbance Footprint which contain threatened species records or habitat.*

5.2.2 Species Specific Mitigation Measures

Mitigation and management measures specific to the known and potentially occurring threatened fauna species within the Study Area are detailed in **Table 5.2** below. Greater consideration has been given to threatened species that may be particularly sensitive to potential Project impacts including the greater glider (southern and central) (*Petauroides volans*), yellow-bellied glider (south-eastern) (*Petaurus australis australis*) and northern quoll (*Dasyurus hallucatus*).

Sections 5.2.3 provides detail regarding the BBAMP, which largely includes measures relevant to potential operational impacts on threatened birds and bats, as well as migratory birds.

Table 5.2 Threatened Species Specific Management Measures

Fauna Species	Measures
glossy black-cockatoo (*Calyptorhynchus lathami*)	• Any active breeding places will be managed under an approved DES High Risk SMP. • As detailed in the BBAMP, a single glossy black-cockatoo (*Calyptorhynchus lathami*) death will be a reportable incident to DES and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to glossy black-cockatoo (*Calyptorhynchus lathami*) are detailed in the BBAMP.
greater glider (*Petauroides volans*) and yellow-bellied glider (*Petaurus australis australis*)	• Where clearing is proposed for areas of greater glider (southern and central) and/or yellow-bellied glider (south-eastern) breeding and denning habitat, pre-clearance surveys must include canopy searches and inspections of suitably sized hollows (>8 cm diameter). Where inspection of hollows cannot be safely undertaken prior to felling, the hollow-bearing tree will be slow felled to minimise the chances of injury or death and will be inspected by a qualified fauna spotter to confirm presence or absence of either glider species. If an individual is found to be present, it will be inspected for injury and if healthy, relocated to an adjacent area of mapped breeding and denning habitat after dusk. If the individual is injured it will be transported to a local wildlife carer and rehabilitated prior to releasing in a suitable area adjacent to the location in which it was found. • Every effort will be made to retain suitable hollow bearing trees (those containing hollows >8 cm diameter) within areas identified as breeding and denning habitat including *Eucalyptus moluccana* woodlands. The retention of trees >30 cm DBH on patch edges will be prioritised next in areas of potential greater glider (southern and central) and yellow-bellied glider (south-eastern) habitat. Trees to be retained within the Disturbance Footprint must be clearly demarcated and avoided. If deemed necessary, a TPZ may be established. • Glider poles are proposed to be installed at 13 locations within the Disturbance Footprint to provide movement opportunities between areas of suitable habitat in the landscape. The proposed glider pole locations represent areas important for dispersal and where ongoing connectivity is required to avoid isolation of patches and retention of possible high use areas (i.e. riparian corridors). Glider pole locations will be finalised during the detailed design phase of the Project. • Five 'pinch points' are proposed within the Disturbance Footprint associated with areas of greater glider (southern and central) and/or yellow-bellied glider (south-eastern) modelled habitat to maintain movement opportunities and minimise fragmentation impacts on the species. Pinch points describe locations of the Disturbance Footprint which are reduced in width to the extent that individuals can easily disperse across (i.e. based on usual volplane distances, the clearing will have a width no greater than 1.2 times the average canopy height at that location). Pinch points locations will be finalised during the detailed design phase of the Project. • In areas of habitat where greater gliders (southern and central) and/or yellow-bellied gliders (south-eastern) are known to occur (i.e. the far northern Study Area), cleared suitable hollows (>8 cm diameter) will be replaced at a 1:2 ratio with a suitable nest box, to be installed in adjacent suitable habitat (i.e. two nest boxes for every hollow removed). A nest box is considered suitable if it is a design known to be used by the greater glider/yellow-bellied glider.

Fauna Species	Measures
	• Nest boxes will be checked annually for two years following installation to determine success. Nest box inspections should continue every 5 years after, and be maintained or replaced as required. • In the unlikely event that a greater glider (southern and central) or yellow-bellied glider (south-eastern) is killed as a result of Project activities, DCCEEW/DES will be notified within a maximum period of 2 business days.
grey-headed flying-fox (*Pteropus poliocephalus*)	• In the event that a flying-fox congregation is identified within the Disturbance Footprint, an exclusion zone will be established. A suitably qualified person will refer to the *Interim Policy for Determining When a Flying-fox Congregation is Regarding as flying-fox Roost under Section 88C of the Nature Conservation Act 1992 (*DES, 2021) to determine if the congregation could be considered a roost. If determined that the congregation constitutes a roost, impacts to the flying-fox congregation will be managed in accordance with the *Code of practice – Ecologically Sustainable Management of Flying-fox Roosts* (DES, 2020). • As detailed in the BBAMP, a single grey-headed flying-fox death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to the grey-headed flying-fox are detailed in the BBAMP.
ghost bat (Macroderma gigas)	• Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads. • As detailed in the BBAMP, a single ghost bat death will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to the ghost bat are detailed in the BBAMP.
northern quoll (Dasyurus hallucatus)	• Micro-siting of Project infrastructure will aim to retain potential denning habitat features including large hollow logs and large boulders piles. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance). • Vegetation clearing required within or directly adjacent to areas of breeding and denning habitat should be completed outside of the northern quoll breeding season (late July to late August). Where this cannot be committed to, a trapping and relocation program for northern quoll in these areas must be undertaken prior to vegetation clearing commencing. Potential denning sites in areas to be cleared will have entrances closed to avoid use by northern quoll prior to and during clearing. • Following the completion of the trapping program, should an active den be found within the Disturbance Footprint, measures outlined in a pre-approved high-risk SMP will be implemented to ensure no impacts occur to an active breeding place. This may include blocking access to dens once vacated to ensure they are not re-utilised during construction.

Fauna Species	Measures
	• Where pits, voids or trenches are required, include appropriate cover to prevent extended water retention in these spaces and/or subsequent breeding opportunities for cane toads. • Carcass surveys will be conducted by a suitably qualified ecologist to detect and remove carrion in operational areas that may attract northern quolls. The BBAMP will include a carcass survey protocol and include details such as survey frequency and timing. • Construction areas that may inadvertently provide potential denning opportunities through stockpiling of materials will have fauna exclusion fencing installed around the perimeter. • In the unlikely event that a northern quoll is killed as a result of Project activities, DCCEEW will be notified within a maximum period of 2 business days.
Squatter pigeon (southern) (Geophaps scripta scripta)	• Where clearing is proposed for areas of squatter pigeon (southern) breeding, foraging or dispersal habitat, pre-clearance surveys must include flushing to encourage the movement of individuals out of the clearing area. • As squatter pigeon (southern) nests on the ground and is at high risk of direct mortality, nests should be identified and clearly demarcated by a spotter-catcher during pre-clearance surveys. If the spotter-catcher determines a nest to be active, it will be managed in accordance with an approved High-risk SMP. • To reduce vehicle or plant collision or crushing of nests, all vehicles and pedestrians will remain within designated access tracks in squatter pigeon breeding habitat. • To minimise the chances of a collision, in known squatter pigeon (southern) occurrence areas speed limits (in private areas) will be reduced to 40 km/hr or less and signage will be installed that indicates subspecies' presence. Signage will also be installed within the public road corridor. • The construction contractor will not conduct water extraction activities at any location that provide suitable resources for squatter pigeon (southern) (i.e. suitable watercourses and reservoirs mapped on **Figure 3.8**). • As outlined in the Preliminary BBAMP, a single squatter pigeon (southern) death resulting from potential wind turbine collision will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to squatter pigeon (southern) are detailed in the Preliminary BBAMP.

Fauna Species	Measures
red goshawk (*Erythrotriorchis radiatus)*	• Pre-clearance nest surveys will be undertaken for red goshawk within the Disturbance Footprint. Searches will be undertaken during fauna spotter catcher pre-clearance surveys whereby suitably qualified fauna spotter catchers will actively search for red goshawk nests. Where a potential nest is identified, clearance activities within the area will cease and a suitably qualified ecologist will undertake an investigation to determine the species that the nest belongs to. If the nest does not belong to a red goshawk, or any other threatened or migratory fauna species, clearance activities will continue as planned in accordance with the Project management plans. In the event that a red goshawk nest is identified within the Study Area DES/DCCEEW will be notified within 10 business days. A review of the current mitigation measures outlined in the BBAMP and recommendation of additional actions will be made where necessary. • As detailed in the Preliminary BBAMP, a single red goshawk death will be a reportable incident to DES/DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revise. • Other operational measures relevant to red goshawk are detailed in the Preliminary BBAMP.
white-throated needletail (*Hirundapus caudacutus*)	• As detailed in the BBAMP the single death of a white-throated needletail will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to this species are detailed in the BBAMP.
collared delma (*Delma torquata*)	• Micro-siting of Project infrastructure will aim to retain terrestrial habitat features including large stones, boulders and coarse woody debris. Habitat features that can be avoided will be demarcated. Where they cannot be retained in situ, features will be relocated to adjacent areas of suitable habitat if safe and practical (i.e. the relocation of habitat features must not cause unnecessary disturbance). • Where clearing is proposed for areas of potential collared delma habitat, pre-clearance surveys must include active searches targeting areas with common surface rocks. Should an individual or eggs of the species be located, the pre-clearance survey constraints protocol (see **Section 5.3**) will be enacted to ensure any potential impacts on the species are avoided or managed appropriately. • In the unlikely event that a collared delma is killed as a result of Project activities, DES/DCCEEW will be notified within a maximum period of 2 business days.
koala (Phascolarctos cinereus)	• Pre-clearance surveys will include canopy searches for koalas. If a koala is located during pre-clearance surveys or during clearing activities: o the individual must not be forcibly relocated o any tree which houses a koala as well as any tree with a crown that overlaps that tree will not be cleared until the koala vacates the tree on its own volition o allow a clearing buffer surrounding the tree, equal to the height of the tree or deemed suitable by the fauna spotter-catcher o any injured koala (and fauna in general) should be transported to a vet or recognised wildlife carer

Fauna Species	Measures
	o requirements for koalas subject to handling to be examined and if suspected of Chlamydia infection will be taken to a predesignated veterinarian/wildlife care facility for treatment prior to release. • Clearing must be carried out in a way that ensures any koala present have time to move out of the clearing site without human intervention. • In the unlikely event that a koala is killed as a result of Project activities, DES/DCCEEW will be notified within a maximum period of 2 business days.
short-beaked echidna (*Tachyglossus aculeatus*)	• Pre-clearance surveys will include on-ground searches for short-beaked echidna. If an echidna is located during pre-clearance surveys or during clearing activities: o the individual will be relocated to a nearby area of suitable habitat o any injured echidna should be transported to a vet or recognised wildlife carer.
Migratory birds	• As detailed in the BBAMP, the single death of a white-throated needletail, fork-tailed swift, oriental cuckoo, black-faced monarch, satin flycatcher, rufous fantail or spectacled monarch will be a reportable incident to DCCEEW and trigger further investigation with regard to causation. Dependent on the outcome of the investigation, the overall collision risk determination for the species may be revised. • Other operational measures relevant to migratory birds are detailed in the BBAMP.

5.2.3 Bird and Bat Adaptive Management Plan

Monitoring and management actions relating to threatened birds and bats will be undertaken in accordance with a pre-approved BBAMP. The strategy of the BBAMP is to monitor and mitigate the potential impacts of turbine strike on birds and bats via trigger based, adaptive management.
The implementation of a trigger will be the primary mechanism for monitoring and managing impacts on the white-throated needletail.

Pre- and post-commissioning monitoring of bird and bat activity (including flight behaviours) is a key requirement of the plan. The monitoring will inform a risk profile for each turbine. This strategy leads to direct and tailored management actions, applied at the appropriate locations and times.

5.2.4 Injured Fauna Procedure

Fauna may be susceptible to injury from Project activities during all phases, with elevated risk of injury associated with construction activities (including vegetation clearance and increased vehicle activity). Fauna spotter catchers will be onsite during all clearing activities and will respond to fauna injury events if they arise. If an injury occurs and a fauna spotter catcher is not present, site personnel may conduct the rescue if they are suitably trained in fauna handling procedures. Site personnel must not handle injured bat species.

- Injured animals encountered during clearing activities will be thoroughly checked by fauna spotter catchers and the assessment made will inform whether the animal will be sent to an experienced wildlife carer or vet. If an injury is considered too severe to support rehabilitation, the animal will be euthanised using blunt force trauma in accordance with the Animal Care guidelines (DES 2013).
- A suitably vaccinated ecologist or fauna spotter catcher will undertake all handling of injured bats using relevant personal protective equipment (PPE) and must have the appropriate vaccinations.
- Transport and care of an injured animal will be undertaken in accordance with the Care of Sick, Injured or Orphaned Protected Animals in Queensland Code of Practice (Department of Environment and Science, 2020).
- Relevant wildlife first aid may be administered by the fauna spotter catcher if they are experienced in providing basic care to injured animals. This may include providing food or water to the animal, maintaining relevant body temperature, treating minor wounds or providing basic pain medication.
- The location of the capture will be recorded and provided to the vet or wildlife carer upon delivery of the injured animal.
- Injured animals will be handled such that additional injury or stress will be minimised, this includes:
- Using towels or soft blankets to support the animal.
- Maintaining a firm, supportive grip.
- Keeping the animal in a quiet location, at the correct temperature.
- Suitable carry enclosures will be used specific to the injured animal such as cloth bags for mammals and reptiles, large, secure cages for medium sized mammals and plastic containers for amphibians.

- Transportation will occur in an air-conditioned vehicle with the animal suitably restrained to avoid escape during transport.
- Release of rehabilitated fauna will take place at least 50 m from the Disturbance Footprint, in the same area as where it was captured and in suitable habitat for the species. Release must be undertaken in consideration of the species behavioural characteristics (i.e. nocturnal fauna must be released after dusk; diurnal fauna must be released a minimum of two hours prior to sunset to ensure animals can seek suitable refuge).

Veterinary services and wildlife carer details for the Rockhampton region are provided in **Table 5.3**.

Table 5.3 Wildlife Carer and Veterinary Services of the Rockhampton Region

Vet / Wildlife Carer	Phone Number	Address
RSPCA Rockhampton	1300 264 625	391 Yaamba Rd, North Rockhampton QLD 4701
Hope Animal Sanctuary and Rescue Inc	0427 028 704	n/a
Alma Street Veterinary Hospital	(07) 4922 8138	67 Alma St, Rockhampton QLD 4700
Wildlife Rockhampton	0429 469 453	PO Box 2066 Wandal QLD 4700

5.3 Pre-clearance Survey Methodology

Pre-clearance surveys are ecological surveys that will be undertaken no later than three months prior to clearing works and the permanent removal of vegetation. The following will be conducted prior to and during the pre-clearance surveys within the Disturbance Footprint:

- Field surveys will be led by suitably qualified ecologists[2] and will include:
  - Identify and mark high-value fauna microhabitat features (i.e. hollow bearing trees; hollow logs; boulder piles) and potential or active breeding places (which are to be managed under an appropriate DES SMP) to be avoided or managed during clearing.
  - Opportunistic threatened and migratory fauna identification. Any individuals observed will be recorded including number of individuals, behaviour at the time of observation (i.e. foraging, roosting, dispersing) and GPS location.
  - All pest fauna species encountered during opportunistic pre-clearance surveys will be recorded including number of individuals, behaviour at the time of observation and GPS location.

[2] A suitably qualified ecologist is a person who possessed a degree in environmental planning, environmental science, environmental management or similar from a recognised tertiary institution, and has at least five years of relevant experience in environmental assessment.

5.3.1 Pre-clearance Surveys Constraints Protocol – Collared Delma

To mitigate impacts for collared delma, the Project has committed to a constraints protocol in the event of an unexpected find during construction. This commitment relates to approval applications made under the EPBC Act, given the cryptic nature of the species.

The trigger to undertake the pre-clearance surveys constraints protocol is the observation of one or more individual of a collared delma within the Disturbance Footprint during future surveys or construction. If the species is found, the constraints protocol below will then be followed.

- **STEP 1:** Halt construction/clearing activities in the area (i.e. adjacent areas within the Disturbance Footprint where suitable habitat is present – to be determined by a suitably qualified ecologist).
- **STEP 2:** Undertake investigation into potential impacts on the species. This should include:
    - Updating of habitat mapping.
    - Updating of Significant Residual Impact Assessment.
    - Determination of avoidance and mitigation strategies.
- **STEP 3:** Communicate outcomes with DES/DCCEEW and determine next steps as required.

6.0 Compliance Management

6.1 Training Requirements

Training will be undertaken to ensure site personnel are familiar with the content and requirements of this PFMP. The site manager will be responsible for ensuring individuals are aware of their responsibilities and reporting requirements. The following training requirements will be provided, at a minimum, to all site personnel:

- Environmental induction.
- Environmental awareness training.
- Daily tool-box talks.

Site inductions and toolbox talks will be used as implementation methods before commencing work on site.

6.2 Relevant Permits and Licences

Permits and licences required to undertake activities outlined in this plan include:

- Animal Welfare and Ethics, administered by the Queensland Department of Agriculture and Fisheries (DAF) under the *Animal Care and Protection Act 2001*.
- Scientific Purposes Permit, administered by DES under the NC Act.
- DES Low Risk and High Risk Species Management Plan (supported by this PFMP).
- Rehabilitation permit, administered by DES under the NC Act and relevant to fauna spotter catcher activities.

6.3 Monitoring and Reporting

The mitigation and management measures outlined in **Section 5.0** will be monitored throughout the duration of the Project. Regularly monitoring the effectiveness of the mitigation and management measures allows the PFMP to be reviewed and updated if performance criteria are not being met.

As part of compliance reporting an Annual Compliance Report will be provided to DCCEEW in accordance with Project approval conditions (if obtained). It is anticipated that all actions relating to the management of fauna will be included, including any non-compliance items. Non-compliance items will also require notification to DCCEEW, where relevant.

6.3.1 Pre-construction

Table 6.1 below outlines the monitoring requirements associated with the pre-construction phase, which includes a pre-clearance survey. Refer to **Section 5.2.3** for details pertaining to the pre-clearance survey methodology.

Table 6.1 Pre-construction Monitoring Requirements

Activity	Timing	Purpose	Deliverable	Responsibility
Pre-clearance survey	To coincide with pre-clearance survey for threatened flora and vegetation as per the Project's Vegetation Management Plan (prior to commencement of site disturbance and any construction activities).	• Identify and mark high-value fauna microhabitat features and potential or active breeding places. • Opportunistic threatened and migratory fauna identification. • Identification of pest fauna species.	Pre-clearance Report	Suitably qualified ecologist
A baseline weed and pest fauna survey	To occur within six-months prior to construction	• Establish a baseline of weed and pest fauna species occurring within the Disturbance Footprint. • Baseline data will be used to compare pre and post construction assemblages of weed and pest fauna species.	Baseline weed and pest fauna monitoring report	Suitably qualified ecologist

6.3.2 Construction and Operation

The key monitoring and reporting requirements during the construction phase relate to the monitoring of fauna and fauna habitat within areas disturbed by Project construction. The key monitoring and reporting requirements during the operation phase pertain to pest fauna monitoring and nest-box and glider pole monitoring. **Table 6.2** below contains the monitoring requirements associated with these phases.

Table 6.2 Construction and Operation Monitoring Requirements

Activity	Timing	Purpose and Requirements	Deliverable	Responsibility
Post-clearing fauna monitoring	After clearing activities have ceased in an area.	Provide an update on the extent, status and condition of fauna values removed during construction. Including: • Identification and relocation of fauna microhabitat features. • Details of fauna injuries or mortalities. • A register of micro-habitat features identified by the fauna spotter catcher and relocated. • Register of species (including threatened or migratory species) identified by fauna spotter-catcher.	Post-clearing Monitoring Report.	Environment Officer and qualified ecologist

Activity	Timing	Purpose and Requirements	Deliverable	Responsibility
Pest fauna monitoring	Within two years of construction being completed.	Pest fauna monitoring will be undertaken to assess the degree of change between baseline pest fauna levels and post construction levels.	Pest fauna monitoring report recommending corrective actions should a significant increase in pest fauna be identified.	Environment Officer
Nest box and glider pole monitoring	Annually for two years after installation. Maintenance checks every 5 years.	• Nest box management will be undertaken to establish the success of the installments based on the utilisation of nest boxes by greater glider/yellow-bellied glider (as well as other hollow-dependent species). • Glider pole monitoring will be undertaken to assess the utilisation of glider poles by glider species. • Maintenance checks will be completed every 5 years. Damaged nest boxes will be replaced or repaired.	Fauna habitat installment utilisation report.	Suitably qualified ecologist

6.4 Roles and Responsibilities

The roles and responsibilities for Project staff are outlined in **Table 6.3** below.

Table 6.3 Roles and Responsibilities

Role	Responsibility	Duties
Project Manager	Oversees the construction and operation phases of the Project.	• Ensure contractors and all on site personnel are given adequate training in the requirements of this PFMP. • Ensure processes and procedures are in place prior to site mobilisation to ensure the successful implementation of this PFMP. • Implement the monitoring program, outlined in **Section 6.2**. • Record any non-compliance and corrective actions undertaken. • Report to administrating authorities where required.
Construction Manager	Oversees site construction and reports to the Project Manager.	• Ensure the implementation of this PFMP and the CEMP throughout the construction phase.

Role	Responsibility	Duties
Environment Officer or suitable delegate	Ensures the implementation of this PFMP through the construction and operation phases. Reports to the Project Manager.	• Notify the Project Manager of any environmental incidents/ non compliances that occur on site. • Audit site works in accordance with this PFMP. Notify the Project Manager on project progression. • Undertake environmental monitoring and reporting, where applicable.
Rehabilitation Contractor	Undertakes rehabilitation works. Reports to the Environment Officer.	• Undertake rehabilitation works as per the requirements of this PFMP and the Rehabilitation Management Plan to be developed.
Suitably Qualified Ecologist	Provides independent ecological expertise. Reports to the Environment Officer.	• Undertake pre-clearance surveys and baseline monitoring as per the requirements of this PFMP. • Undertake ecological monitoring and reporting, where applicable.
Fauna Spotter Catcher	Undertakes management and relocation of fauna during vegetation clearing.	• Undertake an assessment of the clearing area to identify important habitat features prior to the commencement of clearing activities. • Responsible for the safe handling and relocation of fauna species associated with vegetation clearing activities.
All Project personnel	Construction, operation, and maintenance. Reporting requirements will differ depending on Project roles.	• Report environmental incidents and non-compliance to the Environment Officer. • Undertake site and role specific training. • Follow the requirements outlined in this PFMP.

6.5 PFMP Amendments and Corrective Actions

The PFMP is a dynamic document that requires review and amendment throughout the life of the Project to ensure the measures within remain effective. It is recommended that a suitably qualified person will update this plan:

- When additional ecological data relevant to the protection of threatened fauna values is collected for the Project.
- Where there is significant change to the Project schedule, Disturbance Footprint or a change in the construction methods.
- When an incident occurs that is reportable, such as the injury or mortality of a threatened or migratory fauna species or the identification of a threatened or migratory fauna species that has not been identified in this plan.
- Where a change in legislation or best practice methodology has been identified.

To ensure compliance with this PFMP, a schedule of obligations will be developed to outline all obligations and track how obligations are being met.

During the Project lifecycle corrective actions should be implemented if the performance criteria and management objectives outlined in **Section 5.1** are not being adhered to, when undertaking monitoring activities outlined in **Table 6.1** and **Table 6.2**. The Project Manager and the Construction Manager will be notified within one week of each monitoring event (outlined in **Section 6.2**) if any of the following triggers in **Table 6.4** occur, resulting in non-compliance.

Table 6.4 Corrective Actions

Risk/ threat	Trigger	Corrective Action
Fauna habitat loss, habitat fragmentation or degradation	Clearing of fauna habitat outside of the Disturbance Footprint or approved clearing limits exceeded	• Notify the Project Environmental Officer. • Immediately stop work and review clearing procedures. • Re-train site personnel on clearing procedures. • Install additional fencing or flagging to reinforce no go areas. • Undertake toolbox talks and re-educate site personnel on site practices management obligations.
Loss of individual threatened fauna	Threatened fauna species killed during Project works	• Assess mitigation and management procedures and update PFMP as necessary. • Relevant notification procedure to DCCEEW or DES if a threatened fauna species is killed. Bird and bat notification procedures provided in the Project's BBAMP. • Install additional control measures such as additional fencing, signs, and flagging tape. • Undertake toolbox talks and re-educate site personnel on site practices management obligations.
Loss of native fauna	Native fauna injured or killed by Project activities	• Injured fauna are to be managed in accordance with the Injured Fauna Procedure (**Section 5.2.4**). • Events of injury or mortality will be recorded and reported to the Environmental Officer. • Assess mitigation and management procedures and update PFMP as necessary.
Introduction and exacerbation of pest fauna species	Increased encounters of pest fauna species (cane toad, horse, feral cat, feral pig, black rat, brown hare)	• Develop a species-specific control program necessary for managing the pest species population. • Review and update the species-specific control program as necessary.
Facilitation of breeding for cane toads	Evidence of cane toads breeding in Project water storage (egg strings or tadpoles identified)	• Review management and mitigation strategies and update as necessary. • Minimise opportunities for water to pond.

Risk/ threat	Trigger	Corrective Action
Loss of native fauna and fauna habitat as a result of bushfire	Bushfire occurring due to project activities.	• Rehabilitate impacted areas as per the Project's PVMP. • Process injured fauna as per the Injured Fauna Procedure in **Section 5.2.4**. • Review the cause of the incident and any immediate actions taken. • Review relevant procedures and update where necessary. • Re-educate / train site personnel on management requirements, practices and site rules.

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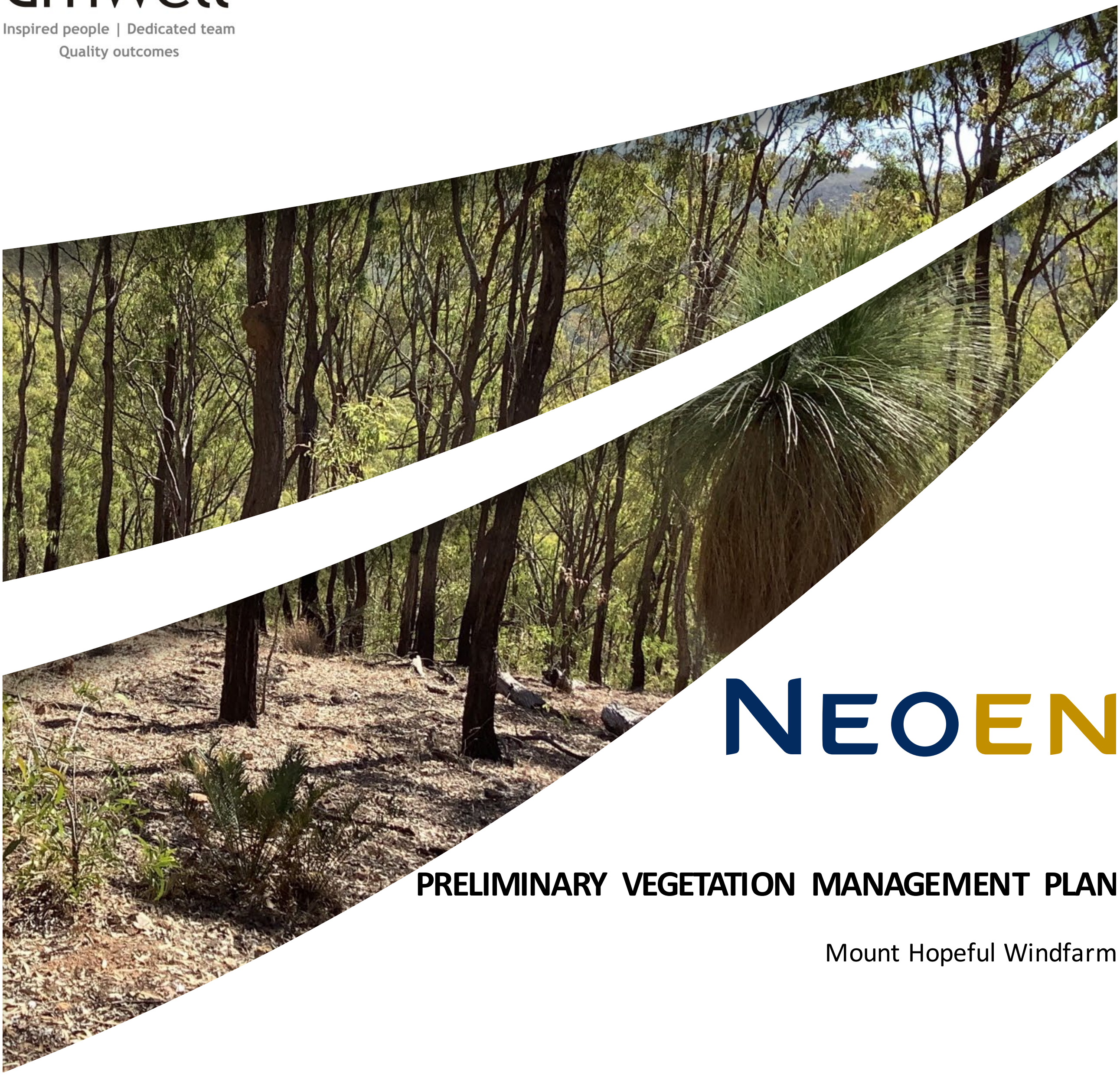
APPENDIX H

Preliminary Vegetation Management Plan



PRELIMINARY VEGETATION MANAGEMENT PLAN

Mount Hopeful Windfarm

FINAL

May 2023

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FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
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Report No. 7053/R28
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Document Status

Abbreviations

Abbreviations	Description
AEMO	Australian Energy Market Operator
AHD	Australian Height Datum
BESS	battery energy storage systems
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DoR	Department of Resources
DSDILGP	Department of State Development, Infrastructure, Local Government and Planning
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPMs	Exploration Permits for Minerals
ha	hectare
km	kilometres
LGA	Local Government Areas
MCU	Material Change of Use
MNES	Matters of National Environmental Significance
MSES	Matter of State Environmental Significance
MW	megawatts
NC Act	*Nature Conservation Act 1992* (Qld)
Neoen	Neoen Australia Pty Ltd
PO	Performance Outcome
PVMP	Preliminary Vegetation Management Plan
QREZ	Queensland Renewable Energy Zones
RE	Regional Ecosystem
SIS	State Infrastructure Strategy
TEC	Threatened Ecological Communities
the Project	Mount Hopeful Wind Farm
Umwelt	Umwelt (Australia) Pty Ltd
VM Act	*Vegetation Management Act 1999* (Qld)
WoNS	Weeds of National Significance
WTG	wind turbine generators

Table of Contents

Figures

Tables

Appendices

1.0 Introduction

Umwelt (Australia) Pty Ltd (Umwelt) is supporting Neoen Australia Pty Ltd (Neoen) in seeking project approvals for the Mount Hopeful Wind Farm (the Project). The Project is located approximately 45 kilometres (km) south of Rockhampton and 65 km west of Gladstone, within the Central Queensland Region.

The Project involves the development of a wind farm that contains 63 wind turbine generators (WTGs), ancillary infrastructure including up to ten temporary and ten permanent wind monitoring masts, six substations, battery energy storage systems (BESS), temporary construction compound/laydown areas, a concrete batching plant, high voltage (275 kilovolt (kV)) overhead powerlines, as well as underground power and communication cables. The Project includes a Road Access Corridor which would involve upgrades to approximately 30 km of existing road between the Burnett Highway at Dixalea and Glengowan Road to ensure the safe transport of Project infrastructure. The Project is expected to have a maximum generation capacity of approximately 400 megawatts (MW).

The purpose of this Preliminary Vegetation Management Plan (PVMP) is to inform State and Federal assessment agencies, and provide an overview of how vegetation, and overlapping threatened species will be managed for the Project. This PVMP has also been prepared to comply with the conditions of the initial development approval (2109-24892 SDA) dated 17 June 2022 from the State Assessment and Referral Agency (SARA), and has been prepared in consideration of the amended design that is presently being considered by SARA as a Minor Change.

1.1 Ecology Study Boundaries

Information contained within the *Terrestrial Flora Report* (Umwelt 2022), have been used to inform and develop this plan for the Project. Four distinct boundaries are presented that are relevant to the Project and this management plan including:

- Study Area: refer to **Section 1.1.1**.
- Ground-truthed Mapping Extent: refer to **Section 1.1.2**.
- Development Corridor: refer to **Section 1.1.3**.
- Disturbance Footprint: refer to **Section 1.1.4**.

Figure 1.1 displays the above boundaries.

1.1.1 Study Area

The Study Area refers to the land parcels proposed to host the Project, where development consent is being applied for development of the proposed wind farm. The total area of the Study Area is approximately 16,758 hectares (ha) and extends approximately 25 km north-south at the longest point and 13 km east-west at the widest point. The Project will be developed on 17 land parcels which will be collectively referred to as the 'Study Area'.

The Study Area is within the Rockhampton Regional Council and Banana Shire Council Local Government Areas (LGA). The predominant land use in both LGAs is rural agriculture comprising mostly beef cattle grazing and farmland cropping including cotton and lucerne. Some forestry, coal mining and power generation also occur. Elevations within the Study Area ranges from approximately 500 metres (m) Australian Height Datum (AHD) to 120 m AHD, characterised by varying landform within the Study Area that comprises of peaks and valleys, with areas of lower, generally flatter topography surrounding the Study Area to the east and west.

Major highways in proximity to the Study Area include the Bruce Highway to the east, Burnett Highway to the west, and the Dawson Highway to the south. These major transport corridors link to the cities of Rockhampton and Gladstone, as well as the Port of Gladstone from which the proposed turbine components will be transported. Access to the Study Area is primarily via the Burnett Highway located to the east of the Study Area, as well as lower order roads in Banana Shire Council including McDonalds Road and Playfields Road. Details of all land parcels within the Study Area are provided in **Table 1.1**.

Table 1.1 Study Area Land Parcels

Lot and Plan	Address	Area (ha)	Tenure	Local Government Area
Wind Farm Area				
Lot 21 RN1345	Glengowan Road, Ulogie QLD	5,196.6	Freehold	Banana
Lot 24 RN34	Glengowan Road, Ulogie QLD	2,752.5	Freehold	Banana
Lot 23 RN25	Glengowan Road, Ulogie QLD	976.2	Freehold	Banana
Lot 30 RN72	Glengowan Road, Ulogie QLD	1,723.7	Freehold	Banana
Lot 21 RN46	1682A South Ulam Road, Bajool QLD	1,470.6	Freehold	Rockhampton
Lot 25 RN25	1682A South Ulam Road, Bajool QLD	183.5	Freehold	Rockhampton
Lot 2039 RAG4056	1682A South Ulam Road, Bajool QLD	801.0	Freehold	Rockhampton
Lot 1933 RAG4058	1682A South Ulam Road, Bajool QLD	826.3	Freehold	Rockhampton
Lot 2057 RAG4059	1682A South Ulam Road, Bajool QLD	845.9	Freehold	Rockhampton
Lot 15 RN1089	1682A South Ulam Road, Bajool QLD	585.9	Freehold	Rockhampton
Lot 148 DS151	1682 South Ulam Road, Bajool QLD	235.4	Freehold	Rockhampton
Lot 2420 DT4077	1682 South Ulam Road, Bajool QLD	64.8	Freehold	Rockhampton
Lot 2345 DT4077	1682 South Ulam Road, Bajool QLD	105.3	Freehold	Rockhampton
Lot 50 DT40144	1682 South Ulam Road, Bajool QLD	24.3	Freehold	Rockhampton
Lot 33 DT40123	1682 South Ulam Road, Bajool QLD	66.5	Freehold	Rockhampton
Lot 38 DT40131	1682 South Ulam Road, Bajool QLD	71.5	Freehold	Rockhampton
Lot 100 SP28944	1682 South Ulam Road, Bajool QLD	595.0	Freehold	Rockhampton
Road reserves	Not Applicable	232.6	Road Reserve	Banana and Rockhampton
	Total Area	**16,758 ha**		

1.1.2 Ground-Truthed Mapping Extent

The Ground-truthed Mapping Extent covers approximately 12,924 ha and represents the limit of the vegetation mapped within the Study Area. Due to the dynamic nature of the Project, some areas surveyed no longer fall within the Study Area boundary, and within the Study Area, not all areas of each land parcel were entirely surveyed.

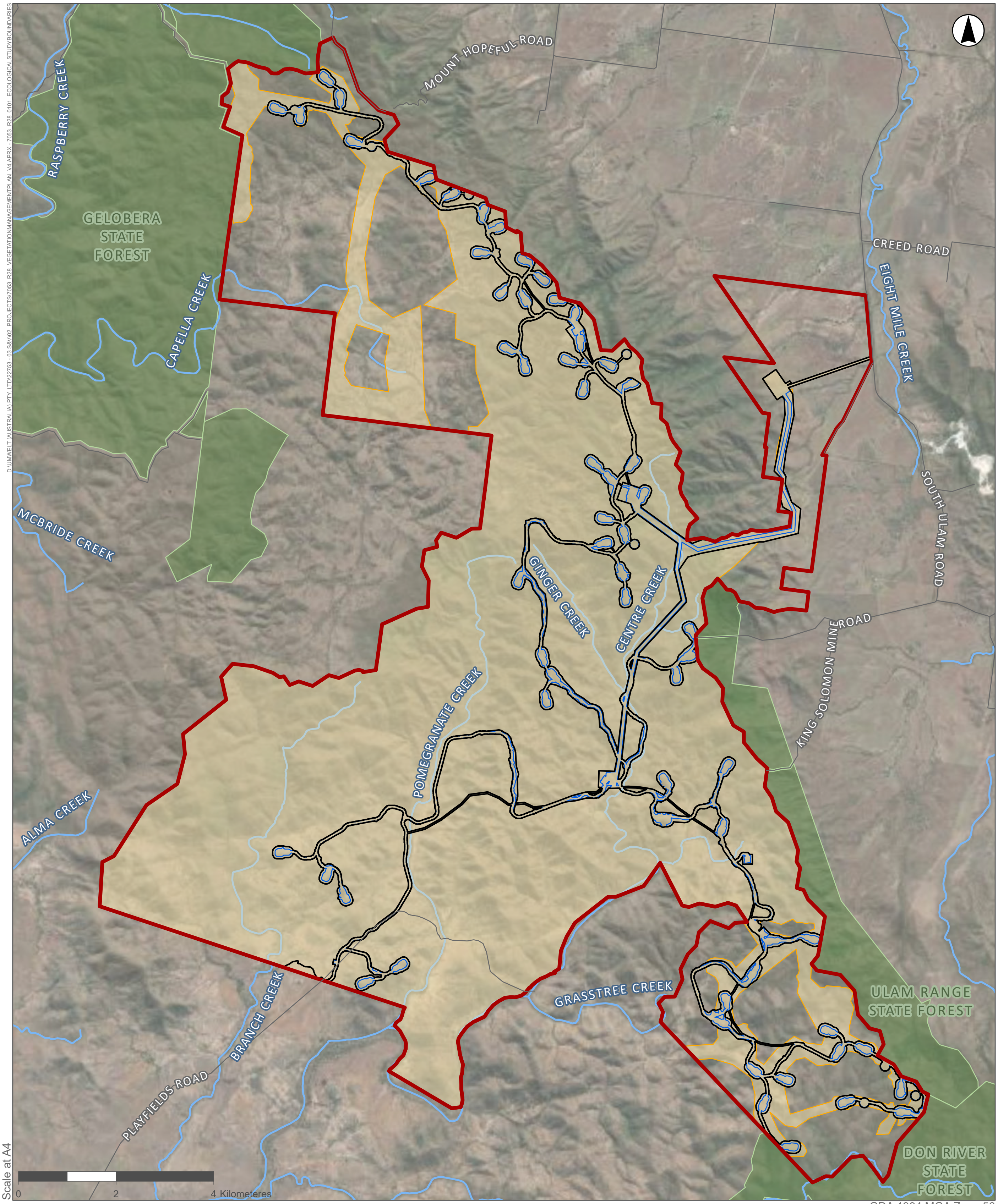
It should be noted that this boundary does not represent the spatial bounds in which all Project field surveys have been conducted (this area being larger and including areas outside of the Study Area). This area will not be referred to within this report.

1.1.3 Development Corridor

The Development Corridor is a 'buffered' version of the indicative Project layout, covering approximately 1,347 ha. This area represents the maximum spatial extent where disturbance may occur within the Study Area and includes areas required for temporary and permanent Project infrastructure, equipment and materials laydown, installation and access.

1.1.4 Disturbance Footprint

The Disturbance Footprint covers approximately 877.5 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure. It is a 'worst-case' scenario in terms of the extent of clearing works.



Legend
- Roads
- Watercourse
- Study Area
- Development Corridor
- Disturbance Footprint
- Ground-truthed Mapping Extent
- State Forest

FIGURE 1.1

Ecological Study Boundaries

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

1.2 Project Description

1.2.1 Project Infrastructure

The Project will utilise existing infrastructure as well as construct new Project infrastructure, refer **Section 1.2.1.1** and **Section 1.2.1.2** below.

1.2.1.1 Existing Infrastructure

Powerlink electricity towers and associated overhead electricity transmission lines intersect the Study Area in a north-west to south-east direction. An existing telecommunication tower is located approximately 2 km north of the Study Area. A 120 m guyed lattice meteorological mast was erected over the Study Area in August 2020, as well as a 140 m and 110 m guyed lattice meteorological mast in November 2022.

Other rights and encumbrances of note include:

- An easement (A RP612717) for high voltage electricity transmission line intersecting the eastern portion of the Study Area on Lot 100 SP289441.
- A strata for a Profit à Prendre (030 RN72) over Lot 30 RN72 for a Forest Consent Area to the State of Queensland (represented by the Department of Agriculture and Fisheries).
- Three Exploration Permits for Minerals (EPMs) overlap the Study Area, comprising EPM 15810 held by Mount Morgan Exploration Pty Ltd, EPM 27098 held by GBM Resources Limited, and EMP Application area 27105 held by Prophet Resources Pty Ltd.
- An existing road reserve (Playfields, McDonalds and Glengowan Roads) exists within the western extent of the Study Area (the access road corridor).

1.2.1.2 Proposed Infrastructure

The Project will construct 63 WTGs with the turbine specifications used for the assessment shown in **Table 1.2**. These specifications are an upper limit and are intended to provide flexibility for any innovation in turbine design between now and the time of detailed design and construction.

Table 1.2 Turbine Specifications

Feature	Maximum Specifications
Project generation capacity	Approximately 400 MW
Turbine electrical output	Approximately 6.5 MW
Maximum number of turbines	63
Tip height	Up to 260 m
Blade length	Up to 90 m

The Project will also require the provision of ancillary infrastructure, including the following:

- Up to 10 temporary wind monitoring towers.
- Up to 10 permanent wind monitoring towers.
- Up to six substations, a BESS and ancillary electrical infrastructure.
- Up to 13 km of high voltage (275 kV) overhead powerlines.
- Site operational, maintenance and storage areas containing permanent site offices, workshops, warehouses, mobile offices, lunchroom, amenities and ablutions.
- Overhead and/or underground power and communication cables.
- Up to 175 km of gravel capped roads.
- Two permanent site access points.
- An access road corridor including approximate 30 km of road upgrades along McDonalds, Playfields and Glengowan Roads.
- A range of temporary infrastructure to facilitate the construction of the Project, including:
  - One construction compound.
  - A temporary worker's accommodation camp to provide for a peak construction workforce of up to 450 people and including a water treatment plant, sewage treatment plant and sprayfield.
  - Three concrete batching plants.
  - Two laydown areas.

1.2.2 Anticipated Project Timeline

A summary of the anticipated construction works associated with the Project are provided in **Table 1.3**.

Table 1.3 Anticipated Construction Works

Project Stage/Component	Description
Construction Commencement, Completion and Commissioning of Project	• Commencement of construction works: Quarter 4, 2023. • Completion of construction works: Quarter 3, 2025. • Commissioning of the Project: Scheduled in Quarter 4, 2025.
Duration of Construction Works	Between 22–28 months
Planned Construction Activities	• Site establishment (temporary site facilities, lay down areas, equipment and materials). • Earthworks for access roads and wind turbine hardstands. • Excavations for the foundations. • Construction of wind turbine foundations. • Installation of electrical and communications cabling and equipment.

Project Stage/Component	Description
	• Installation of wind turbine transformers, in parallel with electrical reticulation works. • Arrival of wind turbine components to the Project Site. • Installation of wind turbines. • Commissioning of wind turbines. • Reliability testing.

1.3 Aim and Objectives

The aim of this PVMP is to reduce the potential impact on flora and vegetation communities within the Study Area, by outlining mitigation and management measures to be implemented throughout the duration of the Project. The specific objectives of the PVMP are to:

- Provide a description of the nature and location of project activities including approximate timing where possible.
- Provide a description of the extent and condition of vegetation communities across the Study Area and Disturbance Footprint, including threatened flora habitat, known threatened species records and Threatened Ecological Communities (TEC).
- Provide a description of the location and extent of works required, including how Project activities have been designed to minimise impacts on flora and vegetation.
- Provide information on the roles, responsibilities, and training requirements in relation to vegetation management.
- Outline mitigation and management measure to be implemented throughout the duration of the Project to reduce impacts on flora and vegetation communities.
- Outline the pre-clearance survey methodology.
- Outline the restoration and rehabilitation measures, which will include the following:
    - Rehabilitation acceptance criteria.
    - A summary of the procedures, including contingency measures.
    - A summary of a monitoring program.
- Detail the monitoring and reporting requirements for pre-construction, construction, post-construction, and operation phases of the Project, including:
    - Threatened flora monitoring.
    - Introduced flora (weed) monitoring.
    - Rehabilitation monitoring.

In addition to this PVMP, a Construction Environmental Management Plan (CEMP) will be developed for the Project to address management of environmental values. This plan will include, but not be limited to, the management of noise and vibration, sediment and erosion control, air quality and weed and pest management.

Potential impacts on vegetation and flora values detailed in this document have been determined based on the Disturbance Footprint, which represents worst-case scenario direct impacts (see **Section 1.1.3** above).

2.0 Legislative Context

The legislation relevant to the PVMP is summarised in **Table 2.1**.

Table 2.1 Legislation Relevant to the Project

Relevant Legislation	Governing Agency	Summary	Project Relevance
Commonwealth Legislation			
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	The EPBC Act is Australia's key piece of environmental legislation. It outlines nine Matters of National Environmental Significance (MNES). Actions that adversely affect MNES may be deemed to be a controlled action under the EPBC Act.	The following MNES are relevant to the Project: • Threatened Species. • Migratory Species.
EPBC Act Environmental Offsets Policy	DCCEEW	The EPBC Act Environmental Offsets Policy outlines the use of environmental offsets under the EPBC Act and are considered during the assessment phase of an environmental impact assessment. Specifically, this policy applies to project assessments and approvals under Parts 8 and 9 of the EPBC Act, in addition to strategic assessments under Part 10.	Pending the outcomes of the EPBC Act referral decision, offsets may be required.
State Legislation			
Planning Act 2016 (Planning Act)	Department of State Development, Infrastructure, Local Government and Planning (DSDILGP)	Applications for a Material Change of Use MCU for a new or expanding wind farm and Operational Works for Native Vegetation Clearing must be assessed against the benchmarks included in State Code 23 and State Code 16 of the State Development Assessment Provisions 16. Development that is a Material Change of Use (MCU) for a wind farm should demonstrate compliance with 13 performance outcomes (PO) and associated acceptable outcomes within the code.	State Code 23 requires assessment against PO5 – Flora and Fauna: *Development is designed, sited and operated to ensure that flora, fauna and associated ecological processes are protected from adverse impacts.* State Code 16 requires assessment against benchmarks relating to offset areas, minimisation of clearing, and clearing associated with wetlands, watercourses and drainage features, connectivity areas, Endangered and Of Concern Regional Ecosystems (REs), and Essential Habitat.

Relevant Legislation	**Governing Agency**	**Summary**	**Project Relevance**
Nature Conservation Act 1992 (NC Act)	Department of Environment and Science (DES)	The purpose of the NC Act is to conserve biodiversity by creating and managing protected areas, managing and protecting native wildlife, and managing the spread of non-native wildlife. The flora survey trigger map identifies high-risk areas where Endangered, Vulnerable or Near Threatened native plants are present or are likely to be present. The map is used to determine requirements to be considered before clearing native plants.	Where a proposed development will result in impacts to flora protected under the NC Act, authorisation from the Director General of the DES is required. The following values under the NC Act are relevant to the Project: • Threatened flora species. • High-risk areas for protected plants are mapped within the Study Area, therefore a protected plants flora survey in accordance with the NC Act *Flora Survey Guidelines – Protected Plants* (DES 2020) is required prior to clearing native plants.
Vegetation Management Act 1999 (VM Act)	Department of Resources (DoR)	The purpose of the VM Act is to regulate the clearing of vegetation in a way that conserves REs, to prevent the loss of biodiversity and maintain ecological processes. REs are vegetation communities in a bioregion that are consistently associated with a combination of geology, landform, and soil (Sattler & Williams 1999). Under the VM Act, REs is assigned a conservation status based on an assessment of the pre-clearing and remnant extent of each RE.	The VM Act will be referred to prior to the development stage to conserve and minimise the impact to remnant and threatened ecosystem. The Project is required to obtain approval under section 22A of the VM Act.
Biosecurity Act 2014	Department of Agriculture and Fisheries	The *Biosecurity Act 2014* lists flora pest species as either a Prohibited or Restricted biosecurity matter.	The *Biosecurity Act 2014* defines specific requirements for notification and management actions for all listed biosecurity matters, including specific requirements for the disposal of Restricted Matters.
Environmental Offsets Act 2014 (EO Act)	DES	An environmental offset condition may be imposed under certain Queensland legislation that applies to development assessment where the activity is a prescribed activity under the EO Act. Activities which have an impact on a Matter of State Environmental Significance (MSES) may require offsetting under the Act.	Consideration of offsetting requirements for the Project will need to be determined once a fixed design for the Project is completed. Requirements for offsets are therefore not discussed as part of this report.

3.0 Vegetation Values

The field survey program completed for the Project extended over four years from 2019 to 2022. During this time, a total of six flora field surveys were completed over 33 field days by suitably qualified ecologists. The aim of these field assessments was to validate vegetation communities, including REs, and determine the presence of threatened species and communities within the Study Area. Field survey methods are detailed in the *Terrestrial Flora Report* (Umwelt 2022).

3.1 Study Area Characteristics

The Study Area is characterised by a variety of vegetated environments, including cleared agricultural land as well as regrowth and remnant Eucalypt woodlands and vine thicket across an undulating terrain. The dominant vegetation communities across the Study Area are woodlands and forests dominated by *Eucalyptus crebra*, *Corymbia citriodora* and *Eucalyptus acmenoides*.

The Bouldercombe Gorge Resources Reserve, Gelobera State Forest, Don River State Forest and Ulam Range State Forest are Protected Areas located adjacent to the Study Area, providing connectivity to the broader region.

3.2 Vegetation Communities

Field surveys within the Ground-truthed Mapping Extent verified 15 REs, recorded in both remnant and regrowth condition. Within the Disturbance Footprint, 11 REs are mapped. The REs verified within the Study Area are described in **Table 3.1**.

Of the verified REs, one RE is listed as Of Concern and fourteen REs are listed as Least Concern under the VM Act. Dominant vegetation communities within the Study Area include *Corymbia citriodora* open forest on igneous rocks (RE 11.12.6), *Eucalyptus crebra* woodlands on hills and slopes (RE 11.12.1) and *Corymbia citriodora, Eucalyptus crebra*, *Eucalyptus acmenoides* open forest on old sedimentary rocks (RE 11.11.3). Non-remnant vegetation is also relatively common within the Study Area, occurring primarily in the centre and to the north covering approximately 2,234 ha.

For the purposes of this assessment not all areas within the Study Area have been verified and have been displayed accordingly on **Figure 3.1**. Based on the Vegetation Management Report (Department of Resources (DoR) 2022) the areas that have not been verified within the Study Area comprise of non-remnant vegetation and the following four mapped REs; 11.11.3, 11.11.5, 11.11.15 and 11.11.4. All of the mapped REs are Least Concern under the VM Act and been verified within other areas in the Study Area (**Table 3.1**).

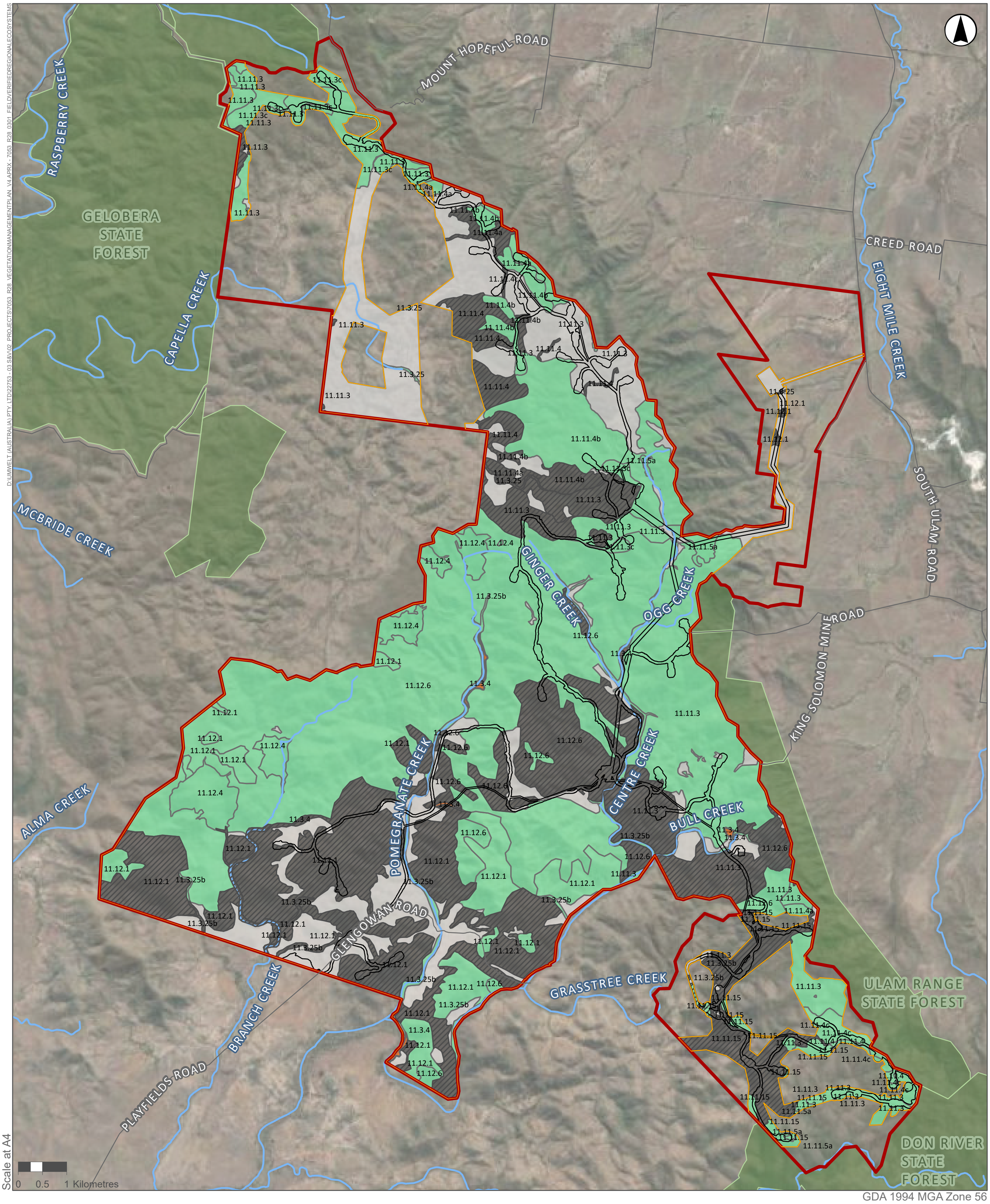
Table 3.1 Study Area Vegetation Communities as per the Field Verified Regional Ecosystems Map

RE	REDD Description	VM Act Class[1]
11.3.4	Eucalyptus tereticornis and/or Eucalyptus spp. woodland on alluvial plains	OC
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	LC
11.3.25b	*Melaleuca leucadendra* and/or *M. fluviatilis*, *Nauclea orientalis* open forest fringing drainage lines	LC
11.11.3	*Corymbia citriodora*, *Eucalyptus crebra*, *E. acmenoides* open forest on old sedimentary rocks with varying degrees of metamorphism and folding	LC
11.11.3c	*Eucalyptus moluccana* woodland on lower slopes in association with *Eucalyptus crebra* and/or *Corymbia citriodora* and/or *Eucalyptus* spp.	LC
11.11.4	*Eucalyptus crebra* woodland on old sedimentary rocks with varying degrees of metamorphism and folding	LC
11.11.4a	*Eucalyptus tereticornis* dominated woodland with varying degrees of metamorphism and folding	LC
11.11.4b	*Corymbia trachyphloia* or *Eucalyptus acmenoides*, *E. crebra* woodland +/- *Acacia leiocalyx* with varying degrees of metamorphism and folding	LC
11.11.4c	*Eucalyptus moluccana* dominated woodland with varying degrees of metamorphism and folding	LC
11.11.52	Vine thicket, usually with no *Araucaria cunninghamii* emergents on old sedimentary rocks with varying degrees of metamorphism and folding	LC
11.11.5a	Vine thicket, usually with no *Araucaria cunninghamii* emergents on old sedimentary rocks with varying degrees of metamorphism and folding	LC
11.11.15	*Eucalyptus crebra* woodland to open woodland on deformed and metamorphosed sediments and interbedded volcanics	LC
11.12.1	*Eucalyptus crebra* woodland on igneous rocks	LC
11.12.4[2]	Semi-evergreen vine thicket and microphyll vine forest on igneous rocks	LC
11.12.6	*Corymbia citriodora* open forest on igneous rocks (granite)	LC

[1] VM Act Class –OC = Of Concern and LC = Least Concern.
[2] Vegetation Communities that do not occur within the Disturbance Footprint.

3.2.1 Threatened Ecological Communities

As per the findings of the *Terrestrial Flora Report* (Umwelt 2022), there are no TECs within the Study Area or Disturbance Footprint. TECs are therefore not discussed further.



Legend

- Roads
- Watercourse
- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- State Forest

Field Verified Regional Ecosystems

- Remnant - Of Concern
- Remnant - Least Concern
- Non-remnant
- Unmapped
- Regrowth

FIGURE 3.1

Field Verified Regional Ecosystems

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

3.3 Flora Diversity

A total of 207 flora species from 56 families and 134 genera were identified during field survey program (Umwelt 2023). The plant families representing the most taxa were Poaceae (32 taxa), Myrtaceae (24 taxa), Fabaceae (16 taxa), Mimosaceae (10 taxa) and Asteraceae (10 taxa). The surveys also identified 32 introduced species, which represents 15.5% of the total flora recorded, described further in **Section 3.3.1** below.

3.3.1 Introduced Flora

A total of 32 introduced flora were identified during field surveys within the Study Area. Of these 32 species, five species are identified as Category 3 Restricted Matters under the *Biosecurity Act 2014* and Weeds of National Significance (WoNS) (refer **Table 3.2**). WoNS are weed species that have been agreed by Australian governments using an assessment process that prioritised these weeds based on their invasiveness, potential for spread and environmental, social, and economic impacts. High biomass grasses increase fire risk as well as smoother the ground, reducing plant germination and threatened species growth and recovery.

Introduced flora classified as Category 3 Restricted Matters or WoNS, as well as high biomass grasses will be the target of management within this PVMP referred to as 'weed species' within this report (see **Section 5.0**). Commonly recorded high biomass grasses include *Cenchrus ciliaris* and *Megathyrsus maximus*.

Table 3.2 Introduced Flora Identified During Field Surveys

Scientific Name	Common Name	Biosecurity Act Category	WoNS
Lantana camara	Lantana	Category 3	Yes
Opuntia stricta	Prickly pear		
Opuntia tomentosa	Velvety pear		
Cryptostegia grandiflora	Rubber vine		
Parthenium hysterophorus	Parthenium		

3.3.2 Threatened Flora

Based on the findings of the *Terrestrial Flora Report* (Umwelt 2022), one threatened species is Known to occur, one species has a High likelihood of occurring and four species have a Moderate potential to occur within the Study Area (**Table 3.3**). Excluding *Cycas megacarpa*, potential habitat within the Study Area for these species is restricted to vegetation communities in remnant condition.

Figure 3.2 displays the known threatened species records within the Study Area and the associated habitat types.

Table 3.3 Likelihood of Occurrence Assessment Results: Known, High or Moderate Flora Species

Species	Status (EPBC Act, NC Act)[1]	Likelihood of Occurrence	Suitable Vegetation Communities within Study Area	Potential Habitat Within the Study Area (ha)	Habitat Extent within the Disturbance Footprint (ha)
Cycas megacarpa[3, 4]	E, E	Known	All remnant and regrowth REs and non-remnant areas. Known habitat (confirmed and suspected) has only been mapped within the Development Corridor.	-	0.7 ha of high density (25-50 plants); 16.8 ha of moderate density (10-25 plants) and 195.7 ha of low density (1-10 plants).
Hernandia bivalvis[2]	-, NT	High	11.11.5a, 11.12.4	330.3	8.3
Cossinia australiana[2]	E, E	Moderate	11.11.5a, 11.12.4	330.3	8.3
Dansiea elliptica[2]	-, NT	Moderate	11.11.5a, 11.12.4	330.3	8.3
Decaspermum struckoilicum[5]	E, CE	Moderate	11.11.5a, 11.12.4	39.1	2.1
Samadera bidwillii[2]	V, V	Moderate	11.3.4, 11.3.25, 11.3.25b, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.5a, 11.11.15, 11.12.1 11.12.4 and 11.12.6	6,681.9	284.0

[1] EPBC Act and NC Act Status – CE = Critically Endangered, E = Endangered, V = Vulnerable, NT = Near Threatened
[2] Regrowth communities excluded due to the prevalence of weeds.
[3] Habitat associated with non-remnant vegetation has only been identified where associated with a known record of the species. To capture areas that may contain seed and/or root suckers, a conservative 80 m buffer was applied to the record location. The potential habitat within the Study Area is based on vegetation communities where this species has been recorded.
[4] The Habitat Extent within the Disturbance Footprint includes 235.7 ha of confirmed and suspected known habitat. This consists of all land within 80 m of a confirmed record (confirmed known habitat) as well as areas where Cycas megacarpa presence is presumed or reasonably suspected and does not overlap with confirmed known habitat (suspected known habitat).
[5] Potential habitat within the Study Area includes select REs in remnant condition only, below 300 m altitude. Non-remnant and regrowth vegetation has been excluded due to the high degrees of disturbance, including clearing and weed species.

Profiles of known and potentially occurring threatened species listed under the NC Act or EPBC Act with the potential to be impacted by Project activities are described in **Table 3.4**.

Table 3.4 Threatened Flora Species Profiles

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
***Cycas megacarpa* – Endangered under the EPBC Act and NC Act**			
	*Cycas megacarpa* is a small to medium sized Cycad with an erect trunk standing around 3 m tall and approximately 15 cm wide. It is endemic to south-east Queensland, occurring from Woolooga in the south to Bouldercombe in the north. The extent of occurrence for *Cycas megacarpa* is 18 726 km^2, while the area of occupancy is 46 km^2. The Queensland Herbarium (2007) has identified 46 populations in total. *Cycas megacarpa* occurs in *Eucalyptus maculata* and *Eucalyptus crebra* woodland and open forest with a grassy understorey. It has also been recorded on rainforest margins. The species usually grows on hill tops and steep slopes at altitudes of 40–600 m above sea level. The soil is typically a well-draining rocky or shallow clay, clay/loam, derived from acid volcanic, ironstone or mudstone. Many populations of *Cycas megacarpa* are very small and greatly fragmented, with only a handful of adult plants (Forster 2007). Cycad species are known to have little genetic flow between fragmented populations and do not disperse far from the parent plant.	*Cycas megacarpa* was recorded across all vegetation communities within the Study Area including within regrowth and non-remnant areas. The primary habitat for this species (i.e., where the species was most consistently recorded and abundant) was woodland to open forest on upper slopes and crests consisting of *Corymbia citriodora*, *Eucalyptus crebra*, *Eucalyptus melanophloia*, *Corymbia intermedia* and *Eucalyptus tereticornis* on metamorphosed sediments and volcanic geologies at altitudes of between 200 and 500 m. Clearing within the Disturbance Footprint will result in the loss of approximately 4,131 *Cycas megacarpa* individuals and 147.1 ha of known confirmed habitat (confirmed records) and 88.6 ha of known suspected habitat (reasonable extrapolation of known habitat (confirmed) mapping) within the Disturbance Footprint. It should be noted that these numbers are subject to change as the Disturbance Footprint is refined.	The primary threats identified for the species are: • Destruction due to land clearing. • Legal and illegal harvesting of adult plants and seed. • Loss of genetic variation and insect pollinators. • Predation and climate change. • Land management practises including fire, timber harvesting and drought. The National Multi-Species Recovery Plan for cycads (Queensland Herbarium 2007) includes this species and provides additional details including measures to manage populations.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	Cycads are unisexual, and generally considered to be long lived plants with Australian Macrozamia species ranging from 60 to 1530 years.		
***Hernandia bivalvis*- Near Threatened under the NC Act**			
	*Hernandia bivalvis* is a tree growing up to 20 m. The leaves are ovate or ovate lanceolate and the upper surface is shining green, and the lower surface is paler and dull. The black, ovoid fruit is about 2 cm in diameter and has 10 ribs and the flowers are grouped in clusters comprising of one stalkless female and two short, stalked male flowers. The species is known to occur from Dryander Creek (near Proserpine) south down to Mt Tamborine. Most known occurrences of this species are from either vine thicket or microphyll vine forest or outcrops with shallow soils up to 620 m in altitude.	This species was not recorded during the field survey program but is considered a potential occurrence due to the presence of nearby records and suitable habitat. A total of 330.3 ha of potential habitat has been identified within the Study Area, associated with REs 11.11.5a and 11.12.4. A total of 8.3 ha of potential habitat will be directly impacted via vegetation clearing.	The possible threats for the species are: • Habitat fragmentation. • Inappropriate fire regimes. • Degradation of habitat by weeds.

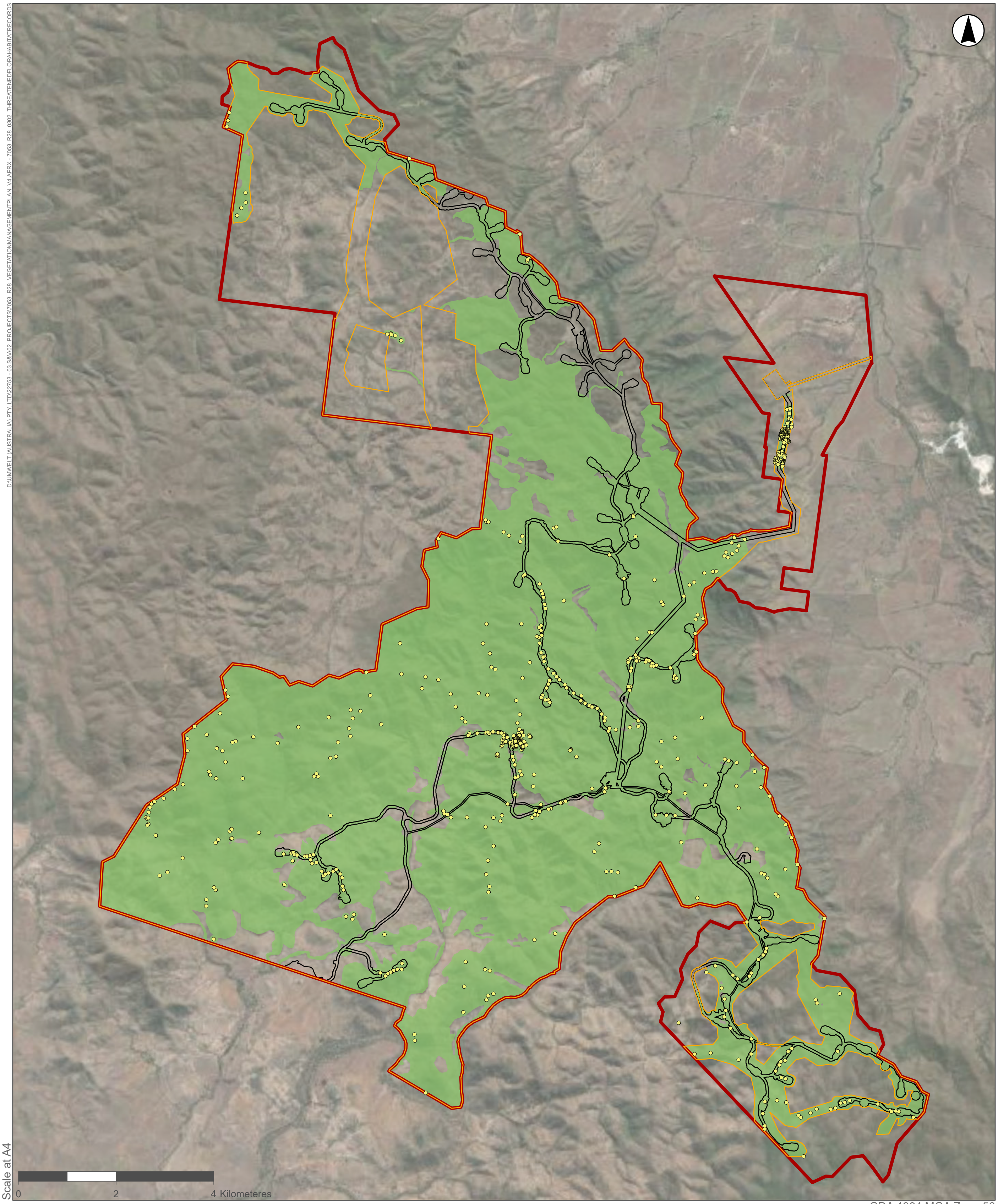
Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
***Cossinia australiana* - Endangered under the EPBC Act and NC Act**			
	*Cossinia australiana* is a shrub or small slender tree to 7 m, with a sparse crown (Department of the Environment Water Heritage and the Arts 2008). Leaves are compound, usually with a winged rachis and 3–5 elliptical to oblong leaflets. Fruits are hairy, three-lobed, inflated capsules with an orange inner surface and brown seeds. The species is known to occur from Rockhampton to Kingaroy, east of the Great Dividing Range, at altitudes from 20 m to 520 m. It is found in Araucarian vine forest or vine thicket on fertile soils. Within these habitats it is generally uncommon, found as scattered individuals. The species appears to prefer ecotonal situations around dry rainforest edges. Trees and shrubs which *Cossinia australiana* is often associated include *Alyxia ruscifolia*, *Capparis arborea*, *Drypetes deplanchei*, *Flindersia australis*, *Owenia venosa* and *Siphonodon australis.*	This species was not recorded during the field survey program but is considered a potential occurrence due to the presence of nearby records and suitable habitat. A total of 330.3 ha of potential habitat has been identified within the Study Area, associated with REs 11.11.5a and 11.12.4. A total of 8.3 ha of potential habitat will be directly impacted via vegetation clearing.	The primary threats identified for the species are: • Exotic weeds, including *Lantana camara, Aristolochia elegans, Anredera cordifolia, Macfadyena unguis-cati* and *Asparagus plumosus.* • Invasion of vine forest margins by weeds also increases fuel loads and leads to fire incursions. • Habitat loss due to clearing. • Increased disease and susceptibility to insects due to the very small, isolated populations and fragmented habitat. • Road widening and maintenance activities.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
***Dansiea elliptica*- Near Threatened under the NC Act**			
	*Dansiea elliptica* is a tree that grows up to 35 m. The leaves are spirally arranged or subopposite, elliptical in shape, apiculate at the apex and shortly attenuate at the base. The flowers are cream-pale green, about 20 cm long and the mature fruit are two or four winged, formed from two orbicular bracteoles below the flowers. The species is known to occur in several localities within Queensland including within Dinden National Park, Wooroonooran National Park, Rundle State Forest and Deep Water National Park. The area of occupancy in Queensland is less than 40 square km in total. Habitat for the species includes lowland dry rainforest and vine thicket on substrates derived from rhyolite, basalt and greywacke. Species associated with *Dansiea elliptica* include *Flindersia australis, Casuarina cristata*, *Gossia bidwillii*, *Drypetes deplanchei*, *Planchonella cotinifolia, Pleiogynium timorense, Terminalia porphyrocarpa, Polyscias elegans, Flindersia spp., Elaeocarpus eumundi, Synima, Cryptocarya mackinnoniana* and *Cryptocarya vulgaris*.	This species was not recorded during the field survey program but is considered a potential occurrence due to the presence of nearby records and suitable habitat. A total of 330.3 ha of potential habitat has been identified within the Study Area, associated with REs 11.11.5a and 11.12.4. A total of 8.3 ha of potential habitat will be directly impacted via vegetation clearing.	The primary threats identified for the species are: • Land clearing activities. • Inappropriate fire regimes.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
***Decaspermum struckoilicum*- Endangered under the EPBC Act and Critically Endangered under the NC Act**			
	*Decaspermum struckoilicum* is an erect shrub or small tree growing to 4 m high (Department of the Environment Water Heritage and the Arts 2008a). The leaves are elliptical, arranged in opposite pairs along the branchlets. The flowers are borne in clusters in the leaf axils, white, with four or five petals and sepals and 16–25 stamens. The fruit is a globose berry up to 8.5 mm in diameter, soft and dark bluish-black when ripe. The species is known from five localities in an area known as Struck Oil, approximately 8 km east of Mount Morgan in Queensland. Records for the species are 10.5 km north of the Study area. It is known to occur in semi-evergreen vine thicket on chocolate or reddish soil, often in disturbed areas and at elevations up to 300 m.	This species was not recorded during the field survey program but is considered a potential occurrence due to the presence of nearby records and suitable habitat. A total of 39.1 ha of potential habitat has been identified within the Study Area, associated with REs 11.11.5a and 11.12.4. A total of 2.0 ha of potential habitat will be directly impacted via vegetation clearing.	The primary threats identified for the species are: • Weed incursion, particularly by *Lantana camara*, *Megathyrsus maximus* and *Cryptostegia grandiflora.* Potential threats to the species include: • Wildfire from adjoining sclerophyll forests. • Habitat disturbance from domestic stock.
***Samadera bidwillii*- Vulnerable under the EPBC Act and NC Act**			
	*Samadera bidwillii* is a small shrub or tree that grows to about 6 m. Its leaves are narrowly elliptic or narrowly ovate, the apex is obtuse, the base cuneate to attenuate. The flowers occur in axillary clusters of 1 to 4, and each flower has 8 to 10 stamens.	This species was not recorded during the field survey program but is considered a potential occurrence due to the presence of nearby records and suitable habitat.	The primary threats identified for the species are: • Soil erosion. • Habitat clearing.

Species	Distribution, Habitat and Ecology[1]	Study Area Values	Threats to the species[1]
	The fruits are compressed, ovoid or ellipsoid, about 1 cm long and are 1-seeded (Ross, 1984). The species is known to occur in several localities between Scawfell Island near Mackay and Goomboorian, north of Gympie within Queensland. *Samadera bidwillii* prefers lowland rainforest or at rainforest margins, and can occur in other forest types, such as open eucalypt forests and woodlands. Species associated with *Samadera bidwillii* include: *Corymbia citriodora, Eucalyptus propinqua, Eucalyptus acmenoides, Eucalyptus tereticornis, Corymbia intermedia, Eucalyptus siderophloia, Eucalyptus moluccana, Eucalyptus cloeziana* and *Eucalyptus fibrosa*. It is commonly found in areas adjacent to both temporary and permanent watercourses up to 510 m altitude on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils.	A total of 6,681.9 ha of potential habitat has been identified within the Study Area, associated with REs 11.3.4, 11.3.25, 11.3.25b, 11.11.3, 11.11.3c, 11.11.4, 11.11.4a, 11.11.4b, 11.11.4c, 11.11.5a, 11.11.15, 11.12.1 11.12.4 and 11.12.6. A total of 284.0 ha of potential habitat will be directly impacted via vegetation clearing.	Potential threats to the species include: • Inappropriate fire regimes. • Exotic shrubs and grasses (e.g., *Lantana camara*, *Megathyrsus maximus* and *Chloris gayana*).

[1]Species descriptions including key threats, distribution, habitat and ecology have been derived from information within DES Species Profiles (Department of Environment and Science 2021) and within the Species Profile and Threats Database (DCCEEW 2022).



GDA 1994 MGA Zone 56

Legend

- Ground-truthed Mapping Extent
- Disturbance Footprint
- Study Area
- *Cycas megacarpa* (Endangered EPBC Act and NC Act) Records
- *Cycas megacarpa* Habitat

FIGURE 3.2

Threatened Flora Habitat and Records

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

4.0 Potential Impacts

4.1 Overview

The Project has the potential to impact on flora and vegetation values within the Study Area during the construction, operation and maintenance and decommissioning phases of the Project. The key potential impacts associated with the different Project phases have been summarised below in **Table 4.1**.

The greatest potential impact on ecological values will be from direct impacts associated with the clearing of vegetation during the construction phase of the Project. Within the Study Area, a maximum area of approximately 877.5 ha will be directly impacted as determined by the Disturbance Footprint (**Figure 1.1**). Approximate impacts on vegetation communities have been provided below in **Table 4.2.**

Mitigation and management measures to reduce Project impacts are discussed in **Section 5.0**.

Table 4.1 Project Activities, Risks and Potential Impacts

Project Phase	Project Activity	Risk/ Threat	Potential Impacts
Construction	Site establishment and vegetation clearing	Habitat loss, fragmentation, and degradation	• Increase or the introduction of edge effects. • Reduce the extent and condition of suitable habitat. • Reduction in population size and number of individuals within a community.
		Introduction and exacerbation of weed species	
	Construction activities including vehicular movement	Dust generation	
		Soil erosion and sedimentation	
Operation and Maintenance	Project activities	Introduction and exacerbation of weed species	
Decommissioning	Project conclusion and rehabilitation works	Dust generation	
		Introduction and exacerbation of weed species	

4.2 Potential Impacts to Vegetation Communities

As per the field-validated vegetation mapping, the Project will result in the removal of up to 372.0 ha of remnant vegetation, 261.8 ha of regrowth vegetation and 243.5 ha of non-remnant cleared vegetation within the Disturbance Footprint (**Figure 3.1**). **Table 4.2** below provides a breakdown per RE and details the mapped extent of each community within the Development Corridor and within the Disturbance Footprint. As described in **Section 3.2.1**, no impacts on TECs are anticipated as none are considered likely to occur.

Table 4.2 Extent of Ground-truthed REs within the Development Corridor and Disturbance Footprint

Regional Ecosystem	Remnant Area (ha) within Development Corridor	Regrowth Area (ha) within Development Corridor	Remnant Area (ha) within Disturbance Footprint	Regrowth Area (ha) within Disturbance Footprint
VM Act Class: Of Concern				
11.3.4	0.6	0.0	0.4	0.0
11.3.25	0.0	0.7	0.0	0.2
11.3.25b	4.1	1.6	3.3	1.4
11.11.3	249.7	99.6	160.2	68.4
11.11.3c	38.6	0.0	23.8	0.0
11.11.4	11.3	5.7	6.0	3.0
11.11.4a	22.5	5.4	14.1	3.1
11.11.4b	69.4	3.2	40.4	2.1
11.11.4c	44.6	2.4	29.6	2.1
11.11.5	0.0	7.9	0.0	0.0
11.11.5a	20.9	0.0	8.4	0.0
11.11.15	15.7	112.4	10.9	81.3
11.12.1	0.0	81.1	0.0	51.2
11.12.4	0.0	0.0	0.0	0.0
11.12.6	116.6	68.0	75.0	48.0
Total	**594.0**	**388.1**	**372.0**	**261.8**

4.2.1 Threatened Flora

Cycas megacarpa individuals occur within the Disturbance Footprint and therefore may be directly impacted via vegetation clearing. The Project will also result in the removal of suitable habitat for both known and potentially occurring threatened flora species, as outlined in **Table 3.3**.

Significant impact assessments were undertaken in accordance with the MNES Guidelines (Department of the Environment 2013) for *Cycas megacarpa, Cossinia australiana, Decaspermum struckoilicum* and *Samadera bidwillii* as these species are listed under the EPBC Act (refer **Section 2.0**). In summary, this assessment identified that after avoidance and mitigation measures were considered, the Project is likely to have a significant impact on *Cycas megacarpa.*

An assessment against the Significant Residual Impact Guideline: For matters of state environmental significance and prescribed activities under the Sustainable Planning Act 2009 (Department of State Development Infrastructure and Planning 2014) was also undertaken to determine whether the Project is likely to have a Significant Residual Impact on a MSES (refer **Section 2.0**). As per the Significant Residual Impact assessments detailed in the *Terrestrial Flora Report* (Umwelt 2022), related impacts on *Cycas megacarpa* and *Hernandia bivalvis* may result in a Significant Residual Impact and require offsetting under the EO Act (Queensland). It should be noted, that while Essential Habitat is mapped for both *Cycas megacarpa* and *Hernandia bivalvis*, the field survey did not identify any appropriate habitat for *Hernandia bivalvis* within the mapped Essential Habitat extent that covers the Study Area.

Project related impacts on *Cycas megacarpa* protected wildlife habitat may also result in a SRI.

5.0 Mitigation and Management

5.1 Objectives

To reduce impacts to remnant vegetation and threatened flora species due to vegetation clearance, the following management and mitigation measures have been developed with the aim to achieve the following objectives:

- No loss of known populations of threatened flora species.
- Identification of all threatened flora species within the Disturbance Footprint during pre-clearance surveys.
- Clear communication and delineation of ‘no-go’ areas where impacts will be avoided during construction.
- Approved clearing limits will not be exceeded, as outlined in Project’s Development Approval.
- Management of weed species, to ensure there are no new species or infestations identified within the Disturbance Footprint.
- Restoration and rehabilitation to be undertaken of disturbed areas no longer required for active use or construction, including creek lines.
- Implementation of erosion and sediment control and dust suppression measures.
- Micro-siting does not result in additional disturbance to threatened flora above the approved limits.

5.2 Roles and Responsibilities

The roles and responsibilities for Project staff are outlined in **Table 5.1** below.

Table 5.1 Roles and Responsibilities

Role	Responsibility	Duties
Project Manager	Oversees the construction and operation phases of the Project.	• Ensure contractors and all on site personnel are given adequate training in the requirements of this PVMP. • Ensure processes and procedures are in place prior to site mobilisation to ensure the successful implementation of this PVMP. • Implement the monitoring program, outlined in **Section 6.2**. • Undertake and record corrective actions and non-compliance. • Report to administrating authorities where required.
Construction Manager	Oversees site construction and reports to the Project Manager.	• Ensure the implementation of this PVMP and the CEMP throughout the construction phase.

Role	Responsibility	Duties
Environment Officer or suitable delegate	Ensures the implementation this PVMP through the construction and operation phases. Reports to the Project Manager.	• Notify the Project Manager of any environmental incidents/ non compliances that occur on site. • Audit site works in accordance with this PVMP. Notify the Project Manager on project progression. • Undertake environmental monitoring and reporting, where applicable.
Rehabilitation Contractor	Undertakes rehabilitation works. Reports to the Environment Officer.	• Undertake rehabilitation works as per the requirements of this PVMP and the Rehabilitation Management Plan to be developed.
Suitably Qualified Ecologist	Provides independent ecological expertise. Reports to the Environment Officer.	• Undertake pre-clearance surveys and baseline monitoring as per the requirements of this PVMP. • Undertake environmental monitoring and reporting, where applicable.
All Project personnel	Construction, operation, and maintenance. Reporting requirements will differ depending on Project roles.	• Reports environmental incidents and non-compliance to the Environment Officer. • Undertake site and role specific training. • Follow the requirements outlined in this PVMP.

5.3 Measures

The mitigation and management measures presented in this PVMP have been developed with the aim to achieve the objectives outlined in **Section 5.1**. Mitigation and management measures are based on information within the following supporting documents:

- *Mitigating Biodiversity Impacts Associated with Solar and Wind Energy Development* (Bennun *et al.* 2021).
- Rockhampton Region Planning Scheme (Rockhampton Regional Council 2015).
- Banana Shire Planning Scheme 2021 (Banana Shire Council 2021).
- *Environmental Management Plan Guidelines* (Department of Environment 2014).
- Information contained within Conservation Advice and Recovery plans for relevant species (DCCEEW, 2022).

Table 5.2 contains the mitigation and management measures that relate to flora and vegetation communities identified within and adjacent to the Disturbance Footprint. Measures have been provided for the following key risks:

- Vegetation clearing, habitat loss, fragmentation and degradation.
- Soil erosion and sedimentation.
- Dust generation.
- Introduction and exacerbation of introduced flora species.

Table 5.2 Management and Mitigation Measures for the Avoidance of Impacts to Flora and Vegetation Communities

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
Vegetation clearing, habitat loss, fragmentation and degradation	Approved clearing limits will not be exceeded, as outlined in approval document	• All Project activities including site access, laydown of plant and equipment and construction activities must be within the finalised Disturbance Footprint. Retention of vegetation for use in on-site rehabilitation and specific requirements for clearing vegetation surrounding creek lines and watercourses. • To ensure all Project activities are within the finalised Disturbance Footprint the following measures will be implemented: ○ Final clearing extents within the Disturbance Footprint will be demarcated with flagging tape and fencing. ○ Spatial files (shapefile format) will be provided detailing the Disturbance Footprint and clearing extents. ○ The Environment Officer will inspect this area on a weekly basis to ensure work is being undertaken within the final clearing extents within the Disturbance Footprint, and that the fencing/ flagging tape is still within the correct location. • Where possible, locate access tracks and electrical connections adjacent to existing access or farm tracks to minimise clearing.	Prior to commencement of site disturbance and any construction activities
	Micro-siting does not result in additional disturbance to threatened flora or communities above the approved limits	Pre-clearance surveys will be undertaken within appropriate habitat for the threatened species known and likely to occur within the Disturbance Footprint and 5 m either side of the Disturbance Footprint to inform the micro-siting process. Where possible, optimise the placement of infrastructure within the Disturbance Footprint to further minimise disturbance to: • Known *Cycas megacarpa* individuals (particularly large reproductive age individuals and mature female plants). • Riparian zones, including avoiding placement of turbines within 50 m of waterways potential threatened flora species habitat. • Refer to **Section 5.4** for details pertaining to pre-clearance survey methods.	Prior to commencement of site disturbance and any construction activities

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
	No loss or decline of Known populations of threatened flora species	• Personnel will be informed of the sensitive areas[1] within the Disturbance Footprint as well as the procedures for minimising ecological impacts through site inductions, training, and toolbox talks. • Pre-clearance surveys within the Disturbance Footprint will include searches for threatened species that have a Moderate or High likelihood of occurring (Refer to **Table 3.3**). If any individuals or populations are located during the targeted surveys, a detailed account of their occurrence will be recorded including number of individuals, GPS location and extent. The plants or population area including a 5 m buffer must be demarcated and avoided via micro-siting. No direct or indirect impacts will be permitted without prior consultation with DCCEEW and DES. A *Cycas megacarpa* Species Management Plan will be developed and approved prior to site disturbance, which will contain detailed species-specific mitigation. • A pre-approved translocation management plan will be implemented for *Cycas megacarpa* individuals that would otherwise be removed through clearing for the Project. The plan will specify pre and post monitoring requirements, translocation and propagation methods protocols, reporting requirements and performance criteria.	Prior to personnel entering and working on the Project site
	Delineation of conservation/ sensitive areas	• 'No-go' areas, including clearing limits will be clearly demarcated including the implementation of signage and fencing. Information fact sheets will also be given to applicable land holders. 'No go' areas will include the following: o Where watercourses intersect linear areas of the Project (i.e. access tracks and reticulation cabling), the clearing width will be reduced to 25 m or less wherever it is feasible. The full implementation of this measure is subject to final design, and safe transport of Project components. • 'No go' areas will include areas adjacent to the Disturbance Footprint which contain habitat (known or potential) or *Cycas megacarpa* individuals. • Where Of Concern remnant REs occur immediately adjacent to areas of earthworks, tree protection measures will be installed in accordance with Australian Standard: Protection of trees on development sites (AS 4970–2009).	Prior to commencement of site disturbance and any construction activities

[1] Sensitive areas are defined as locations outside the Disturbance Footprint which contain known threated species records or habitat.

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
		• Personnel will be informed of the sensitive areas within the Disturbance Footprint as well as the procedures for minimising ecological impacts through site inductions, training, and toolbox talks.	
	Restoration and rehabilitation to be undertaken of disturbed areas no longer required for active use or construction.	**Pre-construction** • Soil (topsoil and subsoil) and vegetation stockpile locations will be identified prior to construction. The location will be in previously cleared areas and will be clearly communicated to personnel prior to the commencement of onsite works. Stockpiles will be used for the retention of soil and reinstatement of vegetation for rehabilitation works. **Post-construction** • The period between construction activities and restoration of disturbed areas will be kept to a minimum to prevent the establishment of exotic species and loss of soil. • Disturbed areas that do not form part of the operational footprint will be re-profiled to stable and/or original contours, re-establishing surface drainage lines and other land features. An Erosion and Sediment Control Plan will be developed and approved prior to site disturbance, which will contain detailed species-specific mitigation. • Compacted areas to be ripped where required and practicable to do so. • Seed mix to contain relevant species, aligned with prior land use. The species that will be used in rehabilitation works will be identified in consultation with the landowners. Where practicable vegetation best aligned with the historic vegetation at the rehabilitation site will be selected. • In areas where the Disturbance Footprint is adjacent to sensitive areas[1], revegetation is to occur through natural regeneration and through assisted planting to create a vegetated buffer between the Disturbance Footprint and sensitive areas. The vegetation within these areas will consist of native species analogous to adjacent vegetation community. • Where rock was naturally occurring on the ground surface, the rock can be reinstated as part of rehabilitation works. Rock is not to be reinstated where its use will create a new impact or hazard to the landowner's ability to utilise their land. • Cleared native vegetation will be mulched and reused during progressive rehabilitation activities.	**Pre-construction:** 0–6 months prior to commencement of site disturbance and any construction activities. **Post-construction:** Restoration and rehabilitation work of disturbed, non-operational areas will be undertaken progressively throughout the Disturbance Footprint. Initial rehabilitation works will be completed within 3 months of the construction phase (**Section 1.2.2**). Monitoring of rehabilitated areas will be ongoing until the disturbance is stabilised.

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
Soil erosion and sedimentation	Implementation of erosion and sediment control and dust suppression measures during the construction phase.	• The potential impacts of erosion and sedimentation will be mitigated and managed through the development and implementation of an Erosion and Sediment Control Plan. This will include the establishment of temporary erosion and sediment control until construction is complete or exposed areas have been rehabilitated to prevent the sedimentation of waterways within the Disturbance Footprint.	Prior to commencement of site disturbance and any construction activities.
Dust generation		• Progressive rehabilitation of bare/ disturbed areas will be completed as soon as the area is no longer needed for construction. • Areas of bare earth will be limited to essential areas needed for the construction of Project infrastructure. Vegetation cover, mulch, and other suitable methods to prevent dust generation will be adopted, where practicable. • Stockpiles (topsoil and subsoil) will be maintained to prevent windblown dust generation, especially during dry and/or windy conditions. This will include watering or covering of material. • A maximum speed limit of 40 km/hr will apply to access tracks within the wind farm area. The speed limit will be reduced to 20 km/hr where tracks occur in proximity to dwellings or site offices. When passing livestock and stationary work crew’s vehicles must not exceed 10 km/hr. Speeds on public roads are to be observed as per road signage. • Restrict vehicles to approved access tracks (where constructed, or where approval for use exists with the landowner) and only vehicles required for the safe and essential construction activities will be allowed in work areas. • Cover all loose loads for transport to and from the work site. • Construction water cart will be used to suppress dust during earthworks. Where watering is used, ensure that there is no surface ponding/pooling of water. • Secure an appropriately licensed water source for dust suppression during the construction phase. • Immediately clean up spilled materials on traffic areas before it will be disturbed by vehicle movement.	During all phases of the Project lifecycle.

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
Introduction and exacerbation of weeds	Management of introduced flora to ensure that new species or infestations are identified within the Disturbance Footprint.	**Pre-construction** • Pre-clearance surveys will be undertaken within the Disturbance Footprint (plus 5 m buffer) to record the presence and abundance of introduced flora considered a high biomass grass, and those classified as Category 3 Restricted Matters and/or WoNS, defined as a weed species within this report (see **Section 3.3.1**). These surveys will serve to identify areas requiring treatment and establish baseline conditions prior to construction such that impacts from the Project can be monitored throughout the Project lifecycle. Areas containing infestations will be treated prior to the commencement of site disturbance and any construction activities. Refer to **Appendix A** for species specific control methods. Chemical treatment adjacent to sensitive areas[1] should be avoided, where possible. If chemical treatment is required, spot spraying methods will be undertaken. **Construction and Operation** • Ongoing weed inspections and management will be completed within the Disturbance Footprint during construction and operation. The weed management area shall be increased where operational maintenance activities are required to be undertaken from unformed areas of the Project site until such time when weed presence in this area (if existing) can no longer be directly attributed to the project. • Management of weeds within areas disturbed as part of Project construction (including rehabilitation areas) will continue up to two years post construction, or until weed presence in these areas can no longer be directly attributed to Project activities. Refer to **Appendix A** for species specific control methods. Chemical treatment adjacent to sensitive areas[1] should be avoided, where possible. If chemical treatment is required, spot spraying methods will be undertaken. • Use of chemical treatment in infestation areas, to be prioritised for use in the early wet season to limit seed formation. Personnel using herbicides are to receive appropriate training prior to commencing work and hold any necessary licences required under Queensland law. Only herbicides registered for use over water will be used within 10 m of watercourses.	**Pre-construction:** 0–6 months prior to commencement of site disturbance and any construction activities (during suitable seasonal conditions). **Construction and Operation:** During all phases of the Project lifecycle.

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
		• Site vehicles (mobile plant including light vehicles) must drive to conditions and remain on approved access tracks, to avoid mud, organic matter and weed seeds becoming attached to the vehicle. Offroad driving will be minimised to avoid contamination when driving between properties within the project site. • A wash down area with a capture vessel will be established on or in proximity to the Project Site to ensure machinery hygiene. • Site vehicles to be washed down after working in areas where infestations are noted within the project site (where identified), and where weed control measures have not been implemented. • During the annual wet season light vehicles shall be maintained, washed down periodically, and kept in a clean condition. • Light vehicles and worker transport vehicles to remain on sealed roads when offsite, for example between work shifts. Further inspections will not be required when this action is implemented. • Site vehicles (mobile plant including light vehicles) and equipment is to arrive on site 'clean' of weed seeds and other organic matter. Site vehicles are to be inspected and recorded with documented evidence, via a washdown register and weed and seed certificate, prior to site mobilisation. • Personnel boots must be cleaned regularly, as well as between properties by removing excess mud / organic material. Clothing to be checked for weed seeds prior to moving between properties and offsite. • Equipment or material being brought into port facilities for direct transfer to the Project site is required to pass the quarantine inspections and protocols, as per by the Australian Quarantine and Inspection Service. • Material imported into the Study Area (i.e., for use as road base etc) must be obtained from an appropriately licensed source where the source location is deemed 'weed clean'. Evidence must be obtained from the provider prior to importation of material to the Project site. Imported fill (rocks/screenings) shall be free of contamination from mud clumps and weed seeds. • Use only native or certified weed free seeds in all rehabilitation works, including hydro mulch. No viable weed species are to be mulched or chipped in rehabilitation works.	

Risk/ Threat	Associated Performance Criteria	Mitigation Measures and Management Action(s)	Timing
		• All personnel are to be trained in the identification of key weed species (refer **Section 3.3.1**) during general induction and toolbox talks. Known weed species on the site are to be displayed on posters on the HSE board and any other suitable locations around the Project site.	

[1]*Sensitive areas are defined as locations outside the Disturbance Footprint which contain known threated species records or habitat.*

5.4 Pre-clearance Survey Methodology

Pre-clearance surveys are ecological surveys that will be undertaken prior to clearing works and the permanent removal of vegetation. The following will be conducted prior to and during the pre-clearance surveys within the Disturbance Footprint:

- Desktop assessment will be undertaken to understand the extent, locality, and presence of vegetation communities and threatened flora species.
- Field surveys will be completed by suitably qualified ecologists[2] and will include:
  - Threatened species searches for the five threatened species with a 'high' to 'moderate' likelihood of occurrence within vegetation communities with potential habitat (**Table 3.3**), to inform the micro-siting process. It should be noted that pre-clearance surveys will also occur within the areas 5 m either side of the Disturbance Footprint (to account for GPS inaccuracies) and include detecting the presence of *Cycas megacarpa* individuals. Pre-clearance requirements for *Cycas megacarpa* will be addressed in a in a *Cycas megacarpa* Species Management Plan which will be developed and approved prior to site disturbance.
  - Habitat assessments to mark fauna habitat features, including hollow-bearing trees, logs, nest boxes to be avoided or managed during clearing.
  - Weed surveys to record the presence and abundance weed species (see **Section 3.3.1**). Areas containing infestations will be treated prior to the commencement of site disturbance and any construction activities.
  - Protected plant survey in accordance with the *Flora Survey Guidelines – Protected Plants* (DES 2020).

5.4.1 Pre-clearance Survey Constraints Protocol

This section defines an adaptive management response which is to be engaged if a threatened species not already known to occur within the Study Area is encountered during pre-clearance surveys or any other surveys undertaken prior to construction. The trigger to undertake the pre-clearance surveys constraint protocol is the observation of one or more individual of a flora species listed as threatened under the EPBC Act and/or NC Act within the Disturbance Footprint during future surveys or construction. If either are to be found, the constraints protocol below will then be followed.

STEP 1: Halt construction/clearing activities in the area (i.e. adjacent areas within the Disturbance Footprint where suitable habitat is present – to be determined by a suitably qualified ecologist).

STEP 2: Undertake investigation into potential impacts on the species. This should include:

- Updating of habitat mapping.
- Updating of Significant Impact Assessment.
- Determination of avoidance and mitigation strategies.

[2] A suitably qualified ecologist is a person who possessed a degree in environmental planning, environmental science, environmental management or similar from a recognised tertiary institution, and has at least five years of relevant experience in environmental assessment.

STEP 3: Communicate outcomes with DCCEEW and DES as appropriate to determine next steps.

Where threatened (NC Act or EPBC Act) and weed species have been identified then the following information will be recorded:

- GPS location.
- Collector, date and time.
- Species (scientific and common name).
- Number or density of individuals.
- Habit.
- Vegetation community in which it was recorded.
- General notes on the feature identified.
- Collect a reference specimen.

A pre-clearance survey report will be populated after the field surveys as detailed in **Section 6.2**.

It is noted that should a threatened species listed only under the NC Act be encountered, potential impacts to this species will be managed in consultation with DES via the Protected Plants assessment process outlined in the Nature Conservation (Plants) Regulation 2020.

5.5 Restoration and Rehabilitation

Rehabilitation of Project areas no longer used for construction activities will further reduce potential impacts to threatened species and vegetation. Refer to **Table 5.2** for the management and mitigation measures that will be undertaken within disturbed areas no longer required for active use or construction.

Successful rehabilitation of these areas includes the implementation of rehabilitation objectives and rehabilitation acceptance criteria. Rehabilitation objectives provide a clear explanation of proposed rehabilitation outcomes, whereas acceptance criteria are the indicators used to measure rehabilitation success, to demonstrate that the rehabilitation objective has been achieved.

Rehabilitation objectives for the Project include the following:

- Safe to humans and wildlife.
- Stable.
- Self-sustaining.

To achieve this, the following acceptance criteria is proposed:

- Vegetation and species consistent aligned with prior land use (prior to clearing) and reflects surrounding vegetation species.
- Weed species presence consistent with undisturbed areas.
- Landform stable and generally free of significant erosion features such as rills and gullies.

Progressive rehabilitation monitoring will occur as per the requirements stipulated in **Table 6.2** and **Table 6.3**. If rehabilitated areas are not tracking towards the assigned acceptance criteria, then additional mitigation measures will be implemented. This will be determined at a later stage and as rehabilitation and rehabilitation monitoring progresses. Examples of contingency measures could include:

- Additional planting/ seeding could occur to establish or re-establish species within rehabilitated areas consistent with the surrounding vegetation.
- Additional treatments of new weed infestations.
- Backfill the erosion, divert runoff through doming, and cap the inflow entrance point. Topsoil the channel (if topsoil available) and seed with native grass seed mix.

5.5.1 Progressive Rehabilitation Monitoring

A Rehabilitation Monitoring Program will be prepared which includes the detailed monitoring methodology, refined rehabilitation acceptance criteria, monitoring sites and monitoring implementation schedule. Refer to **Table 6.2** and **Table 6.3** for the frequency of rehabilitation monitoring during construction and operation.

6.0 Compliance Management

6.1 Training Requirements

Training will be undertaken to ensure site personnel are familiar with the content and requirements of this PVMP. The site manager will be responsible for ensuring individuals are aware of their responsibilities and reporting requirements. Site inductions and toolbox talks will be used as implementation methods before commencing work on site.

6.2 Monitoring and Reporting

The mitigation and management measures outlined in **Section 5.0** will be monitored throughout the duration of the Project. Regularly monitoring the effectiveness of the mitigation and management measures allows the PVMP to be reviewed and updated if performance criteria are not being met.

As part of compliance reporting an Annual Compliance Report will be provided to DCCEEW in accordance with Project approval conditions. It is anticipated that all actions relating to the management of vegetation will be included, including any non-compliance items. Non-compliance items will also require notification to DCCEEW, where relevant.

6.2.1 Pre-construction

A set of baseline data showing the condition of environmental values prior to disturbance will be undertaken during the pre-construction phase. **Table 6.1** below outlines the monitoring requirements associated with the pre-construction phase, which includes a pre-clearance survey. Refer to **Section 5.4** for details pertaining to the pre-clearance survey methodology.

Table 6.1 Pre-Construction Monitoring Requirements

Activity	Frequency	Timing	Purpose and Requirements	Deliverable	Responsibility
Pre-clearance survey	Once off activity	0–6 months prior to clearing activities during suitable seasonal conditions	Identify and quantify known threatened flora and weed infestations to be avoided or managed during construction with the Disturbance Footprint (plus 5 m buffer).	Pre-clearance Report	Independent qualified ecologist

6.2.1.1 Pre-Clearance Report

Following completion of the pre-clearance survey, a report will be developed that includes the following details:

- The total area (ha) of disturbance required for Project activities within the Disturbance Footprint.
- The location, extent and abundance of introduced flora classified as weed species (refer **Section 3.3.1**).

6.2.2 Construction

The key monitoring and reporting requirements during the construction phase pertain to vegetation protection, the management of weed species and rehabilitation works as outlined in **Section 5.0**. Regular site inspections will be undertaken to ensure adherence to the performance criteria and management objectives. **Table 6.2** contains the monitoring requirements associated with the construction phase.

Table 6.2 Construction Monitoring Requirements

Activity	Frequency	Timing	Purpose and Requirements	Deliverable	Responsibility
Construction audits	Weekly	During Project construction	Site inspections will be completed to monitor the environmental controls as per this PVMP and to ensure corrective actions are being implemented, where required. A site inspection checklist will include the key performance indicators to be monitored, as per **Section 5.1**.	Site Inspection Checklist and Environmental Incidents Register	Site Construction Manager
Post-clearing audit	Once off activity	After construction has been completed	Provide an update on the extent, status and condition of ecological values removed during construction. Including the location and number of threatened flora species removed and the total area of disturbance. The post-clearing audit will also include an assessment of weed species presence to determine if additional treatment of infestation areas is required.	Post-clearing Monitoring Report	Environment Officer
Rehabilitation monitoring	Every six months for the first two years and then reassessed after this period based on progression towards completion criteria.	During Project construction and continuing until meets completion objectives.	The intent of rehabilitation monitoring is to re-establish a native ground cover after disturbance to prevent the establishment of weed species and to assist with erosion mitigation measures.	Progressive Rehabilitation Monitoring Report	Independent qualified ecologist

6.2.3 Post-Construction and Operation

The key monitoring and reporting requirements during the post-construction and operation phase pertain to vegetation protection, management of weed species and rehabilitation management and mitigation measures as outlined in **Section 5.0**. **Table 6.3** below contains the monitoring requirements associated with this phase.

Table 6.3 Post-construction and Operation Monitoring Requirements

Activity	Frequency	Purpose and Requirements	Deliverable	Responsibility
Weed monitoring	To be determined in the final VMP, however it is anticipated that monitoring will be undertaken annually for the first two years of operation and then be undertaken every five years for the remainder of the EPBC Act approval (should it be granted).	Weed monitoring will be undertaken to prevent the establishment or exacerbation of weed species within the Disturbance Footprint.	Monitoring report detailing the areas requiring management, the weeds that require management and associated treatment options.	Environment Officer
Rehabilitation monitoring	Timing will be based on progression towards completion criteria.	The intent of rehabilitation monitoring is to re-establish a native ground cover after disturbance to prevent the establishment of weed species and to assist with erosion mitigation measures.	Progressive Rehabilitation Monitoring Repot	Independent qualified ecologist

6.3 Additional Reporting Requirements

Any activity resulting in the unlawful/unauthorised removal of native vegetation or threatened flora species during site activities shall be reported to the Project Environment Officer immediately. Any known instance of ecological disturbance occurring due to Project activities, where the disturbance results in impacts to MSES or MNES outside of the Disturbance Footprint, will be reported to the Project Environment Officer who will escalate and report this occurrence to the relevant government authority.

A series of registers relevant to vegetation management practices will be maintained throughout the life of the Project, and include:

- Training register.
- Vehicle washdown register.
- Environmental incident register.
- Site Inspection Checklist.

6.4 PVMP Amendments and Corrective Actions

The PVMP is a dynamic document that requires review and amendment throughout the life of the Project to ensure the measures within remain effective. It is recommended that this plan be updated:

- When additional ecological data relevant to the protection of vegetation and threatened flora values is collected for the Project.
- Where there is significant change to the Project schedule, Disturbance Footprint or a change in the construction methods.
- Where a change in legislation or best practice methodology has been identified.

To ensure compliance with this PVMP a schedule of obligations will be developed to outline all obligations and track how obligations are being met.

During the Project lifecycle corrective actions should be implemented if the performance criteria and management objectives outlined in **Section 5.1** are not being adhered to, when undertaking monitoring activities outlined in **Table 6.1,Table 6.2** and **Table 6.3**. The Project Manager and the Construction Manager will be notified within one week of each monitoring event (outlined in **Section 6.2**) if any of the following triggers in **Table 6.4** occur, resulting in non-compliance.

Table 6.4 Corrective Actions

Risk/ threat	Trigger	Corrective Action
Vegetation Clearing: approved clearing limits are exceeded	Clearing outside of the Disturbance Footprint or approved clearing limits exceeded	• Review clearing procedures. • Install additional fencing or flagging to reinforce no go areas. • Undertake toolbox talks and re-educate site personnel on site practices and management obligations.
Loss or decline of Known populations of threatened flora species	Loss, damage or severe stress of individuals or populations noted	• Undertake toolbox talks and re-educate site personnel on site practises management obligations. • Review and update this PVMP. • Install additional control measures such as additional fencing, signs, and flagging tape.
Reduced vegetation condition or species health from dust generation, soil erosion and/or sedimentation	Evidence of dust deposition on adjacent individuals or vegetation.	• Review mitigation and management procedures within the Erosion and Sediment Control Plan. • Increase frequency of dust suppression measures. • Undertake toolbox talks and re-educate site personnel on site practises and management obligations.
Introduction and exacerbation of introduced flora	Evidence of infestations by introduced flora species	• Treat new infestations within the Disturbance Footprint (plus 5 m buffer). • Undertake additional monitoring to review the success of treatment on infestations. • Undertake toolbox talks and re-educate site personnel on site practices and management obligations. • Review weed management procedures contained within this PVMP.

7.0 References

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APPENDIX A

Identified Weeds and Management Actions

Species	Classification	Management Actions[1]	Image[2]
Cryptostegia grandiflora (rubber vine)	Category 3 Restricted Matter and WoNS	**Physical Control**: Infestations of rubber vine can be controlled by burning individuals and/or infestations. **Mechanical Control**: Repeated slashing of individuals close to ground level is recommended for scattered or medium density infestations. Blade ploughing or stick raking also reduces infestation size. **Herbicide Control**: Several methods are recommended for the chemical treatment of rubber vine, such as: • Aerial application: foliar and soil applied. • Foliar spray: Most effective on plants less than 2 m high. Large plants with stem diameter over 8 cm may not be killed. • Basal bark treatment: Spray around base of plant to 20–100 cm above ground level on smaller plants. • Cut stump treatment: Horizontally cut stem off as close to ground as possible. Then, spray or swab cut surface. • Soil application: soil-applied herbicide applied after 50–80 mm of rainfall.	
Lantana camara (lantana)	Category 3 Restricted Matter and WoNS	**Physical Control**: Using fire and implementing a fire control program reduces the survival rate of Lantana. Effectiveness of burning will depend on the suitability of available fuel loads, fire intensity, temperature, relative humidity, soil moisture and season. **Mechanical Control**: Grubbing, slashing, stick raking, or ploughing are suggested mechanical control methods for Lantana. **Herbicide Control**: Different control methods are suggested for single-stemmed and multi stemmed individuals. Basal bark spraying and cut-stump methods is suggested for single stems, whereas foliage spraying is suggested for muti stemmed plants less than 2 m tall. **Biological Control**: The most popular biological control agents to treat lantana are sap-sucking bug (*Teleonemia scrupulosa*), leaf-mining beetle (*Uroplata girardi*), leaf-mining beetle (*Octotoma scabripennis*) and seed-feeding fly (*Ophiomyia lantanae*).	

Species	Classification	Management Actions[1]	Image[2]
Opuntia stricta	Category 3 Restricted Matter and WoNS	**Mechanical Control**: Fire is an effective control method for dense Opuntia spp. infestations. Before burning, speak to Biosecurity Queensland to see if this practice is suitable for your pasture and land management practices. **Herbicide Control**: Refer to the "Opuntioid cacti Restricted Invasive Plant" factsheet as control methods differ between species. **Biological Control**: There are several biological control agents that remain established in Queensland with the most successful including the Cactoblastis stem-boring moth and the 4 cochineal mealybugs.	
Opuntia tomentosa (velvety tree pear)	Category 3 Restricted Matter and WoNS		
Parthenium hysterophorus (parthenium)	Category 3 Restricted Matter and WoNS	**Herbicide Control:** Herbicide control differs between cropping and non-cropping areas. In non-cropping areas treat small and/or isolated infestations with a knockdown herbicide and a residual herbicide to control future germinations. For cropping areas use a selective herbicide and /or undertake crop rotations. **Biological Control:** Ten biological control agents are suggested to reduce parthenium's density and vigour, including but not limited to, stem galling moth (*Epiblema strenuana*), stem weevil (*Listronotus setosipennis*), leaf beetle (*Zygogramma bicolorata*), seed weevil (*Smicronyx lutulentus*) and stem galling weevil (*Conotrachelus albocinereus*).	

1 *For detailed management actions pertaining to this species refer to the Queensland Government Restricted invasive plants factsheets (Department of Agriculture and Fisheries 2021).*
2 *Photos are taken from government factsheets based on the species mentioned above (Department of Agriculture and Fisheries 2021) or publicly available google images (2022).*

Environmental & Social Consultants

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APPENDIX I

Traffic Impact Assessment

ACCESS TRAFFIC
CONSULTING

Mount Hopeful Wind Farm

Traffic Impact Assessment

May 2023

Prepared for Umwelt (Australia) Pty Ltd

Quality Information

Document	Traffic Impact Assessment
Client	Umwelt (Australia) Pty Ltd
Reference	UMW0123-001
Date	9 May 2023
Prepared By	

Revision History

Rev	Revision Date	Details	Authorised	
			Name / Position	Signature
0	24/03/2021	Draft for Client Comment		Original Signed
A	28/05/2021	Final		Original Signed
B	08/06/2021	Final – Revised Project Timeframe		Original Signed
C	23/03/2023	Reduced Number Turbines and Inclusion of Construction Camp		Original Signed
D	09/05/2023	Removal of Construction Camp		

Table of Contents

Executive Summary

Access Traffic Consulting was commissioned by Umwelt (Australia) Pty Ltd on behalf of Neoen Australia Pty Ltd (Neoen) to undertake a Traffic Impact Assessment (TIA) for the proposed Mount Hopeful Wind Farm (the Project), which is to be located approximately 50 km south of the regional centre of Rockhampton, on land parcels within both the Rockhampton Regional Council and Banana Shire Council Local Government Areas (LGAs).

This report has been prepared to determine the level of potential impacts of both the construction and operational phases of the Project on the operation of the surrounding road network. The outcomes of the TIA will be used in support of the development application for the Project, with the Rockhampton Regional Council (RRC), Banana Shire Council (BSC) and the Department of Transport and Main Roads (DTMR) all expected to be advice agencies.

The assessment identified that the Project's construction phase was the most critical in terms of traffic impact, with only negligible traffic volumes (and therefore impacts) expected to be generated by the Project's operational phase. The assessment identified that the proposed construction works were conservatively forecast to generate between 3-250 vehicles per day (vpd) on the state-controlled road network (3-18vpd on sections of OSOM transport route and up to 250vpd on section of Burnett Highway adjacent to main site area egress from SCRN) and up to 390vpd on the BSC controlled links of McDonalds Road and Playfields Road, noting that these are peak daily volumes and unlikely to be realised every day.

It is also noted that Neoen is currently considering a delivery methodology for the Project which would include the provision of an on-site workers accommodation camp for the Project, which would be expected to significantly reduce the daily staff volumes commuting between Biloela and the subject site, and therefore the Project traffic volumes on the relevant sections of the Burnett Highway, McDonalds Road and Playfields Road.

Notwithstanding this, based on the increase in traffic volumes forecast, the construction and operational phases of the Project are expected to have a minor impact to the surrounding road network, with the technical assessment completed identifying the requirement for the following upgrade works and mitigation treatments to be provided as part of the Project to maximise the safety and operational performance of the surrounding road network:

- Completion of works along the identified transport route to accommodate the swept paths of the oversize over mass (OSOM) turbine component transport vehicles, including the relocation of signage and road lighting infrastructure and construction of required temporary hardstand pavement areas as identified in the Preliminary Transport Route Assessment for the Project. It is noted that the exact extent and scope of these works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed.
- Upgrade of the existing Burnett Highway / McDonalds Road intersection to provide basic left (BAL) and basic right (BAR) turn treatments on the Capricorn Highway approaches, as per Austroads standards. Upgrade to also include the completion of vegetation clearing works on the eastern side of the northern approach to the intersection to improve sight distances to/from McDonalds Road and implementation of traffic management measures on the northern Burnett Highway approach during temporary Project construction phase (22 - 28 months).
- Installation of advisory "truck turning" signage be installed on the approaches to the Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections during the construction phase, to highlight to motorists the presence of the Project access locations and the potential for turning vehicles to/from the side roads.

- Upgrade of the existing unsealed sections of McDonalds Road (Ch. 0.000 to 5.720km) and Playfields Road (Ch. 5.080 to Ch. 24.420km) to provide a minimum 6.5m (unsealed) road pavement width in accordance with the BSC requirements for a rural access road.
- Construct new site access from South Ulam Road (LHS approx. Ch. 16.800km) to cater for Project volumes associated with the proposed eastern substation area. The new site access is to be provided in accordance with the requirements for a bitumen road (<300vpd) as per Standard Drawing CMDG-R-040 (Rural Road Access and Property Access Over Table Drains).
- Complete suitable road rehabilitation works (pavement / road surface) to the relevant 400m section of the Callide Mine Haul Road Access (between Dawson Highway and Argoon-Kilburnie Road) to provide appropriate road conditions to cater for the proposed OSOM turbine component transport movements.
- Upgrade of the existing drainage (floodway / culvert) and cattle grid structures on Mount Alma Road, Calliope Station Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road respectively to provide adequate carriageway width and suitable vertical geometry for the proposed turbine component transport vehicle configurations associated with the Project. It is noted that the exact configuration of these upgrade works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed.

In addition to the traffic assessments completed, a preliminary desktop pavement impact assessment of the relevant road network was also undertaken for the construction phase of the Project. The results of the assessment indicate that the heavy vehicle movements associated with the development of the proposed Mount Hopeful Wind Farm are expected to lead to negligible increases in pavement loadings on the majority of the identified sections of the state-controlled road network, with calculated values of loading increase generally below the typical 5% increase trigger threshold. The results did however identify higher increases on the following sections of the state-controlled road network:

- Leichhardt Highway (26A) – TMR Ch. 0.115km – 25.680km (gazettal direction).
- Burnett Highway (41E) – TMR Ch. 0.000km – 71.730km (gazettal and against-gazettal directions).

It is therefore expected that pavement maintenance contributions will be required to be provided to TMR to mitigate/offset the expected pavement impacts of the Project on these sections of the state-controlled road network. The exact amount of these contributions has not been calculated as part of this assessment, due to the preliminary nature of the Project details at this initial planning stage of the proposed Mount Hopeful Wind Farm. Therefore, further detailed calculations to confirm the required pavement maintenance contribution will be undertaken in subsequent stages of the Project once the site configuration, transport vehicle configurations and construction phase details (quantities, material sources etc.) are finalised.

It is also noted that the increases in loading on the identified section of the Leichhardt Highway are primarily due to the expected road gravel and aggregate transport movements for the Project from the currently proposed quarry source. As such, the mitigation of the impacts of these movements on the identified sections of the state-controlled network are expected to fall on the quarry operator and be covered by their typical maintenance contribution (c/tonne) to TMR as part of the general operation of the quarry.

In addition to the state-controlled road network, the results above indicated that the additional vehicle movements from the proposed construction phase of the Mount Hopeful Wind Farm will also lead to a significant (>5%) increase in pavement loadings on the RRC controlled South Ulam Road (gazettal direction) and the BSC controlled links of McDonalds Road and Playfields Road. Further to this, while no percentage increase could be established due to the lack of current traffic data for the identified Gladstone Regional Council (GRC) controlled links of Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road and the BSC links of Callide Mine Haul Road, Argoon-

Kilburnie Road and Jambin-Dakenba Road it is anticipated that the use of these roads as part of the proposed turbine component transport operations for the Project will also lead to an increase in pavement loadings.

Based on this, it is recommended that the proponent enter into an Infrastructure Agreement with RRC, GRC and BSC regarding the required mitigation works on the identified links to offset the calculated pavement impacts of the Project. It also recommended that this infrastructure agreement references the requirement for pre and post dilapidation inspections to be undertaken on the relevant sections of Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road (GRC), South Ulam Road (RRC) and Callide Mine Haul Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road by representatives of the proponent and the appropriate Council (GRC / RRC / BSC). These inspections are required to identify and document the current condition of the roads (pre construction) and establish the required maintenance and/or rehabilitation works (to be completed by the proponent at no cost to Council) deemed necessary to reinstate the roads to their documented condition prior to the introduction of Project traffic (post construction).

Taking the above into consideration, this report demonstrates that the Project complies with Performance Outcomes 6 (Traffic and Access) and 13 (Construction Impact - local transport networks and road infrastructure) of *State Code 23: Wind farm development.*

1.0 Introduction

1.1 Project Background

Neoen Australia Pty Ltd (Neoen), is the proponent of the Mount Hopeful Wind Farm (the Project and proposing to develop the Project on land approximately 50 km to the south of Rockhampton, and approximately 25 km east of the township of Dululu, in Central Queensland. The Project consists of up to 63 wind turbine generators (WTGs) and has a generation capacity of approximately 400 megawatts (MW).

1.2 Scope and Study Area

Access Traffic Consulting was subsequently commissioned by Umwelt (Australia) Pty Ltd on behalf of Neoen to undertake a Traffic Impact Assessment (TIA) for the proposed Mt Hopeful wind farm development, located on land straddling both the Rockhampton Regional Council and Banana Shire Council Local Government Areas (LGAs).

This Traffic Impact Assessment (TIA) was carried out to determine the level of potential impacts of both the construction and operational phases of the Project on the operation of the surrounding road network. The outcomes of the TIA will be used in support of the development application for the Project, with the Rockhampton Regional Council (RRC), Banana Shire Council (BSC) and the Department of Transport and Main Roads (DTMR) expected to be advice agencies.

Further to this, the purpose of this report is also to assess the Project's compliance with Performance Outcome (PO) 6 (Traffic and Access) and PO13 (Construction Impact - local transport networks and road infrastructure) under State Code 23: Wind farm development (State Code 23).

The following methodology was adopted to undertake the required assessments as part of the TIA, as summarised in the key tasks listed below.

- Broadly identify the existing transport infrastructure which is of relevance to the Project.
- Estimate traffic generation associated with the construction and operational phases of the Project and the distribution of this Project traffic on the identified road network, including the movement of materials, plant and equipment in addition to the construction and operational phase workforce.
- Assess the potential impact of the Project on the surrounding transport infrastructure during both the construction and operational phases.
- Identify potential mitigation and management strategies to be implemented during the construction and operational phases to offset the impact of the proposed Project (if required).

The adopted methodology centres on establishing a background, “without Project” traffic scenario for the identified sections of the surrounding transport routes and comparing this with a scenario including the Project-generated traffic, i.e. the “with Project” scenario.

The process allows for the assessment of the traffic impacts of the Project in terms of road safety, access requirements, intersection operations, road link capacity, pavement loading and other transport infrastructure. Following this, if required, potential mitigation and/or management measures would be formulated to address the potential traffic impacts caused by the proposed Project.

Finally, it is noted that the assessment completed is preliminary only and represents the current proposal for the Mount Hopeful Wind Farm Project as provided by the Proponent (Neoen). It is therefore anticipated that additional revisions to this assessment will be required when the exact configuration and construction phase details (material sources etc.) are confirmed during future stages of the Project.

1.2.1 Study Area

As noted above, the Project is located approximately 50 km south of Rockhampton and 25 km east of the regional township of Dululu, as shown in **Figure 1** below.

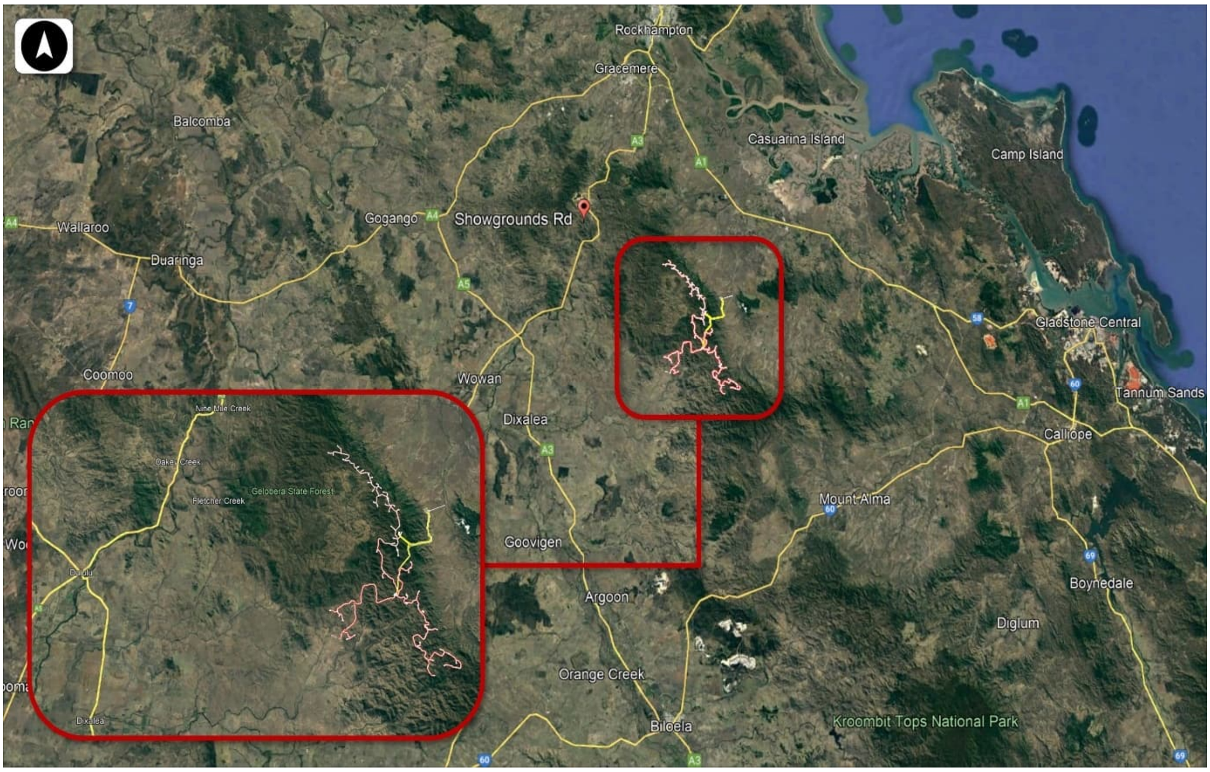


Figure 1 Mount Hopeful Wind Farm - Study Area [Source: Google Earth Pro]

The overall Project area encompasses four properties covering a total of approximately 16,757 hectares (ha), while the Project footprint (i.e. maximum area of disturbance) is a much smaller area. The four properties forming the overall Project area consist of a number of individual land parcels, as summarised in **Table 1** below.

Table 1 Land Parcel Details

Lot and Plan	Address	Area (ha)	Tenure	Landowner/s	LGA
Lot 21 RN1345	Glengowan Road, Ulogie QLD	5196.6	Freehold	Harry Walker Treelopping Pty Ltd	Banana
Lot 24 RN34	Glengowan Road, Ulogie QLD	2752.5	Freehold	Harry Walker Treelopping Pty Ltd	Banana
Lot 23 RN25	Glengowan Road, Ulogie QLD	976.2	Freehold	Harry Walker Treelopping Pty Ltd	Banana
Lot 30 RN72	Glengowan Road, Ulogie QLD	1723.7	Freehold	Brett Christie and Renee Christie	Banana
Lot 21 RN46	1682A South Ulam Road, Bajool QLD	1470.6	Freehold	LTH Grazing Pty Ltd	Rockhampton
Lot 25 RN25	1682A South Ulam Road, Bajool QLD	183.5	Freehold	LTH Grazing Pty Ltd	Rockhampton
Lot 2039 RAG4056	1682A South Ulam Road, Bajool QLD	801.0	Freehold	LTH Grazing Pty Ltd	Rockhampton
Lot 1933 RAG4058	1682A South Ulam Road, Bajool QLD	826.3	Freehold	LTH Grazing Pty Ltd	Rockhampton

Lot and Plan	Address	Area (ha)	Tenure	Landowner/s	LGA
Lot 2057 RAG4059	1682A South Ulam Road, Bajool QLD	845.9	Freehold	LTH Grazing Pty Ltd	Rockhampton
Lot 15 RN1089	1682A South Ulam Road, Bajool QLD	585.9	Freehold	LTH Grazing Pty Ltd	Rockhampton
Lot 148 DS151	1682 South Ulam Road, Bajool QLD	235.4	Freehold	Brett McCamley	Rockhampton
Lot 2420 DT4077	1682 South Ulam Road, Bajool QLD	64.8	Freehold	Brett McCamley	Rockhampton
Lot 2345 DT4077	1682 South Ulam Road, Bajool QLD	105.3	Freehold	Brett McCamley	Rockhampton
Lot 50 DT40144	1682 South Ulam Road, Bajool QLD	24.3	Freehold	Brett McCamley	Rockhampton
Lot 33 DT40123	1682 South Ulam Road, Bajool QLD	66.5	Freehold	Brett McCamley	Rockhampton
Lot 38 DT40131	1682 South Ulam Road, Bajool QLD	71.5	Freehold	Brett McCamley	Rockhampton
Lot 100 SP28944	1682 South Ulam Road, Bajool QLD	595.0	Freehold	Brett McCamley	Rockhampton
Local road reserves	Not Applicable	232.6	Road reserve	DoR	Banana and Rockhampton
Total Area		16757.5 ha			

1.3 Approval Agency Advice

1.3.1 Pre-Lodgement Meeting Minutes

As part of the development application process for the Project a pre-lodgement meeting was held with representatives of the State Assessment & Referral Agency (SARA) on 27 August 2020. Minutes of this meeting have been included for reference in **Appendix A**, with a summary of the relevant items provided below.

6. State transport infrastructure

- *Access is proposed from a local road rather than directly from a state-controlled road.*
- *The primary issue to be addressed at the material change of use stage is to have demonstrated a genuine attempt at detailing the haulage route from the port to the project site.*
- *It is recommended the proponent consider how construction materials / product are going to be transported to the site and identify existing conflict points (eg. crossing under bridges, intersections), design vehicles and movement activities.*
- *Additional details can be added or refined at in the detailed design stage in downstream approvals under the Transport Infrastructure Act 1994 (eg. section 33 approvals for works within state transport corridor).*
- *There is the ability for SARA to condition a Traffic Impact Assessment (TIA), which could include a pavement impact assessment as part of the material change of use. Any TIA will need to be undertaken in accordance with DTMR requirements.*
- *Depending upon the number and type of future roadworks requirement, it is recommended to allow at least 6 to 12 months for DTMR assessment of the downstream approvals.*
- *If a TIA is available upfront at the time of making the development application, this will assist but is not required. The route assessment is what is required at the material change of use stage.*

<u>Haulage Route</u>

24. *The proposed haulage route on both state and local roads for the movement of OSOM vehicles should be identified. It is recommended that the National Heavy Vehicle Regulator (NHVR) Route Planner (also known as Journey Planner) is used to demonstrate compliance. The Route Planner Tool is an interactive, online mapping system contained within the NHVR Portal to assist with the process of planning routes, applying for access permits and viewing heavy vehicle network routes.*

    More information can be found at https://www.nhvr.gov.au/road-access/route-planner

25. *After obtaining a development approval for a material change of use for a wind farm, the proponent would also need to identify the impacts associated with the wind farm in greater detail and put in place mitigation strategies in order to obtain the various downstream approvals and permits required before construction can begin. Items that need be resolved prior to the first construction vehicle is in movement may include, but is not limited to the following:*
    - *Identify 'pinch points' on road infrastructure and operations along the proposed haulage route impacted by the movement of OSOM vehicles for example at intersections, lane closures, road widening, structures and railway crossings.*
    - *Develop strategies to specifically manage the 'pinch points' impacted on the haulage route.*
    - *Construction movement schedules for example, commencement of haulage, expected duration of each haulage, total duration of all construction movement activities.*
    - *Traffic Management Plan.*
    - *Road Use Management Plan.*
    - *Road Safety Audit.*
    - *Communication Plan.*
    - *Alternative Haulage Routes (if required).*
    - *Additional permits or approvals for example, Queensland Police Services.*

    DTMR will work with proponents, post decision to ensure that all additional information necessary is provided and the required downstream approvals and permits are obtained to ensure construction can proceed smoothly.

    However, these processes take time and often require the submission of very detailed information. It is recommended that contact be made with DTMR and/or local governments as soon as possible post decision, but at least 12 months before construction is scheduled to commence.

    For more information please contact the Heavy Vehicle Access team via LDAccess_HVROPO@tmr.qld.gov.au

This TIA has been prepared in response to a number of the items identified above and aims to provide additional information and clarification to the traffic assessment undertaken, in particular regarding the expected traffic and pavement impact of the proposed wind farm development on the state and local government controlled road networks.

Further information regarding the turbine component transport movements and routes for the Project is provided in the Preliminary Transport Route Assessment report, which should be read in conjunction with this TIA report.

In addition, while identified above, the preparation of traffic management and road use management plans are proposed to be undertaken as part of the subsequent detailed design phases of the Project when more accurate information regarding the proposed wind farm is available. It is noted that this approach is consistent with other wind farm Projects previously assessed and approved under State Code 23.

1.4 Data Sources

The following sources of data have been used for the purpose of this assessment:

- TMR AADT Road Segment Data for identified sections of the state-controlled road network.
- TMR Site Weekly Volume Report data for Site 60055 – 41E Burnett Highway (Biloela-Mount Morgan), included for reference in **Appendix B**.
- TMR Intersection Count for Bruce Highway / South Ulam Road (2016), included for reference in **Appendix C**.
- Queensland Globe (https://qldglobe.information.qld.gov.au) - crash data in vicinity of the site.

1.5 Limitations

Whilst the assessment undertaken is deemed appropriate to assess the anticipated traffic impacts of the proposed Mount Hopeful Wind Farm on the surrounding road network, the following limitations should be noted:

- No assessment has been undertaken to determine the acceptability of the use of the existing culvert and bridge infrastructure along the identified turbine component transport route from a structure load limits / restrictions perspective. This is due to the fact that the vehicle and load configurations for the turbine component transport operations adopted in this assessment are indicative only, with the exact vehicle and load configurations to be confirmed by a suitable transport contractor. It is therefore expected that the assessment of these structure will be completed by this transport contractor as part of the updated route assessment / traffic management plan / road use management plan undertaken as part of subsequent stages of the Project.
- The assessment of the traffic impact of the proposed Project does not consider the works anticipated to be required as part of the route preparation works for the turbine component transport operation, as identified in the associated Preliminary Transport Route Assessment completed for the Project (dated November 2020). It is expected that these works will form part of additional road corridor works permit for the Project.

2.0 Existing Conditions

2.1 Land Use and Zoning

Currently the land contained within the identified Project area is generally used for agricultural purposes, mainly grazing. The land is identified as a "rural" under the zoning mapping contained within the current Rockhampton Regional Council (RRC) and Banana Shire Council (BSC) planning schemes, as shown in **Figure 2** and **Figure 3**.

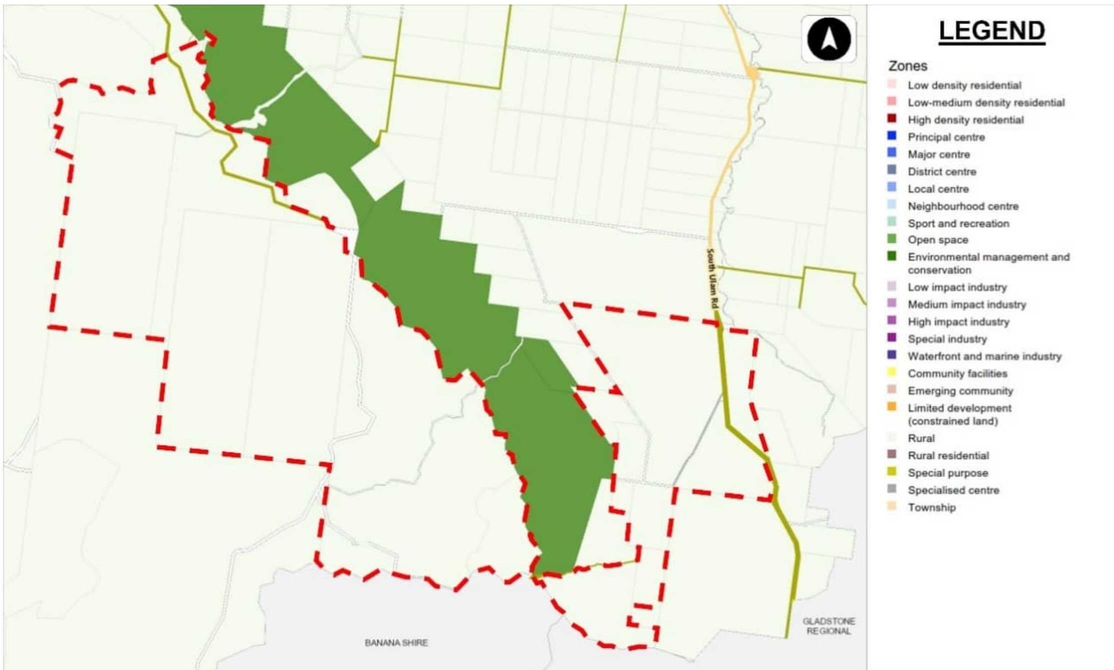


Figure 2 Land Use Zoning [Source: RRC Planning Scheme Zone Mapping]

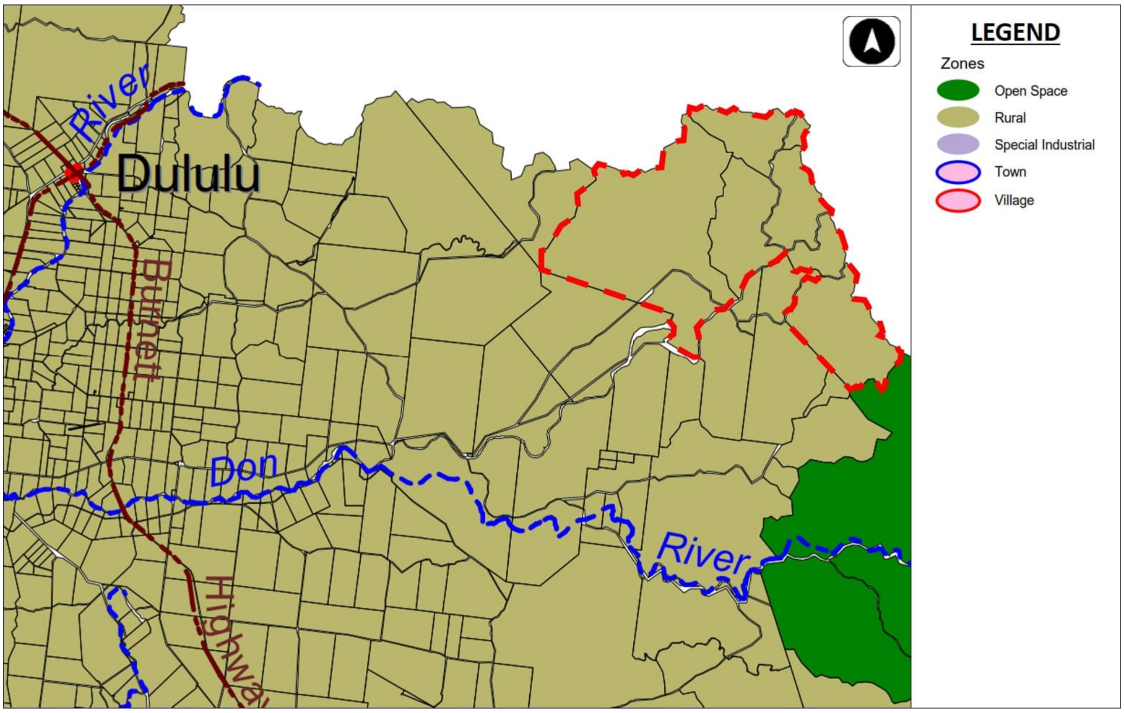


Figure 3 Land Use Zoning [Source: BSC Planning Scheme Zone Mapping]

2.2 Adjacent Land Use / Approvals

As shown in **Figure 2** and **Figure 3** above, all of the adjacent land parcels to the Project site are currently zoned rural land under either the Rockhampton Regional Council or Banana Shire Council planning schemes.

Further to this, no active or planned development approvals which could influence this TIA are understood to be currently held over the adjacent properties.

2.3 Surrounding Road Network Details

2.3.1 Project Transport Routes

The following updated information regarding the expected construction and operations activities associated with the Project was provided by Neoen.

2.3.1.1 Project Construction Phase

- The main workforce during construction will consist of local workers (commuting generally from Biloela), and specialist FIFO workers, for whom accommodation will also be provided in Biloela and will commute daily to/from the Project site. An option to provide an on-site workers accommodation camp for the Project is also currently being considered by Neoen, with the provision of such camp facilities expected to significantly reduce daily staff commute volumes between Biloela and the subject site.
- The construction workforce for the construction on the eastern substation and battery storage facility (via South Ulam Road) will consist of local workers (commuting generally from Rockhampton), and specialist FIFO workers, who will also commute daily to/from the eastern site from Rockhampton.
- Construction equipment (bulk earthworks plant, prefabricated buildings) and materials (such as cement, concrete aggregates, reinforcing steels and road gravels) will primarily be sourced locally (as far as reasonably practical).
  - Equipment and materials for the main Project site (via McDonalds Road / Playfields Road) will be sourced from either Gladstone or Biloela, with gravel materials expected to be sourced from quarry sites near Westwood and site water sourced from Biloela.
  - Equipment and materials for the eastern substation and battery storage site (via South Ulam Road) will be sourced from Rockhampton (including concrete), with gravel materials expected to be sourced from the quarry operations in Midgee.
- Significant turbine components and specialist equipment will be imported from overseas and shipped to the Port of Gladstone, before being transported by road using both state controlled and local government controlled roads (Gladstone Regional Council (GRC) and Banana Shire Council) to the wind farm site.
- A preliminary transport route assessment from these port facilities has been undertaken, with the following routes for the transport of wind farm components from the Port of Gladstone identified.

A summary of the preliminary OSOM turbine component transport routes is provided in **Table 2**, with the proposed Project transport routes indicatively shown in **Figure 4**.

It is noted that further assessment works are currently being undertaken in regard to the potential OSOM transport routes for the Project based on potential alternative turbine component dimensions, with any amendments to the currently proposed OSOM transport routes expected to be further assessed as part of subsequent operational works approvals for the Project.

Table 2 Preliminary Turbine Component Transport Routes

From Port of Gladstone			
Blades	Drive Trains / Hubs	Tower Sections 5-7 & Nacelles	Tower Sections 1-4
Macfarlane Drive (GRC) Hopper Road (GRC) Gladstone Port Access Rd Gladstone-Mt Larcom Rd Bruce Highway Dawson Highway Burnett Highway McDonalds Road (BSC) Playfields Road (BSC)	Macfarlane Drive (GRC) Hopper Road (GRC) Gladstone Port Access Rd Gladstone-Mt Larcom Rd Red Rover Road (GRC) Don Young Drive (GRC) Dawson Highway Burnett Highway McDonalds Road (BSC) Playfields Road (BSC)	Macfarlane Drive (GRC) Flinders Parade (GRC) Lord Street (GRC) Gladstone-Mt Larcom Rd Red Rover Road (GRC) Don Young Drive (GRC) Dawson Highway Burnett Highway McDonalds Road (BSC) Playfields Road (BSC)	Macfarlane Drive (GRC) Flinders Parade (GRC) Lord Street (GRC) Gladstone-Mt Larcom Rd Red Rover Road (GRC) Don Young Drive (GRC) Dawson Highway Bruce Highway Mt Alma Road (GRC) Calliope Station Road (GRC) Dawson Highway Callide Mine Haul Rd Access (BSC) Argoon-Kilburnie Road (BSC) Jambin-Dakenba Road (BSC) Burnett Highway McDonalds Road (BSC) Playfields Road (BSC)

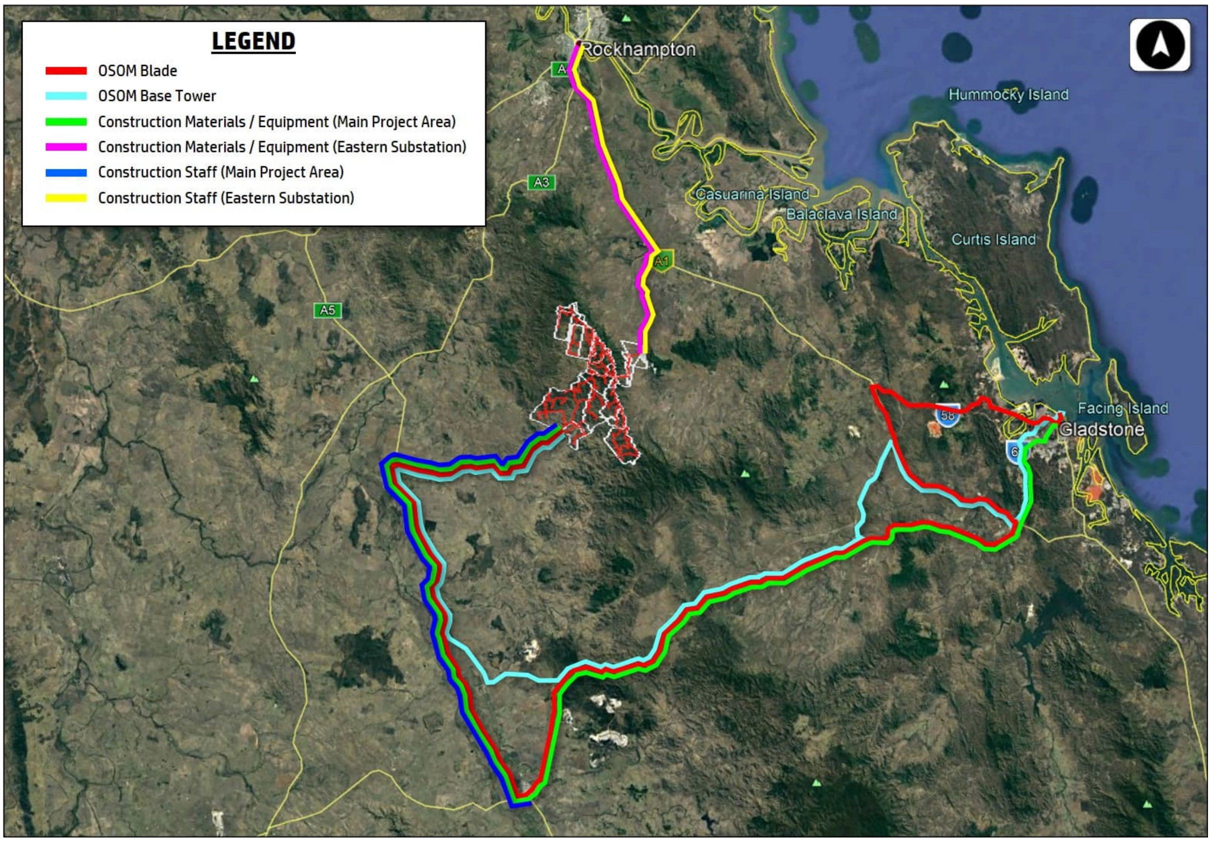


Figure 4 Project Transport Routes [Source: Qld Globe]

2.3.1.2 Project Operations Phase

- The workforce during operation will consist of a small number of local workers (i.e. approximately 10 staff) who are expected to reside locally to the Project site (likely in Biloela).
- Heavy vehicle movements during the operations stage of the Project are anticipated to be extremely low, with only occasional movements to/from site (in the order of 1 vehicle per week from Biloela) associated with maintenance activities, routine removal of waste and delivery of consumables to the site operations facility.

2.3.2 State Controlled Road Links

2.3.2.1 Gladstone Port Access Road (183)

The Gladstone Port Access Road is an approved B-double route approximately 850m in length and provides a connection from the Port of Gladstone to the external state-controlled road network via Hanson Road (Gladstone-Mount Larcom Road). The road currently operates as a two-way, two-lane carriageway with a posted speed limit of 60km/h.

2.3.2.2 Gladstone-Mount Larcom Road (181)

The full length of Gladstone – Mount Larcom Road is expected to be relevant to the Project, with the section between the intersection with Gladstone Port Access Road in Gladstone and the Bruce Highway at Mt Larcom proposed to form part of the transport route for the turbine blades, while the remaining turbine components will utilise the section of the link between Lord Street and Red Rover Road. In addition, the initial section of the link between the Dawson Highway and the Gladstone Port Access Road is expected to be utilised by the return turbine transport vehicle movements to the port.

Gladstone – Mount Larcom Road is an approved B-Double route that contains both urban and rural road conditions, with the urban section within Gladstone operating as a two-way, four lane, median divided carriageway with a posted speed limit of 60km/h before transitioning to a higher speed (100 km/h) rural connection with a standard two-way, two-lane configuration.

2.3.2.3 Dawson Highway (46A – Gladstone-Biloela)

The Dawson Highway is proposed to be utilised as part of a diversion for the turbine component transport operations as well as a transport route from equipment and materials for the Project sourced from Gladstone. As such the full length of the link is expected to be relevant to the Project. In general, the Dawson Highway is a two-way, two-lane rural highway approved for B-Double use, with a posted speed limit of 100 km/h, however lower speed (60 km/h) sections are also provided in built up areas through townships.

2.3.2.4 Dawson Highway (46B – Biloela-Banana)

The relevant section of the 46B section of the Dawson Highway is the short length (1.366m) between the intersections with the northbound and southbound sections of the Burnett Highway in Biloela. This section of the link is anticipated to be utilised as part of the turbine blade transport route, as well as the route for construction materials and equipment to the main Project site. In general, this section of the Dawson Highway is configured as a two-way, four lane median divided carriageway approved for B-Double use, with a posted speed limit of 60 km/h.

2.3.2.5 Bruce Highway (10E – Benaraby-Rockhampton)

Two sections of the Bruce Highway (10E) are expected to be relevant to the Project, namely the section between the intersections with the Dawson Highway (Ch. 11.445km) and Gladstone-Mount Larcom (Ch. 45.420km) which is proposed to be utilised by turbine component transport vehicles, and the section between South Ulam Road (Ch. 86.183km) and the end of the link in Rockhampton, which will be utilised by construction traffic associated with the eastern substation area of the Project site. In general, this section of the Highway is a two-way, two-lane road approved for B-Double use, with a posted speed limit of 100 km/h, except within built-up areas through townships where the posted speed typically decreases to 60km/h.

2.3.2.6 Burnett Highway (41E – Biloela-Mt Morgan)

The section of the Burnett Highway (41E) expected to be relevant to the Project is the 71.730km length stretching from the Dawson Highway in Biloela, to the intersection with the Leichhardt Highway in Dululu. The section of the link south of McDonalds Road (Ch. 56.310km) is proposed to be utilised for Highway at Mt Larcom proposed to form part of the turbine component transport route, as well as be utilised for the transport of construction materials and equipment. While the section of the link north of McDonalds Road to Dululu is proposed to be used as part of the transport route for road gravel and aggregate materials from the quarry to the main Project area. The relevant section of the Burnett Highway currently provides a two-way, two-lane rural highway road carriageway approved for B-doubles, with a posted speed limit of 100 km/h.

2.3.2.7 Leichhardt Highway (26A – Westwood-Taroom)

The Leichhardt Highway is a key north-south inland route and provides a connection between Westwood (to the west of Rockhampton) to Miles in the south. The initial 25.680km of the link between the Capricorn Highway and the Burnett Highway at Dululu is anticipated to be relevant to the Project and is proposed to be used as part of the transport route for road gravel and aggregate materials from the quarry operation to the main Project area. The Leichhardt Highway currently provides a two-way, two-lane road carriageway approved for Type 1 road trains, with a posted speed limit of 100 km/h.

2.3.3 Local Government Controlled Road Links

2.3.3.1 Macfarlane Drive (GRC)

An approved B-double route, Macfarlane Drive is a local road controlled by Gladstone Regional Council that provides connectivity and access to the adjacent port facilities. The length of the link relevant to the Project is the 1.210 km section between the intersections of Hopper Road and Flinders Parade, which is expected to be utilised as part of the route for the turbine component transport operations. Currently the configuration of the road is a two-way two-lane sealed carriageway with sections allowing for kerbside parking, while the available sealed width of the link varies between 11-16m.

2.3.3.2 Flinders Parade (GRC)

The relevant section of Flinders Parade is the 670m section between Macfarlane Drive and Lord Street, which is controlled by Gladstone Regional Council. This section of the link is expected to be utilised as part of the transport route for the turbine tower section and nacelle component transport operations. The initial 350m of the link is generally restricted to vehicles (with removable bollards) and travels through the adjacent parklands, providing a 7.5m wide sealed carriageway, while the southern portion of the link provides a two-way, two-lane carriageway with a sealed width of approximately 11m, with the whole link identified as an approved B-Double route.

2.3.3.3 Lord Street (GRC)

Lord Street is a local road controlled by Gladstone Regional Council. The length of the link relevant to the Project is the 515m section between the Flinders Parade and Hanson Road (Gladstone-Mt Larcom Road), which is proposed to be utilised as part of the transport route for the turbine tower section and nacelle components. The link is an approved B-double route), with the current configuration providing a two-way two-lane sealed carriageway with a typical width of 13m.

2.3.3.4 Red Rover Road (GRC)

Red Rover Road is an industrial collector style road controlled by Gladstone Regional Council. The length of the link relevant to the Project is the full 3.390 km length between the Gladstone-Mount Larcom Road and Don Young Drive, which is proposed to be utilised as part of the diversion of the transport route for the over mass and oversize (height) turbine components. The link is an approved B-double route with the current configuration providing a two-way two-lane sealed carriageway with a typical width of 11m.

2.3.3.5 Don Young Drive (GRC)

Similarly, Don Young Drive is also an industrial collector style road controlled by Gladstone Regional Council, which in conjunction with Red Rover Road provides a connection between Gladstone-Mount Larcom Road and the Dawson Highway. The full length of the link is considered relevant to the Project and is proposed to be utilised as part of the diversion of the transport route for the over mass and oversize (height) turbine components. The link is also an approved B-double route, and currently provides an 11m wide two-way two-lane sealed carriageway.

2.3.3.6 South Ulam Road (RRC)

South Ulam Road is identified as a minor rural collector road which is controlled by the Rockhampton Regional Council. The section of this road relevant to the Project is the 16.773km section from the Bruce Highway to the proposed secondary site access, which is expected to be utilised by Project traffic (staff and material/equipment delivery heavy vehicles) associated with the construction phase of the eastern substation area. The link is also an approved B-double route, and currently provides a 6.5m wide two-way two-lane sealed carriageway.

2.3.3.7 Mount Alma Road (GRC)

Mount Alma Road is a rural access road controlled by Gladstone Regional Council, which in conjunction with Calliope River Road provides a connection between the Bruce Highway (10E) and the Dawson Highway (46A). The full length of the link is considered relevant to the Project and is proposed to be utilised as part of the diversion of the transport route for the oversize tower turbine components (Sections 1-4 of 7).

Currently the link provides a two-way two-lane unsealed carriageway, with a general road width of 5-5.5m (refer to **Figure 5** and **Figure 6** below), noting that narrower road widths do occur at a number of cattle grids and floodways along the length of Mount Alma Road.

Figure 5 Northern End of Mount Alma Road

Figure 6 Southern End of Mount Alma Road

2.3.3.8 Calliope Station Road (GRC)

Calliope Station Road is also a rural access road under the control of Gladstone Regional Council. As noted above the link forms part of an informal connection between the Bruce Highway and the Dawson Highway, with the section between Mount Alma Road and the Dawson Highway considered relevant to the Project as it is proposed to be utilised for the oversize tower turbine components transport movements (Sections 1-4 of 7).

Currently the road operates as a two-way, two lane unsealed rural road with a general width of 6m (refer **Figure 7** and **Figure 8**). Again, a number of cattle grid structures (3) and a culvert/floodway structure is located along the relevant section of the link, with the available road width noted to narrow to approximately 4m (and one lane operation) at these locations.

Figure 7 Western End of Calliope Station Road

Figure 8 Eastern End of Calliope Station Road

2.3.3.9 Callide Mine Haul Road Access (BSC)

The Callide Mine Haul Road Access is a gated access road which acts as a bypass route around the Callide Mine Road overpass over the Dawson Highway. Located primarily within a BSCroad reserve, the road is access restricted and controlled by the operator of the Callide Mine. The full length of the access road between the Dawson Highway and Argoon-Kilburnie Road is proposed to be utilised by the oversize tower turbine components transport movements (Sections 1-4 of 7), with the current alignment of the link shown in **Figure 9** below.

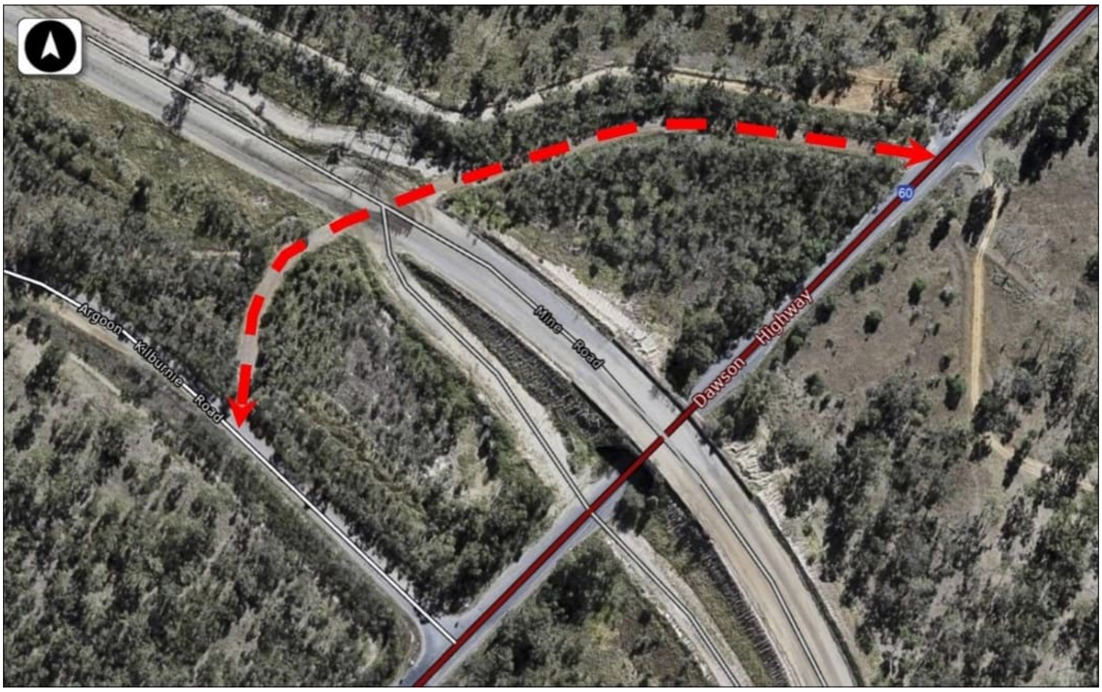


Figure 9 Callide Mine Haul Road Bypass Alignment [Source: Qld Globe]

The access road is currently provided at a width of 6m, with the road surface generally unsealed, with signs of previous seal and deterioration observed, as shown in **Figure 10** and **Figure 11**.

Figure 10 Eastern End of Callide Mine Haul Road Access

Figure 11 Western End of Callide Mine Haul Road Access

2.3.3.10 Argoon-Kilburnie Road (BSC)

Argoon-Kilburnie Road is a rural collector road under the control of Banana Shire Council, which provides a lower order connection between the Dawson Highway and the Burnett Highway. The section of the link deemed relevant to the Project is the 12.940km length between the Callide Mine Haul Road Access and Jambin-Dakenba Road, which is proposed to be utilised as a bypass (around Biloela) transport route for the over height base tower section turbine components of the project. The road is identified as an approved B-Double route, and currently the operates as a two-way, two lane sealed rural road with a general width of 6m (refer **Figure 12** and **Figure 13**).

Figure 12 Eastern End of Argoon-Kilburnie Road

Figure 13 Western End of Argoon-Kilburnie Road

2.3.3.1 Jambin-Dakenba Road (BSC)

Similarly, Jambin-Dakenba Road is also a rural collector style road under the control of Banana Shire Council. The section of the link relevant to the Project is the 9.400km length between the Argoon-Kilburnie Road in the south and the Burnett Highway at Jambin to the north, which is proposed to be utilised as part of the bypass (around Biloela) transport route for the over height base tower section turbine components of the project. Currently, Jambin-Dakenba Road is identified as an approved B-Double route, which operates as a two-way, two lane sealed rural road with a general width of 6.5-7m (refer **Figure 14** and **Figure 15**).


Figure 14 Southern End of Jambin-Dakenba Road


Figure 15 Northern End of Jambin-Dakenba Road

2.3.3.1 McDonalds Road (BSC)

McDonalds Road is a rural access road under the control of Banana Shire Council, which connects the Burnett Highway to both Playfields Road to the east and Dixalea Dooreen Road to the north. The full length of the link is anticipated to be utilised by both the turbine component transport vehicles and the Project traffic for both construction and operations phase of the proposed wind farm development.

Currently the road operates as a two-way, two lane unsealed rural road with a general width of 5-5.5m (refer **Figure 16** and **Figure 17**). Finally, from site observations it was noted that the road was displaying signs of deterioration, with limited gravel pavement material currently provided on the road.


Figure 16 Western End of McDonalds Road


Figure 17 Eastern End of McDonalds Road

2.3.3.1 Playfields Road (BSC)

Playfields Road is also a rural access road under the control of Banana Shire Council, with the Project traffic (including both the turbine component transport vehicles and the construction and operations phase vehicles) proposed to utilise the 24.420km section to the east of McDonalds Road to gain access to the main Project area site.

Currently the road provides two distinct carriageway configurations, with the initial 5km section operating as a two-way, two lane sealed rural road with a general width of 6m (refer **Figure 18**), with the remaining length of the link providing a two-way, two-lane unsealed (gravel) road whose width varies from 5-6m (refer **Figure 19**). A number of cattle grid and floodway structures are located along the relevant length of Playfields Road, with the available road width noted to narrow (various widths down to 4m), restricting use of the link to one lane operation at these locations. As with McDonalds Road, site observations identified that the relevant section of Playfield Road was displaying signs of deterioration, with only limited gravel pavement material provided at various sections of the link.

Figure 18 Western Sealed Section of Playfields Road

Figure 19 Eastern Unsealed Section of Playfields Road

2.3.4 Intersections

In terms of the traffic impact assessment for the proposed Mount Hopeful Wind Farm, the critical intersections on the external road network were identified to be the access intersections from the state-controlled road networks to both the main site area, via the intersection of the Burnett Highway / McDonalds Road, and the access to the eastern substation and battery storage area, via the Bruce Highway / South Ulam Road intersection. Further details of the current configuration of these intersections are provided below.

All other intersections on the external road network were noted to primarily only be utilised by turbine component transport vehicles. The movements of these Project vehicles are only temporary and as they are expected to travel out of hours and under full escort, they are not anticipated to have a significant impact on the operation of intersections. As such no further assessment of these intersections was deemed warranted.

2.3.4.1 Burnett Highway / McDonalds Road

The current configuration of the Burnett Highway / McDonalds Road intersection is a standard three-way priority controlled (give way) rural intersection, noting offset to lower order Dingles Road to the west. A single approach and departure lane is provided on each approach to the intersection, with no designated turn treatments currently provided on either of the major road Burnett Highway approaches for turning movements in to McDonalds Road as shown in **Figure 20**. Suitable site distances from McDonalds Road are expected to be available to the south along the Burnett Highway (refer **Figure 21**), but the sight distances to the north were observed to be restricted due to vegetation in the verge and the existing horizontal geometry (curve) on the northern approach to the intersection (refer **Figure 22**).

Figure 20 Burnett Highway / McDonalds Road - Existing Configuration [Source: Qld Globe]

Figure 21 North on Burnett H'way from McDonalds Rd

Figure 22 South on Burnett H'way from McDonalds Rd

2.3.4.2 Bruce Highway / South Ulam Road

The current configuration of the Bruce Highway / South Ulam Road intersection is a standard three-way priority controlled (give way) rural intersection.

A single approach and departure lane is provided on each approach to the intersection, with a full length channelised right turn (CHR) and short auxiliary left turn (AULs) treatments provided on the northern and southern Bruce Highway approach respectively for the turning movements into South Ulam Road, as shown in **Figure 23**. In addition, based on site observations it is noted that suitable site distances are available to/from South Ulam Road in both directions of travel along the Bruce Highway (refer **Figure 24** and **Figure 25**).

Figure 23 Bruce Highway / South Ulam Road - Existing Configuration [Source: Qld Globe]

Figure 24 North on Bruce Highway from South Ulam Rd

Figure 25 South on Bruce Highway from South Ulam Rd

2.4 Traffic Volumes

2.4.1 Road Link Volumes

The existing background traffic volumes on the road sections deemed relevant to the Project were typically established using the available AADT segment traffic count data provided by TMR. These road segment volumes were utilised with the identified 10-year growth rates (average growth rate, compounding annually) for the relevant road sections to establish a forecast of the current (2023) traffic volumes. It is noted that for any segments where a historical 10-year growth rate was negative, a conservative growth rate of 1.0% was applied to estimate the volume forecasts.

No traffic count data was available for the relevant sections of the GRC controlled links of Macfarlane Drive, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive Mount Alma Road and the BSC controlled sections of Callide Mine Haul Road Access, Argoon-Kilburnie Road and Jambin-Dakenba Road. However, as the use of these roads by Project traffic is limited to the oversize over mass (OSOM) turbine transport vehicles which will be travelling under permit and full escort, the current traffic volumes on the links are not deemed critical for the assessment as the traffic impact is considered minor (due to traffic management controls) and as such these roads have been disregarded in the assessment.

No recent traffic count data was available for the BSC controlled sections of McDonalds Road and Playfields Road. Therefore, an estimate of the expected daily traffic volumes on these links was conservatively estimated to be 50 vpd (25 vpd each direction) for both of these links, with the traffic volumes expected to include approximately 10% heavy vehicles. The same conservative growth rate of 1% was also applied to the estimated volumes on McDonalds Road and Playfields Road to enable future traffic volume forecasts to be developed.

Further to this, as no daily volume traffic count data was available for RRC controlled link of South Ulam Road, an estimate of the daily traffic volumes on this link was established from the total recorded 12-hour inbound and outbound traffic volumes on the approach as identified in the intersection count provided by TMR (refer Appendix C), noting that recorded volumes have been adjusted to account for the recent reconfiguration of the intersection, with relevant growth rates applied to the recorded volumes (2016) to forecast current (2023) volumes.

The daily directional volumes on the approach were then estimated by applying a 12-hour volume to daily (ADT) traffic volume adjustment factor of 1.3 for low volume roads, as specified in Section 5.2.1 of Austroads *Guide to Pavement Technology: Selection and Design of Sprayed Seals*, with a conservative heavy vehicle percentage of 10% adopted for the link.

Based on the volume data and assumptions identified above, estimates of the traffic volumes on the relevant roads forming the Project transport routes were established, as summarised in Table 3.

Table 3 Current (2023) AADT Traffic Volumes

Site ID	Road Segment		Base Data Year	Base Year AADT				10 Yr. GR %	Current AADT (2023)			
	Start (km)	End (km)		Gaz	% HV	A-Gaz	% HV		Gaz		A-Gaz	
									Total	HV	Total	HV
Gladstone Port Access Road (183)												
61605	0.000	0.858	2018	778	33.29%	743	31.76%	1.00%	818	272	781	248
Macfarlane Road												
GRC	0.000	0.350	-	No Information Available								
GRC	0.350	1.210	-	No Information Available								
Hopper Road (John Bates Drive)												
GRC	0.000	0.790	-	No Information Available								
Flinders Parade												
GRC	0.000	0.680	-	No Information Available								
Lord Street												
GRC	0.000	0.520	-	No Information Available								
Gladstone-Mount Larcom Road (181)												
60071	0.000	*0.175*	2019	3,563	18.52%	3,085	15.24%	1.00%	3,708	687	3,210	489
	0.175	*0.919*	2019	3,563	18.52%	3,085	15.24%	1.00%	3,708	687	3,210	489
	0.919	1.409	2019	3,563	18.52%	3,085	15.24%	1.00%	3,708	687	3,210	489
60073	1.409	3.258	2018	3,025	16.07%	3,150	16.16%	1.00%	3,179	511	3,311	535
61052	3.258	*3.830*	2018	4,706	11.52%	4,542	14.11%	1.00%	4,946	570	4,774	674
	3.830	4.625	2018	4,706	11.52%	4,542	14.11%	1.00%	4,946	570	4,774	674
60074	4.625	12.292	2018	3,206	13.54%	3,189	15.96%	1.00%	3,370	456	3,352	535
60076	12.292	32.140	2018	1,480	21.89%	1,482	30.23%	1.00%	1,555	340	1,558	471
Red Rover Road												
GRC	0.000	3.390	-	No Information Available								
Don Young Drive												
GRC	0.000	2.280	-	No Information Available								
Dawson Highway (46A Gladstone – Biloela)												
60061	0.000	1.498	2019	5,133	4.93%	5,653	6.62%	1.00%	5,341	263	5,883	389
61083	1.498	2.238	2019	8,579	4.93%	8,639	6.62%	1.00%	8,927	440	8,990	595
61000	2.238	3.130	2018	10,717	4.72%	11,655	6.12%	1.00%	11,264	532	12,250	750
60063	3.130	4.391	2019	12,828	7.25%	17,786	7.61%	1.00%	13,349	968	18,508	1,408
60064	4.391	5.179	2019	10,219	9.78%	9,871	9.09%	1.00%	10,634	1,040	10,272	934
60062	5.179	*7.129*	2018	3,076	7.64%	3,584	9.54%	1.00%	3,233	247	3,767	359
	7.129	10.296	2018	3,076	7.64%	3,584	9.54%	1.00%	3,233	247	3,767	359
60065	10.296	*19.050*	2019	3,282	7.64%	3,575	9.54%	1.00%	3,415	261	3,720	355
60066	*19.050*	21.650	2019	3,897	20.24%	3,814	119.20%	1.00%	4,055	821	3,969	4,731
60128	21.650	25.640	2018	1,102	20.24%	1,094	119.20%	1.00%	1,158	234	1,150	1,371
60005	25.640	*46.518*	2019	592	40.37%	594	28.28%	1.00%	616	249	618	175

Site ID	Road Segment Start (km)	Road Segment End (km)	Base Data Year	Base Year AADT Gaz	% HV	A-Gaz	% HV	10 Yr. GR %	Current AADT (2023) Gaz Total	Gaz HV	A-Gaz Total	A-Gaz HV
	46.518	*101.008*	2019	592	40.37%	594	28.28%	1.00%	616	249	618	175
60067	*101.008*	113.728	2019	599	20.70%	627	23.65%	1.53%	637	132	666	158
61084	113.728	116.836	2018	816	21.69%	1,152	13.11%	1.00%	858	186	1,211	159
61085	116.836	119.836	2019	3,059	12.26%	3,214	9.15%	1.00%	3,183	390	3,345	306
Mount Alma Road												
GRC	0.000	16.970	-	No Information Available								
Calliope Station Road												
GRC	0.000	2.600	-	No Information Available								
Bruce Highway (10E Benaraby – Rockhampton)												
60006	11.445	*35.812*	2018	2,483	26.38%	2,373	24.74%	2.20%	2,768	730	2,646	655
	35.812	*45.420*	2018	2,483	26.38%	2,373	24.74%	2.20%	2,768	730	2,646	655
60023	*45.420*	85.308	2018	2,841	21.68%	2,842	23.82%	1.00%	2,986	647	2,987	711
61551	85.308	*86.183*	2018	3,478	28.32%	3,524	26.14%	2.33%	3,903	1,105	3,954	1,034
	86.183	*107.400*	2018	3,478	28.32%	3,524	26.14%	2.33%	3,903	1,105	3,954	1,034
	107.400	108.938	2018	3,478	28.32%	3,524	26.14%	2.33%	3,903	1,105	3,954	1,034
60130	108.938	114.388	2018	3,062	24.95%	3,067	27.06%	1.67%	3,326	830	3,332	902
60024	114.388	116.961	2018	4,798	15.46%	4,412	21.01%	1.00%	5,043	780	4,637	974
South Ulam Road												
RRC	0.000	16.773	2021	101	10.00%	108	10.00%	1.00%	103	10	110	11
Dawson Highway (46B Biloela – Banana)												
60068	0.000	0.650	2019	2,681	7.16%	2,922	12.97%	1.00%	2,790	200	3,041	394
61883	0.650	1.366	2019	2,143	8.35%	2,083	16.03%	1.00%	2,230	186	2,168	347
Leichhardt Highway (26A Westwood – Taroom)												
60001	0.000	0.115	2019	370	32.70%	376	32.71%	1.00%	385	126	391	128
	0.115	25.680	2019	370	32.70%	376	32.71%	1.00%	385	126	391	128
Burnett Highway (41E Biloela – Mt Morgan)												
61081	0.000	*27.290*	2019	559	37.57%	594	23.91%	1.00%	582	219	618	148
	27.290	35.401	2019	559	37.57%	594	23.91%	1.00%	582	219	618	148
60055	35.401	*56.310*	2019	455	36.70%	479	39.67%	1.00%	473	174	498	198
	56.310	71.730	2019	455	36.70%	479	39.67%	1.00%	473	174	498	198
Callide Mine Haul Road Access												
BSC	0.000	0.400	-	No Information Available								
Argoon-Kilburnie Road												
BSC	0.000	12.940	-	No Information Available								
Jambin-Dakenba Road												
BSC	0.000	9.400	-	No Information Available								

Site ID	Road Segment		Base Data Year	Base Year AADT				10 Yr. GR %	Current AADT (2023)			
	Start (km)	End (km)		Gaz	% HV	A-Gaz	% HV		Gaz		A-Gaz	
									Total	HV	Total	HV
McDonalds Road												
BSC	0.000	0.400	2021	25	10.00%	25	10.00%	1.00%	26	3	26	3
Playfields Road												
BSC	0.000	5.080	2021	25	10.00%	25	10.00%	1.00%	26	3	26	3
BSC	5.080	7.680	2021	25	10.00%	25	10.00%	1.00%	26	3	26	3

Macfarlane Road chainage assumed to run west from Hopper Road | Hopper Road chainage assumed to run south from Macfarlane Road | Flinders Parade chainage assumed to run south from Macfarlane Road | Lord Street chainage assumed to run south-west from Flinders Parade | Red Rover Road chainage assumed to run south from Gladstone-Mount Larcom Road | Don Young Drive chainage assumed to run south from Red Rover Road | Mount Alma Road chainage assumed to run south from Bruce Highway | Calliope Station Road chainage assumed to run east from Mount Alma Road | South Ulam Road chainage assumed to run south-west from Bruce Highway | Callide Mine Haul Road Access chainage assumed to run east-west from Dawson Highway | Argoon-Kilburnie Road chainage assumed to run north from Dawson Highway | Jambin-Dakenba Road chainage assumed to run north from Argoon-Kilburnie Road | McDonalds Road chainage assumed to run east from Burnett Highway | Playfields Road chainage assumed to run east from McDonalds Road.

TMR Chainage 0.175km (181) – Intersection of Gladstone-Mount Larcom Road / Gladstone Port Access Road | TMR Chainage 0.919km (181) – Intersection of Gladstone-Mount Larcom Road / Lord Street | TMR Chainage 3.830km (181) – Intersection of Gladstone-Mount Larcom Road / Red Rover Road | TMR Chainage 7.129km (46A) – Intersection of Dawson Highway / Don Young Drive | TMR Chainage 19.050km (46A) – Intersection of Dawson Highway / Bruce Highway | TMR Chainage 46.518km (46A) – Intersection of Dawson Highway / Calliope Station Road | TMR Chainage 101.008km (46A) – Intersection of Dawson Highway / Callide Mine Haul Road Access | TMR Chainage 35.812km (10E) – Intersection of Bruce Highway / Mount Alma Road | TMR Chainage 45.420km (10E) – Intersection of Bruce Highway / Gladstone-Mount Larcom Road | TMR Chainage 86.183km (10E) – Intersection of Bruce Highway / South Ulam Road | TMR Chainage 107.400km (10E) – Intersection of Bruce Highway / Hopkins Brothers Quarry Access | TMR Chainage 27.290km (41E) – Intersection of Burnett Highway / Jambin-Dakenba Road | TMR Chainage 56.310km (41E) – Intersection of Burnett Highway / McDonalds Road | TMR Chainage 0.155km (26A) – Intersection of Leichhardt Highway / Quarry Access.

2.4.2 Intersection Volumes

2.4.2.1 Burnett Highway / McDonalds Road

No existing intersection count data was available at the key intersections of Burnett Highway / McDonalds Road. Therefore, an estimate of the peak hour turning movement volumes at the intersection have been determined using the following information methodology:

- 2019 Weekly volume reports for the Burnett Highway 41E AADT Site 60055 (included as **Appendix B**), to determine the northbound and southbound through volumes on the highway during the AM and PM peak hours. Values for the AM and PM peaks for the “average weekday” volumes have been adopted for the purpose of this assessment; and
- Heavy vehicle percentages from the 2018 AADT segment traffic count data (18D – Site 40320) provided by TMR.

Based on the available information the following assumptions of current volumes have been adopted for this intersection:

- The peak hour turning movement volumes to/from McDonalds Road have been estimated through the application of the following assumptions:
  - Peak hour movements on McDonalds Road are 15% of daily volumes (estimated at 50vpd).
  - 50% of McDonalds Road movements are to/from the north, and 50% are to/from the south.
  - A 30% in / 70% out split for movements in AM peak hour on McDonalds Road.
  - A 70% in / 30% out split for movements in PM peak hour on McDonalds Road.

Future year traffic volumes for this intersection have been determined through the application of the growth rates for each of the relevant road segments as outlined in **Table 3**, with the design horizon for the assessment identified to be 2024, which is expected to be the period of peak construction traffic volumes at the intersection. The resultant estimate of the current (2023) and forecast (2024) peak hour turning movement volumes at the Burnett Highway / McDonalds Road intersection are summarised in **Table 4** below, with further details of the calculations used to establish these intersection volumes provided in **Appendix D**.

Table 4 Peak Hour Turning Movement Volumes, Burnett Highway / McDonalds Road Intersection

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	Burnett Highway S				McDonalds Road E				Burnett Highway N			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak												
2023	32	18	1	0	3	0	3	0	1	0	30	20
2024	32	19	1	0	3	0	3	0	1	0	30	20
PM Peak												
2023	32	18	3	0	1	0	1	0	3	0	24	16
2024	32	19	3	0	1	0	1	0	3	0	25	16

2.4.2.2 Bruce Highway / South Ulam Road

An estimate of the current (2023) traffic volumes at the Bruce Highway / South Ulam Road intersection has been established based on the 2016 TMR count for the intersection. It is noted that the configuration of the intersection has recently been modified as part of the relocation of the intersection, and as such the recorded volumes from the count have been adjusted to align with the new configuration, with growth rates for the relevant approach roads adopted from **Table 3** to forecast the current (2023) and expected peak construction period (2024) traffic volumes.

Further details of the calculations to establish the traffic volumes at the Bruce Highway / South Ulam Road intersection are provided in **Appendix D**, with a summary of the forecast intersection volumes shown in **Table 5**.

Table 5 Peak Hour Turning Movement Volumes, Bruce Highway / South Ulam Road Intersection

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	Bruce Highway N				South Ulam Road W				Bruce Highway S			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak												
2023	191	68	3	0	3	0	6	1	4	0	131	52
2024	195	69	3	0	3	0	6	1	4	0	134	53
PM Peak												
2023	191	68	3	0	3	0	6	1	4	0	131	52
2024	195	69	3	0	3	0	6	1	4	0	134	53

2.5 Intersection and Network Performance

2.5.1 Road Links

Based on the background traffic volumes forecast and the existing configurations of the road links identified to be relevant to the Project, it is expected that all sections of the proposed Project transport routes would currently be operating satisfactorily and within capacity (based on road type / classification) under existing traffic conditions.

2.5.2 Intersections

An assessment of the current operational performance of the existing configuration of the key Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections has been undertaken, based upon the forecast current (2023) background AM peak and PM peak periods identified in **Table 4** and **Table 5** above.

The results of these analyses are summarised in **Table 6** below, with the detailed results provided for reference in **Appendix E and Appendix F**. These results revealed that the current configurations of both intersections are expected to be operate satisfactorily for the forecast current (2023) background or pre project traffic conditions. This is shown by the calculated values of Degree of Saturation (DOS), Level of Service (LOS), average delay and vehicle queue lengths for both intersections being well within acceptable limits of operation for a priority-controlled intersection for all analysis scenarios.

Table 6 SIDRA Results – Existing Intersection Operation

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Burnett Highway (41E) / McDonalds Road				
2023 AM Peak Existing	0.034	LOS A	0.4	0.1
2023 PM Peak Existing	0.035	LOS A	0.5	0.2
Bruce Highway (10E) / South Ulam Road				
2023 AM Peak Background	0.162	LOS B	0.3	0.5
2023 PM Peak Background	0.151	LOS B	0.6	0.9

** LOS value identified is for worst movement at the intersection, not the overall intersection.

2.6 Road Safety Issues

2.6.1 Existing Site Conditions

A site investigation of the existing traffic conditions on the relevant sections of the road network was undertaken by Andrew Barrie (RPEQ / Senior Road Safety Auditor). As part of this inspection a number of minor road safety considerations regarding the current operation of the existing road network and its potential use by Project traffic were identified, including:

1) Reduced carriageway width of McDonalds Road and Playfields Road

As previously identified, the unsealed sections of the BSC controlled McDonalds Road (Ch. 0.000 - 5.720 km) and Playfields Road (Ch. 5.080 – 24.420km) currently provide road widths of 5.0-5.5m and 5-6m respectively, noting that widths less than 6m have the potential to lead to increased conflict between vehicles travelling in opposing directions.

It is noted however, that the adjacent road shoulders are currently being utilised to allow two opposing vehicles to pass each other, and as the existing background traffic volumes on the relevant sections of McDonalds Road and Playfields Road are low (approximately 50 vpd), the likelihood of vehicles passing on the link is also anticipated to be relatively low.

2) One Way Operation of Floodways and Cattle Grids on McDonalds Road and Playfields Road

A number of floodway/culvert and cattle grid structures were identified on the relevant sections of McDonalds Road and Playfields Road at which the available trafficable width is reduced (to as low as 4m) across the structures. Based on the reduction of width, the structures are only providing sufficient width to cater for two-way, one lane traffic flow across the structure.

Further to this, limited control measures (i.e. Give Way signage) or vehicle storage areas were noted to be currently provided at and on the approaches to the structures to manage the vehicle movements across the one lane structure. The lack of trafficable width and lack of traffic control measures has the potential for increased conflict between vehicles travelling in opposing directions, in particular due the restricted visibility at a number of the structures due to the existing horizontal and vertical geometry of both roads.

It is noted however that the existing background traffic volumes on the relevant sections of McDonalds Road and Playfields Road are relatively low (approx. 50 vpd), therefore it is considered unlikely that vehicles would be required to pass on the floodways / or cattle grids.

3) Reduced carriageway width of Mount Alma Road

As previously identified, the unsealed sections of the GRC controlled Mount Alma Road (Ch. 0.000 – 16.970 km) currently provides a road width of 5.0-5.5m, noting that widths less than 6m have the potential to lead to increased conflict between vehicles travelling in opposing directions.

Notwithstanding this, it is noted however that the adjacent road shoulders are currently being utilised to allow two opposing vehicles to pass each other, and as the existing traffic volumes on the relevant sections of Mount Alma Road are anticipated to be low (approximately 50 vpd), the likelihood of vehicles passing on the link is also anticipated to be relatively low.

4) One Way Operation of Floodways and Cattle Grids on Mount Alma Road and Calliope Station Road

A number of floodway/culvert and cattle grid structures were also identified on the relevant sections of Mount Alma Road and Calliope Station Road, at which the available trafficable width is reduced (to as low as 4m) across the structures. Based on the reduction of width, the structures are only providing sufficient width to cater for two-way, one lane traffic flow across the structure.

Further to this, limited control measures (i.e. Give Way signage) or vehicle storage areas were noted to be currently provided at and on the approaches to the structures to manage the vehicle movements across the one lane structure. The lack of trafficable width and lack of traffic control measures has the potential for increased conflict between vehicles travelling in opposing directions, in particular due the restricted visibility at a number of the structures due to the existing horizontal and vertical geometry of both roads.

It is noted however that the existing background traffic volumes on the relevant sections of Mount Alma Road and Calliope Road are relatively low (assumed to be up to 50 vpd), therefore it is considered unlikely that vehicles would be required to pass on the floodways / or cattle grids.

2.6.2 Road Crash History Review

A review of the road crash history on the sections of the Burnett Highway (500m either side of McDonalds Road intersection) and McDonalds Road and Playfields Road relevant to the main Project area, and the sections of the Bruce Highway (500m either side of South Ulam Road) and South Ulam Road associated with the proposed eastern substation area, was undertaken using the road crash data available from the Queensland Globe database (2001-2019).

As shown in **Figure 26**, 2 recorded crashes were identified within the sections of the network relevant to the proposed main Project access (via McDonalds Road and Playfields Road), while 4 recorded crashes were identified on the links associated with the eastern substation area (South Ulam Road - refer **Figure 27**). A summary of the details of the recorded crash data is provided for reference in **Table 7**.

Table 7 Summary of Road Crash History

Crash Reference Number	Crash Year	Crash Severity	Crash Type	DCA Code	Crash Description
Burnett Highway, McDonalds Road & Playfields Road – Main Project Area					
73375	2017	Hospitalisation	Single Vehicle	704	Off Path Straight: Right Off C'way Hit Object
311337	2007	Property Damage	Single Vehicle	609	Pass & Misc: Hit Animal
Bruce Highway & South Ulam Road – Eastern Substation Area					
324982	2015	Medical Treatment	Multiple Vehicle	303	Veh's Same Direction: Right Rear
150505	2013	Hospitalisation	Single Vehicle	805	Off Path Curve: Out of Control on Carriageway
269787	2008	Hospitalisation	Single Vehicle	803	Off Path Curve: Off C'way on RT Bend Hit Object
229383	2006	Hospitalisation	Single Vehicle	803	Off Path Curve: Off C'way on RT Bend Hit Object

Figure 26 Road Crash Locations – Burnett Hway, McDonalds Rd & Playfields Rd [Source: Qld Globe]

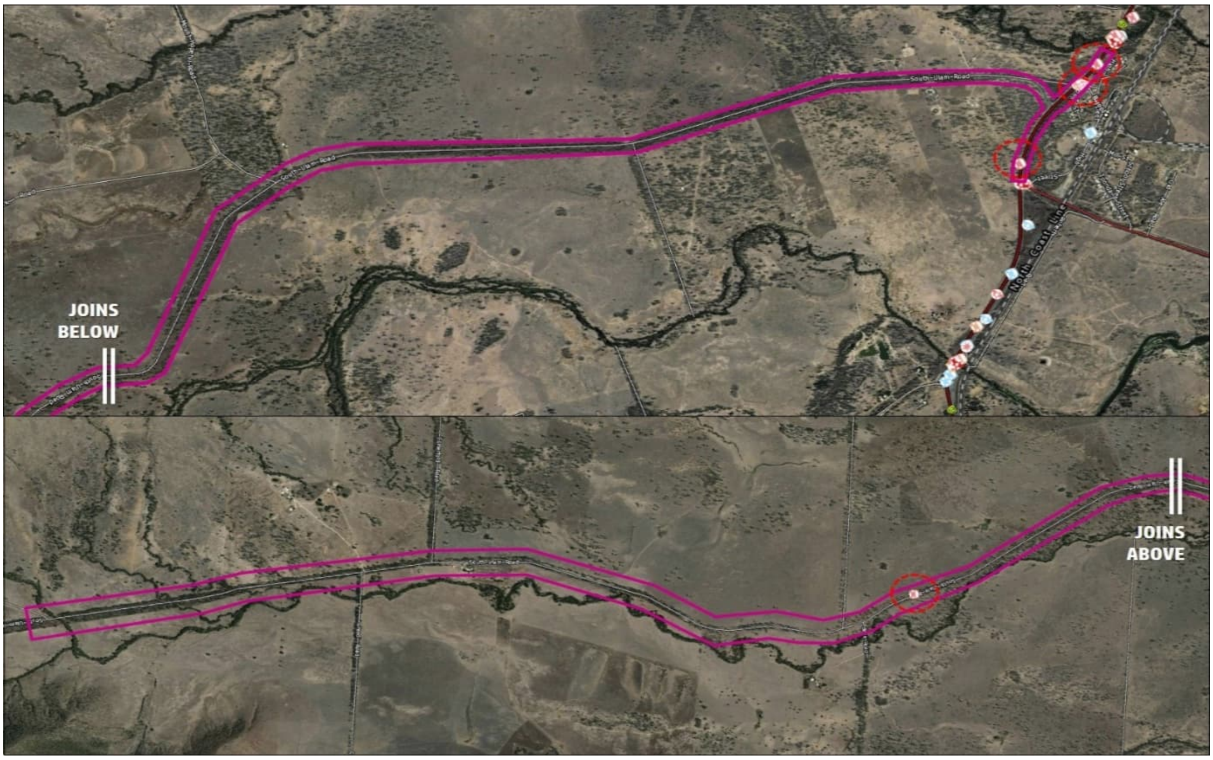


Figure 27 Road Crash Locations – Bruce Hway & South Ulam Rd [Source: Qld Globe]

Based on the limited number of crashes recorded (only 1 crash in the last 10 years), the variety of crash types and the current traffic volumes on the relevant road sections, it can be concluded that there is no specific road feature or design deficiency at either location which is directly contributing to the recorded vehicle crashes, which should be addressed as part of the Project.

2.7 Existing Site Access

The existing vehicle access to the main project site is gained via a cattle grid access on Playfields Road at the south-western boundary of Lot 21 RN1345 (see **Figure 28**), located approximately 24.4km east of the Burnett Highway. From here traffic is expected to utilise both Playfields Road, McDonalds Road and the intersection of Burnett Highway / McDonalds Street to gain access to/from the external road network.

Figure 28 Existing Site Access [Source: QLD Globe}

Further to this, it is noted that no access point currently exists from South Ulam Road to the proposed eastern substation area located on Lot 38 DT40131.

2.8 Pavement Loadings

Estimates were generated for the forecast background pavement loadings on each of the identified road segments over the proposed Project duration. Traffic loads on the pavement are defined in terms of Equivalent Standard Axle (ESA) for granular pavements and Standard Axle Repetitions (SAR) for other pavement types. The ESA for the background traffic heavy vehicle component on the network was calculated based on the identified heavy vehicle percentages for the relevant road sections, with the following assumptions applied to this calculation.

- The existing percentage of heavy vehicles will be maintained for future years.
- The impact of light vehicles can be ignored as the contribution to pavement loading (ESAs) is negligible in comparison to heavy vehicles.
- Equivalent Standard Axles per Heavy Vehicle (ESAs/HV) were adopted as follows (based on advice previously received from TMR for similar pavement impact assessments):
  - 2.9 ESAs/HV for the Bruce Highway.
  - 3.2 ESAs/HV for all other roads (including local government roads).
- The background period of the assessment is the proposed duration of construction i.e. 22 months which equates to approximately 669 days.

A summary of the forecast background ESAs for the each of the relevant road segments is provided in **Table 8** below.

Table 8 Forecast Future Background ESAs

Segment ID	AADT Segment		Base Data Year	Base Year HV %		Base Year HV Volume		10 Yr. GR %	2024 HV Volumes		ESAs / HV	No. Days	Background ESAs	
	Start (km)	End (km)		Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz			Gaz	A-Gaz
Gladstone Port Access Road (183)														
61605	0.000	0.858	2018	33.29%	31.76%	259	236	1.00%	275	250	3.2	669	588,716	536,391
Gladstone-Mount Larcom Road (181)														
60071	0.000	0.175	2019	18.52%	15.24%	660	470	1.00%	694	494	3.2	669	1,485,074	1,058,111
	0.175	*0.919*	2019	18.52%	15.24%	660	470	1.00%	694	494	3.2	669	1,485,074	1,058,111
	0.919	1.409	2019	18.52%	15.24%	660	470	1.00%	694	494	3.2	669	1,485,074	1,058,111
60073	1.409	3.258	2018	16.07%	16.16%	486	509	1.00%	516	540	3.2	669	1,104,978	1,157,083
61052	3.258	*3.830*	2018	11.52%	14.11%	542	641	1.00%	575	680	3.2	669	1,232,301	1,456,755
	3.830	4.625	2018	11.52%	14.11%	542	641	1.00%	575	680	3.2	669	1,232,301	1,456,755
60074	4.625	12.292	2018	13.54%	15.96%	434	509	1.00%	461	540	3.2	669	986,722	1,156,911
60076	12.292	32.140	2018	21.89%	30.23%	324	448	1.00%	344	476	3.2	669	736,411	1,018,354
Dawson Highway (46A Gladstone – Biloela)														
60061	0.000	1.498	2019	4.93%	6.62%	253	374	1.00%	266	393	3.2	669	569,520	842,225
61083	1.498	2.238	2019	4.93%	6.62%	423	572	1.00%	445	601	3.2	669	951,864	1,287,101
61000	2.238	3.130	2018	4.72%	6.12%	506	713	1.00%	537	757	3.2	669	1,149,814	1,621,348
60063	3.130	4.391	2019	7.25%	7.61%	930	1,353	1.00%	977	1,422	3.2	669	2,093,091	3,044,168
60064	4.391	5.179	2019	9.78%	9.09%	999	897	1.00%	1,050	943	3.2	669	2,249,253	2,019,371
60062	5.179	*7.129*	2018	7.64%	9.54%	235	342	1.00%	249	363	3.2	669	534,186	777,193
	7.129	10.296	2018	7.64%	9.54%	235	342	1.00%	249	363	3.2	669	534,186	777,193
60065	10.296	19.050	2019	7.64%	9.54%	251	341	1.00%	264	358	3.2	669	564,317	767,566

Segment ID	AADT Segment		Base Data Year	Base Year HV %		Base Year HV Volume		10 Yr. GR %	2024 HV Volumes		ESAs / HV	No. Days	Background ESAs	
	Start (km)	End (km)		Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz			Gaz	A-Gaz
60066	19.050	21.650	2019	20.24%	119.20%	789	4,546	1.00%	829	4,778	3.2	669	1,775,138	10,231,707
60128	21.650	25.640	2018	20.24%	119.20%	223	1,304	1.00%	237	1,384	3.2	669	506,996	2,964,190
60005	25.640	*46.518*	2019	40.37%	28.28%	239	168	1.00%	251	177	3.2	669	537,863	378,057
	46.518	*101.008*	2019	40.37%	28.28%	239	168	1.00%	251	177	3.2	669	537,863	378,057
60067	*101.008*	113.728	2019	20.70%	23.65%	124	148	1.53%	134	160	3.2	669	286,453	342,574
61084	113.728	116.836	2018	21.69%	13.11%	177	151	1.00%	188	160	3.2	669	402,311	343,295
61085	116.836	119.836	2019	12.26%	9.15%	375	294	1.00%	394	309	3.2	669	844,036	661,848
Bruce Highway (10E Benaraby – Rockhampton)														
60006	11.445	*35.812*	2018	26.38%	24.74%	655	587	2.20%	746	669	2.9	669	1,448,402	1,298,181
60023	*35.812*	*45.420*	2018	26.38%	24.74%	655	587	2.20%	746	669	2.9	669	1,448,402	1,298,181
60023	*45.420*	85.308	2018	21.68%	23.82%	616	677	1.00%	654	719	2.9	669	1,268,794	1,394,525
61551	85.308	*86.183*	2018	28.32%	26.14%	985	921	2.33%	1,131	1,058	2.9	669	2,194,689	2,052,540
	86.183	*107.400*	2018	28.32%	26.14%	985	921	2.33%	1,131	1,058	2.9	669	2,194,689	2,052,540
	107.400	108.938	2018	28.32%	26.14%	985	921	2.33%	1,131	1,058	2.9	669	2,194,689	2,052,540
60130	108.938	114.388	2018	24.95%	27.06%	764	830	1.67%	844	917	2.9	669	1,637,438	1,778,815
60024	114.388	116.961	2018	15.46%	21.01%	742	927	1.00%	787	984	2.9	669	1,528,024	1,909,511
South Ulam Road														
RRC	0.000	16.773	2021	10.00%	10.00%	10	11	1.00%	10	11	3.2	669	22,283	23,827
Dawson Highway (46B Biloela – Mt Morgan)														
60068	0.000	0.650	2019	7.16%	12.97%	192	379	1.00%	202	398	3.2	669	432,017	852,926
61883	0.650	1.366	2019	8.35%	16.03%	179	334	1.00%	188	351	3.2	669	402,717	751,474

Segment ID	AADT Segment		Base Data Year	Base Year HV %		Base Year HV Volume		10 Yr. GR %	2024 HV Volumes		ESAs / HV	No. Days	Background ESAs	
	Start (km)	End (km)		Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz			Gaz	A-Gaz
Leichhardt Highway (26A Biloela – Banana)														
60001	0.000	0.115	2019	32.70%	32.71%	121	123	1.00%	127	129	3.2	669	272,296	276,796
	0.115	25.680	2019	32.70%	32.71%	121	123	1.00%	127	129	3.2	669	272,296	276,796
Burnett Highway (41E Biloela – Mt Morgan)														
61081	0.000	*27.290*	2019	37.57%	23.91%	210	142	1.00%	221	149	3.2	669	472,655	319,637
	27.290	35.401	2019	37.57%	23.91%	210	142	1.00%	221	149	3.2	669	472,655	319,637
60055	35.401	*56.310*	2019	36.70%	39.67%	167	190	1.00%	176	200	3.2	669	375,810	427,650
	56.310	71.730	2019	36.70%	39.67%	167	190	1.00%	176	200	3.2	669	375,810	427,650
McDonalds Road														
BSC	0.000	5.720	2021	10.00%	10.00%	3	3	1.00%	3	3	3.2	669	5,516	5,516
Playfields Road														
BSC	0.000	5.080	2021	10.00%	10.00%	3	3	1.00%	3	3	3.2	669	5,516	5,516
BSC	5.080	7.680	2021	10.00%	10.00%	3	3	1.00%	3	3	3.2	669	5,516	5,516

TMR Chainage 0.175km (181) – Intersection of Gladstone-Mount Larcom Road / Gladstone Port Access Road | TMR Chainage 0.919km (181) – Intersection of Gladstone-Mount Larcom Road / Lord Street | TMR Chainage 3.830km (181) – Intersection of Gladstone-Mount Larcom Road / Red Rover Road | TMR Chainage 7.129km (46A) – Intersection of Dawson Highway / Don Young Drive | TMR Chainage 19.050km (46A) – Intersection of Dawson Highway / Bruce Highway | TMR Chainage 46.518km (46A) – Intersection of Dawson Highway / Calliope Station Road | TMR Chainage 101.008km (46A) – Intersection of Dawson Highway / Callide Mine Haul Road Access | TMR Chainage 35.812km (10E) – Intersection of Bruce Highway / Mount Alma Road | TMR Chainage 45.420km (10E) – Intersection of Bruce Highway / Gladstone-Mount Larcom Road | TMR Chainage 86.183km (10E) – Intersection of Bruce Highway / South Ulam Road | TMR Chainage 107.400km (10E) – Intersection of Bruce Highway / Hopkins Brothers Quarry Access | TMR Chainage 27.290km (41E) – Intersection of Burnett Highway / Jambin-Dakenba Road | TMR Chainage 56.310km (41E) – Intersection of Burnett Highway / McDonalds Road | TMR Chainage 0.155km (26A) – Intersection of Leichhardt Highway / Quarry Access.

The forecast background ESAs in **Table 8** above have been used as the basis for the assessment of the pavement impact of the proposal during the peak construction period (2024), which is detailed further in **Section 5.6.1**.

2.9 Transport Infrastructure

2.9.1 Drainage and Cattle Grids Structures

In addition to the road links and intersections highlighted above, a number of drainage (floodway/culvert) and cattle grid structures along the minor roads included in the proposed Project transport routes have been identified as relevant to the impact assessment for the Project. These structures are located on Mount Alma Road and Calliope Station Road (GRC), Argoon-Kilburnie Road and Jambin-Dakenba Road (BSC) which form part of the OSOM turbine component (tower sections) transport route, as well as on McDonalds Road and Playfields Road (BSC) which provide the connection from the Burnett Highway to the main Project area. The locations of the relevant structures are indicatively shown in **Figure 29** to **Figure 31** below.

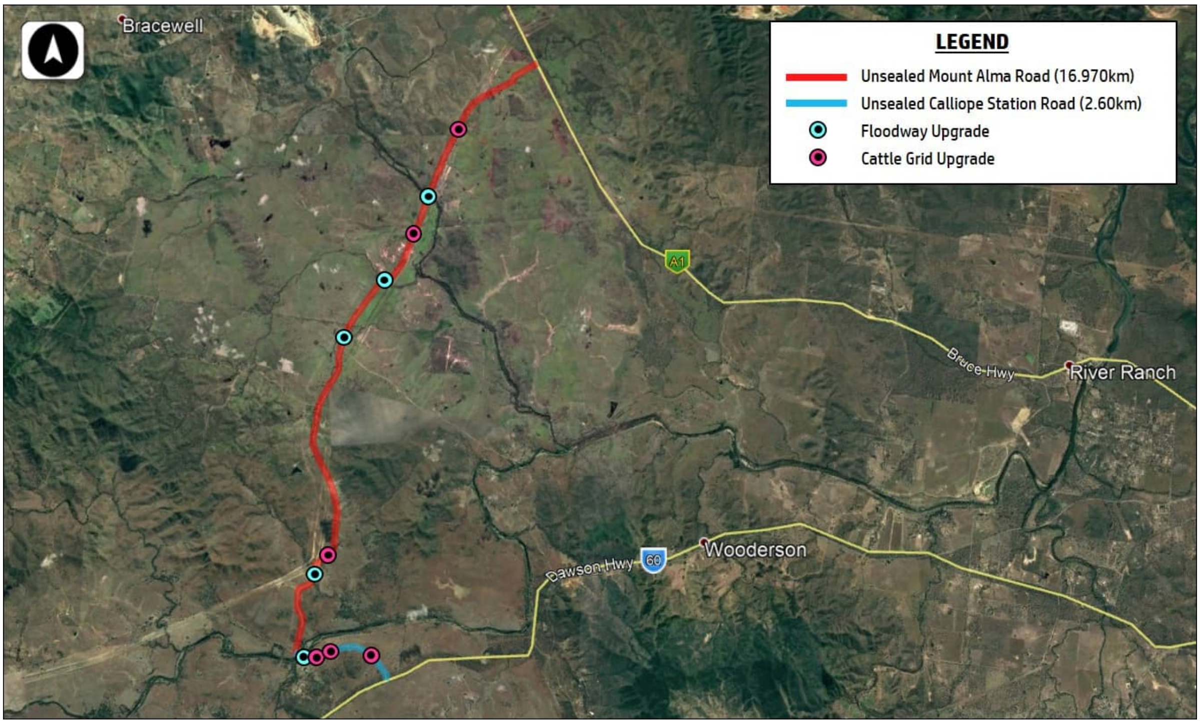


Figure 29 Indicative Structure Locations – Mount Alma Road / Calliope Station Road [Source: QLD Globe]

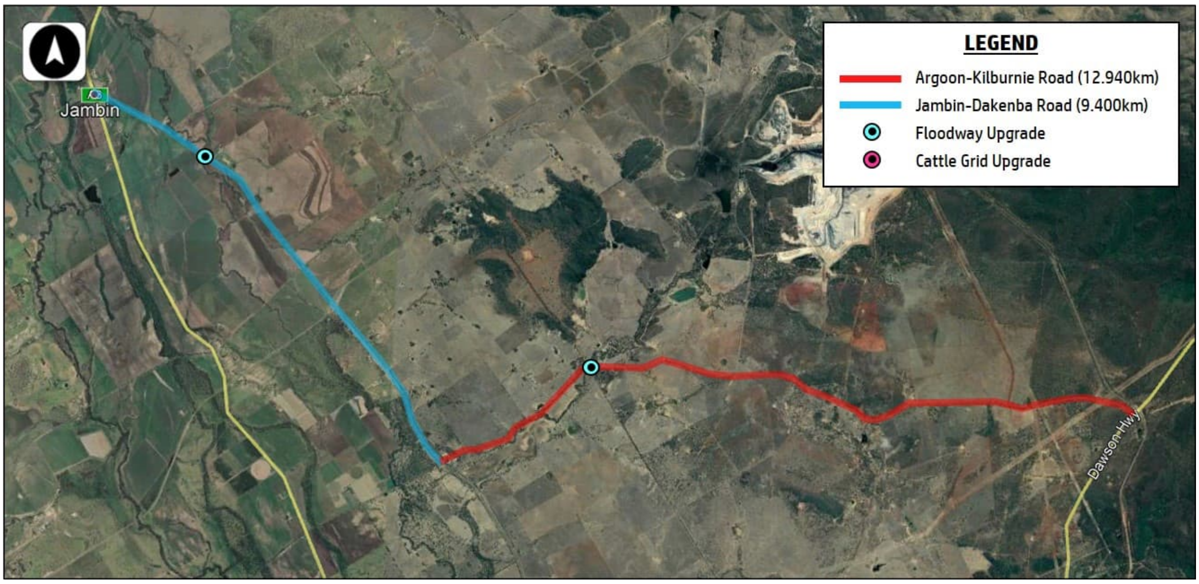


Figure 30 Indicative Structure Locations – Argoon-Kilburnie Road / Jambin-Dakenba Road [Source: QLD Globe]

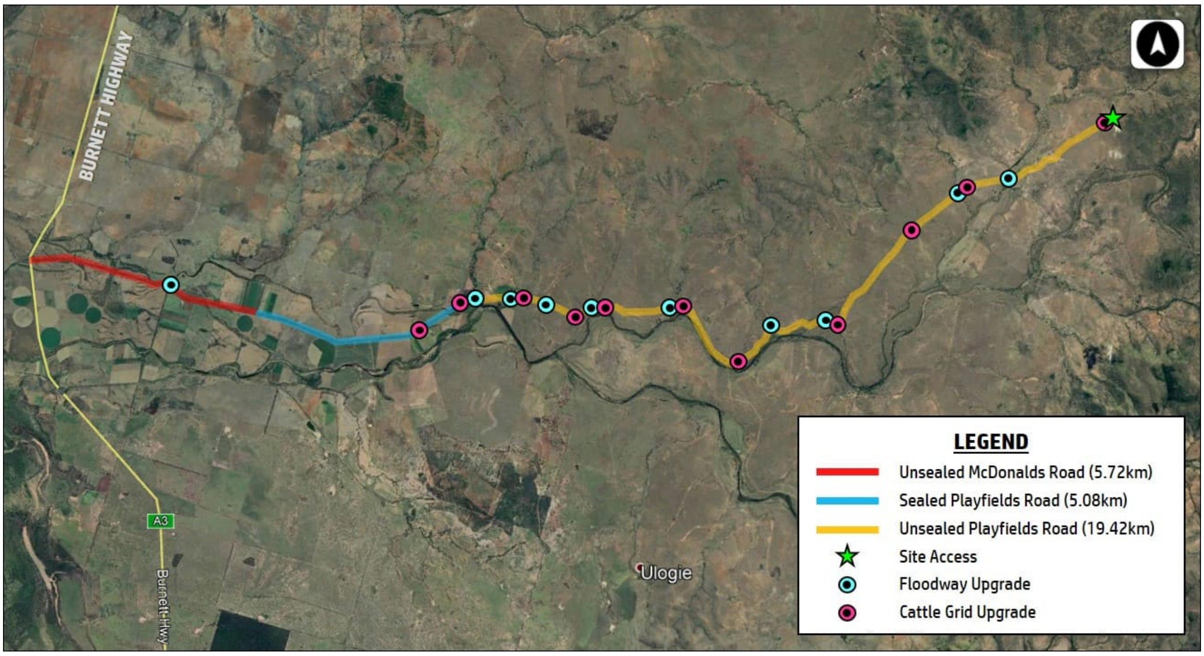


Figure 31 Indicative structure Locations – McDonalds Road / Playfields Road [Source: QLD Globe]

Generally, the existing configuration of the drainage (floodway/culvert) and cattle grid structures on the identified links only provide narrow trafficable widths, restricting their operation to two-lane, one-way operation. This means that two vehicles could not safely pass while crossing the structure.

Furthermore, it is noted that the existing structures are also anticipated to be unsuitable to cater for the higher axle loadings from the OSOM turbine component transport movements, noting the current vehicle loading restrictions of heavy vehicles on Mount Alma Road and Calliope River Road to 10 tonnes (which is significantly less than the expected OSOM transport vehicle loadings).

Based on this, it is expected that each of the drainage (floodway/culvert) and cattle grid structures along the identified sections of Mount Alma Road, Calliope Station Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road will need to be upgraded to provide a trafficable width suitable to cater for the transport vehicle swept paths (minimum width of 6m), as well as being structurally adequate to cater for the increased OSOM vehicle loads required for the Project. Alternatively, diversions (including relevant gate infrastructure and fencing amendments) around the existing cattle grid structures may be provided were possible to reduce the requirement to upgrade the existing structures.

2.9.2 Rail Crossings

Two minor open level rail crossings of the Moura System Rail Line are currently provided on Jambin-Dakenba Road, approximately 6km south-east of the intersection of the link with the Burnett Highway as shown in **Figure 32** below. Currently, both of the open level crossings are sign controlled due to the low traffic volumes on Jambin-Dakenba Road (refer **Figure 32**), and it is noted that suitable approach sight distances to each crossing are available on all Jambin-Dakenba Road approaches.

Figure 32 Indicative Locations – Rail Crossings (Jambin-Dakenba Road) [Source: QLD Globe]

3.0 Proposed Development Details

3.1 Development Site Plan

A preliminary plan of development for the Project was provided by Neoen. This layout identified the currently proposed project area boundaries and indicative turbine and site access locations, as shown in **Figure 33** below. A detailed copy of this plan is provided for reference in **Appendix G**.

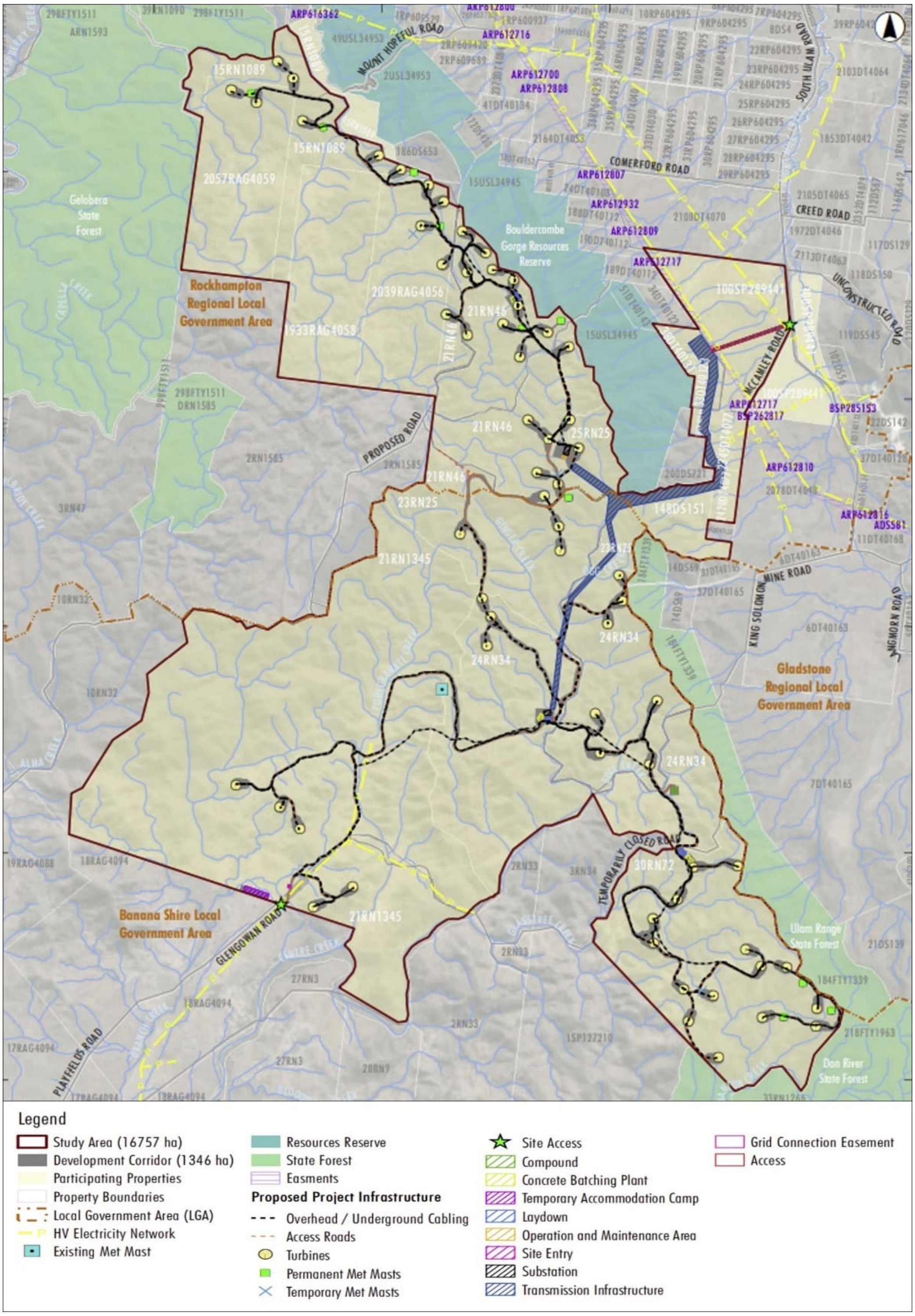


Figure 33 Proposed Mount Hopeful Wind Farm - Plan of Development [Source: Umwelt]

As shown in **Figure 33** above, the Project is a Renewable Energy Facility (Wind Farm) comprising of up to 63 turbines as well as associated infrastructure. The primary vehicular access point to the main wind farm area is proposed to be located off Playfields Road (via Burnett Highway and McDonalds Road) and cater for Project traffic during both the construction and operational stages of the Project. The site layout also identifies a secondary access to the eastern substation and battery storage area of the Project, proposed to be provided off South Ulam Road, via the Bruce Highway.

The proposed site layout also identifies the proposed alignment of the internal access tracks, as well as the location of the internal substations, construction compound, operation and maintenance area, batch plants and laydown areas as well as the eastern substation and battery storage area for the Project.

3.2 Project Details

Information regarding the proposed construction activities and ultimate day to day operation of the proposed Mount Hopeful Wind Farm has been provided by the proponent (Neoen), with a summary of the key site elements of the Project provided in **Table 9**.

Table 9 Key Elements of Mount Hopeful Wind Farm

Element	Quantity
Turbines	63
Accesses	2 (Playfields Rd & South Ulam Rd)
Length of Access Tracks (Main Site)	91,320 m
Length of Access Tracks (Eastern Substation Site)	1,800 m
Length of Access Road Upgrade	25,140 m
Number of Substation & Battery Storage Areas (Eastern)	1
Number of Substation Areas (Internal)	2
Number of Turbine Construction Laydown Areas	63
Number of Site Laydown Areas (Internal x3)	3
Number of Site Batch Plant Areas (Internal x3)	3
Number of Site Construction Compound Areas (Internal x1)	1
Number of Site Entrance Areas (Internal x1)	1
Number of Site Operational and Maintenance Facility Areas	1
Number of Meteorology Masts	10

3.2.1 Construction Phase

Based on updated information provided by the proponent (Neoen) it is understood that the construction of the Project is anticipated to be completed over a period of between 22 to 28 months. Notwithstanding this, for the purpose of this assessment the worst-case scenario (in regard to traffic impacts) of the shorter 22-month construction period has conservatively been adopted, with this timeframe expected to commence in Q4 2023 (pending approvals) and conclude in Q3 (July) 2025.

Preliminary details of the proposed construction phase activities have been provided, with a high-level summary of the key construction tasks, the likely order of completion and anticipated timeframes provided in **Table 10**. Based on the proposed schedule below, the peak period of construction is expected to occur in late Q1 and Q2 2024.

Table 10 Proposed Construction Schedule – Mount Hopeful Wind Farm [Source: Neoen]

ID	TASK	DURATION	MONTH																					
			Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
			Q4 2023			Q1 2024			Q2 2024			Q3 2024			Q4 2024			Q1 2025			Q2 2025			Q3
A	Mobilisation	1 M																						
B	Access Roads and Site Entrances	9 M																						
C	Substation and Site Areas	9 M																						
D	Cabling	8 M																						
E	Turbine Foundations	11 M																						
F	Turbine Transportation	12 M																						
G	Turbine Erection	9 M																						
H	Finalisation / Commissioning / Demobilisation	3 M																						
I	Project Float	1 M																						

Further to this, the proposed hours of the construction operations for the Project are expected to typically be 12 hours per day (6:30am to 6:30pm) Monday to Saturday, equating to approximately 24 working days per month, noting that there may be minor exceptions to these timings as required throughout the construction process.

3.2.2 Operations Phase

The operations phase of the Project will commence upon completion of the construction works, with the wind farm to be operated by a relatively small number of staff (approximately 10) at the main Project site (via McDonalds Road and Playfields Road). In addition, it is expected that only limited numbers of heavy vehicles will access the Project site during operations, with only periodic maintenance (monthly) and routine service vehicles (weekly) anticipated to travel to/from the main site area.

3.3 Site Access

The key element of the proposed site layout is the proposed access arrangements for the site from the Burnett Highway. As shown in **Figure 33** above, it is currently proposed that the main access for Project traffic to the site will be via a new access on Playfields Road, which will be accessed from the state controlled road network via the existing intersection of McDonalds Road with the Burnett Highway, located on the right hand side of the carriageway (gazettal direction) at approximate TMR chainage 56.310 km (41E). From this intersection with the Burnett Highway, Project traffic is proposed to travel along the BSC controlled sections of McDonalds Road (5.72 km) and Playfields Road (24.42 km) to the proposed Project site entrance, located approximately 30.14 km east of the Burnett Highway.

Currently the relevant section of McDonalds Road is configured as an unsealed road varying in width between 5-6m with limited depths of gravel pavement. The next 5.00 km of Playfields Road provides a 6m sealed carriageway, while the remaining 19.42 km of Playfields Road is currently configured as a 5-6m wide unsealed road, again with limited depths of gravel pavement.

Based on the expected Project traffic volumes, it is anticipated that the current configuration of the sealed section of Playfields Road will be adequate to cater for the traffic volumes generated by the Project, while the unsealed sections of both McDonalds Road (5.72 km) and Playfields Road (last 19.42 km) are expected to be required to be upgraded to provide a minimum 6.5m (unsealed) road pavement width (on 8m formation) in accordance with the Banana Shire Council requirements for a rural minor access road as per Table D1.27.05 of the Capricorn Municipal Design Guidelines (CMDG).

Further to this, it is anticipated that upgrade works will also be required to a number of existing cattle grid and floodway structures on both McDonalds Road and Playfields Road, with localised works also expected to be required to amend the vertical geometry of the road (existing dips) to accommodate the size and mass (loading) of the large turbine component transport vehicle configurations required to be utilised for the Project. **Figure 34** below shows a summary of the expected works requirements for the main site access route for the Project via McDonalds Road and Playfields Road.

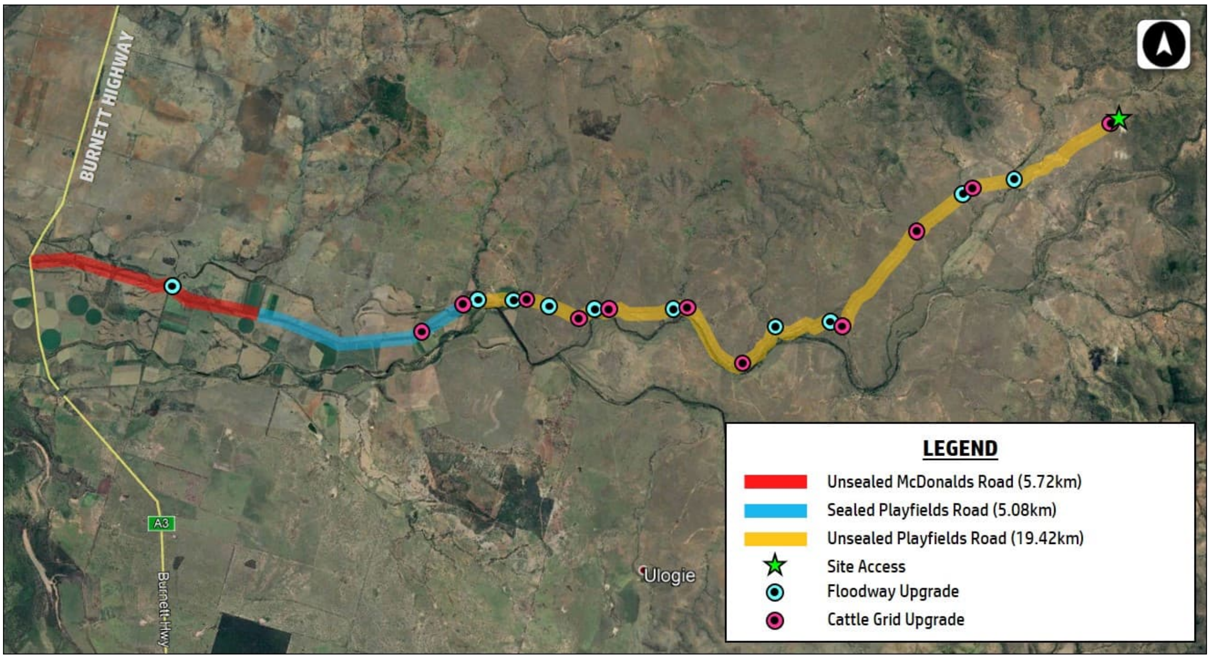


Figure 34 Mount Hopeful Wind Farm – Proposed Site Access Arrangements

In addition to the main site access, a secondary access is also proposed to be provided to the eastern substation and battery storage area of the Project from the RRC controlled South Ulam Road (refer **Figure 33**). This secondary site access is proposed to cater for minor Project traffic volumes associated with the construction and operation of the Project's eastern substation and battery storage infrastructure.

Access to this secondary site area is proposed to be provided via a new site access located approximately 16.8 km south of the Bruce Highway / South Ulam Road intersection, which serves as the access to the wider state-controlled road network for Project traffic. As no access point currently exists at this location, it is proposed that a new site access in accordance with the requirements for a bitumen road (<300vpd) as per Standard Drawing CMDG-R-040 (Rural Road Access and Property Access Over Table Drains) be provided to service the expected Project traffic volumes.

3.4 Internal Site Facilities

As previously identified, the proposed plan of development for the wind farm (refer **Appendix G**) includes a series of internal access tracks throughout the Project site which provide vehicular access between the external road network and the turbine locations and associated internal infrastructure. The access track layout has been designed to utilise the existing topography of the land, avoiding steep areas where possible, and to avoid areas of sensitive native vegetation.

The project will comprise a total of approximately 91.3 km of internal access roads, with a summary of the intended design criteria for the internal tracks provided below:

- The access tracks will typically be 5.5 m wide.
- Regular passing places and turning areas will be provided.

- The access tracks will only link to the identified site access points, with no other connections to adjacent roads provided.
- Tracks will not be sealed but will be constructed from aggregate which is locally sourced.
- The number of water course crossings have been minimised as far as practicable.
- Track margins will be vegetated to reduce potential sediment-laden run-off.

The plan of development for the Project also identifies a number of site facilities, including the proposed substations, battery storage, construction compound and accommodation facilities and onsite concrete batch plant and laydown areas, as shown in **Figure 33** above.

Further to this, whilst not currently shown on the proposed site layout it is understood that the suitable parking facilities will be provided for the Project in accordance with the requirements of all relevant standards, guidelines and policies. In addition, due to the large area of land available within the Project site for the required internal facilities (including the construction site office and parking facilities), and the current setback from the external road network, it is not anticipated that either the construction or operational phases of the proposed Mount Hopeful Wind Farm will lead to an overspill of parking or vehicle queuing at site accesses that would lead to negative impacts to the operation of the surrounding road network.

4.0 Development Traffic

There will be two distinct periods of development traffic generation for the Project, being the construction, and operational phases. The expected traffic generation and distribution during both these phases of the Project is discussed in the sections below.

4.1 Construction Phase

As identified above, construction will indicatively commence in Q4 2023 (pending approvals) and it is proposed that all construction activities across the site will be completed within 22 to 28 months (conservatively assumed to be 22 months for this assessment - i.e. by Q3 (July) 2025), with the peak period of construction expected to occur in late Q1 and Q2 2024.

Based on the information provided by Neoen, it has been identified that the main traffic generating activities occurring within the construction phase of the Project are the transport of the various construction materials / equipment to site and the daily construction staff movements. Further details of these activities, including the Project traffic generation and its expected distribution on the surrounding road network, are provided in the following sections.

4.1.1 Turbine Component Transport Movements

As previously identified the turbine components will be imported from overseas, shipped to port facilities in Gladstone, before being transported by road to the wind farm site. On average, two light escort vehicles will be accompanying each over dimension turbine component, with a summary of the proposed Project turbine transport traffic volumes provided below:

- 2,467 vehicles total from Port of Gladstone, including:
  - 1,638 light vehicle escorts.
  - 819 turbine component transport vehicles.
  - 10 meteorology mast transport vehicles.

4.1.2 Materials and Equipment Delivery Movements

Neoen has provided preliminary information and assumptions regarding the expected construction phase of the Project based on their experience in developing similar wind farm developments. This information has been used to calculate the expected material and equipment quantities for the Project and the associated vehicle movements for the delivery of these items, based on the following general assumptions regarding the expected Project traffic numbers.

- General equipment and plant for the main Project area is proposed to be imported to site from either Gladstone or Biloela, with equipment for the eastern substation area proposed to be imported to site from Rockhampton.
- Gravel materials for the internal access roads, site entrance and external access roads (McDonalds Road and Playfield Roads), site areas and concrete aggregates are conservatively assumed to be 100% imported to site, with no internal sources currently identified within the Project area.

  At this stage, it is indicatively assumed that the gravel materials for the main Project site will be sourced from the quarries located to the north on the Leichhardt Highway, while the gravel materials for the eastern substation site are indicatively assumed to be sourced from quarry operations at Midgee.
- Construction water requirements for the site have also conservatively been assumed to be 100% imported, with the no viable bores currently identified onsite. For the purpose of this assessment, it has been assumed that the construction water will be sourced from BSC facilities in Biloela.

- Concrete for the main Project area is to be sourced from on-site batch plant facilities, with the materials (cement, steel and aggregates) proposed to be 100% imported, primarily from Biloela.
- Concrete required for the eastern substation site is to be imported as wet concrete in trucks from commercial suppliers in Rockhampton.

A calculated breakdown of the Project generated traffic movements by construction task, is summarised in **Table 11**, while the detailed calculations completed in order to convert operational / construction information into vehicle movements are included for reference in **Appendix H.**

Table 11 Summary of Total Project Material / Equipment Delivery Movement Volumes

<table>
<tr><th>Task</th><th>Duration</th><th>Total Vehicles</th><th>Type of Vehicles</th><th>Max Vehicles per Day</th></tr>
<tr><td>Task A – Site Mobilisation</td><td>1 month</td><td>100 vehicles</td><td>Semi / Low Loaders</td><td>5 vehicles / day</td></tr>
<tr><td>Task B – Access Roads and Site Entrances</td><td>9 months
1 month to eastern site</td><td>6,178 vehicles, including:
<u>Main Project Site</u>
• 6,079 movements from quarry.
<u>Eastern Substation Area</u>
• 99 movements from quarry.</td><td>Truck & Dog Trailers</td><td>33 vehicles / day (Quarry to site)
5 vehicles / day (Quarry to eastern site)</td></tr>
<tr><td>Task C – Substation and Construction Compound</td><td>9 months
3 months to eastern site</td><td>5,755 vehicles, including:
<u>Main Project Site</u>
• 316 movements from Gladstone / Biloela.
• 5,133 movements from quarry.
<u>Eastern Substation Area</u>
• 126 movements from Rockhampton.
• 180 movements from quarry.</td><td>Semi-Trailers
Concrete Trucks
Truck & Dog Trailers
Water Truck</td><td>2 vehicles / day (R'ton to eastern site)
3 vehicles / day (Quarry to eastern site)
24 vehicles / day (Quarry to main site)
2 vehicles / day (G'stone to main site)
2 vehicles / day (Biloela to main site)</td></tr>
<tr><td>Task D - Cabling</td><td>8 months
4 months to eastern site</td><td>626 vehicles, including:
<u>Main Project Site</u>
• 64 movements from Gladstone.
• 548 movements from quarry.
<u>Eastern Substation Area</u>
• 14 movements from Rockhampton.</td><td>Semi-Trailers
Truck & Dog Trailers</td><td>1 vehicle / day (R'ton to eastern site)
1 vehicles / day (G'stone to main site)
3 vehicles / day (Quarry to main site)</td></tr>
<tr><td>Task E – Turbine Foundations</td><td>11 months</td><td>3,526 vehicles (external), including:
<u>Main Project Site</u>
• 1,106 movements from Biloela.
• 2,420 movements from quarry.
8,247 concrete truck movements internal to site.</td><td>Semi-Trailers
Truck & Dog Trailers
Concrete Trucks</td><td>10 vehicles / day (Quarry to main site)
5 vehicles / day (Biloela to main site)</td></tr>
<tr><td>Task F – Turbine Transportation</td><td>12 months (Delivery Rate of 2 Turbines per Week)</td><td>2,467 vehicles total (including 1,638 light vehicle escorts)</td><td>Special Transport Vehicles (Permit)
Escorts (light vehicle)</td><td>15 vehicles / day (including 5 OSOM vehicles)</td></tr>
</table>

Task	Duration	Total Vehicles	Type of Vehicles	Max Vehicles per Day
Task G – Turbine Erection	9 months (crane transport in 5 days)	Main Project Site 10 vehicles required for nacelle crane delivery.	Special Transport Vehicles (Permit)	2 vehicles / day (G'stone to main site)
Task H – Finalisation / Commissioning / Demobilisation	3 months	Main Project Site 245 vehicles	Semi-Trailers	4 vehicles / day (G'stone to main site)
Other – Site Water (Does not include internal water truck movements)	21 months	Main Project Site 4,755 vehicles	Water Trucks	10 vehicles / day (Biloela to main site)
Site Fuel	21 months	Main Project Site 241 vehicles	Water Trucks	1 vehicle / day (Biloela to main site)

4.1.3 Construction Staff Movements

The proponent has also provided the following information and assumptions regarding the proposed staff movements for the proposed construction phase of the Mount Hopeful Wind Farm:

- Maximum (peak) construction workforce expected on site is 450 staff, of which 80% (360 staff) will be local employees, and the remaining 20% (90 staff) will be specialist fly-in, fly-out (FIFO) staff.
- Outside of the peak construction period, the staff numbers to the main site are expected to be significantly less (i.e. in the order of 50-125 staff).
- Local workers for the main site are expected to be from Biloela (100%), with FIFO workers also accommodated in Biloela.
- A small number of staff (max. 50 staff) are also expected to travel to the eastern substation site temporarily (approx. 6-9 months) during its construction and are expected to commute to/from the site daily from Rockhampton.
- Construction staff are expected to commute using a mixture of private vehicles (light vehicles and 4WDs) and minibuses, with an average capacity of 2 staff per vehicle and 15 staff members per bus.
- The split of private vehicles and minibus usage by staff is anticipated to be approximately 30% / 70% for both the local and FIFO staff.

Based on these general staff assumptions, the expected staff numbers and associated vehicle movements were established, with **Table 12** summarises the expected number of staff by construction task and by month, and **Table 13** converting the estimated staff numbers to anticipated vehicle movement numbers.

As previously identified, Neoen is currently considering a delivery methodology for the Project which would include the provision of an on-site workers accommodation camp for the Project, which would be expected to significantly reduce the daily staff volumes commuting between Biloela and the subject site.

ID	Duration (Days)	Task	Max Staff	MONTH																					
				Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
				Q4 2023			Q1 2024			Q2 2024			Q3 2024			Q4 2024			Q1 2025			Q2 2025			Q3
A	24	Mobilisation	50	50																					
B	216	Access Roads and Site Entrances	125	75	100	125	125	125	125	125	100	75													
C	216	Substation and Site Areas	75		50	75	75	75	75	75	75	75	50												
D	192	Cabling	75			75	75	75	75	75	75	75	75												
E	264	Turbine Foundations	125			100	125	125	125	125	125	125	125	125	125	150									
F	288	Turbine Transportation	50						25	50	50	50	50	50	50	50	50	50	50	25					
G	216	Turbine Erection	75										50	75	75	75	75	75	75	75	50				
H	72	Finalisation / Demobilisation / Commissioning	50																			50	50	50	
I	24	Project Float	0																						0

Table 12 Forecast Staff Numbers during Construction

				MONTH																					
				Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
				Q4 2023			Q1 2024			Q2 2024			Q3 2024			Q4 2024			Q1 2025			Q2 2025			Q3
Total Staff Numbers				125	150	375	400	400	425	450	425	400	350	250	250	275	125	125	125	100	50	50	50	50	0
Staff	Vehicle	100%		125	150	375	400	400	425	450	425	400	350	250	250	275	125	125	125	100	50	50	50	50	0
		Capacity	Utilisation by Staff																						
Local Staff (Biloela)	100%			125	150	375	400	400	425	450	425	400	350	250	250	275	125	125	125	100	50	50	50	50	0
	Mini Bus	15	70%	6	7	18	19	19	20	21	20	19	16	12	12	13	6	6	6	5	2	2	2	2	0
	LV	2	30%	19	23	56	60	60	64	68	64	60	53	38	38	41	19	19	19	15	8	8	8	8	0
External Staff Movement Total				25	30	74	79	79	84	89	84	79	69	50	50	54	25	25	25	20	10	10	10	10	0

Table 13 Forecast Daily Staff Vehicle Volumes

4.2 Operations Phase

The proponent (Neoen) has also advised that the workforce during operations phase of the Project (i.e. following the completion of the construction stages) will only consist of a small number of local workers (approximately 10 staff) who are expected to reside locally to the Project site (most likely in Biloela).

Further to this, the heavy vehicle movements during the operations phase of the Project are likely to be extremely low (approx. 1 HV per week) and is considered to be negligible from a traffic engineering or transport planning perspective.

In light of the information regarding the Project traffic volumes provided above, it can clearly be seen that the construction stage of the Project is critical in terms of the impact upon the public road network and has been used as the basis of the assessment of this impact considering road safety, road capacity, and pavement impact.

4.3 Project Traffic Volumes on the Network

The volumes of traffic forecast to be generated by staff and equipment / materials delivery have been distributed onto the public road network based upon an understanding of the locations from which these equipment / materials are intended to be sourced / delivered, and other Project operational information provided by the proponent.

4.3.1 Road Links

As previously identified, the use of the external road network by typical day to day Project traffic is anticipated to be generally limited to the state controlled network and a small number of BSC (McDonalds Road, Playfields Road) controlled local access roads in close proximity to the main Project site, with smaller volumes of traffic associated with the construction of the eastern substation and battery storage area also anticipated to utilise the RRC controlled link of South Ulam Road temporarily (approx. 6-9 months).

Notwithstanding this, it is also noted that a number of local roads controlled by GRC (Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road) and BSC (Callide Mine Haul Road Access, Argoon-Kilburnie Road, Jambin-Dakenba Road) are also proposed to be utilised as part of the turbine component transport operations from the Port of Gladstone to the Project area.

Detailed calculations were undertaken to establish the peak daily Project traffic volumes on the relevant sections of the road network, with a copy of these included for reference as **Appendix H**. A summary of the calculated Project traffic volumes (conservatively based on the total of the individual maximum movements from concurrently scheduled construction activities) for each identified road link is provided in **Table 14**, noting that typically these peak volumes are experienced during the construction period where Tasks B to F (refer **Table 10** / **Table 12** above) are being completed concurrently with typical site water and staff movements on the network.

Table 14 Forecast Maximum Project Traffic Volumes on External Road Network

<table>
<tr><th rowspan="2">Road ID</th><th rowspan="2">Road Description</th><th rowspan="2">AADT Segment ID</th><th colspan="2">AADT Segment</th><th colspan="3">Maximum Daily Project Traffic</th></tr>
<tr><th>Start (km)</th><th>End (km)</th><th>Gaz</th><th>A-Gaz</th><th>Bi-Dir</th></tr>
<tr><td>183</td><td>Gladstone Port Access Road</td><td>61605</td><td>0.000</td><td>0.858</td><td>9</td><td>15</td><td>24</td></tr>
<tr><td rowspan="2">-</td><td rowspan="2">Macfarlane Road</td><td>GRC</td><td>0.000</td><td>0.350</td><td>15</td><td>15</td><td>30</td></tr>
<tr><td>GRC</td><td>0.350</td><td>1.210</td><td>6</td><td>0</td><td>6</td></tr>
<tr><td>-</td><td>Hopper Road (John Bates Drive)</td><td>GRC</td><td>0.000</td><td>0.790</td><td>6</td><td>0</td><td>6</td></tr>
<tr><td>-</td><td>Flinders Parade</td><td>GRC</td><td>0.000</td><td>0.670</td><td>6</td><td>0</td><td>6</td></tr>
<tr><td>-</td><td>Lord Street</td><td>GRC</td><td>0.000</td><td>0.515</td><td>6</td><td>0</td><td>6</td></tr>
<tr><td rowspan="8">181</td><td rowspan="8">Gladstone - Mount Larcom Road</td><td rowspan="3">60071</td><td>0.000</td><td>0.175</td><td>0</td><td>15</td><td>15</td></tr>
<tr><td>0.175</td><td>0.919</td><td>9</td><td>0</td><td>9</td></tr>
<tr><td>0.919</td><td>1.409</td><td>15</td><td>0</td><td>15</td></tr>
<tr><td>60073</td><td>1.409</td><td>3.258</td><td>15</td><td>0</td><td>15</td></tr>
<tr><td rowspan="2">61052</td><td>3.258</td><td>3.830</td><td>15</td><td>0</td><td>15</td></tr>
<tr><td>3.830</td><td>4.625</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>60074</td><td>4.625</td><td>12.292</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>60076</td><td>12.292</td><td>32.140</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>-</td><td>Red Rover Road</td><td>GRC</td><td>0.000</td><td>3.390</td><td>12</td><td>0</td><td>12</td></tr>
<tr><td>-</td><td>Don Young Drive</td><td>GRC</td><td>0.000</td><td>2.280</td><td>12</td><td>0</td><td>12</td></tr>
<tr><td rowspan="6">46A</td><td rowspan="6">Dawson Highway (Gladstone - Biloela)</td><td>60061</td><td>0.000</td><td>1.498</td><td>3</td><td>18</td><td>21</td></tr>
<tr><td>61083</td><td>1.498</td><td>2.238</td><td>3</td><td>18</td><td>21</td></tr>
<tr><td>61000</td><td>2.238</td><td>3.130</td><td>3</td><td>18</td><td>21</td></tr>
<tr><td>60063</td><td>3.130</td><td>4.391</td><td>3</td><td>18</td><td>21</td></tr>
<tr><td>60064</td><td>4.391</td><td>5.179</td><td>3</td><td>18</td><td>21</td></tr>
<tr><td>60062</td><td>5.179</td><td>7.129</td><td>3</td><td>18</td><td>21</td></tr>
</table>

Road ID	Road Description	AADT Segment ID	AADT Segment		Maximum Daily Project Traffic		
			Start (km)	End (km)	Gaz	A-Gaz	Bi-Dir
			7.129	10.296	15	18	33
		60065	10.296	19.050	15	18	33
		60066	19.050	21.650	15	18	33
		60128	21.650	25.640	15	18	33
		60005	25.640	*46.518*	15	18	33
			46.518	*101.008*	18	18	36
		60067	*101.008*	113.728	15	18	33
		61084	113.728	116.836	15	18	33
		61085	116.836	119.836	15	18	33
-	Mount Alma Road	GRC	0.000	16.970	3	0	3
-	Calliope Station Road	GRC	0.000	2.600	3	0	3
10E	Bruce Highway (Benaraby - Rockhampton)	60006	11.445	*35.812*	6	0	6
		60023	*35.812*	*45.420*	6	0	6
		60023	*45.420*	85.308	0	0	0
		61551	85.308	*86.183*	0	0	0
			86.183	*107.400*	11	11	22
			107.400	108.938	3	3	6
		60130	108.938	114.388	3	3	6
		60024	114.388	116.961	3	3	6
-	South Ulam Road	RRC	0.000	16.773	26	26	52
46B	Dawson Highway (Biloela - Banana)	60068	0.000	0.650	22	25	47
		61883	0.650	1.366	22	25	47
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.000	0.115	0	0	0
			0.115	25.680	70	70	140
41E	Burnet Highway (Biloela – Mt Morgan)	61081	0.000	*27.290*	122	125	247
			27.290	35.401	125	125	250
		60055	35.401	*56.310*	125	125	250
			56.310	71.730	70	70	140
-	Callide Mine Haul Road Access	BSC	0.000	0.400	3	0	3
-	Argoon-Kilburnie Road	BSC	0.000	12.940	3	0	3
-	Jambin-Dakenba Road	BSC	0.000	9.400	3	0	3
-	McDonalds Road	BSC	0.000	5.720	195	195	390
-	Playfields Road	BSC	0.000	5.080	195	195	390
			5.080	7.680	195	195	390

4.3.2 Intersections

From the information regarding the proposed staff and heavy vehicle movement numbers during the critical construction phase of the Project, the peak hour volumes at the key Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections were established.

A summary of the resultant peak hour Project traffic volumes at these intersections is outlined in **Table 15** and **Table 16**, with further details of the calculations undertaken to establish these volumes are provided for reference in **Appendix D**.

Table 15 Construction Traffic - Peak Hour Traffic Volumes, Burnett Highway / McDonalds Road Intersection

Traffic Scenario	Burnett Highway S				McDonalds Road E				Burnett Highway N			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak												
Project “In Construction”	0	0	89	3	0	3	0	6	0	6	0	0
PM Peak												
Project “In Construction”	0	0	0	3	89	3	0	6	0	6	0	0

Table 16 Construction Traffic - Peak Hour Traffic Volumes, Bruce Highway / South Ulam Road Intersection

Traffic Scenario	Bruce Highway N				South Ulam Road W				Bruce Highway S			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak												
Project “In Construction”	0	0	15	1	0	1	0	0	0	0	0	0
PM Peak												
Project “In Construction”	0	0	0	1	15	1	0	0	0	0	0	0

5.0 Impact Assessment and Mitigation

Based on the information provided above, it was determined that the critical elements of the surrounding road network in terms of the potential impact of the proposed wind farm development were the identified road links forming the proposed transport routes for the site, and the key intersections of the Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road.

Further assessment of the impact of the Project on these elements is provided in the following sections.

5.1 With and Without Project Traffic Volumes

5.1.1 Road Link Volumes

5.1.1.1 Construction Phase

As identified above, the peak traffic generation from the proposed Mount Hopeful Wind Farm is expected to occur during the peak construction period for the Project, with the expected maximum traffic volumes from the site identified in **Table 14** above. Based on these volumes and the adopted distribution identified in **Section 4.3** above, the forecast pre project and "in construction" traffic volumes on the relevant sections of the road network were established, as summarised in **Table 17**.

Table 17 Forecast Pre Project and "In Construction" Traffic Volumes

Site ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		In Construction Daily Volumes	
	Start (km)	End (km)	2024		Gaz	A-Gaz	2024	
			Gaz	A-Gaz			Gaz	A-Gaz
Gladstone Port Access Road (183)								
61605	0.000	0.858	826	789	9	15	835	804
Macfarlane Road								
GRC	0.000	0.350	-	-	15	15	-	-
GRC	0.350	1.210	-	-	6	0	-	-
Hopper Road (John Bates Drive)								
GRC	0.000	0.790	-	-	6	0	-	-
Flinders Parade								
GRC	0.000	0.670	-	-	6	0	-	-
Lord Street								
GRC	0.000	0.515	-	-	6	0	-	-
Gladstone-Mount Larcom Road (181)								
60071	0.000	*0.175*	3,745	3,242	0	15	3,745	3,257
	0.175	*0.919*	3,745	3,242	9	0	3,754	3,242
	0.919	1.409	3,745	3,242	15	0	3,760	3,242
60073	1.409	3.258	3,211	3,344	15	0	3,226	3,344
61052	3.258	*3.830*	4,996	4,821	15	0	5,011	4,821
	3.830	4.625	4,996	4,821	3	0	4,999	4,821
60074	4.625	12.292	3,403	3,385	3	0	3,406	3,385
60076	12.292	32.140	1,571	1,573	3	0	1,574	1,573

Site ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		In Construction Daily Volumes	
	Start (km)	End (km)	2024		Gaz	A-Gaz	2024	
			Gaz	A-Gaz			Gaz	A-Gaz
Red Rover Road								
GRC	0.000	3.390	-	-	12	0	-	-
Don Young Drive								
GRC	0.000	2.280	-	-	12	0	-	-
Dawson Highway (46A Gladstone – Biloela)								
60061	0.000	1.498	5,395	5,941	3	18	5,398	5,959
61083	1.498	2.238	9,017	9,080	3	18	9,020	9,098
61000	2.238	3.130	11,376	12,372	3	18	11,379	12,390
60063	3.130	4.391	13,482	18,693	3	18	13,485	18,711
60064	4.391	5.179	10,740	10,375	3	18	10,743	10,393
60062	5.179	*7.129*	3,265	3,804	3	18	3,268	3,822
	7.129	10.296	3,265	3,804	15	18	3,280	3,822
60065	10.296	19.050	3,449	3,757	15	18	3,464	3,775
60066	19.050	21.650	4,096	4,009	15	18	4,111	4,027
60128	21.650	25.640	1,170	1,161	15	18	1,185	1,179
60005	25.640	*46.518*	622	624	15	18	637	642
	46.518	*101.008*	622	624	18	18	640	642
60067	*101.008*	113.728	646	676	15	18	661	694
61084	113.728	116.836	866	1,223	15	18	881	1,241
61085	116.836	119.836	3,215	3,378	15	18	3,230	3,396
Mount Alma Road								
GRC	0.000	16.970	-	-	3	0	-	-
Calliope Station Road								
GRC	0.000	2.600	-	-	3	0	-	-
Bruce Highway (10E Benaraby – Rockhampton)								
60006	11.445	*35.812*	2,829	2,704	6	0	2,835	2,704
	35.812	*45.420*	2,829	2,704	6	0	2,835	2,704
60023	*45.420*	85.308	3,016	3,017	0	0	3,016	3,017
61551	85.308	*86.183*	3,993	4,046	0	0	3,993	4,046
	86.183	*107.400*	3,993	4,046	11	11	4,004	4,057
	107.400	108.938	3,993	4,046	3	3	3,996	4,049
60130	108.938	114.388	3,382	3,387	3	3	3,385	3,390
60024	114.388	116.961	5,093	4,683	3	3	5,096	4,686
South Ulam Road								
RRC	0.000	16.773	104	111	26	26	130	137

Site ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		In Construction Daily Volumes	
	Start (km)	End (km)	2024		Gaz	A-Gaz	2024	
			Gaz	A-Gaz			Gaz	A-Gaz
Dawson Highway (46B Biloela – Banana)								
60068	0.000	0.650	2,818	3,071	22	25	2,840	3,096
61883	0.650	1.366	2,252	2,189	22	25	2,274	2,214
Leichhardt Highway (26A Westwood – Taroom)								
60001	0.000	0.115	389	395	0	0	389	395
	0.115	25.680	389	395	70	70	459	465
Burnett Highway (41E Biloela – Mt Morgan)								
61081	0.000	*27.290*	588	624	122	125	710	749
	27.290	35.401	588	624	125	125	713	749
60055	35.401	*56.310*	478	503	125	125	603	628
	56.310	71.730	478	503	70	70	548	573
Callide Haul Road Access								
BSC	0.000	0.400	-	-	3	0	-	-
Argoon-Kilburnie Road								
BSC	0.000	12.940	-	-	3	0	-	-
Jambin-Dakenba Road								
BSC	0.000	9.400	-	-	3	0	-	-
McDonalds Road								
BSC	0.000	5.720	26	26	195	195	221	221
Playfields Road								
BSC	0.000	5.080	26	26	195	195	221	221
	5.080	7.680	26	26	195	195	221	221

5.1.1.2 Operational Phase

As previously outlined, Neoen has advised that the predominant Project traffic volumes during the operations phase will be the movements to/from the site by the relatively small number of local workers (i.e. approximately 10 staff) who are expected to reside locally to the Project (likely Biloela). Further to this, it has been advised that heavy vehicle movements during the operational stage of the Project will be extremely low (1 per week) and limited to periodic maintenance activities or site deliveries.

Based on the above, the increase in traffic volumes on the road network as a result of the operations phase of the Project can be seen to be very minor. As such, the corresponding traffic impacts of the ongoing operation of the Mount Hopeful Wind Farm can be considered negligible, and no further traffic assessment of the relevant road links is deemed necessary.

5.1.2 Intersection Volumes

To establish the anticipated "in construction" traffic volumes at the key Burnett Highway / McDonalds Street and Bruce Highway / South Ulam Road intersections, the Project construction traffic volumes identified in **Section 4.3** were added to the estimated 2024 background or pre project traffic volumes as per

Table 4 in **Section 2.4.2** above. The resultant "in construction" traffic volumes at the intersections are summarised in **Table 18** and **Table 19** below.

Table 18 Forecast Traffic Volumes, Burnett Highway / McDonalds Road Intersection

Scenario	Burnett Highway S				McDonalds Road E				Burnett Highway N			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak												
2024 Background	32	19	1	0	3	0	3	0	1	0	30	20
Project Traffic	0	0	89	3	0	3	0	6	0	6	0	0
2024 "In Construction"	**32**	**19**	**90**	**3**	**3**	**3**	**3**	**6**	**1**	**6**	**30**	**20**
PM Peak												
2024 Background	32	19	3	0	1	0	1	0	3	0	25	16
Project Traffic	0	0	0	3	89	3	0	6	0	6	0	0
2024 "In Construction"	**32**	**19**	**3**	**3**	**90**	**3**	**1**	**6**	**3**	**6**	**25**	**16**

Table 19 Forecast Traffic Volumes, Bruce Highway / South Ulam Road Intersection

Scenario	Bruce Highway N				South Ulam Road W				Bruce Highway S			
	Through		Right		Left		Right		Left		Through	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak												
2024 Background	195	69	3	0	3	0	6	1	4	0	134	53
Project Traffic	0	0	15	1	0	1	0	0	0	0	0	0
2024 "In Construction"	**195**	**69**	**18**	**1**	**3**	**1**	**6**	**1**	**4**	**0**	**134**	**53**
PM Peak												
2024 Background	159	56	4	0	8	1	10	1	6	1	175	69
Project Traffic	0	0	0	1	15	1	0	0	0	0	0	0
2024 "In Construction"	**159**	**56**	**4**	**1**	**23**	**2**	**10**	**1**	**6**	**1**	**175**	**69**

5.2 Access and Frontage Impact Assessment and Mitigation

5.2.1 Critical Intersections

An assessment has been undertaken to establish the appropriate turn treatments at the identified intersections of Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections based on the forecasts in construction traffic volumes for the Project. This assessment is based on the turn treatment warrants identified in Figure 2.26(a) of Austroads *Guide to Traffic Management - Part 6: Intersections*, *Interchanges and Crossings* for higher speed highway intersections.

The forecast turning movement volumes at the proposed intersections during the peak project construction period identified in **Table 18** and **Table 19** above have been used as the basis of this assessment, with the results shown in **Figure 34** and **Figure 35**. Further details of the turn warrant assessment calculations are included for reference as **Appendix I**.

5.2.1.1 Burnett Highway / McDonalds Road

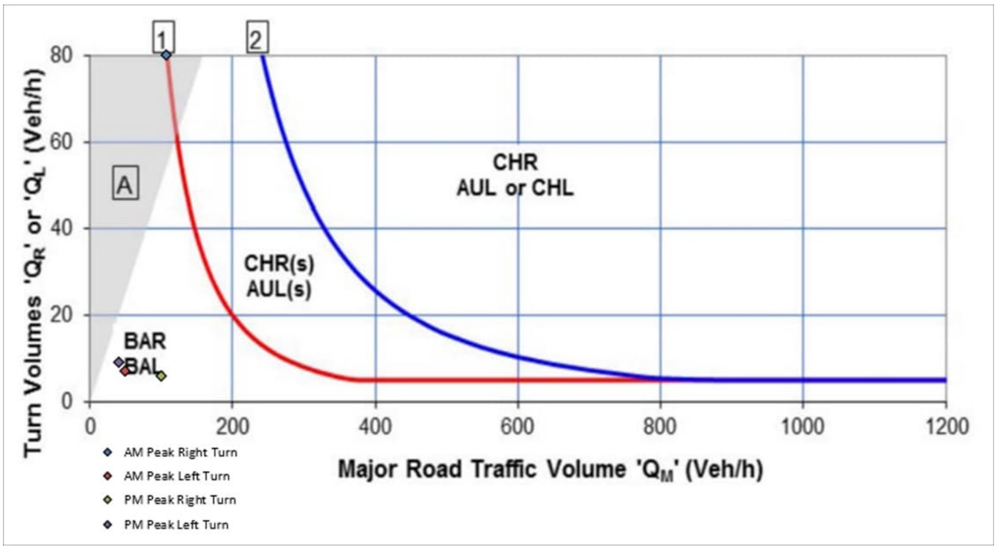


Figure 34 Burnett Highway / McDonalds Road Intersection Turn Warrants – 2024 "In Construction"

Based on Figure 34 above, it can be seen that the forecast peak hour "in construction" traffic volumes at the critical Burnett Highway / McDonalds intersection warrant the provision of basic right (BAR) and basic left (BAL) turn treatments at the intersection. Further to this, it is recommended that these required turn treatments at the intersection be designed in accordance with Figure 7.5 (2010) and Figure 8.2 (2019) of Austroads *Guide to Road Design Part 4A*.

In addition to the intersection upgrade works, further vegetation clearing is recommended to be undertaken on the eastern side of the highway to improve the available sight distances to/from McDonalds Road on the northern Burnett Highway approach. Following these clearing works, if suitable sight distances are still not available, further traffic management measures (such as advanced warning truck turning signage and potential speed reductions) should be implemented on the northern approach to the McDonalds Road intersection (for the duration of the construction period) to delineate the intersection for approaching motorists and highlight the potential for Project traffic (including heavy vehicles) turning onto/from the highway at McDonalds Road. These works are considered suitable based on the existing deficiency in sight distance at the intersection, and the temporary nature of the use of the intersection by Project traffic.

Finally, it is noted that temporary pavement works are expected to be required at the Burnett Highway / McDonalds Road intersection to provide additional hardstand areas at the intersections to accommodate the swept paths of required turbine component transport vehicle movements for the Project. The exact extents of these temporary works at the intersections will be confirmed as the turbine component and transport vehicle configurations are finalised in subsequent stages of the Project, however preliminary details can be seen in the Preliminary Transport Route Assessment report completed for the Project.

5.2.1.2 Bruce Highway / South Ulam Road

Figure 35 below indicates that the existing provision of channelised right turn (CHR) and auxiliary left turn (AULs) treatments at the key Bruce Highway / South Ulam Road will be more than adequate to accommodate the minor increases in peak hour volumes associated with the construction activities at the eastern substation area of the proposed Mount Hopeful Wind Farm.

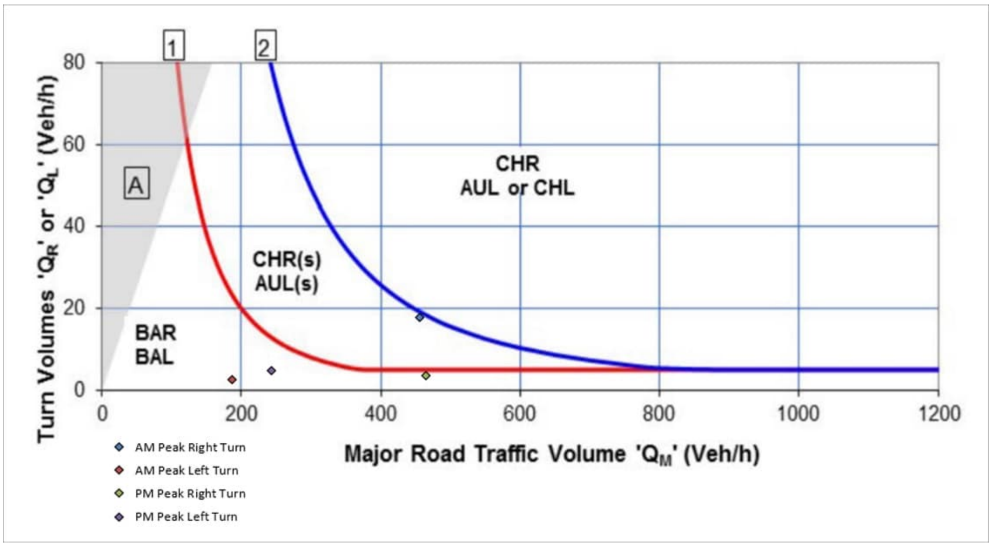


Figure 35 Bruce Highway / South Ulam Road Intersection Turn Warrants – 2024 "In Construction"

5.2.2 Site Accesses

Access to the main Project area is proposed to be provided via a continuation of Playfields Road, over a cattle grid structure (to be upgraded) at the south-western boundary of Lot 21 RN1345. Once upgraded to provide sufficient width to cater for two-way, two-lane traffic flow, this access point is expected to be suitable to cater for the expected Project traffic volumes associated with both the construction and operations phase of the Project.

In addition, access to this secondary site area is proposed to be provided via a new site access on the western side of South Ulam Road, approximately 16.8 km south of the Bruce Highway. As no access point currently exists at this location, it is proposed that a new site access intersection in accordance with the requirements for an access from a bitumen road (<300vpd) as per Standard Drawing CMDG-R-040 (Rural Road Access and Property Access Over Table Drains) be provided to service the expected Project traffic volumes.

5.3 Road Safety Impact Assessment and Mitigation

Based on the road environments (<8,000vpd) of the relevant sections of the surrounding road network, it was determined that the completion of a lower order road safety assessment would be sufficient to establish the existing and post development road safety risks relevant to the proposed Mount Hopeful Wind Farm, in accordance with the provisions of TMR's *Guide to Traffic Impact Assessment* (Section 9.3.3).

As part of this road safety assessment a site inspection of the existing traffic conditions at the proposed site access locations and the adjacent road network was undertaken by Andrew Barrie (RPEQ / TMR Senior Road Safety Auditor). To establish the level of risk regarding the existing and expected post development road safety considerations identified, a safety risk score matrix as shown in **Figure 36** was utilised, with the results of the road safety risk assessment summarised in **Table 20**.

Figure 9.3.2(a) – Safety risk score matrix

Potential likelihood	Potential consequence: Property only (1)	Minor injury (2)	Medical treatment (3)	Hospitalisation (4)	Fatality (5)
Almost certain (5)	M	M	H	H	H
Likely (4)	M	M	M	H	H
Moderate (3)	L	M	M	M	H
Unlikely (2)	L	L	M	M	M
Rare (1)	L	L	L	M	M

L: Low risk
M: Medium risk
H: High risk

Figure 36 Adopted Risk Score Matrix [Source: TMR GTIA]

Table 20 Project Road Safety Assessment – Mount Hopeful Wind Farm

		Existing / Pre-Development			In Construction				In Construction with Mitigation		
Risk Item		Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
1	Reduced carriageway width currently provided on unsealed sections of McDonalds Road (Ch. 0.000 to 5.720km) and Playfields Road (Ch. 5.080 to 24.420km) has the potential for increased conflict between vehicles travelling in opposing directions	Unlikely	Hospitalisation	Medium	Likely	Hospitalisation	High	Provision of carriageway widening works to provide an unsealed road configuration providing 6.5m pavement width in accordance with the requirements for a rural access road as per Table D1.27.05 of CMDG. This increased width is expected to be adequate for the temporary increase in traffic on the link during the Project construction phase and accommodate two-way traffic flow (including HVs).	Unlikely	Hospitalisation	Medium
2	The existing drainage (floodway/culvert) and cattle grid structures on McDonalds Road and Playfields Road provide reduced trafficable width only catering for two-way, one lane traffic flow, which has the potential for increased conflict between vehicles travelling in opposing directions.	Unlikely	Hospitalisation	Medium	Likely	Hospitalisation	High	Completion of works to upgrade all relevant drainage and cattle grid structures to provide adequate width (min. 6.0m) across floodway to enable two vehicles to pass clear of each other and accommodate the required vehicles paths of the OSOM turbine transport vehicles. Alternatively, diversions (including relevant gate infrastructure and fencing amendments) around the existing cattle grid structures may be provided were possible to reduce the requirement to upgrade the existing structures.	Unlikely	Hospitalisation	Medium

3	Reduced carriageway width currently provided on unsealed sections of Mount Alma Road (Ch. 0.000 to 16.970km) has the potential for increased conflict between vehicles travelling in opposing directions	Unlikely	Hospitalisation	Medium	Moderate	Hospitalisation	Medium	As the only Project traffic proposed to utilise the narrow sections of Mount Alma Road are the OSOM turbine tower transport vehicles, which will be travelling under escort and under a traffic management plan, the likelihood of conflict with opposing vehicles on Mount Alma Road is expected to be very low. With the existing carriageway width generally expected to be suitable to cater for the required Project vehicle movements.	Unlikely	Hospitalisation	Medium
4	The existing drainage (floodway/culvert) and cattle grid structures on Mount Alma Road and Calliope Station Road only provide reduced trafficable width only catering for two-way, one lane traffic flow across the structure. This has potential for increased conflict between vehicles travelling in opposing directions. Further to this, no control measures are currently provided to manage traffic flows at the structures.	Unlikely	Hospitalisation	Medium	Likely	Hospitalisation	High	Completion of works to upgrade all relevant drainage and cattle grid structures to provide adequate width (min. 6.0m) across floodway to enable two vehicles to pass clear of each other and accommodate the required vehicles paths of the OSOM turbine transport vehicles. Alternatively, diversions (including relevant gate infrastructure and fencing amendments) around the existing cattle grid structures may be provided were possible to reduce the requirement to upgrade the existing structures.	Unlikely	Hospitalisation	Medium
5	The Project is also expected to lead to an increase in turning vehicle movements at the existing Burnett Highway / McDonalds Road intersection. This increase in turning vehicles has the potential to lead to an increase in vehicle conflicts at the proposed intersection location.	Unlikely	Hospitalisation	Medium	Moderate / Likely	Hospitalisation	Medium / High	Proposed that works be undertaken as part of the Project to provide an upgraded intersection configuration BAR / BAL at the existing Burnett Highway / McDonalds Road intersection in accordance with the turn warrants assessment undertaken and the requirements of Austroads GRD Chapter 4a. It is also recommended that advisory “truck turning” signage be installed on the approaches to each of the identified intersections during the peak construction phase of the Project, to highlight to motorists the presence of the intersection and the potential for turning Project traffic (including heavy vehicles) to/from the side road.	Unlikely	Hospitalisation	Medium

6	The Project is also expected to lead to an increase in turning vehicle movements at the existing Bruce Highway / South Ulam Road intersection. This increase in turning vehicles has the potential to lead to an increase in vehicle conflicts at the proposed intersection location.	Unlikely	Medical Treatment	**Medium**	Unlikely	Medical Treatment	**Medium**	**No mitigation works required.** Detailed intersection analysis identified that existing intersection configuration (CHR / AULs) is adequate to cater for the proposed in construction traffic volumes at the intersection.	Unlikely	Medical Treatment	**Medium**

5.4 Intersection Delay Impact Assessment and Mitigation

SIDRA analysis was undertaken to establish the operational performance of the key Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections, with this analysis considering the AM and PM peak periods during the established peak construction period (2024) for the Project. A summary of the results of the completed intersection analysis is provided in **Table 21** and **Table 22** below, with detailed SIDRA output summaries included for reference in **Appendix E** and **Appendix F**.

Table 21 SIDRA Results – Burnett Highway / McDonalds Road Intersection

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Burnett Highway / McDonalds Road Intersection				
2024 Pre Development AM Peak	0.034	LOS A	0.4	0.1
2024 Pre Development PM Peak	0.035	LOS A	0.5	0.2
2024 “In Construction” AM Peak	0.090	LOS A	3.2	3.3
2024 “In Construction” PM Peak	0.073	LOS A	3.3	2.2

** LOS value identified is for worst movement at the intersection, not the overall intersection.

Table 22 SIDRA Results – Bruce Highway / South Ulam Road Intersection

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Bruce Highway / South Ulam Road				
2024 Pre Development AM Peak	0.165	LOS B	0.3	0.5
2024 Pre Development PM Peak	0.154	LOS B	0.6	0.9
2024 “In Construction” AM Peak	0.165	LOS B	0.6	0.6
2024 “In Construction” PM Peak	0.154	LOS B	0.8	1.4

** LOS value identified is for worst movement at the intersection, not the overall intersection.

The results above indicate that both the proposed BAR/BAL configuration of the Burnett Highway / McDonalds Road and the existing configuration (CHR/AULs) of the Bruce Highway / South Ulam Road intersections are expected to operate satisfactorily during the peak construction phase traffic scenarios identified of the Project, with all values for DOS, LOS, average delay and vehicle queue length being within acceptable limits of operation for priority-controlled intersections.

As such, it can be concluded that the proposed configuration (BAR /BAL) of the Burnett Highway / McDonalds Road and the existing configuration of the Bruce Highway / South Ulam Road can be considered appropriate to cater for the additional traffic volumes generated by the peak construction phase of the proposed Mount Hopeful Wind Farm.

Notwithstanding this, it is recommended that advisory "truck turning" signage be installed on the approaches to the Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections during the construction phase, to highlight to motorists the presence of the Project access locations and the potential for turning vehicles to/from the side roads.

5.5 Road Link Capacity Assessment and Mitigation

A summary of the assessment of the percentage increase in daily traffic volumes on the road network as a result of the critical construction phase Project traffic from the Mount Hopeful Wind Farm is shown in **Table 23** below, with further details of the calculations undertaken provided in **Appendix H**.

Table 23 Road Link Daily Traffic Volume Comparison (Construction Phase)

Site ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		% Increase in Daily Traffic Volume	
	Start (km)	End (km)	2024		Gaz	A-Gaz	2024	
			Gaz	A-Gaz			Gaz	A-Gaz
Gladstone Port Access Road (183)								
61605	0.000	0.858	826	789	9	15	1.09%	1.90%
Macfarlane Road								
GRC	0.000	0.350	-	-	15	15	-	-
GRC	0.350	1.210	-	-	6	0	-	-
Hopper Road (John Bates Drive)								
GRC	0.000	0.790	-	-	6	0	-	-
Flinders Parade								
GRC	0.000	0.670	-	-	6	0	-	-
Lord Street								
GRC	0.000	0.515	-	-	6	0	-	-
Gladstone-Mount Larcom Road (181)								
60071	0.000	*0.175*	3,745	3,242	0	15	0.00%	0.46%
	0.175	*0.919*	3,745	3,242	9	0	0.24%	0.00%
	0.919	1.409	3,745	3,242	15	0	0.40%	0.00%
60073	1.409	3.258	3,211	3,344	15	0	0.47%	0.00%
61052	3.258	*3.830*	4,996	4,821	15	0	0.30%	0.00%
	3.830	4.625	4,996	4,821	3	0	0.06%	0.00%
60074	4.625	12.292	3,403	3,385	3	0	0.09%	0.00%
60076	12.292	32.140	1,571	1,573	3	0	0.19%	0.00%
Red Rover Road								
GRC	0.000	3.390	-	-	12	0	-	-

Site ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		% Increase in Daily Traffic Volume	
	Start (km)	End (km)	2024		Gaz	A-Gaz	2024	
			Gaz	A-Gaz			Gaz	A-Gaz
Don Young Drive								
GRC	0.000	2.280	-	-	12	0	-	-
Dawson Highway (46A Gladstone – Biloela)								
60061	0.000	1.498	5,395	5,941	3	18	0.06%	0.30%
61083	1.498	2.238	9,017	9,080	3	18	0.03%	0.20%
61000	2.238	3.130	11,376	12,372	3	18	0.03%	0.15%
60063	3.130	4.391	13,482	18,693	3	18	0.02%	0.10%
60064	4.391	5.179	10,740	10,375	3	18	0.03%	0.17%
60062	5.179	*7.129*	3,265	3,804	3	18	0.09%	0.47%
	7.129	10.296	3,265	3,804	15	18	0.46%	0.47%
60065	10.296	19.050	3,449	3,757	15	18	0.43%	0.48%
60066	19.050	21.650	4,096	4,009	15	18	0.37%	0.45%
60128	21.650	25.640	1,170	1,161	15	18	1.28%	1.55%
60005	25.640	*46.518*	622	624	15	18	2.41%	2.88%
	46.518	*101.008*	622	624	18	18	2.89%	2.88%
60067	*101.008*	113.728	646	676	15	18	2.32%	2.66%
61084	113.728	116.836	866	1,223	15	18	1.73%	1.47%
61085	116.836	119.836	3,215	3,378	15	18	0.47%	0.53%
Mount Alma Road								
GRC	0.000	16.970	-	-	3	0	-	-
Calliope Station Road								
GRC	0.000	2.600	-	-	3	0	-	-
Bruce Highway (10E Benaraby – Rockhampton)								
60006	11.445	*35.812*	2,829	2,704	6	0	0.21%	0.00%
	35.812	*45.420*	2,829	2,704	6	0	0.21%	0.00%
60023	*45.420*	85.308	3,016	3,017	0	0	0.00%	0.00%
61551	85.308	*86.183*	3,993	4,046	0	0	0.00%	0.00%
	86.183	*107.400*	3,993	4,046	11	11	0.28%	0.27%
	107.400	108.938	3,993	4,046	3	3	0.08%	0.07%
60130	108.938	114.388	3,382	3,387	3	3	0.09%	0.09%
60024	114.388	116.961	5,093	4,683	3	3	0.06%	0.06%
South Ulam Road								
RRC	0.000	16.773	104	111	26	26	24.99%	23.37%

Site ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		% Increase in Daily Traffic Volume	
	Start (km)	End (km)	2024		Gaz	A-Gaz	2024	
			Gaz	A-Gaz			Gaz	A-Gaz
Dawson Highway (46B Biloela – Banana)								
60068	0.000	0.650	2,818	3,071	22	25	0.78%	0.81%
61883	0.650	1.366	2,252	2,189	22	25	0.98%	1.14%
Leichhardt Highway (26A Westwood – Taroom)								
60001	0.000	0.115	389	395	0	0	0.00%	0.00%
	0.115	25.680	389	395	70	70	18.00%	17.71%
Burnett Highway (41E Biloela – Mt Morgan)								
61081	0.000	*27.290*	588	624	122	125	20.77%	20.02%
	27.290	35.401	588	624	125	125	21.28%	20.02%
60055	35.401	*56.310*	478	503	125	125	26.14%	24.83%
	56.310	71.730	478	503	70	70	14.64%	13.90%
Callide Haul Road Access								
BSC	0.000	0.400	-	-	3	0	-	-
Argoon-Kilburnie Road								
BSC	0.000	12.940	-	-	3	0	-	-
Jambin-Dakenba Road								
BSC	0.000	9.400	-	-	3	0	-	-
McDonalds Road								
BSC	0.000	5.720	26	26	195	195	757.06%	757.06%
Playfields Road								
BSC	0.000	5.080	26	26	195	195	757.06%	757.06%
	5.080	7.680	26	26	195	195	757.06%	757.06%

As can be seen by the results in **Table 23** above, the addition of the expected construction phase traffic volumes from the proposed Mount Hopeful Wind Farm is shown to have a minimal impact on the majority of identified sections of the state-controlled road network.

The results did however reveal that a limited number of sections of the state-controlled road network on the Project transport routes were anticipated to see an increase in daily traffic volumes of more than 5% due to the peak construction traffic. These included the section of the Leichhardt Highway from the quarry operations near Westwood to the Burnett Highway, and all identified sections of the Burnett Highway (Biloela to Dululu).

Notwithstanding this, the maximum increase in traffic volumes on the section of the Leichhardt Highway during the temporary peak construction period is only in the order of 140vpd (70vpd each direction), which only raises the overall daily volume to approximately 924vpd (459vpd gazettal / 465vpd against-gazettal). While the maximum increase in daily volumes on the Burnett Highway is in the order of 250vpd (125vpd each direction), equating to “in construction” link volumes of between 1,120vpd-1,462vpd. From this it can be seen that although the increase in traffic volumes on the relevant Leichhardt Highway and Burnett Highway link was greater than 5%, the resultant "in construction" volumes are still well within the capacity of a two-lane rural highway (typically 12,000-15,000 vpd).

In regard to the local government controlled links, the results in Table 23 also identified significant (>5%) increases in traffic volumes for the relevant lengths of South Ulam Road (RRC) and McDonalds Road and Playfields Road (BSC). The primary reason for the large percentage increases identified on these roads is the relatively low background traffic volumes on these links (South Ulam Road – 215vpd / McDonalds Road & Playfields Road – approx. 50vpd), with the expected maximum increase in traffic volumes due to the peak construction phase of the Project in the order of 52vpd (26vpd inbound / 26vpd outbound) on South Ulam Road (to/from eastern substation area) and up to 390vpd (195vpd inbound / 195vpd outbound) on McDonalds Road and Playfields Road (to/from main Project site area).

Further to this, it is noted that the expected peak increase in traffic volumes on these links are only anticipated to be generated for a short period, in the order of 6-9 months, with no further traffic expected on South Ulam Road and reduced volumes anticipated on McDonalds Road and Playfields Road for the remainder of the overall construction period.

Looking closer at the "impacted" sections of local government controlled road network, the total peak "in construction" volumes will be in the order of 267vpd on South Ulam Road and approximately 442vpd (158vpd both directions) on the unsealed sections of McDonald Street and Playfields Road.

Based on these forecast volumes and the temporary nature of the increase in traffic volumes due to construction, it is expected that the existing configuration of South Ulam Road will be adequate to cater for the temporary increase in Project traffic, while upgrade works to provide a 6.5m road pavement (in accordance with the BSC requirements for a rural access road as per Table D1.27.05 of CMDG Geometric Road Design) will be required on the unsealed sections of McDonald Street and Playfields Road to cater for the additional traffic volumes generated by the proposed Mount Hopeful Wind Farm.

It is noted that the provision of upgrade works in accordance with the requirements of a rural access road are deemed acceptable due to the temporary nature of the increase in traffic from the construction phase of the Project, with volumes on both McDonalds Road and Playfields Road during the subsequent operations phase anticipated to be significantly reduced (in the order of 70vpd – 35vpd in each direction).

Finally, while no percentage increases have been calculated, it is also noted that the turbine component transport operations associated with the Project will also lead to an increase in traffic volumes on a number of additional local government controlled links including:

- Macfarlane Road, Hopper Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road (GRC).
- Callide Mine Haul Road Access, Argoon-Kilburnie Road and Jambin-Dakenba Road (BSC).

Based on the current configurations of these links, and the fact that the increase in traffic volumes on the links will be limited to OSOM turbine transport movements travelling under escort, it is anticipated that in general the current configuration and capacity of the majority of these links will be suitable to cater for the temporary increase in Project traffic (assuming the localised works identified in the Preliminary Transport Route Assessment are undertaken).

Of the local government road links identified above, only the Callide Mine Haul Road Access has been identified to require upgrade works to provide suitable road conditions for the OSOM turbine component (tower section) transport movements. While the existing width (approx. 6m) of this link was considered suitable, the existing road pavement/surface was observed to be heavily deteriorated and deemed to require rehabilitation.

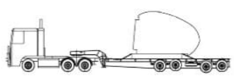
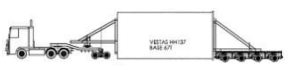
5.6 Pavement Impact Assessment and Mitigation

5.6.1 Construction Phase

The assessment of potential pavement impacts during the construction phase of the Project involved the comparison of the pavement loadings (ESA) associated with the background traffic volumes on the road links to the ESAs estimated to be generated by the heavy vehicle movements across the proposed construction period. Table 24 shows the assumed heavy vehicle classes that are expected to be used throughout the construction phase of the Project and the average loaded and unloaded ESAs/HV values for each configuration.

It is noted that the values for the OSOM turbine component transport movements have been adopted from information provided from a previously assessed wind farm development and provide indicative component loading information which will need to be reassessed in subsequent stages of the Project when the turbine component and transport vehicle configurations have been confirmed.

Table 24 Assumed Vehicle Class and ESA/HV Values

Vehicle Class	Vehicle Configuration	Task	Average Loaded ESAs / HV	Average Unloaded ESAs / HV
4 Axle Rigid (Concrete Truck)		Concrete transport	4.13	0.36
6 Axle Semi-trailer (GML)		General material and equipment transport	5.54	1.68
Truck and 4 Axle Dog (GML)		General material and equipment transport	6.15	1.64
Prime mover with dolly & extendable blade trailer		Transport of blade components, 3 per turbine	11.47	7.95
Prime mover with platform trailer		Transport of turbine nacelle component	24.41	4.88
Prime mover with platform trailer		Transport of turbine drive train component	22.78	4.98
Prime mover with low loader		Transport of turbine hub component	12.38	4.77
Prime mover with bookend trailer Prime Mover with dolly & jinker trailer	 	Transport of tower sections (7 per turbine)	20.86	2.70

A summary of the comparison of the background and Project generated pavement loadings is provided in Table 25, with further details of the Project pavement loading calculations undertaken included for reference in Appendix J.

Table 25 Project Pavement Loading Comparison

Site ID	Road Segment		Background ESA		Project-Generated ESA		% Increase in ESAs	
	Start (km)	End (km)	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
Gladstone Port Access Road (183)								
61605	0.000	0.858	588,716	536,391	4,498	3,694	0.76%	0.69%
Macfarlane Road								
GRC	0.000	0.350	-	-	3,694	4,498	-	-
GRC	0.350	1.210	-	-	10,737	1,498	-	-
Hopper Road (John Bates Drive)								
GRC	0.000	0.790	-	-	10,737	1,498	-	-
Flinders Parade								
GRC	0.000	0.670	-	-	10,737	1,498	-	-
Lord Street								
GRC	0.000	0.515	-	-	10,737	1,498	-	-
Gladstone-Mount Larcom Road (181)								
60071	0.000	*0.175*	1,485,074	1,058,111	3,694	0	0.25%	0.00%
	0.175	*0.919*	1,485,074	1,058,111	4,498	0	0.30%	0.00%
	0.919	1.409	1,485,074	1,058,111	15,235	0	1.03%	0.00%
60073	1.409	3.258	1,104,978	1,157,083	15,235	0	1.38%	0.00%
61052	3.258	*3.830*	1,232,301	1,456,755	15,235	0	1.24%	0.00%
	3.830	4.625	1,232,301	1,456,755	2,283	0	0.19%	0.00%
60074	4.625	12.292	986,722	1,156,911	2,283	0	0.23%	0.00%
60076	12.292	32.140	736,411	1,018,354	2,283	0	0.31%	0.00%
Red Rover Road								
GRC	0.000	3.390	-	-	12,952	0	-	-
Don Young Drive								
GRC	0.000	2.280	-	-	12,952	0	-	-
Dawson Highway (46A Gladstone – Biloela)								
60061	0.000	1.498	569,520	842,225	2,897	5,803	0.51%	0.69%
61083	1.498	2.238	951,864	1,287,101	2,897	5,803	0.30%	0.45%
61000	2.238	3.130	1,149,814	1,621,348	2,897	5,803	0.25%	0.36%
60063	3.130	4.391	2,093,091	3,044,168	2,897	5,803	0.14%	0.19%
60064	4.391	5.179	2,249,253	2,019,371	2,897	5,803	0.13%	0.29%
60062	5.179	*7.129*	534,186	777,193	15,849	5,803	2.97%	0.75%
	7.129	10.296	534,186	777,193	15,849	5,803	2.97%	0.75%
60065	10.296	19.050	564,317	767,566	15,849	5,803	2.81%	0.76%
60066	19.050	21.650	1,775,138	10,231,707	12,875	5,803	0.73%	0.06%

Site ID	Road Segment		Background ESA		Project-Generated ESA		% Increase in ESAs	
	Start (km)	End (km)	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
60128	21.650	25.640	506,996	2,964,190	12,875	5,803	2.54%	0.20%
60005	25.640	*46.518*	537,863	378,057	12,875	5,803	2.39%	1.53%
	46.518	*101.008*	537,863	378,057	18,131	5,803	3.37%	1.53%
60067	*101.008*	113.728	286,453	342,574	12,875	5,803	4.49%	1.69%
61084	113.728	116.836	402,311	343,295	12,875	5,803	3.20%	1.69%
61085	116.836	119.836	844,036	661,848	12,875	5,803	1.53%	0.88%
Mount Alma Road								
GRC	0.000	16.970	-	-	5,257	0	-	-
Calliope River Road								
GRC	0.000	2.600	-	-	5,257	0	-	-
Bruce Highway (10E Benaraby – Rockhampton)								
60006	11.445	*35.812*	1,448,402	1,298,181	5,257	2,283	0.36%	0.18%
	35.812	*45.420*	1,448,402	1,298,181	5,257	2,283	0.36%	0.18%
60023	*45.420*	85.308	1,268,794	1,394,525	0	0	0.00%	0.00%
61551	85.308	*86.183*	2,194,689	2,052,540	0	0	0.00%	0.00%
	86.183	*107.400*	2,194,689	2,052,540	1,047	1,946	0.05%	0.09%
	107.400	108.938	2,194,689	2,052,540	143	677	0.01%	0.03%
60130	108.938	114.388	1,637,438	1,778,815	143	677	0.01%	0.04%
60024	114.388	116.961	1,528,024	1,909,511	143	677	0.01%	0.04%
South Ulam Road								
RRC	0.000	16.773	22,283	23,827	2,393	600	10.74%	2.52%
Dawson Highway (46B Biloela – Banana)								
60068	0.000	0.650	432,017	852,926	19,258	7,739	4.46%	0.91%
61883	0.650	1.366	402,717	751,474	19,258	7,739	4.78%	1.03%
Leichhardt Highway (26A Westwood – Taroom)								
60001	0.000	0.115	272,296	276,796	0	0	0.00%	0.00%
	0.115	25.680	272,296	276,796	87,361	23,296	32.08%	8.42%
Burnett Highway (41E Biloela – Mt Morgan)								
61081	0.000	*27.290*	472,655	319,637	46,936	16,132	9.93%	5.05%
	27.290	35.401	472,655	319,637	46,936	16,132	9.93%	5.05%
60055	35.401	*56.310*	375,810	427,650	46,936	16,132	12.49%	3.77%
	56.310	71.730	375,810	427,650	23,296	87,361	6.20%	20.43%
Callide Haul Road Access								
BSC	0.000	0.400	-	-	5,257	0	-	-
Argoon-Kilburnie Road								

Site ID	Road Segment		Background ESA		Project-Generated ESA		% Increase in ESAs	
	Start (km)	End (km)	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
BSC	0.000	12.940	-	-	5,257	0	-	-
Jambin-Dakenba Road								
BSC	0.000	9.400	-	-	5,257	0	-	-
McDonalds Road								
BSC	0.000	5.720	5,516	5,516	137,803	38,897	2,498.45%	705.23%
Playfields Road								
BSC	0.000	5.080	5,516	5,516	137,803	38,897	2,498.45%	705.23%
	5.080	7.680	5,516	5,516	137,803	38,897	2,498.45%	705.23%

The results in **Table 25** above indicate that the heavy vehicle movements associated with the development of the proposed Mount Hopeful Wind Farm development are expected to lead to negligible increases in pavement loadings on the majority of the identified sections of the state-controlled road network, with calculated values of loading increase generally below the typical 5% increase trigger threshold. The results did however identify higher increases on the following sections of the state-controlled road network:

- Leichhardt Highway (26A) – TMR Ch. 0.115km – 25.680km (gazettal direction).
- Burnett Highway (41E) – TMR Ch. 0.000km – 71.730km (gazettal and against-gazettal directions).

It is therefore expected that pavement maintenance contributions will be required to be provided to TMR to mitigate/offset the expected pavement impacts of the Project on these sections of the state-controlled road network. The exact amount of these contributions has not been calculated as part of this assessment, due to the preliminary nature of the Project details at this initial planning stage of the proposed Mount Hopeful Wind Farm. Therefore, further detailed calculations to confirm the required pavement maintenance contribution will be undertaken in subsequent stages of the Project once the site configuration, transport vehicle configurations and construction phase details (quantities, material sources etc.) are finalised.

It is also noted that the increases in loading on the identified section of the Leichhardt Highway (TMR Ch. 0.115km – 25.680km) are primarily due to the expected road gravel and aggregate transport movements for the Project from the currently proposed quarry source. As such, the mitigation of the impacts of these movements on the identified sections of the state-controlled network are expected to fall on the quarry operator and be covered by their typical maintenance contribution (c/tonne) to TMR as part of the general operation of the quarry.

In addition to the state-controlled road network, the results above indicated that the additional vehicle movements from the proposed construction phase of the Mount Hopeful Wind Farm will also lead to a significant (>5%) increase in pavement loadings on the RRC controlled South Ulam Road (gazettal direction) and the BSC controlled links of McDonalds Road and Playfields Road.

Further to this, while no percentage increase could be established due to the lack of current traffic data for the identified GRC controlled links of Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road and the BSC links of Callide Mine Haul Road, Argoon-Kilburnie Road and Jambin-Dakenba Road it is anticipated that the use of these roads for proposed turbine component transport operations for the Project will also lead to an increase in pavement loadings.

Based on this, it is recommended that the proponent enter into an Infrastructure Agreement with RRC, GRC and BSC regarding the required mitigation works on the identified links to offset the calculated pavement impacts of the Project.

It also recommended that this infrastructure agreement include reference the requirement for pre and post dilapidation inspections to be undertaken on the relevant sections of Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road (GRC), South Ulam Road (RRC) and Callide Mine Haul Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road by representatives of the proponent and the appropriate Council (GRC / RRC / BSC).

These inspections are required to identify and document the current condition of the roads (pre construction) and establish the required maintenance and/or rehabilitation works (to be completed by the proponent at no cost to Council) deemed necessary to reinstate the roads to their documented condition prior to the introduction of Project traffic (post construction).

5.6.2 Operations Phase

As identified above, it is understood that the operational phase of the Project will only generate relatively low traffic volumes on the network (approx. 10 vehicles to/from site daily), with negligible heavy vehicle movements (approximately 1 HV per week). Therefore, it can be considered that this phase of the Project will have a negligible impact to the operation (and pavement loadings) of all relevant road links.

5.7 Transport Infrastructure Impact Assessment and Mitigation

5.7.1 Drainage and Cattle Grid Structures

As previously identified, a number of the existing drainage (floodway/culvert) and cattle grid structures on Mount Alma Road, Calliope Station Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road currently only provide sufficient trafficable width for two-lane, one-way operation. As such it is recommended that upgrade works be provided to widen the structure to a minimum of 6m to enable two-way, two-lane flow across the structure. Alternatively, diversions (including relevant gate infrastructure and fencing amendments) around the existing cattle grid structures may be provided were possible to reduce the requirement to upgrade the existing structures.

Additional works are also expected to be required at several locations to accommodate the swept path and loading of the OSOM turbine component transport vehicles, with localised works to amend the vertical geometry of the roads anticipated to be required at up to four locations along the transport routes to accommodate the turbine blade transport vehicles.

The exact configuration of these upgrade works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed. A preliminary summary of the required upgrade works provided in Table 26 below, with further details of each structure provided in Preliminary Transport Route Assessment also completed for the Project.

Table 26 Preliminary Drainage and Cattle Grid Structure Upgrade Requirements

Road Section	Approx. Chainage	Structure Type	Expected Works
Mount Alma Rd	2.604km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	4.571km	Culverts	Culvert load rating and width upgrade.
	4.920km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	5.640km	Floodway	Floodway load rating and width upgrade.
	7.093km	Floodway	Floodway load rating and width upgrade.
	8.729km	Floodway	Floodway load rating and width upgrade.
	14.340km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	15.060km	Floodway	Floodway load rating and width upgrade.
	0.200km	Culverts	Culvert load rating and width upgrade.

Calliope Station Rd	0.315km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	0.685km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	1.900km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
Argoon-Kilburnie Rd	9.846km	Floodway	Floodway load rating and width upgrade.
Jambin-Dakenba Rd	6.973km	Floodway	Floodway load rating and width upgrade.
McDonalds Rd	3.526km	Vertical Dip	Vertical geometry through structure to be flattened for blade transport.
Playfields Rd	4.002km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	5.225km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	5.610km	Floodway / Vertical Dip	Floodway load rating and width upgrade. Vertical geometry through structure to be flattened for blade transport.
	6.392km	Floodway	Floodway load rating and width upgrade.
	6.663km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	7.263km	Floodway	Floodway load rating and width upgrade.
	8.075km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	8.530km	Floodway	Floodway load rating and width upgrade.
	8.635km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	10.372km	Floodway	Floodway load rating and width upgrade.
	10.699km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	12.866km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	14.085km	Floodway	Floodway load rating and width upgrade.
	15.587km	Floodway	Floodway load rating and width upgrade.
	15.770km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	18.860km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	20.226km	Floodway / Vertical Dip	Floodway load rating and width upgrade. Vertical geometry through structure to be flattened for blade transport.
	21.454km	Floodway / Vertical Dip	Floodway load rating and width upgrade. Vertical geometry through structure to be flattened for blade transport.
	21.510km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.
	24.420km	Cattle Grid	Cattle grid load rating and width upgrade or diversion.

5.7.2 Rail Crossings

As previously identified, the two open level crossing of the Moura System rail line on Jambin-Dakenba Road is located approximately 6km southeast from the intersection of Jambin-Dakenba Road with the Burnett Highway. Further to this, it is noted that the sight distance along the rail lines in both directions from a vehicle propped on both Jambin-Dakenba Road approaches are generally unrestricted. As Jambin-Dakenba Road is only proposed to be utilised as route for the over height tower section turbine components, the additional traffic on the link and therefore over the rail crossings is very minor (average of 3vpd), with minimal queuing expected to occur on the approaches to the crossings.

In addition, the required OSOM tower section transport vehicles are proposed to travel under the control of escort vehicles which will further reduce the potential for vehicle conflict at the crossing locations. Finally, it is also recommended that the transport vehicle movements over the crossings be scheduled with the rail authority responsible for the operation of the Moura System rail lines, to reduce the potential for conflict with train movements at the crossings.

Notwithstanding these management measures, it is also noted that the use of the rail crossing by Project traffic will be limited to the turbine component transport period (12 months), with no further use of the crossing during the remainder of the overall construction period or the operations phase of the Project.

As such, permanent upgrade works to the crossing (to provide additional permanent controls i.e. signals or boom gates) are not considered necessary or reasonable to be conditioned as part of this Project.

Notwithstanding this, it is recommended that further negotiation be undertaken with Queensland Rail to establish the traffic management requirements at the rail crossings during the proposed transport vehicle movement, noting that wayleave and QR Over dimensional Road Loads applications are expected to be required for both crossings.

It is therefore considered that based on the provision of agreed traffic management measures during the limited turbine transport phase, that the proposed Mount Hopeful Wind Farm will only have a minor impact on the operation of the existing open level crossings of Jambin-Dakenba Road and that no permanent upgrade works to the existing crossing infrastructure is required.

6.0 Conclusions and Recommendations

6.1 Summary of Impacts and Mitigation Measures Proposed

6.1.1 Traffic Impacts

Based on the identified increase in traffic numbers anticipated as a result of the construction and operational phases of the proposed development, it is anticipated that the Project will have a minimal impact on the traffic operation of the surrounding road network, from a capacity perspective. Notwithstanding this, the following mitigation treatments are recommended to maximise vehicle safety on the sections of the road network utilised by Project traffic:

- Completion of works along the identified transport route to accommodate the swept paths of the OSOM turbine component transport vehicles, including the relocation of signage and road lighting infrastructure and construction of required temporary hardstand pavement areas as identified in the Preliminary Transport Route Assessment for the Project. It is noted that the exact extents and scope of these works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed.
- Upgrade of the existing Burnett Highway / McDonalds Road intersection to provide basic left (BAL) and basic right (BAR) turn treatments on the Capricorn Highway approaches, as per Austroads standards. Upgrade to also include the completion of vegetation clearing works on the eastern side of the northern approach to the intersection to improve sight distances to/from McDonalds Road and implementation of traffic management measures on the northern Burnett Highway approach during temporary Project construction phase (22-28 months).
- Installation of advisory "truck turning" signage be installed on the approaches to the Burnett Highway / McDonalds Road and Bruce Highway / South Ulam Road intersections during the construction phase, to highlight to motorists the presence of the Project access locations and the potential for turning vehicles to/from the side roads.
- Upgrade of the existing unsealed sections of McDonalds Road (Ch. 0.000 to 5.720km) and Playfields Road (Ch. 5.080 to Ch. 24.420km) to provide a minimum 6.5m (unsealed) road pavement width in accordance with the BSC requirements for a rural access road.
- Construct new site access from South Ulam Road (LHS approx. Ch. 16.800km) to cater for Project volumes associated with the proposed eastern substation area. The new site access is to be provided in accordance with the requirements for a bitumen road (<300vpd) as per Standard Drawing CMDG-R-040 (Rural Road Access and Property Access Over Table Drains).
- Complete suitable road rehabilitation works (pavement / road surface) to the relevant 400m section of the Callide Mine Haul Road Access (between Dawson Highway and Argoon-Kilburnie Road) to provide appropriate road conditions to cater for the OSOM turbine component transport movements.
- Upgrade of the existing drainage (floodway / culvert) and cattle grid structures on Mount Alma Road, Calliope Station Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road respectively to provide adequate carriageway width and suitable vertical geometry for the proposed turbine component transport vehicle configurations associated with the Project. It is noted that the exact configuration of these upgrade works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed.

It is also noted that Neoen is currently considering a delivery methodology for the Project which would include the provision of an on-site workers accommodation camp for the Project, which would be expected to significantly reduce the daily staff volumes between Biloela and the subject site, and therefore the traffic volumes on the relevant sections of the Burnett Highway, McDonalds Road and Playfields Road.

6.1.2 Pavement Impacts

In addition to the traffic assessments completed, a preliminary desktop pavement impact assessment of the relevant road network was also undertaken for the construction phase of the Project. The results of the assessment indicate that the heavy vehicle movements associated with the development of the proposed Mount Hopeful Wind Farm are expected to lead to negligible increases in pavement loadings on the majority of the identified sections of the state-controlled road network, with calculated values of loading increase generally below the typical 5% increase trigger threshold. The results did however identify higher increases on the following sections of the state-controlled road network:

- Leichhardt Highway (26A) – TMR Ch. 0.115km – 25.680km (gazettal direction).
- Burnett Highway (41E) – TMR Ch. 0.000km – 71.730km (gazettal and against-gazettal directions).

It is therefore expected that pavement maintenance contributions will be required to be provided to TMR to mitigate/offset the expected pavement impacts of the Project on these sections of the state-controlled road network. The exact amount of these contributions has not been calculated as part of this assessment, due to the preliminary nature of the Project details at this initial planning stage of the proposed Mount Hopeful Wind Farm. Therefore, further detailed calculations to confirm the required pavement maintenance contribution will be undertaken in subsequent stages of the Project once the site configuration, transport vehicle configurations and construction phase details (quantities, material sources etc.) are finalised.

It is also noted that the increases in loading on the identified section of the Leichhardt Highway are primarily due to the expected road gravel and aggregate transport movements for the Project from the currently proposed quarry source. As such, the mitigation of the impacts of these movements on the identified sections of the state-controlled network are expected to fall on the quarry operator and be covered by their typical maintenance contribution (c/tonne) to TMR as part of the general operation of the quarry.

In addition to the state-controlled road network, the results above indicated that the additional vehicle movements from the proposed construction phase of the Mount Hopeful Wind Farm will also lead to a significant (>5%) increase in pavement loadings on the RRC controlled South Ulam Road (gazettal direction) and the BSC controlled links of McDonalds Road and Playfields Road. Further to this, while no percentage increase could be established due to the lack of current traffic data for the identified GRC controlled links of Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road and the BSC links of Callide Mine Haul Road, Argoon-Kilburnie Road and Jambin-Dakenba Road it is anticipated that the use of these roads as part of the proposed turbine component transport operations for the Project will also lead to an increase in pavement loadings.

Based on this, it is recommended that the proponent enter into an Infrastructure Agreement with RRC, GRC and BSC regarding the required mitigation works on the identified links to offset the calculated pavement impacts of the Project. It also recommended that this infrastructure agreement include reference the requirement for pre and post dilapidation inspections to be undertaken on the relevant sections of Macfarlane Road, Flinders Parade, Lord Street, Red Rover Road, Don Young Drive, Mount Alma Road and Calliope Station Road (GRC), South Ulam Road (RRC) and Callide Mine Haul Road, Argoon-Kilburnie Road, Jambin-Dakenba Road, McDonalds Road and Playfields Road by representatives of the proponent and the appropriate Council (GRC / RRC / BSC). These inspections are required to identify and document the current condition of the roads (pre construction) and establish the required maintenance and/or rehabilitation works (to be completed by the proponent at no cost to Council) deemed necessary to reinstate the roads to their documented condition prior to the introduction of Project traffic (post construction).

6.1.3 Recommendations

In light of the information provided above, it can be considered that conditional to the provision of the identified upgrade works and the proponent entering into a suitable infrastructure agreement with both GRC, BSC and RRC to mitigate the construction phase pavement impacts to the relevant sections of the transport network, that the construction and operational phases of the proposed Mount Hopeful Wind Farm will have minimal impact on the relevant sections of the local government and state controlled road networks.

Therefore, it is recommended that the Project be approved from a traffic engineering viewpoint as, in combination with the Preliminary Route Assessment, the Project demonstrates compliance with PO6 and PO13 of State Code 23.

6.2 Certification Statement and Authorisation

A copy of the RPEQ certification and authorisation statement covering this assessment of the proposed Mount Hopeful Wind Farm is included for reference as **Appendix K**.

Appendix A – Pre-Lodgement Meeting Minutes

Queensland Government

Queensland Treasury

Our reference: 2008-18071 SPL
Your reference: 7053

27 August 2020

Neoen Australia Pty Ltd
c/- Umwelt (Australia) Pty Ltd
Level 7, 500 Queen Street
BRISBANE QLD 4000
rbrozovich@umwelt.com.au

Attention: Renee Brozovich

Dear Sir/Madam,

Pre-lodgement meeting record

This pre-lodgement record provides a summary of the matters discussed at the pre-lodgement meeting in addition to providing further advice prepared subsequent to the meeting. This record provides advice regarding the likely major issues relevant to the development proposal to assist in the timely processing of a development application. While this advice is provided in good faith, if the proposal is changed from that which was discussed with the State Assessment and Referral Agency (SARA) during the pre-application meeting, this advice is not binding.

Reference information

SARA role:	Assessment manager
SARA jurisdiction:	Planning Regulation 2017 Schedule 10, part 3, div 2, item 5 — operational work that is the clearing of native vegetation Schedule 10, part 21, div 1, item 35 — material change of use for a wind farm
Pre-lodgement meeting date:	Monday 17 August 2020

Meeting attendees:

Name	Position	Organisation
Renee Brozovich	Senior Environmental Planner (Consultant applicant)	Umwelt (Australia) Pty Ltd
Mark Herod	National Renewables Lead	Umwelt (Australia) Pty Ltd
David Gatfield	Principal Ecologist	Umwelt (Australia) Pty Ltd

Fitzroy/Central regional office
Level 2, 209 Bolsover Street,
Rockhampton
PO Box 113, Rockhampton QLD 4700

Natasha Lawrence	Queensland State Leader	Neoen Australia Pty Ltd
Tim O'Leary	Manager, Development Assessment Division	SARA
Elva Bobongie	Natural Resource Management Officer, Natural Resource Assessment	Department of Natural Resources, Mines and Energy (DNRME)
Adam Gilmore	Senior Natural Resource Management Officer, Natural Resource Assessment	DNRME
Kaley Honeyman	Senior Land Officer, State Asset Land Management	DNRME
Emily Vandermeer	Senior Land Officer, State Asset Land Management	DNRME
Elena Churilova	Project Officer, Water Services	DNRME
Megan Rosenberg	Principal Natural Resource Officer, Planning Services	DNRME
Scot Tait	Senior Planner, Development Compliance and Support	Department of Transport and Main Roads (DTMR)
Corey Culpitt	Town Planner, Corridor and Land Management	DTMR
Anthony Walsh	Manager, Fitzroy & Central	SARA
Kate Lipke	Principal Planning Officer, Fitzroy & Central	SARA

Location details

Street address:	1682 South Ulam Road, Bajool; Glengowan Road, Ulogie; 1682A South Ulam Road, Bajool; Beschs Hill Road, Bajool
Real property description:	148DS151; 21RN1345; 21RN46; 2345DT4077; 23RN25; 2420DT4077; 24RN34; 25RN25; 2RN1585; 33DT40123; 38DT40131; 50DT40144
Local government area:	Banana Shire Council; Rockhampton Regional Council
Existing use:	Rural/grazing

Details of proposal

Development type:	Material change of use AND Operational work
Development description:	Neoen Australia Pty Ltd is proposing to develop a wind farm, called the Mount Hopeful Wind Farm (the Project). A preliminary area of approximately 13,810 hectares (ha) (the Study Area) has been identified to facilitate up to 87 wind turbine generators and ancillary wind farm infrastructure. The proposed wind farm footprint is anticipated to cover a much smaller portion of the total Study Area.

Supporting information

Drawing/report title	Prepared by	Date	Reference no.	Version/issue
Pre-lodgement meeting request letter	Umwelt (Australia) Pty Ltd	6 August 2020	7053	2.0

Meeting minutes

1. ***Overview***

   Mount Hopeful wind farm is located over 11 freehold properties and one leasehold property in the Rockhampton Region and Banana Shire local government areas. The project will consist of approximately 87 wind turbines and will include battery storage. A range of ancillary works such as laydown areas, access tracks, construction compounds are associated with the proposed development. A high-level concept plan has been prepared but will be further refined overtime.

   The project is proposed by Neoen Pty Ltd which has undertaken solar, wind and battery powered facilities throughout Australia. Mount Hopeful is Neoen's first wind farm proposed for the state of Queensland and is its priority project for its Queensland based team.

2. ***State Land Asset Management (SLAM)***
   - SLAM will not be able to provide owners consent for the leasehold block as it is currently a grazing lease which is being converted to freehold.
   - Once final payment has been made by the landowner to freehold this property, it is approximately a three-month process to finalise the conversion to freehold.
   - SLAM has no requirements to provide owner's consent for local roads unless the road is being severed.

3. ***Vegetation Management***
   - A relevant purpose determination for clearing native vegetation will be required under s22A of the *Vegetation Management Act 1999* prior to submitting a development application to SARA.
   - Relevant purpose determinations are made directly to the DNRME. There is no fee for applying for a determination. The application form is available on the DNRME website.
   - There is guidance material about how to address the relevant purpose determination available on DNRME website.
   - Any determination should be accompanied by a defined clearing footprint in ARC GIS format.
   - For the development application, you will need to demonstrate compliance with requirements of State Code 16 of the State Development Assessment Provisions (SDAP) and address both the material change of use and operational works requirements. Guidance material is also available about how to respond to the SDAP criteria.
   - In terms of firebreak buffers, DNRME will consider either ground-truthed values or either 20m or 1.5 times the tree height, whichever is greater.

   <u>ACTION:</u> DNRME to provide advice about whether firebreaks are assessable development for category B vegetation type. DNRME to also provide advice about whether ground-truthed values should be utilised to calculate values for the relevant purpose determination and operational works (native vegetation clearing) applications.

4. ***Watercourse determination***
   - Unlikely to have any requirements under the *Planning Act 2016* relating to watercourses.
   - Watercourse determinations may be needed for accesses however, will require specific details to assist in any determinations.
   - Requests for watercourse determinations are made directly to DNRME.
   - Consideration should also be given early to water access requirements for the project, such as for dust suppression, concrete batching, etc. as the *Water Act 2000* requirements relating to access to water have the potential to hold up such projects if not considered and addressed in early project planning stages.
   - Discuss water requirements, water access arrangements and *Water Act 2000* matters directly with DNRME.

5. ***Waterway barrier works***
    - If access tracks cross a waterway, they may require planning approval for operational works for waterway barrier works.
    - Location of waterways can be identified from SARA DAMS mapping.
    - There is an Accepted development code relevant for specific works on certain waterways.
    - Further advice will be provided on this matter subsequent to the meeting.

6. ***State transport infrastructure***
    - Access is proposed from a local road rather than directly from a state-controlled road.
    - The primary issue to be addressed at the material change of use stage is to have demonstrated a genuine attempt at detailing the haulage route from the port to the project site.
    - It is recommended the proponent consider how construction materials / product are going to be transported to the site and identify existing conflict points (eg. crossing under bridges, intersections), design vehicles and movement activities.
    - Additional details can be added or refined at in the detailed design stage in downstream approvals under the *Transport Infrastructure Act* 1994 (eg. section 33 approvals for works within state transport corridor).
    - There is the ability for SARA to condition a Traffic Impact Assessment (TIA), which could include a pavement impact assessment as part of the material change of use. Any TIA will need to be undertaken in accordance with DTMR requirements.
    - Depending upon the number and type of future roadworks requirement, it is recommended to allow at least 6 to 12 months for DTMR assessment of the downstream approvals.
    - If a TIA is available upfront at the time of making the development application, this will assist but is not required. The route assessment is what is required at the material change of use stage.

7. ***Windfarm code***
    - Recommend keeping the application as code assessable by keeping the wind turbines at least 1.5km from a sensitive land use.
    - Keep consulting with community prior to, during and after the development application process. SARA recommends consultation to be in accordance with the Clean Energy Council guidelines
    - The planning guideline that accompanies State Code 23 provides useful information on how to comply with the code.
    - It is important to demonstrate how construction materials can be safely transported to the site by providing a haul route analysis.
    - The SARA Windfarm team engages specialists to assist with its assessment, including acoustic and ecology specialists. These specialists are only engaged upon lodgement of the development application.
    - Third party advice is usually sought from DTMR, Department of Environment and Science, relevant councils (from the port to the site), aviation sector and Queensland Fire and Emergency Services.

8. ***General***
    - A development application can be made for both a material change of use and operational works in conjunction and this is the preferred approach for this type of project proposal.
    - SARA will be the Assessment Manager.
    - Triggers and fees are detailed in the schedules of the Planning Regulation 2017. For instance, in relation to clearing native vegetation which is assessable development, the applicable fee is determined by referring to item 8 in whichever of Schedule 10, part 3, div 3, table 1 or Schedule 10, part 3, div 4, table 1-3 which applies to the circumstances of the application. In relation to the material change of use for a wind farm, the applicable fee is determined by referring to item 5 in Schedule 10, part 21, div 2, table 1.
    - The development application will be assessed against the SDAP version current at the time of making the application.
    - The relevant SDAP codes will include:
        - State code 16 – Native vegetation clearing
        - State code 23 – Wind Farm

- SDAP State code 18 – Waterway barrier works will also potentially be relevant where access roads cross waterway and the crossings are unable to comply with the accepted development requirements.
- The relevant purpose determination under s22A of the *Vegetation Management Act 1999* is required prior to lodging a development application involving operational works to clear native vegetation.
- Any quarry, concrete batching plant or other such use required to support the project would require a separate development application. Development applications for such uses are usually assessable by the local government against its planning scheme, with SARA involved as a referral agency. Where a use assessable by a local government is proposed across more than a single local government jurisdiction, a Ministerial determination of the assessment manager for the application will be required.

It is considered that the above summary is an accurate record of the matters discussed at the pre-lodgement meeting.

Further advice
The following information is provided as further advice prepared subsequent to the meeting:

Vegetation Management

1. The proposed clearing of native vegetation might be able to be undertaken as Accepted Development, should the proposal satisfy clearing that is Exempt Clearing Work requirements under Schedule 21 of the Planning Regulation 2017.

   In order to avoid a referral for native vegetation clearing under Schedule 10 of the Planning Regulation 2017, all new proposed infrastructure must be located within a category X area and must include the necessary setbacks for firebreaks and safety buffer distance of at least 20m or 1.5 times the height of the tallest adjacent tree, whichever is greater, from the nearest Category B areas.

   Should the application not satisfy the requirements of an applicable exemption, then the clearing might be able to be undertaken under an Accepted Development Vegetation Clearing Code (ADVCC) (Schedule 7 and 21, Planning Regulation 2017): See Clearing for infrastructure ADVCC. Clearing must be undertaken in accordance with the code in effect at the time of the clearing and record-keeping requirements apply. Prior to undertaking any clearing, a notification must first be lodged with DNRME. You can notify online for free and the notification is valid for two years. This code and details for lodging a notification for this code are available online at https://www.qld.gov.au/environment/land/management/vegetation/clearing-codes.

   If the clearing cannot satisfy the requirements of an applicable exemption or ADVCC then a development permit will be required before undertaking the clearing of native vegetation as the proposal will involve clearing that is Assessable Development under the *Planning Act 2016*, or the development will result in accepted operational work under Schedule 21 of the Planning Regulation 2017.

2. The development application will need to address and meet the requirements of State code 16: Native vegetation clearing of SDAP.

   Guidance on how to comply with this code is provided in State Development Assessment Provisions Guidance material: State code 16: Native vegetation clearing, Department of Natural Resources, Mines and Energy, 2020. This guideline is available online at https://www.qld.gov.au/environment/land/management/vegetation/development. Appendix 2 of this guideline provides details on the standard application information for all development applications involving the clearing of native vegetation.

3. As discussed, the final clearing footprint of native vegetation and associated firebreaks may be calculated utilising Umwelt's ecologists' ground truthed values. Data and reasoning to support the firebreak values should be provided with the application. The minimum firebreak is calculated at 20

metres or 1.5 times the height of the tallest adjacent tree, whichever is greater from the nearest Category B areas. The appropriate firebreak is necessary to protect the integrity of the infrastructure, therefore the clearing of the firebreaks should be included in the assessment footprint.

4. Prior to submitting the development application to clear native vegetation, the applicant must first obtain written confirmation from DNRME that the proposed development is for a relevant purpose under section 22A of the *Vegetation Management Act 1999*. To ensure the efficiency of the application, the applicant is encouraged to provide the defined development footprint as an ***ArcGIS compatible shapefile***.

   Requests for a "relevant purpose determination" must be lodged in writing directly to DNRME, and can be sent to either Level 1, 44 Nelson Street, Mackay, QLD, 4740 or cwvegetationapplication@dnrme.qld.gov.au. There is no fee for these requests. The application form and further information and assistance to apply for a section 22A determination is available online at https://www.qld.gov.au/environment/land/management/vegetation/development.

State Land Asset Management

5. In accordance with section 16 of the *Land Act 1994,* it has already been assessed that the most appropriate tenure for the proposed venture is freehold; therefore it is suggested that discussions be held with the holder of GHFL 35/9037 (Lot 2 RN1585) to facilitate this process. Lot 2 on RN1585 is currently held as Grazing Homestead Freehold Lease which is required to be paid out prior to a freehold title being created.

6. If the material change of use includes dedicated road areas which may be impacted by access tracks, then owner's consent will be required with the development application. This consent must be sought from DNRME prior to any works commencing.

7. It is recommended the proponent liaise with any relevant council, as road manager, for any proposed works on the local road network.

Water Management and Use

General Information

8. The project is located within the *Water Plan (Fitzroy Basin) 2011* (Fitzroy WP) which regulates surface water (water in watercourses and overland flow) and groundwater (within a groundwater management area and not linked to artesian sediments).

9. The project is located within Fitzroy Groundwater Management Area and Callide Groundwater Management Area as defined in the Fitzroy WP.

10. The below advice will not negate the possible requirement to obtain a development permit for works if they are considered assessable development.

11. The proponent is encouraged to contact the Water Management and Use team within DNRME on 1800 822 100 or via email to centralwaterservices@dnrme.qld.gov.au to discuss any riverine protection requirements, water use requirements, or quarry material requirements prior to undertaking works or submitting any applications or notifications.

Watercourse Identification

12. A number of features that appear within the project area have been mapped on the Watercourse Identification Map (WIM located on Queensland Globe: https://www.business.qld.gov.au/business/support-tools-grants/services/mapping-dataimagery/queensland-globe/watercourse-map) as *Yet To Be Mapped* features (their status for purposes of the *Water Act 2000* has not been formally determined yet).

13. Should any works occur within a *Yet To Be Mapped* feature shown on WIM, it is recommended that a request for a Watercourse Determination be submitted to DNRME via centralwaterservices@dnrme.qld.gov.au. DNRME will clarify whether such features are considered a *drainage feature* or a *watercourse* for the purposes of the *Water Act 2000*.

Water Use Requirements

14. The pre-lodgement request has not indicated whether a water source will be accessed to provide water for the project.

    Should the proponent seek to access water or interfere with the flow of water on site as part of the project, an appropriate authorisation under the *Water Act 2000* may be required.

15. For further information refer to: https://www.business.qld.gov.au/industries/mining-energy-water/water/authorisations/industry-government

16. *Overland Flow* – Water that flows within a drainage feature or across the land is considered *overland flow*. Within the area of the proposed developments, a storage can be constructed to take overland flow water to satisfy the requirements of an environmental authority or under the Code for self-assessable development for taking overland flow water using limited capacity works**.** Limitation on storage volume constructed under this code within the Fitzroy WP area is 50 megalitres in all areas except the subcatchment downstream of the Fitzroy Barrage where the capped volume is 5 megalitres. The works constructed under this code allow the taking of water for any purposes. Once constructed, the works will need to be notified to DNRME within 60 days of their completion.

17. *Watercourse Water* – Water that flows within *a watercourse* as defined under the *Water Act 2000* is considered *watercourse water*. The taking of *watercourse water* will require an authorisation.

18. *Groundwater* – In accordance with the provisions of the Fitzroy WP, any works to take groundwater within a groundwater management area for purposes that are not exempt (such as stock and domestic) will require an authorisation (a water permit/licence) and a development permit.

Riverine Protection

19. Should the proposed projects include the excavation, placement of fill or destruction of vegetation within a *watercourse, lake or spring*, the proponent may need to apply for a riverine protection permit under the *Water Act 2000* in addition to any relevant approvals under the *Planning Act 2016*.

20. For further details regarding the provisions of riverine protection, see https://www.business.qld.gov.au/industry/water/managing-accessing/accessingwater/authorisations/riverine-protection.

21. There are exemptions to requiring a riverine protection permit, should the proponent be able to meet the exemption criteria. For further details regarding riverine protection permit exemptions, see https://www.dnrm.qld.gov.au/?a=109113:policy_registry/riverine-protection-permit-exemption-requirements.pdf

Quarry Material

22. Should any quarrying activity intercept *a watercourse*, an application for a quarry material allocation notice (QMAN) would need to be sent to DNRME via centralwaterservices@dnrme.qld.gov.au.

    Specific information to support an application for a QMAN is available online at https://www.business.qld.gov.au/industry/mining/quarries/riverine-quarrying-materials.

Geological Survey of Queensland

23. The proposed development may have an impact on activities authorised under Exploration Permit for Minerals (EPM) EPM27105 and EPM15810 within the project area. The proposed project should limit any adverse impacts on exploration and/or production activities in the area.

    It is advised that the applicant consult with the affected tenure holders prior to undertaking any works within the project area likely to impact upon the existing EPMs.

    The Authorised Holder Representatives contact details are listed below:

    - EPM27105 - PROPHET RESOURCES PTY LTD (Application)
      UTM Global Pty Ltd

GPO BOX 1661 BRISBANE QLD 4001
Email: reception@utmglobal.com.au

- EPM15810 - MOUNT MORGAN EXPLORATION PTY LTD (Granted – Exp 27/05/2020)
  Hetherington Exploration & Mining Title Services (QLD) Pty Ltd
  PO BOX 49 SPRING HILL LPO SPRING HILL QLD 4004
  Email: brisbane@hemtsqld.com.au

Haulage route

24. The proposed haulage route on both state and local roads for the movement of OSOM vehicles should be identified. It is recommended that the National Heavy Vehicle Regulator (NHVR) Route Planner (also known as Journey Planner) is used to demonstrate compliance. The Route Planner Tool is an interactive, online mapping system contained within the NHVR Portal to assist with the process of planning routes, applying for access permits and viewing heavy vehicle network routes. More information can be found at https://www.nhvr.gov.au/road-access/route-planner.

25. After obtaining a development approval for a material change of use for a wind farm, the proponent would also need to identify the impacts associated with the wind farm in greater detail and put in place mitigation strategies in order to obtain the various downstream approvals and permits required before construction can begin. Items that need be resolved prior to the first construction vehicle is in movement may include, but is not limited to the following:

    - Identify 'pinch points' on road infrastructure and operations along the proposed haulage route impacted by the movement of OSOM vehicles for example at intersections, lane closures, road widening, structures and railway crossings.
    - Develop strategies to specifically manage the 'pinch points' impacted on the haulage route.
    - Construction movement schedules for example, commencement of haulage, expected duration of each haulage, total duration of all construction movement activities
    - Traffic Management Plan
    - Road Use Management Plan
    - Road Safety Audit
    - Communication Plan
    - Alternative Haulage Routes (if required)
    - Additional permits or approvals for example, Queensland Police Services.

    DTMR will work with proponents, post decision to ensure that all additional information necessary is provided and the required downstream approvals and permits are obtained to ensure construction can proceed smoothly.

    However, these processes take time and often require the submission of very detailed information. It is recommended that contact be made with DTMR and/or local governments as soon as possible post decision, but at least 12 months before construction is scheduled to commence.

    For more information please contact the Heavy Vehicle Access team via QLDAccess_HVROPO@tmr.qld.gov.au.

General – process

26. The required DA Form 1 for making a development application, the DA forms guide relating to DA Form 1 and the DA forms guide relating the preparation of plans, as well as various other forms and templates of use to applicants are available at https://planning.dsdmip.qld.gov.au/planning/better-development/application-forms-and-templates.

27. Whether referring or lodging a development application to SARA, the easiest way is to use the online lodgement system MyDAS. This system allows you to both prepare and lodge online.

This pre-lodgement advice is valid for period of 9 months from time of issue, unless a change in legislation or policy has occurred that would affect the pre-lodgement advice. This pre-lodgement advice does not constitute an approval or an endorsement that SARA supports the development proposal. Additional information may be required to allow SARA to properly assess the development proposal when a formal application has been lodged.

For further information please contact Kate Lipke, Principal Planning Officer, on 49242916 or via email RockhamptonSARA@dsdmip.qld.gov.au who will be pleased to assist.

Yours sincerely

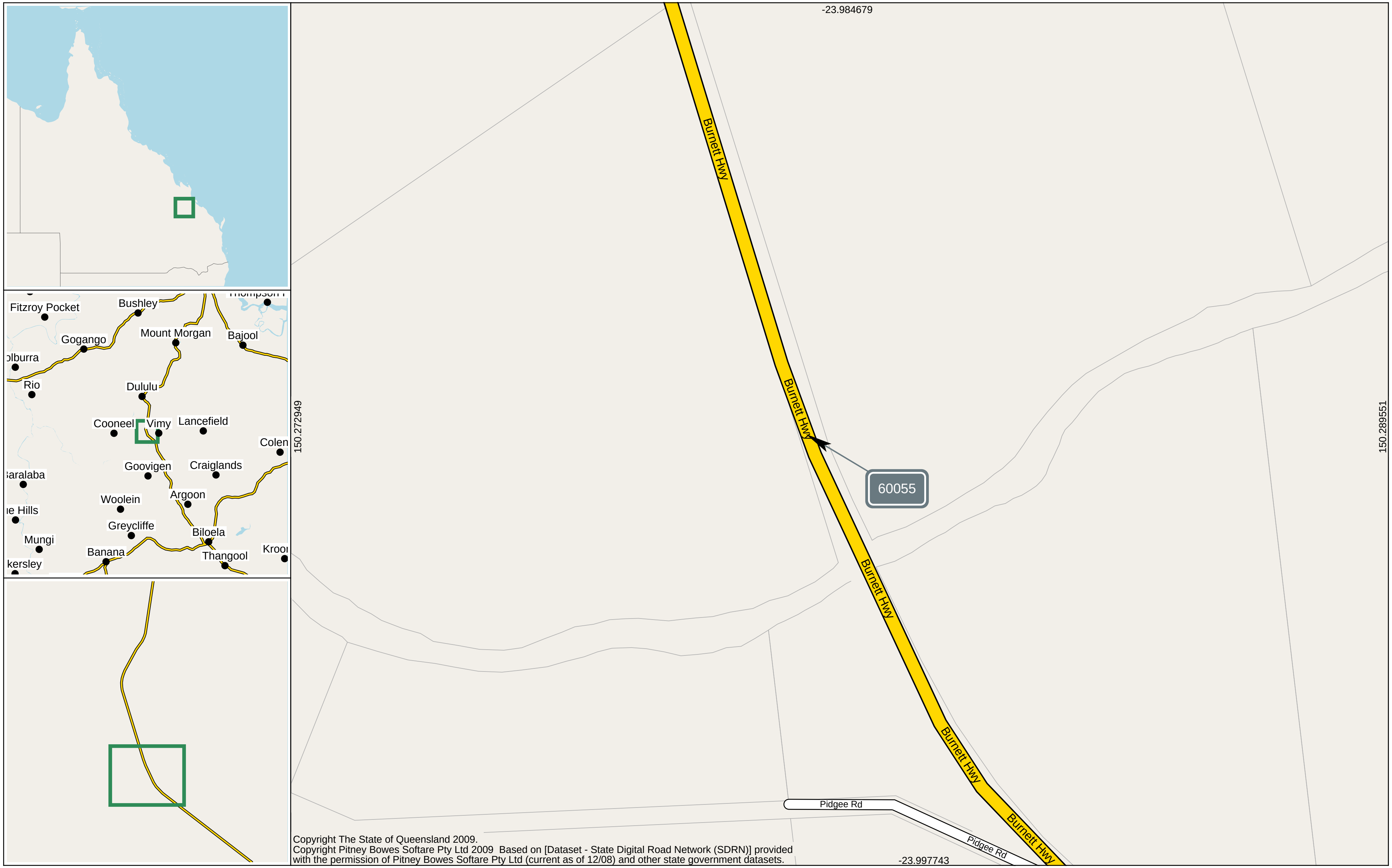
Anthony Walsh
Manager Planning

Appendix B – Burnett Highway (41E) Weekly Volume Report (AADT Segment 60055)

Weekly Volume Report

Area 404 - Fitzroy District   Road Section 41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)

Site 60055 - Burnett Hwy 120m Nth of Don River   TDist 54.260km   Speed Limit 100



Weekly Volume Report

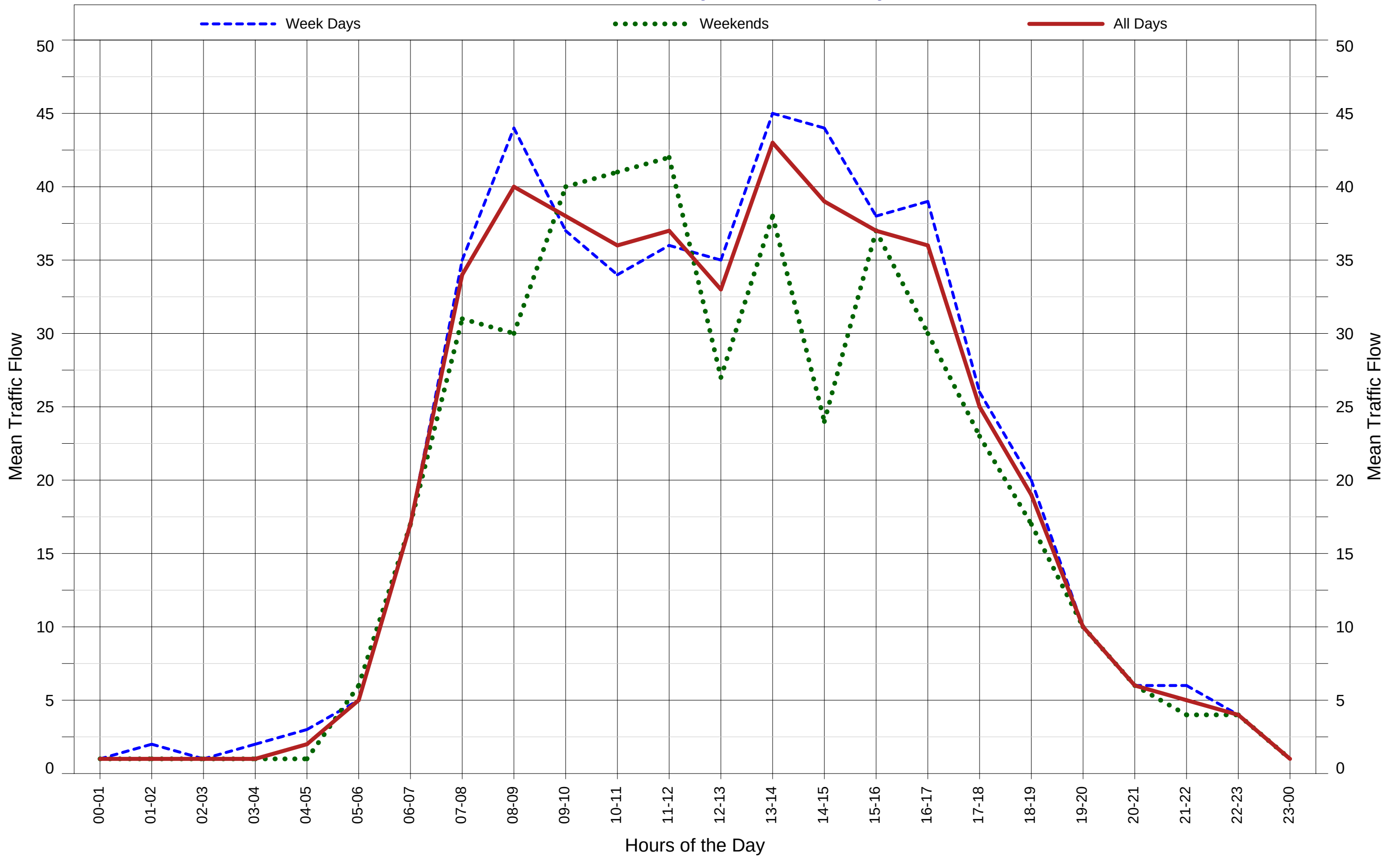
Week 2019-W42

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TG - Thru traffic -in gazettal dirn
Traffic Class	00 - All Vehicles
Week	2019-W42
Date Range	Monday 14-Oct-2019 - Sunday 20-Oct-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	1	1
Calendar Events	0	0	0	0	0	0	0

Mean Traffic Flow by Hours of the Day



Traffic Analysis and Reporting System

Weekly Volume Report

Week 2019-W42

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
00-01	3	0.6%	1	0.2%					3	0.6%	2	0.5%			1	0.2%	1	0.2%	1	0.2%
01-02	1	0.2%	2	0.4%	2	0.4%	1	0.2%	2	0.4%	1	0.2%			2	0.4%	1	0.2%	1	0.2%
02-03	3	0.6%					1	0.2%					2	0.5%	1	0.2%	1	0.2%	1	0.2%
03-04	5	1.1%	2	0.4%	2	0.4%					1	0.2%			2	0.4%	1	0.2%	1	0.2%
04-05	4	0.8%	4	0.8%	2	0.4%	4	0.9%	2	0.4%	1	0.2%			3	0.6%	1	0.2%	2	0.4%
05-06	7	1.5%	4	0.8%	3	0.6%	4	0.9%	7	1.3%	7	1.6%	4	1.0%	5	1.0%	6	1.4%	5	1.1%
06-07	11	2.3%	18	3.5%	16	3.3%	24	5.4%	18	3.4%	21	4.7%	12	2.9%	17	3.5%	17	3.9%	17	3.6%
07-08	28	5.9%	31	6.0%	41	8.5%	37	8.4%	37	7.0%	45	10.2%	17	4.1%	35	7.1%	31	7.2%	34	7.2%
08-09	42	8.9%	45	8.7%	44	9.1%	41	9.3%	46	8.7%	37	8.4%	22	5.3%	44	9.0%	30	6.9%	40	8.5%
09-10	43	9.1%	39	7.5%	31	6.4%	29	6.6%	41	7.7%	53	12.0%	27	6.6%	37	7.5%	40	9.2%	38	8.1%
10-11	31	6.6%	28	5.4%	42	8.7%	25	5.7%	45	8.5%	37	8.4%	45	10.9%	34	6.9%	41	9.5%	36	7.6%
11-12	47	9.9%	33	6.4%	28	5.8%	32	7.2%	38	7.2%	48	10.8%	35	8.5%	36	7.3%	42	9.7%	37	7.9%
12-13	35	7.4%	45	8.7%	37	7.6%	29	6.6%	29	5.5%	23	5.2%	31	7.5%	35	7.1%	27	6.2%	33	7.0%
13-14	43	9.1%	50	9.7%	52	10.7%	39	8.8%	43	8.1%	33	7.4%	43	10.4%	45	9.2%	38	8.8%	43	9.1%
14-15	43	9.1%	47	9.1%	43	8.9%	41	9.3%	48	9.0%	23	5.2%	25	6.1%	44	9.0%	24	5.5%	39	8.3%
15-16	29	6.1%	43	8.3%	46	9.5%	31	7.0%	39	7.3%	30	6.8%	43	10.4%	38	7.7%	37	8.5%	37	7.9%
16-17	38	8.0%	43	8.3%	27	5.6%	35	7.9%	51	9.6%	23	5.2%	37	9.0%	39	7.9%	30	6.9%	36	7.6%
17-18	23	4.9%	26	5.0%	28	5.8%	25	5.7%	29	5.5%	23	5.2%	22	5.3%	26	5.3%	23	5.3%	25	5.3%
18-19	21	4.4%	21	4.1%	17	3.5%	19	4.3%	23	4.3%	15	3.4%	19	4.6%	20	4.1%	17	3.9%	19	4.0%
19-20	5	1.1%	11	2.1%	10	2.1%	13	2.9%	9	1.7%	7	1.6%	13	3.2%	10	2.0%	10	2.3%	10	2.1%
20-21	4	0.8%	8	1.5%	6	1.2%	4	0.9%	9	1.7%	5	1.1%	7	1.7%	6	1.2%	6	1.4%	6	1.3%
21-22	7	1.5%	8	1.5%	3	0.6%	3	0.7%	7	1.3%	4	0.9%	4	1.0%	6	1.2%	4	0.9%	5	1.1%
22-23			5	1.0%	4	0.8%	5	1.1%	4	0.8%	3	0.7%	4	1.0%	4	0.8%	4	0.9%	4	0.8%
23-24			3	0.6%	1	0.2%			1	0.2%	1	0.2%			1	0.2%	1	0.2%	1	0.2%

Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	12:00	47	09:00	45	08:45	49	08:15	41	08:30	47	09:45	53	11:00	45	09:00	44	11:45	42	08:30	38
PM	14:30	53	14:15	54	14:15	54	13:30	45	17:15	57	17:30	35	16:15	44	14:15	47	14:00	37	14:00	41

12-Hour	423	89.4%	451	87.2%	436	89.9%	383	86.7%	469	88.3%	390	88.0%	366	88.8%	433	88.2%	380	87.8%	417	88.5%
16-Hour	450	95.1%	496	95.9%	471	97.1%	427	96.6%	512	96.4%	427	96.4%	402	97.6%	472	96.1%	417	96.3%	455	96.6%
18-Hour	450	95.1%	504	97.5%	476	98.1%	432	97.7%	517	97.4%	431	97.3%	406	98.5%	477	97.1%	422	97.5%	460	97.7%
24-Hour	473	100.0%	517	100.0%	485	100.0%	442	100.0%	531	100.0%	443	100.0%	412	100.0%	491	100.0%	433	100.0%	471	100.0%

Avg Week Day		96.3%		105.3%		98.8%		90.0%		108.1%						100.0%		88.2%		95.9%
Avg Weekend Day												102.3%		95.2%		113.4%		100.0%		108.8%
Avg Day		100.4%		109.8%		103.0%		93.8%		112.7%		94.1%		87.5%		104.2%		91.9%		100.0%

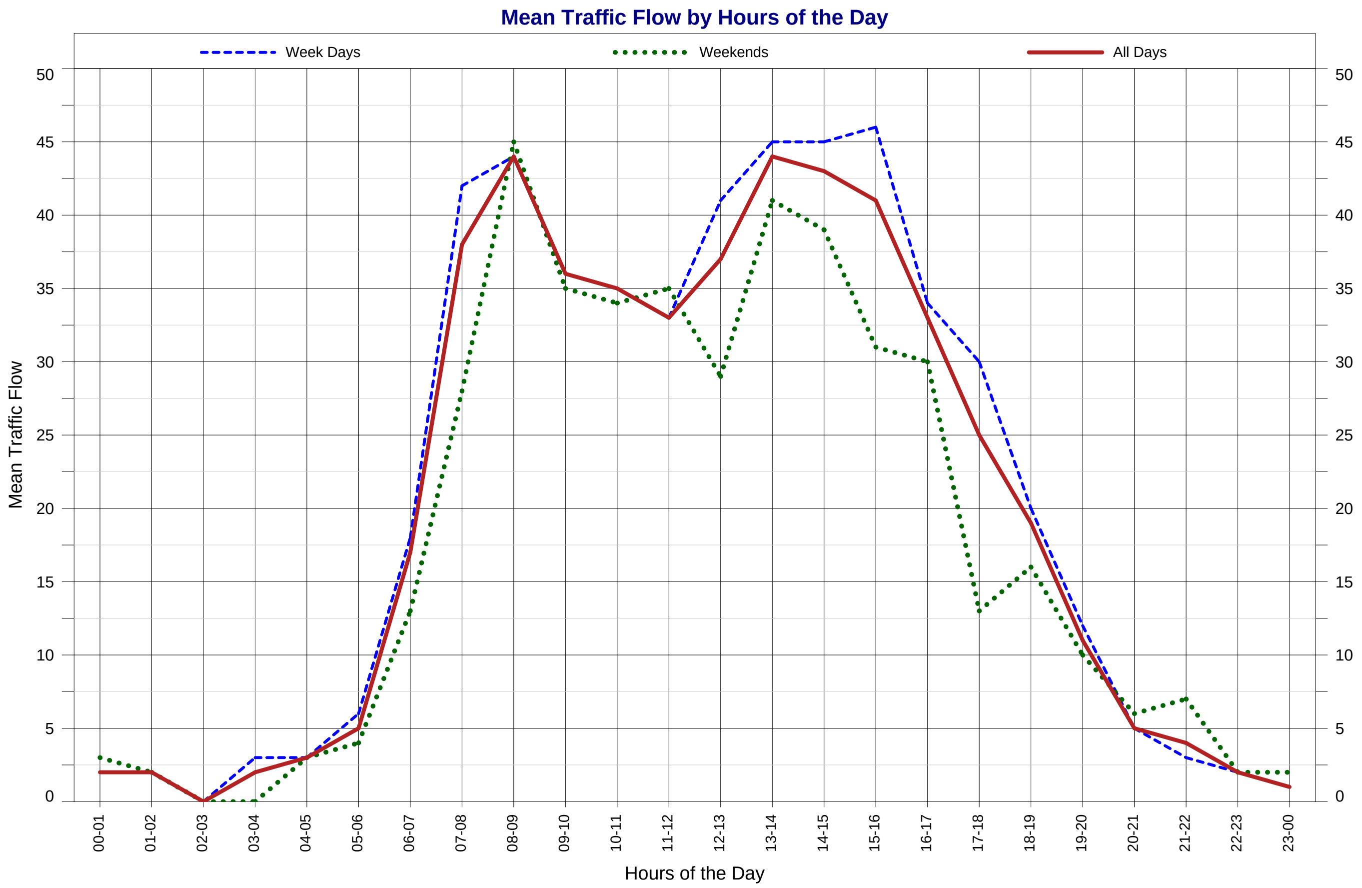
Weekly Volume Report

Week 2019-W43

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TG - Thru traffic -in gazettal dirn
Traffic Class	00 - All Vehicles
Week	2019-W43
Date Range	Monday 21-Oct-2019 - Sunday 27-Oct-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	1	1
Calendar Events	0	0	0	0	0	0	0



Weekly Volume Report

Week 2019-W43

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
00-01	3	0.6%	1	0.2%	1	0.2%	1	0.2%	2	0.4%	3	0.7%	2	0.5%	2	0.4%	3	0.7%	2	0.4%
01-02	3	0.6%	1	0.2%	1	0.2%	2	0.4%	3	0.6%	2	0.5%	1	0.2%	2	0.4%	2	0.5%	2	0.4%
02-03					2	0.4%														
03-04	6	1.2%	4	0.8%	3	0.5%	2	0.4%	2	0.4%					3	0.6%			2	0.4%
04-05	6	1.2%	2	0.4%	4	0.7%	1	0.2%	3	0.6%	2	0.5%	3	0.7%	3	0.6%	3	0.7%	3	0.6%
05-06	5	1.0%	2	0.4%	8	1.5%	8	1.7%	6	1.2%	5	1.1%	2	0.5%	6	1.2%	4	0.9%	5	1.0%
06-07	29	5.7%	12	2.4%	19	3.5%	17	3.6%	15	2.9%	18	4.1%	8	2.0%	18	3.5%	13	3.0%	17	3.5%
07-08	39	7.6%	30	5.9%	53	9.7%	42	9.0%	46	8.9%	36	8.2%	20	4.9%	42	8.3%	28	6.5%	38	7.9%
08-09	51	10.0%	39	7.6%	46	8.4%	40	8.5%	45	8.7%	53	12.1%	37	9.0%	44	8.7%	45	10.5%	44	9.1%
09-10	27	5.3%	37	7.3%	38	6.9%	32	6.8%	48	9.3%	49	11.2%	21	5.1%	36	7.1%	35	8.2%	36	7.5%
10-11	40	7.8%	26	5.1%	40	7.3%	33	7.0%	36	7.0%	38	8.7%	29	7.1%	35	6.9%	34	7.9%	35	7.3%
11-12	34	6.7%	28	5.5%	34	6.2%	36	7.7%	33	6.4%	35	8.0%	34	8.3%	33	6.5%	35	8.2%	33	6.8%
12-13	40	7.8%	47	9.2%	47	8.6%	31	6.6%	38	7.4%	28	6.4%	30	7.3%	41	8.1%	29	6.8%	37	7.7%
13-14	48	9.4%	59	11.6%	50	9.1%	32	6.8%	38	7.4%	31	7.1%	50	12.2%	45	8.9%	41	9.6%	44	9.1%
14-15	44	8.6%	49	9.6%	55	10.1%	38	8.1%	41	7.9%	29	6.6%	48	11.7%	45	8.9%	39	9.1%	43	8.9%
15-16	42	8.2%	44	8.6%	48	8.8%	39	8.3%	55	10.7%	27	6.2%	35	8.6%	46	9.1%	31	7.2%	41	8.5%
16-17	34	6.7%	39	7.6%	27	4.9%	43	9.2%	29	5.6%	36	8.2%	24	5.9%	34	6.7%	30	7.0%	33	6.8%
17-18	29	5.7%	33	6.5%	34	6.2%	23	4.9%	29	5.6%	11	2.5%	15	3.7%	30	5.9%	13	3.0%	25	5.2%
18-19	13	2.5%	23	4.5%	18	3.3%	21	4.5%	27	5.2%	19	4.3%	13	3.2%	20	3.9%	16	3.7%	19	3.9%
19-20	11	2.2%	16	3.1%	6	1.1%	16	3.4%	10	1.9%	5	1.1%	15	3.7%	12	2.4%	10	2.3%	11	2.3%
20-21	4	0.8%	9	1.8%	7	1.3%	4	0.9%	2	0.4%	4	0.9%	8	2.0%	5	1.0%	6	1.4%	5	1.0%
21-22	3	0.6%	3	0.6%	3	0.5%	5	1.1%	3	0.6%	4	0.9%	10	2.4%	3	0.6%	7	1.6%	4	0.8%
22-23			4	0.8%	1	0.2%	2	0.4%	5	1.0%			3	0.7%	2	0.4%	2	0.5%	2	0.4%
23-24			2	0.4%	2	0.4%	1	0.2%			3	0.7%	1	0.2%	1	0.2%	2	0.5%	1	0.2%

Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:45	55	08:45	49	08:15	56	08:45	46	09:15	59	09:15	63	08:45	37	08:30	48	09:15	48	08:30	46
PM	15:45	50	14:15	63	14:45	60	16:45	52	16:00	55	17:00	36	14:30	55	14:15	48	13:45	42	14:15	44
12-Hour	441	86.3%	454	89.0%	490	89.6%	410	87.4%	465	90.1%	392	89.5%	356	87.0%	451	88.8%	376	87.9%	428	88.8%
16-Hour	488	95.5%	494	96.9%	525	96.0%	452	96.4%	495	95.9%	423	96.6%	397	97.1%	489	96.3%	412	96.3%	465	96.5%
18-Hour	488	95.5%	500	98.0%	528	96.5%	455	97.0%	500	96.9%	426	97.3%	401	98.0%	492	96.9%	416	97.2%	468	97.1%
24-Hour	511	100.0%	510	100.0%	547	100.0%	469	100.0%	516	100.0%	438	100.0%	409	100.0%	508	100.0%	428	100.0%	482	100.0%
Avg Week Day		100.6%		100.4%		107.7%		92.3%		101.6%						100.0%		84.3%		94.9%
Avg Weekend Day												102.3%		95.6%		118.7%		100.0%		112.6%
Avg Day		106.0%		105.8%		113.5%		97.3%		107.1%		90.9%		84.9%		105.4%		88.8%		100.0%

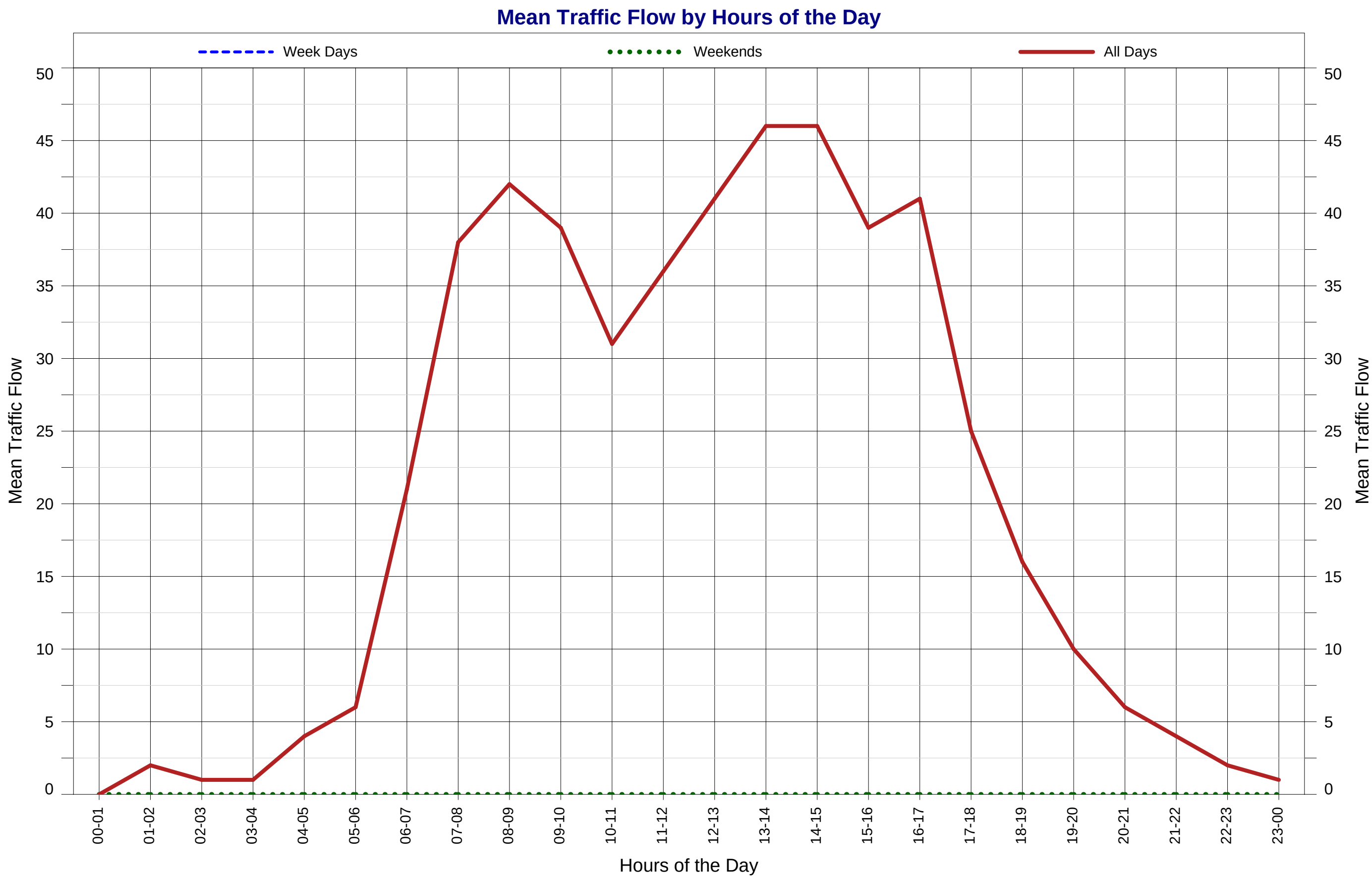
Weekly Volume Report

Week 2019-W44

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TG - Thru traffic -in gazettal dirn
Traffic Class	00 - All Vehicles
Week	2019-W44
Date Range	Monday 28-Oct-2019 - Sunday 03-Nov-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	0	0
Calendar Events	0	0	0	0	0	0	0



Weekly Volume Report

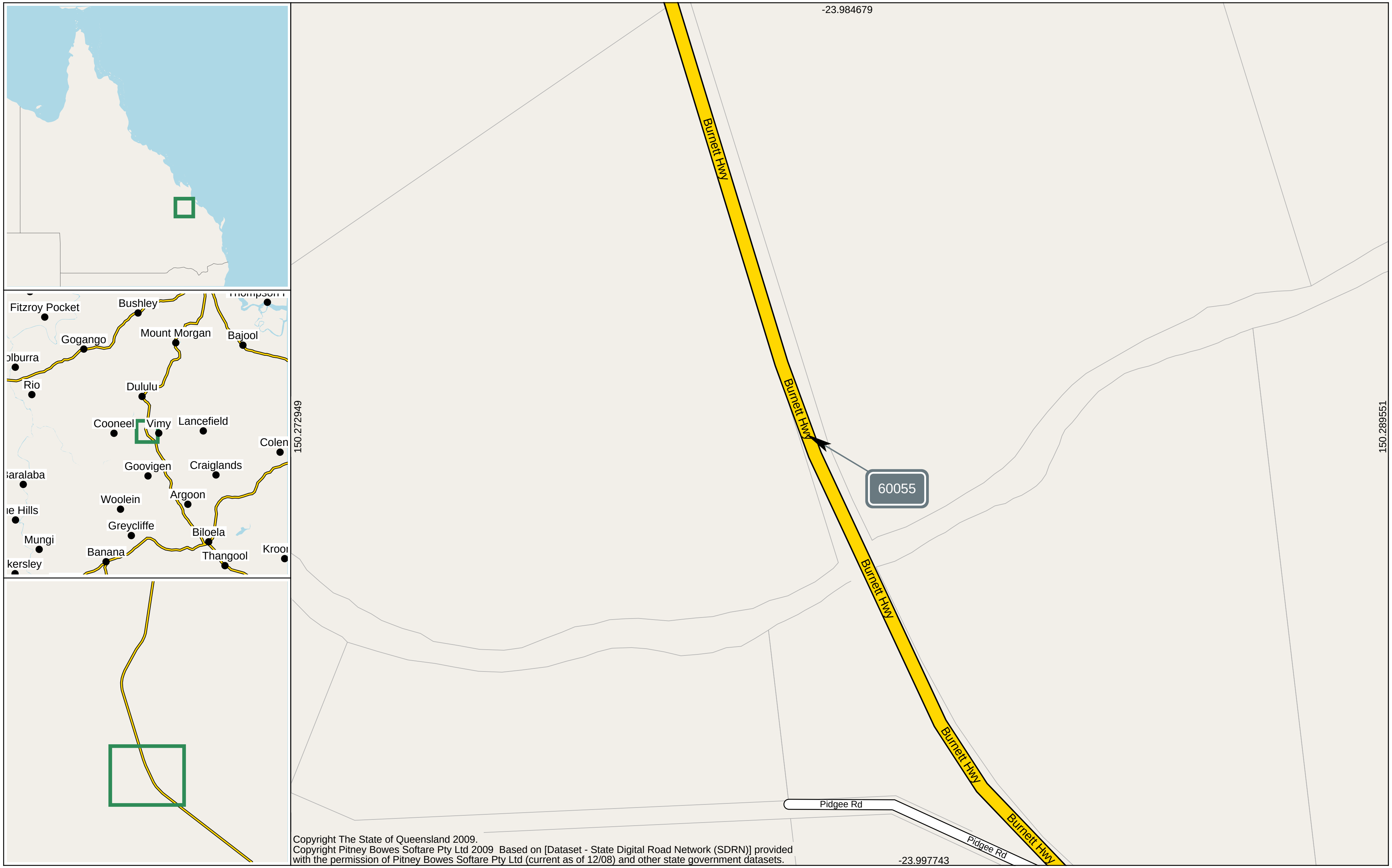
Week 2019-W44

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Average Week Day		Average Day	
00-01									2	0.4%				
01-02	1	0.2%	1	0.2%	1	0.2%	1	0.2%	4	0.8%	2	0.4%	2	0.4%
02-03	2	0.5%			2	0.4%	2	0.5%			1	0.2%	1	0.2%
03-04	2	0.5%	1	0.2%	1	0.2%					1	0.2%	1	0.2%
04-05	4	0.9%	4	0.7%	5	0.9%	3	0.7%	6	1.1%	4	0.8%	4	0.8%
05-06	8	1.9%	4	0.7%	3	0.6%	9	2.0%	7	1.3%	6	1.2%	6	1.2%
06-07	24	5.6%	23	4.1%	26	4.9%	15	3.4%	16	3.0%	21	4.2%	21	4.2%
07-08	32	7.5%	34	6.1%	38	7.2%	44	9.9%	42	8.0%	38	7.6%	38	7.6%
08-09	33	7.7%	43	7.7%	62	11.7%	33	7.4%	41	7.8%	42	8.4%	42	8.4%
09-10	28	6.5%	51	9.1%	41	7.7%	37	8.3%	40	7.6%	39	7.8%	39	7.8%
10-11	22	5.1%	33	5.9%	31	5.8%	31	7.0%	37	7.0%	31	6.2%	31	6.2%
11-12	36	8.4%	41	7.3%	37	7.0%	23	5.2%	42	8.0%	36	7.2%	36	7.2%
12-13	32	7.5%	54	9.6%	36	6.8%	41	9.2%	40	7.6%	41	8.2%	41	8.2%
13-14	46	10.7%	45	8.0%	52	9.8%	33	7.4%	54	10.2%	46	9.2%	46	9.2%
14-15	30	7.0%	62	11.1%	49	9.2%	37	8.3%	52	9.9%	46	9.2%	46	9.2%
15-16	29	6.8%	52	9.3%	52	9.8%	30	6.8%	30	5.7%	39	7.8%	39	7.8%
16-17	43	10.0%	35	6.2%	39	7.3%	42	9.5%	48	9.1%	41	8.2%	41	8.2%
17-18	23	5.4%	23	4.1%	26	4.9%	29	6.5%	23	4.4%	25	5.0%	25	5.0%
18-19	16	3.7%	21	3.7%	13	2.4%	13	2.9%	17	3.2%	16	3.2%	16	3.2%
19-20	10	2.3%	15	2.7%	8	1.5%	8	1.8%	10	1.9%	10	2.0%	10	2.0%
20-21	4	0.9%	8	1.4%	7	1.3%	2	0.5%	9	1.7%	6	1.2%	6	1.2%
21-22			7	1.2%	2	0.4%	6	1.4%	4	0.8%	4	0.8%	4	0.8%
22-23	2	0.5%	3	0.5%			2	0.5%	3	0.6%	2	0.4%	2	0.4%
23-24	1	0.2%	1	0.2%			3	0.7%			1	0.2%	1	0.2%
Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:45	38	09:45	54	09:00	62	08:30	46	08:15	47	08:15	43	09:15	29
PM	17:15	47	15:00	62	15:15	55	14:30	43	14:30	59	14:30	48	14:30	33
12-Hour	370	86.4%	494	88.1%	476	89.6%	393	88.5%	466	88.4%	440	88.4%	440	88.4%
16-Hour	408	95.3%	547	97.5%	519	97.7%	424	95.5%	505	95.8%	481	96.6%	481	96.6%
18-Hour	411	96.0%	551	98.2%	519	97.7%	429	96.6%	508	96.4%	484	97.2%	484	97.2%
24-Hour	428	100.0%	561	100.0%	531	100.0%	444	100.0%	527	100.0%	498	100.0%	498	100.0%
Avg Week Day		85.9%		112.7%		106.6%		89.2%		105.8%		100.0%		100.0%
Avg Day		85.9%		112.7%		106.6%		89.2%		105.8%		100.0%		100.0%

Weekly Volume Report

Area 404 - Fitzroy District Road Section 41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)

Site 60055 - Burnett Hwy 120m Nth of Don River TDist 54.260km Speed Limit 100



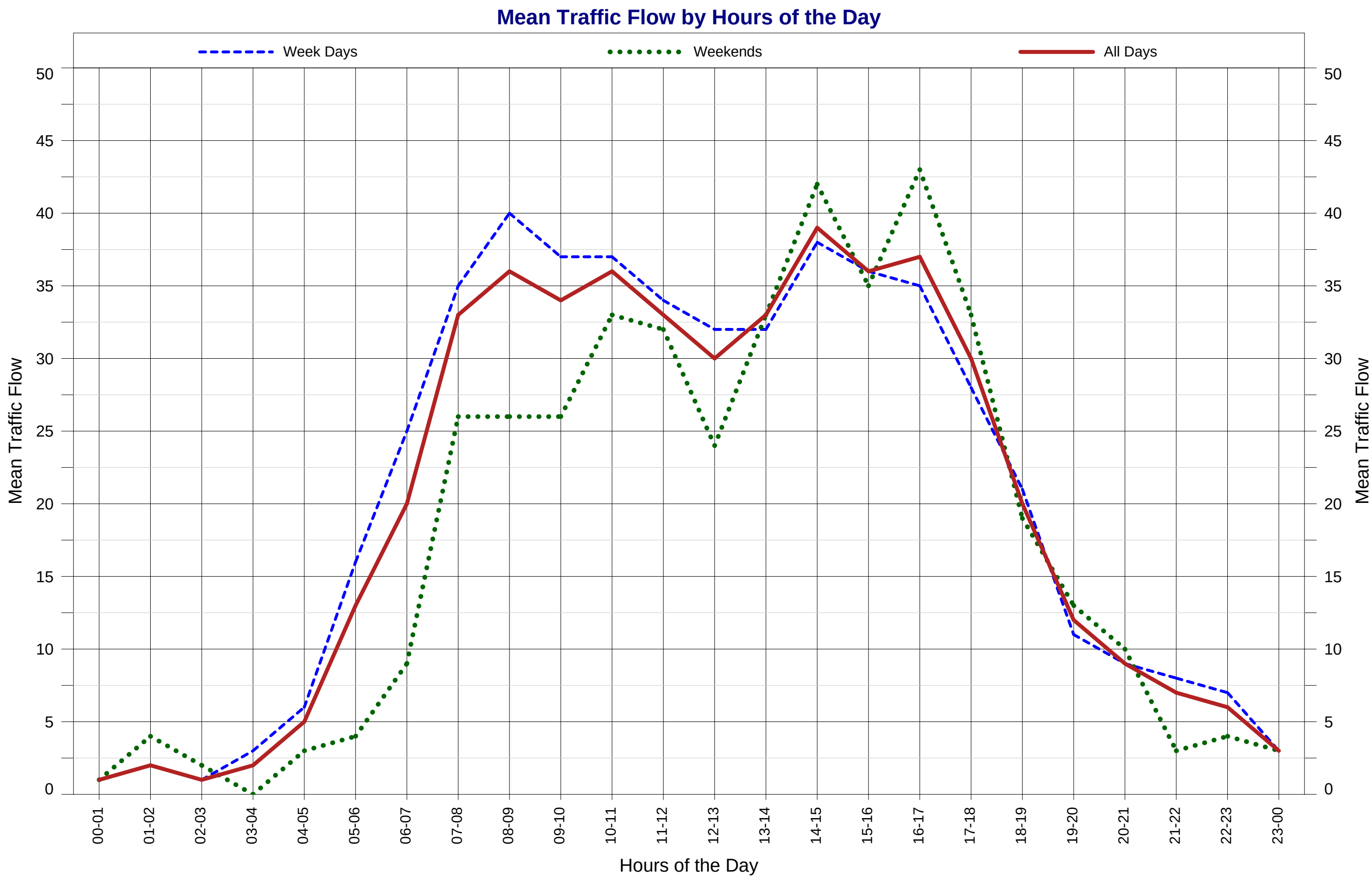
Weekly Volume Report

Week 2019-W42

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TA - Thru traffic -against gazettal
Traffic Class	00 - All Vehicles
Week	2019-W42
Date Range	Monday 14-Oct-2019 - Sunday 20-Oct-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	1	1
Calendar Events	0	0	0	0	0	0	0



Weekly Volume Report

Week 2019-W42

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
00-01			1	0.2%	2	0.4%			1	0.2%	1	0.2%	1	0.2%	1	0.2%	1	0.2%	1	0.2%
01-02	1	0.2%	1	0.2%	3	0.6%	1	0.2%	2	0.4%	5	1.2%	2	0.5%	2	0.4%	4	0.9%	2	0.4%
02-03			2	0.4%	2	0.4%					2	0.5%	1	0.2%	1	0.2%	2	0.5%	1	0.2%
03-04	3	0.7%	1	0.2%	4	0.8%	2	0.4%	3	0.5%					3	0.6%			2	0.4%
04-05	9	2.2%	7	1.4%	7	1.4%	3	0.6%	6	1.1%	4	1.0%	2	0.5%	6	1.2%	3	0.7%	5	1.0%
05-06	15	3.7%	13	2.6%	20	4.0%	17	3.3%	16	2.9%	6	1.5%	2	0.5%	16	3.2%	4	0.9%	13	2.7%
06-07	22	5.4%	18	3.6%	35	6.9%	28	5.5%	22	3.9%	9	2.2%	9	2.1%	25	5.0%	9	2.1%	20	4.2%
07-08	41	10.0%	32	6.4%	32	6.3%	33	6.4%	39	7.0%	35	8.5%	16	3.7%	35	7.0%	26	6.1%	33	6.9%
08-09	35	8.6%	35	7.0%	50	9.9%	37	7.2%	43	7.7%	34	8.2%	17	3.9%	40	8.0%	26	6.1%	36	7.5%
09-10	32	7.8%	34	6.8%	45	8.9%	41	8.0%	35	6.2%	34	8.2%	18	4.1%	37	7.4%	26	6.1%	34	7.1%
10-11	25	6.1%	39	7.8%	40	7.9%	45	8.8%	35	6.2%	27	6.5%	38	8.8%	37	7.4%	33	7.7%	36	7.5%
11-12	32	7.8%	39	7.8%	32	6.3%	28	5.5%	39	7.0%	30	7.3%	33	7.6%	34	6.8%	32	7.5%	33	6.9%
12-13	17	4.2%	36	7.2%	40	7.9%	25	4.9%	42	7.5%	21	5.1%	27	6.2%	32	6.4%	24	5.6%	30	6.3%
13-14	31	7.6%	25	5.0%	24	4.8%	45	8.8%	37	6.6%	28	6.8%	38	8.8%	32	6.4%	33	7.7%	33	6.9%
14-15	30	7.3%	40	8.0%	26	5.2%	47	9.2%	45	8.0%	42	10.2%	42	9.7%	38	7.6%	42	9.8%	39	8.2%
15-16	27	6.6%	35	7.0%	31	6.2%	39	7.6%	48	8.6%	29	7.0%	40	9.2%	36	7.2%	35	8.2%	36	7.5%
16-17	23	5.6%	39	7.8%	28	5.6%	32	6.2%	52	9.3%	38	9.2%	48	11.1%	35	7.0%	43	10.0%	37	7.7%
17-18	24	5.9%	28	5.6%	24	4.8%	29	5.7%	37	6.6%	23	5.6%	43	9.9%	28	5.6%	33	7.7%	30	6.3%
18-19	16	3.9%	16	3.2%	26	5.2%	28	5.5%	18	3.2%	17	4.1%	21	4.8%	21	4.2%	19	4.4%	20	4.2%
19-20	9	2.2%	13	2.6%	10	2.0%	9	1.8%	15	2.7%	11	2.7%	15	3.5%	11	2.2%	13	3.0%	12	2.5%
20-21	7	1.7%	14	2.8%	6	1.2%	11	2.1%	9	1.6%	7	1.7%	12	2.8%	9	1.8%	10	2.3%	9	1.9%
21-22	3	0.7%	17	3.4%	8	1.6%	7	1.4%	6	1.1%	2	0.5%	4	0.9%	8	1.6%	3	0.7%	7	1.5%
22-23	6	1.5%	14	2.8%	5	1.0%	2	0.4%	7	1.2%	5	1.2%	3	0.7%	7	1.4%	4	0.9%	6	1.3%
23-24	1	0.2%	2	0.4%	4	0.8%	3	0.6%	4	0.7%	3	0.7%	2	0.5%	3	0.6%	3	0.7%	3	0.6%
Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:30	44	10:45	46	09:30	60	11:00	45	10:30	44	09:30	44	11:15	47	09:15	42	11:15	37	09:15	35
PM	14:15	36	15:30	43	13:00	40	14:30	49	16:45	56	15:15	43	16:45	52	15:45	38	16:45	42	15:00	37
12-Hour	333	81.4%	398	79.4%	398	79.0%	429	83.8%	470	83.8%	358	86.7%	381	87.8%	405	81.5%	372	86.9%	397	83.1%
16-Hour	374	91.4%	460	91.8%	457	90.7%	484	94.5%	522	93.0%	387	93.7%	421	97.0%	458	92.2%	407	95.1%	445	93.1%
18-Hour	381	93.2%	476	95.0%	466	92.5%	489	95.5%	533	95.0%	395	95.6%	426	98.2%	468	94.2%	414	96.7%	454	95.0%
24-Hour	409	100.0%	501	100.0%	504	100.0%	512	100.0%	561	100.0%	413	100.0%	434	100.0%	497	100.0%	428	100.0%	478	100.0%
Avg Week Day		82.3%		100.8%		101.4%		103.0%		112.9%						100.0%		86.1%		96.2%
Avg Weekend Day												96.5%		101.4%		116.1%		100.0%		111.7%
Avg Day		85.6%		104.8%		105.4%		107.1%		117.4%		86.4%		90.8%		104.0%		89.5%		100.0%

Weekly Volume Report

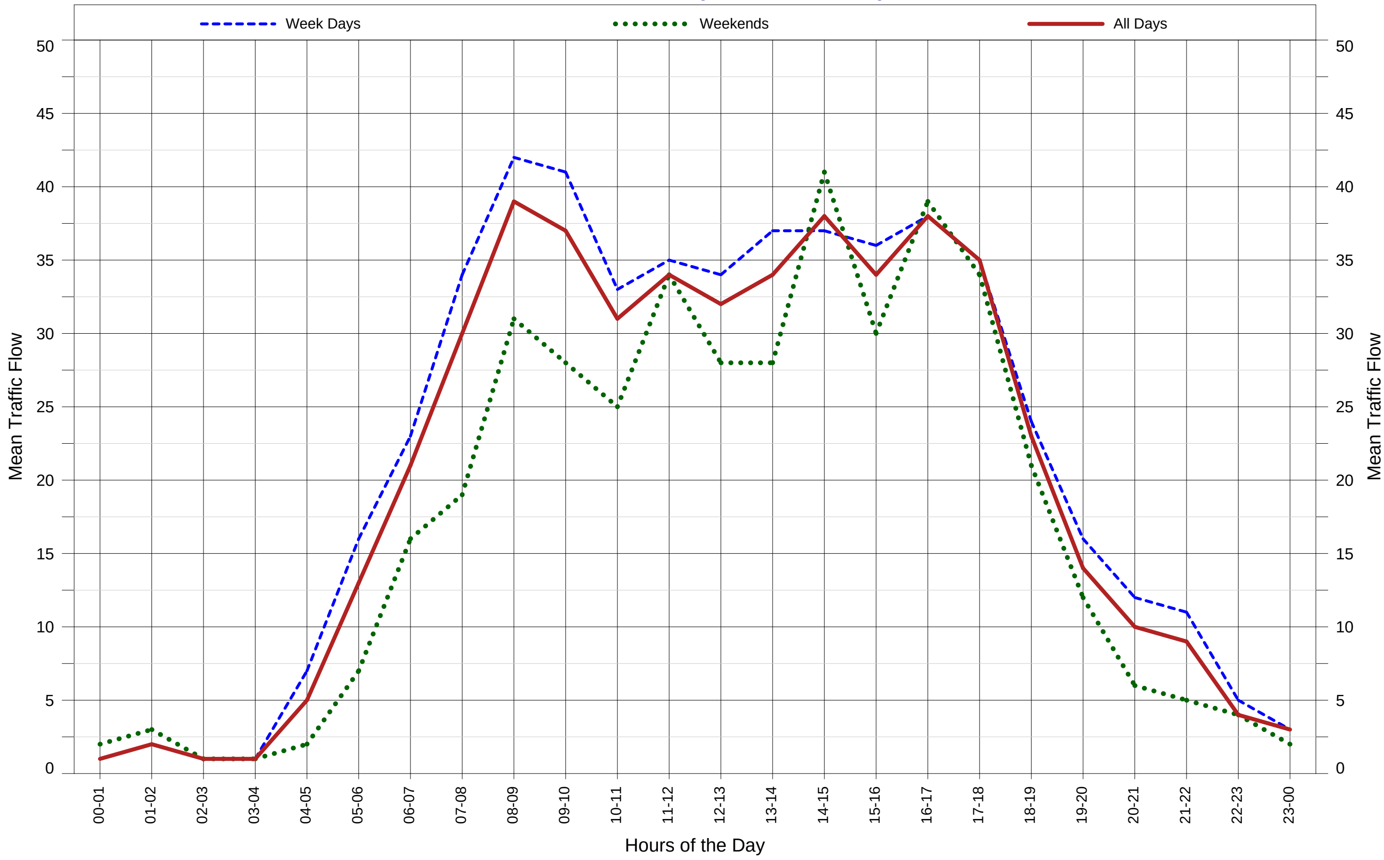
Week 2019-W43

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TA - Thru traffic -against gazettal
Traffic Class	00 - All Vehicles
Week	2019-W43
Date Range	Monday 21-Oct-2019 - Sunday 27-Oct-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	1	1
Calendar Events	0	0	0	0	0	0	0

Mean Traffic Flow by Hours of the Day



Traffic Analysis and Reporting System

Weekly Volume Report

Week 2019-W43

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
00-01			1	0.2%	1	0.2%	1	0.2%	2	0.4%	3	0.7%			1	0.2%	2	0.5%	1	0.2%
01-02	2	0.4%	3	0.6%	3	0.5%			3	0.5%	2	0.5%	3	0.8%	2	0.4%	3	0.7%	2	0.4%
02-03			1	0.2%	2	0.3%	2	0.4%	1	0.2%	1	0.2%	1	0.3%	1	0.2%	1	0.2%	1	0.2%
03-04					1	0.2%	2	0.4%	2	0.4%	2	0.5%			1	0.2%	1	0.2%	1	0.2%
04-05	10	2.2%	1	0.2%	10	1.7%	5	1.0%	8	1.4%	2	0.5%	1	0.3%	7	1.3%	2	0.5%	5	1.0%
05-06	20	4.4%	13	2.6%	15	2.6%	12	2.3%	21	3.8%	9	2.1%	4	1.0%	16	3.1%	7	1.7%	13	2.7%
06-07	30	6.6%	18	3.6%	24	4.1%	23	4.4%	21	3.8%	24	5.5%	7	1.8%	23	4.4%	16	3.8%	21	4.3%
07-08	42	9.2%	36	7.2%	41	7.1%	30	5.8%	23	4.1%	26	6.0%	12	3.1%	34	6.5%	19	4.5%	30	6.1%
08-09	23	5.0%	32	6.4%	75	13.0%	48	9.2%	33	5.9%	37	8.5%	24	6.2%	42	8.0%	31	7.4%	39	8.0%
09-10	30	6.6%	38	7.6%	39	6.7%	40	7.7%	57	10.2%	36	8.3%	19	4.9%	41	7.8%	28	6.7%	37	7.6%
10-11	23	5.0%	32	6.4%	38	6.6%	36	6.9%	36	6.5%	27	6.2%	23	6.0%	33	6.3%	25	6.0%	31	6.3%
11-12	31	6.8%	27	5.4%	47	8.1%	30	5.8%	39	7.0%	33	7.6%	34	8.8%	35	6.7%	34	8.1%	34	7.0%
12-13	23	5.0%	34	6.8%	38	6.6%	42	8.1%	31	5.6%	26	6.0%	29	7.5%	34	6.5%	28	6.7%	32	6.5%
13-14	39	8.6%	33	6.6%	40	6.9%	34	6.5%	38	6.8%	28	6.4%	27	7.0%	37	7.1%	28	6.7%	34	7.0%
14-15	34	7.5%	33	6.6%	34	5.9%	32	6.1%	51	9.1%	30	6.9%	51	13.2%	37	7.1%	41	9.8%	38	7.8%
15-16	23	5.0%	33	6.6%	43	7.4%	40	7.7%	40	7.2%	26	6.0%	34	8.8%	36	6.9%	30	7.2%	34	7.0%
16-17	34	7.5%	48	9.6%	35	6.0%	37	7.1%	34	6.1%	44	10.1%	34	8.8%	38	7.3%	39	9.3%	38	7.8%
17-18	34	7.5%	31	6.2%	30	5.2%	32	6.1%	47	8.4%	32	7.3%	36	9.4%	35	6.7%	34	8.1%	35	7.2%
18-19	22	4.8%	27	5.4%	22	3.8%	27	5.2%	24	4.3%	23	5.3%	18	4.7%	24	4.6%	21	5.0%	23	4.7%
19-20	11	2.4%	12	2.4%	18	3.1%	17	3.3%	20	3.6%	9	2.1%	14	3.6%	16	3.1%	12	2.9%	14	2.9%
20-21	11	2.4%	17	3.4%	11	1.9%	10	1.9%	10	1.8%	6	1.4%	5	1.3%	12	2.3%	6	1.4%	10	2.0%
21-22	8	1.8%	18	3.6%	5	0.9%	13	2.5%	10	1.8%	2	0.5%	7	1.8%	11	2.1%	5	1.2%	9	1.8%
22-23	4	0.9%	8	1.6%	4	0.7%	5	1.0%	2	0.4%	6	1.4%	1	0.3%	5	1.0%	4	1.0%	4	0.8%
23-24	2	0.4%	4	0.8%	3	0.5%	3	0.6%	5	0.9%	2	0.5%	1	0.3%	3	0.6%	2	0.5%	3	0.6%

Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:00	42	10:15	39	09:15	77	08:45	49	10:00	57	09:30	40	12:00	34	08:30	44	12:00	32	09:00	36
PM	14:45	42	17:00	48	16:15	44	16:15	45	15:30	54	17:00	44	15:00	51	14:15	39	15:00	40	14:45	37

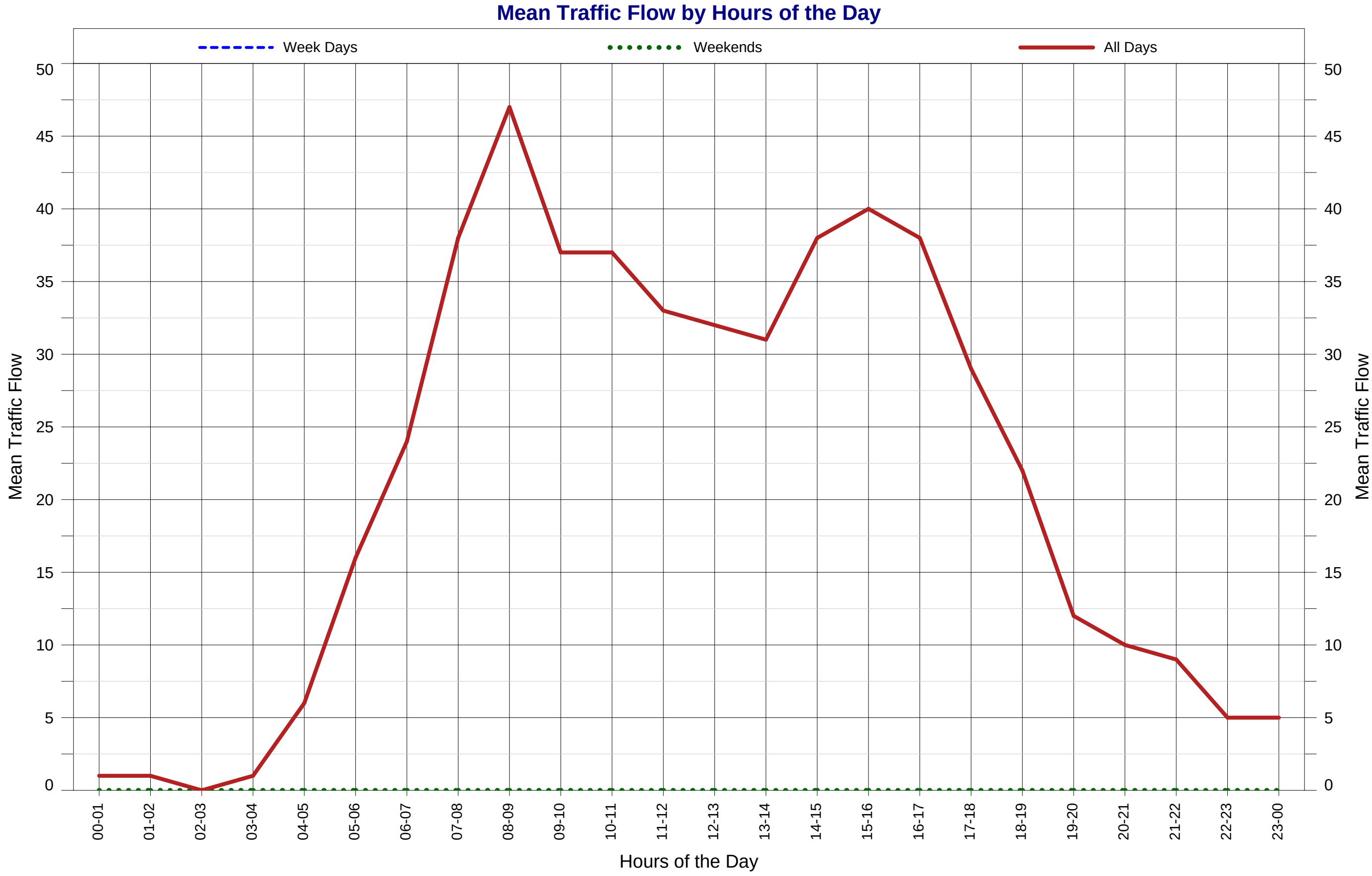
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
12-Hour	358	78.5%	404	80.8%	482	83.2%	428	82.1%	453	81.2%	368	84.4%	341	88.6%	426	81.3%	358	85.4%	405	82.8%
16-Hour	418	91.7%	469	93.8%	540	93.3%	491	94.2%	514	92.1%	409	93.8%	374	97.1%	488	93.1%	397	94.7%	459	93.9%
18-Hour	424	93.0%	481	96.2%	547	94.5%	499	95.8%	521	93.4%	417	95.6%	376	97.7%	496	94.7%	403	96.2%	466	95.3%
24-Hour	456	100.0%	500	100.0%	579	100.0%	521	100.0%	558	100.0%	436	100.0%	385	100.0%	524	100.0%	419	100.0%	489	100.0%
Avg Week Day		87.0%		95.4%		110.5%		99.4%		106.5%						100.0%		80.0%		93.3%
Avg Weekend Day												104.1%		91.9%		125.1%		100.0%		116.7%
Avg Day		93.3%		102.2%		118.4%		106.5%		114.1%		89.2%		78.7%		107.2%		85.7%		100.0%

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TA - Thru traffic -against gazettal
Traffic Class	00 - All Vehicles
Week	2019-W44
Date Range	Monday 28-Oct-2019 - Sunday 03-Nov-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	0	0
Calendar Events	0	0	0	0	0	0	0

Mean Traffic Flow by Hours of the Day



Traffic Analysis and Reporting System

Weekly Volume Report

Week 2019-W44

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Average Week Day		Average Day	
00-01									5	0.9%	1	0.2%	1	0.2%
01-02	2	0.4%	1	0.2%	1	0.2%	1	0.2%	1	0.2%	1	0.2%	1	0.2%
02-03					1	0.2%								
03-04	3	0.7%	2	0.4%	2	0.4%					1	0.2%	1	0.2%
04-05	10	2.2%	3	0.6%	6	1.2%	6	1.1%	7	1.3%	6	1.2%	6	1.2%
05-06	14	3.1%	17	3.5%	19	3.7%	18	3.2%	13	2.3%	16	3.1%	16	3.1%
06-07	27	6.0%	21	4.3%	30	5.8%	28	5.0%	13	2.3%	24	4.7%	24	4.7%
07-08	45	10.0%	35	7.2%	34	6.6%	40	7.1%	37	6.6%	38	7.4%	38	7.4%
08-09	41	9.1%	33	6.8%	50	9.7%	57	10.2%	52	9.3%	47	9.2%	47	9.2%
09-10	33	7.3%	32	6.6%	42	8.2%	40	7.1%	36	6.4%	37	7.2%	37	7.2%
10-11	37	8.2%	27	5.6%	44	8.6%	37	6.6%	38	6.8%	37	7.2%	37	7.2%
11-12	27	6.0%	28	5.8%	43	8.4%	34	6.1%	34	6.1%	33	6.4%	33	6.4%
12-13	30	6.7%	26	5.4%	23	4.5%	43	7.7%	40	7.2%	32	6.2%	32	6.2%
13-14	25	5.6%	37	7.7%	34	6.6%	29	5.2%	30	5.4%	31	6.1%	31	6.1%
14-15	30	6.7%	36	7.5%	36	7.0%	39	7.0%	49	8.8%	38	7.4%	38	7.4%
15-16	28	6.2%	33	6.8%	38	7.4%	54	9.6%	46	8.2%	40	7.8%	40	7.8%
16-17	28	6.2%	44	9.1%	27	5.3%	39	7.0%	53	9.5%	38	7.4%	38	7.4%
17-18	23	5.1%	27	5.6%	23	4.5%	29	5.2%	44	7.9%	29	5.7%	29	5.7%
18-19	16	3.6%	24	5.0%	15	2.9%	30	5.3%	26	4.7%	22	4.3%	22	4.3%
19-20	10	2.2%	13	2.7%	10	1.9%	13	2.3%	13	2.3%	12	2.3%	12	2.3%
20-21	10	2.2%	18	3.7%	10	1.9%	6	1.1%	8	1.4%	10	2.0%	10	2.0%
21-22	4	0.9%	15	3.1%	10	1.9%	8	1.4%	6	1.1%	9	1.8%	9	1.8%
22-23	1	0.2%	5	1.0%	6	1.2%	7	1.2%	5	0.9%	5	1.0%	5	1.0%
23-24	5	1.1%	6	1.2%	9	1.8%	3	0.5%	3	0.5%	5	1.0%	5	1.0%
Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:30	46	08:15	39	09:00	50	09:15	59	09:00	52	09:00	48	09:00	31
PM	16:30	37	17:00	44	14:30	41	16:00	54	17:30	58	15:15	39	15:15	27
12-Hour	363	80.8%	382	79.1%	409	79.7%	471	84.0%	485	86.8%	422	82.4%	422	82.4%
16-Hour	414	92.2%	449	93.0%	469	91.4%	526	93.8%	525	93.9%	477	93.2%	477	93.2%
18-Hour	420	93.5%	460	95.2%	484	94.3%	536	95.5%	533	95.3%	487	95.1%	487	95.1%
24-Hour	449	100.0%	483	100.0%	513	100.0%	561	100.0%	559	100.0%	512	100.0%	512	100.0%
Avg Week Day		87.7%		94.3%		100.2%		109.6%		109.2%		100.0%		100.0%
Avg Day		87.7%		94.3%		100.2%		109.6%		109.2%		100.0%		100.0%

Queensland Government

01-Feb-2021 11:13

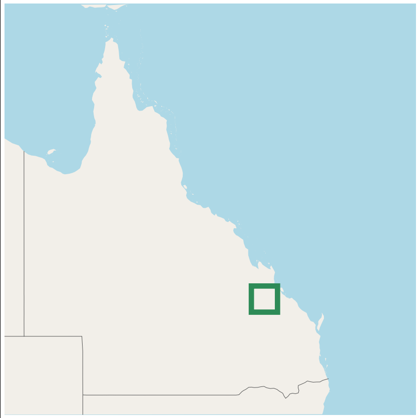
Traffic Analysis and Reporting System

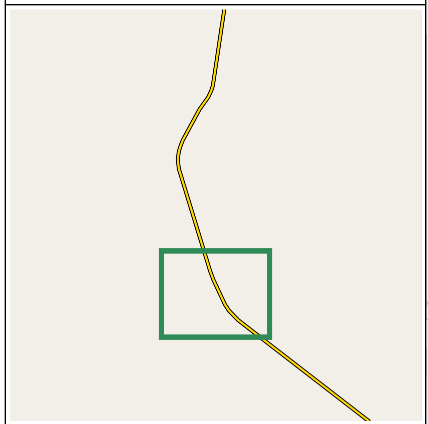
Weekly Volume Report

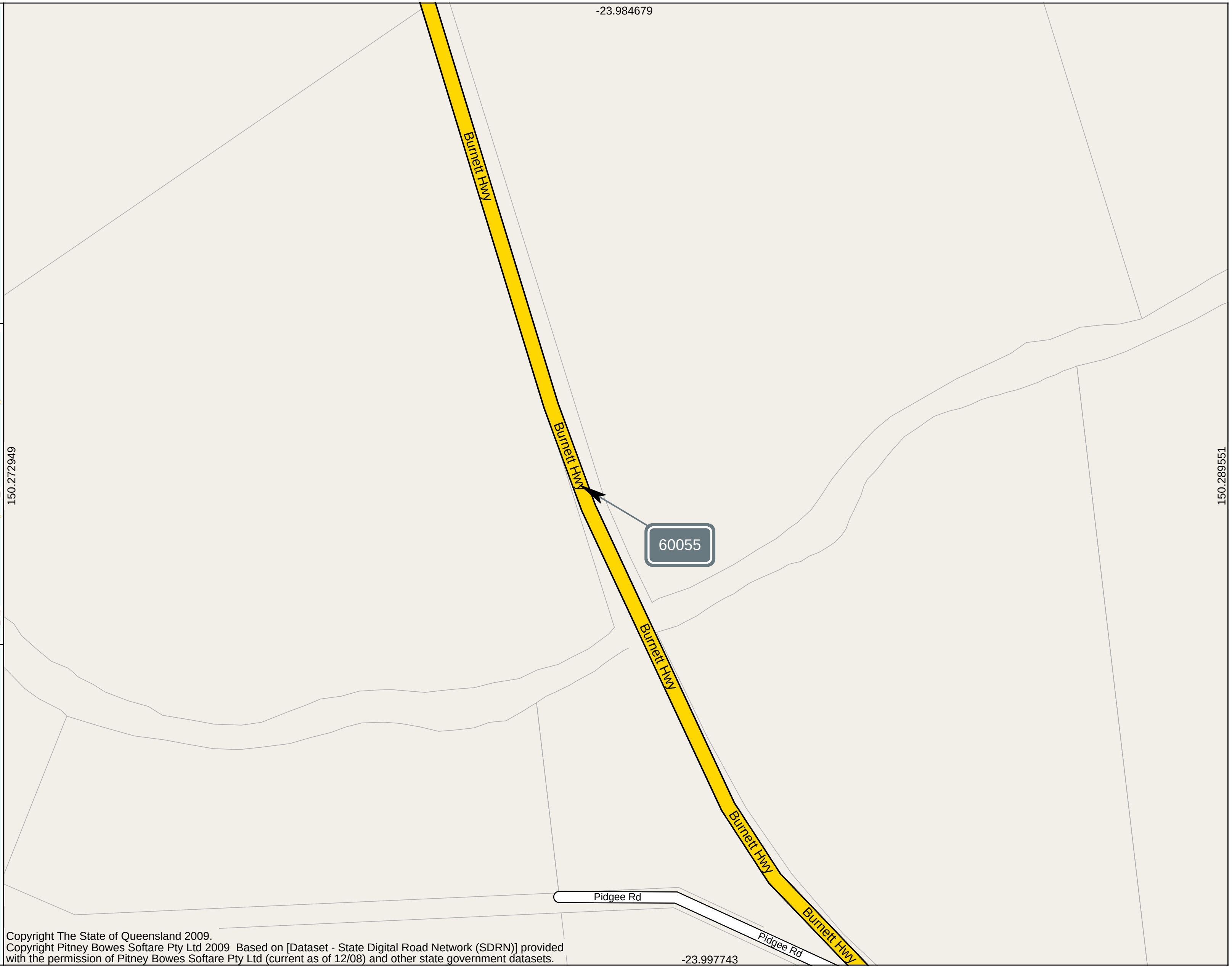
Area 404 - Fitzroy District Road Section 41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)

Site 60055 - Burnett Hwy 120m Nth of Don River TDist 54.260km Speed Limit 100

TARS







Weekly Volume Report

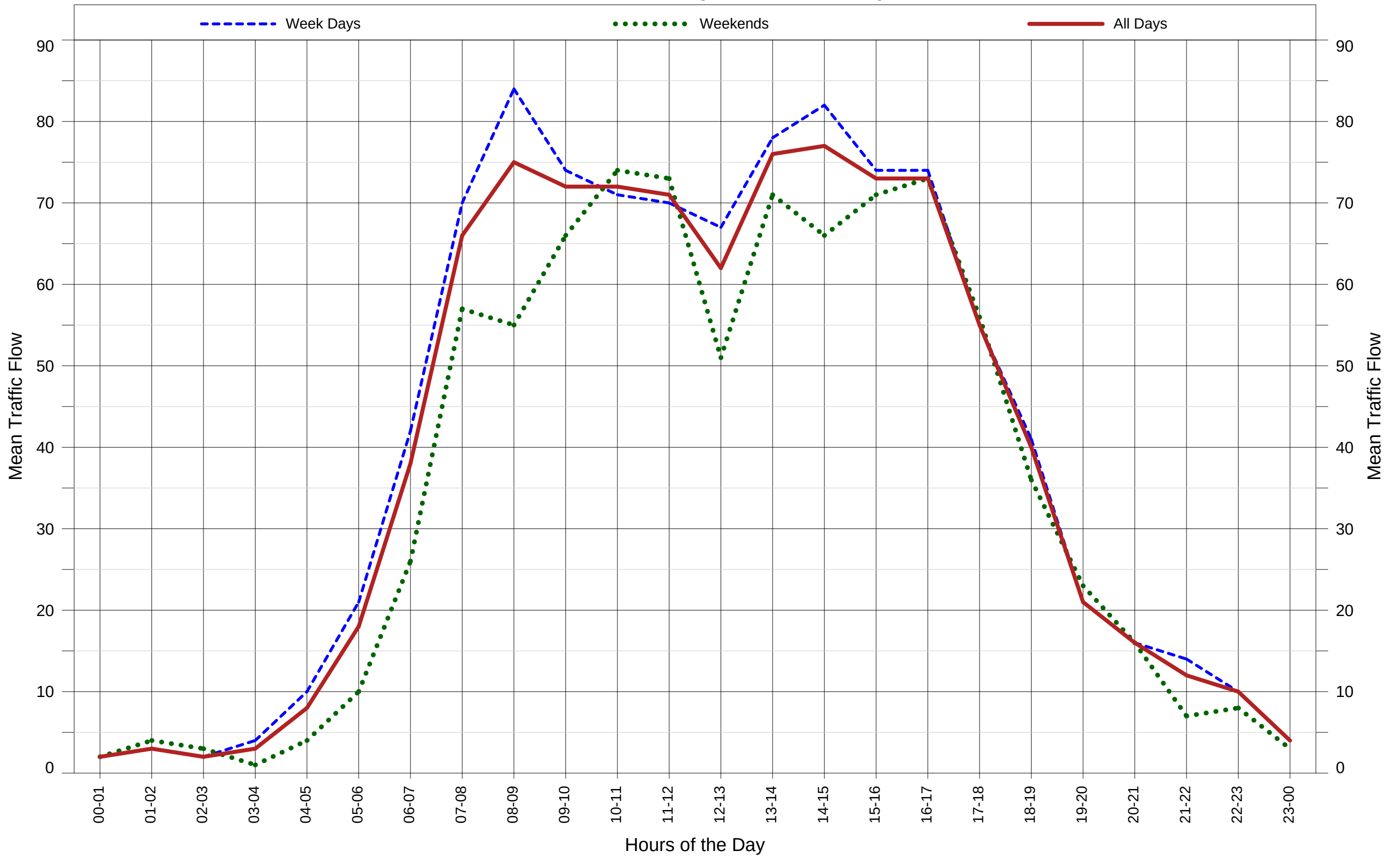
Week 2019-W42

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TB - Bi-directional traffic flow
Traffic Class	00 - All Vehicles
Week	2019-W42
Date Range	Monday 14-Oct-2019 - Sunday 20-Oct-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	1	1
Calendar Events	0	0	0	0	0	0	0

Mean Traffic Flow by Hours of the Day



Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
00-01	3	0.3%	2	0.2%	2	0.2%			4	0.4%	3	0.4%	1	0.1%	2	0.2%	2	0.2%	2	0.2%
01-02	2	0.2%	3	0.3%	5	0.5%	2	0.2%	4	0.4%	6	0.7%	2	0.2%	3	0.3%	4	0.5%	3	0.3%
02-03	3	0.3%	2	0.2%	2	0.2%	1	0.1%			2	0.2%	3	0.4%	2	0.2%	3	0.4%	2	0.2%
03-04	8	0.9%	3	0.3%	6	0.6%	2	0.2%	3	0.3%	1	0.1%			4	0.4%	1	0.1%	3	0.3%
04-05	13	1.5%	11	1.1%	9	0.9%	7	0.7%	8	0.7%	5	0.6%	2	0.2%	10	1.0%	4	0.5%	8	0.8%
05-06	22	2.5%	17	1.7%	23	2.3%	21	2.2%	23	2.1%	13	1.5%	6	0.7%	21	2.1%	10	1.2%	18	1.9%
06-07	33	3.7%	36	3.5%	51	5.2%	52	5.5%	40	3.7%	30	3.5%	21	2.5%	42	4.2%	26	3.0%	38	4.0%
07-08	69	7.8%	63	6.2%	73	7.4%	70	7.3%	76	7.0%	80	9.3%	33	3.9%	70	7.1%	57	6.7%	66	7.0%
08-09	77	8.7%	80	7.9%	94	9.5%	78	8.2%	89	8.2%	71	8.3%	39	4.6%	84	8.5%	55	6.4%	75	7.9%
09-10	75	8.5%	73	7.2%	76	7.7%	70	7.3%	76	7.0%	87	10.2%	45	5.3%	74	7.5%	66	7.7%	72	7.6%
10-11	56	6.3%	67	6.6%	82	8.3%	70	7.3%	80	7.3%	64	7.5%	83	9.8%	71	7.2%	74	8.6%	72	7.6%
11-12	79	9.0%	72	7.1%	60	6.1%	60	6.3%	77	7.1%	78	9.1%	68	8.0%	70	7.1%	73	8.5%	71	7.5%
12-13	52	5.9%	81	8.0%	77	7.8%	54	5.7%	71	6.5%	44	5.1%	58	6.9%	67	6.8%	51	6.0%	62	6.5%
13-14	74	8.4%	75	7.4%	76	7.7%	84	8.8%	80	7.3%	61	7.1%	81	9.6%	78	7.9%	71	8.3%	76	8.0%
14-15	73	8.3%	87	8.5%	69	7.0%	88	9.2%	93	8.5%	65	7.6%	67	7.9%	82	8.3%	66	7.7%	77	8.1%
15-16	56	6.3%	78	7.7%	77	7.8%	70	7.3%	87	8.0%	59	6.9%	83	9.8%	74	7.5%	71	8.3%	73	7.7%
16-17	61	6.9%	82	8.1%	55	5.6%	67	7.0%	103	9.4%	61	7.1%	85	10.0%	74	7.5%	73	8.5%	73	7.7%
17-18	47	5.3%	54	5.3%	52	5.3%	54	5.7%	66	6.0%	46	5.4%	65	7.7%	55	5.6%	56	6.5%	55	5.8%
18-19	37	4.2%	37	3.6%	43	4.3%	47	4.9%	41	3.8%	32	3.7%	40	4.7%	41	4.1%	36	4.2%	40	4.2%
19-20	14	1.6%	24	2.4%	20	2.0%	22	2.3%	24	2.2%	18	2.1%	28	3.3%	21	2.1%	23	2.7%	21	2.2%
20-21	11	1.2%	22	2.2%	12	1.2%	15	1.6%	18	1.6%	12	1.4%	19	2.2%	16	1.6%	16	1.9%	16	1.7%
21-22	10	1.1%	25	2.5%	11	1.1%	10	1.0%	13	1.2%	6	0.7%	8	0.9%	14	1.4%	7	0.8%	12	1.3%
22-23	6	0.7%	19	1.9%	9	0.9%	7	0.7%	11	1.0%	8	0.9%	7	0.8%	10	1.0%	8	0.9%	10	1.1%
23-24	1	0.1%	5	0.5%	5	0.5%	3	0.3%	5	0.5%	4	0.5%	2	0.2%	4	0.4%	3	0.4%	4	0.4%

Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	09:30	82	10:45	82	08:45	99	09:15	82	08:30	90	09:30	95	11:15	91	09:00	83	11:15	75	09:15	76
PM	14:30	88	15:30	88	13:45	82	13:45	88	16:45	108	15:30	75	16:15	91	13:45	82	15:30	72	13:45	76

12-Hour	756	85.7%	849	83.4%	834	84.3%	812	85.1%	939	86.0%	748	87.4%	747	88.3%	840	84.9%	749	87.5%	812	85.6%
16-Hour	824	93.4%	956	93.9%	928	93.8%	911	95.5%	1,034	94.7%	814	95.1%	823	97.3%	933	94.3%	821	95.9%	899	94.7%
18-Hour	831	94.2%	980	96.3%	942	95.2%	921	96.5%	1,050	96.2%	826	96.5%	832	98.3%	947	95.8%	832	97.2%	913	96.2%
24-Hour	882	100.0%	1,018	100.0%	989	100.0%	954	100.0%	1,092	100.0%	856	100.0%	846	100.0%	989	100.0%	856	100.0%	949	100.0%

Avg Week Day		89.2%		102.9%		100.0%		96.5%		110.4%						100.0%		86.6%		96.0%
Avg Weekend Day												100.0%		98.8%		115.5%		100.0%		110.9%
Avg Day		92.9%		107.3%		104.2%		100.5%		115.1%		90.2%		89.1%		104.2%		90.2%		100.0%

Traffic Analysis and Reporting System

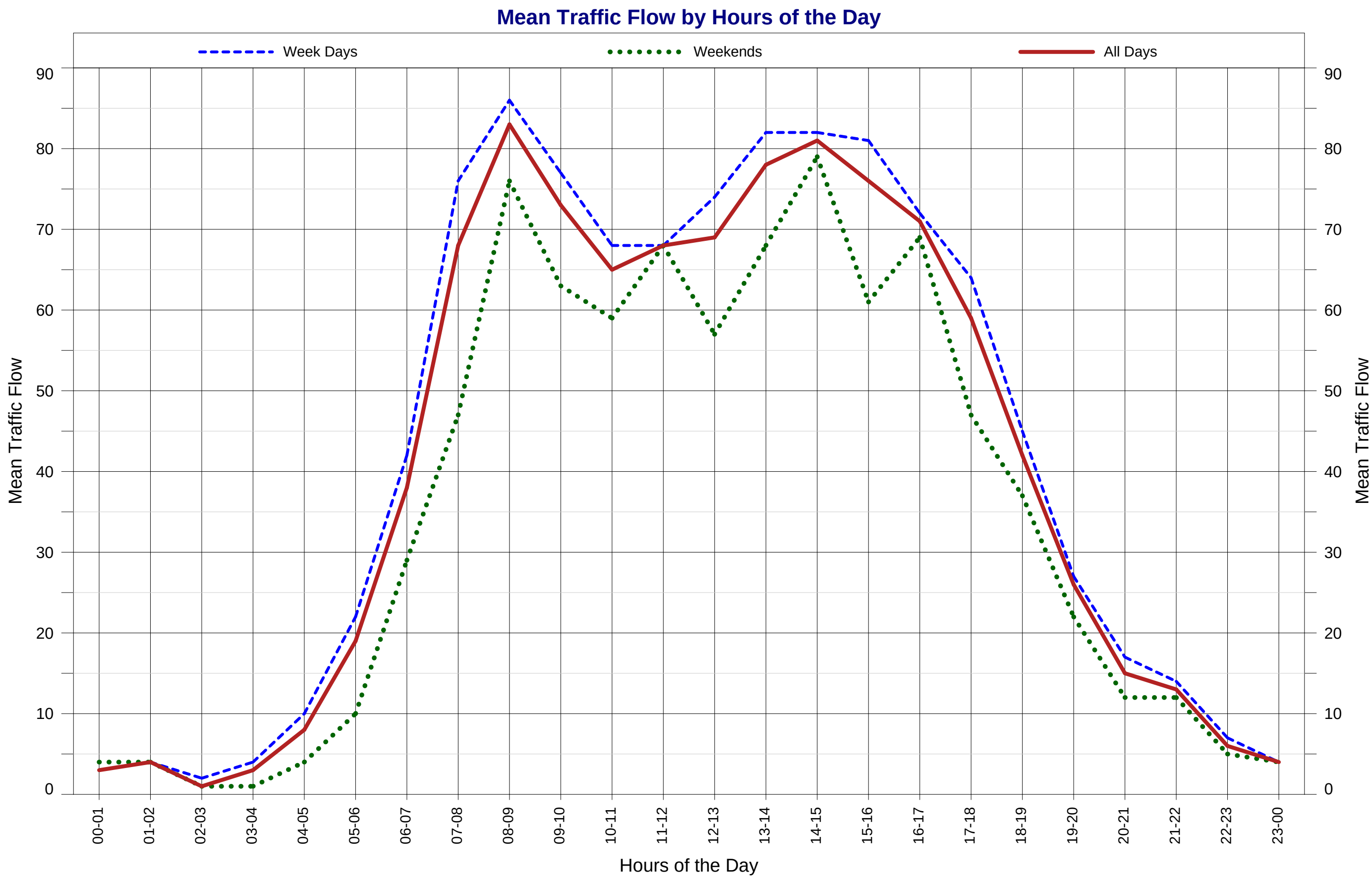
Weekly Volume Report

Week 2019-W43

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TB - Bi-directional traffic flow
Traffic Class	00 - All Vehicles
Week	2019-W43
Date Range	Monday 21-Oct-2019 - Sunday 27-Oct-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	1	1
Calendar Events	0	0	0	0	0	0	0



Weekly Volume Report

Week 2019-W43

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Average Week Day		Average Weekend Day		Average Day	
00-01	3	0.3%	2	0.2%	2	0.2%	2	0.2%	4	0.4%	6	0.7%	2	0.3%	3	0.3%	4	0.5%	3	0.3%
01-02	5	0.5%	4	0.4%	4	0.4%	2	0.2%	6	0.6%	4	0.5%	4	0.5%	4	0.4%	4	0.5%	4	0.4%
02-03			1	0.1%	4	0.4%	2	0.2%	1	0.1%	1	0.1%	1	0.1%	2	0.2%	1	0.1%	1	0.1%
03-04	6	0.6%	4	0.4%	4	0.4%	4	0.4%	4	0.4%	2	0.2%			4	0.4%	1	0.1%	3	0.3%
04-05	16	1.7%	3	0.3%	14	1.2%	6	0.6%	11	1.0%	4	0.5%	4	0.5%	10	1.0%	4	0.5%	8	0.8%
05-06	25	2.6%	15	1.5%	23	2.0%	20	2.0%	27	2.5%	14	1.6%	6	0.8%	22	2.1%	10	1.2%	19	2.0%
06-07	59	6.1%	30	3.0%	43	3.8%	40	4.0%	36	3.4%	42	4.8%	15	1.9%	42	4.1%	29	3.5%	38	3.9%
07-08	81	8.4%	66	6.5%	94	8.3%	72	7.3%	69	6.4%	62	7.1%	32	4.0%	76	7.4%	47	5.6%	68	7.0%
08-09	74	7.7%	71	7.0%	121	10.7%	88	8.9%	78	7.3%	90	10.3%	61	7.7%	86	8.3%	76	9.1%	83	8.5%
09-10	57	5.9%	75	7.4%	77	6.8%	72	7.3%	105	9.8%	85	9.7%	40	5.0%	77	7.5%	63	7.5%	73	7.5%
10-11	63	6.5%	58	5.7%	78	6.9%	69	7.0%	72	6.7%	65	7.4%	52	6.5%	68	6.6%	59	7.0%	65	6.7%
11-12	65	6.7%	55	5.4%	81	7.2%	66	6.7%	72	6.7%	68	7.8%	68	8.6%	68	6.6%	68	8.1%	68	7.0%
12-13	63	6.5%	81	8.0%	85	7.5%	73	7.4%	69	6.4%	54	6.2%	59	7.4%	74	7.2%	57	6.8%	69	7.1%
13-14	87	9.0%	92	9.1%	90	8.0%	66	6.7%	76	7.1%	59	6.8%	77	9.7%	82	8.0%	68	8.1%	78	8.0%
14-15	78	8.1%	82	8.1%	89	7.9%	70	7.1%	92	8.6%	59	6.8%	99	12.5%	82	8.0%	79	9.4%	81	8.3%
15-16	65	6.7%	77	7.6%	91	8.1%	79	8.0%	95	8.8%	53	6.1%	69	8.7%	81	7.9%	61	7.3%	76	7.8%
16-17	68	7.0%	87	8.6%	62	5.5%	80	8.1%	63	5.9%	80	9.2%	58	7.3%	72	7.0%	69	8.2%	71	7.3%
17-18	63	6.5%	64	6.3%	64	5.7%	55	5.6%	76	7.1%	43	4.9%	51	6.4%	64	6.2%	47	5.6%	59	6.1%
18-19	35	3.6%	50	5.0%	40	3.6%	48	4.8%	51	4.7%	42	4.8%	31	3.9%	45	4.4%	37	4.4%	42	4.3%
19-20	22	2.3%	28	2.8%	24	2.1%	33	3.3%	30	2.8%	14	1.6%	29	3.7%	27	2.6%	22	2.6%	26	2.7%
20-21	15	1.6%	26	2.6%	18	1.6%	14	1.4%	12	1.1%	10	1.1%	13	1.6%	17	1.6%	12	1.4%	15	1.5%
21-22	11	1.1%	21	2.1%	8	0.7%	18	1.8%	13	1.2%	6	0.7%	17	2.1%	14	1.4%	12	1.4%	13	1.3%
22-23	4	0.4%	12	1.2%	5	0.4%	7	0.7%	7	0.7%	6	0.7%	4	0.5%	7	0.7%	5	0.6%	6	0.6%
23-24	2	0.2%	6	0.6%	5	0.4%	4	0.4%	5	0.5%	5	0.6%	2	0.3%	4	0.4%	4	0.5%	4	0.4%

Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:30	89	08:45	83	09:15	122	08:45	95	10:00	105	09:15	102	12:00	68	08:30	92	09:15	79	08:30	83
PM	14:00	87	14:15	100	14:45	98	16:45	91	15:30	102	17:00	80	14:30	103	14:15	87	15:00	78	14:45	82

12-Hour	799	82.6%	858	85.0%	972	86.3%	838	84.6%	918	85.5%	760	87.0%	697	87.8%	875	84.9%	731	87.1%	833	85.6%
16-Hour	906	93.7%	963	95.3%	1,065	94.6%	943	95.3%	1,009	93.9%	832	95.2%	771	97.1%	975	94.6%	806	96.1%	925	95.1%
18-Hour	912	94.3%	981	97.1%	1,075	95.5%	954	96.4%	1,021	95.1%	843	96.5%	777	97.9%	986	95.6%	815	97.1%	935	96.1%
24-Hour	967	100.0%	1,010	100.0%	1,126	100.0%	990	100.0%	1,074	100.0%	874	100.0%	794	100.0%	1,031	100.0%	839	100.0%	973	100.0%

Avg Week Day	93.8%	98.0%	109.2%	96.0%	104.2%			100.0%	81.4%	94.4%
Avg Weekend Day						104.2%	94.6%	122.9%	100.0%	116.0%
Avg Day	99.4%	103.8%	115.7%	101.7%	110.4%	89.8%	81.6%	106.0%	86.2%	100.0%

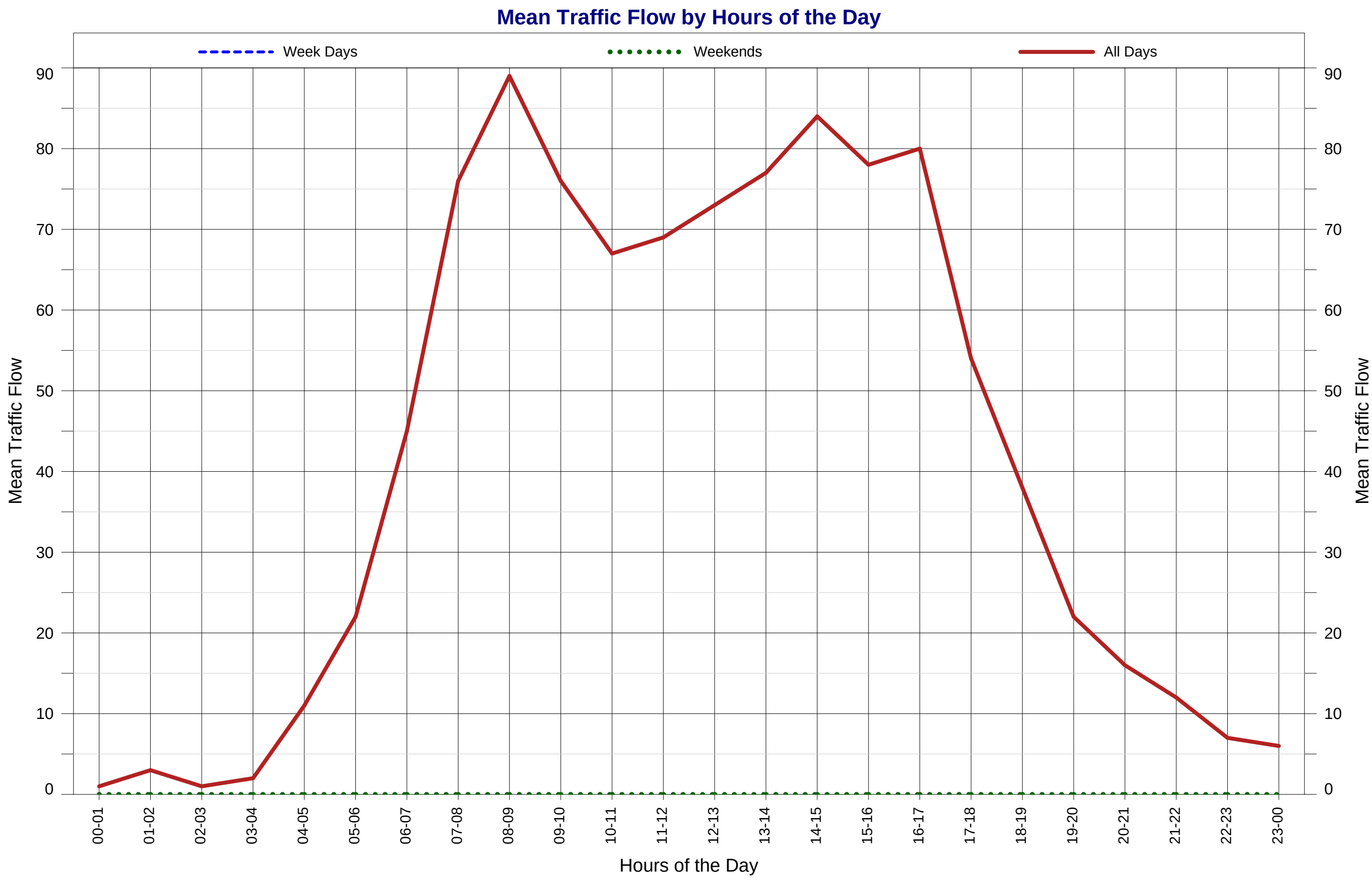
Weekly Volume Report

Week 2019-W44

Area	404 - Fitzroy District
Road Section	41E - BURNETT HIGHWAY (BILOELA - MT MORGAN)
Site	60055 - Burnett Hwy 120m Nth of Don River
Thru Dist	54.26
Type	C - Coverage
Stream	TB - Bi-directional traffic flow
Traffic Class	00 - All Vehicles
Week	2019-W44
Date Range	Monday 28-Oct-2019 - Sunday 03-Nov-2019

Data Profile

	Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
Days in Date Range	1	1	1	1	1	1	1
Days Included	1	1	1	1	1	0	0
Calendar Events	0	0	0	0	0	0	0



Weekly Volume Report

Week 2019-W44

Hour	Monday		Tuesday		Wednesday		Thursday		Friday		Average Week Day		Average Day	
00-01									7	0.6%	1	0.1%	1	0.1%
01-02	3	0.3%	2	0.2%	2	0.2%	2	0.2%	5	0.5%	3	0.3%	3	0.3%
02-03	2	0.2%			3	0.3%	2	0.2%			1	0.1%	1	0.1%
03-04	5	0.6%	3	0.3%	3	0.3%					2	0.2%	2	0.2%
04-05	14	1.6%	7	0.7%	11	1.1%	9	0.9%	13	1.2%	11	1.1%	11	1.1%
05-06	22	2.5%	21	2.0%	22	2.1%	27	2.7%	20	1.8%	22	2.2%	22	2.2%
06-07	51	5.8%	44	4.2%	56	5.4%	43	4.3%	29	2.7%	45	4.5%	45	4.5%
07-08	77	8.8%	69	6.6%	72	6.9%	84	8.4%	79	7.3%	76	7.5%	76	7.5%
08-09	74	8.4%	76	7.3%	112	10.7%	90	9.0%	93	8.6%	89	8.8%	89	8.8%
09-10	61	7.0%	83	8.0%	83	8.0%	77	7.7%	76	7.0%	76	7.5%	76	7.5%
10-11	59	6.7%	60	5.7%	75	7.2%	68	6.8%	75	6.9%	67	6.6%	67	6.6%
11-12	63	7.2%	69	6.6%	80	7.7%	57	5.7%	76	7.0%	69	6.8%	69	6.8%
12-13	62	7.1%	80	7.7%	59	5.7%	84	8.4%	80	7.4%	73	7.2%	73	7.2%
13-14	71	8.1%	82	7.9%	86	8.2%	62	6.2%	84	7.7%	77	7.6%	77	7.6%
14-15	60	6.8%	98	9.4%	85	8.1%	76	7.6%	101	9.3%	84	8.3%	84	8.3%
15-16	57	6.5%	85	8.1%	90	8.6%	84	8.4%	76	7.0%	78	7.7%	78	7.7%
16-17	71	8.1%	79	7.6%	66	6.3%	81	8.1%	101	9.3%	80	7.9%	80	7.9%
17-18	46	5.2%	50	4.8%	49	4.7%	58	5.8%	67	6.2%	54	5.4%	54	5.4%
18-19	32	3.6%	45	4.3%	28	2.7%	43	4.3%	43	4.0%	38	3.8%	38	3.8%
19-20	20	2.3%	28	2.7%	18	1.7%	21	2.1%	23	2.1%	22	2.2%	22	2.2%
20-21	14	1.6%	26	2.5%	17	1.6%	8	0.8%	17	1.6%	16	1.6%	16	1.6%
21-22	4	0.5%	22	2.1%	12	1.1%	14	1.4%	10	0.9%	12	1.2%	12	1.2%
22-23	3	0.3%	8	0.8%	6	0.6%	9	0.9%	8	0.7%	7	0.7%	7	0.7%
23-24	6	0.7%	7	0.7%	9	0.9%	6	0.6%	3	0.3%	6	0.6%	6	0.6%
Peaks	Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count		Hour End & Count	
AM	08:45	83	09:30	89	09:00	112	09:15	97	08:45	93	09:00	89	09:00	62
PM	17:15	74	15:00	98	15:30	92	15:45	86	15:00	101	15:00	84	15:15	59
12-Hour	733	83.6%	876	83.9%	885	84.8%	864	86.0%	951	87.6%	861	85.3%	861	85.3%
16-Hour	822	93.7%	996	95.4%	988	94.6%	950	94.5%	1,030	94.8%	956	94.7%	956	94.7%
18-Hour	831	94.8%	1,011	96.8%	1,003	96.1%	965	96.0%	1,041	95.9%	969	96.0%	969	96.0%
24-Hour	877	100.0%	1,044	100.0%	1,044	100.0%	1,005	100.0%	1,086	100.0%	1,009	100.0%	1,009	100.0%
Avg Week Day		86.9%		103.5%		103.5%		99.6%		107.6%		100.0%		100.0%
Avg Day		86.9%		103.5%		103.5%		99.6%		107.6%		100.0%		100.0%

Appendix C – Bruce Highway / South Ulam Road Intersection Count

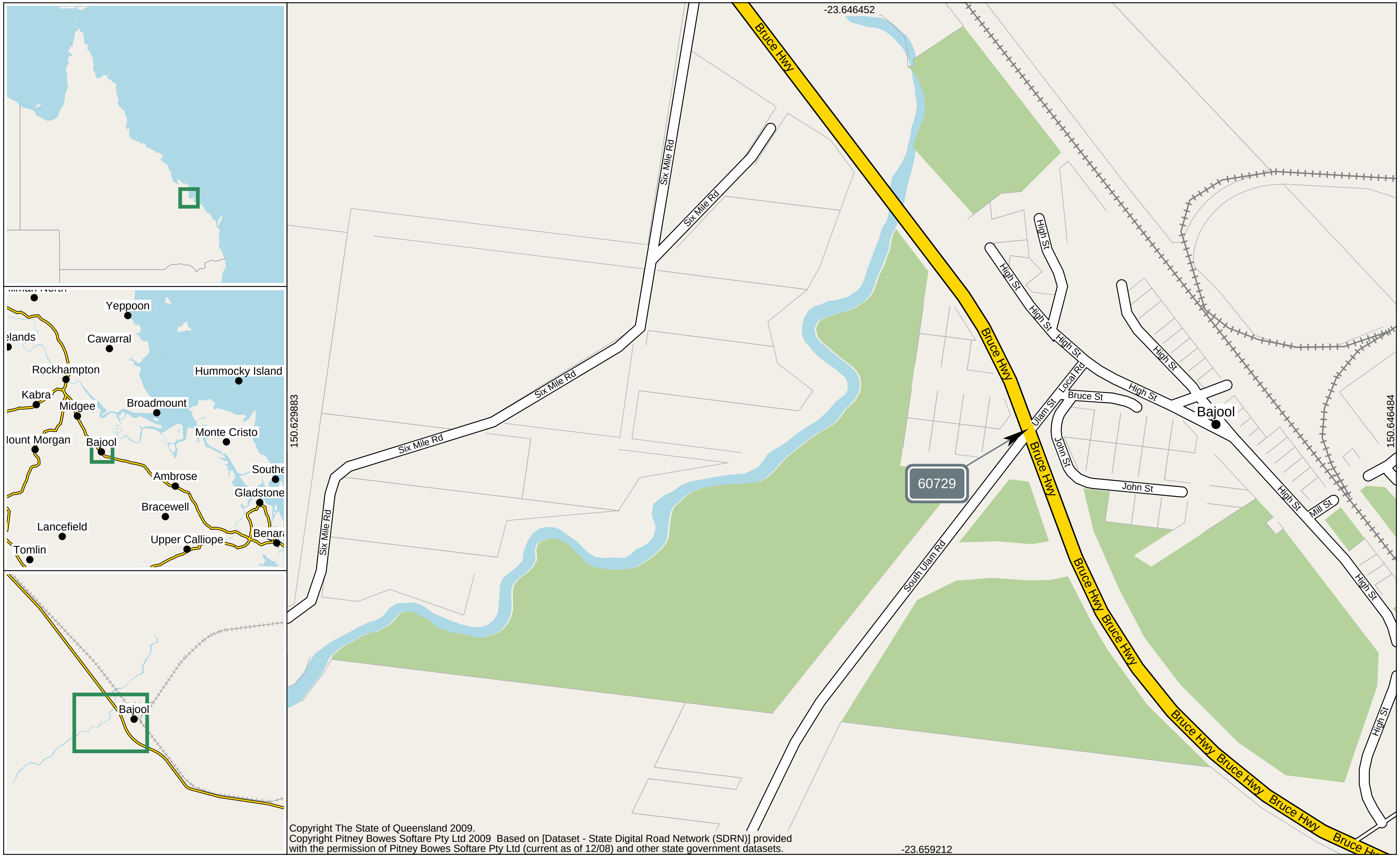
Traffic Analysis and Reporting System

Intersection Analysis Report

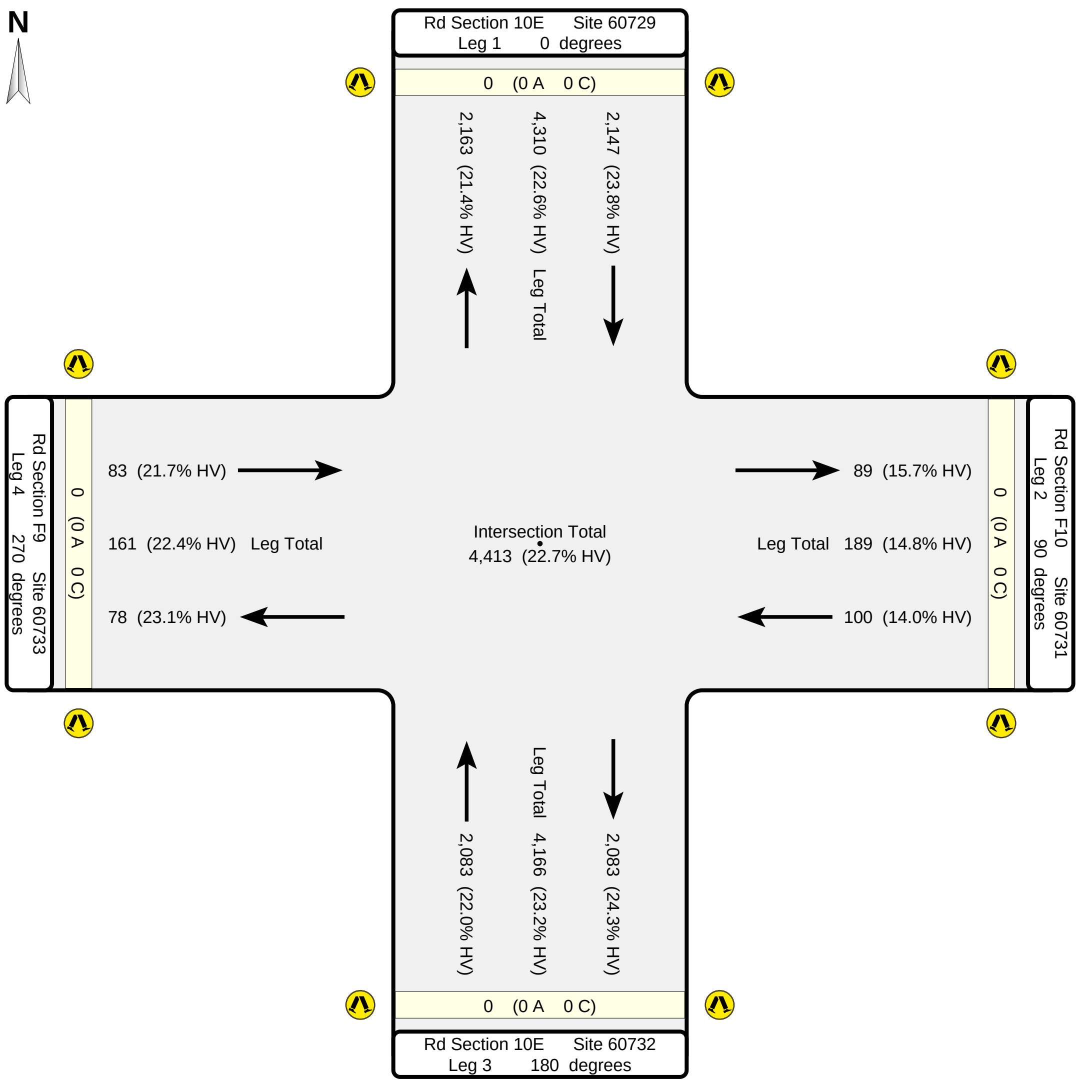
Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)

Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road

Wednesday 24-Feb-2016 06:15 - 18:15



Summary



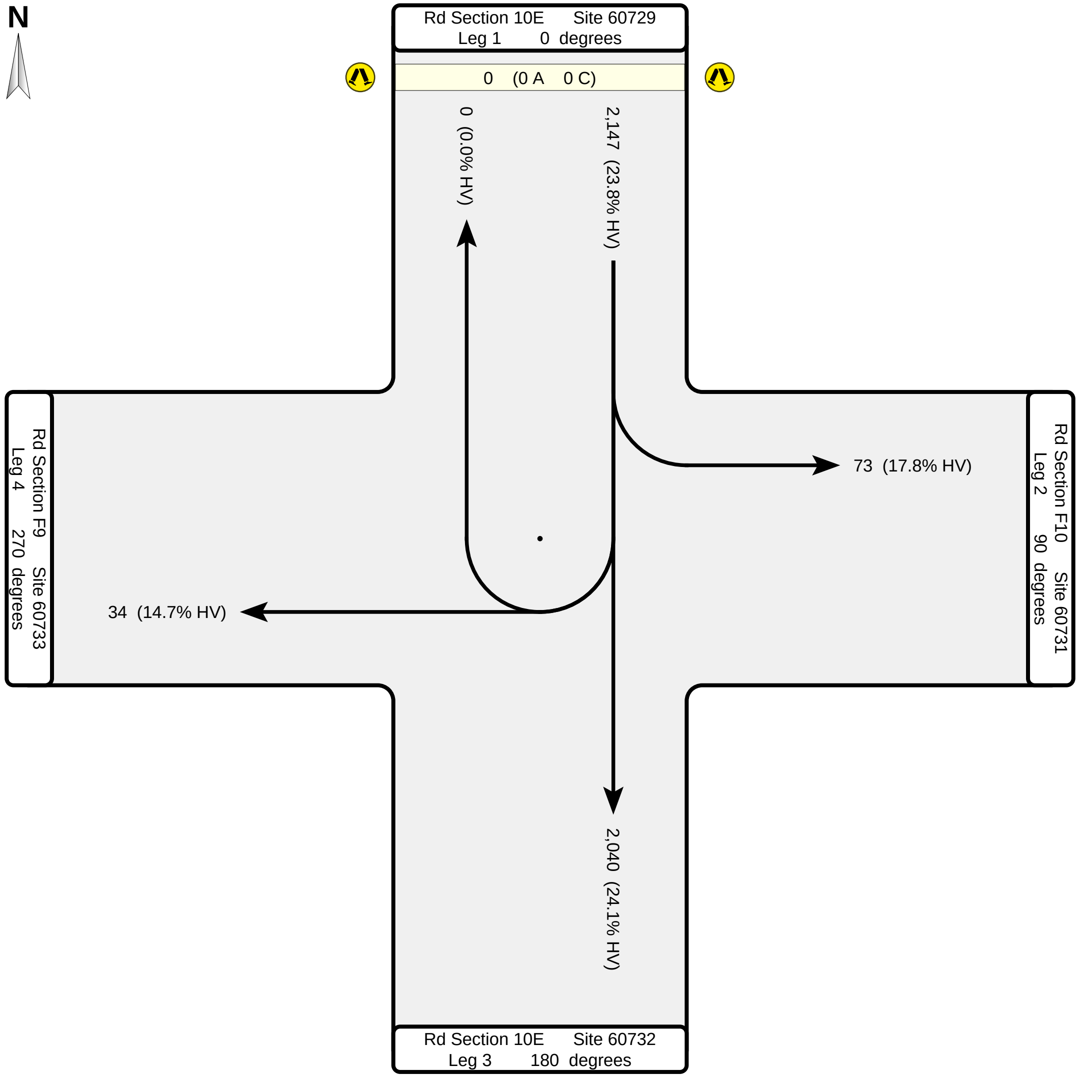
Leg	Angle	Road Section	Site	TDist	Site Description
1	0	10E	60729	86.183	Bruce Hwy to R'ton @ South Ulam Rd
2	90	F10	60731	0.000	Bajool Rd to Bajool @ Bruce Hwy
3	180	10E	60732	86.182	Bruce Hwy to Marmor @ South Ulam Rd
4	270	F9	60733	0.000	South Ulam Rd to Upper Ulam @ Bruce Hwy

Traffic Analysis and Reporting System

Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016   06:15 - 18:15

Leg 1   Site 60729   Tdist 86.183 km   Bruce Hwy to R'ton @ South Ulam Rd



Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 1 Site 60729 Tdist 86.183 km Bruce Hwy to R'ton @ South Ulam Rd

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15					
06:15-06:30	0	35	1		
06:30-06:45	0	34	1		
06:45-07:00	1	32	0		
07:00-07:15	2	45	3		
07:15-07:30	0	44	1		
07:30-07:45	2	50	0		
07:45-08:00	2	36	1		

Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	4	69	1		
08:15-08:30	1	60	0		
08:30-08:45	3	51	0		
08:45-09:00	4	37	0		
09:00-09:15	1	51	0		
09:15-09:30	4	54	1		
09:30-09:45	1	68	1		
09:45-10:00	2	48	2		
10:00-10:15	1	38	2		
10:15-10:30	3	49	0		
10:30-10:45	2	41	0		
10:45-11:00	2	53	0		
11:00-11:15	2	50	0		
11:15-11:30	2	31	0		
11:30-11:45	3	40	0		
11:45-12:00	0	36	0		
12:00-12:15	1	31	0		
12:15-12:30	4	39	1		
12:30-12:45	0	38	0		
12:45-13:00	2	52	1		
13:00-13:15	3	43	0		
13:15-13:30	0	38	0		
13:30-13:45	0	51	1		
13:45-14:00	0	36	0		
14:00-14:15	1	50	1		
14:15-14:30	2	36	1		
14:30-14:45	1	44	0		
14:45-15:00	1	47	2		
15:00-15:15	1	46	0		
15:15-15:30	0	41	0		
15:30-15:45	3	30	1		
15:45-16:00	3	57	2		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	1	47	1		
16:15-16:30	3	34	1		
16:30-16:45	1	42	0		
16:45-17:00	1	50	4		
17:00-17:15	1	29	1		
17:15-17:30	1	33	2		
17:30-17:45	0	29	0		
17:45-18:00	1	27	1		
18:00-18:15	0	18	0		
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)

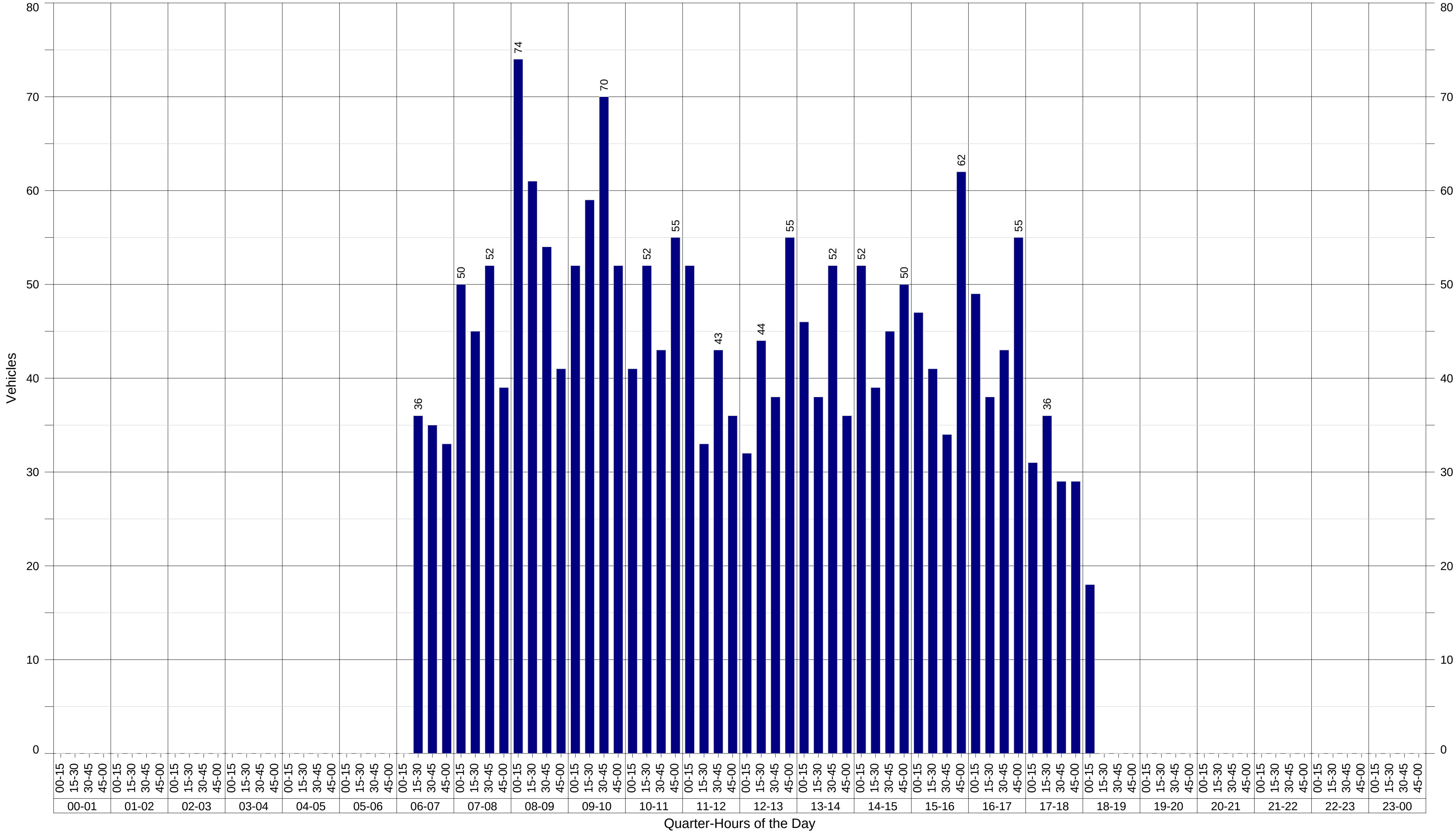
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road

Wednesday 24-Feb-2016 06:15 - 18:15

Leg 1 Site 60729 Tdist 86.183 km Bruce Hwy to R'ton @ South Ulam Rd

Total volume 2,147

Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes

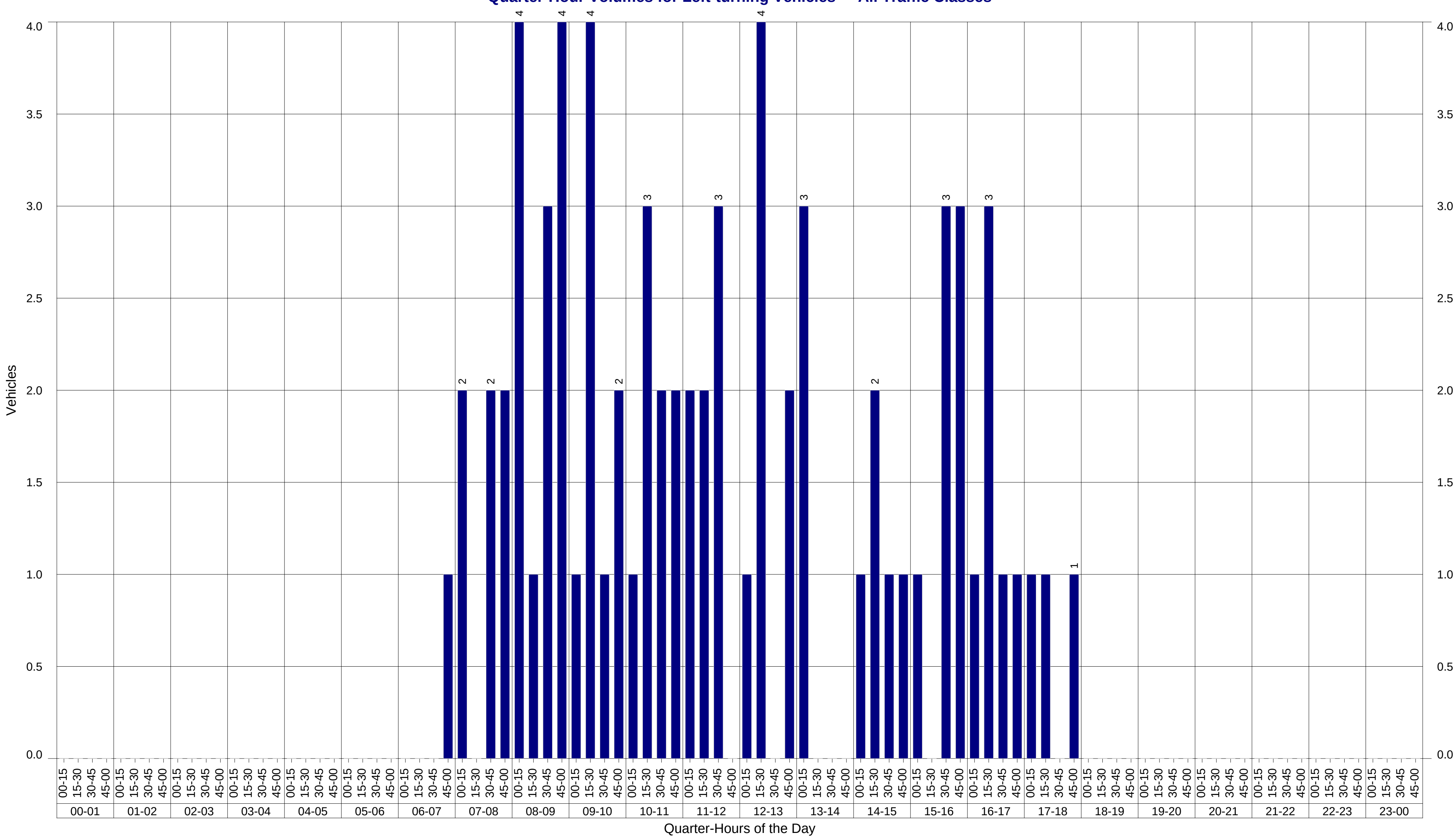


Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 1 Site 60729 Tdist 86.183 km Bruce Hwy to R'ton @ South Ulam Rd

Total volume 73



Traffic Analysis and Reporting System

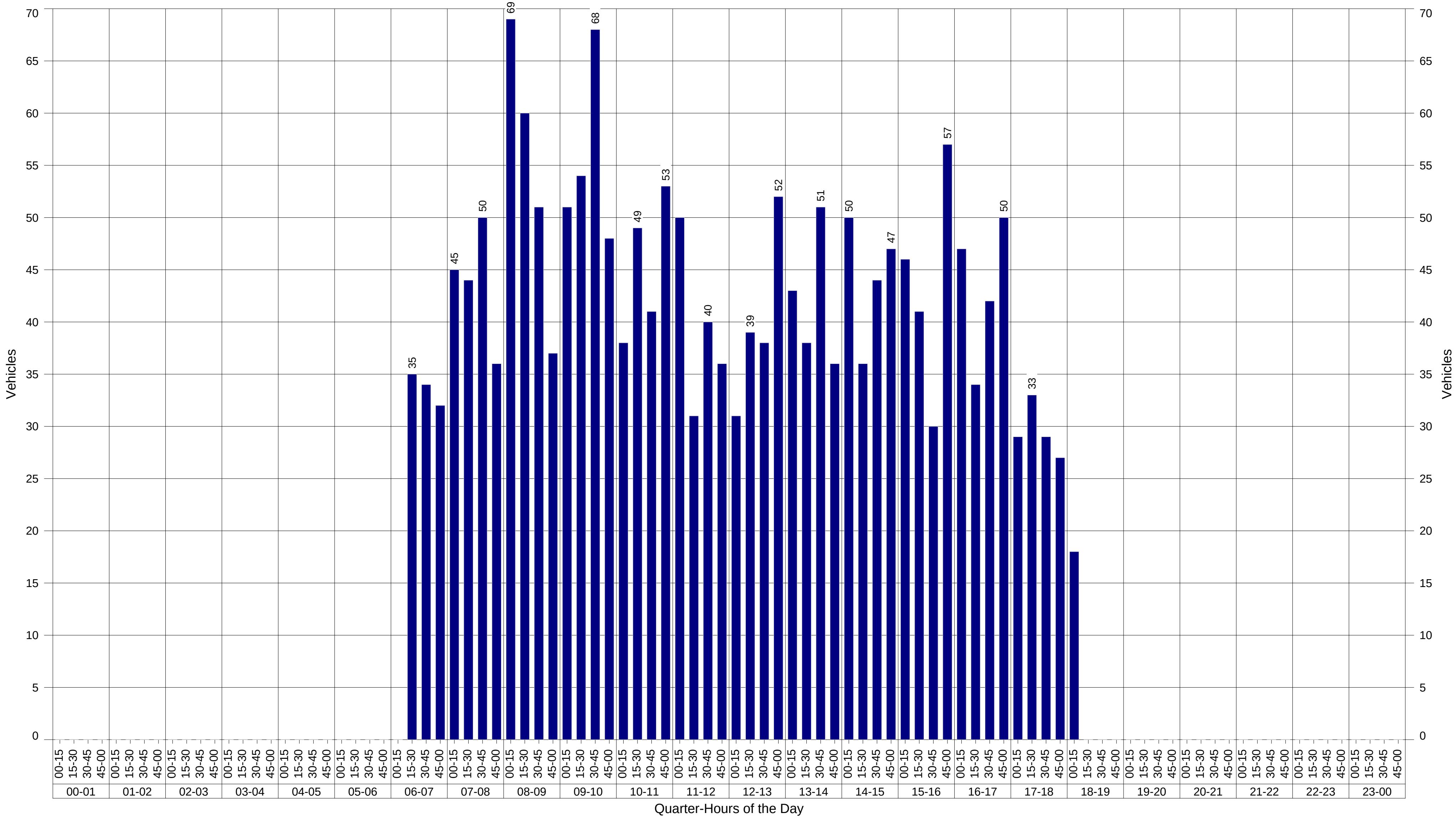
Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 1 Site 60729 Tdist 86.183 km Bruce Hwy to R'ton @ South Ulam Rd

Total volume 2,040

Quarter-Hour Volumes for Through Vehicles - All Traffic Classes



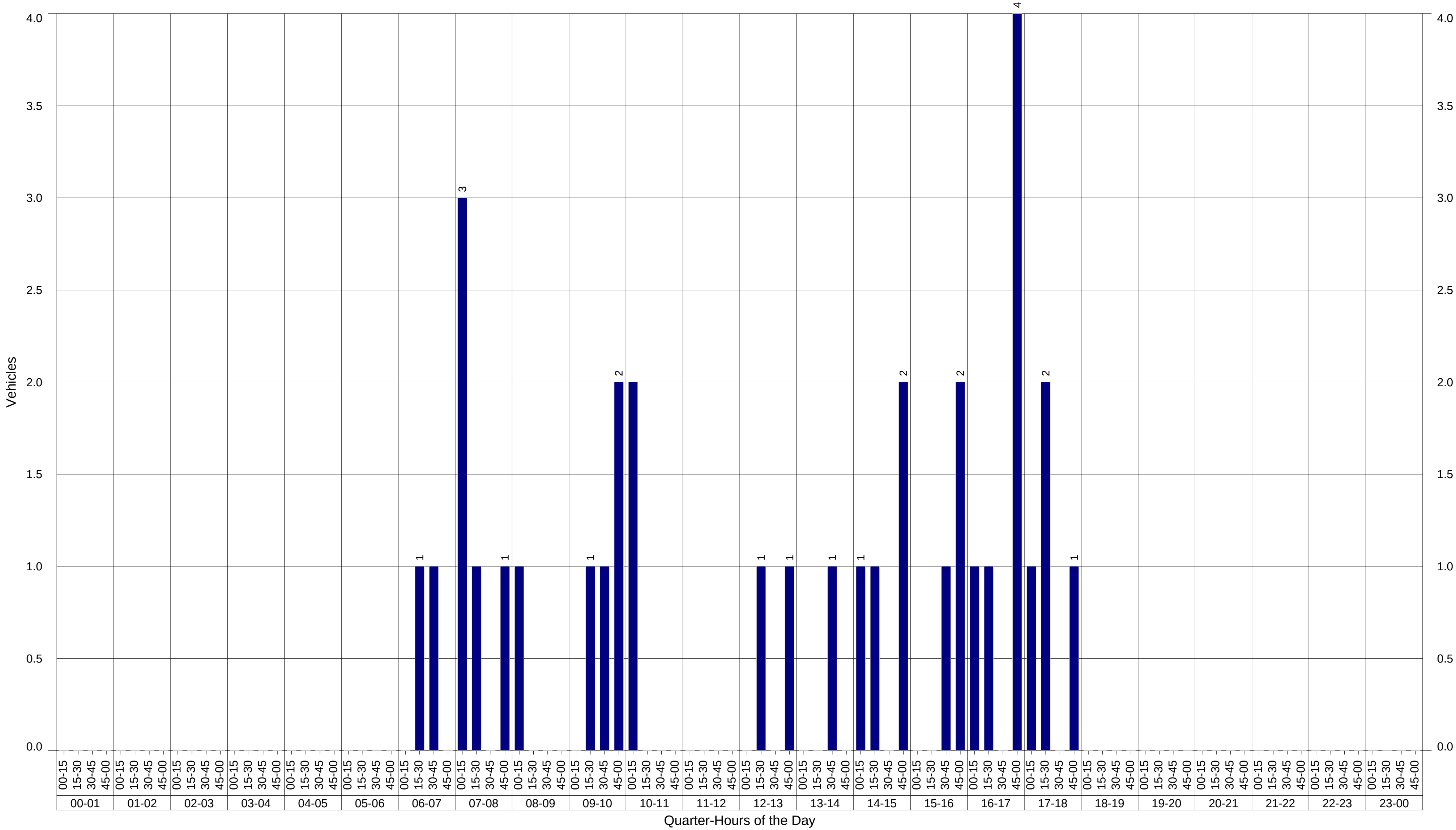
Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 1   Site 60729   Tdist 86.183 km   Bruce Hwy to R'ton @ South Ulam Rd

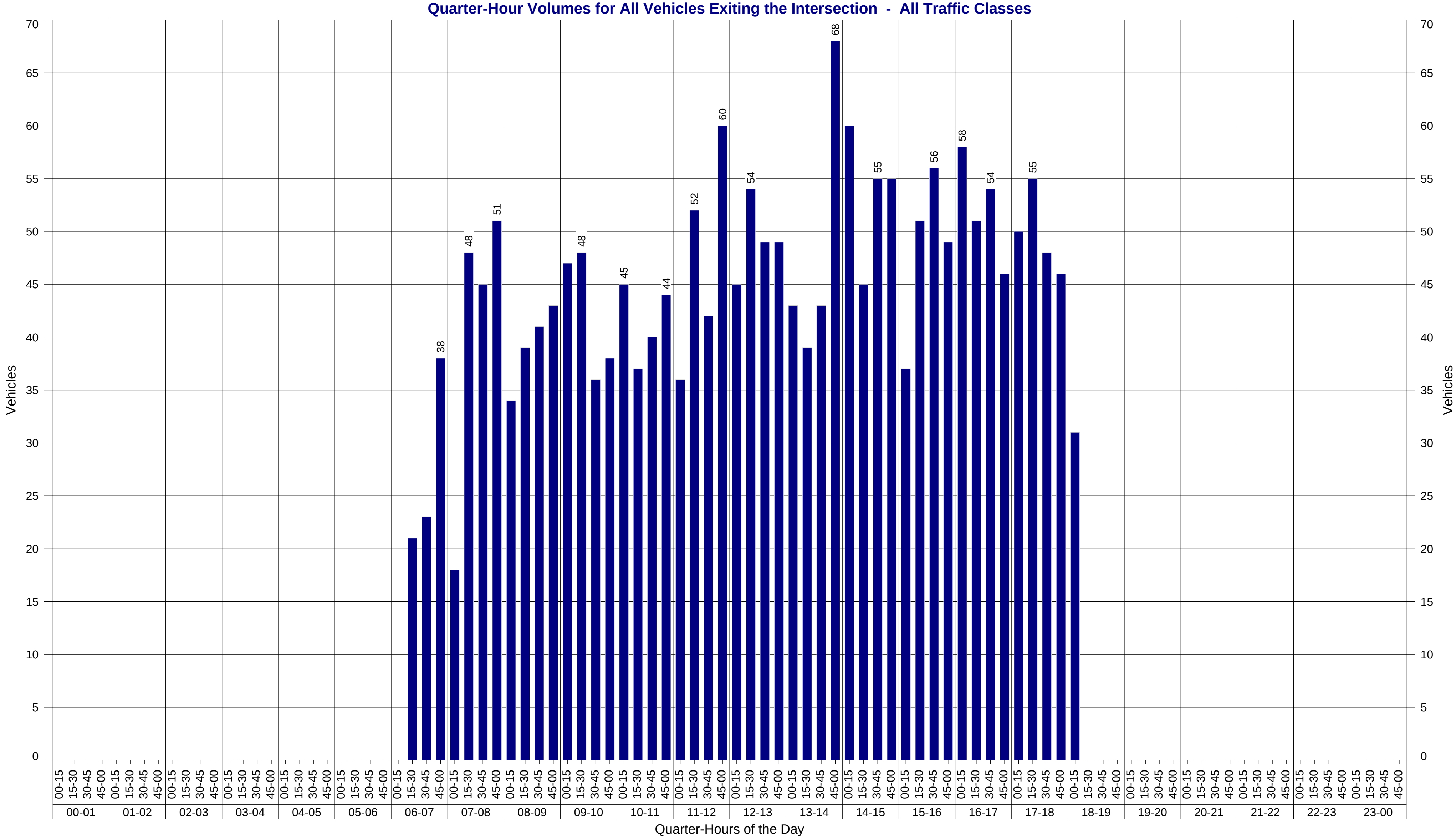
Total volume 34

Quarter-Hour Volumes for Right-turning Vehicles - All Traffic Classes



Leg 1 Site 60729 Tdist 86.183 km Bruce Hwy to R'ton @ South Ulam Rd

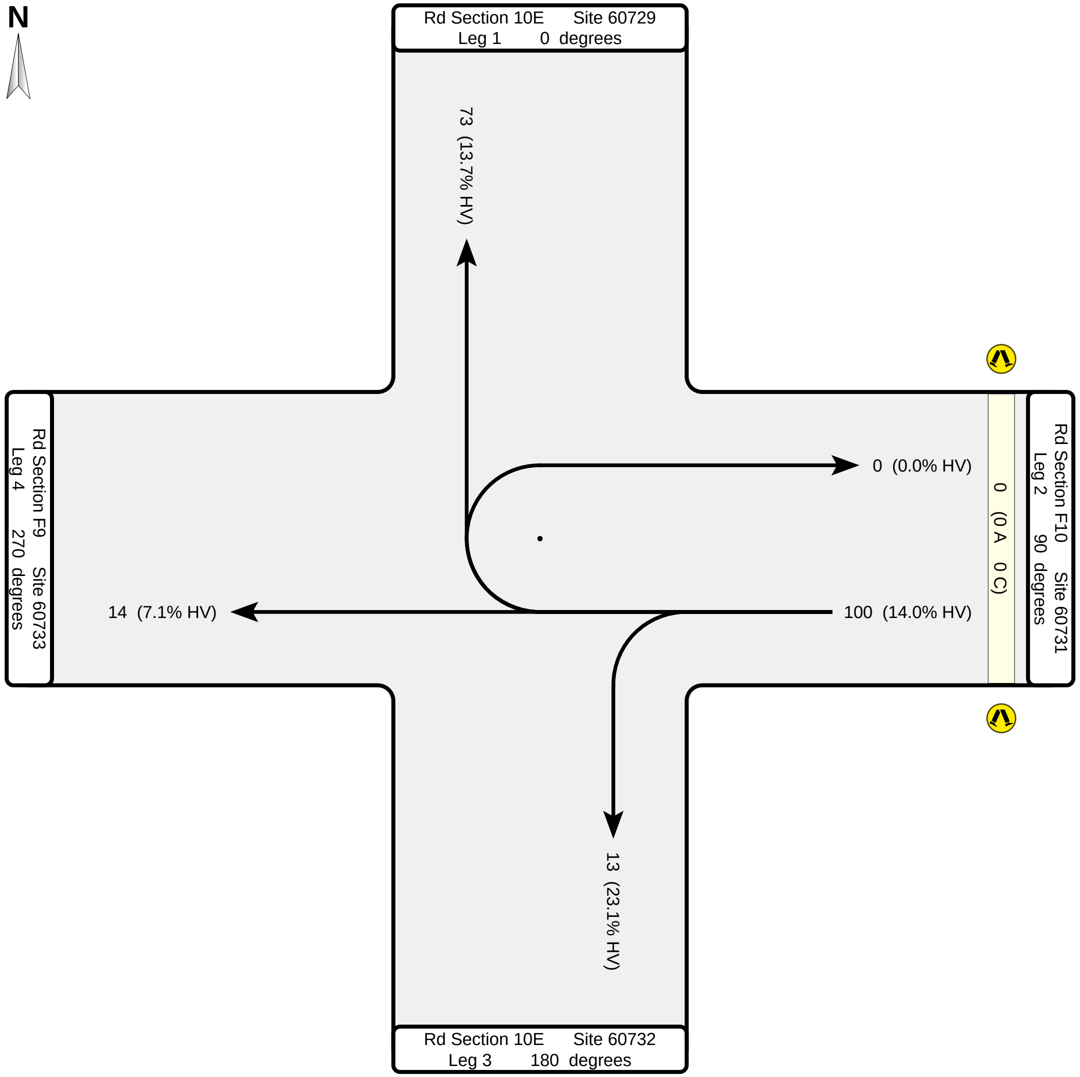
Total volume 2,163



Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 2   Site 60731   Tdist 0.000 km   Bajool Rd to Bajool @ Bruce Hwy



Leg 2 Site 60731 Tdist 0.000 km Bajool Rd to Bajool @ Bruce Hwy

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15					
06:15-06:30	1	0	0		
06:30-06:45	0	0	2		
06:45-07:00	0	1	0		
07:00-07:15	0	0	1		
07:15-07:30	0	0	2		
07:30-07:45	0	1	1		
07:45-08:00	1	1	3		

Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	0	0	1		
08:15-08:30	2	0	3		
08:30-08:45	1	0	1		
08:45-09:00	1	0	5		
09:00-09:15	0	1	4		
09:15-09:30	0	0	4		
09:30-09:45	0	0	2		
09:45-10:00	0	0	1		
10:00-10:15	0	0	4		
10:15-10:30	0	1	2		
10:30-10:45	0	0	2		
10:45-11:00	1	0	1		
11:00-11:15	0	1	0		
11:15-11:30	0	1	2		
11:30-11:45	0	0	3		
11:45-12:00	0	0	2		
12:00-12:15	0	0	1		
12:15-12:30	0	0	0		
12:30-12:45	0	0	2		
12:45-13:00	0	0	2		
13:00-13:15	1	0	1		
13:15-13:30	0	1	1		
13:30-13:45	0	0	0		
13:45-14:00	0	1	0		
14:00-14:15	1	0	1		
14:15-14:30	0	0	4		
14:30-14:45	0	0	0		
14:45-15:00	1	0	0		
15:00-15:15	0	1	0		
15:15-15:30	0	0	1		
15:30-15:45	0	0	1		
15:45-16:00	1	0	0		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	1	0	2		
16:15-16:30	0	2	3		
16:30-16:45	1	0	0		
16:45-17:00	0	1	2		
17:00-17:15	0	0	0		
17:15-17:30	0	0	3		
17:30-17:45	0	0	1		
17:45-18:00	0	1	1		
18:00-18:15	0	0	1		
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

Traffic Analysis and Reporting System

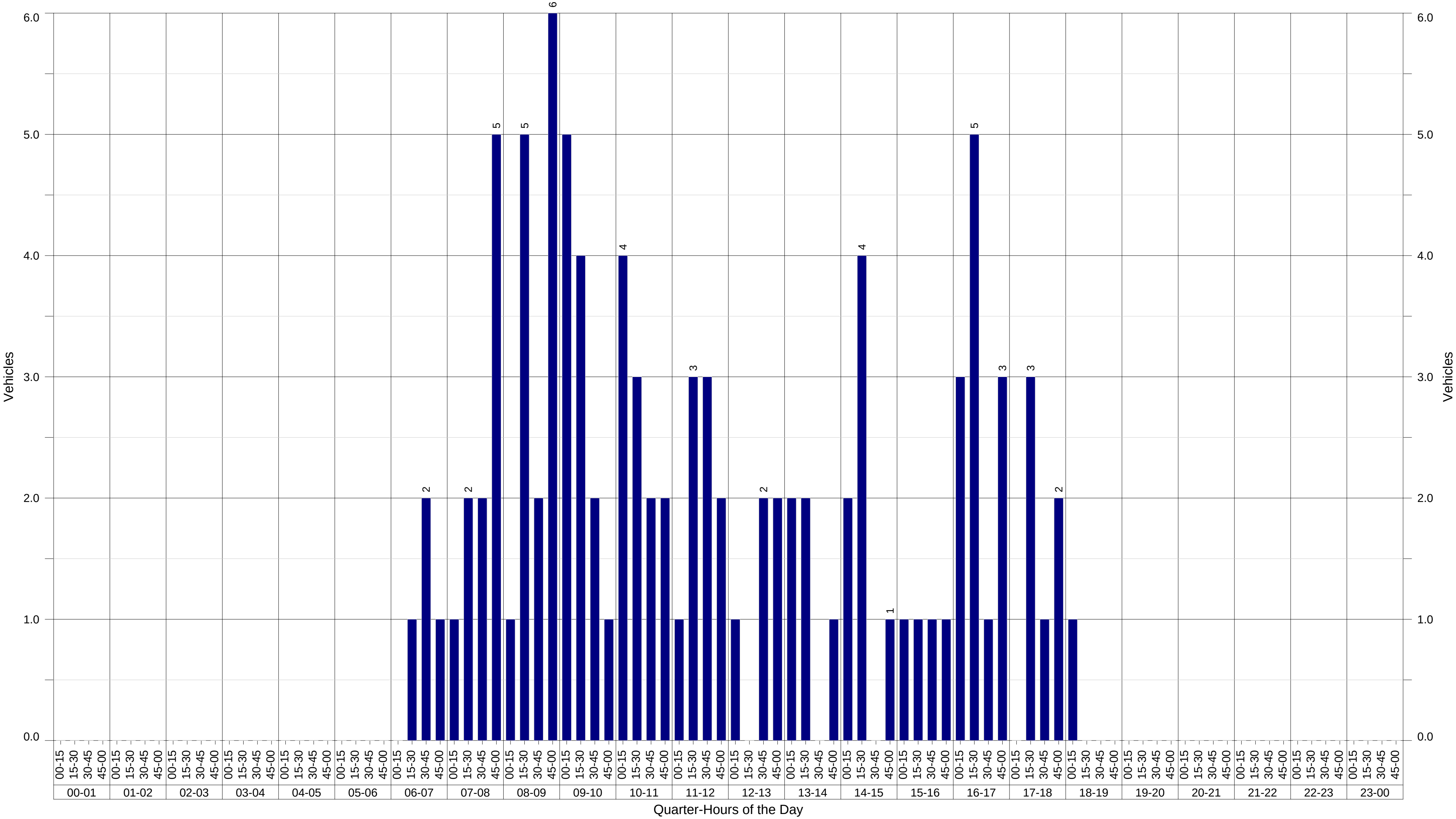
Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 2   Site 60731   Tdist 0.000 km   Bajool Rd to Bajool @ Bruce Hwy

Total volume 100

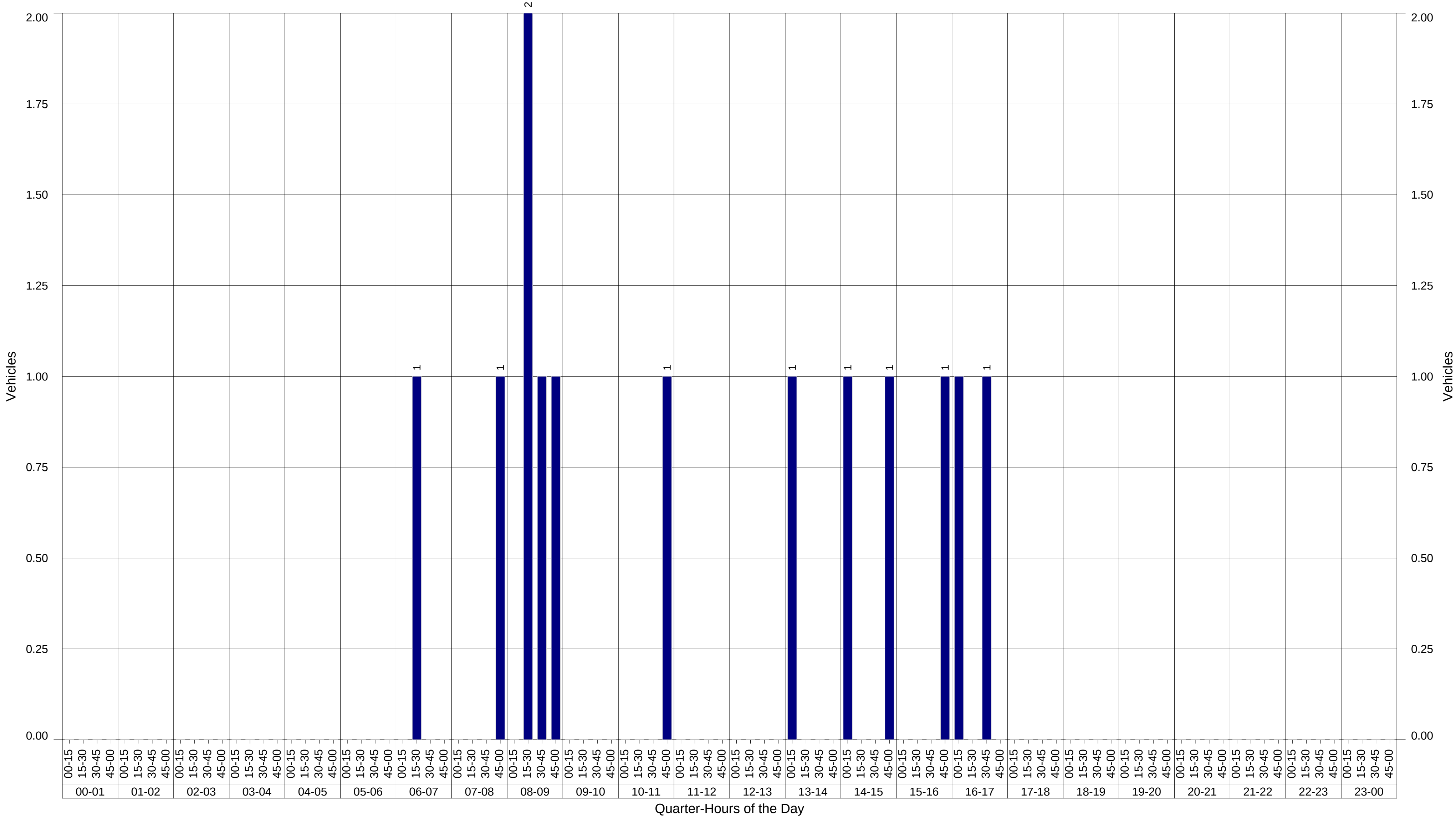
Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes



Leg 2 Site 60731 Tdist 0.000 km Bajool Rd to Bajool @ Bruce Hwy

Total volume 13

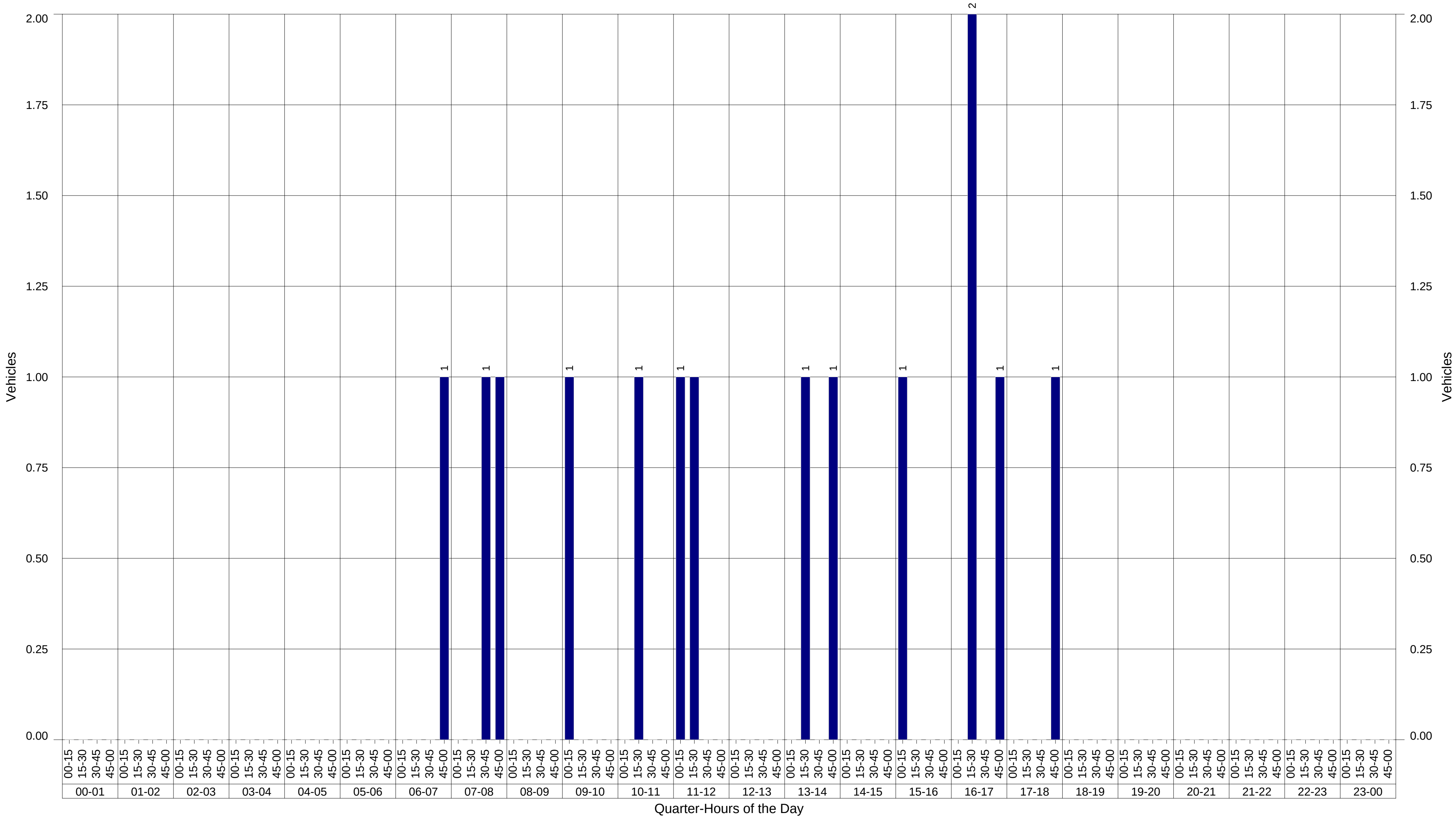
Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes



Leg 2 Site 60731 Tdist 0.000 km Bajool Rd to Bajool @ Bruce Hwy

Total volume 14

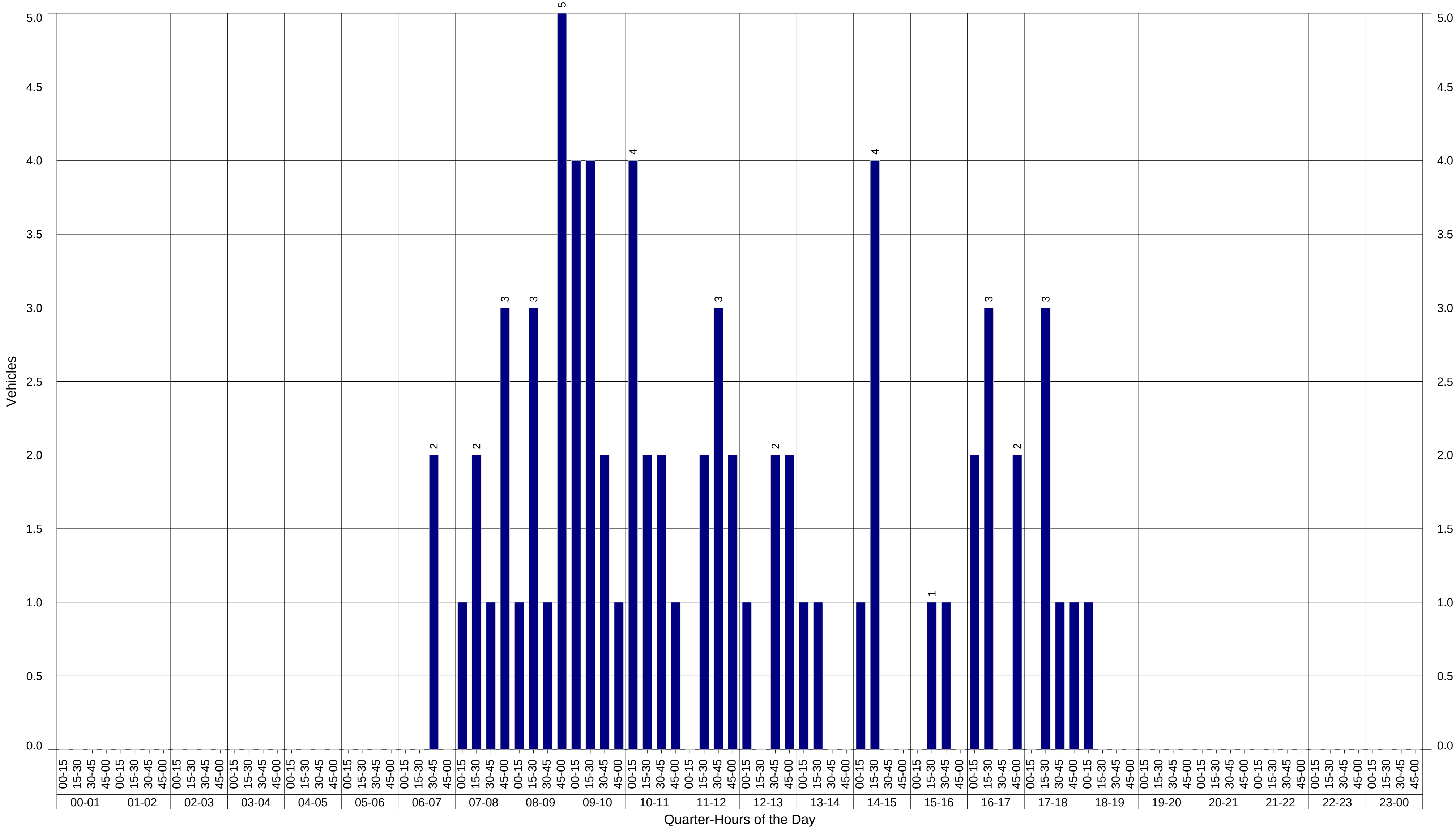
Quarter-Hour Volumes for Through Vehicles - All Traffic Classes



Leg 2 Site 60731 Tdist 0.000 km Bajool Rd to Bajool @ Bruce Hwy

Total volume 73

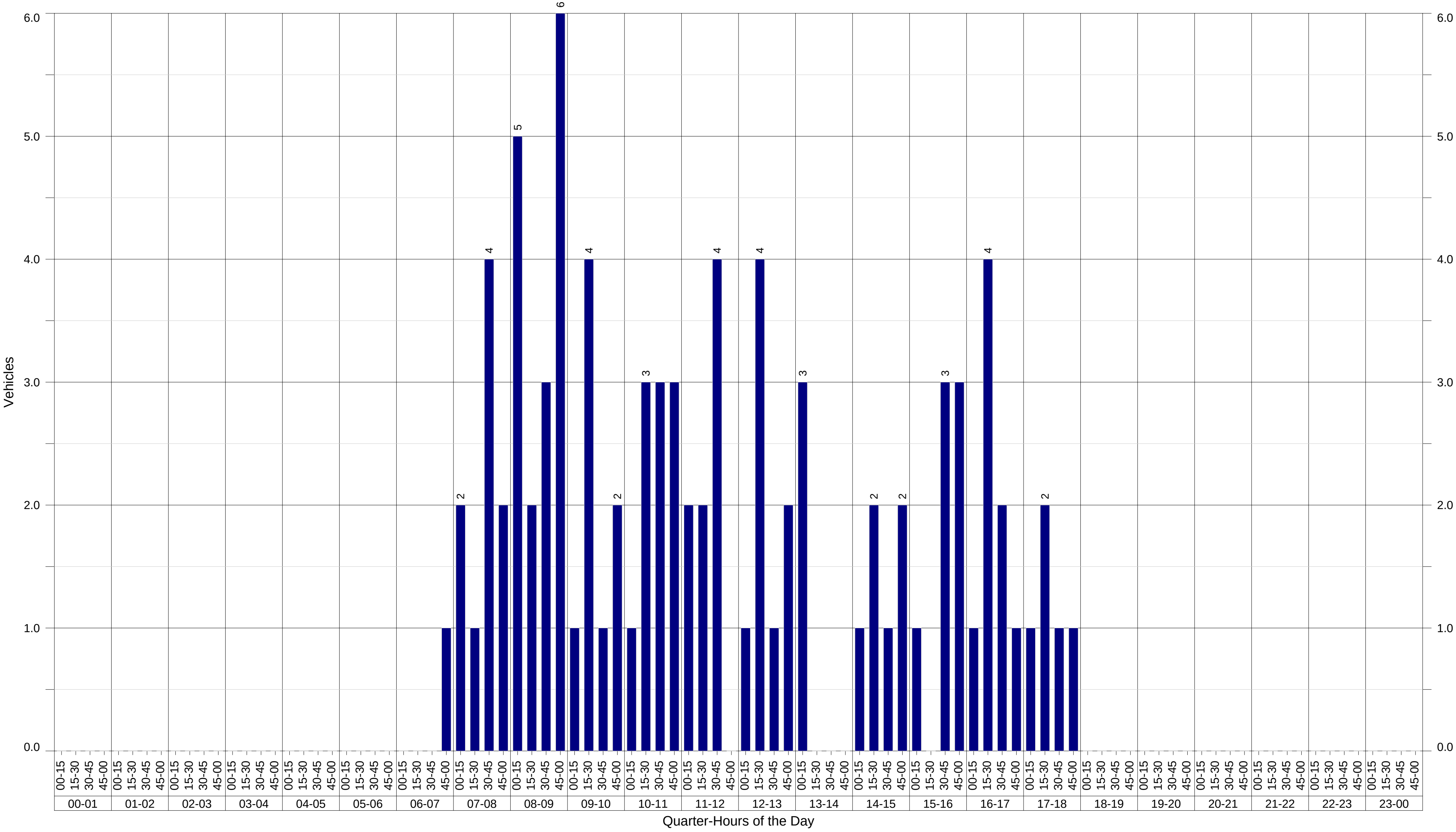
Quarter-Hour Volumes for Right-turning Vehicles - All Traffic Classes



Leg 2 Site 60731 Tdist 0.000 km Bajool Rd to Bajool @ Bruce Hwy

Total volume 89

Quarter-Hour Volumes for All Vehicles Exiting the Intersection - All Traffic Classes



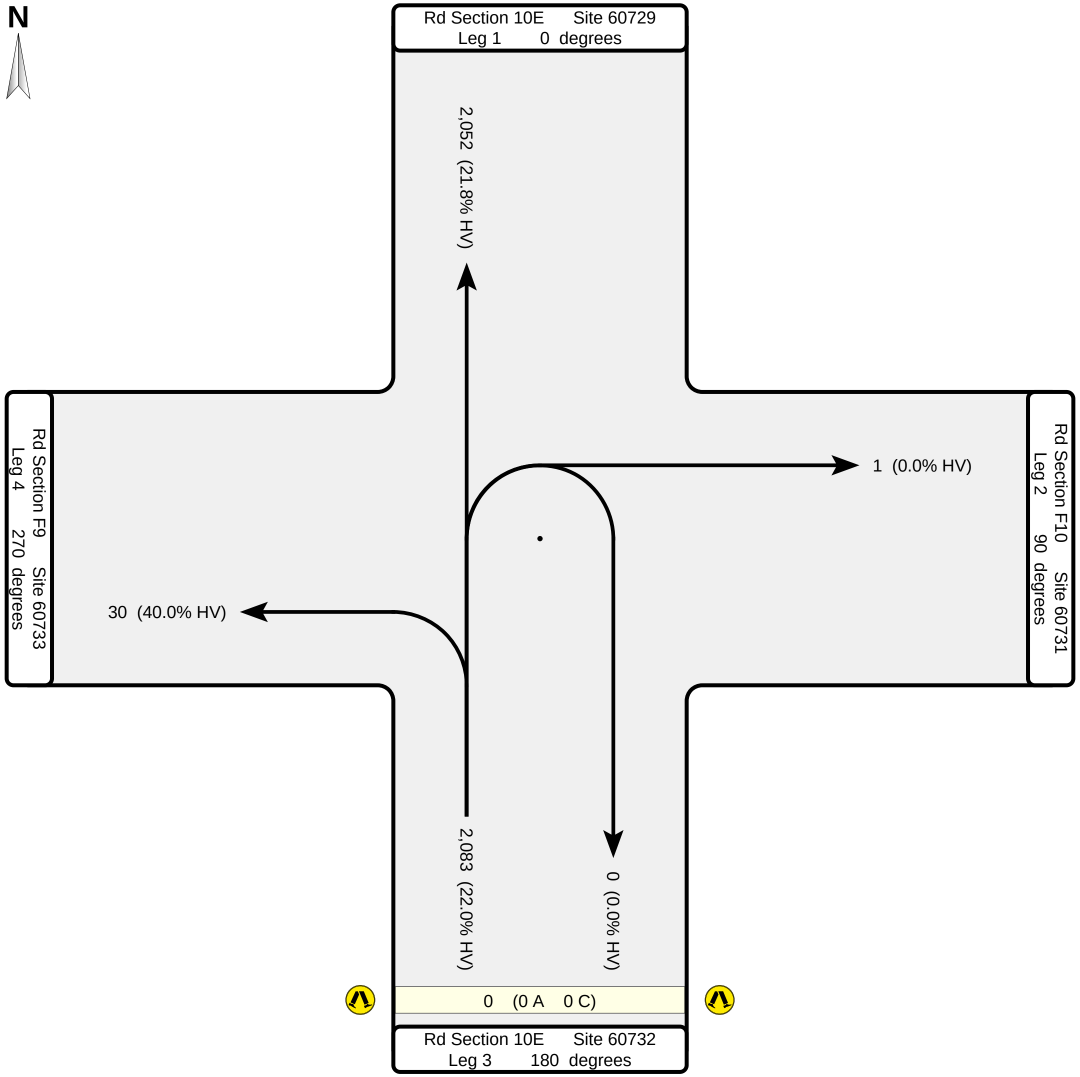
Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)

Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road

Wednesday 24-Feb-2016 06:15 - 18:15

Leg 3   Site 60732   Tdist 86.182 km   Bruce Hwy to Marmor @ South Ulam Rd



Leg 3 Site 60732 Tdist 86.182 km Bruce Hwy to Marmor @ South Ulam Rd

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15					
06:15-06:30	0	20	0		
06:30-06:45	0	21	0		
06:45-07:00	0	38	0		
07:00-07:15	2	16	0		
07:15-07:30	0	45	0		
07:30-07:45	0	43	0		
07:45-08:00	0	48	0		

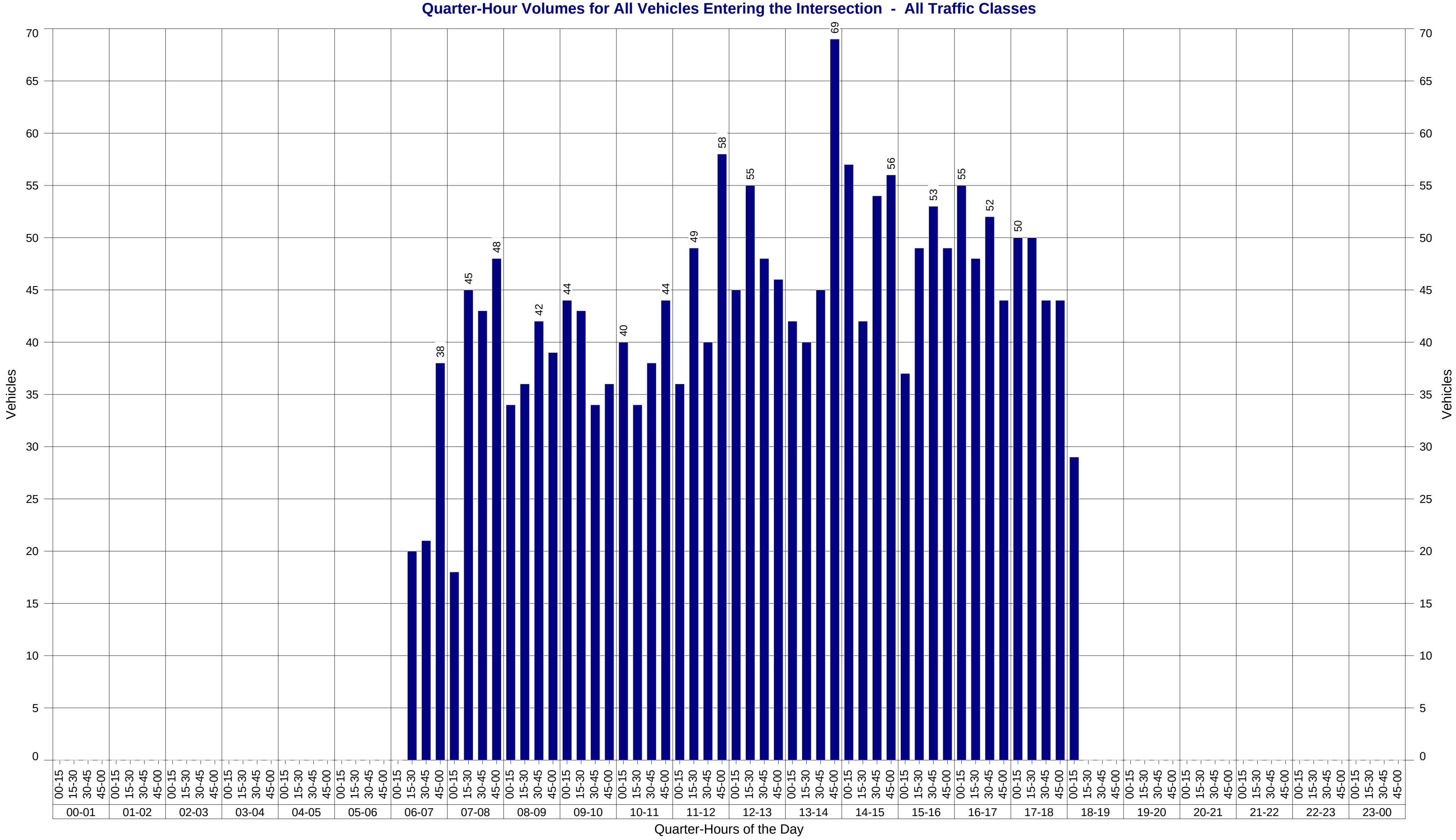
Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	0	33	1		
08:15-08:30	2	34	0		
08:30-08:45	2	40	0		
08:45-09:00	1	38	0		
09:00-09:15	3	41	0		
09:15-09:30	0	43	0		
09:30-09:45	0	34	0		
09:45-10:00	0	36	0		
10:00-10:15	0	40	0		
10:15-10:30	0	34	0		
10:30-10:45	1	37	0		
10:45-11:00	1	43	0		
11:00-11:15	0	36	0		
11:15-11:30	0	49	0		
11:30-11:45	1	39	0		
11:45-12:00	1	57	0		
12:00-12:15	1	44	0		
12:15-12:30	1	54	0		
12:30-12:45	1	47	0		
12:45-13:00	0	46	0		
13:00-13:15	0	42	0		
13:15-13:30	2	38	0		
13:30-13:45	2	43	0		
13:45-14:00	2	67	0		
14:00-14:15	1	56	0		
14:15-14:30	1	41	0		
14:30-14:45	0	54	0		
14:45-15:00	4	52	0		
15:00-15:15	0	37	0		
15:15-15:30	0	49	0		
15:30-15:45	0	53	0		
15:45-16:00	0	49	0		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	0	55	0		
16:15-16:30	1	47	0		
16:30-16:45	0	52	0		
16:45-17:00	0	44	0		
17:00-17:15	0	50	0		
17:15-17:30	0	50	0		
17:30-17:45	0	44	0		
17:45-18:00	0	44	0		
18:00-18:15	0	29	0		
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

Leg 3 Site 60732 Tdist 86.182 km Bruce Hwy to Marmor @ South Ulam Rd

Total volume 2,083



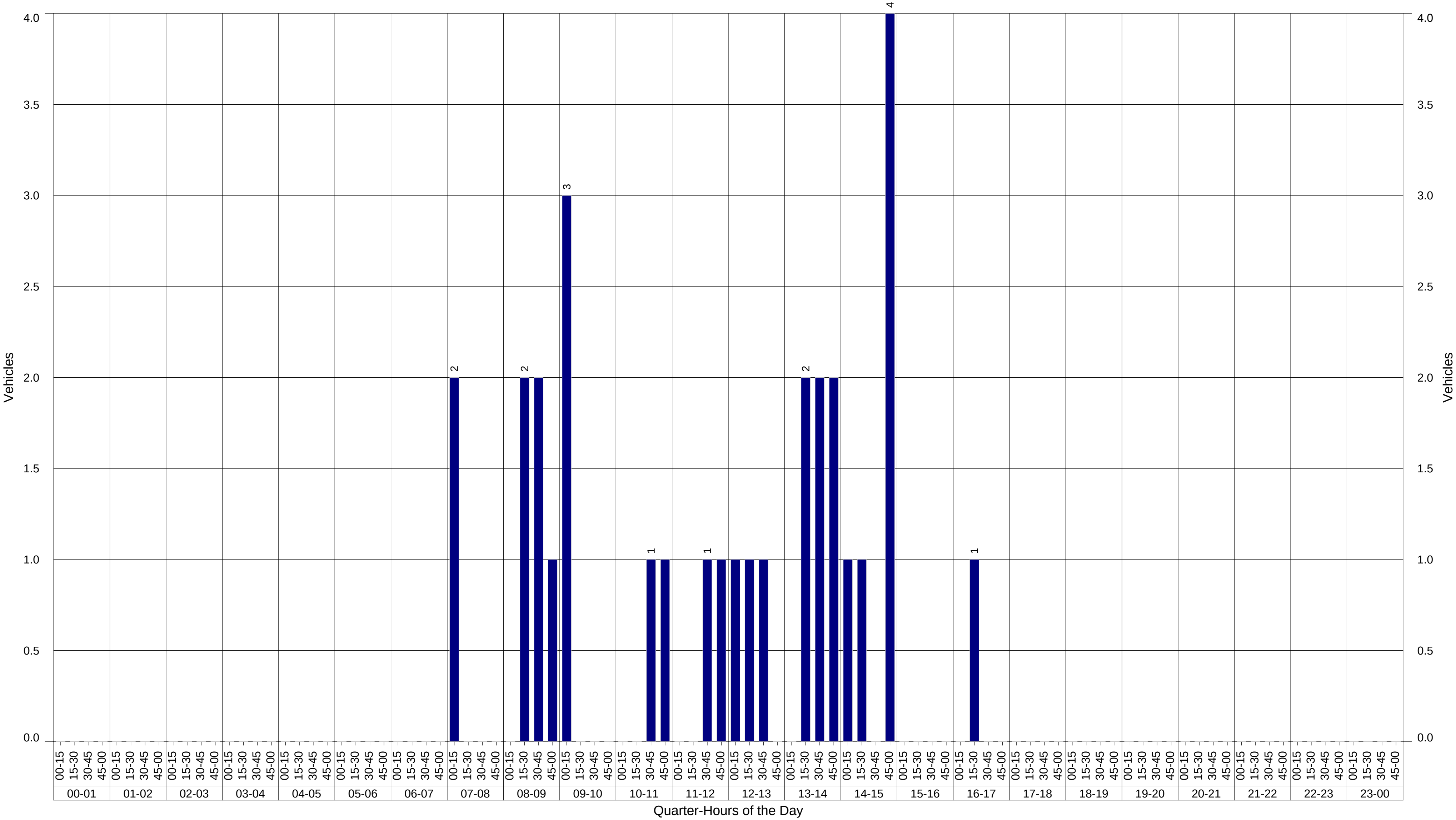
Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 3   Site 60732   Tdist 86.182 km   Bruce Hwy to Marmor @ South Ulam Rd

Total volume 30

Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes

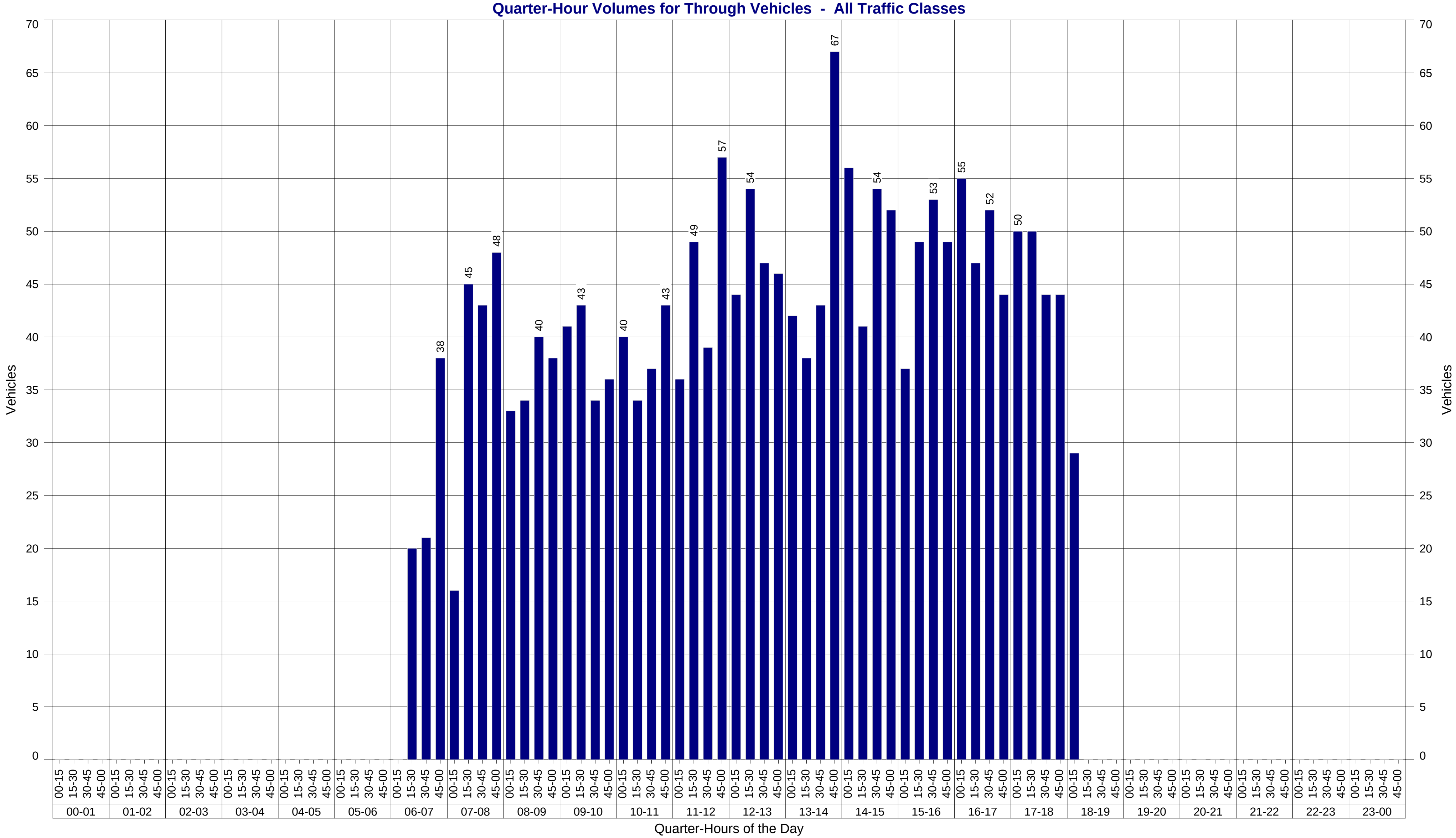


Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 3 Site 60732 Tdist 86.182 km Bruce Hwy to Marmor @ South Ulam Rd

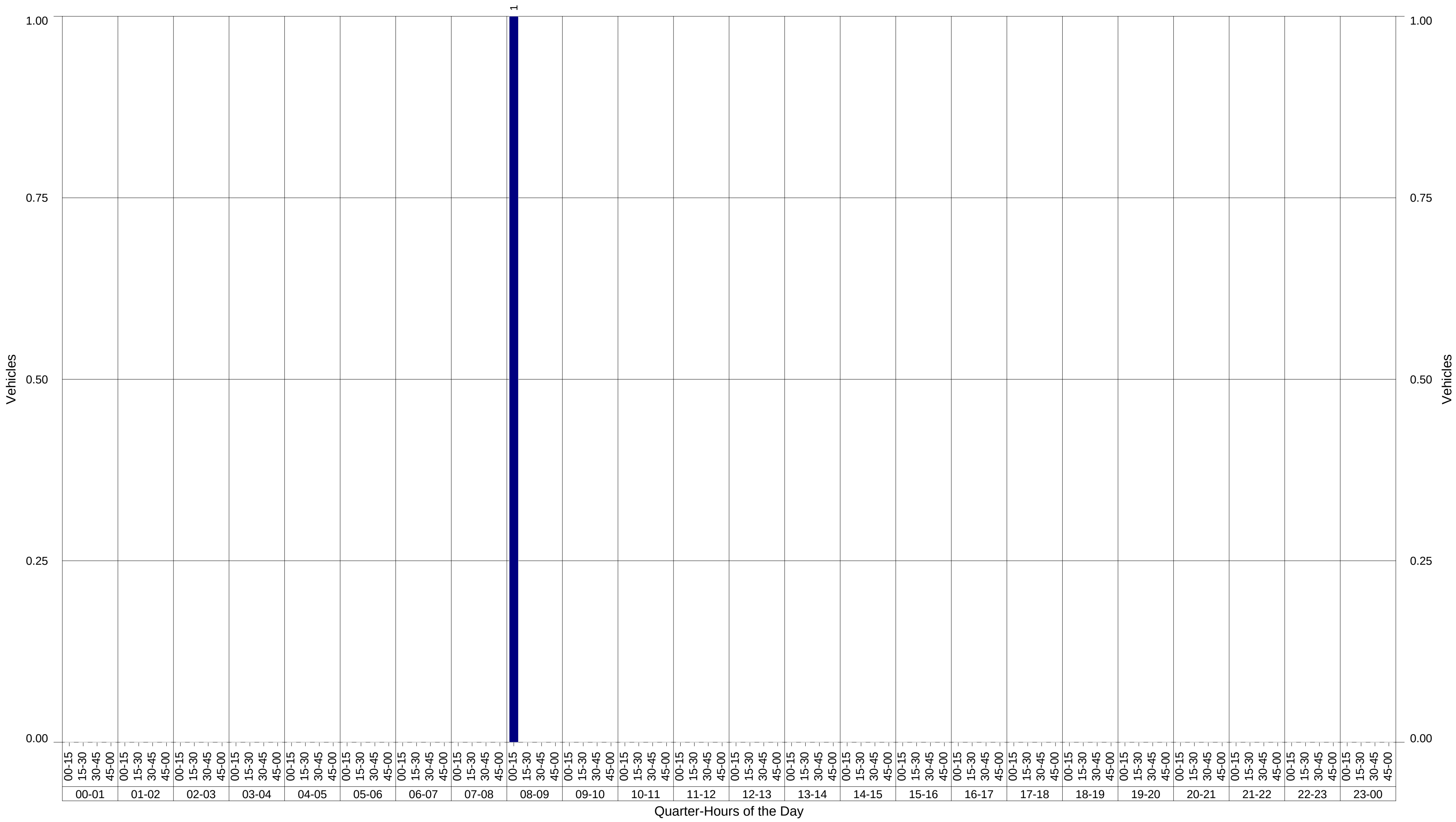
Total volume 2,052



Leg 3 Site 60732 Tdist 86.182 km Bruce Hwy to Marmor @ South Ulam Rd

Total volume 1

Quarter-Hour Volumes for Right-turning Vehicles - All Traffic Classes



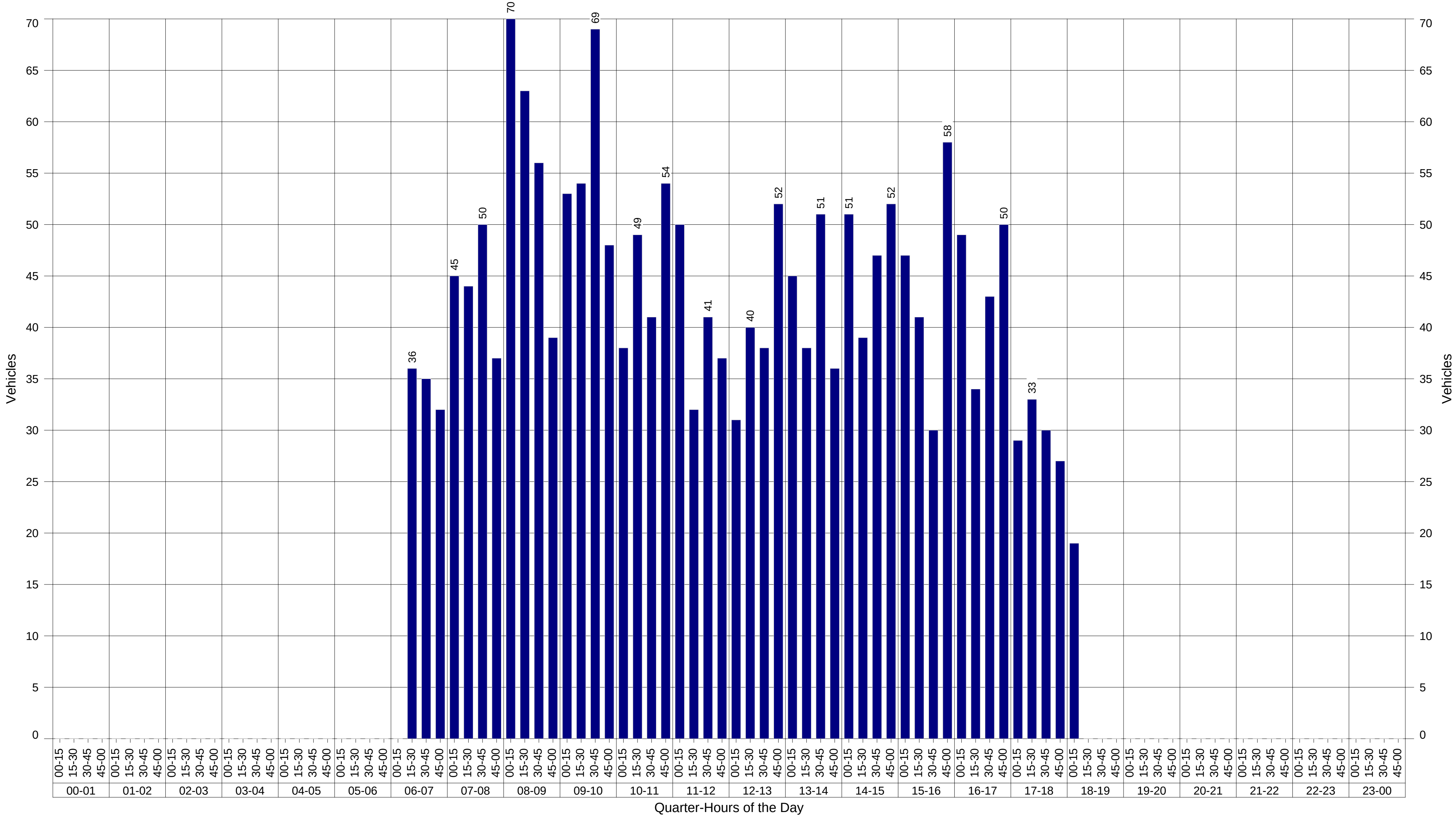
Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 3 Site 60732 Tdist 86.182 km Bruce Hwy to Marmor @ South Ulam Rd

Total volume 2,083

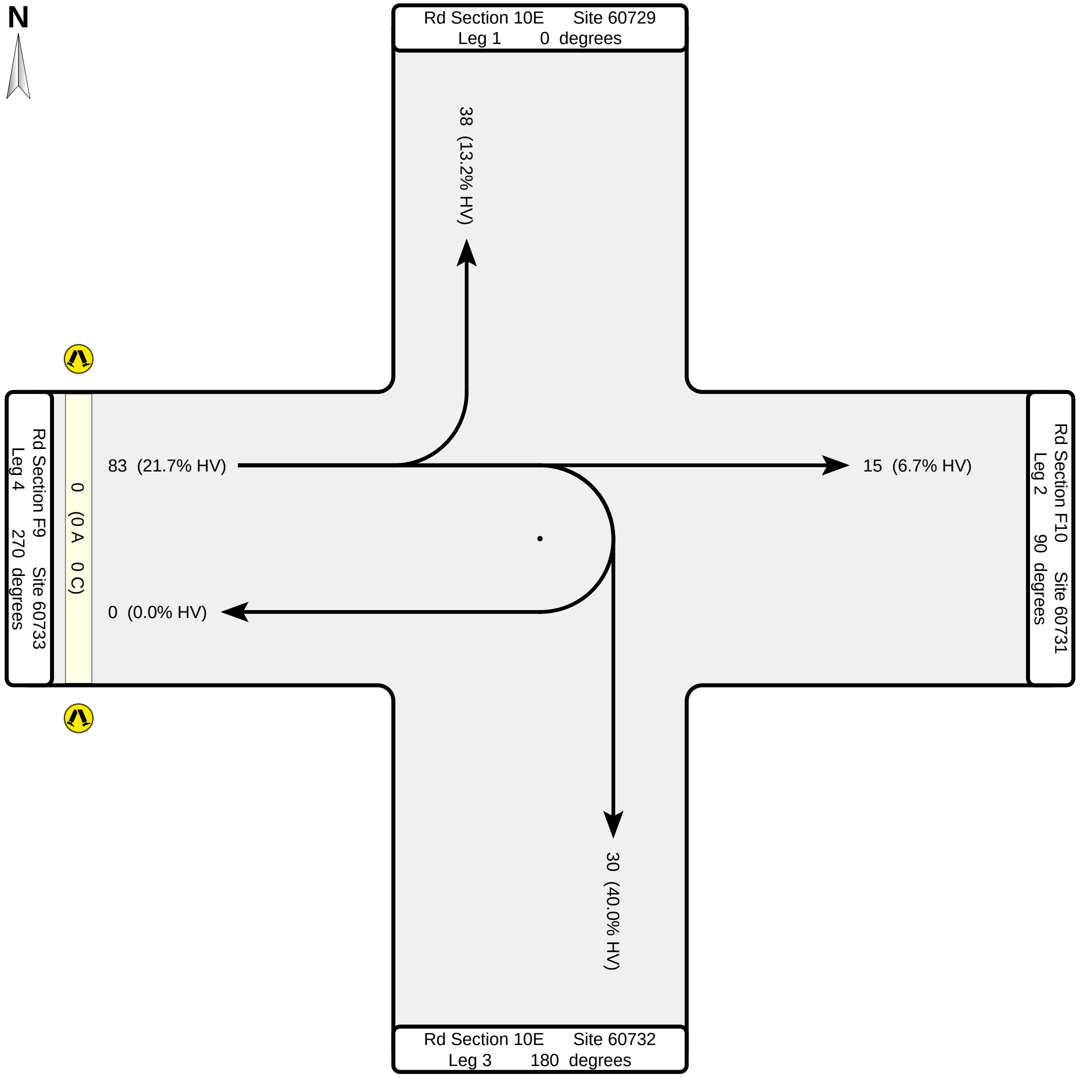
Quarter-Hour Volumes for All Vehicles Exiting the Intersection - All Traffic Classes



Intersection Analysis Report

Area 404 - Fitzroy District   Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 4   Site 60733   Tdist 0.000 km   South Ulam Rd to Upper Ulam @ Bruce Hwy



Leg 4 Site 60733 Tdist 0.000 km South Ulam Rd to Upper Ulam @ Bruce Hwy

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15					
06:15-06:30	1	0	0		
06:30-06:45	0	0	1		
06:45-07:00	0	0	0		
07:00-07:15	1	0	0		
07:15-07:30	1	1	0		
07:30-07:45	1	2	0		
07:45-08:00	0	0	0		

Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	0	0	1		
08:15-08:30	2	1	1		
08:30-08:45	0	0	4		
08:45-09:00	0	2	1		
09:00-09:15	2	0	2		
09:15-09:30	1	0	0		
09:30-09:45	0	0	1		
09:45-10:00	1	0	0		
10:00-10:15	1	0	0		
10:15-10:30	1	0	0		
10:30-10:45	1	1	0		
10:45-11:00	0	1	0		
11:00-11:15	0	0	0		
11:15-11:30	1	0	1		
11:30-11:45	0	1	1		
11:45-12:00	1	0	1		
12:00-12:15	0	0	0		
12:15-12:30	0	0	1		
12:30-12:45	0	1	0		
12:45-13:00	1	0	0		
13:00-13:15	0	0	1		
13:15-13:30	0	0	0		
13:30-13:45	0	0	0		
13:45-14:00	1	0	0		
14:00-14:15	3	0	0		
14:15-14:30	0	0	3		
14:30-14:45	1	0	3		
14:45-15:00	3	1	4		
15:00-15:15	0	0	1		
15:15-15:30	1	0	0		
15:30-15:45	2	0	0		
15:45-16:00	0	0	0		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	1	0	1		
16:15-16:30	1	1	0		
16:30-16:45	2	1	0		
16:45-17:00	0	0	0		
17:00-17:15	0	0	0		
17:15-17:30	2	1	0		
17:30-17:45	3	1	1		
17:45-18:00	1	0	0		
18:00-18:15	1	0	1		
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

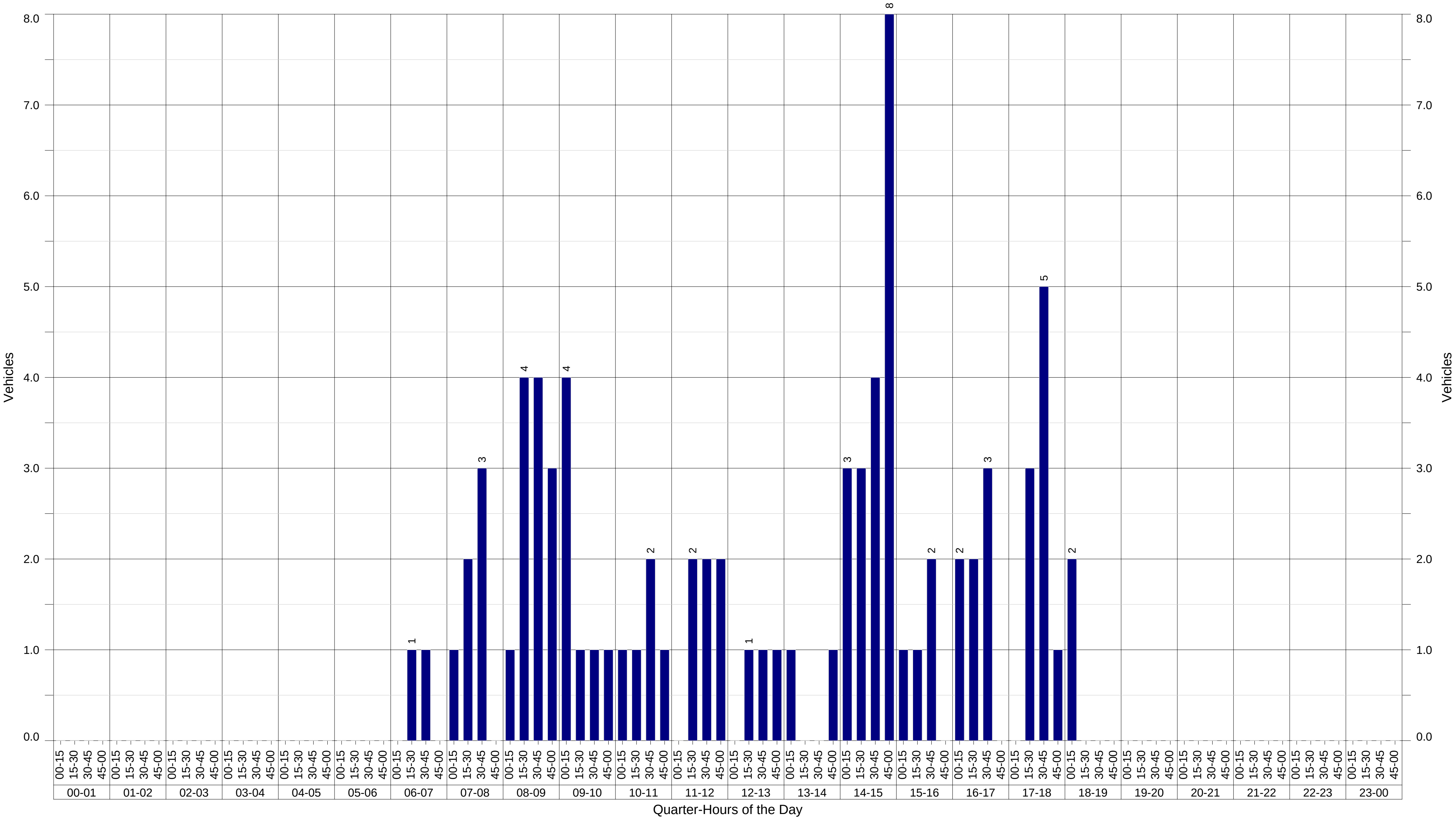
Blank cells indicate the non-collection of corresponding counts.

Intersection Analysis Report
Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 4 Site 60733 Tdist 0.000 km South Ulam Rd to Upper Ulam @ Bruce Hwy

Total volume 83

Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes



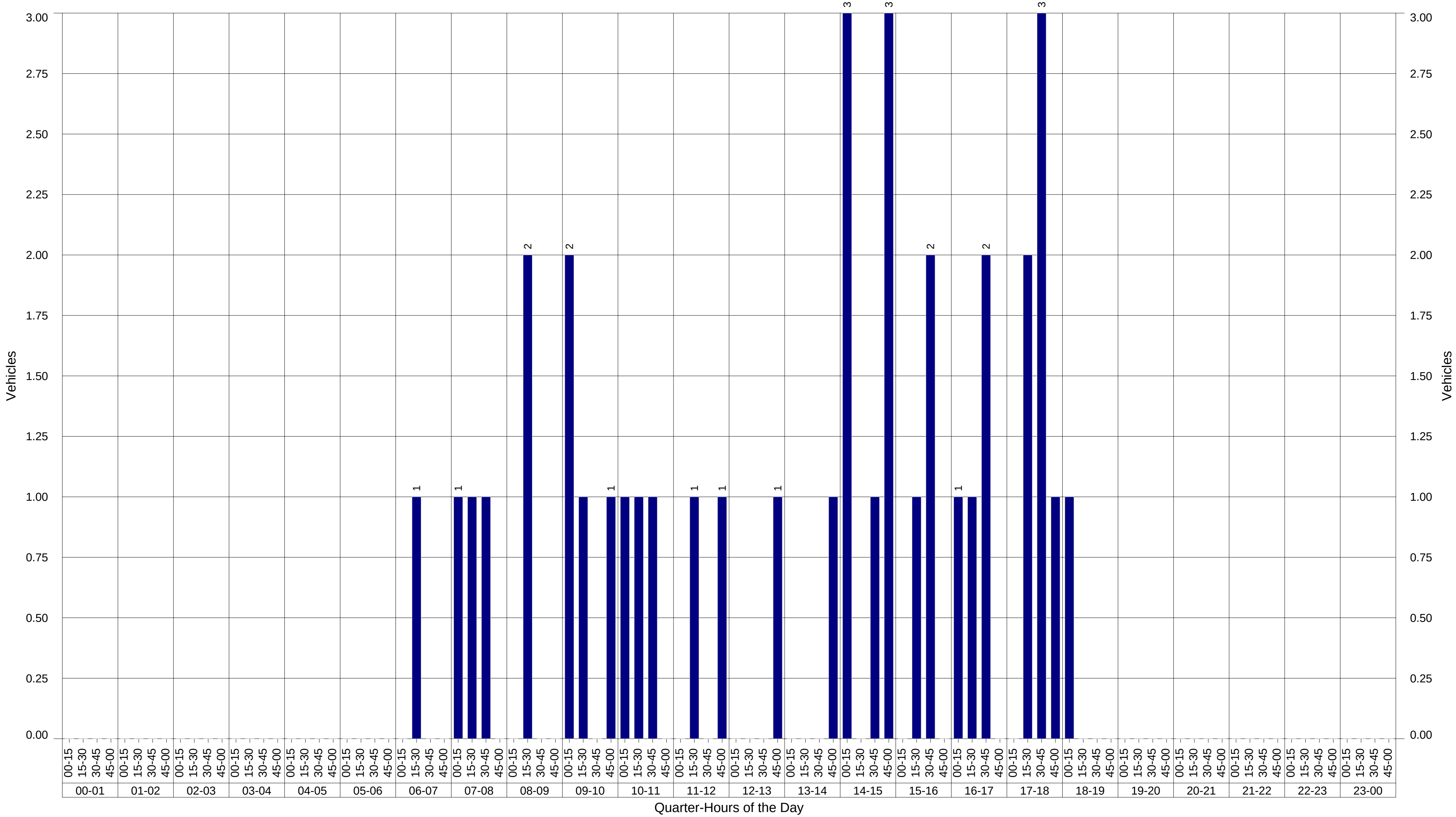
Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road
Wednesday 24-Feb-2016 06:15 - 18:15

Leg 4 Site 60733 Tdist 0.000 km South Ulam Rd to Upper Ulam @ Bruce Hwy

Total volume 38

Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes



Traffic Analysis and Reporting System

Intersection Analysis Report

Area 404 - Fitzroy District Road Section 10E - BRUCE HIGHWAY (BENARABY - ROCKHAMPTON)

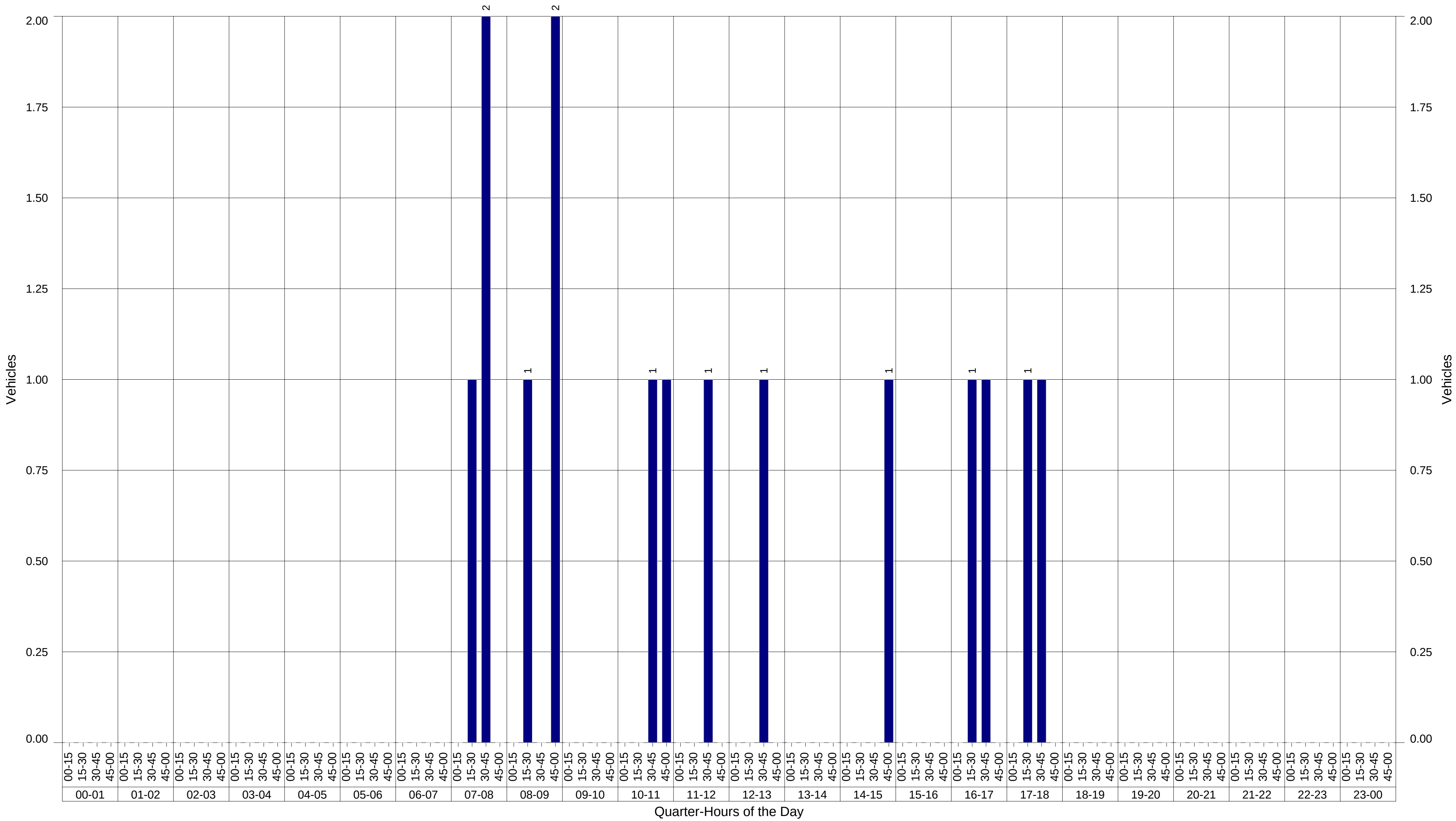
Intersection 6123 - Bruce Highway & Sth Ulam - Bajool Road

Wednesday 24-Feb-2016 06:15 - 18:15

Leg 4 Site 60733 Tdist 0.000 km South Ulam Rd to Upper Ulam @ Bruce Hwy

Total volume 15

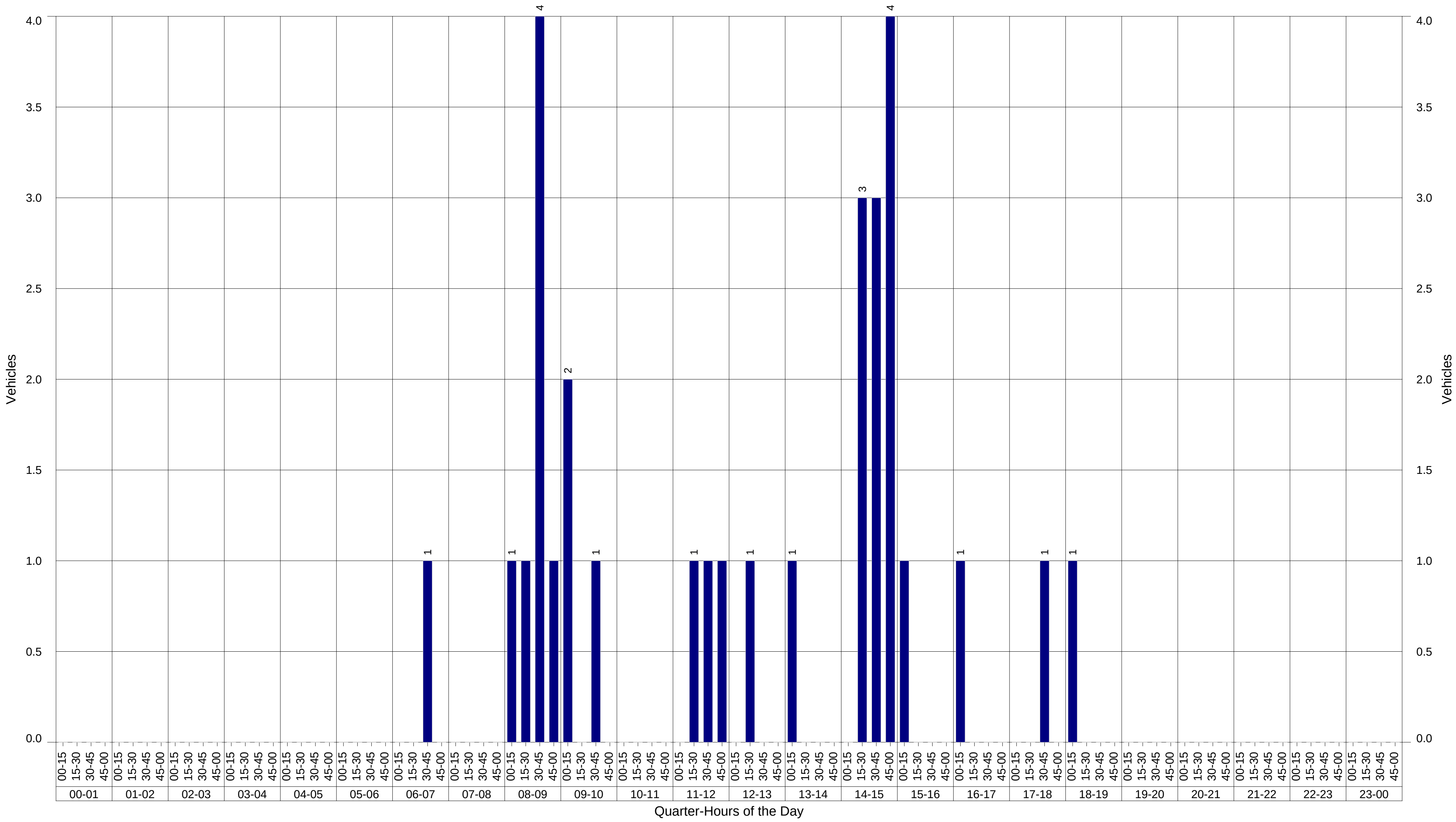
Quarter-Hour Volumes for Through Vehicles - All Traffic Classes



Leg 4   Site 60733   Tdist 0.000 km   South Ulam Rd to Upper Ulam @ Bruce Hwy

Total volume 30

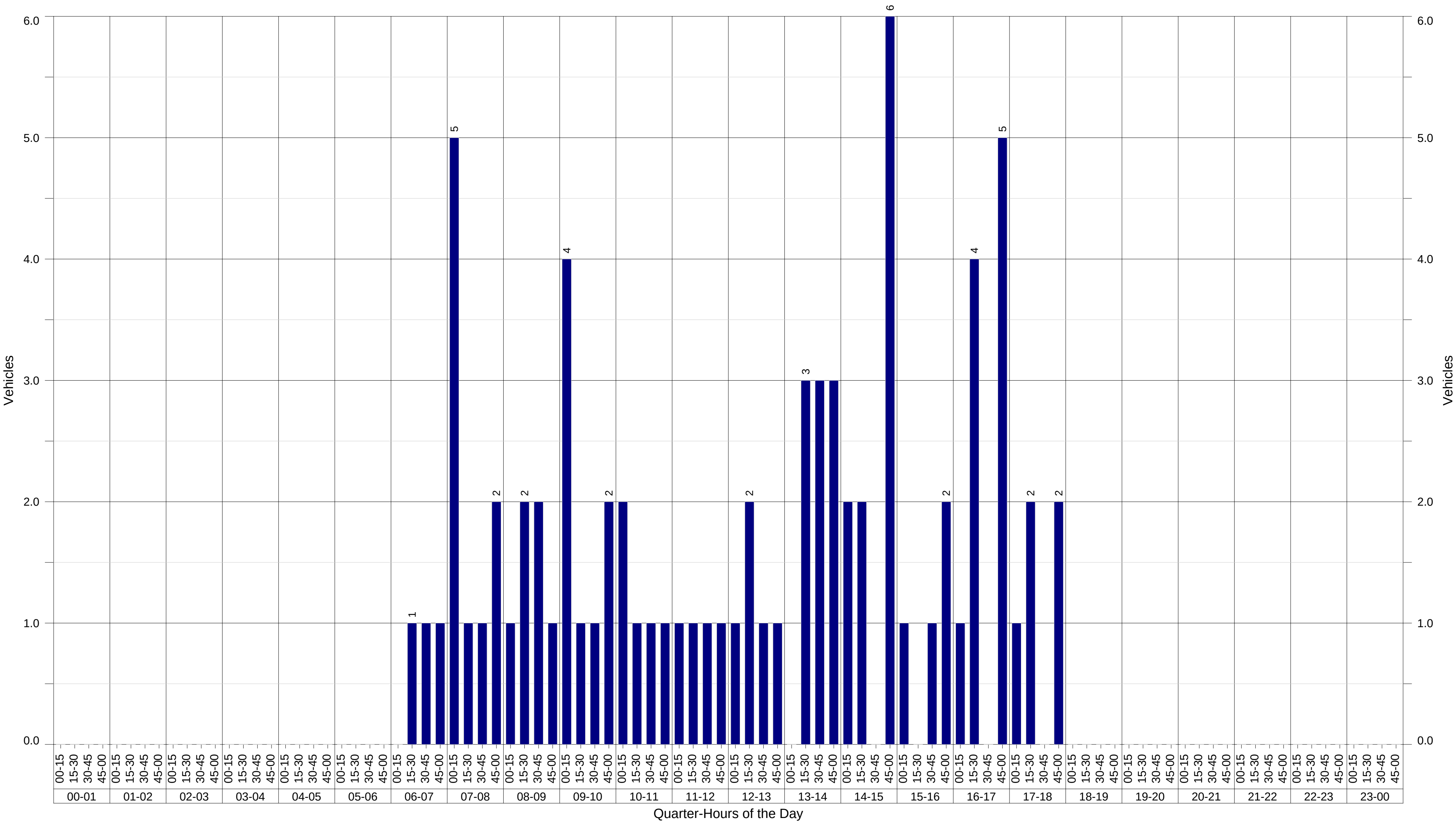
Quarter-Hour Volumes for Right-turning Vehicles - All Traffic Classes



Leg 4 Site 60733 Tdist 0.000 km South Ulam Rd to Upper Ulam @ Bruce Hwy

Total volume 78

Quarter-Hour Volumes for All Vehicles Exiting the Intersection - All Traffic Classes



Appendix D – Intersection Volume Forecast Calculations

UMW0123-001 | Mount Hopeful Wind Farm

Burnett Highway / McDonalds Road

Peak Hour Intersection Volume Forecasts

AM PEAK

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	Burnett Highway S				McDonalds Rd E				Burnett Highway N			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2019	30	18	1	0	3	0	3	0	1	0	29	19
2020	31	18	1	0	3	0	3	0	1	0	29	19
2021	31	18	1	0	3	0	3	0	1	0	30	19
2022	31	18	1	0	3	0	3	0	1	0	30	20
2023	32	18	1	0	3	0	3	0	1	0	30	20
2024	32	19	1	0	3	0	3	0	1	0	30	20
PROJECT TRAFFIC	0	0	89	3	0	3	0	6	0	6	0	0
IN CONSTRUCTION	32	19	90	3	3	3	3	6	1	6	30	20

PM PEAK

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	Burnett Highway S				McDonalds Rd E				Burnett Highway N			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2019	30	18	3	0	1	0	1	0	3	0	24	15
2020	31	18	3	0	1	0	1	0	3	0	24	16
2021	31	18	3	0	1	0	1	0	3	0	24	16
2022	31	18	3	0	1	0	1	0	3	0	24	16
2023	32	18	3	0	1	0	1	0	3	0	24	16
2024	32	19	3	0	1	0	1	0	3	0	25	16
PROJECT TRAFFIC	0	0	0	3	89	3	0	6	0	6	0	0
IN CONSTRUCTION	32	19	3	3	90	3	1	6	3	6	25	16

Background Traffic Assumptions

* Assume peak hour movements on McDonalds Road to be approximately 15% of daily volumes.
* Assume peak hour heavy vehicle movements on McDonalds Road same as % of estimated daily volumes.
* Assume 50% of McDonalds Road movements to/from North, 50 % to/from South.
* Assume 30% in / 70% out split for movements in AM peak hour on McDonalds Rd.
* Assume 70% in / 30% out split for movements in PM peak hour on MCDonalds Rd.

50 vpd	McDonalds Rd AADT
8 vph	Peak Hr Volumes (15% Daily)

AM PEAK

2 vph	*Inbound*
1 vph	from Burnett Hway N
1 vph	from Burnett Hway S
6 vph	*Outbound*
3 vph	to Burnett Hway N
3 vph	to Burnett Hway S

PM PEAK

6 vph	*Inbound*
3 vph	from Burnett Hway N
3 vph	from Burnett Hway S
2 vph	*Outbound*
1 vph	to Burnett Hway N
1 vph	to Burnett Hway S

Development Scenario - Schedule Task B + C+ D + E + F + Site Water + Max Staff

Daily Heavy Vehicle Movements to McDonalds Road

Task	Burnett Highway S				McDonalds Rd E				Burnett Highway N			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
B	0	0	0	0	0	0	0	33	0	33	0	0
C	0	0	0	4	0	4	0	24	0	24	0	0
D	0	0	0	1	0	1	0	3	0	3	0	0
E	0	0	0	5	0	5	0	10	0	10	0	0
F	0	0	0	15	0	15	0	0	0	0	0	0
Water	0	0	0	10	0	10	0	0	0	0	0	0
Fuel	0	0	0	1	0	1	0	0	0	0	0	0
Total (12 hrs)	**0**	**0**	**0**	**36**	**0**	**36**	**0**	**70**	**0**	**70**	**0**	**0**
Peak Hour	**0**	**0**	**0**	**3**	**0**	**3**	**0**	**6**	**0**	**6**	**0**	**0**

Staff Vehicle Movements to McDonalds Road

AM Peak Hour	**0**	**0**	**89**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PM Peak Hour	**0**	**0**	**0**	**0**	**89**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

UMW0123-001 | Mount Hopeful Wind Farm

Bruce Highway / South Ulam Road

Peak Hour Intersection Volume Forecasts

AM PEAK

GR %	2.33%	2.33%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	2.33%	2.33%
YEAR	Bruce Highway North				South Ulam Road West				Bruce Highway South			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2016	162	58	3	0	3	0	5	1	4	0	112	44
2017	166	59	3	0	3	0	5	1	4	0	114	45
2018	170	60	3	0	3	0	5	1	4	0	117	46
2019	174	62	3	0	3	0	6	1	4	0	120	47
2020	178	63	3	0	3	0	6	1	4	0	123	48
2021	182	65	3	0	3	0	6	1	4	0	125	50
2022	187	66	3	0	3	0	6	1	4	0	128	51
2023	191	68	3	0	3	0	6	1	4	0	131	52
2024	195	69	3	0	3	0	6	1	4	0	134	53
PROJECT TRAFFIC	0	0	15	1	0	1	0	0	0	0	0	0
IN CONSTRUCTION	195	69	18	1	3	1	6	1	4	0	134	53

PM PEAK

GR %	2.33%	2.33%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	2.33%	2.33%
YEAR	Bruce Highway North				South Ulam Road West				Bruce Highway South			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2016	132	47	4	0	7	1	9	1	5	1	146	57
2017	135	48	4	0	7	1	9	1	5	1	149	59
2018	138	49	4	0	7	1	9	1	6	1	152	60
2019	142	50	4	0	7	1	9	1	6	1	156	62
2020	145	51	4	0	7	1	9	1	6	1	160	63
2021	148	53	4	0	8	1	9	1	6	1	163	65
2022	152	54	4	0	8	1	10	1	6	1	167	66
2023	155	55	4	0	8	1	10	1	6	1	171	68
2024	159	56	4	0	8	1	10	1	6	1	175	69
PROJECT TRAFFIC	0	0	0	1	15	1	0	0	0	0	0	0
IN CONSTRUCTION	159	56	4	1	23	2	10	1	6	1	175	69

Development Scenario - Schedule Task B + C+ D + E + F + Site Water + Max Staff

Heavy Vehicle Movements to McDonalds Road

Task	Bruce Highway North				South Ulam Road West				Bruce Highway South			
	T		R		L		R		L		T	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
B	0	0	0	5	0	5	0	0	0	0	0	0
C	0	0	0	5	0	5	0	0	0	0	0	0
D	0	0	0	1	0	1	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0	0	0	0	0	0
Total (12 hrs)	**0**	**0**	**0**	**11**	**0**	**11**	**0**	**0**	**0**	**0**	**0**	**0**
Peak Hour	**0**	**0**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**

Staff Vehicle Movements to South Ulam Road

AM Peak Hour	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
PM Peak Hour	**0**	**0**	**0**	**0**	**15**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Construction Workforce Distribution

Location	Dist.	Unit	Qty	Vehicle Type	% Vehicle	Staff No. per Vehicle Type	Average Vehicle Capacity	M'ments Round Trip (per day)
Rockhampton	100%	%	50	LV	50%	25	2	13
				Bus	50%	25	15	2
							Total	**15**

Appendix E – SIDRA Results – Burnett Highway / McDonalds Road Intersection

MOVEMENT SUMMARY

▽ Site: 1 [EXISTING 2023 AM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Burnett Highway / McDonalds Road
Existing Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Burnett Highway															
2	T1	All MCs	53	36.0	53	36.0	0.033	0.0	LOS A	0.0	0.1	0.01	0.01	0.01	59.8
3	R2	All MCs	1	0.0	1	0.0	0.033	5.5	LOS A	0.0	0.1	0.01	0.01	0.01	57.0
Approach			54	35.3	54	35.3	0.033	0.1	NA	0.0	0.1	0.01	0.01	0.01	59.8
East: McDonalds Road															
4	L2	All MCs	3	0.0	3	0.0	0.005	5.7	LOS A	0.0	0.1	0.16	0.54	0.16	52.4
6	R2	All MCs	3	0.0	3	0.0	0.005	5.8	LOS A	0.0	0.1	0.16	0.54	0.16	52.2
Approach			6	0.0	6	0.0	0.005	5.8	LOS A	0.0	0.1	0.16	0.54	0.16	52.3
North: Burnett Highway															
7	L2	All MCs	1	0.0	1	0.0	0.034	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	57.3
8	T1	All MCs	53	40.0	53	40.0	0.034	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach			54	39.2	54	39.2	0.034	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles			114	35.2	114	35.2	0.034	0.4	NA	0.0	0.1	0.01	0.04	0.01	59.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [EXISTING 2023 PM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Burnett Highway / McDonalds Road
Existing Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Burnett Highway															
2	T1	All MCs	53	36.0	53	36.0	0.035	0.0	LOS A	0.0	0.2	0.02	0.04	0.02	59.5
3	R2	All MCs	3	0.0	3	0.0	0.035	5.5	LOS A	0.0	0.2	0.02	0.04	0.02	56.7
Approach			56	34.0	56	34.0	0.035	0.3	NA	0.0	0.2	0.02	0.04	0.02	59.3
East: McDonalds Road															
4	L2	All MCs	1	0.0	1	0.0	0.002	5.7	LOS A	0.0	0.0	0.14	0.54	0.14	52.5
6	R2	All MCs	1	0.0	1	0.0	0.002	5.8	LOS A	0.0	0.0	0.14	0.54	0.14	52.3
Approach			2	0.0	2	0.0	0.002	5.7	LOS A	0.0	0.0	0.14	0.54	0.14	52.4
North: Burnett Highway															
7	L2	All MCs	3	0.0	3	0.0	0.029	5.5	LOS A	0.0	0.0	0.00	0.04	0.00	56.9
8	T1	All MCs	42	40.0	42	40.0	0.029	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.4
Approach			45	37.2	45	37.2	0.029	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.2
All Vehicles			103	34.7	103	34.7	0.035	0.5	NA	0.0	0.2	0.01	0.05	0.01	59.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 1 [PRE DEV 2024 AM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Burnett Highway / McDonalds Road
Existing Intersection Configuration
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Burnett Highway															
2	T1	All MCs	54	37.3	54	37.3	0.034	0.0	LOS A	0.0	0.1	0.01	0.01	0.01	59.8
3	R2	All MCs	1	0.0	1	0.0	0.034	5.5	LOS A	0.0	0.1	0.01	0.01	0.01	57.0
Approach			55	36.5	55	36.5	0.034	0.1	NA	0.0	0.1	0.01	0.01	0.01	59.8
East: McDonalds Road															
4	L2	All MCs	3	0.0	3	0.0	0.005	5.7	LOS A	0.0	0.1	0.16	0.54	0.16	52.4
6	R2	All MCs	3	0.0	3	0.0	0.005	5.9	LOS A	0.0	0.1	0.16	0.54	0.16	52.2
Approach			6	0.0	6	0.0	0.005	5.8	LOS A	0.0	0.1	0.16	0.54	0.16	52.3
North: Burnett Highway															
7	L2	All MCs	1	0.0	1	0.0	0.034	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	57.3
8	T1	All MCs	53	40.0	53	40.0	0.034	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach			54	39.2	54	39.2	0.034	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles			115	35.8	115	35.8	0.034	0.4	NA	0.0	0.1	0.01	0.04	0.01	59.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 1 [PRE DEV 2024 PM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Burnett Highway / McDonalds Road
Existing Intersection Configuration
Site Category: Future Conditions 1
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Burnett Highway															
2	T1	All MCs	54	37.3	54	37.3	0.035	0.0	LOS A	0.0	0.2	0.02	0.03	0.02	59.5
3	R2	All MCs	3	0.0	3	0.0	0.035	5.5	LOS A	0.0	0.2	0.02	0.03	0.02	56.7
Approach			57	35.2	57	35.2	0.035	0.3	NA	0.0	0.2	0.02	0.03	0.02	59.3
East: McDonalds Road															
4	L2	All MCs	1	0.0	1	0.0	0.002	5.7	LOS A	0.0	0.0	0.15	0.54	0.15	52.5
6	R2	All MCs	1	0.0	1	0.0	0.002	5.8	LOS A	0.0	0.0	0.15	0.54	0.15	52.2
Approach			2	0.0	2	0.0	0.002	5.7	LOS A	0.0	0.0	0.15	0.54	0.15	52.4
North: Burnett Highway															
7	L2	All MCs	3	0.0	3	0.0	0.029	5.5	LOS A	0.0	0.0	0.00	0.04	0.00	56.9
8	T1	All MCs	43	39.0	43	39.0	0.029	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.4
Approach			46	36.4	46	36.4	0.029	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.2
All Vehicles			105	35.0	105	35.0	0.035	0.5	NA	0.0	0.2	0.01	0.05	0.01	59.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 1 [IN CONST 2024 AM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Burnett Highway / McDonalds Road
Existing Intersection Configuration
Site Category: Future Conditions 2
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Burnett Highway															
2	T1	All MCs	54	37.3	54	37.3	0.090	0.0	LOS A	0.4	3.3	0.17	0.38	0.17	55.7
3	R2	All MCs	98	3.2	98	3.2	0.090	5.8	LOS A	0.4	3.3	0.17	0.38	0.17	53.2
Approach			152	15.3	152	15.3	0.090	3.8	NA	0.4	3.3	0.17	0.38	0.17	54.0
East: McDonalds Road															
4	L2	All MCs	6	50.0	6	50.0	0.018	6.4	LOS A	0.1	0.6	0.23	0.55	0.23	50.2
6	R2	All MCs	9	66.7	9	66.7	0.018	7.8	LOS A	0.1	0.6	0.23	0.55	0.23	49.2
Approach			16	60.0	16	60.0	0.018	7.2	LOS A	0.1	0.6	0.23	0.55	0.23	49.6
North: Burnett Highway															
7	L2	All MCs	7	85.7	7	85.7	0.040	6.5	LOS A	0.0	0.0	0.00	0.07	0.00	53.4
8	T1	All MCs	53	40.0	53	40.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.07	0.00	59.8
Approach			60	45.6	60	45.6	0.040	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles			227	26.4	227	26.4	0.090	3.2	NA	0.4	3.3	0.13	0.31	0.13	54.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 1 [IN CONST 2024 PM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Burnett Highway / McDonalds Road
Existing Intersection Configuration
Site Category: Future Conditions 2
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Burnett Highway															
2	T1	All MCs	54	37.3	54	37.3	0.039	0.0	LOS A	0.0	0.5	0.04	0.07	0.04	59.4
3	R2	All MCs	6	50.0	6	50.0	0.039	6.6	LOS A	0.0	0.5	0.04	0.07	0.04	54.2
Approach			60	38.6	60	38.6	0.039	0.7	NA	0.0	0.5	0.04	0.07	0.04	58.8
East: McDonalds Road															
4	L2	All MCs	98	3.2	98	3.2	0.073	5.7	LOS A	0.3	2.2	0.14	0.54	0.14	52.3
6	R2	All MCs	7	85.7	7	85.7	0.073	7.5	LOS A	0.3	2.2	0.14	0.54	0.14	48.7
Approach			105	9.0	105	9.0	0.073	5.9	LOS A	0.3	2.2	0.14	0.54	0.14	52.1
North: Burnett Highway															
7	L2	All MCs	9	66.7	9	66.7	0.035	6.3	LOS A	0.0	0.0	0.00	0.10	0.00	53.9
8	T1	All MCs	43	39.0	43	39.0	0.035	0.0	LOS A	0.0	0.0	0.00	0.10	0.00	59.4
Approach			53	44.0	53	44.0	0.035	1.1	NA	0.0	0.0	0.00	0.10	0.00	58.3
All Vehicles			218	25.6	218	25.6	0.073	3.3	NA	0.3	2.2	0.08	0.31	0.08	55.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Appendix F – SIDRA Results – Bruce Highway / South Ulam Road Intersection

MOVEMENT SUMMARY

Site: 2 [EXISTING 2023 AM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Bruce Highway / South Ulam Road
Exisitng Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	4	0.0	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	52.9
2	T1	All MCs	193	28.4	193	28.4	0.116	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			197	27.8	197	27.8	0.116	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
North: Bruce Highway															
8	T1	All MCs	273	26.3	273	26.3	0.162	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
9	R2	All MCs	3	0.0	3	0.0	0.003	6.4	LOS A	0.0	0.1	0.31	0.53	0.31	51.9
Approach			276	26.0	276	26.0	0.162	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.8
West: South Ulam Road															
10	L2	All MCs	3	0.0	3	0.0	0.019	6.4	LOS A	0.1	0.5	0.50	0.63	0.50	49.9
12	R2	All MCs	7	14.3	7	14.3	0.019	11.2	LOS B	0.1	0.5	0.50	0.63	0.50	49.6
Approach			11	10.0	11	10.0	0.019	9.8	LOS A	0.1	0.5	0.50	0.63	0.50	49.7
All Vehicles			483	26.4	483	26.4	0.162	0.3	NA	0.1	0.5	0.01	0.02	0.01	59.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 2 [EXISTING 2023 PM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Bruce Highway / South Ulam Road
Exisitng Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	7	14.3	7	14.3	0.004	5.7	LOS A	0.0	0.0	0.00	0.57	0.00	52.3
2	T1	All MCs	252	28.5	252	28.5	0.151	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			259	28.0	259	28.0	0.151	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.7
North: Bruce Highway															
8	T1	All MCs	221	26.2	221	26.2	0.131	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
9	R2	All MCs	4	0.0	4	0.0	0.004	6.7	LOS A	0.0	0.1	0.36	0.55	0.36	51.8
Approach			225	25.7	225	25.7	0.131	0.2	NA	0.0	0.1	0.01	0.01	0.01	59.8
West: South Ulam Road															
10	L2	All MCs	9	11.1	9	11.1	0.035	7.0	LOS A	0.1	0.9	0.49	0.65	0.49	49.9
12	R2	All MCs	12	9.1	12	9.1	0.035	11.0	LOS B	0.1	0.9	0.49	0.65	0.49	50.2
Approach			21	10.0	21	10.0	0.035	9.2	LOS A	0.1	0.9	0.49	0.65	0.49	50.1
All Vehicles			505	26.3	505	26.3	0.151	0.6	NA	0.1	0.9	0.02	0.04	0.02	59.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2 [PRE DEV 2024 AM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Bruce Highway / South Ulam Road
Exisitng Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	4	0.0	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	52.9
2	T1	All MCs	197	28.3	197	28.3	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			201	27.7	201	27.7	0.118	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
North: Bruce Highway															
8	T1	All MCs	278	26.1	278	26.1	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
9	R2	All MCs	3	0.0	3	0.0	0.003	6.4	LOS A	0.0	0.1	0.32	0.53	0.32	51.9
Approach			281	25.8	281	25.8	0.165	0.1	NA	0.0	0.1	0.00	0.01	0.00	59.8
West: South Ulam Road															
10	L2	All MCs	3	0.0	3	0.0	0.019	6.4	LOS A	0.1	0.5	0.51	0.63	0.51	49.9
12	R2	All MCs	7	14.3	7	14.3	0.019	11.4	LOS B	0.1	0.5	0.51	0.63	0.51	49.5
Approach			11	10.0	11	10.0	0.019	9.9	LOS A	0.1	0.5	0.51	0.63	0.51	49.6
All Vehicles			493	26.3	493	26.3	0.165	0.3	NA	0.1	0.5	0.01	0.02	0.01	59.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

▽ Site: 2 [PRE DEV 2024 PM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Bruce Highway / South Ulam Road
Exisitng Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	7	14.3	7	14.3	0.004	5.7	LOS A	0.0	0.0	0.00	0.57	0.00	52.3
2	T1	All MCs	257	28.3	257	28.3	0.154	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			264	27.9	264	27.9	0.154	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.7
North: Bruce Highway															
8	T1	All MCs	226	26.0	226	26.0	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
9	R2	All MCs	4	0.0	4	0.0	0.004	6.7	LOS A	0.0	0.1	0.37	0.55	0.37	51.8
Approach			231	25.6	231	25.6	0.134	0.2	NA	0.0	0.1	0.01	0.01	0.01	59.8
West: South Ulam Road															
10	L2	All MCs	9	11.1	9	11.1	0.035	7.1	LOS A	0.1	0.9	0.50	0.66	0.50	49.8
12	R2	All MCs	12	9.1	12	9.1	0.035	11.2	LOS B	0.1	0.9	0.50	0.66	0.50	50.1
Approach			21	10.0	21	10.0	0.035	9.3	LOS A	0.1	0.9	0.50	0.66	0.50	50.0
All Vehicles			516	26.1	516	26.1	0.154	0.6	NA	0.1	0.9	0.02	0.04	0.02	59.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2 [IN CONST 2024 AM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Bruce Highway / South Ulam Road
Exisitng Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	4	0.0	4	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	52.9
2	T1	All MCs	197	28.3	197	28.3	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			201	27.7	201	27.7	0.118	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
North: Bruce Highway															
8	T1	All MCs	278	26.1	278	26.1	0.165	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
9	R2	All MCs	20	5.3	20	5.3	0.018	6.5	LOS A	0.1	0.5	0.32	0.56	0.32	51.7
Approach			298	24.7	298	24.7	0.165	0.5	NA	0.1	0.5	0.02	0.04	0.02	59.3
West: South Ulam Road															
10	L2	All MCs	4	25.0	4	25.0	0.021	7.0	LOS A	0.1	0.6	0.50	0.63	0.50	49.0
12	R2	All MCs	7	14.3	7	14.3	0.021	11.7	LOS B	0.1	0.6	0.50	0.63	0.50	49.6
Approach			12	18.2	12	18.2	0.021	10.0	LOS A	0.1	0.6	0.50	0.63	0.50	49.3
All Vehicles			511	25.8	511	25.8	0.165	0.6	NA	0.1	0.6	0.02	0.04	0.02	59.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 2 [IN CONST 2024 PM Peak (Site Folder: General)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

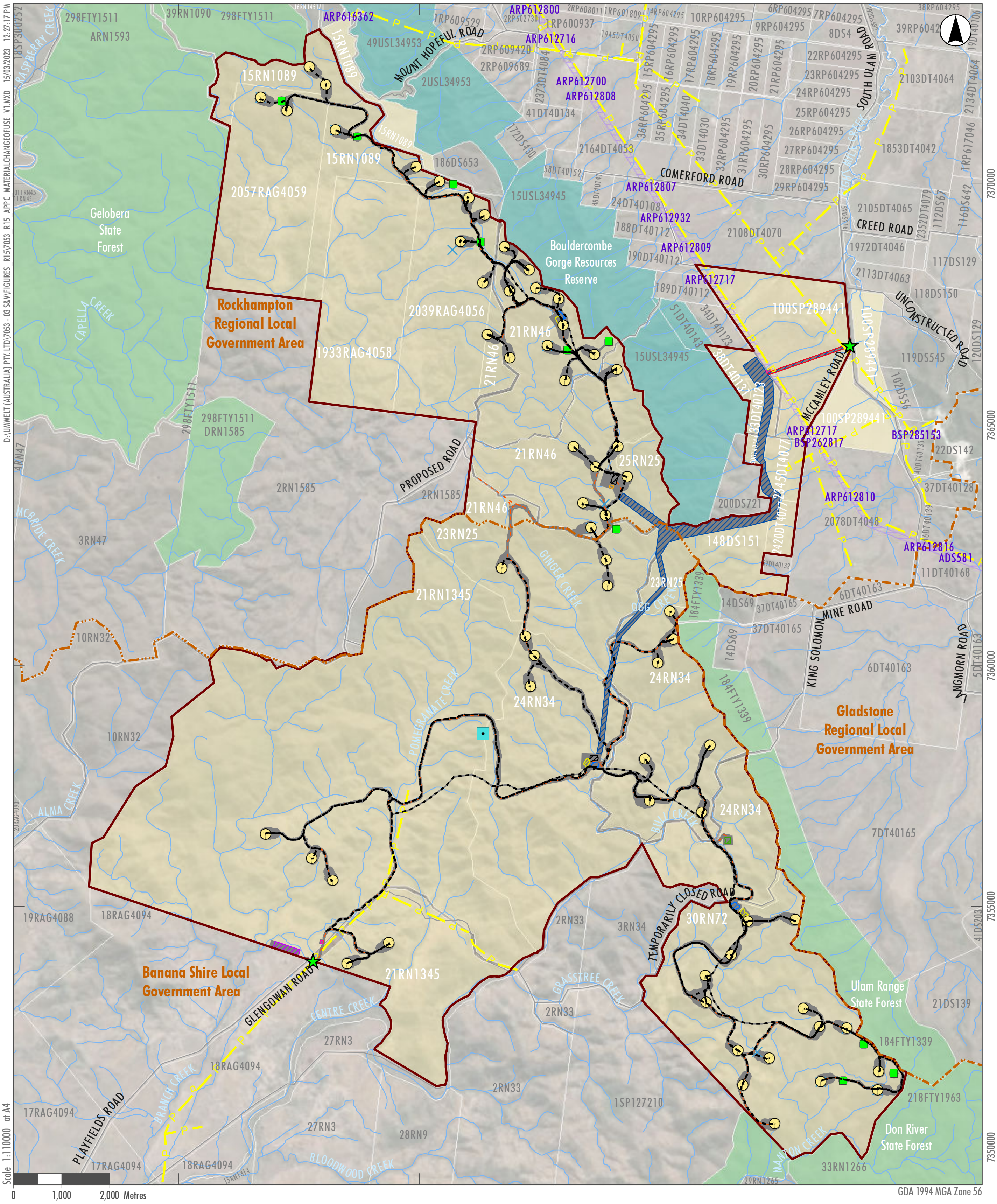
Bruce Highway / South Ulam Road
Exisitng Intersection Configuration
Site Category: Base Year
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Bruce Highway															
1	L2	All MCs	7	14.3	7	14.3	0.004	5.7	LOS A	0.0	0.0	0.00	0.57	0.00	52.3
2	T1	All MCs	257	28.3	257	28.3	0.154	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			264	27.9	264	27.9	0.154	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.7
North: Bruce Highway															
8	T1	All MCs	226	26.0	226	26.0	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
9	R2	All MCs	5	20.0	5	20.0	0.006	7.3	LOS A	0.0	0.2	0.39	0.56	0.39	50.9
Approach			232	25.9	232	25.9	0.134	0.2	NA	0.0	0.2	0.01	0.01	0.01	59.7
West: South Ulam Road															
10	L2	All MCs	26	8.0	26	8.0	0.053	7.0	LOS A	0.2	1.4	0.45	0.64	0.45	50.6
12	R2	All MCs	12	9.1	12	9.1	0.053	11.4	LOS B	0.2	1.4	0.45	0.64	0.45	50.8
Approach			38	8.3	38	8.3	0.053	8.3	LOS A	0.2	1.4	0.45	0.64	0.45	50.7
All Vehicles			534	25.6	534	25.6	0.154	0.8	NA	0.2	1.4	0.04	0.06	0.04	58.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Appendix G – Plan of Development



Legend

- Study Area (16757 ha)
- Development Corridor (1346 ha)
- Participating Properties
- Property Boundaries
- Local Government Area (LGA)
- HV Electricity Network
- Existing Met Mast
- Resources Reserve
- State Forest
- Easments

Proposed Project Infrastructure

- Overhead / Underground Cabling
- Access Roads
- Turbines
- Permanent Met Masts
- Temporary Met Masts
- Site Access
- Compound
- Concrete Batching Plant
- Temporary Accommodation Camp
- Laydown
- Operation and Maintenance Area
- Site Entry
- Substation
- Transmission Infrastructure
- Grid Connection Easement
- Access

APPENDIX C

Material Change of Use Proposal Plans

Image Source: ESRI Basemap (2021) Data source: QLD Spatial (2021)

NB: Layout is Indicative Only

Appendix H – Project Traffic Volumes and Impact Calculations

UMW0123-001 | Mount Hopeful Wind Farm

Site Properties

Site Components

Element	Qty	Unit
Number of Turbines	63	ea
Length of Access Tracks	91,320	m
Length of McDonalds Road (Site Access) Upgrade	5,720	m
Length of Playfields Road (Site Access) Upgrade	19,420	m
Length Access Track Eastern Substation	1,800	m
Average Width of McDonalds Road Section to Upgrade	5	m
Average Width of Playfields Road Section to Upgrade	5	m
Number of Substation & Battery Storage Areas (Eastern)	1	ea
Number of Substation Areas (Internal)	2	ea
Number of Turbine Construction Laydown Areas	63	ea
Number of Site Laydown Areas (Internal x3)	3	ea
Number of Site Batch Plant Areas (Internal x3)	3	ea
Number of Site Construction Compound Areas (Internal x1)	1	ea
Number of Site Entrance Areas (Internal x1)	1	ea
Number of Site Operational and Maintenance Facility Areas	1	ea
Number of Meteorology Masts	10	ea
Length of Underground Powerline Cable (Assume same as Internal Access Track)	91,320	m
Length of Overhead Powerline Cable (Main Site)	8,559	m
Length of Overhead Powerline Cable (Eastern Substation)	5,089	m
Water	126	ML
% of Gravel Materials Sourced Onsite	0%	%
% of Gravel Materials Imported	100%	%
% of Water Sourced Onsite	0%	%
% of Water Imported	100%	%
% of Bedding Sand (Electrical) Sourced Onsite	0%	%
% of Bedding Sand (Electrical) Imported	100%	%

Site Areas (Each Area)

Element	Number Sites	Total Hardstand Area	Unit	% Gravel	Gravel Area	% Concrete	Concrete Area	Unit
Substation & Battery Storage Area (Eastern - via South Ulam Road)	1	20,000	m2	90%	18,000	10%	2,000	m2
Substation Area (Internal - x2 sites)	2	27,500	m2	90%	24,750	10%	2,750	m2
Turbine Hardstands	63	6,500	m2	100%	409,500			
Laydown Area (Internal - x3 sites)	3	30,000	m2	100%	30,000			
Batch Plant Area (Internal - x3 sites)	3	30,000	m2	90%	27,000	10%	3,000	m2
Site Construction Compound Area (Internal x1)	1	15,000	m2	90%	13,500	10%	1,500	m2
Site Entrance Area (Internal x1)	1	2,500	m2	100%	2,500			
Operational and Maintenance Facility (Internal x1)	1	5,000	m2	90%	4,500	10%	500	m2

Concrete Composition

Element	Composition	Unit
Cement	15%	%
Aggregates	75%	%
Steel	5%	%
Water	5%	%
Total	100%	%

Material Assumptions

Element	Qty	Unit
Access Track Width	5.5	m
Access Track Pavement Depth	0.2	m
External Road Upgrade Width	6.5	m
External Road Upgrade (Existing Road) Depth	0.1	m
External Road Upgrade (Widening) Depth	0.2	m
Substation & Battery Storage Area (East) Concrete Depth	0.2	m
Substation (Internal) Concrete Depth	0.2	m
Batch Plant Area (Internal) Concrete Depth	0.2	m
Site Construction Compound Area (Internal) Concrete Depth	0.2	m
O&M Facility (Internal) Concrete Depth	0.2	m
Substation (East) Area Gravel Depth	0.2	m
Substation (Internal) Area Gravel Depth	0.2	m
Turbine Hardstands Area Gravel Depth	0.2	m
Laydown Area Gravel Depth	0.2	m
Batch Plant Area Gravel Depth	0.2	m
Site Construction Compound Area Gravel Depth	0.2	m
Site Entrance Area Gravel Depth	0.2	m
Operational and Maintenance Facility Gravel Depth	0.2	m
Concrete Sand/Aggregates Mass	1.8	t/m3
Concrete Cement Mass	1.51	t/m3
Concrete Steel Mass	7.8	t/m3
Concrete Water Mass	1	t/m3
Wet Concrete Mass	2.5	t/m3
Power Line Length per Roll / Drum	250	m
Power Line Mass per Roll / Drum	2.925	tonnes
Spacing Overhead Powerline Poles	50.0	m
Underground Powerline Trench Width	0.4	m
Underground Powerline Bedding Sand Depth	0.3	m

Movements

Site Component Vehicle Movements

Element	Task	Qty per Turbine	Unit	Site Qty	Site Transport Qty	Vehicle Type	Vehicle Capacity	Movements
Concrete Volume in Turbine Footings	E	750	m3	47,250				
Concrete Aggregates for Turbine Footings	E	563	m3	35,438	35,438	Truck & Dog Trailer	14.7	2,407
Reinforcing Steel for Turbine Footings	E	38	m3	2,363	2,363	Semi	3.4	695
Other Concrete Supplies for Turbine Footings	E	113	m3	7,088	7,088	Semi	17.5	404
Wet Concrete for Turbine Footings (Internal)	E	1,875	tonnes	118,125	118,125	Concrete Truck	14.4	8,203
Turbine Blades	F	3	each	189	189	Special	1	189
Turbine Nacelles	F	1	each	63	63	Special	1	63
Turbine Drive Trains	F	1	each	63	63	Special	1	63
Turbine Hubs	F	1	each	63	63	Special	1	63
Tower Sections	F	7	each	441	441	Special	1	441
Escorting LV	F	26	each	1,638	1,638	LV	1	1,638
Site Turbine Crane & Secondary Crane (mobilise)	G			10	10	Special	1	10
Meteorology masts	F			10	10	Special	1	10
Mobilisation (Buildings / EW Plant)	A			100	100	Semi / Low Loader	1	100
							Total	14,286

Met Mast Footings

Element	Task	Qty per Met Mast	Unit	Site Qty	Site Transport Qty	Vehicle Type	Vehicle Capacity	Movements
Concrete Volume in Met Mast Footings	E	25	m3	250				
Concrete Aggregates for Met Mast Footings	E	18.75	m3	188	188	Truck & Dog Trailer	14.7	13
Reinforcing Steel for Met Mast Footings	E	1.25	m3	13	13	Semi	3.4	4
Other Concrete Supplies for Met Mast Footings	E	3.75	m3	38	38	Semi	17.5	3
Wet Concrete for Met Mast Footings (Internal)	E	62.5	tonnes	625	625	Concrete Truck	14.4	44
							Total	64

Additional Material / Component Quantities

Element	Task	Qty per Area	Unit	Site Qty	Site Transport Qty	Vehicle Type	Vehicle Capacity	Movements
Substation & Battery Storage Area (East) Establishment	C	50	each	50	50	Semi	1	50
Substation Areas (Internal) Establishment	C	50	each	100	100	Semi	1	100
Batch Plant Areas (Internal) Establishment	C	25	each	75	75	Semi	1	75
Construction Compound Area (Internal) Establishment	C	50	each	50	50	Semi	1	50
Site Entry Area (Internal) Establishment	C	20	each	20	20	Semi	1	20
Operational and Maintenance Facility Area (Internal) Establishment	C	25	each	25	25	Semi	1	25
							Total	320

Demobilisation

Element	Task	Qty per Unit	Unit	Site Qty	Site Transport Qty	Vehicle Type	Vehicle Capacity	Movements
Batch Plant Areas (Internal) Decommissioning	H	25	each	75	75	Semi	1	75
Construction Compound Area (Internal) Decommissioning	H	50	each	50	50	Semi	1	50
Site Entry Area (Internal) Decommissioning	H	20	each	20	20	Semi	1	20
General Demobilisation (Buildings / EW Plant)	H			100	100	Semi	1	100
							Total	245

Construction Materials

Element	Task	Qty per Unit	Unit	Volume (m3)	Site Qty (tonnes)	Site Transport Qty	Vehicle Type	Vehicle Capacity (tonnes)	Movements
Substation & Battery Storage Area (East) Slab Concrete	C	2.5	t/m3	400	1,000	1,000	Concrete Truck	14.4	70
Substation & Battery Storage Area (East) Reinforcing Steel	C	7.8	t/m3	20	156	156	Semi	26.5	6
Substation Areas (Internal) Slab Concrete Aggregates	C	1.8	t/m3	413	743	743	Truck & Dog Trailer	36	21
Substation Areas (Internal) Portland Cement	C	1.51	t/m3	83	125	125	Semi	26.5	5
Substation Areas (Internal) Reinforcing Steel	C	7.8	t/m3	28	215	215	Semi	26.5	9
Substation Areas (Internal) Water	C	1	t/m3	28	28	28	Semi Water Truck	26.5	2
Internal Access Tracks Gravel Pavement Materials	B	1.8	t/m3	100,452	180,814	180,814	Truck & Dog Trailer	36	5,023
Access Intersection Pavement (TMR) Materials	B	1.8	t/m3	1,000	1,800	1,800	Truck & Dog Trailer	36	50
Access Track Eastern (Substation) Gravel Pavement Materials	B	1.8	t/m3	1,980	3,564	3,564	Truck & Dog Trailer	36	99
External Road Upgrade (McDonalds Road) Gravel Pavement	B	1.8	t/m3	4,576	8,237	8,237	Truck & Dog Trailer	36	229
External Road Upgrade (Playfields Road) Gravel Pavement	B	1.8	t/m3	15,536	27,965	27,965	Truck & Dog Trailer	36	777
Batch Plant Areas (Internal) Slab Concrete Aggregates	C	1.8	t/m3	450	810	810	Truck & Dog Trailer	36	23
Batch Plant Areas (Internal) Portland Cement	C	1.51	t/m3	90	136	136	Semi	26.5	6
Batch Plant Areas (Internal) Reinforcing Steel	C	7.8	t/m3	30	234	234	Semi	26.5	9
Batch Plant Areas (Internal) Water	C	1	t/m3	30	30	30	Semi Water Truck	26.5	2
Site Construction Compound (Internal) Slab Concrete Aggregates	C	1.8	t/m3	225	405	405	Truck & Dog Trailer	36	12
Site Construction Compound (Internal) Portland Cement	C	1.51	t/m3	45	68	68	Semi	26.5	3
Site Construction Compound (Internal) Reinforcing Steel	C	7.8	t/m3	15	117	117	Semi	26.5	5
Site Construction Compound (Internal) Water	C	1	t/m3	15	15	15	Semi Water Truck	26.5	1
O&M Facility Area (Internal) Slab Concrete Aggregates	C	1.8	t/m3	75	135	135	Truck & Dog Trailer	36	4
O&M Facility Area (Internal) Portland Cement	C	1.51	t/m3	15	23	23	Semi	26.5	1
O&M Facility Area (Internal) Reinforcing Steel	C	7.8	t/m3	5	39	39	Semi	26.5	2
O&M Facility Area (Internal) Water	C	1	t/m3	5	5	5	Semi Water Truck	26.5	1
Substation & Battery Storage Area (East) Gravel	C	1.8	t/m3	3,600	6,480	6,480	Truck & Dog Trailer	36	180
Substation Areas (Internal) Gravel	C	1.8	t/m4	4,950	8,910	8,910	Truck & Dog Trailer	36	248
Turbine Hardstand Areas (Internal) Gravel	C	1.8	t/m3	81,900	147,420	147,420	Truck & Dog Trailer	36	4,095
Laydown Areas (Internal) Gravel	C	1.8	t/m3	6,000	10,800	10,800	Truck & Dog Trailer	36	300
Batch Plant Areas (Internal) Gravel	C	1.8	t/m3	5,400	9,720	9,720	Truck & Dog Trailer	36	270
Construction Compound Area (Internal) Gravel	C	1.8	t/m3	2,700	4,860	4,860	Truck & Dog Trailer	36	135
Site Entry Area (Internal) Gravel	C	1.8	t/m3	500	900	900	Truck & Dog Trailer	36	25
Site Camp Facilitiy (Internal) Gravel)	C	1.8	t/m3	0	0	0	Truck & Dog Trailer	36	0
O&M Facility Area (Internal) Gravel	C	1.8	t/m3	900	1,620	1,620	Truck & Dog Trailer	36	45
Underground Powerline Cable (Main Site)	D		tonnes		1,068	1,068	Semi	26.5	41
Underground Powerline Bedding Sand (Main Site)	D	1.8	t/m3	10,958	19,725	19,725	Truck & Dog Trailer	36	548
Overheads Powerline Cable (Main Site)	D		tonnes		401	401	Semi	26.5	16
Overheads Powerline Poles (Main Site)	D				171	171	Semi	25	7
Overheads Powerline Cable (Eastern Substation)	D		tonnes		238	238	Semi	26.5	9
Overheads Powerline Poles (Eastern Substation)	D				102	102	Semi	25	5
Site Water - Overall	W	1	t/m3	126,000	126,000	126,000	Semi Water Truck	26.5	4,755
Site Fuel - Overall	F	0.85	t/m3	7,500	6,375	6,375	Semi Tanker	26.5	241
								Total	17,280

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Site Movements

TASK A - SITE MOBILISTATION

Mobilisation (Buildings / EW Plant)	100	Semi / Low Loader	Gladstone
Task Transport Duration	1	month	
Biloela to Site Access	100	overall	
Trips per month	100		
Max Trips per day	**5**		

TASK B - ACCESS ROADS & SITE ENTRANCES

Internal Access Tracks Gravel Pavement Materials	5,023	Truck & Dog Trailer	QMQ Quarry
Access Intersection Pavement (TMR) Materials	50	Truck & Dog Trailer	QMQ Quarry
Access Track (Substation East) Gravel Pavement Materials	99	Truck & Dog Trailer	Hopkins Quarry Midgee
Road Upgrade (McDonalds / Playfields) Gravel Pavement	1,006	Truck & Dog Trailer	QMQ Quarry
Task Transport Duration (Internal Access Tracks)	9	months	
Task Transport Duration (Access Intersection)	1	month	
Task Transport Duration (Eastern Substation)	1	month	
Task Transport Duration (McDonalds / Playfield Upgrade)	6	months	
QMQ Quarry to Site Access (McDonalds / Playfields)	6,079	overall	
Trips per month	776		
Max Trips per day	**33**		
Hopkins Quarry Midgee to Eastern Substation Access	99	overall	
Trips per month	99		
Max Trips per day	**5**		

TASK C - SUBSTATION AND SITE AREAS

Substation & Battery Storage Area (East) Establishment	50	Semi	Rockhampton
Substation Areas (Internal) Establishment	100	Semi	Gladstone
Batch Plant Areas (Internal) Establishment	75	Semi	Gladstone
Construction Compound Area (Internal) Establishment	50	Semi	Gladstone
Site Entry Area (Internal) Establishment	20	Semi	Gladstone
Operational and Maintenance Facility Area (Internal) Establishment	25	Semi	Gladstone
Substation & Battery Storage Area (East) Slab Concrete	70	Concrete Truck	Rockhampton
Substation & Battery Storage Area (East) Gravel	180	Truck & Dog Trailer	Hopkins Quarry Midgee
Substation & Battery Storage Area (East) Reinforcing Steel	6	Semi	Rockhampton
Substation Areas (Internal) Slab Concrete Aggregates	21	Truck & Dog Trailer	QMQ Quarry
Substation Areas (Internal) Portland Cement	5	Semi	Biloela
Substation Areas (Internal) Reinforcing Steel	9	Semi	Biloela
Substation Areas (Internal) Water	2	Semi Water Truck	Biloela
Batch Plant Areas (Internal) Slab Concrete Aggregates	23	Truck & Dog Trailer	QMQ Quarry
Batch Plant Areas (Internal) Portland Cement	6	Semi	Biloela
Batch Plant Areas (Internal) Reinforcing Steel	9	Semi	Biloela
Batch Plant Areas (Internal) Water	2	Semi Water Truck	Biloela
Site Construction Compound (Internal) Slab Concrete Aggregates	12	Truck & Dog Trailer	QMQ Quarry
Site Construction Compound (Internal) Portland Cement	3	Semi	Biloela
Site Construction Compound (Internal) Reinforcing Steel	5	Semi	Biloela
Site Construction Compound (Internal) Water	1	Semi Water Truck	Biloela
O&M Facility Area (Internal) Slab Concrete Aggregates	4	Truck & Dog Trailer	QMQ Quarry
O&M Facility Area (Internal) Portland Cement	1	Semi	Biloela
O&M Facility Area (Internal) Reinforcing Steel	2	Semi	Biloela
O&M Facility Area (Internal) Water	1	Semi Water Truck	Biloela
Substation Areas (Internal) Gravel	248	Truck & Dog Trailer	QMQ Quarry
Turbine Hardstand Areas (Internal) Gravel	4,095	Truck & Dog Trailer	QMQ Quarry
Laydown Areas (Internal) Gravel	300	Truck & Dog Trailer	QMQ Quarry
Batch Plant Areas (Internal) Gravel	270	Truck & Dog Trailer	QMQ Quarry
Construction Compound Area (Internal) Gravel	135	Truck & Dog Trailer	QMQ Quarry
Site Entry Area (Internal) Gravel	25	Truck & Dog Trailer	QMQ Quarry
Task Transport Duration	9	months	
Task Transport Duration (Eastern Substation)	3	months	
Rockhampton to Eastern Substation Site Access	126		
Trips per month	42		
Max Trips per day	**2**		
Hopkins Midgee Quarry to Eastern Substation Site Access	180		
Trips per month	60		
Max Trips per day	**3**		
QMQ Quarry to Site Access (McDonalds / Playfields)	5,133		
Trips per month	571		
Max Trips per day	**24**		
Gladstone to Site Access	270		
Trips per month	30		
Max Trips per day	**2**		
Biloela to Site Access	316		
Trips per month	35		
Max Trips per day	**2**		

TASK D - CABLING

Underground Powerline Cable (Main Site)	41	Semi	Gladstone
Underground Powerline Bedding Sand (Main Site)	548	Truck & Dog Trailer	QMQ Quarry
Overheads Powerline Cable (Main Site)	16	Semi	Gladstone
Overheads Powerline Poles (Main Site)	7	Semi	Gladstone
Overheads Powerline Cable (Eastern Substation)	9	Semi	Rockhampton
Overheads Powerline Poles (Eastern Substation)	5	Semi	Rockhampton

Task Transport Duration	8	months
Task Transport Duration (Eastern Substation)	4	months
Rockhampton to Eastern Substation Access	14	
Trips per month	4	
Max Trips per day	**1**	
Gladstone to Site Access	64	
Trips per month	8	
Max Trips per day	**1**	
QMQ Quarry to Site Access (McDonalds / Playfields)	548	
Trips per month	69	
Max Trips per day	**3**	

TASK E - TURBINE FOUNDATIONS

Concrete Aggregates for Turbine Footings	2,407	Truck & Dog Trailer	QMQ Quarry
Reinforcing Steel for Turbine Footings	695	Semi	Biloela
Other Concrete Supplies for Turbine Footings	404	Semi	Biloela
Wet Concrete for Turbine Footings (Internal)	*8,203*	*Concrete Truck*	Internal
Concrete Aggregates for Met Mast Footings	13	Truck & Dog Trailer	QMQ Quarry
Reinforcing Steel for Met Mast Footings	4	Semi	Biloela
Other Concrete Supplies for Met Mast Footings	3	Semi	Biloela
Wet Concrete for Met Mast Footings (Internal)	*44*	*Concrete Truck*	Internal

Task Transport Duration	11	months
Biloela to Site Access	1106	
Trips per month	101	
Max Trips per day	**5**	
QMQ Quarry to Site Access	2,420	
Trips per month	220	
Max Trips per day	**10**	

TASK F - TURBINE TRANSPORTATION

Turbine Blades	189	Special	Gladstone
Turbine Nacelles	63	Special	Gladstone
Turbine Drive Trains	63	Special	Gladstone
Turbine Hubs	63	Special	Gladstone
Tower Sections	441	Special	Gladstone
Escorting LV	1,638	LV	Gladstone
Meteorology masts	10	Special	Gladstone

One of Each Turbine Component per Day

LVs escort per component	2
Vehicles per component	3
Working days per week	6
Components per day	5
Max Components per day	**5**
Max vehicles per day	**15**

TASK G - TURBINE ERECTION

Site Turbine Crane & Secondary Crane (mobilise)	10	Special	Gladstone

Task Transport Duration	5	days
Gladstone to Site Access	10	
Max trips per day	**2**	

TASK H - FINALISATION / COMMISSIONING / DEMOBILISATION

Batch Plant Areas (Internal) Decommissioning	75	Semi	Gladstone
Construction Compound Area (Internal) Decommissioning	50	Semi	Gladstone
Site Entry Area (Internal) Decommissioning	20	Semi	Gladstone
General Demobilisation (Buildings / EW Plant)	100	Semi	Gladstone

Task Transport Duration	3	months
Gladstone to Site Access	245	
Trips per month	82	
Max Trips per day	**4**	

SITE WATER

Task Transport Duration	21	months	
Site Water - Overall	4,755	Semi Water Truck	Biloela
Biloela to Site Access	4,755	veh	
Trips per month	226		
Max Trips per day	**10**		

SITE FUEL

Task Transport Duration	21	months	
Site Fuel - Overall	241	Semi Tanker	Biloela
Biloela to Site Access	241	veh	
Trips per month	11		
Max Trips per day	**1**		

UMW0123-001 | Mount Hopeful Wind Farm

Project Staff Movements

Project Timeframe

Element	Qty	Unit
Hours per day	12	hrs
Working days per week	6	days
Working days per month	24	days
Expected project length	22	months

Construction Workforce

Element	Max Staff	Unit
Peak Workforce - Main Site	450	staff
Peak Workforce - Eastern Substation Site	50	staff

Construction Workforce Distribution - Main Site

Location	Distribution	Unit	Qty	Vehicle Type	% Vehicle	Staff No. per Vehicle Type	Average Vehicle Capacity	Movements Round Trip (per day)
Local (Biloela) - External	100%	%	450	LV	30%	135	2	68
				Bus	70%	315	15	21
							Total	89

Construction Workforce Distribution - Eastern Substation Site

Location	Distribution	Unit	Qty	Vehicle Type	% Vehicle	Staff No. per Vehicle Type	Average Vehicle Capacity	Movements Round Trip (per day)
Rockhampton	100%	%	50	LV	50%	25	2	13
				Bus	50%	25	15	2
							Total	15

Operations

Element	Qty	Unit
Hours per day	12	hrs
Working days per week	6	days
Working days per month	24	days
Peak Workforce	10	each

Location	Distribution	Unit	Qty	Vehicle Type	Vehicle Capacity	Movements 2-way (per day)
Biloela	100%	%	10	LV	1	10
					Total	10

ACCESS TRAFFIC CONSULTING

UMW0123-001 | Mount Hopeful Wind Farm

Project Traffic Impact % Calculations

Road ID	Road Description	AADT Segment	AADT Segment Start (km)	AADT Segment End (km)	Base Data Year	Base Year AADT Gaz	Base Year AADT A-Gaz	Base Year AADT Bi-Dir	Base Year HV% Gaz	Base Year HV% A-Gaz	Base Year HV Gaz	Base Year HV A-Gaz	10 Yr GR%	2024 AADT Gaz	2024 AADT A-Gaz	2024 AADT Bi-Dir	2024 HV Gaz	2024 HV A-Gaz
183	Gladstone Port Access Road	61605	0.000	0.858	2018	778	743	1,521	33.29%	31.76%	259	236	1.00%	826	789	1,615	275	250
-	Macfarlane Road	GRC	0.000	0.350	-	No Information Available												
-	Macfarlane Road	GRC	0.350	1.210	-	No Information Available												
-	Hopper Road (John Bates Drive)	GRC	0.000	0.790	-	No Information Available												
-	Flinders Parade	GRC	0.000	0.670	-	No Information Available												
-	Lord Street	GRC	0.000	0.515	-	No Information Available												
181	Gladstone - Mount Larcom Road	60071	0.000	***0.175***	2019	3,563	3,085	6,648	18.52%	15.24%	660	470	1.00%	3,745	3,242	6,987	694	494
181	Gladstone - Mount Larcom Road	60071	***0.175***	***0.919***	2019	3,563	3,085	6,648	18.52%	15.24%	660	470	1.00%	3,745	3,242	6,987	694	494
181	Gladstone - Mount Larcom Road	60071	***0.919***	1.409	2019	3,563	3,085	6,648	18.52%	15.24%	660	470	1.00%	3,745	3,242	6,987	694	494
181	Gladstone - Mount Larcom Road	60073	1.409	3.258	2018	3,025	3,150	6,175	16.07%	16.16%	486	509	1.00%	3,211	3,344	6,555	516	540
181	Gladstone - Mount Larcom Road	61052	3.258	***3.830***	2018	4,706	4,542	9,248	11.52%	14.11%	542	641	1.00%	4,996	4,821	9,817	575	680
181	Gladstone - Mount Larcom Road	61052	***3.830***	4.625	2018	4,706	4,542	9,248	11.52%	14.11%	542	641	1.00%	4,996	4,821	9,817	575	680
181	Gladstone - Mount Larcom Road	60074	4.625	12.292	2018	3,206	3,189	6,395	13.54%	15.96%	434	509	1.00%	3,403	3,385	6,788	461	540
181	Gladstone - Mount Larcom Road	60076	12.292	32.140	2018	1,480	1,482	2,962	21.89%	30.23%	324	448	1.00%	1,571	1,573	3,144	344	476
-	Red Rover Road	GRC	0.000	3.390	-	No Information Available												
-	Don Young Drive	GRC	0.000	2.280	-	No Information Available												
46A	Dawson Highway (Gladstone - Biloela)	60061	0.000	1.498	2019	5,133	5,653	10,786	4.93%	6.62%	253	374	1.00%	5,395	5,941	11,336	266	393
46A	Dawson Highway (Gladstone - Biloela)	61083	1.498	2.238	2019	8,579	8,639	17,218	4.93%	6.62%	423	572	1.00%	9,017	9,080	18,096	445	601
46A	Dawson Highway (Gladstone - Biloela)	61000	2.238	3.130	2018	10,717	11,655	22,372	4.72%	6.12%	506	713	1.00%	11,376	12,372	23,748	537	757
46A	Dawson Highway (Gladstone - Biloela)	60063	3.130	4.391	2019	12,828	17,786	30,614	7.25%	7.61%	930	1,353	1.00%	13,482	18,693	32,176	977	1,422
46A	Dawson Highway (Gladstone - Biloela)	60064	4.391	5.179	2019	10,219	9,871	20,090	9.78%	9.09%	999	897	1.00%	10,740	10,375	21,115	1,050	943
46A	Dawson Highway (Gladstone - Biloela)	60062	5.179	***7.129***	2018	3,076	3,584	6,660	7.64%	9.54%	235	342	1.00%	3,265	3,804	7,070	249	363
46A	Dawson Highway (Gladstone - Biloela)	60062	***7.129***	10.296	2018	3,076	3,584	6,660	7.64%	9.54%	235	342	1.00%	3,265	3,804	7,070	249	363
46A	Dawson Highway (Gladstone - Biloela)	60065	10.296	19.050	2019	3,282	3,575	6,857	7.64%	9.54%	251	341	1.00%	3,449	3,757	7,207	264	358
46A	Dawson Highway (Gladstone - Biloela)	60066	19.050	21.650	2019	3,897	3,814	7,711	20.24%	119.20%	789	4,546	1.00%	4,096	4,009	8,104	829	4,778
46A	Dawson Highway (Gladstone - Biloela)	60128	21.650	25.640	2018	1,102	1,094	2,196	20.24%	119.20%	223	1,304	1.00%	1,170	1,161	2,331	237	1,384
46A	Dawson Highway (Gladstone - Biloela)	60005	25.640	***46.518***	2019	592	594	1,186	40.37%	28.28%	239	168	1.00%	622	624	1,246	251	177
46A	Dawson Highway (Gladstone - Biloela)	60005	***46.518***	***101.008***	2019	592	594	1,186	40.37%	28.28%	239	168	1.00%	622	624	1,246	251	177
46A	Dawson Highway (Gladstone - Biloela)	60067	***101.008***	113.728	2019	599	627	1,226	20.70%	23.65%	124	148	1.53%	646	676	1,323	134	160
46A	Dawson Highway (Gladstone - Biloela)	61084	113.728	116.836	2018	816	1,152	1,968	21.69%	13.11%	177	151	1.00%	866	1,223	2,089	188	160
46A	Dawson Highway (Gladstone - Biloela)	61085	116.836	119.836	2019	3,059	3,214	6,273	12.26%	9.15%	375	294	1.00%	3,215	3,378	6,593	394	309
-	Mt Alma Road	GRC	0.000	16.970	-	No Information Available												
-	Calliope Station Road	GRC	0.000	2.600	-	No Information Available												
10E	Bruce Highway (Benaraby - Rockhampton)	60006	11.445	***35.812***	2018	2,483	2,373	4,856	26.38%	24.74%	655	587	2.20%	2,829	2,704	5,533	746	669
10E	Bruce Highway (Benaraby - Rockhampton)	60006	***35.812***	***45.420***	2018	2,483	2,373	4,856	26.38%	24.74%	655	587	2.20%	2,829	2,704	5,533	746	669
10E	Bruce Highway (Benaraby - Rockhampton)	60023	***45.420***	85.308	2018	2,841	2,842	5,683	21.68%	23.82%	616	677	1.00%	3,016	3,017	6,033	654	719
10E	Bruce Highway (Benaraby - Rockhampton)	61551	85.308	***86.183***	2018	3,478	3,524	7,002	28.32%	26.14%	985	921	2.33%	3,993	4,046	8,040	1,131	1,058
10E	Bruce Highway (Benaraby - Rockhampton)	61551	***86.183***	***107.400***	2018	3,478	3,524	7,002	28.32%	26.14%	985	921	2.33%	3,993	4,046	8,040	1,131	1,058
10E	Bruce Highway (Benaraby - Rockhampton)	61551	***107.400***	108.938	2018	3,478	3,524	7,002	28.32%	26.14%	985	921	2.33%	3,993	4,046	8,040	1,131	1,058
10E	Bruce Highway (Benaraby - Rockhampton)	60130	108.938	114.388	2018	3,062	3,067	6,129	24.95%	27.06%	764	830	1.67%	3,382	3,387	6,769	844	917
10E	Bruce Highway (Benaraby - Rockhampton)	60024	114.388	116.961	2018	4,798	4,412	9,210	15.46%	21.01%	742	927	1.00%	5,093	4,683	9,777	787	984
-	South Ulam Road	RRC	0.000	16.773	2021	101	108	209	10.00%	10.00%	10	11	1.00%	104	111	215	10	11
46B	Dawson Highway (Biloela - Banana)	60068	0.000	0.650	2019	2,681	2,922	5,603	7.16%	12.97%	192	379	1.00%	2,818	3,071	5,889	202	398
46B	Dawson Highway (Biloela - Banana)	61883	0.650	1.366	2019	2,143	2,083	4,226	8.35%	16.03%	179	334	1.00%	2,252	2,189	4,442	188	351
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.000	0.115	2019	370	376	746	32.70%	32.71%	121	123	1.00%	389	395	784	127	129
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.115	25.680	2019	370	376	746	32.70%	32.71%	121	123	1.00%	389	395	784	127	129
41E	Burnett Highway (Biloela - Mt Morgan)	61081	0.000	***27.290***	2019	559	594	1,153	37.57%	23.91%	210	142	1.00%	588	624	1,212	221	149
41E	Burnett Highway (Biloela - Mt Morgan)	61081	***27.290***	35.401	2019	559	594	1,153	37.57%	23.91%	210	142	1.00%	588	624	1,212	221	149
41E	Burnett Highway (Biloela - Mt Morgan)	60055	35.401	***56.310***	2019	455	479	934	36.70%	39.67%	167	190	1.00%	478	503	982	176	200
41E	Burnett Highway (Biloela - Mt Morgan)	60055	***56.310***	71.730	2019	455	479	934	36.70%	39.67%	167	190	1.00%	478	503	982	176	200
-	Callide Mine Haul Road Access	BSC	0.000	0.400	-	No Information Available												
-	Argoon-Kilburnie Road	BSC	0.000	12.940	-	No Information Available												
-	Jambin-Dakenba Road	BSC	0.000	9.400	-	No Information Available												
-	McDonalds Road	BSC	0.000	5.720	2021	25	25	50	10.00%	10.00%	3	3	1.00%	26	26	52	3	3
-	Playfields Road	BSC	0.000	5.080	2021	25	25	50	10.00%	10.00%	3	3	1.00%	26	26	52	3	3
-	Playfields Road	BSC	5.080	24.420	2021	25	25	50	10.00%	10.00%	3	3	1.00%	26	26	52	3	3

Dev Traffic (Daily) - Construction

Road ID	Road Description	AADT Segment	Start (km)	End (km)	Gazettal A	Gazettal B	Gazettal C	Gazettal D	Gazettal E	Gazettal F	Gazettal G	Gazettal H	Gazettal Water	Gazettal Fuel	Gazettal Staff	Gazettal Max	A-Gazettal A	A-Gazettal B	A-Gazettal C	A-Gazettal D	A-Gazettal E	A-Gazettal F	A-Gazettal G	A-Gazettal H	A-Gazettal Water	A-Gazettal Fuel	A-Gazettal Staff	A-Gazettal Max	Bi-Dir
183	Gladstone Port Access Road	61605	0.000	0.858	0	0	0	0	0	9	0	0	0	0	0	9	0	0	0	0	0	15	0	0	0	0	0	15	24
-	Macfarlane Road	GRC	0.000	0.350	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	15	30
-	Macfarlane Road	GRC	0.350	1.210	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
-	Hopper Road (John Bates Drive)	GRC	0.000	0.790	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
-	Flinders Parade	GRC	0.000	0.670	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
-	Lord Street	GRC	0.000	0.515	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
181	Gladstone - Mount Larcom Road	60071	0.000	***0.175***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	15	15
181	Gladstone - Mount Larcom Road	60071	***0.175***	***0.919***	0	0	0	0	0	9	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	9
181	Gladstone - Mount Larcom Road	60071	***0.919***	1.409	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	15
181	Gladstone - Mount Larcom Road	60073	1.409	3.258	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	15
181	Gladstone - Mount Larcom Road	61052	3.258	***3.830***	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	15
181	Gladstone - Mount Larcom Road	61052	***3.830***	4.625	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
181	Gladstone - Mount Larcom Road	60074	4.625	12.292	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
181	Gladstone - Mount Larcom Road	60076	12.292	32.140	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
-	Red Rover Road	GRC	0.000	3.390	0	0	0	0	0	12	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	12
-	Don Young Drive	GRC	0.000	2.280	0	0	0	0	0	12	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	12
46A	Dawson Highway (Gladstone - Biloela)	60061	0.000	1.498	5	0	2	1	0	0	2	4	0	0	0	3	5	0	2	1	0	15	2	4	0	0	0	18	21
46A	Dawson Highway (Gladstone - Biloela)	61083	1.498	2.238	5	0	2	1	0	0	2	4	0	0	0	3	5	0	2	1	0	15	2	4	0	0	0	18	21
46A	Dawson Highway (Gladstone - Biloela)	61000	2.238	3.130	5	0	2	1	0	0	2	4	0	0	0	3	5	0	2	1	0	15	2	4	0	0	0	18	21
46A	Dawson Highway (Gladstone - Biloela)	60063	3.130	4.391	5	0	2	1	0	0	2	4	0	0	0	3	5	0	2	1	0	15	2	4	0	0	0	18	21
46A	Dawson Highway (Gladstone - Biloela)	60064	4.391	5.179	5	0	2	1	0	0	2	4	0	0	0	3	5	0	2	1	0	15	2	4	0	0	0	18	21
46A	Dawson Highway (Gladstone - Biloela)	60062	5.179	***7.129***	5	0	2	1	0	0	2	4	0	0	0	3	5	0	2	1	0	15	2	4	0	0	0	18	21
46A	Dawson Highway (Gladstone - Biloela)	60062	***7.129***	10.296	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	60065	10.296	19.050	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	60066	19.050	21.650	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	60128	21.650	25.640	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	60005	25.640	***46.518***	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	60005	***46.518***	***101.008***	5	0	2	1	0	15	2	4	0	0	0	18	5	0	2	1	0	15	2	4	0	0	0	18	36
46A	Dawson Highway (Gladstone - Biloela)	60067	***101.008***	113.728	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	61084	113.728	116.836	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
46A	Dawson Highway (Gladstone - Biloela)	61085	116.836	119.836	5	0	2	1	0	12	2	4	0	0	0	15	5	0	2	1	0	15	2	4	0	0	0	18	33
-	Mt Alma Road	GRC	0.000	16.970	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
-	Calliope Station Road	GRC	0.000	2.600	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
10E	Bruce Highway (Benaraby - Rockhampton)	60006	11.445	***35.812***	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
10E	Bruce Highway (Benaraby - Rockhampton)	60006	***35.812***	***45.420***	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	6
10E	Bruce Highway (Benaraby - Rockhampton)	60023	***45.420***	85.308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10E	Bruce Highway (Benaraby - Rockhampton)	61551	85.308	***86.183***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10E	Bruce Highway (Benaraby - Rockhampton)	61551	***86.183***	***107.400***	0	5	5	1	0	0	0	0	0	0	0	11	0	5	5	1	0	0	0	0	0	0	0	11	22
10E	Bruce Highway (Benaraby - Rockhampton)	61551	***107.400***	108.938	0	0	2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	0	0	0	0	0	0	3	6
10E	Bruce Highway (Benaraby - Rockhampton)	60130	108.938	114.388	0	0	2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	0	0	0	0	0	0	3	6
10E	Bruce Highway (Benaraby - Rockhampton)	60024	114.388	116.961	0	0	2	1	0	0	0	0	0	0	0	3	0	0	2	1	0	0	0	0	0	0	0	3	6
-	South Ulam Road	RRC	0.000	16.773	0	5	5	1	0	0	0	0	0	0	15	26	0	5	5	1	0	0	0	0	0	0	15	26	52
46B	Dawson Highway (Biloela - Banana)	60068	0.000	0.650	5	0	4	1	5	12	2	4	0	0	0	22	5	0	4	1	5	15	2	4	0	0	0	25	47
46B	Dawson Highway (Biloela - Banana)	61883	0.650	1.366	5	0	4	1	5	12	2	4	0	0	0	22	5	0	4	1	5	15	2	4	0	0	0	25	47
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.000	0.115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.115	25.680	0	33	24	3	10	0	0	0	0	0	0	70	0	33	24	3	10	0	0	0	0	0	0	70	140
41E	Burnett Highway (Biloela - Mt Morgan)	61081	0.000	***27.290***	5	0	4	1	5	12	2	4	10	1	89	122	5	0	4	1	5	15	2	4	10	1	89	125	247
41E	Burnett Highway (Biloela - Mt Morgan)	61081	***27.290***	35.401	5	0	4	1	5	15	2	4	10	1	89	125	5	0	4	1	5	15	2	4	10	1	89	125	250
41E	Burnett Highway (Biloela - Mt Morgan)	60055	35.401	***56.310***	5	0	4	1	5	15	2	4	10	1	89	125	5	0	4	1	5	15	2	4	10	1	89	125	250
41E	Burnett Highway (Biloela - Mt Morgan)	60055	***56.310***	71.730	0	33	24	3	10	0	0	0	0	0	0	70	0	33	24	3	10	0	0	0	0	0	0	70	140
-	Callide Mine Haul Road Access	BSC	0.000	0.400	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
-	Argoon-Kilburnie Road	BSC	0.000	12.940	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
-	Jambin-Dakenba Road	BSC	0.000	9.400	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
-	McDonalds Road	BSC	0.000	5.720	5	33	28	4	15	15	2	4	10	1	89	195	5	33	28	4	15	15	2	4	10	1	89	195	390
-	Playfields Road	BSC	0.000	5.080	5	33	28	4	15	15	2	4	10	1	89	195	5	33	28	4	15	15	2	4	10	1	89	195	390
-	Playfields Road	BSC	5.080	24.420	5	33	28	4	15	15	2	4	10	1	89	195	5	33	28	4	15	15	2	4	10	1	89	195	390

Road ID	Road Description	AADT Segment	Start (km)	End (km)	Construction Gaz %	Construction A-Gaz %	Construction Bi-Dir %	IN CONS Gaz	IN CONS A-Gaz
183	Gladstone Port Access Road	61605	0.000	0.858	1.09%	1.90%	1.49%	835	804
-	Macfarlane Road	GRC	0.000	0.350	-	-	-	15	15
-	Macfarlane Road	GRC	0.350	1.210	-	-	-	6	0
-	Hopper Road (John Bates Drive)	GRC	0.000	0.790	-	-	-	6	0
-	Flinders Parade	GRC	0.000	0.670	-	-	-	6	0
-	Lord Street	GRC	0.000	0.515	-	-	-	6	0
181	Gladstone - Mount Larcom Road	60071	0.000	***0.175***	0.00%	0.46%	0.21%	3,745	3,257
181	Gladstone - Mount Larcom Road	60071	***0.175***	***0.919***	0.24%	0.00%	0.13%	3,754	3,242
181	Gladstone - Mount Larcom Road	60071	***0.919***	1.409	0.40%	0.00%	0.21%	3,760	3,242
181	Gladstone - Mount Larcom Road	60073	1.409	3.258	0.47%	0.00%	0.23%	3,226	3,344
181	Gladstone - Mount Larcom Road	61052	3.258	***3.830***	0.30%	0.00%	0.15%	5,011	4,821
181	Gladstone - Mount Larcom Road	61052	***3.830***	4.625	0.06%	0.00%	0.03%	4,999	4,821
181	Gladstone - Mount Larcom Road	60074	4.625	12.292	0.09%	0.00%	0.04%	3,406	3,385
181	Gladstone - Mount Larcom Road	60076	12.292	32.140	0.19%	0.00%	0.10%	1,574	1,573
-	Red Rover Road	GRC	0.000	3.390	-	-	-	12	0
-	Don Young Drive	GRC	0.000	2.280	-	-	-	12	0
46A	Dawson Highway (Gladstone - Biloela)	60061	0.000	1.498	0.06%	0.30%	0.19%	5,398	5,959
46A	Dawson Highway (Gladstone - Biloela)	61083	1.498	2.238	0.03%	0.20%	0.12%	9,020	9,098
46A	Dawson Highway (Gladstone - Biloela)	61000	2.238	3.130	0.03%	0.15%	0.09%	11,379	12,390
46A	Dawson Highway (Gladstone - Biloela)	60063	3.130	4.391	0.02%	0.10%	0.07%	13,485	18,711
46A	Dawson Highway (Gladstone - Biloela)	60064	4.391	5.179	0.03%	0.17%	0.10%	10,743	10,393
46A	Dawson Highway (Gladstone - Biloela)	60062	5.179	***7.129***	0.09%	0.47%	0.30%	3,268	3,822
46A	Dawson Highway (Gladstone - Biloela)	60062	***7.129***	10.296	0.46%	0.47%	0.47%	3,280	3,822
46A	Dawson Highway (Gladstone - Biloela)	60065	10.296	19.050	0.43%	0.48%	0.46%	3,464	3,775
46A	Dawson Highway (Gladstone - Biloela)	60066	19.050	21.650	0.37%	0.45%	0.41%	4,111	4,027
46A	Dawson Highway (Gladstone - Biloela)	60128	21.650	25.640	1.28%	1.55%	1.42%	1,185	1,179
46A	Dawson Highway (Gladstone - Biloela)	60005	25.640	***46.518***	2.41%	2.88%	2.65%	637	642
46A	Dawson Highway (Gladstone - Biloela)	60005	***46.518***	***101.008***	2.89%	2.88%	2.89%	640	642
46A	Dawson Highway (Gladstone - Biloela)	60067	***101.008***	113.728	2.32%	2.66%	2.49%	661	694
46A	Dawson Highway (Gladstone - Biloela)	61084	113.728	116.836	1.73%	1.47%	1.58%	881	1,241
46A	Dawson Highway (Gladstone - Biloela)	61085	116.836	119.836	0.47%	0.53%	0.50%	3,230	3,396
-	Mt Alma Road	GRC	0.000	16.970	-	-	-	3	0
-	Calliope Station Road	GRC	0.000	2.600	-	-	-	3	0
10E	Bruce Highway (Benaraby - Rockhampton)	60006	11.445	***35.812***	0.21%	0.00%	0.11%	2,835	2,704
10E	Bruce Highway (Benaraby - Rockhampton)	60006	***35.812***	***45.420***	0.21%	0.00%	0.11%	2,835	2,704
10E	Bruce Highway (Benaraby - Rockhampton)	60023	***45.420***	85.308	0.00%	0.00%	0.00%	3,016	3,017
10E	Bruce Highway (Benaraby - Rockhampton)	61551	85.308	***86.183***	0.00%	0.00%	0.00%	3,993	4,046
10E	Bruce Highway (Benaraby - Rockhampton)	61551	***86.183***	***107.400***	0.28%	0.27%	0.27%	4,004	4,057
10E	Bruce Highway (Benaraby - Rockhampton)	61551	***107.400***	108.938	0.08%	0.07%	0.07%	3,996	4,049
10E	Bruce Highway (Benaraby - Rockhampton)	60130	108.938	114.388	0.09%	0.09%	0.09%	3,385	3,390
10E	Bruce Highway (Benaraby - Rockhampton)	60024	114.388	116.961	0.06%	0.06%	0.06%	5,096	4,686
-	South Ulam Road	RRC	0.000	16.773	24.99%	23.37%	24.15%	130	137
46B	Dawson Highway (Biloela - Banana)	60068	0.000	0.650	0.78%	0.81%	0.80%	2,840	3,096
46B	Dawson Highway (Biloela - Banana)	61883	0.650	1.366	0.98%	1.14%	1.06%	2,274	2,214
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.000	0.115	0.00%	0.00%	0.00%	389	395
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.115	25.680	18.00%	17.71%	17.86%	459	465
41E	Burnett Highway (Biloela - Mt Morgan)	61081	0.000	***27.290***	20.77%	20.02%	20.38%	710	749
41E	Burnett Highway (Biloela - Mt Morgan)	61081	***27.290***	35.401	21.28%	20.02%	20.63%	713	749
41E	Burnett Highway (Biloela - Mt Morgan)	60055	35.401	***56.310***	26.14%	24.83%	25.47%	603	628
41E	Burnett Highway (Biloela - Mt Morgan)	60055	***56.310***	71.730	14.64%	13.90%	14.26%	548	573
-	Callide Mine Haul Road Access	BSC	0.000	0.400	-	-	-	3	0
-	Argoon-Kilburnie Road	BSC	0.000	12.940	-	-	-	3	0
-	Jambin-Dakenba Road	BSC	0.000	9.400	-	-	-	3	0
-	McDonalds Road	BSC	0.000	5.720	757.06%	757.06%	757.06%	221	221
-	Playfields Road	BSC	0.000	5.080	757.06%	757.06%	757.06%	221	221
-	Playfields Road	BSC	5.080	24.420	757.06%	757.06%	757.06%	221	221

Appendix I – Turn Warrants Assessment

Intersection: **Burnett Highway / McDonalds Road**

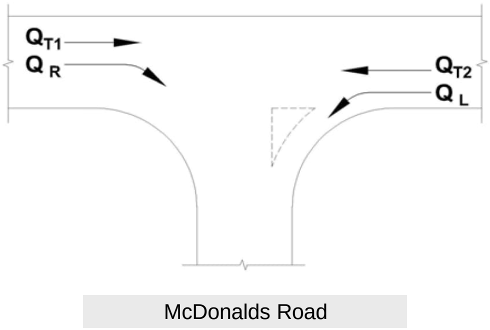
Year / Peak: **2024 AM & PM** Scenario: **In Construction**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	PM Peak
Q_{T1} =	50	50
Q_R =	93	6

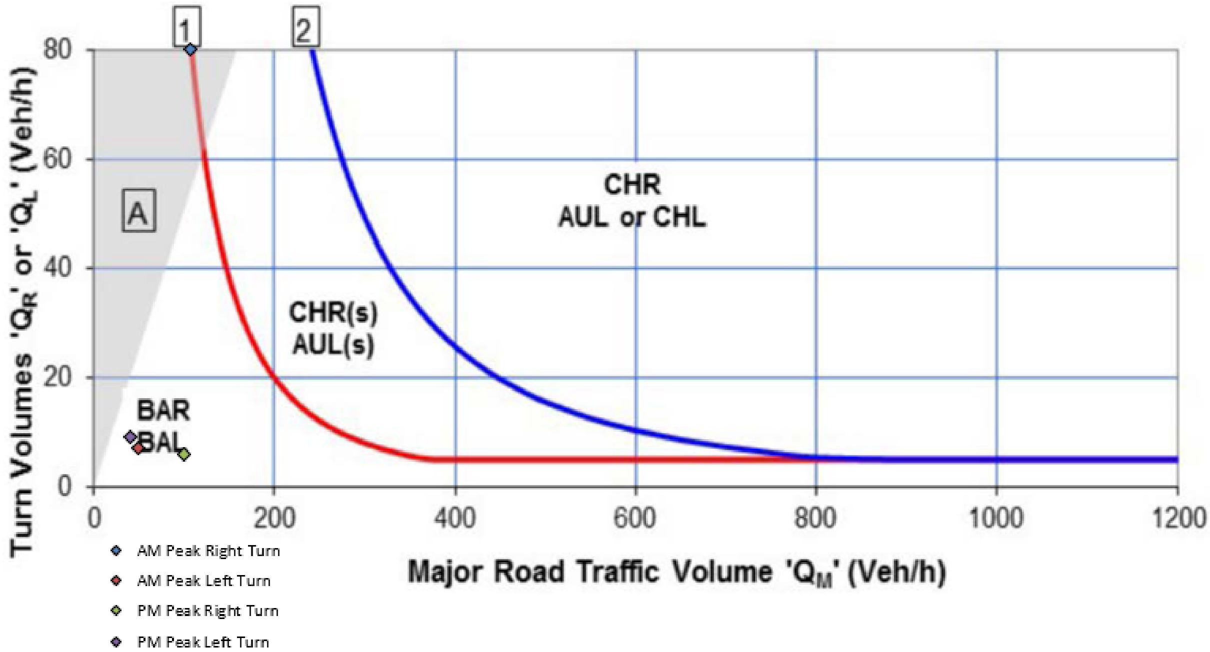
Splitter Island? No

Design speed (km/h) 110



	AM Peak	PM Peak
Q_{T2} =	50	41
Q_L =	7	9

Graph	Q_M	Q_R/Q_L
	AM Peak	
Right	108	93
Left	50	7
	PM Peak	
Right	101	6
Left	41	9



Recommended treatments:

Right Turn	BAR
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

While the AM right turn volume shows a warrant on the border of the BAR / CHRs interface, due to the temporary nature of the peak staff and therefor Project volumes at the intersection (3-6 months), with non-peak construction volumes expected to be significantly lower (and therefore within the BAR area, the provision of BAR treatment in conjunction with propsoed advanced warning truck turning signage is considered appropriate to cater for the forecast "in construction" volumes at the intersection.

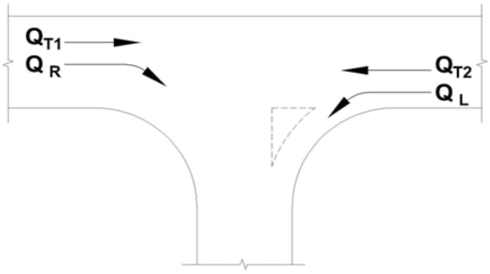
Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	15/03/2023

Intersection:	**Bruce Highway / South Ulam Road** (Major Road / Minor Road)
Year / Peak:	**2024 AM & PM** Scenario: **In Construction**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	265	215
Q_R =	19	5

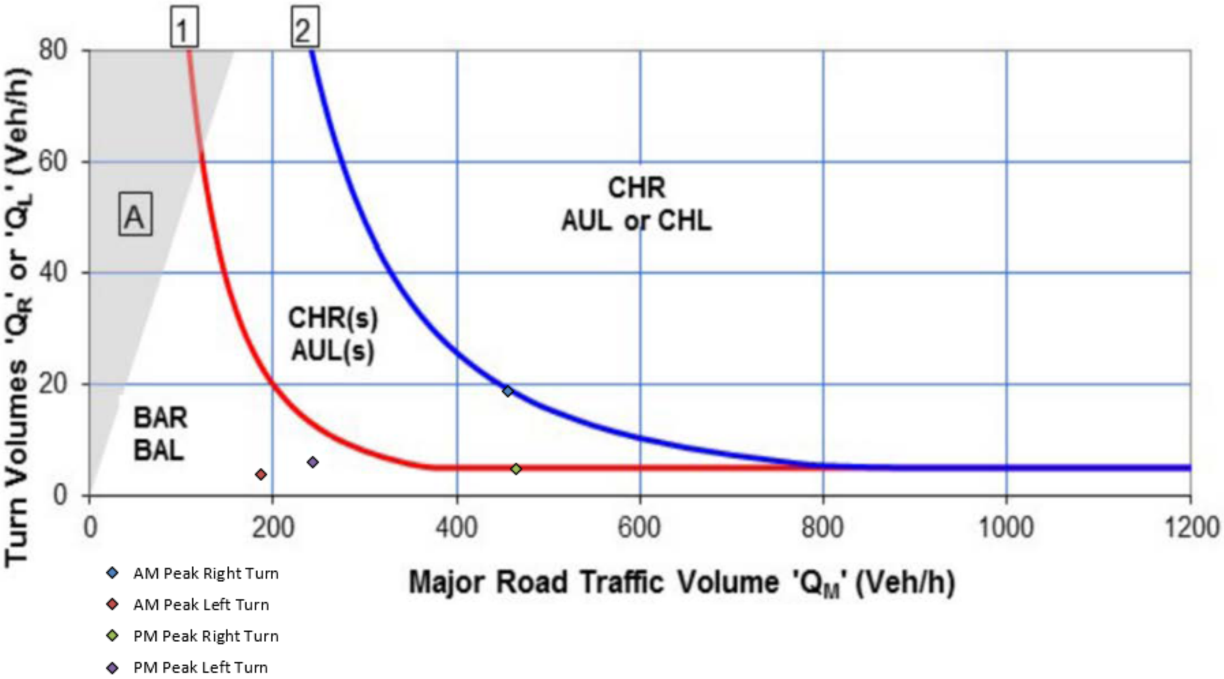
Splitter Island?	No
Design speed (km/h)	110



South Ulam Road

	AM Peak	*PM Peak*
Q_{T2} =	188	244
Q_L =	4	6

Graph	Q_M	Q_R/Q_L
	AM Peak	
Right	456	19
Left	188	4
	PM Peak	
Right	466	5
Left	244	6



Recommended treatments:

Right Turn	CHR
Left Turn	AULs

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Existing intersection configuration (CHR / AULs) is expected to be adequate to cater for expected project "in construction" traffic volumes.

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	15/03/2023

Appendix J – Project Pavement Loading and Impact Calculations

UMW0123-001 | Mount Hopeful Wind Farm

Project Pavement Loadings

TASK A - SITE MOBILISTATION

Mobilisation (Buildings / EW Plant)	100	Semi / Low Loader	Gladstone
Semi Unloaded (0%)	1.68	ESAs	
Semi Loaded (100%)	5.54	ESAs	

	Loaded	Unloaded
Gladstone to Site Access	554	168

TASK B - ACCESS ROADS & SITE ENTRANCES

Internal Access Tracks Gravel Pavement Materials	5,023	Truck & Dog Trailer	QMQ Quarry
Access Intersection Pavement (TMR) Materials	50	Truck & Dog Trailer	QMQ Quarry
Access Track (Substation East) Gravel Pavement Materials	99	Truck & Dog Trailer	Hopkins Quarry Midgee
Road Upgrade (McDonalds / Playfields) Gravel Pavement	1,006	Truck & Dog Trailer	QMQ Quarry
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs	
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs	

	Loaded	Unloaded
QMQ Quarry to Site Access	37,386	9,970
Hopkins Quarry Midgee to Eastern Substation Site	609	162

TASK C - SUBSTATION AND SITE AREAS

Substation & Battery Storage Area (East) Establishment	50	Semi	Rockhampton
Substation Areas (Internal) Establishment	100	Semi	Gladstone
Batch Plant Areas (Internal) Establishment	75	Semi	Gladstone
Construction Compound Area (Internal) Establishment	50	Semi	Gladstone
Site Entry Area (Internal) Establishment	20	Semi	Gladstone
Operational and Maintenance Facility Area (Internal) Establishment	25	Semi	Gladstone
Substation & Battery Storage Area (East) Slab Concrete	70	Concrete Truck	Rockhampton
Substation & Battery Storage Area (East) Gravel	180	Truck & Dog Trailer	Hopkins Quarry Midgee
Substation & Battery Storage Area (East) Reinforcing Steel	6	Semi	Rockhampton
Substation Areas (Internal) Slab Concrete Aggregates	21	Truck & Dog Trailer	QMQ Quarry
Substation Areas (Internal) Portland Cement	5	Semi	Biloela
Substation Areas (Internal) Reinforcing Steel	9	Semi	Biloela
Substation Areas (Internal) Water	2	Semi Water Truck	Biloela
Batch Plant Areas (Internal) Slab Concrete Aggregates	23	Truck & Dog Trailer	QMQ Quarry
Batch Plant Areas (Internal) Portland Cement	6	Semi	Biloela
Batch Plant Areas (Internal) Reinforcing Steel	9	Semi	Biloela
Batch Plant Areas (Internal) Water	2	Semi Water Truck	Biloela
Site Construction Compound (Internal) Slab Concrete Aggregates	12	Truck & Dog Trailer	QMQ Quarry
Site Construction Compound (Internal) Portland Cement	3	Semi	Biloela
Site Construction Compound (Internal) Reinforcing Steel	5	Semi	Biloela
Site Construction Compound (Internal) Water	1	Semi Water Truck	Biloela
O&M Facility Area (Internal) Slab Concrete Aggregates	4	Truck & Dog Trailer	QMQ Quarry
O&M Facility Area (Internal) Portland Cement	1	Semi	Biloela
O&M Facility Area (Internal) Reinforcing Steel	2	Semi	Biloela
O&M Facility Area (Internal) Water	1	Semi Water Truck	Biloela
Substation Areas (Internal) Gravel	248	Truck & Dog Trailer	QMQ Quarry
Turbine Hardstand Areas (Internal) Gravel	4,095	Truck & Dog Trailer	QMQ Quarry
Laydown Areas (Internal) Gravel	300	Truck & Dog Trailer	QMQ Quarry
Batch Plant Areas (Internal) Gravel	270	Truck & Dog Trailer	QMQ Quarry
Construction Compound Area (Internal) Gravel	135	Truck & Dog Trailer	QMQ Quarry
Site Entry Area (Internal) Gravel	25	Truck & Dog Trailer	QMQ Quarry
Site Camp Facilitiy (Internal) Gravel)	0	Truck & Dog Trailer	QMQ Quarry
Semi Unloaded (0%)	1.68	ESAs	
Semi Loaded (100%)	5.54	ESAs	
Concrete Truck (4 Axle Rigid) Unloaded (0%)	0.36	ESAs	
Concrete Truck (4 Axle Rigid) Loaded (100%)	4.13	ESAs	
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs	
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs	

	Loaded	Unloaded
Rockhampton to Eastern Substation Site	599	119
Hopkins Quarry Midgee to Eastern Substation Site	1,107	295
Gladstone to Site Access	1,496	454
Biloela to Site Access	255	77
QMQ Quarry to Site Access	31,722	8,459

TASK D - CABLING

Underground Powerline Cable (Main Site)	41	Semi	Gladstone
Underground Powerline Bedding Sand (Main Site)	548	Truck & Dog Trailer	QMQ Quarry
Overheads Powerline Cable (Main Site)	16	Semi	Gladstone
Overheads Powerline Poles (Main Site)	7	Semi	Gladstone
Overheads Powerline Cable (Eastern Substation)	9	Semi	Rockhampton
Overheads Powerline Poles (Eastern Substation)	5	Semi	Rockhampton

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs

	Loaded	Unloaded
Rockhampton to Eastern Substation Site	78	24
Gladstone to Site Access	355	108
QMQ Quarry to Site Access	3,370	899

TASK E - TURBINE FOUNDATIONS

Concrete aggregates for turbine footings	2,407	Truck & Dog	QMQ Quarry
Reinforcing steel for turbine footings	695	Semi	Biloela
Other concrete supplies for turbine footings	404	Semi	Biloela
Wet concrete or turbine footings	*8,203*	*Conc. Truck*	Internal
Concrete aggregates for met mast footings	13	Truck & Dog	QMQ Quarry
Reinforcing steel for met mast footings	4	Semi	Biloela
Other concrete supplies for met mast footings	3	Semi	Biloela
Wet concrete for met mast footings	*44*	*Conc. Truck*	Internal

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs

	Loaded	Unloaded
QMQ Quarry to Site Access	14,883	3,969
Biloela to Site Access	6,129	1,858

TASK F - TURBINE TRANSPORTATION

Turbine Blades	189	Special	G'stone
Turbine Nacelles	63	Special	G'stone
Turbine Drive Trains	63	Special	G'stone
Turbine Hubs	63	Special	G'stone
Tower Sections	441	Special	G'stone
Escorting LV	1638	LV	G'stone
Meteorology masts	10	Special	G'stone

Turbine Blade Transport Loaded	11.47	ESAs
Turbine Blade Transport Unloaded	7.95	ESAs
Turbine Nacelle Transport Loaded	24.41	ESAs
Turbine Nacelle Transport Unloaded	4.88	ESAs
Turbine Drive Train Transport Loaded	22.78	ESAs
Turbine Drive Train Transport Unloaded	4.98	ESAs
Turbine Hub Transport Loaded	12.38	ESAs
Turbine Hub Transport Unloaded	4.77	ESAs
Turbine Tower Section Transport Loaded (Average)	20.86	ESAs
Turbine Tower Section Transport Unloaded (Average)	2.70	ESAs
Met Mast Transport Loaded	11.47	ESAs
Met Mast Transport Unloaded	7.95	ESAs

	Loaded	Unloaded
Blades	2,168	1,503
Nacelles	1,538	307
Drive Train	1,435	314
Hub	780	301
Tower - 7 all	9,199	1,191
Tower - 4 (Mt Alma / Calliope Stn / Argoon)	5,257	680
Tower - 3 (46A / 41E)	3,943	510
Met Mast	115	80

TASK G - TURBINE ERECTION

Site Turbine Crane & Secondary Crane (mobilise)	10	Special	Gladstone

Special Crane Unloaded (0%) - Assume Same Loading as Blade	2.21	ESAs
Special Crane Loaded (100%) - Assume Same Loading as Blade	8.08	ESAs

	Loaded	Unloaded
Gladstone to Site Access	81	22

TASK H - FINALISATION / COMMISSIONING / DEMOBILISATION

Batch Plant Areas (Internal) Decommissioning	75	Semi	Gladstone
Construction Compound Area (Internal) Decommissioning	50	Semi	Gladstone
Site Entry Area (Internal) Decommissioning	20	Semi	Gladstone
General Demobilisation (Buildings / EW Plant)	100	Semi	Gladstone

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs

	Loaded	Unloaded
Gladstone to Site Access	1,357	412

SITE WATER

Site Water - Overall	4,755	Semi Water Truck	Biloela

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs

	Loaded	Unloaded
Biloela to Site Access	26,343	7,988

SITE WATER

Site Fuel - Overall	241	Semi Tanker	Biloela

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs

	Loaded	Unloaded
Biloela to Site Access	1,335	405

UMW0123-001 | Mount Hopeful Wind Farm

Project Pavement Impact % Calculations

Road ID	Road Description	Seg.	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2024 AADT			2024 HV		ESAs / HV	Days / Year	Background ESAs	
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz			Gaz	A-Gaz
183	Gladstone Port Access Road	61605	0.000	0.858	2018	778	743	1,521	33.29%	31.76%	259	236	*1.00%*	826	789	1,615	275	250	3.2	669	588,716	536,391
-	Macfarlane Road	GRC	0.000	0.350	-	No information Available													-	-	-	-
		GRC	0.350	1.210	-	No information Available													-	-	-	-
-	Hopper Road (John Bates Drive)	GRC	0.000	0.790	-	No information Available													-	-	-	-
-	Flinders Parade	GRC	0.000	0.670	-	No information Available													-	-	-	-
-	Lord Street	GRC	0.000	0.515	-	No information Available													-	-	-	-
181	Gladstone - Mount Larcom Road	60071	0.000	***0.175***	2019	3,563	3,085	6,648	18.52%	15.24%	660	470	*1.00%*	3,745	3,242	6,987	694	494	3.2	669	1,485,074	1,058,111
			0.175	***0.919***	2019	3,563	3,085	6,648	18.52%	15.24%	660	470	*1.00%*	3,745	3,242	6,987	694	494	3.2	669	1,485,074	1,058,111
			0.919	1.409	2019	3,563	3,085	6,648	18.52%	15.24%	660	470	*1.00%*	3,745	3,242	6,987	694	494	3.2	669	1,485,074	1,058,111
		60073	1.409	3.258	2018	3,025	3,150	6,175	16.07%	16.16%	486	509	*1.00%*	3,211	3,344	6,555	516	540	3.2	669	1,104,978	1,157,083
		61052	3.258	***3.830***	2018	4,706	4,542	9,248	11.52%	14.11%	542	641	*1.00%*	4,996	4,821	9,817	575	680	3.2	669	1,232,301	1,456,755
			3.830	4.625	2018	4,706	4,542	9,248	11.52%	14.11%	542	641	*1.00%*	4,996	4,821	9,817	575	680	3.2	669	1,232,301	1,456,755
		60074	4.625	12.292	2018	3,206	3,189	6,395	13.54%	15.96%	434	509	*1.00%*	3,403	3,385	6,788	461	540	3.2	669	986,722	1,156,911
		60076	12.292	32.140	2018	1,480	1,482	2,962	21.89%	30.23%	324	448	*1.00%*	1,571	1,573	3,144	344	476	3.2	669	736,411	1,018,354
-	Red Rover Road	GRC	0.000	3.390	-	No information Available													-	-	-	-
-	Don Young Drive	GRC	0.000	2.280	-	No information Available													-	-	-	-
46A	Dawson Highway (Gladstone - Biloela)	60061	0.000	1.498	2019	5,133	5,653	10,786	*4.93%*	*6.62%*	253	374	*1.00%*	5,395	5,941	11,336	266	393	3.2	669	569,520	842,225
		61083	1.498	2.238	2019	8,579	8,639	17,218	4.93%	6.62%	423	572	*1.00%*	9,017	9,080	18,096	445	601	3.2	669	951,864	1,287,101
		61000	2.238	3.130	2018	10,717	11,655	22,372	4.72%	6.12%	506	713	*1.00%*	11,376	12,372	23,748	537	757	3.2	669	1,149,814	1,621,348
		60063	3.130	4.391	2019	12,828	17,786	30,614	*7.25%*	*7.61%*	930	1,353	*1.00%*	13,482	18,693	32,176	977	1,422	3.2	669	2,093,091	3,044,168
		60064	4.391	5.179	2019	10,219	9,871	20,090	9.78%	9.09%	999	897	*1.00%*	10,740	10,375	21,115	1,050	943	3.2	669	2,249,253	2,019,371
		60062	5.179	***7.129***	2018	3,076	3,584	6,660	7.64%	9.54%	235	342	*1.00%*	3,265	3,804	7,070	249	363	3.2	669	534,186	777,193
			7.129	10.296	2018	3,076	3,584	6,660	7.64%	9.54%	235	342	*1.00%*	3,265	3,804	7,070	249	363	3.2	669	534,186	777,193
		60065	10.296	19.050	2019	3,282	3,575	6,857	*7.64%*	*9.54%*	251	341	*1.00%*	3,449	3,757	7,207	264	358	3.2	669	564,317	767,566
		60066	19.050	21.650	2019	3,897	3,814	7,711	20.24%	119.20%	789	4,546	*1.00%*	4,096	4,009	8,104	829	4,778	3.2	669	1,775,138	10,231,707
		60128	21.650	25.640	2018	1,102	1,094	2,196	20.24%	119.20%	223	1,304	*1.00%*	1,170	1,161	2,331	237	1,384	3.2	669	506,996	2,964,190
		60005	25.640	***46.518***	2019	592	594	1,186	40.37%	28.28%	239	168	*1.00%*	622	624	1,246	251	177	3.2	669	537,863	378,057
			46.518	***101.008***	2019	592	594	1,186	40.37%	28.28%	239	168	*1.00%*	622	624	1,246	251	177	3.2	669	537,863	378,057
		60067	***101.008***	113.728	2019	599	627	1,226	20.70%	23.65%	124	148	1.53%	646	676	1,323	134	160	3.2	669	286,453	342,574
		61084	113.728	116.836	2018	816	1,152	1,968	21.69%	13.11%	177	151	*1.00%*	866	1,223	2,089	188	160	3.2	669	402,311	343,295
		61085	116.836	119.836	2019	3,059	3,214	6,273	12.26%	9.15%	375	294	*1.00%*	3,215	3,378	6,593	394	309	3.2	669	844,036	661,848
-	Mt Alma Road	GRC	0.000	16.970	-	No information Available													-	-	-	-
-	Calliope Station Road	GRC	0.000	2.600	-	No information Available													-	-	-	-
10E	Bruce Highway (Benaraby - Rockhampton)	60006	11.445	***35.812***	2018	2,483	2,373	4,856	26.38%	24.74%	655	587	2.20%	2,829	2,704	5,533	746	669	2.9	669	1,448,402	1,298,181
			35.812	***45.420***	2018	2,483	2,373	4,856	26.38%	24.74%	655	587	2.20%	2,829	2,704	5,533	746	669	2.9	669	1,448,402	1,298,181
		60023	***45.420***	85.308	2018	2,841	2,842	5,683	21.68%	23.82%	616	677	*1.00%*	3,016	3,017	6,033	654	719	2.9	669	1,268,794	1,394,525
		61551	85.308	***86.183***	2018	3,478	3,524	7,002	28.32%	26.14%	985	921	2.33%	3,993	4,046	8,040	1,131	1,058	2.9	669	2,194,689	2,052,540
			86.183	***107.400***	2018	3,478	3,524	7,002	28.32%	26.14%	985	921	2.33%	3,993	4,046	8,040	1,131	1,058	2.9	669	2,194,689	2,052,540
			107.400	108.938	2018	3,478	3,524	7,002	28.32%	26.14%	985	921	2.33%	3,993	4,046	8,040	1,131	1,058	2.9	669	2,194,689	2,052,540
		60130	108.938	114.388	2018	3,062	3,067	6,129	24.95%	27.06%	764	830	1.67%	3,382	3,387	6,769	844	917	2.9	669	1,637,438	1,778,815
		60024	114.388	116.961	2018	4,798	4,412	9,210	15.46%	21.01%	742	927	*1.00%*	5,093	4,683	9,777	787	984	2.9	669	1,528,024	1,909,511
-	South Ulam Road	RRC	0.000	16.773	2021	101	108	209	10.00%	10.00%	10	11	*1.00%*	104	111	215	10	11	3.2	669	22,283	23,827
46B	Dawson Highway (Biloela - Banana)	60068	0.000	0.650	2019	2,681	2,922	5,603	7.16%	12.97%	192	379	*1.00%*	2,818	3,071	5,889	202	398	3.2	669	432,017	852,926
		61883	0.650	1.366	2019	2,143	2,083	4,226	8.35%	16.03%	179	334	*1.00%*	2,252	2,189	4,442	188	351	3.2	669	402,717	751,474
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.000	0.115	2019	370	376	746	32.70%	32.71%	121	123	*1.00%*	389	395	784	127	129	3.2	669	272,296	276,796
			0.115	25.680	2019	370	376	746	32.70%	32.71%	121	123	*1.00%*	389	395	784	127	129	3.2	669	272,296	276,796
41E	Burnett Highway (Biloela - Mt Morgan)	61081	0.000	***27.290***	2019	559	594	1,153	37.57%	23.91%	210	142	*1.00%*	588	624	1,212	221	149	3.2	669	472,655	319,637
			27.290	35.401	2019	559	594	1,153	37.57%	23.91%	210	142	*1.00%*	588	624	1,212	221	149	3.2	669	472,655	319,637
		60055	35.401	***56.310***	2019	455	479	934	36.70%	39.67%	167	190	*1.00%*	478	503	982	176	200	3.2	669	375,810	427,650
			56.310	71.730	2019	455	479	934	36.70%	39.67%	167	190	*1.00%*	478	503	982	176	200	3.2	669	375,810	427,650
-	Callide Mine Haul Road Access	BSC	0.000	0.400	-	No information Available													-	-	-	-
-	Argoon-Kilburnie Road	BSC	0.000	12.940	-	No information Available													-	-	-	-
-	Jambin-Dakenba Road	BSC	0.000	9.400	-	No information Available													-	-	-	-
-	McDonalds Road	BSC	0.000	5.720	2021	25	25	50	10.00%	10.00%	3	3	*1.00%*	26	26	52	3	3	3.2	669	5,516	5,516
-	Playfields Road	BSC	0.000	5.080	2021	25	25	50	10.00%	10.00%	3	3	*1.00%*	26	26	52	3	3	3.2	669	5,516	5,516
			5.080	24.420	2021	25	25	50	10.00%	10.00%	3	3	*1.00%*	26	26	52	3	3	3.2	669	5,516	5,516

UMW0123-001 | Mount Hopeful Wind Farm

Project Pavement Impact % Calculations

Road ID	Road Description	Seg.	AADT Segment		Development ESAs																						ESA Increase %	
			Start (km)	End (km)	Gaz											A-Gaz											Gaz %	A-Gaz %
					A	B	C	D	E	F	G	H	Water	Fuel	Total	A	B	C	D	E	F	G	H	Water	Fuel	Total		
183	Gladstone Port Access Road	61605	0.000	0.858	0	0	0	0	0	4,498	0	0	0	0	4,498	0	0	0	0	0	3,694	0	0	0	0	3,694	0.76%	0.69%
-	Macfarlane Road	GRC	0.000	0.350	0	0	0	0	0	3,694	0	0	0	0	3,694	0	0	0	0	0	4,498	0	0	0	0	4,498	-	-
		GRC	0.350	1.210	0	0	0	0	0	10,737	0	0	0	0	10,737	0	0	0	0	0	1,498	0	0	0	0	1,498	-	-
-	Hopper Road (John Bates Drive)	GRC	0.000	0.790	0	0	0	0	0	10,737	0	0	0	0	10,737	0	0	0	0	0	1,498	0	0	0	0	1,498	-	-
-	Flinders Parade	GRC	0.000	0.670	0	0	0	0	0	10,737	0	0	0	0	10,737	0	0	0	0	0	1,498	0	0	0	0	1,498	-	-
-	Lord Street	GRC	0.000	0.515	0	0	0	0	0	10,737	0	0	0	0	10,737	0	0	0	0	0	1,498	0	0	0	0	1,498	-	-
181	Gladstone - Mount Larcom Road	60071	0.000	0.175	0	0	0	0	0	3,694	0	0	0	0	3,694	0	0	0	0	0	0	0	0	0	0	0	0.25%	0.00%
			0.175	0.919	0	0	0	0	0	4,498	0	0	0	0	4,498	0	0	0	0	0	0	0	0	0	0	0	0.30%	0.00%
			0.919	1.409	0	0	0	0	0	15,235	0	0	0	0	15,235	0	0	0	0	0	0	0	0	0	0	0	1.03%	0.00%
		60073	1.409	3.258	0	0	0	0	0	15,235	0	0	0	0	15,235	0	0	0	0	0	0	0	0	0	0	0	1.38%	0.00%
		61052	3.258	3.830	0	0	0	0	0	15,235	0	0	0	0	15,235	0	0	0	0	0	0	0	0	0	0	0	1.24%	0.00%
			3.830	4.625	0	0	0	0	0	2,283	0	0	0	0	2,283	0	0	0	0	0	0	0	0	0	0	0	0.19%	0.00%
		60074	4.625	12.292	0	0	0	0	0	2,283	0	0	0	0	2,283	0	0	0	0	0	0	0	0	0	0	0	0.23%	0.00%
		60076	12.292	32.140	0	0	0	0	0	2,283	0	0	0	0	2,283	0	0	0	0	0	0	0	0	0	0	0	0.31%	0.00%
-	Red Rover Road	GRC	0.000	3.390	0	0	0	0	0	12,952	0	0	0	0	12,952	0	0	0	0	0	0	0	0	0	0	0	-	-
-	Don Young Drive	GRC	0.000	2.280	0	0	0	0	0	12,952	0	0	0	0	12,952	0	0	0	0	0	0	0	0	0	0	0	-	-
46A	Dawson Highway (Gladstone - Biloela)	60061	0.000	1.498	554	0	1,496	355	0	0	81	412	0	0	2,897	168	0	454	108	0	3,694	22	1,357	0	0	5,803	0.51%	0.69%
		61083	1.498	2.238	554	0	1,496	355	0	0	81	412	0	0	2,897	168	0	454	108	0	3,694	22	1,357	0	0	5,803	0.30%	0.45%
		61000	2.238	3.130	554	0	1,496	355	0	0	81	412	0	0	2,897	168	0	454	108	0	3,694	22	1,357	0	0	5,803	0.25%	0.36%
		60063	3.130	4.391	554	0	1,496	355	0	0	81	412	0	0	2,897	168	0	454	108	0	3,694	22	1,357	0	0	5,803	0.14%	0.19%
		60064	4.391	5.179	554	0	1,496	355	0	0	81	412	0	0	2,897	168	0	454	108	0	3,694	22	1,357	0	0	5,803	0.13%	0.29%
		60062	5.179	7.129	554	0	1,496	355	0	12,952	81	412	0	0	15,849	168	0	454	108	0	3,694	22	1,357	0	0	5,803	2.97%	0.75%
			7.129	10.296	554	0	1,496	355	0	12,952	81	412	0	0	15,849	168	0	454	108	0	3,694	22	1,357	0	0	5,803	2.97%	0.75%
		60065	10.296	19.050	554	0	1,496	355	0	12,952	81	412	0	0	15,849	168	0	454	108	0	3,694	22	1,357	0	0	5,803	2.81%	0.76%
		60066	19.050	21.650	554	0	1,496	355	0	9,978	81	412	0	0	12,875	168	0	454	108	0	3,694	22	1,357	0	0	5,803	0.73%	0.06%
		60128	21.650	25.640	554	0	1,496	355	0	9,978	81	412	0	0	12,875	168	0	454	108	0	3,694	22	1,357	0	0	5,803	2.54%	0.20%
		60005	25.640	46.518	554	0	1,496	355	0	9,978	81	412	0	0	12,875	168	0	454	108	0	3,694	22	1,357	0	0	5,803	2.39%	1.53%
			46.518	101.008	554	0	1,496	355	0	15,235	81	412	0	0	18,131	168	0	454	108	0	3,694	22	1,357	0	0	5,803	3.37%	1.53%
		60067	101.008	113.728	554	0	1,496	355	0	9,978	81	412	0	0	12,875	168	0	454	108	0	3,694	22	1,357	0	0	5,803	4.49%	1.69%
		61084	113.728	116.836	554	0	1,496	355	0	9,978	81	412	0	0	12,875	168	0	454	108	0	3,694	22	1,357	0	0	5,803	3.20%	1.69%
		61085	116.836	119.836	554	0	1,496	355	0	9,978	81	412	0	0	12,875	168	0	454	108	0	3,694	22	1,357	0	0	5,803	1.53%	0.88%
-	Mt Alma Road	GRC	0.000	16.970	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	0	0	0	0	0	0	-	-
-	Calliope Station Road	GRC	0.000	2.600	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	0	0	0	0	0	0	-	-
10E	Bruce Highway (Benaraby - Rockhampton)	60006	11.445	35.812	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	2,283	0	0	0	0	2,283	0.36%	0.18%
			35.812	45.420	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	2,283	0	0	0	0	2,283	0.36%	0.18%
		60023	45.420	85.308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%	0.00%
		61551	85.308	86.183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%	0.00%
			86.183	107.400	0	609	414	24	0	0	0	0	0	0	1,047	0	162	1,706	78	0	0	0	0	0	0	1,946	0.05%	0.09%
			107.400	108.938	0	0	119	24	0	0	0	0	0	0	143	0	0	599	78	0	0	0	0	0	0	677	0.01%	0.03%
		60130	108.938	114.388	0	0	119	24	0	0	0	0	0	0	143	0	0	599	78	0	0	0	0	0	0	677	0.01%	0.04%
		60024	114.388	116.961	0	0	119	24	0	0	0	0	0	0	143	0	0	599	78	0	0	0	0	0	0	677	0.01%	0.04%
-	South Ulam Road	RRC	0.000	16.773	0	609	1,706	78	0	0	0	0	0	0	2,393	0	162	414	24	0	0	0	0	0	0	600	10.74%	2.52%
46B	Dawson Highway (Biloela - Banana)	60068	0.000	0.650	554	0	1,751	355	6,129	9,978	81	412	0	0	19,258	168	0	531	108	1,858	3,694	22	1,357	0	0	7,739	4.46%	0.91%
		61883	0.650	1.366	554	0	1,751	355	6,129	9,978	81	412	0	0	19,258	168	0	531	108	1,858	3,694	22	1,357	0	0	7,739	4.78%	1.03%
26A	Leichhardt Highway (Westwood - Taroom)	60001	0.000	0.115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%	0.00%
			0.115	25.680	0	37,386	31,722	3,370	14,883	0	0	0	0	0	87,361	0	9,970	8,459	899	3,969	0	0	0	0	0	23,296	32.08%	8.42%
41E	Burnett Highway (Biloela - Mt Morgan)	61081	0.000	27.290	554	0	1,751	355	6,129	9,978	81	412	26,343	1,335	46,936	168	0	531	108	1,858	3,694	22	1,357	7,988	405	16,132	9.93%	5.05%
			27.290	35.401	554	0	1,751	355	6,129	9,978	81	412	26,343	1,335	46,936	168	0	531	108	1,858	3,694	22	1,357	7,988	405	16,132	9.93%	5.05%
		60055	35.401	56.310	554	0	1,751	355	6,129	9,978	81	412	26,343	1,335	46,936	168	0	531	108	1,858	3,694	22	1,357	7,988	405	16,132	12.49%	3.77%
			56.310	71.730	0	9,970	8,459	899	3,969	0	0	0	0	0	23,296	0	37,386	31,722	3,370	14,883	0	0	0	0	0	87,361	6.20%	20.43%
-	Callide Mine Haul Road Access	BSC	0.000	0.400	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	0	0	0	0	0	0	-	-
-	Argoon-Kilburnie Road	BSC	0.000	12.940	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	0	0	0	0	0	0	-	-
-	Jambin-Dakenba Road	BSC	0.000	9.400	0	0	0	0	0	5,257	0	0	0	0	5,257	0	0	0	0	0	0	0	0	0	0	0	-	-
-	McDonalds Road	BSC	0.000	5.720	554	37,386	31,722	3,725	21,012	15,235	81	412	26,343	1,335	137,803	168	9,970	8,459	1,006	5,827	3,694	22	1,357	7,988	405	38,897	2498.45%	705.23%
-	Playfields Road	BSC	0.000	5.080	554	37,386	31,722	3,725	21,012	15,235	81	412	26,343	1,335	137,803	168	9,970	8,459	1,006	5,827	3,694	22	1,357	7,988	405	38,897	2498.45%	705.23%
			5.080	24.420	554	37,386	31,722	3,725	21,012	15,235	81	412	26,343	1,335	137,803	168	9,970	8,459	1,006	5,827	3,694	22	1,357	7,988	405	38,897	2498.45%	705.23%

Appendix K – TIA RPEQ Certification and Authorisation

Certification of Traffic Impact Assessment Report

Registered Professional Engineer Queensland

for

Project Title:	Mount Hopeful Wind Farm

As a professional engineer registered by the Board of Professional Engineers of Queensland pursuant to the *Professional Engineers Act 2002* as competent in my areas of nominated expertise, I understand and recognise:

- the significant role of engineering as a profession, and that
- the community has a legitimate expectation that my certification affixed to this engineering work can be trusted, and that
- I am responsible for ensuring its preparation has satisfied all necessary standards, conduct and contemporary practice.

As the responsible RPEQ, I certify:

i) I am satisfied that all submitted components comprising this traffic impact assessment, listed in the following table, have been completed in accordance with the *Guide to Traffic Impact Assessment* published by the Queensland Department of Transport and Main Roads and using sound engineering principles, and

ii) where specialised areas of work have not been under my direct supervision, I have reviewed the outcomes of the work and consider the work and its outcomes as suitable for the purposes of this traffic impact assessment, and that

iii) the outcomes of this traffic impact assessment are a true reflection of results of assessment, and that

iv) I believe the strategies recommended for mitigating impacts by this traffic impact assessment,

v) embrace contemporary practice initiatives and will deliver the desired outcomes.

Name:	Andrew Barrie	RPEQ No:	12801
RPEQ Competencies:	Civil	Date:	09 May 2023
Signature:			
Postal Address:	PO Box 9864, Frenchville QLD 4701		
Email:	andrew.barrie@accesstraffic.com.au		

Traffic impact assessment components to which this certification applies	✓
1. Introduction	
Background	✓
Scope and study area	✓
Pre-lodgement meeting notes	✓
2. Existing Conditions	
Land use and zoning	✓
Adjacent land uses / approvals	✓
Surrounding road network details	✓
Traffic volumes	✓
Intersection and network performance	✓
Road safety issues	✓
Site access	N/A
Public transport (if applicable)	N/A
Active transport (if applicable)	N/A
Parking (if applicable)	N/A
Pavement (if applicable)	✓
Transport infrastructure (if applicable)	✓
3. Proposed Development Details	
Development site plan	✓
Operational details (including year of opening of each stage and any relevant catchment / market analysis)	✓
Proposed access and parking	✓
4. Development Traffic	
Traffic generation (by development stage if relevant and considering light and heavy vehicle trips)	✓
Trip distribution	✓
Development traffic volumes on the network	✓
5. Impact Assessment and Mitigation	
With and without development traffic volumes	✓
Construction traffic impact assessment and mitigation (if applicable)	✓
Road safety impact assessment and mitigation	✓
Access and frontage impact assessment and mitigation	✓
Intersection delay impact assessment and mitigation	✓
Road link capacity assessment and mitigation	✓
Pavement impact assessment and mitigation	✓
Transport infrastructure impact assessment and mitigation	✓
Other impacts assessment relevant to the specific development type / location (if applicable)	N/A
6. Conclusions and Recommendations	
Summary of impacts and mitigation measures proposed	✓
Certification statement and authorisation	✓

APPENDIX J

Landscape and Visual Technical Note

Mount Hopeful Wind Farm – Landscape and Visual Impact Assessment

Technical Memorandum

Item	Description
Reference Number	Technical Memorandum 01: Addendum to Mount Hopeful LVIA
Date	23-02-2023
Project	Mount Hopeful Wind Farm
Project No	Lat Studios reference: 19067.01/LS000224 Client reference: 7053
No of pages	4

To:	Name	Company	Address
		Umwelt (Australia) Pty Ltd	Level 7, 500 Queen Street Brisbane, QLD 4000

1. TECHNICAL MEMORANDUM ISSUED AS AN ADDENDUM TO MOUNT HOPEFUL LANDSCAPE AND VISUAL IMPACT ASSESSMENT

LatStudios (T/A Lat27) prepared a Landscape and Visual Impact Assessment (the LVIA) for the proposed Mount Hopeful Wind Farm on behalf of Umwelt and Neoen Australia Pty Ltd (the Proponent). The Site is located within the Rockhampton Regional Council and the Banana Shire Council Local Government Areas. The final revision of the LVIA (V3) was issued on 28 June 2021.

We understand that Neoen is now considering an alternative project development layout (the Project) with a reduced number of wind turbines, as indicated in the Project layout plan *DESIGN_Umwelt_DesignLayout_230123__v1.kmz* which LatStudios received from Umwelt on 23 January 2023. This technical memorandum has been prepared in response to this revised Project as an addendum to our LVIA (V3) and compares the likely impact of the Project now proposed to that which was considered in the previous LVIA reporting.

2. REVISED PROJECT

It is understood that the Project is now proposed to include 63 wind turbines, which is a significant reduction in comparison with the previous Project. Further to this, it is understood that the proposed wind turbine specifications, such as hub height, blade tip height and rotor diameter is consistent with that of the specifications assessed in the LVIA.

2.1. EFFECT OF PROPOSED WIND TURBINE LOCATIONS

The specific locations of the turbines proposed have been revised, however they are generally located in areas where turbines were located in the previous Project layout, typically extending along the Ulam and Dee ranges, which align to the eastern Site boundary. There are areas within the Site where a significant reduction in the number of turbines is now proposed, particularly in the western extent of the site.

Landscape impact

Overall, due to the significant reduction in the number of turbines, coupled with the proposed spatial distribution of remaining turbines, it is anticipated that the revised turbine layout of the Project would result in an impact on landscape character less than or equal to that identified in the LVIA (V3).

Visual impact

While we have not undertaken a detailed assessment of the visual impact of the revised turbine layout on the individual viewpoints considered in the LVIA, it is anticipated that, due to the reduced number of turbines, the overall visual impact of the Project would be less than or equal to that identified in the LVIA. It is noted that the viewpoints that were previously assessed as likely to be significantly impacted by the project (Viewpoint 3 and Viewpoint 4), would likely remain so due to the continued proposal to locate turbines along the Ulam and Dee ranges within the revised Project turbine layout.

2.2. ANCILLARY PROJECT INFRASTRUCTURE

With regards to ancillary Project infrastructure, such as overhead transmission lines, substations, laydown areas and compounds, it is noted that the revised Project development layout includes a number of changes. These include the following noted in Table 1 below.

Table 1 Description of Ancillary Infrastructure Changes

Item	Description
A	An additional substation, concrete batching plant and laydown area is proposed to be located in the centre of the Site, approximately 1 km west of wind turbine WTG31.
B	An additional 275 kV overhead transmission alignment that extends approximately 6.7 km north from the substation noted above, connecting it to the substation proposed as part of the previous Project.
C	The location of the meteorological masts has been revised but similar to the previous Project the revised mast locations are distributed along the eastern Site boundary. The number of proposed meteorological masts remains at 10.
D	Minor location changes to the location of the construction camp and laydown areas throughout the Site.

It is noted that proposed connection for the Mount Hopeful Wind Farm to the existing 275 kV Bouldercombe to Calliope River transmission line is proposed in the same location.

Of the above changes noted, it is understood that Items A and B represent the greatest departure from the previous Project. Due to the proposed location of Item A within the centre of the Site, it is unlikely that these components would result in a visual impact on previously identified viewpoints that is any greater than that previously reported, due to the location being at a lower elevation than the surrounding topography.

Item B (275 kV overhead transmission line) would potentially be more visible, particularly from locations on the eastern side of the Site such as Viewpoint 4. However, given the reduction of turbines throughout the Site, coupled with the small scale of Item B in comparison with that of the turbines, it is unlikely that the visual impact significance of this infrastructure would exceed that previously reported.

It is anticipated that items C and D would have an overall visual impact less than or equal to that of the previous Project layout.

It is noted that items A (substation) and B (275 kV overhead transmission line) are both located within Landscape Character Area A1 (LCA A1) as identified within the LVIA. As LCA A1 covers the majority of the Site and is the location for the majority of project infrastructure it was identified as being significantly impacted by the Project when assessed in the LVIA. Due to the removal of a significant number of turbines within LCA A1 within the revised Project layout, it is anticipated that the addition of the items A and B as well as the other changes noted i.e. Items C (meteorological mast) and D (construction camp and laydown area) would have an impact less than or equal to that of the previous Project layout.

3. PROPOSED MITIGATION AND CUMULATIVE IMPACT

Due to the reduced number of wind turbines, it is anticipated that the cumulative impacts of the Project, when considered with the other proposed projects identified within the LVIA, is likely to be equal to or less than those impacts identified within the LVIA. It is also noted that the mitigation measures for the Project identified within the LVIA would remain applicable to the revised Project.

4. CONCLUSION

Based on a high-level review of the revised Project layout in comparison with that assessed within the LVIA, it is understood that:

- The number of turbines proposed in the revised Project is significantly reduced and the distribution is generally in accordance with the previous layout with the exception of areas to the west of the Site that are no longer proposed to include turbines.
- The ancillary project infrastructure includes some changes, the more notable being an additional substation, concrete batching area and laydown area in the centre of the Site as well as an additional 275 kV transmission alignment.

Following this comparative review, it is concluded that the impact of the Project on the baseline landscape character and visual context identified in the LVIA, would be of a lower or equal significance than that previously reported in the LVIA. Therefore, the findings of the original landscape and visual impact assessment (V3) remain valid for the purposes of development assessment against PO9 of State Code 23 (February, 2023) by the State Assessment and Referral Agency (SARA).

APPENDIX K

Noise Impact Assessment

Mount Hopeful Wind Farm

Noise Impact Assessment

S6515C7

March 2023

sonus.

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sonus.

Document Title	: Mount Hopeful Wind Farm Noise Impact Assessment
Document Reference	: S6516C7
Date	: March 2023
Prepared by	:

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

EXECUTIVE SUMMARY

A previous assessment was made of the noise from the Mount Hopeful Wind Farm. The 97 turbine wind farm and associated ancillary infrastructure was approved on 17 June 2022, subject to a number of conditions. The conditions include the requirement to prepare an *updated Noise Impact Assessment* to *reflect the final wind turbine model and ancillary equipment selection and siting.*

As a result of further design, the project now consists of wind turbines with a maximum hub height of 170m and two substations with a single 240 MVA transformer at each. This updated Noise Impact Assessment considers the noise from operation of the proposed layout with Goldwind 165 6.0MW turbines and compares predictions against the relevant noise criteria established under the Queensland Government Department of Infrastructure, Government and Planning *State code 23: Wind farm development*, Planning Guideline (February 2022) (**State Code 23**) and the conditions of the existing development approval.

The predicted noise levels from the wind turbines have been compared with noise assessment criteria established in accordance with the conditions of approval and the background noise monitoring. Due to the separation distances to sensitive land uses, the predicted noise levels will satisfy the assessment criteria established under PO11 and PO12 of State Code 23.

The noise from the substations has also been predicted. The predicted noise levels are significantly less than the relevant wind farm criteria and therefore the ancillary wind farm infrastructure will not adversely impact on the existing acoustic amenity at the sensitive land uses.

GLOSSARY AND ABBREVIATIONS

Term	Definition
A weighting	Frequency adjustment representing the response of the human ear.
Ambient noise level	Noise level in the absence of the noise from the wind farm.
Background noise level	The ambient noise level represented by the L_{A90} in the absence of intermittent noise such as vehicles and short term wind gusts.
dB	Linear (unweighted) sound pressure or power level in decibels.
dB(A)	A weighted noise or sound pressure or power level in decibels.
Host Lot	A parcel of land (lot(s)) that accommodates any part of a wind farm development.
L_{A90}	The A weighted sound pressure level exceeded for 90% of the measurement period.
$L_{A90,10min}$	The L_{A90} sound pressure level measured over a 10 minute period.
L_{Aeq}	The A weighted equivalent continuous noise level – the energy-average of noise levels occurring over a measurement period.
May 2013 UK IOA Good Practice Guide	*UK Institute of Acoustics IOA - A Good Practice Guide To The Application Of Etsu-R-97 For The Assessment And Rating Of Wind Turbine Noise*
Non - Host Lot	Premises in proximity to the wind farm that are not Host Lots.
Sensitive land uses	A range of different uses as defined by the Planning Regulations 2017, typically dwellings. Both Non-Host Lots and Host Lots are considered sensitive land uses, albeit subject to different assessment criteria under State Code 23.
State Code 23	Queensland Government Department of Infrastructure, Government and Planning *State code 23: Wind farm development*, Planning Guideline (February 2022).
The Wind Farm	The Mount Hopeful Wind Farm project, including wind turbine generators and ancillary infrastructure
WTG	Wind Turbine Generator

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TABLE OF CONTENTS

1 INTRODUCTION

An updated noise impact assessment has been undertaken for the proposed Mount Hopeful Wind Farm (the **wind farm**), in accordance with the Queensland Government Department of Infrastructure, Government and Planning *State code 23: Wind farm development*, Planning Guideline (February 2022) (**State Code 23**) and the Conditions of Approval (SARA reference: 2109-24892 SDA).

A noise impact assessment of the proposed wind farm has previously been conducted (Sonus report S6516C4) and the 97 turbine wind farm and associated ancillary infrastructure was approved on 17 June 2022, subject to Conditions of Approval. This assessment has been prepared to facilitate an application for a change to the existing development approval for the wind farm to reflect these design changes.

As a result of further design, the project now consists of up to 63 wind turbines with a maximum hub height of 170m, and two substations with a single 240 MVA transformer at each. It is noted using the highest hub height of 170m is a conservative assessment because lower hub heights would result in marginally less onerous criteria. Several turbine models have been considered and the Goldwind 165 6.0MW has been used for this assessment as a conservative approach. That is, the turbine provides the highest predicted noise level of the turbines considered. The updated Noise Impact Assessment considers the noise from operation of the proposed equipment selections and layout and compares predictions against the relevant noise criteria of the approval. The proposed wind farm layout, ancillary infrastructure and sensitive land uses in the vicinity are provided in Figure 1.

Noise levels at sensitive land uses in the vicinity of the proposed wind farm have been predicted using the noise propagation model and the inputs recommended by the *May 2013 UK IOA Good Practice Guide* and State Code 23.

The co-ordinates of the WTGs and the relevant sensitive land uses are provided in Appendices A and B, respectively.

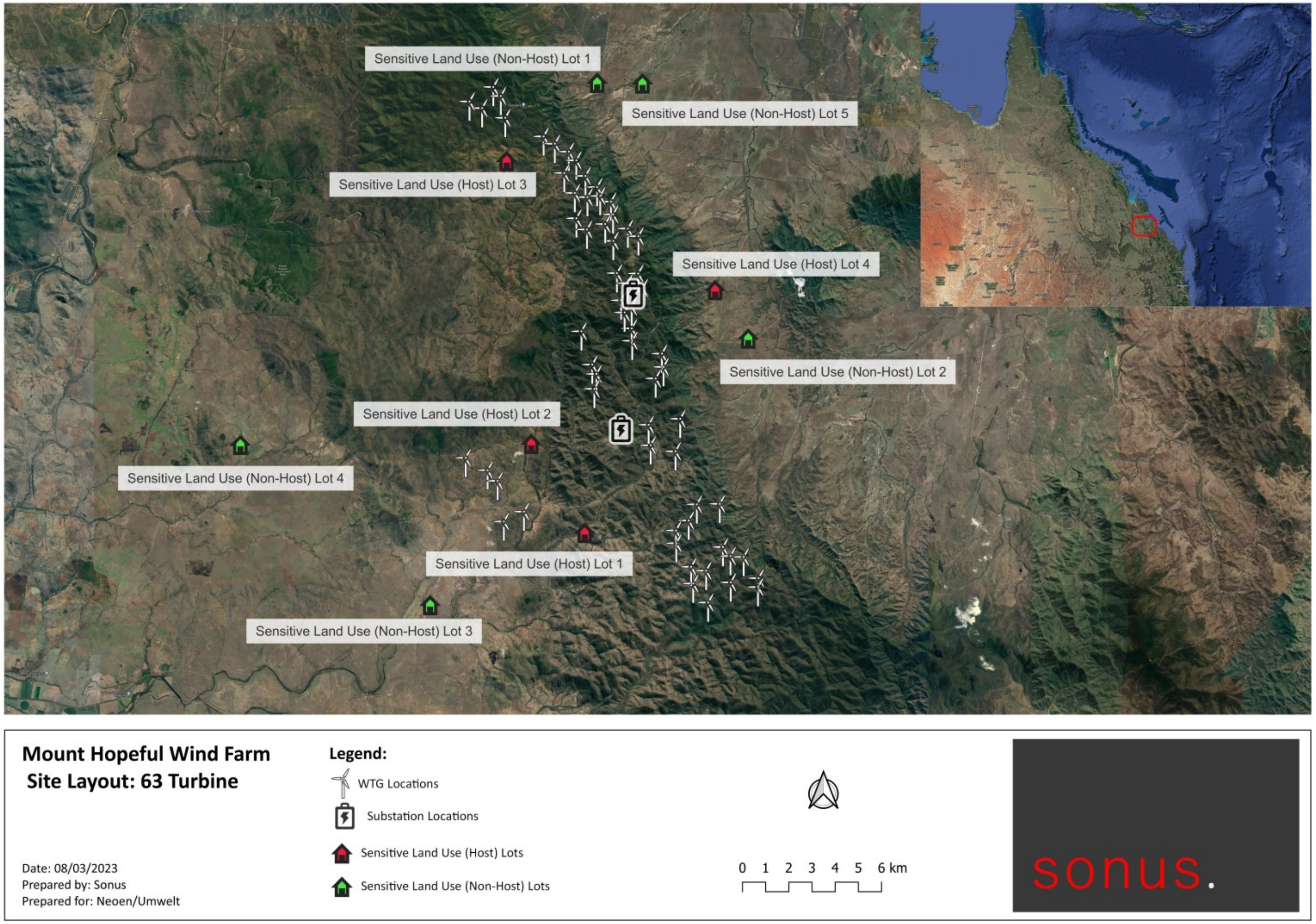


Figure 1: Wind Farm layout and sensitive land uses

2 CONDITIONS OF APPROVAL

Condition 22 of the existing project approval provides noise criteria for existing or approved sensitive land uses on host lots and non-host lots to ensure the health and safety of individuals and the community. The full Condition is provided below:

(a) *Prepare an updated Noise Impact Assessment (NIA).*
(b) *The NIA required under part (a) of this condition must:*
  i) *be prepared by a suitably qualified acoustic consultant*
  ii) *reflect the final wind turbine model and ancillary equipment selection and siting (as a result of detailed design) and address the following criteria for wind speed from cut-in to rated power of the wind turbine and each integer wind speed in between referenced to hub height, demonstrate compliance with the following criteria (whichever is the greater, for wind speed from cut-in to rated power of the wind turbine and each integer wind speed in between referenced to hub height)*
   - *for all existing noise affected sensitive land uses on host lots (as at the date of this approval):*
     - *an outdoor (free-field) night-time (10pm to 6am) A-weighted acoustic level of:*
       - *45dB(A), or*
       - *the background noise (LA90) by more than 5dB(A)*
   - *at all existing noise affected sensitive land uses on non-host lots (as at the date of this approval):*
     - *an outdoor (free-field) night-time (10pm to 6am) A-weighted acoustic level of:*
       - *35dB(A), or*
       - *the background noise (LA90) by more than 5dB(A)*
     - *An outdoor (free-field) day-time (6am to 10pm) A-weighted acoustic level of:*
       - *37dB(A), or*
       - *the background noise (LA90) by more than 5dB(A).*
     - *Alternatively, the acoustic level agreed between the applicant/operator and the non-host lot owner/s via a formal deed of release and not exceeding an outdoor (free-field) night-time (10pm to 6am) A-weighted acoustic level of:*
       - *45dB(A), or*
       - *the background noise (LA90) by more than 5dB(A)*

(c) *Submit the NIA required by parts (a) and (b) of this condition to the Department of State Development, Infrastructure, Local Government and Planning (windfarms@dsdilgp.qld.gov.au).*

Note: A suitably qualified acoustic consultant with suitable acoustic experience is a person who is: 1) eligible for membership of the Australian Acoustical Society, or 2) whose firm is a member of the Association of Australasian Acoustical Consultants, or 3) is an RPEQ with suitable acoustic experience.

3 ENVIRONMENTAL NOISE CRITERIA

In summary, Condition 22 requires that:

- For host lots, noise from the wind farm must not exceed 45 dB(A) or the background noise level plus 5 dB(A), whichever is greater, during the night period (10:00pm to 6:00am).
- For non-host lots, noise from the wind farm must not exceed 35 dB(A) or the background noise level plus 5 dB(A), whichever is greater, during the night period; and 37 dB(A) or the background noise level plus 5 dB(A), whichever is greater, during the day period (6:00am to 10:00pm). Alternatively, a higher level, as setout in a formal deed of release, provided it does not exceed the host lot levels.

The requirements are consistent with the State Code 23, which governs wind farm developments in Queensland.

As described in detail in the previous noise impact assessment, background noise monitoring was conducted at Host Lot 5 (shown in Figure **1**) between 4 February and 17 March 2021. Photographs of the noise monitoring equipment are provided in Appendix C.

The background noise and wind speed data (referenced to the proposed hub height of 170m) have been analysed in accordance with the methodology provided in the State Code 23. The correlations for the data analysis are provided in Appendix D.

Table 1 summarises the background noise levels measured during the daytime and night-time periods for each integer hub height wind speed between 3m/s and 12m/s at Host Lot 5. The resultant criteria that apply to all host and non-host lots is also shown.

Table 1: Background Noise Levels ($L_{90,10min}$).

Based on Measurements at Host Lot 5		**Background Noise Level (dB(A)) at 170m Hub Height Wind Speed (m/s)**									
		3	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Day (6am to 10pm)	Background	32	32	33	34	35	36	37	37	37	35
	Non-Host Lot Criteria	37	37	38	39	40	41	42	42	42	40
	Host Lot Criteria	45	45	45	45	45	45	45	45	45	45
Night (10pm to 6am)	Background	38	37	36	36	36	36	37	37	38	38
	Non-Host Lot Criteria	43	42	41	41	41	41	42	42	43	43
	Host Lot Criteria	45	45	45	45	45	45	45	45	45	45

4 NOISE ASSESSMENT

4.1 Noise Propagation Model

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

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

The noise model uses topographical ground contours but limits the barrier attenuation as noted above.

4.2 Noise Sources

4.2.1 WTGs

The WTG used for this modelling is the Goldwind 165 6.0MW with a hub height of 170m. This WTG model has the highest noise emission among the options being considered for the project.

One-third octave band sound power levels for the proposed wind turbine generator have been provided by *Goldwind* for each integer hub height wind speed from 6m/s to 15m/s. The sound power levels are based on measurement results, summarised in WIND-consult GmbH Reuterstr.9 18211 Bargeshagen Extract 147SE622-01-EX01 of test report 147SA622-01 *Determination of noise emission of a wind turbine (WT) of the type GW165-6.*0.

In accordance with the IOA Good Practice Guide, an allowance of 1.645 times the overall measurement uncertainty for each integer wind speed has been added to the prediction results. Table 2 summarises the specified sound power levels and the measurement uncertainty for each integer wind speed, which have been used for the noise prediction.

Table 2: Goldwind sound power level data

1/3 Octave Band Centre Frequency	Hub height wind speed									
	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s	15 m/s
10 Hz	39.2	43.1	45.3	48.9	47.7	46.7	47.3	46.8	47.1	47.0
12.5 Hz	45.8	49.9	52.0	53.6	53.9	53.5	53.5	52.6	52.4	52.0
16 Hz	50.9	55.0	57.1	58.8	59.4	58.7	58.2	58.3	56.7	56.0
20 Hz	56.7	60.8	63.1	65.8	65.2	65.2	64.7	64.7	63.6	61.6
25 Hz	61.8	66.2	68.8	70.9	70.5	70.1	69.3	69.1	68.0	66.9
31.5 Hz	66.2	70.9	73.5	75.8	74.5	75.1	74.0	73.7	72.8	71.8
40 Hz	69.9	73.8	76.2	78.3	78.0	78.2	77.1	77.2	76.1	75.4
50 Hz	73.2	77.0	79.1	81.3	81.2	81.1	79.8	79.8	78.7	77.7
63 Hz	77.1	80.3	82.7	84.9	84.7	84.4	82.9	83.1	81.8	81.3
80 Hz	81.5	83.7	85.7	88.0	87.2	87.2	85.8	86.1	85.3	84.3
100 Hz	84.0	86.6	88.4	90.2	89.9	90.0	89.0	89.1	88.6	88.2
125 Hz	86.3	89.1	91.0	91.8	92.6	92.6	91.4	91.4	90.8	90.5
160 Hz	88.2	90.7	92.8	94.6	94.9	94.6	93.8	93.7	93.7	93.4
200 Hz	89.9	92.9	95.3	96.8	97.6	97.6	96.5	96.2	96.1	95.9
250 Hz	91.1	94.5	97.1	98.8	99.5	99.4	98.2	97.8	97.5	97.2
315 Hz	90.9	95.4	98.7	100.6	101.2	101.3	100	99.7	99.3	99.2
400 Hz	90.0	95.0	98.6	100.8	101.1	101.3	100.3	100.1	99.9	99.8
500 Hz	87.6	93.1	97.1	99.3	100.9	101.1	100.9	100.9	100.8	100.7
630 Hz	85.1	90.7	95.0	97.5	100.3	100.5	100.7	100.9	100.9	100.9
800 Hz	82.7	88.1	92.4	94.8	98.7	99.0	99.6	100.1	100.2	100.1
1 kHz	80.2	85.5	89.7	92.2	96.8	97.2	98.1	98.7	98.8	98.9
1.25 kHz	78.5	83.4	87.5	90.0	94.2	94.7	95.8	96.5	96.6	96.6
1.6 kHz	74.7	79.2	83.2	86.5	91.6	92.0	93.3	94.2	94.3	94.3
2 kHz	74.5	77.8	81.7	85.1	87.8	88.3	89.7	90.9	90.8	90.7
2.5 kHz	74.1	76.6	80.0	83.6	83.8	84.0	85.9	87.7	86.8	86.9
3.15 kHz	73.6	75.7	78.2	81.7	81.0	81.4	82.4	84.2	83.7	84.1
4 kHz	72.0	73.6	75.6	78.4	78.0	78.4	79.3	81.0	80.5	80.9
5 kHz	70.9	72.1	73.7	75.9	75.7	76.1	76.9	78.6	78.1	78.5
6.3 kHz	71.7	72.6	73.9	75.7	75.5	75.9	76.6	78.1	77.6	78.0
8 kHz	73.2	73.9	74.9	76.3	76.3	76.6	77.2	78.6	78.1	78.5
10 kHz	72.7	73.2	73.9	75.1	75	75.2	75.8	77.0	76.6	76.9
Total	98.7	102.8	106.0	108.0	109.5	109.6	109.3	109.4	109.3	109.2
Measurement Uncertainty	0.75	0.72	0.71	0.68	0.71	0.73	0.74	0.75	0.68	0.76

4.2.2 Ancillary Infrastructure

The proposed wind farm also includes two substation locations, with approximate coordinates detailed in Table 3.

Table 3: Substation coordinates

Substations	Approximate Coordinates (GDA 94 MGA Zone 56)	
	Easting	Easting
Substation 1	254054	7363875
Substation 2	253625	7358075

The main noise generating equipment associated with the substations are the transformers.

Each substation is proposed to have a transformer which is rated up to 240 MVA. Noise levels from the substations have been modelled based on a 240 MVA rated transformer with a sound power level of 99 dB(A), derived for from the Australian/New Zealand Standard *AS/NZS 60076.10:2009 Power transformers – Part 10: Determination of sound levels.*

4.3 Predicted Noise Levels

The noise from the wind farm has been predicted based on the methodology described in Section 4.

4.3.1 WTGs

As shown in Table 2, the highest noise levels from the proposed WTG occurs at an operational wind speed of 11m/s (lower noise levels predicted for higher wind speeds). The highest noise levels (wind speed of 11m/s) are shown in Figure 2 along with the sensitive land uses in the vicinity of the wind farm.

The predicted wind farm noise levels at each sensitive land use for each WTG hub height integer wind speed up to 11m/s are tabulated in Table 4.

Table 4: Predicted wind farm noise levels (L_{eq}) at integer wind speeds from 6m/s to 11m/s

Location ID	**170m Hub Height Wind Speed (m/s)**					
	6	**7**	**8**	**9**	**10**	**11**
Sensitive Land Use (Host) Lots						
Host Lot 1	25	28	31	33	33	34
Host Lot 2	27	30	33	35	36	36
Host Lot 3	31	35	38	40	41	41
Host Lot 4	26	29	32	34	35	35
Sensitive Land Use (Non-Host) Lots						
Non-Host Lot 1	26	29	32	34	35	35
Non-Host Lot 2	25	28	31	33	33	33
Non-Host Lot 3	18	22	24	26	27	27
Non-Host Lot 4	2	5	8	10	10	10
Non-Host Lot 5	25	28	31	33	34	34

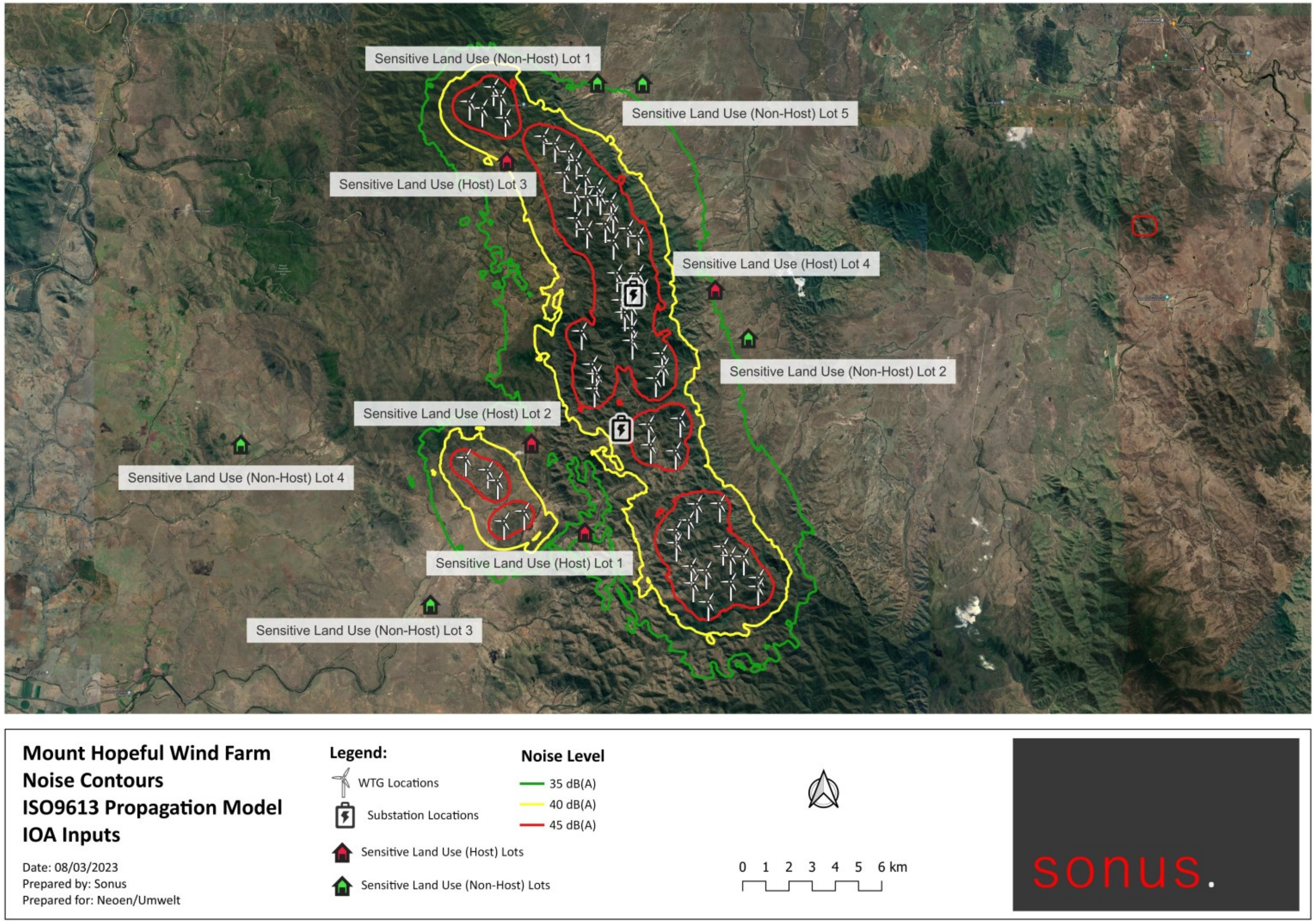


Figure 2: Highest predicted noise levels (L_{eq}) from Goldwind 165 6.0MW turbines

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

- 35 dB(A), or less, at non-host lots (baseline criterion 35 dB(A)); and,
- 41 dB(A), or less, at host lots (baseline criterion 45 dB(A)).

Therefore, the wind farm is predicted to readily satisfy the noise assessment criteria established in accordance with the Conditions of Approval and the State Code 23.

4.3.2 Ancillary Infrastructure

Noise from the substations associated with the wind farm are not required to be assessed in accordance with the State Code 23, however Condition 22 requires the noise to be considered. Therefore, a prediction has been made of noise levels from the substations to the surrounding sensitive land uses.

Given the significant separation distance between the proposed infrastructure and the closest sensitive land uses, the highest noise level is predicted to be much less than 20 dB(A) at all locations.

That is, the noise from the proposed substations will be more than 15 dB(A) below the wind farm assessment criteria. Therefore, the noise from ancillary infrastructure will not adversely impact on the acoustic amenity of the sensitive land uses.

sonus.

5 CONCLUSION

An updated noise impact assessment has been undertaken for the proposed Mount Hopeful Wind Farm (the wind farm), in accordance with the Queensland Government Department of Infrastructure, Government and Planning *State code 23: Wind farm development*, Planning Guideline (February 2022) and the Conditions of Approval (**State Code 23**).

Noise levels at sensitive land uses from the proposed wind farm have been predicted using the noise propagation model and the inputs recommended by the State Code 23.

The noise predictions have been made based on the wind turbine generator (WTG) selection and layout, being 63 of the Goldwind 165 6.0MW turbines. The outcomes of this assessment indicate that the proposed WTG selection complies with the relevant assessment criteria, established under the State Code 23 and the conditions of the existing development approval.

The noise from ancillary infrastructure including substations has also been predicted and will be at levels significantly less than the wind farm assessment criteria. The noise therefore will not result in adverse impacts on the acoustic amenity at the sensitive land uses.

APPENDIX A: COORDINATES OF TURBINES

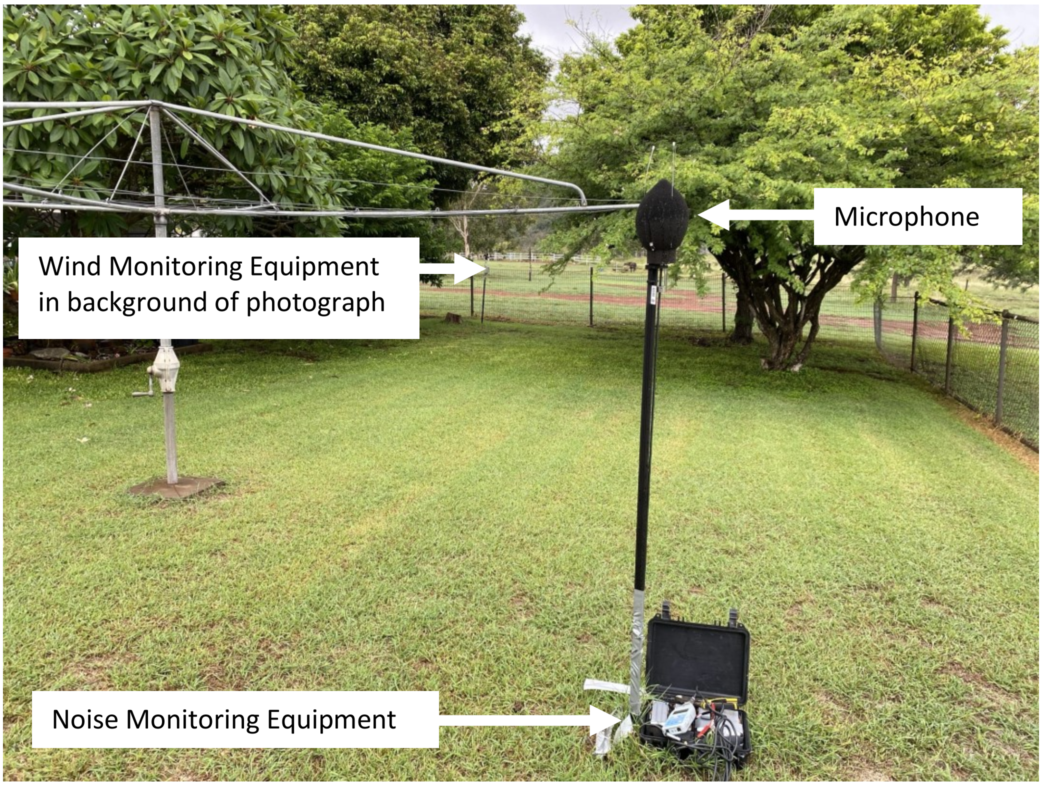
Turbine ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
WTG 01	247250	7371525
WTG 02	248260	7371125
WTG 03	249930	7370355
WTG 04	250420	7370050
WTG 05	251030	7369720
WTG 06	251360	7369350
WTG 07	250850	7368800
WTG 08	251770	7368690
WTG 09	252280	7368220
WTG 10	251870	7367780
WTG 11	252890	7367610
WTG 12	251408	7366866
WTG 13	251875	7366390
WTG 14	252990	7367060
WTG 15	253640	7366460
WTG 16	253020	7365920
WTG 17	254100	7366140
WTG 18	253200	7364540
WTG 19	253660	7364120
WTG 20	254320	7363920
WTG 21	253400	7363380
WTG 22	253880	7362180
WTG 23	253910	7361650
WTG 24	251710	7362020
WTG 25	252200	7360600
WTG 26	252390	7360200
WTG 27	252310	7359560
WTG 28	255200	7361120
WTG 29	255280	7360550
WTG 30	254950	7360050
WTG 31	254680	7358060
WTG 32	256040	7358340

Turbine ID	Coordinates (GDA 94 MGA Zone 56)	
	Easting	Northing
WTG 33	254780	7357180
WTG 34	255860	7356940
WTG 35	246800	7356500
WTG 36	247760	7355990
WTG 37	248200	7355540
WTG 38	249360	7354240
WTG 39	248500	7353800
WTG 40	256820	7354680
WTG 41	257810	7354720
WTG 42	256480	7353980
WTG 43	255940	7353550
WTG 44	255960	7353000
WTG 45	256620	7352000
WTG 46	257270	7351840
WTG 47	256720	7351280
WTG 48	257380	7350480
WTG 49	257980	7352870
WTG 50	258310	7352490
WTG 51	258880	7352460
WTG 52	259540	7351560
WTG 53	259520	7351180
WTG 54	258340	7351360
WTGA01	246700	7371800
WTGA02	247720	7372440
WTGA03	248050	7372060
WTGA04	251320	7367950
WTGA05	252420	7367840
WTGA07	252660	7366640
WTGA08	254120	7364540
WTGA09	253860	7363120
WTGA10	253560	7362860

APPENDIX B: COORDINATES OF SENSITIVE LAND USES

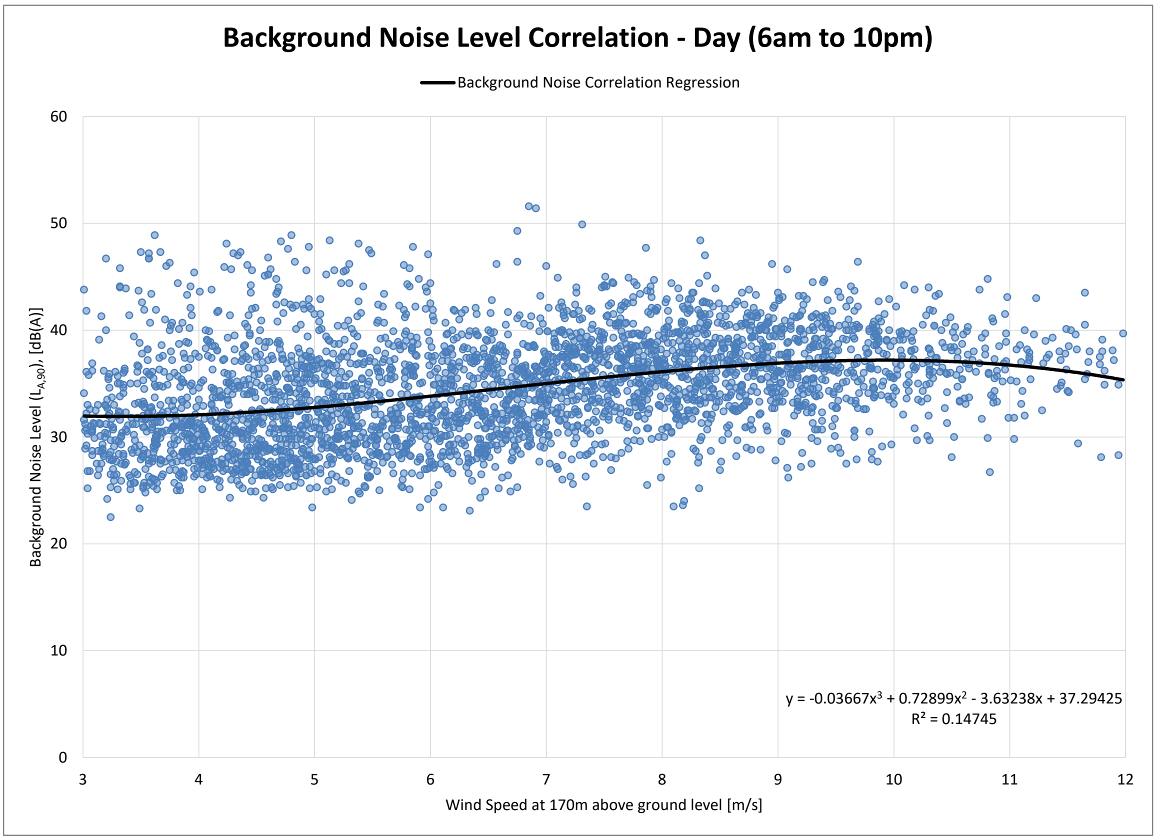
Location ID	Coordinates (GDA 94 MGA Zone 55)	
	Easting	Northing
Sensitive Land Use (Host) Lots		
Host Lot 1	252114	7353621
Host Lot 2	249742	7357399
Host Lot 3	248468	7369516
Host Lot 4	257572	7364134
Sensitive Land Use (Non-host) Lots		
Non-Host Lot 1	252322	7372942
Non-Host Lot 2	259038	7362076
Non-Host Lot 3	245496	7350407
Non-Host Lot 4	237177	7357133
Non-Host Lot 5	254280	7372949

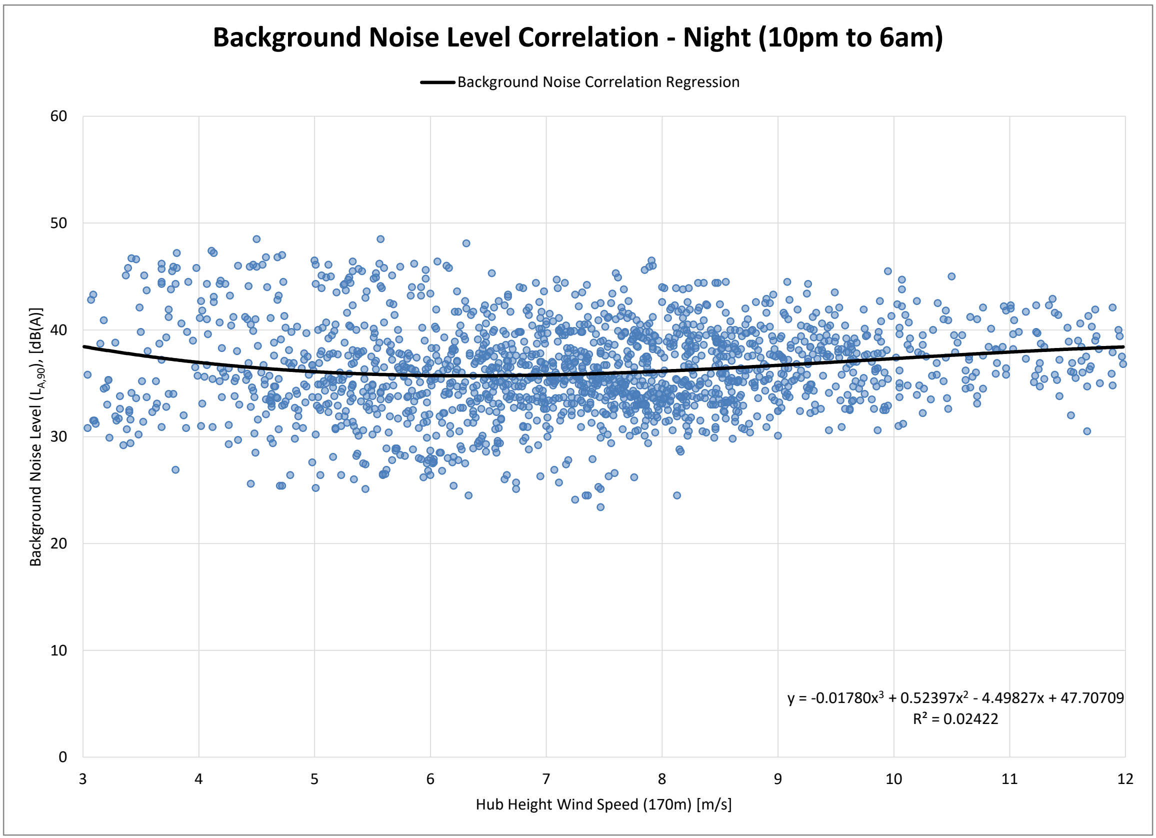
APPENDIX C: PHOTOGRAPH OF THE MONITORING EQUIPMENT AT HOST LOT 5



sonus.

APPENDIX D: NOISE MONITORING RESULTS AND REGRESSION CURVES





APPENDIX L

Bushfire Management Plan

Bushfire management plan

Mount Hopeful Wind Farm | Bajool | Queensland
Prepared for Neoen Australia Power Pty Ltd | 15 March 2023

Land and Environment Consultants Pty Ltd
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Bushfire management plan

Final V1

Report 22120 | Neoen Australia Power Pty Ltd | 15 March 2023

Approved by

Position

Signature

Date 15 March 2023

Document control

Version	Date	Prepared by	Reviewed by
Draft	22 December 2022		
Final	8 March 2023		
Final V1	15 March 2023		

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Table of contents

Contents

Figures

Tables

Appendix

Disclaimer

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a range of conditions. An element of risk, no matter how small always remains, and although AS 3959-2018 is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any building will withstand bushfire attack on every occasion.

It should be noted that upon lodgement of a development proposal, State Government, council and/or the fire service may recommend additional construction requirements.

Although every care has been taken in the preparation of this report, Land and Environment Consultants Pty Ltd accept no responsibility resulting from the use of the information in this report.

Executive Summary

This bushfire management plan (**BMP**) has been prepared for the Mount Hopeful Wind Farm (**the Project**) which is located approximately 45 kilometres (**km**) south of Rockhampton and 65 km west of Gladstone, within the Rockhampton Regional Council and Banana Shire Council local government areas in Central Queensland. It is required for compliance with condition 18a) and b) of the State Assessment and Referral Agency (**SARA**) development permit (**the development permit**) – SARA reference 2109-24892 SDA.

The properties hosting the Project are identified as a bushfire prone area by the Queensland State Planning Policy (**SPP**) *Bushfire prone area map*, as shown in Figures 2.2-2.4. As a result, condition 18a) and b) of the development permit is seeking compliance with the SPP *Bushfire prone area overlay code* (**SPP bushfire prone area overlay code**) and *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire'* (**Bushfire resilient communities**) which was prepared by the Queensland Fire and Emergency Services (**QFES**) to support the implementation of the *Natural Hazards, Risk and Resilience – State Planning Policy State Interest guidance material* (DSDMIP 2019). Although not referred to in condition 18a) and b) of the development permit; compliance with guidelines in *Wind Farms and Bushfire Operations* is also considered relevant to the construction and the operations and maintenance phases of the Project.

The Project involves the development of a wind farm that will deliver approximately 400 megawatts of power to the national grid. It will consist of:

- up to 63 wind turbine generators (**WTGs**) and hardstand areas;
- up to 10 temporary meteorology masts and 10 permanent meteorology masts;
- up to two substations and ancillary electrical infrastructure;
- up to 13 km of high voltage (275 kilovolts) overhead transmission lines;
- operations and maintenance facility which includes maintenance and storage areas containing permanent site offices, workshops, warehouses, mobile offices, lunchroom, amenities and ablutions;
- a variety of temporary infrastructure to facilitate the construction of the Project, including:
  - one construction compound;
  - a temporary worker's accommodation camp to provide for a peak construction workforce of approximately 220 people;
  - three concrete batching plants; and
  - two laydown areas;
- overhead and underground transmission lines and cables;
- up to 175 km of gravel capped roads; and
- two permanent site access points.

The site-specific bushfire hazard assessment confirmed that the Project is within a combination of medium, high and very high potential bushfire intensity areas and the 100 m wide potential impact buffer from these areas.

The SPP bushfire prone area overlay code and Bushfire resilient communities requires above ground infrastructure to be appropriately setback from bushfire and grass fire prone areas. These setbacks are referred to as asset protection zones (**APZs**). APZs were identified for above ground infrastructure based on results of radiant heat exposure assessments and compliance with the radiant heat exposure outcomes of the SPP bushfire prone area overlay code. The recommended width of APZs for the

Project range from 10-45 metres but there is potential for the refinement of the APZs through detailed design and micro-siting of the Project's above ground infrastructure.

Chapter 6 of the BMP provides the bushfire mitigation measures that must be implemented during the construction and the operations and maintenance phases of the Project. These mitigation measures include:

- Design and maintenance specifications for APZs around above ground infrastructure.
- Requirements for vegetation clearing and maintenance under overhead transmission lines.
- Requirements for vegetation clearing around cable pits.
- Design and construction specifications for vehicle access tracks.
- Design specifications for a fire-fighter water supply.
- Requirements for wayfinding signage.
- Requirements for fire danger rating signage.
- Requirements for buildings to comply with the relevant sections of the *National Construction Code–Building Code of Australia* (volume 1) and governing Queensland laws, codes and standards that apply to the building industry.
- Requirements for administrative controls which include:
    - a hot works permit system;
    - provision of fire-extinguishers;
    - information sharing with the QFES and local Rural Fire Brigades;
    - annual bushfire preparedness meetings;
    - project rules and inductions;
    - safety documentation;
    - the monitoring of fire weather conditions and the associated precautions;
    - the planning and implementation of fire-fighting near Powerlink Queensland transmission lines;
    - communication with staff and landowners about bushfire mitigation;
    - emergency response planning;
    - the development of a fire-fighter operations plan poster for the local RFBs;
    - operation of the Project in accordance with the Queensland *Electrical Safety Act 2002* and its regulations and the electrical safety codes of practice by the Electrical Safety Office of Queensland;
    - the storage and handling of hazardous chemicals away from bushfire hazard areas;
    - the shut-down of WTGs during fire-fighting operations; and
    - lighting fires.

This BMP includes a code assessment which demonstrates that with the implementation of the above listed mitigation measures, the Project complies with the SPP bushfire prone area overlay code and Bushfire resilient communities.

1 Introduction

This bushfire management plan (**BMP**) has been prepared for the Mount Hopeful Wind Farm (**the Project**) which is located approximately 45 kilometres (**km**) south of Rockhampton and 65 km west of Gladstone, within the Rockhampton Regional Council and Banana Shire Council local government areas in Central Queensland.

The Project involves 17 properties described as lot 21/RN1345, lot 24/RN34, lots 23 and 25/RN25, lot 30/RN72, lot 21/RN46, lot 2039/RAG4056, lot 1933/RAG4058, lot 2057/RAG4059, lot 15/RN1089, lot 148/DS151, lots 2345 and 2420/DT4077, lot 50/ST40144, lot 33/DT40123, lot 38/DT40131 and lot 100/SP28944 (and local road reserves). These properties have a combined area of approximately 16,758 hectares (**ha**) and are hereafter referred to as the **Study area**.

The disturbance footprint for the Project comprises of 874.5 ha of land within the Study area.

This BMP documents a site-specific bushfire hazard assessment for the disturbance footprint and identifies strategies that will mitigate the potential risk of bushfire hazards for the construction and the operations and maintenance phases of the Project. It includes:

- an introduction (this section) and description of methods and information resources used for the preparation of this BMP;
- description of the Study area and the Project;
- site-specific bushfire hazard assessment;
- identification of bushfire hazards associated with the Study area and the Project;
- radiant heat exposure assessment; and
- a plan for mitigating the potential risk of bushfire hazards.

1.1 Approvals context

On 17 June 2022, the State Assessment and Referral Agency (**SARA**) approved a development permit - material change of use for a wind farm (97 turbines) and associated ancillary infrastructure) and operation works for clearing of native vegetation (**the development permit**) – SARA reference 2109-24892 SDA.

This bushfire management plan has been prepared for compliance with condition 18a) and b) of the development permit which state (sic):

a) Prepare a Bushfire Management Plan (BMP).
b) The BMP required under part (a) of this condition must:
    i. be prepared by a suitably qualified person
    ii. be prepared in consultation with the Queensland Fire and Emergency Services (QFES)
    iii. relate to the operational phase of the wind farm and include:
        - a fire hazard analysis
        - mitigation strategies to achieve the development outcomes in Part E of the State Planning Policy July 2017 – Natural Hazards, Risk and Resilience
        - details of consultation with all host lot owners.

The Study area is identified as a bushfire prone area by the Queensland State Planning Policy (**SPP**) *Bushfire prone area map* (**SPP bushfire prone area map**). As a result, condition 18a) and b) of the development permit is seeking compliance with the SPP *Bushfire prone area overlay code* (**SPP bushfire prone area overlay code**) and *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire'* (QFES 2019) (**Bushfire resilient communities**) which was prepared by the Queensland Fire and Emergency Services

(**QFES**) to support the implementation of the *Natural Hazards, Risk and Resilience – State Planning Policy State Interest guidance material* (DSDMIP 2019) (**SPP guidance material – bushfire**). Although not referred to in condition 18a) and b) of the development permit; compliance with guidelines in *Wind Farms and Bushfire Operations* (AFAC 2018) (**Wind farms and bushfire operations**) is also considered relevant to the construction and the operations and maintenance phases of the Project.

The design of the Project has been amended since the development permit was issued. The site-specific bushfire hazard assessment is based on the amended design but the BMP has been prepared to satisfy condition 18a) and b) of the development permit and demonstrates how compliance with the SPP bushfire prone area overlay code and guidelines in Wind farms and bushfire operations will be achieved during the construction and the operations and maintenance phases of the Project.

1.2 BMP review

This BMP has been prepared to address condition 18a) and b) of the development permit. Upon appointment, the construction contractor and the operations and maintenance contractor may wish to prepare their own version of this BMP to distil the matters which are specific to their contract or to include corporate documentation or procedures. Notwithstanding, this does not permit the construction contractor or operations and maintenance contractor to change or deviate from the mitigation measures specified in Chapter 6.

1.3 Method

To meet requirements of Bushfire resilient communities, the following steps were undertaken:

- review of the SPP bushfire prone area map in the SPP interactive mapping system (DSDILGP 2022) and the Queensland regional ecosystem (**RE**) map, vegetation hazard class (**VHC**) map, severe fire weather map and fire history map in the QFES online mapping system (QFES 2022) (**Catalyst**);
- a drive over the Study area and field inspection of the disturbance footprint for vegetation characteristics, current land management practices, slope and evidence of previous fires;
- consultation with landowners during the field inspection;
- site-specific bushfire hazard assessment in accordance with the method in Bushfire resilient communities;
- radiant heat exposure assessment using the Fire Protection Association of Australia *BAL calculator V4.9* (**BAL calculator**) which models the 'method 2' bushfire attack level assessment procedure in the *Australian Standard* (AS 3959-2018) *Construction of buildings in bushfire prone areas* (Standards Australia 2018); and
- identification of mitigation measures required to reduce the potential risk of bushfire hazards for the construction and the operations and maintenance phases of the Project and for compliance with the SPP bushfire prone area overlay code.

Aerial imagery of the Study area was accessed online from Google Earth to assist in validating observations and measurements made during the field inspection.

1.4 Suitably qualified person

This BMP was technically reviewed and approved by Robert Janssen who is a suitably qualified and experienced bushfire management consultant.

Robert is the managing principal at Land and Environment Consultants Pty Ltd (**LEC**) and has over 20 years of experience in bushfire planning and operations. He has prepared BMPs for residential, commercial and industrial property developments, utilities, government facilities and conservation estates.

Robert’s formal qualifications as an environmental scientist and consulting experience are coupled with 10 years of experience as a nationally accredited fire-fighter with the national parks and wildlife service in New South Wales and Queensland.

2 Description of the Study area and the Project

This chapter provides a description of the Study area and the Project.

2.1 The Study area

The location of the Study area and the disturbance footprint are shown in Figure 2.1. The Study area consists of 17 properties and is approximately 16,758 ha.

Vehicle access into the Study area is via several private and public roads which connect to the Bruce Highway to the east and the Burnett Highway to the west.

The Study area is predominantly agricultural land which is mostly used for cattle grazing and some farmland cropping. However, parts of the Study area remain heavily vegetated with bushland vegetation, particularly in areas which have steep sloping land.

Powerlink Queensland high voltage overhead transmission lines run along the eastern boundary of the Study area and two meteorological masts have been erected within the Study area.

The Study area adjoins numerous conservation reserves, state forests and cattle grazing properties. All of which have large continuous areas of bushland vegetation on rugged terrain and limited vehicle access.

2.2 The Project

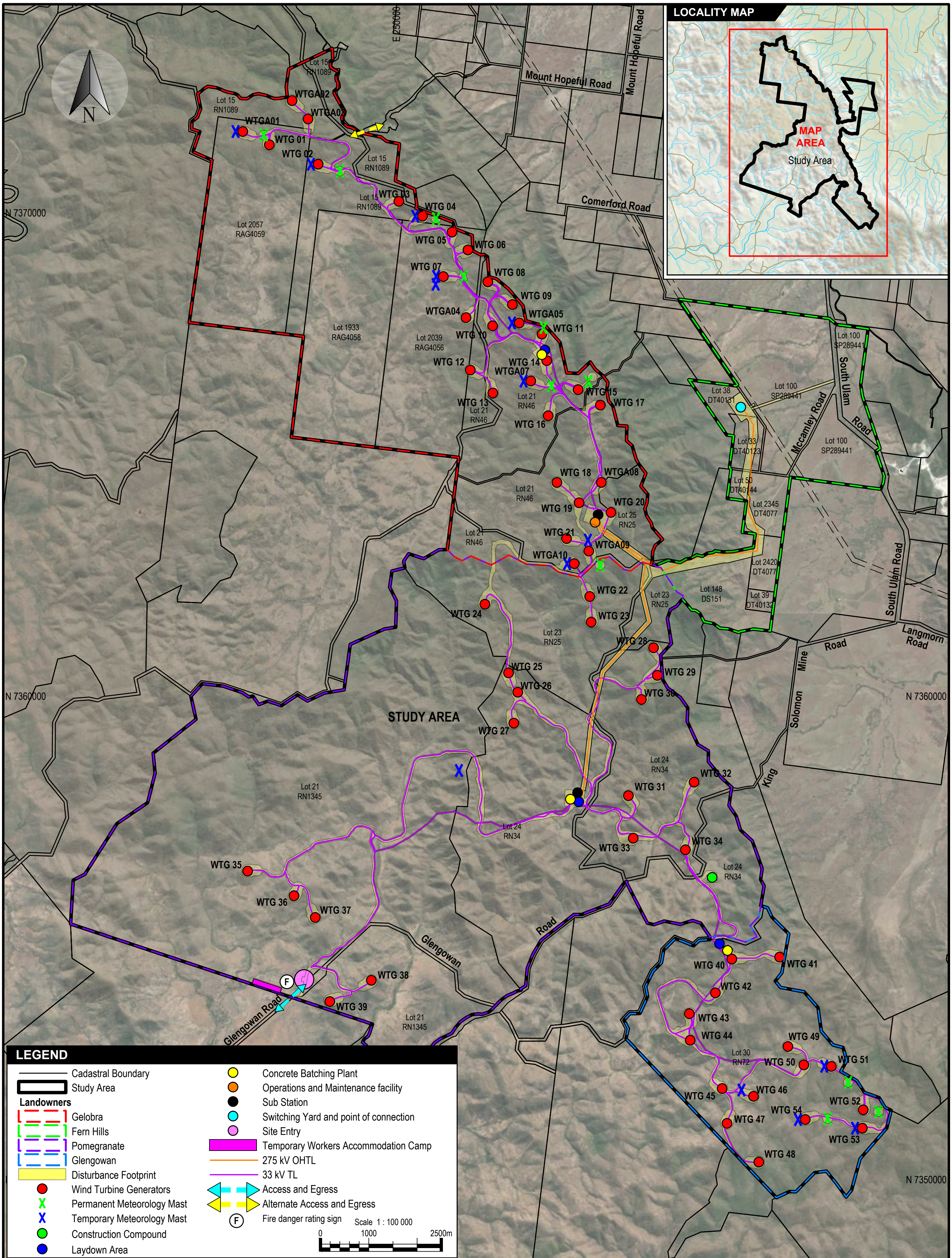
The Project involves the development of a wind farm that will deliver approximately 400 megawatts of power to the national grid. It will consist of:

- up to 63 wind turbine generators (**WTGs**) and hardstand areas;
- up to 10 temporary meteorology masts and 10 permanent meteorology masts;
- up to two substations and ancillary electrical infrastructure;
- up to 13 km of high voltage (275 kilovolts (**kV**)) overhead transmission lines;
- operations and maintenance facility which includes maintenance and storage areas containing permanent site offices, workshops, warehouses, mobile offices, lunchroom, amenities and ablutions;
- a variety of temporary infrastructure to facilitate the construction of the Project, including:
  - one construction compound;
  - a temporary worker's accommodation camp to provide for a peak construction workforce of approximately 220 people;
  - three concrete batching plants; and
  - two laydown areas;
- overhead and underground transmission lines and cables;
- up to 175 km of gravel capped roads; and
- two permanent site access points.

2.3 SPP bushfire prone area map

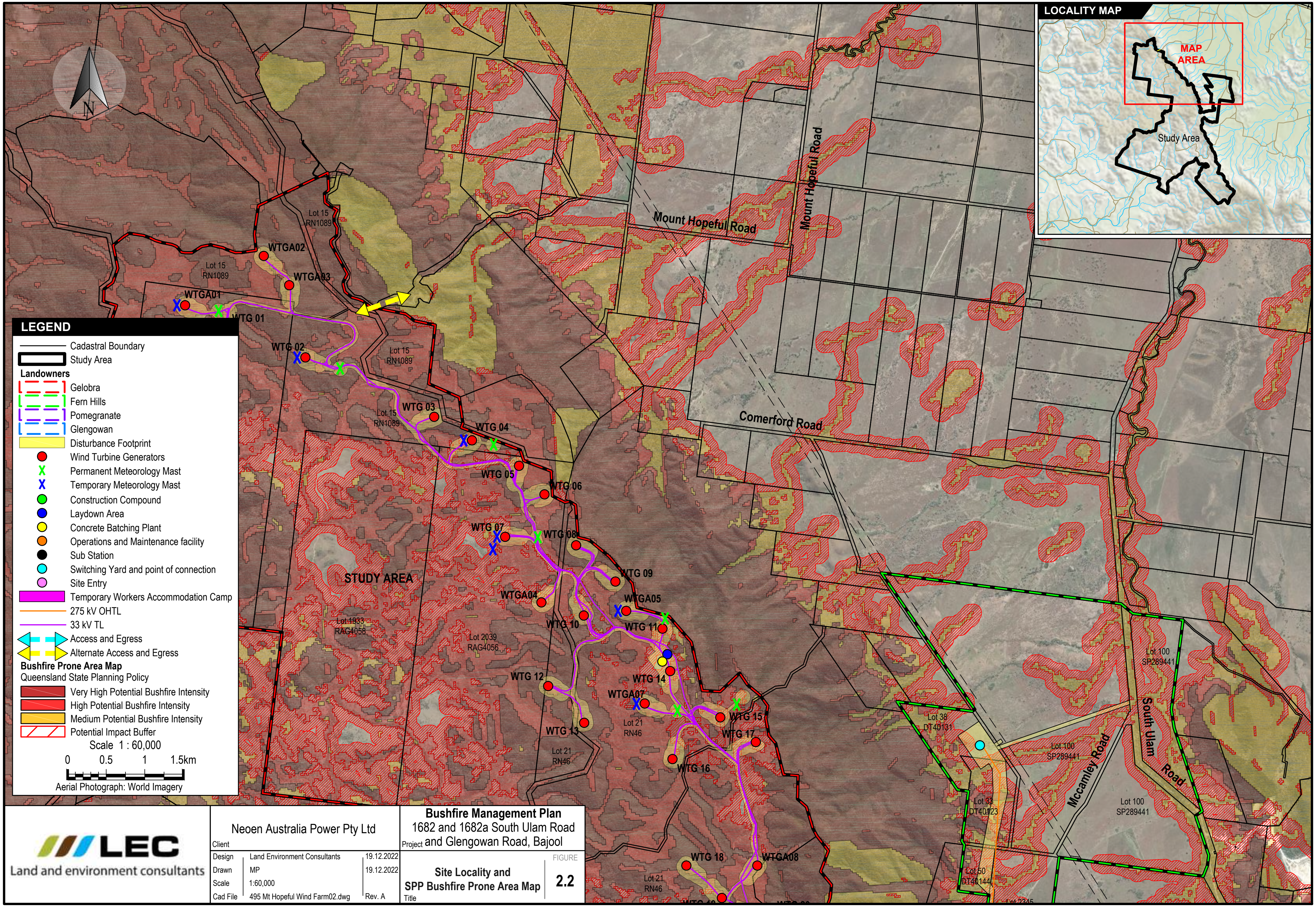
The SPP bushfire prone area map for the Study area is shown in Figures 2.2-2.4. They show that the Project is located within a combination of medium, high and very high potential bushfire intensity areas and potential impact buffer areas.

Please note, the terms 'bushfire prone area' and 'bushfire hazard area' have the same meaning and are interchanged throughout this report. Both terms mean an area of vegetation which is determined to have a potential bushfire intensity ≥ 4,000 kilowatts/metre (**kW/m**) and the land within 100 metres (**m**) of this vegetation.



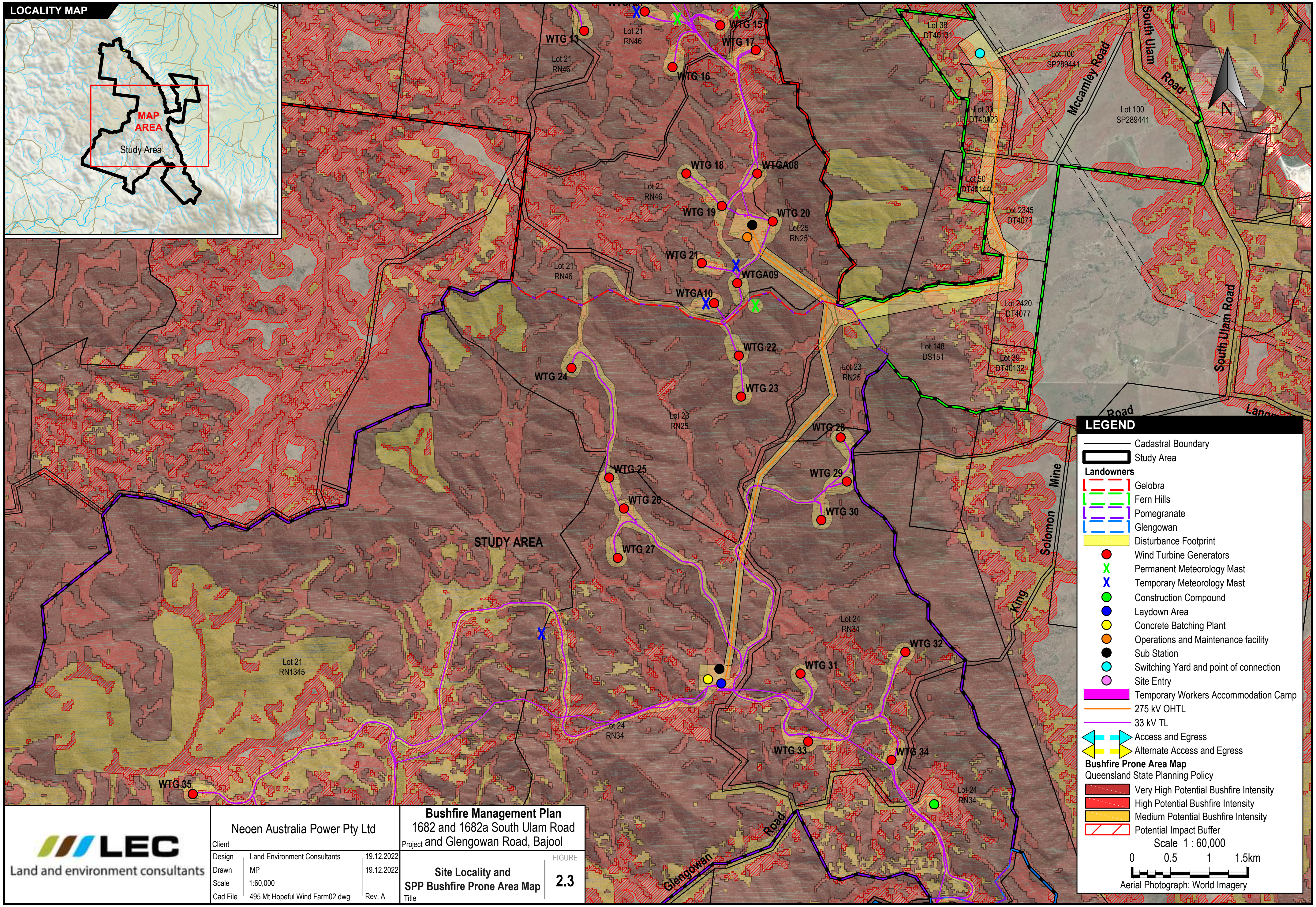
LEC Land and environment consultants

Client	Neoen Australia Power Pty Ltd	Project	Bushfire Management Plan 1682 and 1682a South Ulam Road and Glengowan Road, Bajool
Design	Land Environment Consultants	19.12.2022	
Drawn	MP	19.12.2022	
Scale	1:100,000		Title: Site Plan
Cad File	495 Mt Hopeful Wind Farm02.dwg	Rev. A	FIGURE 2.1

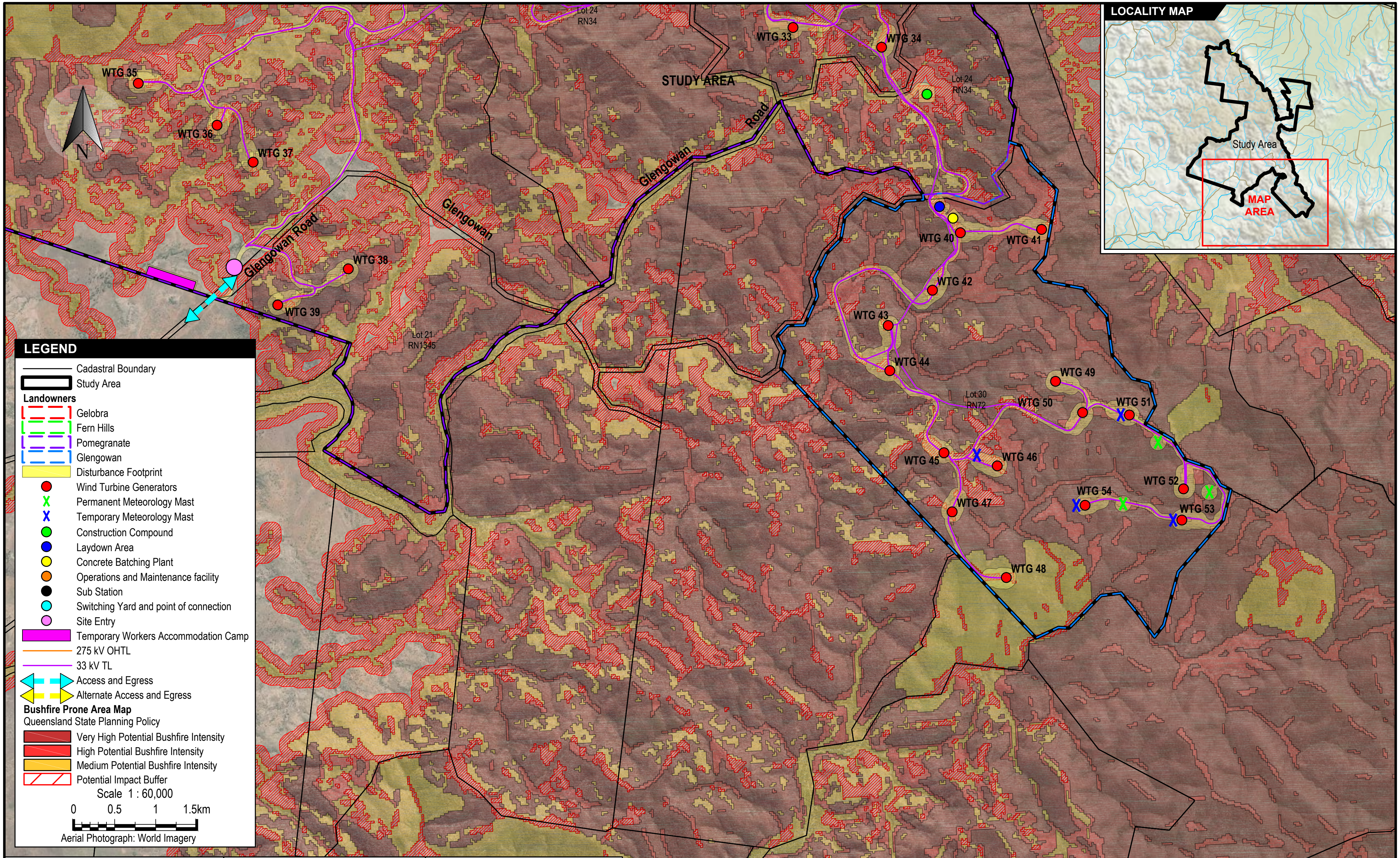


LEC
Land and environment consultants

Client	Neoen Australia Power Pty Ltd	
Project	Bushfire Management Plan 1682 and 1682a South Ulam Road and Glengowan Road, Bajool	
Design	Land Environment Consultants	19.12.2022
Drawn	MP	19.12.2022
Scale	1:60,000	
Cad File	495 Mt Hopeful Wind Farm02.dwg	Rev. A
Title	Site Locality and SPP Bushfire Prone Area Map	FIGURE 2.2



LOCALITY MAP
MAP AREA
Study Area
STUDY AREA
WTG 13
WTG 15
WTG 16
WTG 17
WTG 18
WTGA08
WTG 19
WTG 20
WTG 21
WTGA09
WTGA10
WTG 22
WTG 23
WTG 24
WTG 25
WTG 26
WTG 27
WTG 28
WTG 29
WTG 30
WTG 31
WTG 32
WTG 33
WTG 34
WTG 35
Lot 21 RN46
Lot 38 DT40131
Lot 100 SP289441
Lot 33 DT40123
Lot 50 DT40144
Lot 2345 DT4077
Lot 2420 DT4077
Lot 148 DS151
Lot 39 DT40132
Lot 25 RN25
Lot 23 RN25
Lot 24 RN34
Lot 21 RN1345
Mccamley Road
South Ulam Road
Mine
Solomon
King
Glengowan Road
N
LEGEND
Cadastral Boundary
Study Area
Landowners
Gelobra
Fern Hills
Pomegranate
Glengowan
Disturbance Footprint
Wind Turbine Generators
Permanent Meteorology Mast
Temporary Meteorology Mast
Construction Compound
Laydown Area
Concrete Batching Plant
Operations and Maintenance facility
Sub Station
Switching Yard and point of connection
Site Entry
Temporary Workers Accommodation Camp
275 kV OHTL
33 kV TL
Access and Egress
Alternate Access and Egress
Bushfire Prone Area Map
Queensland State Planning Policy
Very High Potential Bushfire Intensity
High Potential Bushfire Intensity
Medium Potential Bushfire Intensity
Potential Impact Buffer
Scale 1 : 60,000
0 0.5 1 1.5km
Aerial Photograph: World Imagery
LEC
Land and environment consultants
Neoen Australia Power Pty Ltd
Client
Bushfire Management Plan
1682 and 1682a South Ulam Road and Glengowan Road, Bajool
Project
Design Land Environment Consultants 19.12.2022
Drawn MP 19.12.2022
Scale 1:60,000
Cad File 495 Mt Hopeful Wind Farm02.dwg Rev. A
Site Locality and SPP Bushfire Prone Area Map
Title
FIGURE 2.3



LEC
Land and environment consultants

Client	Neoen Australia Power Pty Ltd		Project	Bushfire Management Plan 1682 and 1682a South Ulam Road and Glengowan Road, Bajool
Design	Land Environment Consultants	19.12.2022	Title	Site Locality and SPP Bushfire Prone Area Map
Drawn	MP	19.12.2022	FIGURE	2.4
Scale	1:60,000			
Cad File	495 Mt Hopeful Wind Farm02.dwg	Rev. A		

3 Bushfire hazard assessment

This chapter provides details of the desktop review, field inspection and the site-specific bushfire hazard assessment.

3.1 Severe fire weather

The severe fire weather map in Catalyst indicates the 5 % annual exceedance probability forest fire danger index (**FFDI**) for the Study area is 69. This FFDI value has been used for the potential bushfire intensity calculations in Section 3.4 and the radiant heat exposure assessment in Section 3.6.

3.2 Fire history

Fire history data in Catalyst indicates that the Study area and adjoining land regularly burns. Consultation with a landowner identified that many of the fires within and adjoining the Study area were planned burns by landowners and government agencies for bushfire fuel hazard reduction (Pers Comm. Brett McCamley).

3.3 Field inspection

A drive over the Study area and field inspection of the disturbance footprint was performed by LEC on 11-15 November 2022. Observations were recorded about current land use and management, vegetation characteristics, slope of land and evidence of previous fires.

A summary of observations made at the infrastructure areas shown in Figure 2.1 is provided in Appendix 1. Features of the infrastructure areas are shown in photographs in Appendix 2.

Most of the grassland areas within the property identified as Gelobra in Figure 2.1, were assessed based on the pre-clear RE map and corresponding VHCs. This approach was taken due to there being considerable evidence of native vegetation regrowth in previously improved parts of the property.

3.4 Potential bushfire intensity calculations

The potential bushfire intensity of infrastructure areas was determined using the Queensland Public Safety Business Agency *Potential Bushfire Intensity Calculator* (version November 2014) which is an Excel spreadsheet calculator that models the site-specific bushfire hazard assessment method in Bushfire resilient communities.

Bushfire resilient communities defines bushfire hazard classes as follows:

- very high – potential bushfire intensity > 40,000 kW/m;
- high – potential bushfire intensity 20,000-40,000 kW/m;
- medium – potential bushfire intensity 4,000-20,000 kW/m; and
- non bushfire hazard - potential bushfire intensity <4,000 kW/m.

Results of potential bushfire intensity calculations which determine the bushfire hazard class of the infrastructure areas shown in Figure 2.1 are presented in Appendix 3.

3.5 Bushfire prone areas

Results of the potential bushfire intensity calculations in Appendix 3 generally align with the SPP bushfire prone area map and confirm that the Project is within a combination of medium, high and very high potential bushfire intensity areas or the 100 m wide potential impact buffer of these areas. These results confirm that the Project must comply with the SPP bushfire prone area overlay code.

3.6 Radiant heat exposure assessment

The SPP bushfire prone area overlay code and Bushfire resilient communities requires above ground infrastructure to be appropriately setback from bushfire and grass fire prone areas. They require above ground infrastructure associated with 'community infrastructure for essential services', ie the substations and switching yard, to be setback from bushfire and grass fire prone areas by a distance which achieves a radiant heat flux level ≤ 10 kW/m^2. They also require permanent above ground infrastructure associated with 'other uses', ie the WTGs and the operations and maintenance facility, to be setback from hazardous vegetation by a distance which achieves a radiant heat flux level ≤ 29 kW/m^2. These setbacks are hereafter referred to as asset protection zones (**APZs**).

For temporary infrastructure, ie construction compound, laydown areas and concrete batching plants, and meteorology masts (both temporary and permanent), this BMP applies an alternative solution to the SPP bushfire prone area overlay code and Bushfire resilient communities and recommends an APZ with a nominal cleared width of 10 m.

APZs minimise the impact of bushfire attack on above ground infrastructure and provide a defendable space for fire-fighters to operate.

The radiant heat profile of bushfire attack on the substations, switching yard, WTGs and the operations and maintenance facility shown in Figure 2.1 was assessed using the BAL calculator.

The analysis of bushfire attack scenarios was based on VHCs observed during the field inspection, VHC mapping in Catalyst and the steepest slopes measured for VHCs during the desktop review and field inspection. Inputs used to assess the radiant heat profile of each bushfire attack scenario and results of the BAL calculator are provided in Appendix 4.

APZs were identified for substations, switching yard, WTGs and the operations and maintenance facility on results of the radiant heat exposure assessment and compliance with the radiant heat exposure outcomes of the SPP bushfire prone area overlay code. The APZs around above ground infrastructure are summarised in Table 3.1.

Table 3.1 APZs around above ground infrastructure

Width of APZ around above ground infrastructure (m)[1]						
10	**15**	**20**	**25**	**30**	**40**	**45**
WTG 14, laydown area and concrete batching plant near WTG 14, laydown area and concrete batching plant near WTG 31, construction compound near WTG 34, laydown area concrete batching plant near WTG 40, all of the permanent and temporary meteorology masts and the	WTG 31, WTG 32, WTG 33, WTG 34, WTG 35, WTG 36, WTG 37, WTG 38, WTG 39 and WTG 45	WTG 6, WTG 25, WTG 26 and WTG A10	WTG 10, WTG 11, WTG 21, WTG 42, WTG 48, WTG 51, WTG 54, WTG A03, WTG A04, WTG A07, WTG A09 and the operations and maintenance facility near WTG 20	WTG 1, WTG 2, WTG 3, WTG 5, WTG 7, WTG 8, WTG 12, WTG 13, WTG 15, WTG 16, WTG 17, WTG 18, WTG 19, WTG 24, WTG 40, WTG 44, WTG 46, WTG 49, WTG 50, WTG A01, WTG A08,	WTG 4, WTG 9, WTG 20, WTG 22, WTG 23, WTG 27, WTG 28, WTG 29, WTG 30, WTG 41, WTG 43, WTG 47, WTG 52, WTG 53, WTG A02, and WTG A05	Substation near WTG 20

Width of APZ around above ground infrastructure (m)[1]						
10	**15**	**20**	**25**	**30**	**40**	**45**
temporary worker's accommodation camp				switching yard and point of connection and substation near WTG 31		

Note 1 The locations of above ground infrastructure are shown in Figure 2.1.
2 APZs may be refined and potentially reduced through detailed design and micro-siting of the Project.

APZs are not applied to access tracks, retaining walls, earthwork embankment batters, fences, terraced walkways or above ground transmission lines. Notwithstanding, above ground transmission lines are located within a vegetation clearing which is designed to be relevant to electricity transmission and distribution networks in Queensland.

APZs are measured from the electrical infrastructure within substations and the switching yard, the external walls or supporting posts or columns of buildings and WTGs, the perimeter of laydown areas, the construction compound, concrete batching plants and the guy-wires of meteorological masts (both temporary and permanent).

4 Bushfire hazards associated with the Study area and the Project

This chapter identifies bushfire hazards associated with the Study area and the Project.

4.1 Fire danger season

The fire danger season at the Study Area starts in August, peaks in September and begins to fall in November, but will remain elevated until consistent summer rainfall occurs. Typically, the worst fire weather conditions will be experienced during the fire danger season when the wind direction is from the north or west.

An FFDI of 69, ie the 5 % annual exceedance probability FFDI for the Study area, will be associated with hot, dry and windy conditions. If a bushfire starts and takes hold under these conditions, it will be difficult to control and fast moving in large areas of grassland and bushland vegetation.

The fire danger rating (**FDR**) system provides advice about the level of bushfire threat on a day. The new national FDR system which was introduced in September 2022 is based on a new fire behaviour index system and no longer linked to FFDI values. The FDR system has four levels which are summarised below:

- moderate – most fires can be controlled;
- high – fires can be dangerous;
- extreme – fires will spread quickly and be extremely dangerous; and
- catastrophic – if a fire starts to take hold, it could result in the loss of life.

4.2 Fire history

As discussed in Section 3.2, fire history data indicates that the Study area and adjoining land regularly burns and that many of these fires were planned burns that were implemented by landowners and government agencies for bushfire fuel hazard reduction (Pers. Comm. Brett McCamley).

Based on the fire history data and consultation it is considered almost certain that the Study area will be subject to bushfires in the future, whether they be planned or unplanned.

4.3 Vegetation

The disturbance footprint will be cleared of vegetation in preparation for civil works.

APZs will be established around above ground infrastructure as specified in Table 3.1 and will be maintained for the life of the Project.

APZs will be either hardstand areas which are maintained free of weed and grass cover or grass areas which are maintained at a nominal height of < 30 centimetres (**cm**).

4.4 Bushfire management within the Study area

Neoen Australia Power Pty Ltd (**Neoen**) and the construction contractor or the operations and maintenance contractor will be responsible for bushfire management within the disturbance footprint which is leased from the landowners of the Study area. The landowners hosting the Project are responsible for bushfire management in the balance of the Study area, ie the land outside the disturbance footprint. Notwithstanding, bushfire management is a landscape issue and there will be benefits for both Neoen and landowners if they work collaboratively to manage bushfire hazards within the Study area.

4.5 Bushfire attack and the protection of above ground infrastructure

A bushfire in areas of woodland or open forest vegetation on steep slopes present the main issue for the protection of above ground infrastructure.

During fire weather conditions which correlate with the 5 % annual exceedance probability FFDI for the Study area, a bushfire in areas of woodland or open forest vegetation has potential to generate radiant heat energy up to 73,569 kW/m which in combination with steep slopes will make fire-fighting operations and access difficult. Therefore, direct attack of a fire under these fire weather conditions and the protection of infrastructure may not always be possible.

4.6 Workforce

The Project will not result in the permanent exposure of large numbers of people to bushfire hazard. It is expected that the workforce will peak during construction at 220 personnel and will be reduced to 10 full time equivalent roles during operations.

A temporary on-site construction accommodation facility will be established within the Study area for the construction phase of the Project. The construction workforce may also commute from Rockhampton (approximately 50 minute drive) or seek accommodation in local rental houses, hotels and motels in the surrounding localities and towns. The construction phase is anticipated to take between 22-28 months.

Workers employed for the operations and maintenance phase of the Project will be from the local area or accommodated in surrounding townships.

4.7 Hazardous chemicals

Storage or handling of hazardous chemicals during the construction and the operations and maintenance phases of the Project will be in accordance with *Managing risks of hazardous chemicals in the workplace – Code of Practice* (SWA 2020), applicable safety data sheets, and otherwise in accordance with the Queensland *Work Health and Safety Act 2011* and its regulations.

4.8 Access

The Project will establish an access track network that will link the Project infrastructure. Access tracks will be designed for heavy articulated vehicles and will meet the design standards for emergency vehicle access in the SPP bushfire prone area overlay code including (where required) the provision of turnaround areas on dead-end access tracks. If there are gates across access tracks, they will be at least 4 m wide.

In addition to the Project's access track network, there are numerous property access tracks which are of varying design and maintenance standards and may require restoration prior to use for bushfire management operations.

There are multiple vehicle access points into the Study area. The primary access point is via Glengowan Road on the western side of the Project and the alternate access point is via Mount Hopeful Road on the eastern side of the Project. These access points are shown in Figure 2.1.

4.9 Rural Fire Brigade resources and capability

The local Rural Fire Brigades (**RFBs**) are voluntary primary producer brigades and have limited resources to respond to a fire ignition within the Study area. They are unlikely to have any training or experience operating around electrical infrastructure, ie the substations and switching yard, and have limited capability to respond to structural fires.

Local RFB personnel may not be familiar with the layout of the Project and out of area RFBs will not be familiar with the location of the Study area, ie access roads, water points, terrain, etc.

4.10 Aerial fire-fighting operations

Meteorological masts and WTGs pose a navigation risk to pilots performing aerial fire-fighting operations.

4.11 Fire-fighter water supply

The Project will include a dedicated fire-fighter water supply tank.

There are numerous dams and creeks within the Study area. However, the standard of vehicle access to them and the reliability of their water supply is unknown and they should not be relied upon.

4.12 Warning and evacuation requirements

Queensland emergency services use a range of methods to warn the community about bushfire, severe weather and other emergencies that require preparation and action at the property level. The construction workforce and the operations and maintenance workforce will be subject to advice and warnings by Queensland emergency services via radio, online media and local community safety announcements.

A safety and emergency management plan and an evacuation plan will be prepared for the construction phase and the operations and maintenance phase of the Project. These plans will provide details of actions to be undertaken in response to a bushfire emergency. They are separate plans to this BMP.

4.13 Buildings

Offices, accommodation and worker amenities that are required for the construction phase of the Project will be demountable buildings, ie temporary buildings, that will be located in a cleared compound.

Buildings associated with the operations and maintenance facility, substations and switching yard will be designed to meet the fire resistance and safe access and egress requirements of the *National Construction Code–Building Code of Australia* (**NCC-BCA**) (volume 1) (ABCB 2019) and governing Queensland laws, codes and standards that apply to the building industry.

Fire detection and first attack fire-fighting equipment in buildings will comply with requirements in the NCC–BCA (volume 1) and any Queensland specific requirements.

5 Fire ignition risks

This chapter identifies fire ignition risks within the Study area.

5.1 Land use

The Study area consists of and adjoins freehold tenures used for agricultural purposes, ie cattle grazing and dryland cropping, and adjoins numerous conservation reserves and state forests.

The operation of equipment and machinery or hot works associated with agricultural activities could result in bushfires that impact on the Project, particularly on days with an FDR of extreme or above. In addition, landowners may light fires to burn waste or for bushfire fuel hazard reduction. Therefore, land which is used for agricultural activities within and adjoining the Study area is a potential bushfire hazard to the Project.

The custodians of the conservation reserves and state forests adjoining the Study area are also likely to light fires for bushfire fuel hazard reduction or to achieve biodiversity conservation outcomes. Therefore, these areas are also a potential bushfire hazard to the Project.

5.2 Overhead transmission lines

High voltage overhead transmission lines, ie the existing Powerlink Queensland transmission line and the proposed 275 kV transmission lines which will transverse the Study area, are susceptible to 'flashover' which can cause a fire ignition in surrounding vegetation. Fires with a flame height greater than
1 m adjacent to or under transmissions lines have the potential to:

- create electrical arcs (known as flashovers) that can endanger people, animals and objects;
- damage or destroy wires, insulators and supports of the transmission line; and
- interrupt power supply to households, business and industry.

Vegetation management under high voltage transmission lines will be in accordance with Powerlink Queensland's vegetation management specifications for high voltage transmission lines (Powerlink 2018).

Wind turbines will be connected to the substation by underground and 33 kV overhead transmission lines. The risk of a fire ignition caused by these overhead transmission lines is minor when compared to the risk profile that exists for the high voltage transmission lines. Nonetheless, vegetation management under these overhead transmission lines will be in accordance with *Energy Queensland – Vegetation Management Strategy – Version 2* (EQ 2022).

5.3 Lightning strike

A lightning strike could cause a fire in grassland or bushland vegetation within the Study area, particularly during the fire danger season, ie from late winter to early summer, when dry electrical storms most commonly occur.

The Australasian Fire and Emergency Service Authorities Council Limited suggests that it is possible that WTGs may reduce the risk of bushfires caused by lightning strikes, given that WTGs can attract lightning during thunderstorms. If struck by lightning, a WTG is not expected to start a fire as it has built-in fire protection mechanisms (AFAC 2018).

5.4 Mechanical or electrical fire

There is potential for a fire of electrical or mechanical origin to develop in WTGs, transformer kiosks, substations or the switching yard and result in a fire in grassland or bushland vegetation within the Study area. However, this situation is unlikely to occur as this infrastructure has built-in fire protection mechanisms (AFAC 2018), will be located on cleared land and will be surrounded by an APZ where vegetation is managed.

5.5 Construction activities

The use of tracked earthmoving machinery on rocky ground, vehicles driving or parking in long grass, hot works and people smoking has potential to cause a bushfire during the construction phase.

5.6 Operational activities

Similar risks may exist during the operational phase of the Project that existed during the construction phase, ie vehicles driving or parking in long grass, hot works and people smoking. However, worker numbers will be significantly reduced and access throughout the Study area will be on formed access tracks, meaning vehicle and mobile plant movement off formed access tracks will rarely occur.

6 Bushfire mitigation plan

This chapter identifies bushfire mitigation measures that must be implemented during the construction and the operations and maintenance phases of the Project.

The bushfire mitigation measures will reduce the risk of bushfire hazards to a tolerable level which in this report means compliance with outcomes of the SPP bushfire prone area overlay code.

It is the total of the mitigation measures in this chapter of the report that will reduce the risk of bushfire hazards to a tolerable level. Failure to implement all of the mitigation measures in their entirety could result in an increased level of exposure to bushfire hazards.

6.1 Asset protection zones

APZs must be established and maintained around above ground infrastructure as shown in Figures 6.1-6.3.

The width of APZs around WTGs, substations and the switching yard must comply with the minimum widths determined by the radiant heat exposure assessment in Table 3.1.

APZs must be measured from electrical infrastructure within substations and the switching yard, the external walls or supporting posts or columns of buildings and WTGs, the perimeter of laydown areas, the construction compound, concrete batching plants and the guy-wires of meteorological masts (both temporary and permanent).

APZs must be cleared of vegetation and established as a gravel hardstand area or grass area. A gravel hardstand area must be maintained free of weeds and grass cover. Where establishing a gravel hardstand area is not practical, a grass area must be established. A grass area must be maintained free of woody vegetation and with grass cover which has a height of ≤ 30 cm.

6.2 Overhead transmission lines

Overhead 275 kV high voltage transmission lines must be located, where practical, within an appropriately designed vegetation management area in accordance with Powerlink Queensland's vegetation management specifications for high voltage transmission lines (Powerlink 2018) which is illustrated in Figure 6.4 and summarised as follows:

- The area within up to 30 m of the conductor's centre line (up to 60 m where practical) is to be cleared or selectively cleared of vegetation that could grow to a height > 3.5 m.
- Specimens of *Cycas megacarpa* which are < 3.5 m in height can be retained within this area unless they are located within 6 m of the conductor shadow area.
- The area within 6 m of the conductor shadow area is to be an intensive vegetation management area – one of the 6 m wide areas is to be maintained clear of vegetation and debris for vehicle access and the other is to be maintained with vegetation at a maximum height ≤ 1 m.
- Trees adjacent to the vegetation management area are to be selectively cleared based on the Powerlink Queensland hazardous tree assessment objectives referenced in Figure 6.4.

Overhead 33 kV transmission lines which connect WTGs to the Project's substations will be located within a vegetation management area in accordance with Energy Queensland's vegetation management specifications for rural area corridors (EQ 2022) which is illustrated in Figure 6.5 and summarised as follows:

- The area within 6 m of the centreline is to be selectively cleared of vegetation to form a clearance zone.

- Specimens of *Cycas megacarpa* can be retained within the clearance zone where a minimum vertical height clearance of 4 m to the conductor is achieved.
- Vegetation overhanging the conductor is to be removed.
- Trees identified with defects immediately adjacent to the clearance zone are to be removed.
- Where the transmission lines are located within a previously established enlarged clearing width this cleared width will be maintained.

Note: Full compliance with Powerlink Queensland's vegetation management specifications for high voltage transmission lines (Powerlink 2018) or Energy Queensland's vegetation management specifications for rural area corridors (EQ 2022) may not be required or practical. For example, where the conductor is suspended across a valley and it can be demonstrated that there will be an appropriate distance of separation between the conductor and the canopy of vegetation in the valley or where topography restricts the safe use of plant and equipment required to establish and maintain the vegetation management area.

6.3 Cable pits

A 1 m wide area around cable pits must be cleared of all vegetation greater than 10 cm in height.

6.4 Access and evacuation

The primary access point for the construction and the operations and maintenance phases of the Project is via the Glengowan Road on the western side of the Project and the alternate access point is via the Mount Hopeful Road on the eastern side of the Project. These access points and the access track network that will be constructed for access to the Project's infrastructure are shown in Figures 6.1-6.3.

As a minimum requirement, access tracks must meet the design specifications for category 1 fire-fighter vehicles by the New South Wales Rural Fire Service (NSW RFS 2016) which are summarised as follows:

- Width – The trafficable surface has a width of 4 m except for short constrictions to 3.5 m for no more than 30 m in length where an obstruction cannot be reasonably avoided or removed. Curves have a minimum inner radius of 6 m. The minimum distance between inner and outer curves is 6 m.
- Capacity – Trail surfaces and crossing structures are capable of carrying vehicles with a gross vehicle mass of 15 tonnes (**t**) and an axle load of 9 t.
- Grade and crossfall – The maximum grade of a trail is not more than 15 degrees. The crossfall of the trail surface is not more than 6 degrees. Drainage structures, feature crossings, or other significant changes in the grade of the trail shall be in accordance with the *Fire Trail Design, Construction and Maintenance Manual* (NSW DISCS 2017).
- Clearance – A minimum vertical clearance of 4 m is provided above the surface of the trafficable surface clear of obstructions.
- Passing – Capacity for passing is provided every 250 m comprising:
  - a widened trafficable surface of at least 6 m for a length of at least 20 m; or
  - a 6 m wide and 8 m long area clear of the trafficable surface with a minimum inner curve radius of 6 m and minimum outer radius of 12 m; or
  - a turnaround area is provided (as outlined below).
- Turnarounds – A turning area is provided at the termination of a trail and every 500 m and is achieved by:

- an area clear of the trafficable surface, which is 6 m wide and 8 m deep, with a minimum inner curve radius of 6 m and minimum outer radius of 12 m; or
  - a turning circle of minimum 22 m diameter;
  - a T-junction with each terminating end of the junction being at least 10 m in length from the intersection of the roads and the inner radius of the intersection being at least 6 m; or
  - a fire trail or road intersection.
- Drainage is designed and constructed in accordance with the *Fire Trail Design, Construction and Maintenance Manual* (NSW DISCS 2017).

6.5 Fire-fighter water supply

A fire-fighter water storage tank must be installed at the operations and maintenance facility for the operations and maintenance phase of the Project. The indicative location of the fire-fighter water storage tank is shown in Figure 6.2. It must be kept full of water always and must not be used for activities other than bushfire management.

The fire-fighter water storage tank must have a minimum capacity of 20,000 litres and be made from concrete or metal and fitted with RFB fire-fighter fittings. Above ground fittings, ie valves and pipe, must be made of metal. We recommend contacting the local RFB to confirm the standard RFB fittings in use at the locality.

The fire-fighter water storage tank must have a hardstand area within 4 m of the inlet/outlet point. The hardstand area must have the load bearing capacity and dimensions suitable for a heavy rigid vehicle to park.

6.6 Wayfinding

Reflective wayfinding signage must be installed at the intersection of access tracks and identify the location of project infrastructure and the fire-fighter water storage tank.

Wayfinding signage must be based on a naming and marking convention which enhances accessibility for out of area fire-fighters. For example, marking the intersection of access tracks as A-B to indicate that it links landmark A to landmark B; landmarks used for this purpose must be identifiable on site and marked on any site mapping.

Access track marking must clearly indicate no through access tracks.

6.7 Fire danger rating sign

An FDR sign must be installed at the primary access point to the Study area, ie Glengowan Road, prior to commencing the construction phase of the Project. The FDR sign must be moved to the operations and maintenance facility prior to commencing the operations and maintenance phase of the Project. The approximate location of the FDR sign for the construction and the operations and maintenance phases of the Project are shown in Figure 6.2.

6.8 Buildings

Buildings must comply with the fire resistance and safe access and egress requirements of the NCC-BCA and governing Queensland laws, codes and standards that apply to the building industry.

Fire detection and first attack fire-fighting equipment in buildings must comply with specifications in the NCC–BCA and any Queensland specific requirements.

These matters will be dealt with in detail through the building certification and approvals process.

6.9 Meteorological masts

Meteorological masts are a potential hazard for aerial fire-fighter operations. Mitigation measures in the aviation impact assessment (if prepared) must be implemented.

Otherwise, for compliance with Wind farms and bushfire operations, the following must be undertaken:

- their location must be recorded in the tall structures database maintained by Air Services Australia/Civil Aviation Safety Authority; and
- warning lights or visible markers, ie orange balls, must be installed on meteorological masts.

6.10 Administrative controls

6.10.1 General

Hot works must be managed under a hot works permit system.

Hot works and other high fire risk activities, eg the operation of track machinery on rocky ground, must be monitored for ignitions and only performed if fire management controls are in place.

Vehicles and mobile plant and equipment must not be operated or parked in long grass, ie grass > 30 cm in height, unless fire management controls are in place.

Fire extinguishers must be made available in all work areas. Vehicles and mobile plant and equipment must be fitted with a portable fire extinguisher and ultra-high frequency (UHF) radio. Water carts/water tanks must be located adjacent to construction work areas during the fire danger season, ie from late winter until summer when significant rainfall occurs.

6.10.2 Information transfer

Prior to commencing the operations and maintenance phase of the Project, spatial data which identifies the location of access tracks and infrastructure must be provided to the QFES so that it can be uploaded into the QFES online incident management system and is readily available for bushfire emergency planning.

Neoen must consult with the QFES to determine the information and data format requirements and the specifics of the data transfer.

6.10.3 Bushfire preparedness

The construction contractor and the operations and maintenance contractor must invite the local QFES and RFBs and landowners hosting the Project to participate in an annual bushfire preparedness meeting for the Project.

The meeting will be used to familiarise QFES and RFB personnel and landowners with the Project's infrastructure, access tracks, fire-fighter water storage tank and fittings, communication procedures and safety requirements for operating within the Study area. It will also provide an opportunity to review any bushfire incidents within or adjacent to the Study area and any plans for hazard reduction burns by the landowners.

Opportunities to upgrade dams and access tracks located within the Study area must also be discussed at the preparedness meeting as these upgrades could have benefits for the Project.

The bushfire preparedness meeting also provides an opportunity to run a bushfire response training drill with the local QFES and RFBs.

6.10.4 Project rules and inductions

Access to the Study area during the construction and the operations and maintenance phases of the Project will be conditional on compliance with workers completing an induction and complying with entry rules, including rules regarding smoking.

Smoking must only be permitted in cleared areas, ie the construction compound, laydown areas, the operations and maintenance facility and WTG hardstands.

6.10.5 Safety documentation

Activities associated with the construction and the operations and maintenance phases of the Project must be governed by safety documentation, including safe work method statements. Activity specific bushfire risk management controls must be identified through the safety documentation. Where required, the safety documentation must be managed through a permit to work system which must provide an additional layer of control around bushfire risk management.

6.10.6 Monitor fire weather conditions

FDRs and fire weather warnings must be monitored daily for the construction and the operations and maintenance phases of the Project. The FDR sign must be updated daily and activities during the construction and the operations and maintenance phases of the Project managed accordingly.

FDRs for the Study area are updated daily by the QFES and can be accessed online at https://www.qfes.qld.gov.au/prepare/bushfire/fire-danger-rating - search for Capricornia district. Fire weather warnings are published online by the Bureau of Meteorology at http://www.bom.gov.au/qld/index.shtml.

Table 6.1 provides guidance on precautions for activities during the construction and the operations and maintenance phases of the project in relation to FDRs.

Table 6.1 FDR activity guidelines

FDR	Fire danger guidance	Operational guidance
Moderate	Plan and prepare. Most fires can be controlled. Stay up to date and be ready to act if there is a fire.	Maintain APZs. Access tracks are checked and maintained clear of obstacles. Fire extinguishers are checked and are operational. Fire-fighter water storage tanks are full and plumbing is checked and is operational. During construction - inspect any mulched piles of cleared vegetation for signs of combustion. Hot works are performed in accordance with a hot works permit. Continue to monitor FDR conditions and update the FDR notice boards to indicate the FDR.
High	Be ready to act. Fires can be dangerous. Decide what you will do if a fire starts.	As for moderate FDR. Construction and operational activities that may cause accidental ignitions, eg slashing and machine/vehicle operation in long grass,

FDR	Fire danger guidance	Operational guidance
	There is a heightened risk. Be alert for fires in your area. If a fire starts, avoid bushfire prone areas.	require a spotter and water cart to be present onsite. Hot works require additional approval from the construction contractor and the operations and maintenance contractor or delegate and will occur under a permit to work system.
Extreme	Fires will spread quickly and will be extremely dangerous. Make sure the Project is fire ready. If a fire starts, take immediate action.	As for high FDR. Fire weather warnings and restrictions imposed by the QFES must be observed. Construction and operational activities that may cause accidental ignitions, eg slashing and machine operation in long grass, are not permitted. Hot works must not occur in outdoor areas. Surveillance for fire ignitions and smoke plumes within and adjoining the site. Pre-start briefing to include a reminder of bushfire controls above.
Catastrophic	Do not enter bushfire prone areas. If a fire starts, it will potentially be life threatening. These are the most dangerous conditions for a fire. Stay safe by going to a safer location early. Buildings may not withstand fires in these conditions.	As for extreme FDR. Fire weather warnings and restrictions imposed by the QFES must be observed. No construction activities are permitted (other than administrative activities which occur indoors). No operational or maintenance activities are permitted (other than administrative activities which occur indoors).

6.10.7 Powerlink Queensland transmission lines

Fire-fighting operations near the high voltage overhead transmission lines must be planned and implemented in accordance with the *National Guidelines on Electrical Safety for Emergency Service Personnel* (ENA DOC 008-2006) and the carrier's instructions.

6.10.8 Communications planning

Neoen must ensure the following is in place by the time construction commences:

- all relevant staff are aware of the mitigation measures in this BMP;
- an emergency contact number is available online and is attended to at all times by trained staff;
- contingency communication systems are in place for the onsite representative of the construction contractor and the operations and maintenance contractor in case of failed telephone communication attempts;
- communication with the landowners hosting the Project to ensure that access to the Study area is not constrained for the local QFES and RFBs; and
- a mechanism to provide periodical updates to the landowners hosting the Project and the local QFES and RFBs as the Project is progressively built.

6.10.9 Emergency response planning

A separate emergency response plan must be prepared by the construction contractor for the construction phase of the Project and by the operations contractor for the operational phase of the Project.

The emergency response plan must include procedures to be followed in the event of a bushfire warning by the QFES and a bushfire within properties hosting the Project. It must also identify the location of safe assembly/evacuation areas and the access routes to these areas.

With regards to bushfire, a safe assembly or evacuation area must have a gravel or similar hardstand surface and must not be located in areas identified as medium, high and very high potential bushfire intensity or potential impact buffer in Figures 2.2-2.4.

In the event of a fire ignition that cannot be safely extinguished with available resources, ie a bushfire, the following procedure must be followed:

1. Contact the QFES via a 000 call.
2. Notify property owners hosting the Project of the fire ignition.
3. Evacuate personnel and contractors to a safe assembly/evacuation area and account for all personnel and contractors.
4. Meet the QFES and provide information relevant to the bushfire emergency.
5. Resume construction or operations and maintenance works when advised by the QFES that it is safe to do so.

6.10.10 Fire-fighter operations plan

Prior to the operations and maintenance phase of the Project, a fire-fighter operations plan must be prepared for the site and provided to the local RFBs. It must be in the format of a poster plan that can be rolled out and used in the field.

The fire-fighter operations plan must identify (as a minimum) the location of infrastructure, access tracks, water points and reference wayfinding signage. It must also include contact and communications information, instructions for operating around electrical infrastructure and operational guidelines for fire control.

6.10.11 Electrical safety

The Project must be operated in compliance with the Queensland *Electrical Safety Act 2002* and its regulations and the electrical safety codes of practice by the Electrical Safety Office of Queensland (ESO 2020a, ESO 2020b and ESO 2021).

Electrical equipment installed to support the operation and maintenance phase of the Project must be regularly inspected in accordance with the manufacturer's guidance (where this applies) or in accordance with industry best practice.

6.10.12 Hazardous chemicals

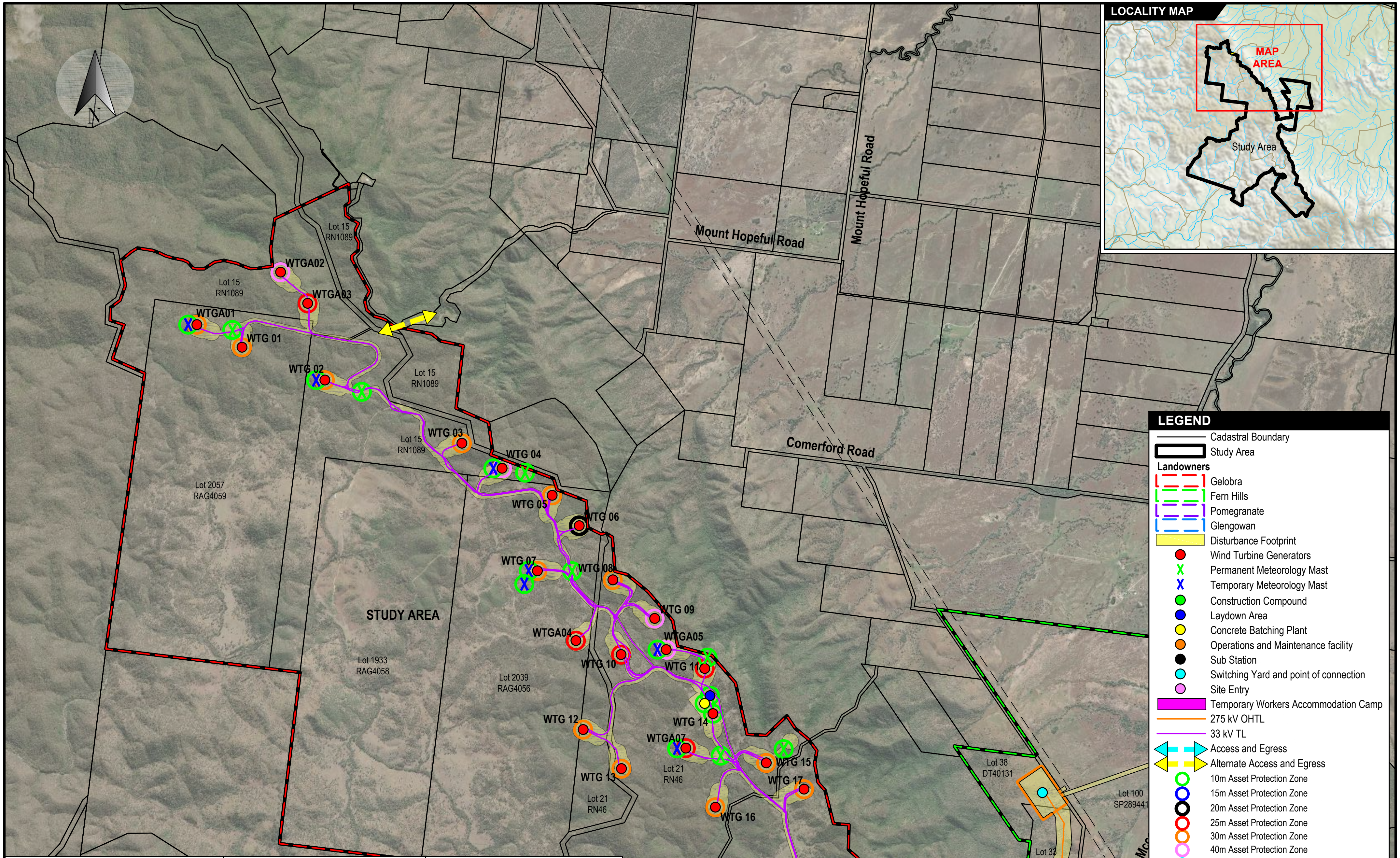
Storage or handling of hazardous chemicals during the construction and the operations and maintenance phases of the Project must not occur in vegetated areas and must be in accordance with *Managing risks of hazardous chemicals in the workplace – Code of Practice* (SWA 2020), applicable safety data sheets, and otherwise in accordance with Queensland *Work Health and Safety Act 2011* and its regulations.

6.10.13 Shut down

The WTGs must be locked in a static position if advised by the QFES that aerial fire-fighting operations are to be undertaken within the properties hosting the Project. Protocols for the operations and maintenance phase of the Project must be explicit about what party has the authority to lock WTGs in a static position.

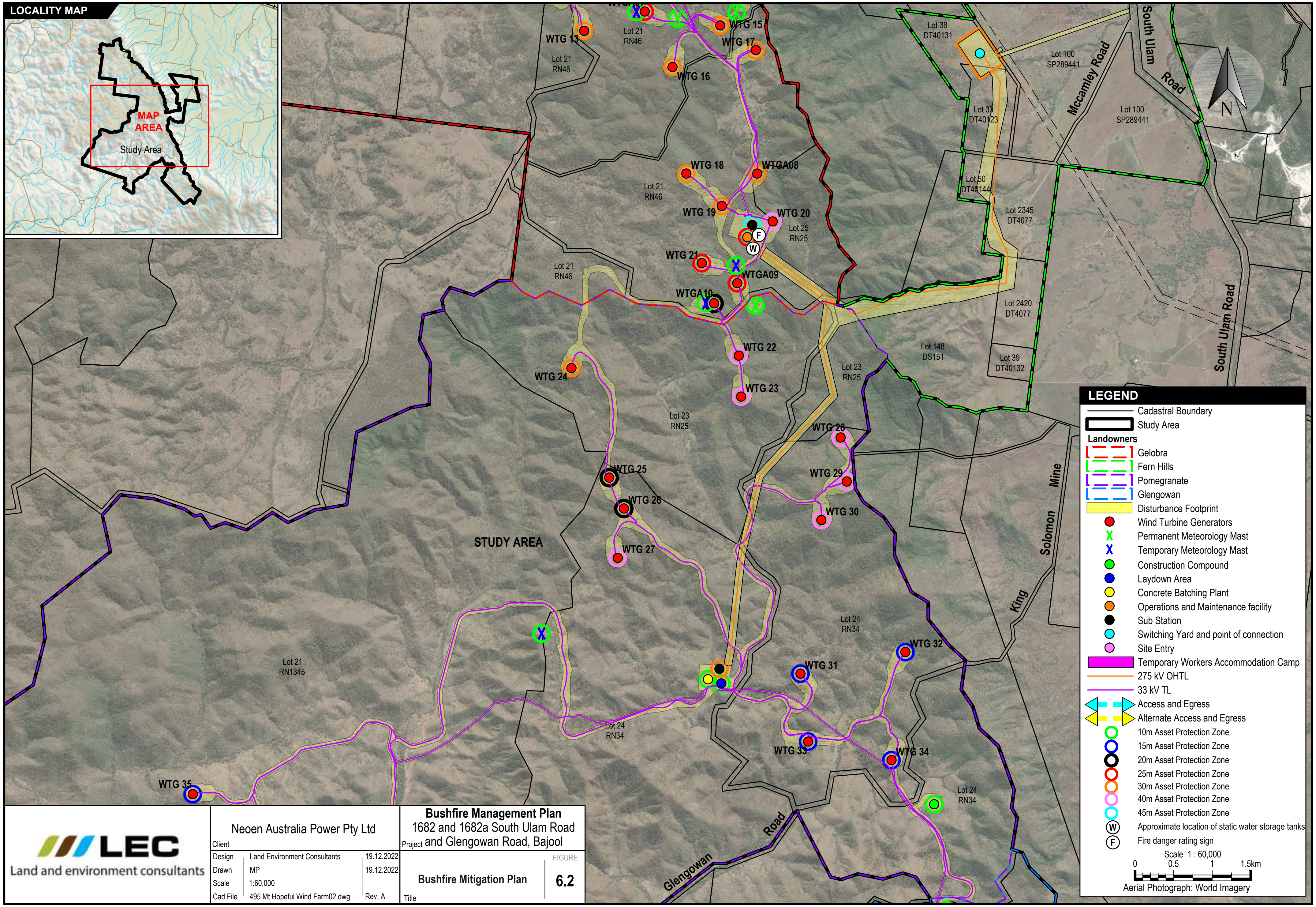
6.10.14 Lighting fires

Lighting fires is prohibited within the Study area (unless requested by the QFES or RFB in response to a bushfire emergency, eg backburning containment lines to protect infrastructure).



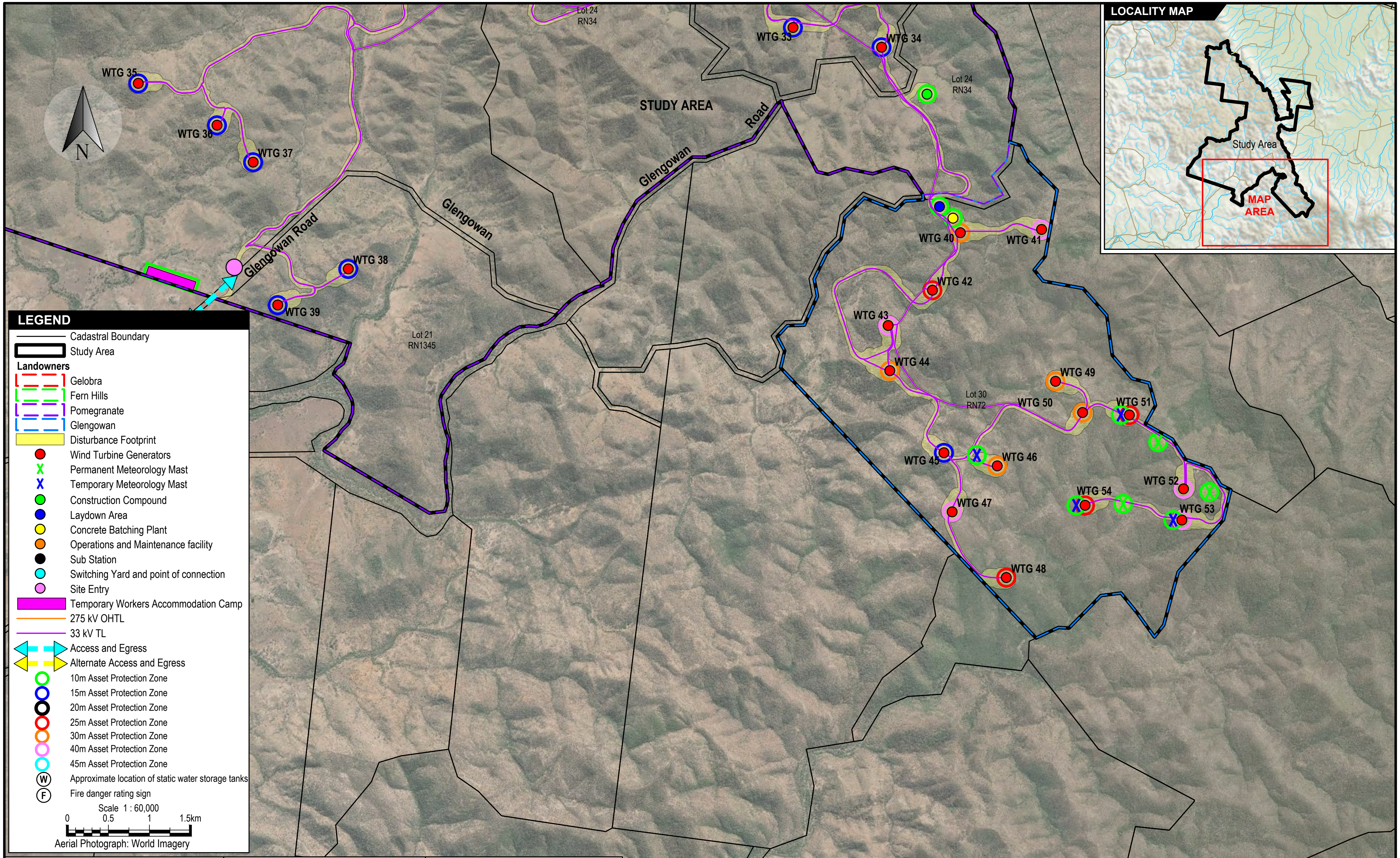
LEC
Land and environment consultants

Client	Neoen Australia Power Pty Ltd	Project	Bushfire Management Plan 1682 and 1682a South Ulam Road and Glengowan Road, Bajool
Design	Land Environment Consultants	19.12.2022	
Drawn	MP	19.12.2022	
Scale	1:60,000		
Cad File	495 Mt Hopeful Wind Farm02.dwg	Rev. A	
Title	Bushfire Mitigation Plan	FIGURE	6.1



LEC Land and environment consultants

Client	Neoen Australia Power Pty Ltd	Project	Bushfire Management Plan 1682 and 1682a South Ulam Road and Glengowan Road, Bajool
Design	Land Environment Consultants	19.12.2022	
Drawn	MP	19.12.2022	
Scale	1:60,000		Title: Bushfire Mitigation Plan
Cad File	495 Mt Hopeful Wind Farm02.dwg	Rev. A	FIGURE 6.2



LEC
Land and environment consultants

Client	Neoen Australia Power Pty Ltd		Project	**Bushfire Management Plan** 1682 and 1682a South Ulam Road and Glengowan Road, Bajool
Design	Land Environment Consultants	19.12.2022	Title	**Bushfire Mitigation Plan**
Drawn	MP	19.12.2022	FIGURE	**6.3**
Scale	1:60,000			
Cad File	495 Mt Hopeful Wind Farm02.dwg	Rev. A		

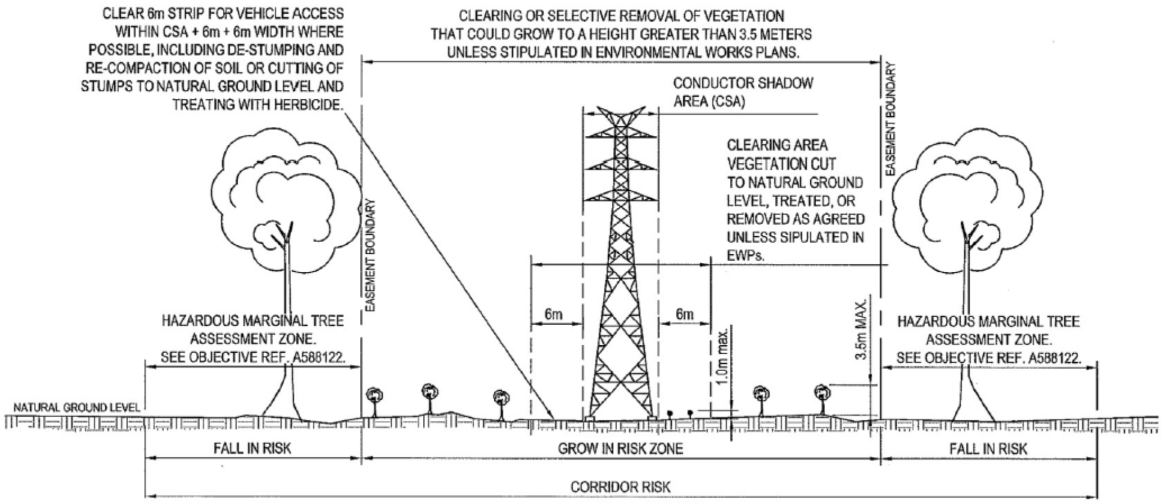


Figure 6.4 Powerlink Queensland vegetation management specifications for high voltage transmission lines

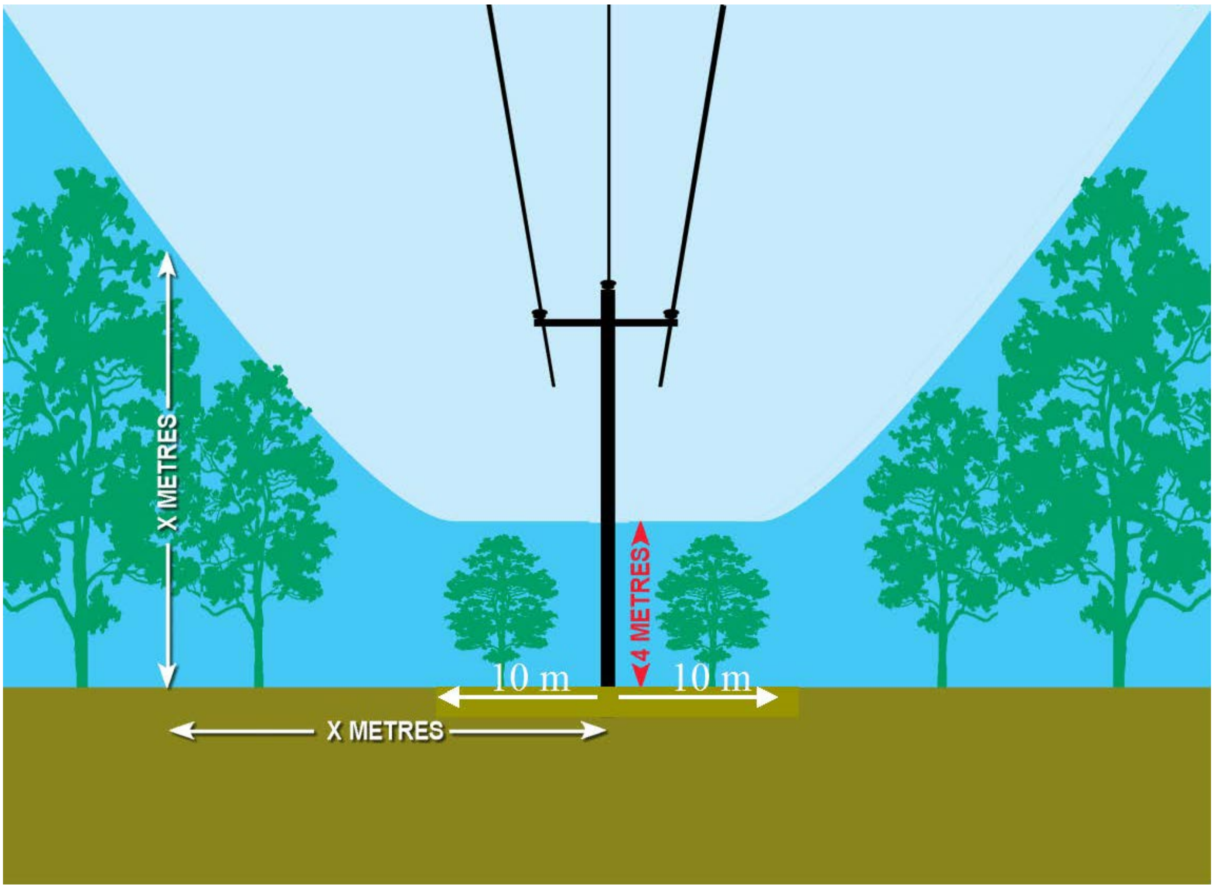


Figure 6.5 Energy Queensland vegetation management specification for overhead transmission lines

7 Closing

This BMP has been prepared for compliance with condition 18a) and b) of the development permit for the Project. It has been technically reviewed and approved by a suitably qualified person, is in general accordance with the requirements of the SPP bushfire prone area overlay code and Bushfire resilient communities. Its preparation involved an in-field inspection of the Study area and consultation with some of the landowners hosting the Project.

The site-specific bushfire hazard assessment in this BMP confirmed that the disturbance footprint of the Project is affected by bushfire hazard and that the construction and the operations and maintenance phases of the Project are subject to compliance with the SPP bushfire prone area overlay code. An assessment of compliance with the SPP bushfire prone area overlay code is provided in Appendix 5.

Mitigation measures that must be implemented during the construction and the operations and maintenance phases of the Project are specified in Chapter 6. Upon appointment, the construction contractor and the operations and maintenance contractor may wish to prepare their own version of this BMP to distil the matters which are specific to their contract or to include corporate documentation or procedures. Notwithstanding, this does not permit the construction contractor or operations and maintenance contractor to change or deviate from the mitigation measures specified in Chapter 6.

There is an opportunity for refining the APZs specified in Chapter 6 through detailed design and micro-siting of the Project's infrastructure.

Compliance with condition 18b)ii of the development permit for the Project requires the draft version of this BMP to be submitted to the QFES for their review and comment. Consideration of QFES comments will be undertaken during the finalisation of this BMP. Compliance with condition 18c) requires details and confirmation that consultation with the QFES has been undertaken to be provided to the Office of The Assistant Commissioner, Central Region QFES at sdu@qfes.qld.gov.au. Compliance with condition 18d) requires the final version of the BMP to be submitted to:

- Department of State Development, Infrastructure, Local Government and Planning at windfarms@dsdilgp.qld.gov.au;
- Banana Shire Council at enquiries@banana.qld.gov.au;
- Rockhampton Regional Council at enquiries@rrc.qld.gov.au; and
- QFES at sdu@qfes.qld.gov.au.

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Appendix 1 Summary of site observations

Summary of site observations at infrastructure areas

Infrastructure	Catalyst VHC	Ground truthed VHC	Notes
Wind turbine generators (WTGs)			
WTG 1	VHC 10.1 *Spotted gum dominated open forests* (**VHC 10.1**)	VHC 10.1	Continuous forest vegetation on 15° slope
WTG 2	VHC 10.1	VHC 10.1	Continuous forest vegetation on 14° slope
WTG 3	VHC 10.1	VHC 10.1	Continuous forest vegetation on 12° slope
WTG 4	VHC 10.1	VHC 10.1	Continuous forest vegetation on 18° slope
WTG 5	VHC 10.1	VHC 10.1	Continuous forest vegetation on 11° slope
WTG 6	VHC 10.1	VHC 10.1	Continuous forest vegetation on 5° slope
WTG 7	VHC 10.1 and VHC 40.4 *Low grass or tree over in rural areas* (**VHC 40.4**)	VHC 10.1	Continuous forest vegetation on 15° slope
WTG 8	VHC 10.1	VHC 10.1	Continuous forest vegetation on 13° slope
WTG 9	VHC 10.1	VHC 10.1	Continuous forest vegetation on 16° slope
WTG 10	VHC 10.1	VHC 10.1	Continuous forest vegetation on 10° slope
WTG 11	VHC 40.4	VHC 10.1	Continuous forest vegetation on 6° slope
WTG 12	VHC 10.1	-	Not ground-truthed
WTG 13	VHC 10.1	-	Not ground-truthed
WTG 14	VHC 10.1	VHC 40.4	Grassland with low tree cover on 7° slope
WTG 15	VHC 10.1 and VHC 40.4	VHC 10.1	Continuous forest vegetation on 13° slope
WTG 16	VHC 10.1	-	Not ground-truthed
WTG 17	VHC 40.4	-	Not ground-truthed
WTG 18	VHC 10.1	-	Not ground-truthed
WTG 19	VHC 10.1	VHC 10.1	Continuous forest vegetation on 11° slope
WTG 20	VHC 10.1 and VHC 40.4	VHC 10.1	Continuous forest vegetation on 20° slope
WTG 21	VHC 10.1	VHC 10.1	Continuous forest vegetation on 8° slope
WTG 22	VHC 10.1	VHC 10.1	Continuous forest vegetation on 18° slope
WTG 23	VHC 10.1	VHC 10.1	Continuous forest vegetation on 18° slope
WTG 24	VHC 10.1	VHC 10.1	Continuous forest vegetation on 13° slope
WTG 25	VHC 10.1	VHC 10.1	Continuous forest vegetation on 5° slope
WTG 26	VHC 10.1	-	Not ground-truthed
WTG 27	VHC 10.1	-	Not ground-truthed
WTG 28	VHC 10.1	-	Not ground-truthed
WTG 29	VHC 10.1	-	Not ground-truthed
WTG 30	VHC 10.1	-	Not ground-truthed

Summary of site observations at infrastructure areas

Infrastructure	Catalyst VHC	Ground truthed VHC	Notes
WTG 31	VHC 10.1	VHC 40.4	Grassland with low tree cover on 20° slope
WTG 32	VHC 10.1	VHC 40.4	Grassland with low tree cover on 21° slope
WTG 33	VHC 10.1	VHC 40.4	Grassland with low tree cover on 16° slope
WTG 34	VHC 10.1 and VHC 40.4	VHC 40.4	Grassland with low tree cover on 23° slope
WTG 35	VHC 13.2 *Dry to moist eucalypt woodlands on undulating metamorphics and granite* (**VHC 13.2**) and VHC 40.4	VHC 40.4	Grassland with low tree cover on 14° slope
WTG 36	VHC 40.4	-	Not ground-truthed
WTG 37	VHC 13.2	-	Not ground-truthed
WTG 38	VHC 13.2	VHC 40.4	Grassland with low tree cover on 21° slope
WTG 39	VHC 13.2	VHC 40.4	Grassland with low tree cover on 17° slope
WTG 40	VHC 10.1	VHC 10.1	Continuous forest vegetation on 13° slope
WTG 41	VHC 10.1	VHC 10.1	Continuous forest vegetation on 16° slope
WTG 42	VHC 10.1	VHC 10.1	Continuous forest vegetation on 6° slope
WTG 43	VHC 40.4	VHC 10.1	Continuous forest vegetation on 19° slope
WTG 44	VHC 10.1	VHC 10.1	Continuous forest vegetation on 14° slope
WTG 45	VHC 10.1 and VHC 40.4	VHC 40.4	Grassland with low tree cover on 17° slope
WTG 46	VHC 40.4	VHC 10.1	Continuous forest vegetation on 12° slope
WTG 47	VHC 10.1	VHC 10.1	Continuous forest vegetation on 16° slope
WTG 48	VHC 7.1 *Semi-evergreen to deciduous microphyll vine forest* (**VHC 7.1**)	-	Not ground-truthed
WTG 49	VHC 10.1	-	Not ground-truthed
WTG 50	VHC 10.1	VHC 10.1	Continuous forest vegetation on 12° slope
WTG 51	VHC 13.2	VHC 13.2	Continuous forest vegetation on 10° slope
WTG 52	VHC 10.1	VHC 10.1	Continuous forest vegetation on 20° slope
WTG 53	VHC 10.1	VHC 10.1	Continuous forest vegetation on 20° slope
WTG 54	VHC 10.1	VHC 10.1	Continuous forest vegetation on 9° slope
WTG A01	VHC 10.1	VHC 10.1	Continuous forest vegetation on 15° slope
WTG A02	VHC 10.1	VHC 10.1	Continuous forest vegetation on 17° slope
WTG A03	VHC 10.1	VHC 10.1	Continuous forest vegetation on 9° slope
WTG A04	VHC 10.1	VHC 10.1	Continuous forest vegetation on 10° slope
WTG A05	VHC 10.1	VHC 10.1	Continuous forest vegetation on 17° slope

Summary of site observations at infrastructure areas

Infrastructure	Catalyst VHC	Ground truthed VHC	Notes
WTG A07	VHC 10.1	VHC 10.1	Continuous forest vegetation on 8° slope
WTG A08	VHC 10.1	VHC 10.1	Continuous forest vegetation on 12° slope
WTG A09	VHC 10.1	VHC 10.1	Continuous forest vegetation on 9° slope
WTG A10	VHC 10.1	VHC 10.1	Continuous forest vegetation on 0° slope
Permanent meteorology masts			
1	VHC 10.1	-	Not ground-truthed
2	VHC 10.1	-	Not ground-truthed
3	VHC 10.1	VHC 10.1	Continuous forest vegetation on 14° slope
4	VHC 10.1	VHC 10.1	Continuous forest vegetation on 15° slope
5	VHC 10.1	-	Not ground-truthed
6	VHC 10.1 and VHC 40.4	-	Not ground-truthed
7	VHC 10.1	-	Not ground-truthed
8	VHC 10.1	-	Not ground-truthed
9	VHC 10.1	-	Not ground-truthed
10	VHC 10.1	-	Not ground-truthed
Infrastructure			
Laydown area and concrete batching plant near WTG 14	VHC 40.4	VHC 40.4	Grassland with low tree cover on 3° slope
Switching yard and point of connection	VHC 16.2 *Eucalyptus dominated woodland on drainage lines and alluvial plains* (**VHC 16.2**) and VHC 40.4	VHC 40.4	Grassland with low tree cover on 2° slope
Substation near WTG 20	VHC 10.1	VHC 10.1	Continuous forest vegetation on 5° slope
Operations and Maintenance facility near WTG 20	VHC 10.1	VHC 10.1	Continuous forest vegetation on 8° slope
Substation near WTG 31	VHC 10.1	VHC 40.4	Grassland with low tree cover on 5° slope
Laydown area and concrete batching plant near WTG 31	VHC 10.1 and VHC 40.4	VHC 40.4	Grassland with low tree cover on 6° slope
Construction compound near WTG 34	VHC 10.1 and VHC 40.4	-	Not ground-truthed
Laydown area and concrete	VHC 10.1 and VHC 40.4	VHC 10.1	Continuous forest vegetation on 17° slope

Summary of site observations at infrastructure areas

Infrastructure	Catalyst VHC	Ground truthed VHC	Notes
batching plant near WTG 40			
Temporary worker's accommodation camp	VHC 16.2 and VHC 40.4	-	Not ground-truthed
275 kilovolt (kV) overhead transmission line (OHTL)			
275 kV OHTL in Fern Hills	VHC 7.1, VHC 16.2, VHC 10.1, VHC 13.2 and VHC 40.4	VHC 40.4	Grassland with low tree cover on 2° slope
275 kV OHTL in Gelobra	VHC 10.1	VHC 10.1	Continuous forest vegetation on 8° slope
275 kV OHTL in Pomegranate	VHC 7.1, VHC 10.1 and VHC 40.4	VHC 40.4	Grassland with low tree cover on 5° slope.

Appendix 2 Photographs of infrastructure areas


Photograph 1 VHC 10.1 at WTG 1


Photograph 2 VHC 10.1 at WTG 2


Photograph 3 VHC 10.1 at WTG 3


Photograph 4 VHC 10.1 at WTG 4


Photograph 5 VHC 10.1 at WTG 5


Photograph 6 VHC 10.1 at WTG 6


Photograph 7 VHC 10.1 at WTG 7


Photograph 8 VHC 10.1 at WTG 8


Photograph 9 VHC 10.1 at WTG 9


Photograph 10 VHC 10.1 at WTG 10


Photograph 11 VHC 10.1 at WTG 11


Photograph 12 VHC 40.4 at WTG 14


Photograph 13 VHC 10.1 at WTG 15


Photograph 14 VHC 10.1 at WTG 19


Photograph 15 VHC 10.1 at WTG 20


Photograph 16 VHC 10.1 at WTG 21


Photograph 17 VHC 10.1 at WTG 22


Photograph 18 VHC 10.1 at WTG 23


Photograph 19 VHC 10.1 at WTG 24


Photograph 20 VHC 10.1 at WTG 25


Photograph 21 VHC 40.4 at WTG 31


Photograph 22 VHC 40.4 at WTG 32


Photograph 23 VHC 40.4 at WTG 33


Photograph 24 VHC 40.4 at WTG 34

Photograph 25 VHC 40.4 at WTG 35

Photograph 26 VHC 40.4 at WTG 38

Photograph 27 VHC 40.4 at WTG 39

Photograph 28 VHC 10.1 at WTG 40

Photograph 29 VHC 10.1 at WTG 41

Photograph 30 VHC 10.1 at WTG 42

Photograph 31 VHC 10.1 at WTG 43

Photograph 32 VHC 10.1 at WTG 44


Photograph 33 VHC 40.4 at WTG 45


Photograph 34 VHC 10.1 at WTG 46

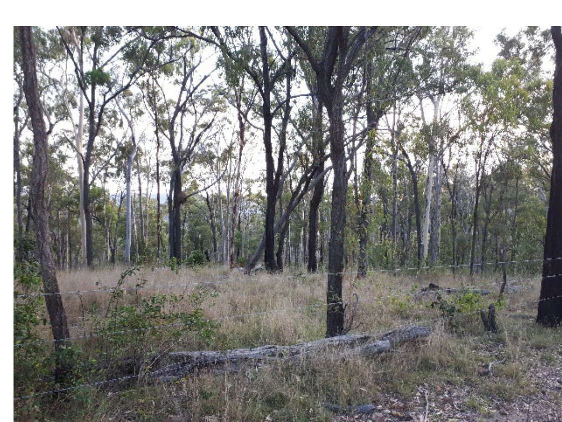

Photograph 35 VHC 10.1 at WTG 47


Photograph 36 VHC 10.1 at WTG 50


Photograph 37 VHC 13.2 at WTG 51


Photograph 38 VHC 10.1 at WTG 52


Photograph 39 VHC 10.1 at WTG 53


Photograph 40 VHC 10.1 at WTG 54


Photograph 41 VHC 10.1 at WTG A01


Photograph 42 VHC 10.1 at WTG A02


Photograph 43 VHC 10.1 at WTG A03


Photograph 44 VHC 10.1 at WTG A04


Photograph 45 VHC 10.1 at WTG A05


Photograph 46 VHC 10.1 at WTG A07


Photograph 47 VHC 10.1 at WTG A08


Photograph 48 VHC 10.1 at WTG A09

Photograph 49 VHC 10.1 at WTG A10

Photograph 50 VHC 10.1 at permanent meteorology mast 3

Photograph 51 VHC 10.1 at permanent meteorology mast 4

Photograph 52 VHC 40.4 at laydown and concrete batching plant near WTG 14

Photograph 53 VHC 10.1 at substation near WTG 20

Photograph 54 VHC 10.1 at operations and maintenance facility near WTG 20


Photograph 55 VHC 40.4 at substation WTG 31


Photograph 56 VHC 40.4 at laydown and concrete batching plant near WTG 31


Photograph 57 VHC 10.1 at laydown area and concrete batching plant near WTG 40


Photograph 58 VHC 40.4 at 275 kV OHTL in Fern Hills


Photograph 59 VHC 10.1 at 275 kV OHTL in Gelobra


Photograph 60 VHC 40.4 at 275 kV OHTL in Pomegranate

Photograph 61 VHC 40.4 at switching yard and point of connection

Appendix 3 Potential bushfire intensity calculations

Potential bushfire intensity calculations

Infrastructure	VHC	Potential fuel load (t/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
Wind turbine generators (WTGs)					
WTG 1	VHC 10.1 *Spotted gum dominated open forests* (**VHC 10.1**)	20.8	15	52,103	Very high
WTG 2	VHC 10.1	20.8	14	48,629	Very high
WTG 3	VHC 10.1	20.8	12	42,361	Very high
WTG 4	VHC 10.1	20.8	18	64,086	Very high
WTG 5	VHC 10.1	20.8	11	39,536	High
WTG 6	VHC 10.1	20.8	5	26,134	High
WTG 7	VHC 10.1	20.8	15	52,103	Very high
WTG 8	VHC 10.1	20.8	13	45,387	Very high
WTG 9	VHC 10.1	20.8	16	55,825	Very high
WTG 10	VHC 10.1	20.8	10	36,900	High
WTG 11	VHC 10.1	20.8	6	28,000	High
WTG 12[3]	VHC 10.1	20.8	15	52,103	Very high
WTG 13[3]	VHC 10.1	20.8	15	52,103	Very high
WTG 14	VHC 40.4 *Low grass or tree over in rural areas* (**VHC 40.4**)	5	7	1,734	Non-bushfire hazard class[2]
WTG 15	VHC 10.1	20.8	13	45,387	Very high
WTG 16[3]	VHC 10.1	20.8	15	52,103	Very high
WTG 17[3]	VHC 10.1	20.8	13	45,387	Very high
WTG 18[3]	VHC 10.1	20.8	11	39,536	High
WTG 19	VHC 10.1	20.8	11	39,536	High
WTG 20	VHC 10.1	20.8	20	73,569	Very high
WTG 21	VHC 10.1	20.8	8	32,144	High
WTG 22	VHC 10.1	20.8	18	64,086	Very high
WTG 23	VHC 10.1	20.8	18	64,086	Very high
WTG 24	VHC 10.1	20.8	13	45,387	Very high
WTG 25	VHC 10.1	20.8	5	26,134	High
WTG 26[3]	VHC 10.1	20.8	5	26,134	High
WTG 27[3]	VHC 10.1	20.8	18	64,086	Very high
WTG 28[3]	VHC 10.1	20.8	18	64,086	Very high
WTG 29[3]	VHC 10.1	20.8	18	64,086	Very high
WTG 30[3]	VHC 10.1	20.8	18	64,086	Very high

Potential bushfire intensity calculations

Infrastructure	VHC	Potential fuel load (t/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
WTG 31	VHC 40.4	5	20	4,251	Medium[2]
WTG 32	VHC 40.4	5	20[4]	4,251	Medium[2]
WTG 33	VHC 40.4	5	16	3,226	Non-bushfire hazard class[2]
WTG 34	VHC 40.4	5	20[4]	4,251	Medium[2]
WTG 35	VHC 40.4	5	14	2,810	Non-bushfire hazard class[2]
WTG 36[3]	VHC 40.4	5	14	2,810	Non-bushfire hazard class[2]
WTG 37[3]	VHC 40.4	5	14	2,810	Non-bushfire hazard class[2]
WTG 38	VHC 40.4	5	20[4]	4,251	Medium[2]
WTG 39	VHC 40.4	5	17	3,456	Non-bushfire hazard class[2]
WTG 40	VHC 10.1	20.8	13	45,387	Very high
WTG 41	VHC 10.1	20.8	16	55,825	Very high
WTG 42	VHC 10.1	20.8	6	28,000	High
WTG 43	VHC 10.1	20.8	19	68,664	Very high
WTG 44	VHC 10.1	20.8	14	48,629	Very high
WTG 45	VHC 40.4	5	17	3,456	Non-bushfire hazard class[2]
WTG 46	VHC 10.1	20.8	12	42,361	Very high
WTG 47	VHC 10.1	20.8	16	55,825	Very high
WTG 48[3]	Non-remnant VHC 7.1 *Semi-evergreen to deciduous microphyll vine forest* (**VHC 7.1**)	12	16	20,485	High
WTG 49[3]	VHC 10.1	20.8	12	42,361	Very high
WTG 50	VHC 10.1	20.8	12	42,361	Very high
WTG 51	VHC 13.2 *Dry to moist eucalypt woodlands on undulating metamorphics and granite* (**VHC 13.2**)	14.4	10	17,686	Medium
WTG 52	VHC 10.1	20.8	20	73,569	Very high
WTG 53	VHC 10.1	20.8	20	73,569	Very high
WTG 54	VHC 10.1	20.8	9	34,440	High
WTG A01	VHC 10.1	20.8	15	52,103	Very high

Potential bushfire intensity calculations

Infrastructure	VHC	Potential fuel load (t/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
WTG A02	VHC 10.1	20.8	17	59,813	Very high
WTG A03	VHC 10.1	20.8	9	34,440	High
WTG A04	VHC 10.1	20.8	10	36,900	High
WTG A05	VHC 10.1	20.8	17	59,813	Very high
WTG A07	VHC 10.1	20.8	8	32,144	High
WTG A08	VHC 10.1	20.8	12	42,361	High
WTG A09	VHC 10.1	20.8	9	34,440	High
WTG A10	VHC 10.1	20.8	0	18,508	Medium
Permanent meteorology masts					
1[3]	VHC 10.1	20.8	15	52,103	Very high
2[3]	VHC 10.1	20.8	14	48,629	Very high
3	VHC 10.1	20.8	14	48,629	Very high
4	VHC 10.1	20.8	15	52,103	Very high
5[3]	VHC 10.1	20.8	9	34,440	High
6[3]	VHC 10.1	20.8	8	32,144	High
7[3]	VHC 10.1	20.8	9	34,440	High
8[3]	VHC 10.1	20.8	20	73,569	Very high
9[3]	VHC 10.1	20.8	20	73,569	Very high
10[3]	VHC 10.1	20.8	9	34,440	High
Infrastructure					
Laydown area and concrete batching plant near WTG 14	VHC 40.4	5	3	1,315	Non-bushfire hazard class[2]
Switching yard and point of connection	VHC 40.4	5	2	1,228	Non-bushfire hazard class[2]
Substation near WTG 20	VHC 10.1	20.8	5	26,134	High
Operations and Maintenance facility near WTG 20	VHC 10.1	20.8	8	32,144	High
Substation near WTG 31	VHC 40.4	5	5	1,510	Non-bushfire hazard class[2]
Laydown area and concrete batching plant near WTG 31	VHC 40.4	5	6	1,618	Non-bushfire hazard class[2]
Construction compound near WTG 34[3]	VHC 40.4	5	4	1,409	Non-bushfire hazard class[2]

Potential bushfire intensity calculations

Infrastructure	VHC	Potential fuel load (t/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
Laydown area and concrete batching plant near WTG 40	VHC 10.1	20.8	17	59,813	Very high
Temporary worker's accommodation camp[3]	VHC 40.4	5	1	1,146	Non-bushfire hazard class[2]
275 kilovolt (kV) overhead transmission line (OHTL)					
275 kV OHTL in Fern Hills	VHC 40.4	5	2	1,228	Non-bushfire hazard class[2]
275 kV OHTL in Gelobra	VHC 10.1	20.8	8	32,144	High
275 kV OHTL in Pomegranate [5]	VHC 10.1	20.8	20	73,569	Very high

Notes

1 Fuel load taken from *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'* (QFES 2019) (**Bushfire resilient communities**).

2 VHC 40.4 is defined as grass fire prone in Bushfire resilient communities.

3 Infrastructure site not inspected - based on information in Catalyst and slope measured using the path tool in Google Earth or a slope measured in the field at nearby infrastructure.

4 Actual slope is > 20°. Slope was set in accordance with Section 4.2.4 of Bushfire resilient communities where max slope is set as 20° down slope or 15° up slope.

5 This infrastructure spans over a large area of land and ground-truthing did not cover the entire infrastructure area. Therefore, VHC is based on Catalyst and slope is measured using the path tool in Google Earth or a slope measured in the field at nearby infrastructure to determine the worst case bushfire attack scenario for this infrastructure.

Appendix 4 Radiant heat exposure assessment

Bushfire attack – WTG 6, WTG 25, WTG 26, WTG A10 and substation near WTG 20

- Forest fire danger index - 69
- Vegetation - VHC 10.1 *Spotted gum dominated open forests*
- Understorey fuel load – 19.3 t/ha[1]
- Total fuel load – 20.8 t/ha[1]
- Effective slope – 5° down slope
- Site slope – 0° slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load taken from *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'* (QFES 2019) (**Bushfire resilient communities**)

FPA AUSTRALIA | FLAMESOL

Calculated November 21, 2022, 5:16 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	69	Rate of spread	2.25 km/h
Vegetation classification	Forest	Flame length	17.16 m
Understorey fuel load	19.3 t/ha	Flame angle	52 °, 62 °, 70 °, 74 °, 75 ° & 82 °
Total fuel load	20.8 t/ha	Elevation of receiver	6.76 m, 7.57 m, 8.06 m, 8.24 m, 8.279999999999999 m & 8.49 m
Vegetation height	n/a	Fire intensity	24,248 kW/m
Effective slope	5 °	Transmissivity	0.867, 0.846, 0.819, 0.793, 0.78 & 0.721
Site slope	0 °	Viewfactor	0.6025, 0.4488, 0.3042, 0.2067, 0.1679 & 0.0455
Flame width	100 m	Minimum distance to < 40 kW/m²	14.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	18.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	27.1 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	37.6 m
		Minimum distance to < 10 kW/m²	44.2 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Bushfire attack – WTG 10, WTG 11, WTG 21, WTG 42, WTG 54, WTG A03, WTG A04, WTG A07, WTG A09 and operations and maintenance facility near WTG 20

- Forest fire danger index - 69
- Vegetation - VHC 10.1 *Spotted gum dominated open forests*
- Understorey fuel load – 19.3 t/ha[1]
- Total fuel load – 20.8 t/ha[1]
- Effective slope – 10° down slope
- Site slope – 6° down slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load taken from Bushfire Resilient Communities.

FPA AUSTRALIA | FLAMESOL

Calculated November 21, 2022, 5:18 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	69	Rate of spread	3.18 km/h
Vegetation classification	Forest	Flame length	23.2 m
Understorey fuel load	19.3 t/ha	Flame angle	55 °, 65 °, 72 °, 77 °, 78 ° & 86 °
Total fuel load	20.8 t/ha	Elevation of receiver	7.61 m, 8 m, 7.48 m, 6.47 m, 5.71 m & 0 m
Vegetation height	n/a	Fire intensity	34,239 kW/m
Effective slope	10 °	Transmissivity	0.859, 0.834, 0.804, 0.778, 0.766 & 0.71
Site slope	6 °	Viewfactor	0.6095, 0.4555, 0.3102, 0.2112, 0.1712 & 0.0461
Flame width	100 m	Minimum distance to < 40 kW/m²	17.9 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	23.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	33.8 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	46 m
		Minimum distance to < 10 kW/m²	53.6 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Bushfire attack – WTG 1, WTG 2, WTG 3, WTG 5, WTG 7, WTG 8, WTG 12, WTG 13, WTG 15, WTG 16, WTG 17, WTG 18, WTG 19, WTG 24, WTG 40, WTG 44, WTG 46, WTG 49, WTG 50, WTG A01 and WTG A08

- Forest fire danger index - 69
- Vegetation - VHC 10.1 *Spotted gum dominated open forests*
- Understorey fuel load – 19.3 t/ha[1]
- Total fuel load – 20.8 t/ha[1]
- Effective slope – 15° down slope
- Site slope – 11° down slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load taken from Bushfire Resilient Communities.

Calculated November 21, 2022, 5:20 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	69	Rate of spread	4.49 km/h
Vegetation classification	Forest	Flame length	31.73 m
Understorey fuel load	19.3 t/ha	Flame angle	57 °, 66 °, 73 °, 78 °, 80 ° & 89 °
Total fuel load	20.8 t/ha	Elevation of receiver	8.81 m, 8.58 m, 6.97 m, 4.57 m, 3.01 m & 0 m
Vegetation height	n/a	Fire intensity	48,345 kW/m
Effective slope	15 °	Transmissivity	0.848, 0.819, 0.788, 0.763, 0.752 & 0.697
Site slope	11 °	Viewfactor	0.6194, 0.4642, 0.3163, 0.2148, 0.1743 & 0.047
Flame width	100 m	Minimum distance to < 40 kW/m²	23.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	30.4 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	42.2 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	56.3 m
		Minimum distance to < 10 kW/m²	64.90000000000001 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Bushfire attack – WTG 4, WTG 9, WTG 20, WTG 22, WTG 23, WTG 27, WTG 28, WTG 29, WTG 30, WTG 41, WTG 43, WTG 47, WTG 52, WTG 53, WTG A02 and WTG A05

- Forest fire danger index - 69
- Vegetation - VHC 10.1 *Spotted gum dominated open forests*
- Understorey fuel load – 19.3 t/ha[1]
- Total fuel load – 20.8 t/ha[1]
- Effective slope – 20° down slope
- Site slope – 16° down slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load taken from Bushfire Resilient Communities.

Calculated November 21, 2022, 5:22 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	69	Rate of spread	6.35 km/h
Vegetation classification	Forest	Flame length	43.78 m
Understorey fuel load	19.3 t/ha	Flame angle	58 °, 66 °, 73 °, 78 °, 80 ° & 92 °
Total fuel load	20.8 t/ha	Elevation of receiver	10.02 m, 8.949999999999999 m, 5.96 m, 1.82 m, 0 m & 0 m
Vegetation height	n/a	Fire intensity	68,263 kW/m
Effective slope	20 °	Transmissivity	0.836, 0.805, 0.774, 0.75, 0.74 & 0.6820000000000001
Site slope	16 °	Viewfactor	0.6277, 0.473, 0.3222, 0.2185, 0.1771 & 0.0481
Flame width	100 m	Minimum distance to < 40 kW/m²	29.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	38.5 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	52.2 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	68.3 m
		Minimum distance to < 10 kW/m²	78 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Bushfire attack – WTG 14, switching yard and point of connection and substation near WTG 31 and temporary worker's accommodation

- Forest fire danger index – 69
- Grassland fire danger index – 100
- Vegetation - VHC 40.4 *Continuous low grass or tree cover*
- Understorey fuel load – 5 t/ha[1]
- Total fuel load – 5 t/ha[1]
- Effective slope – 7° down slope
- Site slope – 3° down slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load taken from Bushfire Resilient Communities.

Calculated November 21, 2022, 5:34 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	100	Rate of spread	21.07 km/h
Vegetation classification	Grassland	Flame length	8.789999999999999 m
Understorey fuel load	5 t/ha	Flame angle	56 °, 67 °, 75 °, 80 °, 82 ° & 87 °
Total fuel load	5 t/ha	Elevation of receiver	3.26 m, 3.52 m, 3.47 m, 3.2 m, 2.99 m & 0.74 m
Vegetation height	n/a	Fire intensity	54,436 kW/m
Effective slope	7 °	Transmissivity	0.884, 0.87, 0.851, 0.828, 0.8159999999999999 & 0.745
Site slope	3 °	Viewfactor	0.5874, 0.4345, 0.2926, 0.1974, 0.1606 & 0.044
Flame width	100 m	Minimum distance to < 40 kW/m²	7.2 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	9.800000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	14.6 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	21.5 m
		Minimum distance to < 10 kW/m²	26 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Bushfire attack – WTG 31, WTG 32, WTG 33, WTG 34, WTG 35, WTG 36, WTG 37, WTG 38, WTG 39 and WTG 45

- Forest fire danger index – 69
- Grassland fire danger index – 100
- Vegetation - VHC 40.4 *Continuous low grass or tree cover*
- Understorey fuel load – 5 t/ha[1]
- Total fuel load – 5 t/ha[1]
- Effective slope – 20° down slope
- Site slope – 14° down slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load taken from Bushfire Resilient Communities.

Calculated November 21, 2022, 5:40 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	100	Rate of spread	51.67 km/h
Vegetation classification	Grassland	Flame length	13.77 m
Understorey fuel load	5 t/ha	Flame angle	63 °, 75 °, 84 °, 89 °, 91 ° & 97 °
Total fuel load	5 t/ha	Elevation of receiver	3.56 m, 3.11 m, 1.53 m, 0 m, 0 m & 0 m
Vegetation height	n/a	Fire intensity	133,490 kW/m
Effective slope	20 °	Transmissivity	0.874, 0.855, 0.829, 0.803, 0.79 & 0.729
Site slope	14 °	Viewfactor	0.5973000000000001, 0.4441, 0.3003, 0.2038, 0.166 & 0.0449
Flame width	100 m	Minimum distance to < 40 kW/m²	10.2 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	14.1 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	21.3 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	30.7 m
		Minimum distance to < 10 kW/m²	36.5 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Bushfire attack – WTG 48 and WTG 51

- Forest fire danger index – 69
- Vegetation - VHC 13.2 *Dry to moist eucalypt woodlands on undulating metamorphics and granite* and VHC 7.1 *Semi-evergreen to deciduous microphyll vine forest* (Non-remnant)
- Understorey fuel load – 12.8 t/ha[1]
- Total fuel load – 14.4 t/ha[1]
- Effective slope – 16° down slope
- Site slope – 10° down slope
- Flame width – 100 m

Note 1 Understorey fuel load and total fuel load is based on VHC 13.2 and is taken from Bushfire Resilient Communities.

Calculated November 21, 2022, 5:48 pm (MDc v.4.9)

J22120

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	69	Rate of spread	3.19 km/h
Vegetation classification	Forest	Flame length	22.5 m
Understorey fuel load	12.8 t/ha	Flame angle	58 °, 69 °, 77 °, 81 °, 83 ° & 90 °
Total fuel load	14.4 t/ha	Elevation of receiver	6.56 m, 6.5 m, 5.23 m, 3.25 m, 2 m & 0 m
Vegetation height	n/a	Fire intensity	23,783 kW/m
Effective slope	16 °	Transmissivity	0.86, 0.835, 0.804, 0.779, 0.767 & 0.711
Site slope	10 °	Viewfactor	0.61, 0.4548, 0.3093, 0.2105, 0.1712 & 0.0461
Flame width	100 m	Minimum distance to < 40 kW/m²	16.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	22.7 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	32.5 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	44.6 m
		Minimum distance to < 10 kW/m²	52 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Appendix 5 SPP bushfire prone area overlay code assessment

Performance outcomes	Acceptable outcomes	Compliance assessment
Section A **Reconfiguring a lot (RaL) – where creating lots of more than 2,000 square metres**		
PO1 The subdivision layout: (a) enables future buildings to be located away from slopes and land forms that expose people or property to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO1.1** A development footprint plan is identified for each lot that avoids ridgelines, saddles and crests where slopes exceed 15 per cent.	**Not applicable**
	AO1.2 A development footprint plan is identified for each lot that is separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all development footprint plan boundaries; or (b) a distance that achieves a radiant heat flux level of 29 kW/m2 or less at all development footprint plan boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document.	**Not applicable**
PO2 The subdivision layout enables: (a) future buildings to be located as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) future site access to be located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions.	**AO2** A development footprint plan is identified for each lot that: (a) is located within 60 metres of the street frontage; and (b) sited to enable a route between the development footprint plan and the street frontage with a gradient that does not exceed of 12.5 per cent.	**Not applicable**
Section B		
Reconfiguring a lot (RaL) – where creating lots of 2,000 square metres or less		
PO3 The subdivision layout: (a) avoids creating lots on slopes and land forms that expose people or property to an intolerable risk to life	**AO3.1** The subdivision layout results in lots that are sited so that they are separated from the closest edge to the adjacent mapped medium, high or very high potential	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all lot boundaries; or : (b) a distance that achieves a radiant heat flux level of 29 kW/m^2 or less: (i) at the building envelope, if identified at RaL stage; or (ii) where a building envelope is not identified, at all lot boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. Note – For staged developments, temporary separation areas may be absorbed as part of subsequent stages. Note - Existing cleared areas external to the site may only be used in calculating necessary separation where tenure ensures that the land will remain cleared of hazardous vegetation (for example the land is a road, watercourse or highly managed park in public ownership).	
	AO3.2 The subdivision layout does not create lots that are within bushfire prone areas and on ridgelines, saddles and crests where slopes exceed 15 per cent (roads and parks may be located in these areas).	**Not applicable**
Section C		
Reconfiguring a lot (RaL) – where creating more than 20 lots		
PO4 The subdivision layout is designed to minimise the length of the development perimeter and number of lots exposed to hazardous vegetation. Note – For example, avoid finger-like subdivision patterns or substantive	**AO4** No acceptable outcome is prescribed	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
vegetated corridors between lots.		
PO5 The subdivision layout provides for adequate access and egress and safe evacuation routes, to achieve an acceptable or tolerable risk to people.	**AO5.1** The subdivision layout: (a) avoids the creation of bottle-neck points in the movement network within the development (for example, avoids hourglass patterns); and (b) ensures the road network has sufficient capacity for the evacuating population.	**Not applicable**
	AO5.2 The subdivision layout ensures evacuation routes: (a) direct occupants away from rather than towards or through areas with a greater potential bushfire intensity; and (b) minimise the length of route through bushfire prone areas. Refer Figure 5.	**Not applicable**

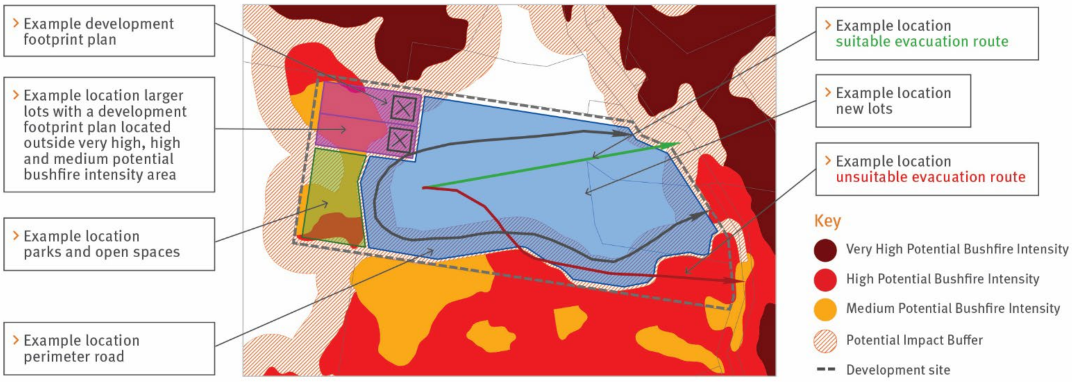
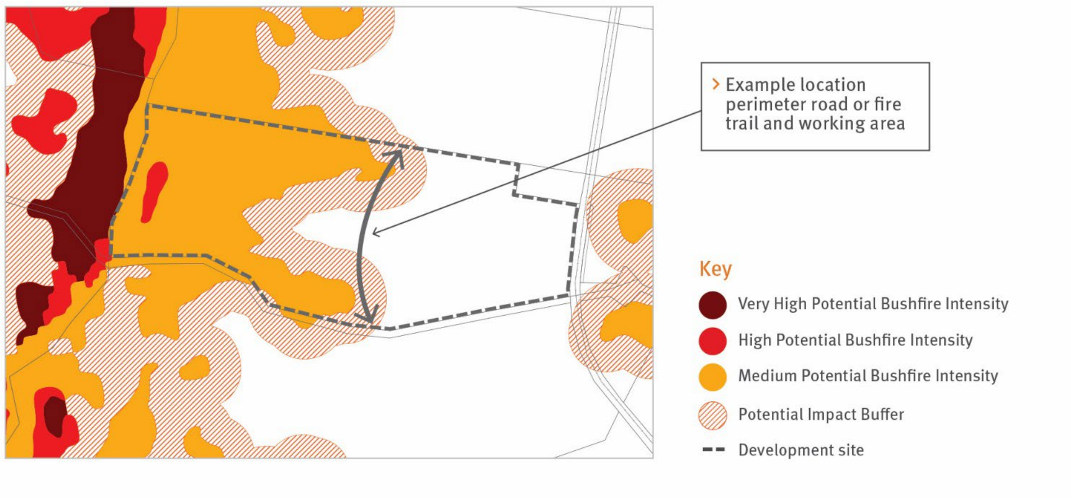


Figure 5 – Subdivision layout and evacuation routes

Performance outcomes	Acceptable outcomes	Compliance assessment
PO6 The subdivision layout provides adequate buffers between hazardous vegetation and development. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous	**AO6.1** The subdivision layout results in an asset protection zone being located to create a separation area from adjacent mapped medium, high or very high potential bushfire intensity areas.	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO6.2** The asset protection zone is comprised of: (a) parks and open spaces; and/or (b) lots greater than 2000 square metres; and/or (c) public roads (termed perimeter roads). Note – Parks and open space may be located within the mapped medium, high and very high potential bushfire intensity areas to create a separation between the development and the balance of the bushfire prone area. Note – Portions of lots greater than 2000 square metres may be located within the mapped medium, high and very high potential bushfire intensity areas. Refer Figure 5.	**Not applicable**
	AO6.3 Where the asset protection zone includes lots greater than 2000 square metres a development footprint plan is identified for each lot that is located in accordance with AO1.2.	**Not applicable**
PO7 Parks or open space provided as part of the asset protection zone do not create additional bushfire prone areas. Note –The undertaking of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO7** Where the asset protection zone includes parks or open spaces, they: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, cultivated gardens and nature strips; or (b) are designed to ensure a potential available fuel load is maintained at less than eight tonnes/hectare in aggregate and with a fuel structure that remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Not applicable**
PO8 Perimeter roads are accessible for fire-fighting vehicles, to facilitate	**AO8.1** Where the asset protection zone includes a perimeter road it: (a) has a two-lane	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
emergency access and operational space for fire- fighting, maintenance works and hazard reduction activities.	sealed carriageway clear of hazardous vegetation; and (b) is connected to the wider public road network at both ends and at intervals of no more than 200 metres; and (c) does not include design elements that may impede access for fire-fighting and maintenance for fire- fighting purposes (for example traffic calming involving chicanes).	
	AO8.2 Where the subdivision contains a reticulated water supply, the road network and fire hydrants are designed and installed in accordance with: (a) *Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots*, Queensland Fire and Emergency Services, 2015, unless otherwise specified by the relevant water entity; and (b) the *Road Planning and Design Manual 2nd edition*, Department of Transport and Main Roads, 2013.	**Not applicable**
Section D		
Reconfiguring a lot (RaL) – where creating additional lots for the purpose of residential development and a reticulated water supply is not provided.		
PO9 The subdivision layout provides for perimeter roads or fire trail and working areas that are accessible by the type of fire-fighting vehicles servicing the area, to facilitate emergency access and operational space for fire-fighting, maintenance works and hazard reduction activities.	**AO9.1** The subdivision layout includes: (a) a fire trail and working area designed and constructed in accordance with the design parameters in Table 6 that separates the residential lot or development footprint plan from adjacent mapped medium, high or very high potential bushfire intensity areas; or (b) a perimeter road designed and constructed in accordance with AO8.1. Refer Figure 6.	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
 *Figure 6 – Siting of fire trail and working area*		
Section E		
Material change of use		
PO10 Site layout achieve an acceptable or tolerable risk to people. Landscape or open space provided as part of the development: (a) acts as a buffer between hazardous vegetation and development; and (b) does not create additional bushfire prone areas. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO10.1** Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas. Refer Figure 7.	**Complies with AO10.1** Asset protection zones (**APZs**) will be established and maintained around above ground infrastructure as specified in Section 6.1 of the bushfire management plan (**BMP**).
	AO10.2 This landscaping and open space comprises protective landscape treatments that: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or (b) are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and that fuel structure remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Complies with AO10.2** APZs will be cleared of vegetation and established as a gravel hardstand area or grass area. A gravel hardstand area will be maintained free of weeds and grass cover. Where establishing a gravel hardstand area is not practical, a grass area will be established and maintained free of woody vegetation and with grass cover which has a height of ≤ 30 centimetres.

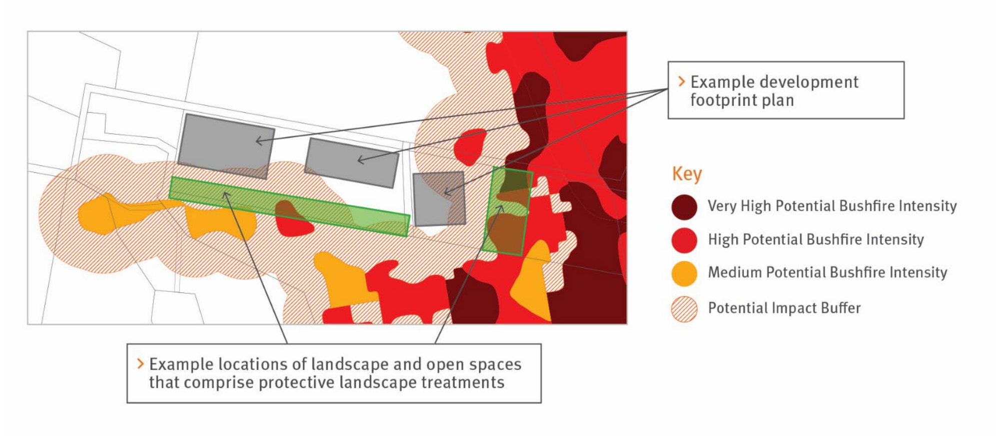
<table>
<tr><th>Performance outcomes</th><th>Acceptable outcomes</th><th>Compliance assessment</th></tr>
<tr><td colspan="3">


Figure 7 – Siting of protective landscape treatments
</td></tr>
<tr>
<td>PO11
The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people.</td>
<td>AO11
If in an isolated location, development establishes direct access to a safe assembly/evacuation area.
Note – Guidance on identifying safe evacuation areas is contained in the QFES Bushfire resilient communities document.</td>
<td>Complies with AO11

Section 6.10.9 of the BMP requires separate emergency response plans to be prepared for the construction and the operations and maintenance phases of the Project.

The emergency response plans must identify the location of safe assembly/evacuation areas and the access routes to these areas.

Section 6.10.9 of the BMP provides guidance for the construction contractor and the operations and maintenance contractor to identify safe assembly and evacuation areas. It states that they must have a gravel or similar hardstand surface and must not be located in areas identified as medium, high and very high potential bushfire intensity and potential impact buffer by the Queensland State Planning Policy Bushfire prone areas overlay map which is shown in Figures 2.2-2.4 of the BMP.</td>
</tr>
<tr>
<td>PO12
If on a lot of over 2,000 m^2, where involving a new premises or an existing premises with an increase in development footprint, development:
(a) locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and
(b) ensures vehicular access is</td>
<td>AO12
No acceptable outcome is prescribed.</td>
<td>Complies with PO12

Specifications for the minimum standard of vehicle access tracks within the Study area are provided in Section 6.4 of the BMP and are based on the design specifications by the New South Wales Rural Fire Service.</td>
</tr>
</table>

Performance outcomes	Acceptable outcomes	Compliance assessment
located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions		
PO13 Development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles. Note – Swimming pools, farm ponds and dams are not considered reliable sources of static water supply in Queensland due to regular drought events. Note for Local Government – Information on how to provide an appropriate static water supply, may form a condition of a development approval. For further information on preferred solutions refer to the QFES *Bushfire resilient communities* document.	**AO13** No acceptable outcome is prescribed	**Complies with PO13** A fire-fighter water storage tank will be installed at the operations and maintenance facility for the operations and maintenance phase of the Project. Design specifications for the fire-fighter water storage tank are based on guidance in *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire'* (QFES 2019) (**Bushfire resilient communities**) and are provided in Section 6.5 of the BMP.
PO14 Vulnerable uses listed in Table 7 are not established or intensified within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides; and (b) there are no other suitable alternative locations within the required catchment; and (c) site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome	**AO14.1** No acceptable outcome is prescribed.	**Not applicable**
PO15 Community infrastructure providing essential services listed in Table 7 are not established within a bushfire prone area unless: (a) there is an overriding need	**AO15** No acceptable outcome is prescribed.	**Complies with PO15** The substations and switching yard could be regarded as community infrastructure providing essential services.

Performance outcomes	Acceptable outcomes	Compliance assessment
in the public interest for the new or expanded service the development provides (for example, there are no other suitable alternative locations that can deliver the required level of service or meet emergency service response times during and immediately after a bushfire event); and (b) the infrastructure can function effectively during and immediately after a bushfire event. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.		Electrical infrastructure within these components of the wind farm will have an APZ which is designed to achieve a radiant heat flux level ≤ 10 kilowatts/square metre (**kW/m²**) at the electrical infrastructure which is considered a tolerable radiant heat flux outcome for community infrastructure providing essential services in Bushfire resilient communities.
PO16 Development avoids or mitigates the risks to public safety and the environment from the manufacture or storage of materials listed in Table 7 that are hazardous in the context of bushfire to an acceptable or tolerable level. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome. Editor's note – In addition to the requirements of this code the *Work Health and Safety Act 2011* and associated Regulation and Guidelines, the *Environmental Protection Act 1994* and the relevant building assessment provisions under the *Building Act 1975* contain requirements for the manufacture and storage of hazardous substances. Information is provided by Business Queensland on the requirements for storing and transporting hazardous chemicals, available at: www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting.	**AO16** No acceptable outcome is prescribed.	**Complies with PO16** Storage or handling of hazardous chemicals during the construction and the operations and maintenance phases of the Project must not occur in vegetated areas and must be in accordance with *Managing risks of hazardous chemicals in the workplace – Code of Practice* (SWA 2020), applicable safety data sheets, and otherwise in accordance with Queensland *Work Health and Safety Act 2011* and its regulations.
Section F		
Where involving an asset protection zone		
PO17 Asset protection zones are designed and managed to ensure they do not	**AO17.1** Landscaping treatments within any asset protection zone comprise only low threat vegetation,	**Complies with AO17.1** APZs will be cleared of vegetation and established as a gravel

Performance outcomes	Acceptable outcomes	Compliance assessment
increase the potential for bushfire hazard. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres. OR	hardstand area or grass area. A gravel hardstand area will be maintained free of weeds and grass cover. Where establishing a gravel hardstand area is not practical, a grass area will be established and maintained free of woody vegetation and with grass cover which has a height of ≤ 30 centimetres.
	AO17.2 Landscaping management within any asset protection zone maintains a: (a) potential available fuel load which is less than eight tonnes/hectare in aggregate; and (b) fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	**Complies with AO17.2** See response to AO17.1.
Section G		
Where planning provisions or conditions of approval require revegetation or rehabilitation		
PO18 Revegetation or rehabilitation areas are designed and managed to ensure they do not result in an unacceptable level of risk or an increase in bushfire intensity level. Note – The undertaking of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO18.1** Required revegetation or rehabilitation: (a) is located outside of any asset protection zone; or (b) maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with acceptable outcome (b).	**Not applicable** There will be no revegetation or rehabilitation within the disturbance footprint.
	AO18.2 Revegetation or rehabilitation of areas located within mapped medium, high or very high potential bushfire intensity areas, revegetate and rehabilitate in a	**Not applicable** There will be no revegetation or rehabilitation within the disturbance footprint.

Performance outcomes	Acceptable outcomes	Compliance assessment
	manner that maintains or reduces the existing fuel load. OR Revegetation or rehabilitation of areas located within the mapped potential impact buffer area, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. Note – The preparation of a vegetation management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	Nonetheless, radiant heat exposure modelling undertaken to determine the width of APZs specified in Section 3.6 of the BMP is based on the potential fuel load for vegetation outside of the disturbance footprint and vegetation hazard classes in Bushfire resilient communities, ie a worst case scenario and considers the potential for natural regeneration of this vegetation to reach the mature state of a functioning regional ecosystem.

APPENDIX M

Supporting Material

Individual owner's consent for making a development application under the *Planning Act 2016*

I, Brett Andrew McCamley

as owner of the premises identified as follows:

148/DS151 | 38/DT40131 | 39/DT40132 | 2420/DT4077 | 50/DT40144 | 2345/DT4077 | 100/SP289441 | 33/DT40123

consent to the making of a development application under the *Planning Act 2016* by:

Neoen Pty Ltd

on the premises described above for:

Any development application that is associated with the delivery of Mount Hopeful Wind Farm project.

B. a. M [signature of owner and 28th January 2021. date signed]

Individual owner's consent for making a development application under the *Planning Act 2016*

I, HARRY WALKER TREELOPPING PTY LTD A.C.N. 104 480 962

as owner of the premises identified as follows:

23/RN25 | 21/RN1345 | 24/RN34

consent to the making of a development application under the *Planning Act 2016* by:

Neoen Pty Ltd

on the premises described above for:

Any development application that is associated with the delivery of Mount Hopeful Wind Farm project.

HL Walker	4/2/21	*[signature of owner and date signed]*

Individual owner's consent for making a development application under the *Planning Act 2016*

I,
Brett Stewart Christie and Renee Michelle Christie

as owner of the premises identified as follows:

30/RN72

consent to the making of a development application under the *Planning Act 2016* by:

Neoen Pty Ltd

on the premises described above for:

Any development application that is associated with the delivery of Mount Hopeful Wind Farm project.

29-1-21	29/1/21	[signature of owner and date signed]

Individual owner's consent for making a development application under the *Planning Act 2016*

I,

LTH Grazing Pty Ltd A.C.N. 133 601 046 as Trustee Under Instrument 713851921

as owner of the premises identified as follows:

15/RN1089 | 2057/RAG4059 | 1933/RAG4058 | 2039/RAG4056 | 21/RN46 | 25/RN25

consent to the making of a development application under the *Planning Act 2016* by:

Neoen Pty Ltd

on the premises described above for:

Any development application that is associated with the delivery of Mount Hopeful Wind Farm project.

3-2-2021

[*signature of Director and date signed*]

Council Chambers
62 Valentine Plains Road
Valentine Plains
Biloela Qld 4715

All Correspondence to
Chief Executive Officer
PO Box 412
Biloela Qld 4715

Phone 07 4992 9500
Fax 07 4992 3493
enquiries@banana.qld.gov.au
www.banana.qld.gov.au
ABN 85 946 116 646

Banana SHIRE
SHIRE OF OPPORTUNITY

Your Reference:
Our Reference: CW: DP: 21-05 (ID1608386)
Contact: Daniel Price

26 May 2021

The Chief Executive Officer
State Assessment and Referral Agency
1 William Street
BRISBANE QLD 4000

Dear Sir/Madam

Re: Letter of Consent – As Road Manager – Mount Hopeful Wind Farm For application of land – Lot 21 RN1345, Lot 24 RN34, Lot 23 RN25, Lot 30 RN72

Banana Shire Council hereby gives consent, as the road manager / authority of the locally controlled roads, to the making of a Material Change of Use Application for Mount Hopeful Wind Farm and an Operational Works Application for Vegetation Clearing application under the *Planning Act 2016*, on land identified as per the provided Mount Hopeful Figures 040321, that is within the Banana Shire Council Local Government area, formally described as:

- Lot 21 RN1345
- Lot 24 RN34
- Lot 23 RN25
- Lot 30 RN72
- Road Reserve

This consent is given on a basis for those parts of the proposed development that will cross local roads, subject to conditions detailed in Attachment 1, and is not given as landowner's consent of the land or the roads.

The proponent must manage the risk of transporting the turbines in a manner that suits the existing road network. It is to be noted that the roads are used by the public, and as such shall not be closed.

Should you have any queries regarding this matter, please contact Council's Manager of Planning Services via enquires@banana.qld.gov.au or (07) 4992 9500.

Yours sincerely

Chris Whitaker
Director Infrastructure Services
Banana Shire Council

Attachment 1

Conditions of Consent

1. Banana Shire Council bears no responsibility to the maintenance nor liability of any future constructed roads as part of this development.
2. This consent does not exempt the applicant or development owner from completing heavy vehicle clearances for any oversized loads.
3. The consent does not exempt the applicant or development owner from completing operational works or minor works applications.
4. Banana Shire Council bears no responsibility of rehabilitation on any disturbed vegetation as part of the application and any subsequent approvals. This responsibility is to the applicant or development owner.
5. All road reserves are to remain as road reserves and the Material Change of Use does not include road reserve land parcels.

17 June 2021

Our Ref:	18325070 / 8026
Your Ref:	7053_R16
Enquiries:	Regional Services
Telephone:	07 4932 9000 or 1300 22 55 77
Fax:	07 4936 8862 or 1300 22 55 79
Email:	enquiries@rrc.qld.gov.au

Umwelt (Australia) Pty Ltd
PO Box 1570
BRISBANE QLD 4000

ATTENTION: RENEE BROZOVICH

Dear Ms Brozovich

PROPOSED WORK – MOUNT HOPEFUL WIND FARM

Receipt is acknowledged of your emails dated 5 and 17 March 2021, concerning the proposed wind farm development and the use of a variety of roads around Mount Hopeful.

This letter supersedes our previous letter dated 7 May 2021. This letter serves as Council's written in principal agreement to the application to use the roads, as detailed in the correspondence "Mount Hopeful Wind Farm, Letter of Consent Request" dated 5 March 2021, subject to the following conditions:

1. The applicant submits a Road Reserve Works Permit Application for the works prior to the commencement of construction. (see attached)
2. Formal plans showing affected roads or road reserves showing area being affected shall be provided to Council prior to commencement on site.
3. A visual condition survey is undertaken by a Registered Professional Engineer Queensland (RPEQ) of the affected roads prior to any usage of the roads. This survey is to determine the current condition of the road. Use of the RACAS or other photographic system is preferred.
4. The Applicant is required to undertake regular inspections of the affected roads during the construction phase to ensure that the roads remain trafficable and safe.
5. The Applicant is required to maintain the affected roads in the same condition, at the applicant's cost, throughout the construction of the wind farm. A RPEQ shall provide a certified report at the end of the construction period that the roads have been maintained to the same condition.
6. The Applicant is required to remove any temporary infrastructure, including gravel pads, from the road reserve once the construction of the wind farm is complete.
7. The Applicant will need to submit applications to the National Heavy Vehicle Regulator for obtaining permits for use of any formed roads.
8. All work to maintain the roads at its current condition must be certified by a RPEQ.
9. Where any assets are to be installed in the road reserve it is imperative that the correct property boundaries are ascertained by Neoen (Australia) Pty Ltd and that cables, plant, etc. are erected on the approved true alignment.

10. Cable markers for all conduit crossings of the roadway are to be placed on the outside of the guideposts on unsealed sections and on one meter of the edge of sealed sections.
11. Plastic warning tape is to be placed in the excavation above all cable locations.
12. Any clearing of vegetation is required to comply with the *Nature Conservation Act 1992*.
13. All timber felled on the road reserve by Neoen (Australia) Pty Ltd or its contractors, including stumps and roots, within 3m of the construction centre line shall be removed from the road reserve.
14. Resulting vegetation should be chipped, but if this option is not available, then it may be burnt in accordance with the *Fire and Emergency Service Act 1990*.
15. The proposed method of treatment of cultivated or ornamental vegetation on roads or other reserves under Council control shall be conveyed to the Manager Civil Operations, not less than 24 hours before work is to commence.
16. The gravel roads shall be maintained to minimise dust issues for residents and workers.

If you have any further queries relating to this matter please contact me on 1300 22 55 77.

Yours faithfully

Corrie Claassen
Acting Manager Civil Operations
Regional Services

Enc Road Reserve Works Permit Application Form

Author: Rayden Smith
Ref number: 2021/000957
Unit: Land Administration and Acquisitions
Phone: (07) 4837 3378

Queensland Government

Department of Resources

21 May 2021

Renee Brozovich
Umwelt (Australia) Pty Limited
PO Box 1570
BRISBANE QLD 4000

Dear Renee

Reference is made to the request for owner's consent on behalf of Neoen Australia Pty Limited required to accompany the development application for a Material Change of Use (Wind Farm) and Operational Works (Clearing Native Vegetation) with part of the proposed works to be located within unnamed road reserve adjoining Lot 30 on RN72.

The department hereby gives owner's consent to the above development application for a Material Change of Use (Wind Farm) and Operational Works (Clearing Native Vegetation) in accordance with section 51(2) of the *Planning Act 2016* as shown on attached Figure 1.1. The owner's consent is subject to compliance with any requirements of Banana Shire Council as road manager.

Although owner's consent for the development has been provided and no tenure under the *Land Act 1994* is required, the applicant is to undertake works on the land only if and when the development application has been approved by the assessment manager or responsible entity, and in accordance with the conditions of that approval.

A copy of this letter is to be attached to your development application as the required evidence of owner's consent.

The applicant will also need to comply with all other legislative and regulatory requirements which may also include approvals that are not part of the assessment of the development application under the *Planning Act 2016* e.g. a marine park permit if in a marine park.

Further, please note that the above consent will expire on **21 November 2021.** Should the development application not be lodged with the assessment manager or responsible entity prior to this date, you will be required again to lodge a further request for owner's consent and any further request will need to be reconsidered by the department.

It is also advised that any land use activities must comply with the *Aboriginal Cultural Heritage Act 2003* or the *Torres Strait Islander Heritage Act 2003.* Please note that it is the responsibility of the assessment manager to address native title rights and interests in accordance with the *Native Title Act 1993.*

Finally, owner's consent is required under the *Planning Act 2016* to enable the application to be considered properly made for lodging with the assessment manager or responsible entity and is a completely separate process to assessment of the application under the *Planning Act 2016.*

Postal :
Resources Rockhampton
PO Box 1762
Rockhampton
4700 QLD

Telephone : (07) 48373300
Fax: (07) 48373421

Accordingly, the State may act at a later date as assessment manager or responsible entity or referral agency or affected entity in the assessment of the development application - providing owner's consent will not influence any role the State may have in this development assessment.

If you wish to discuss this matter please contact Rayden Smith on (07) 4837 3378

All future correspondence relative to this matter is to be referred to the contact Officer at the address below or by email to SLAM-Rockhampton@resources.qld.gov.au. Any hard copy correspondence received will be electronically scanned and filed. For this reason, it is recommended that any attached plans, sketches or maps be no larger than A3-sized.

Please quote reference number 2021/000957 in any future correspondence.

Yours sincerely

RM Smith

For Emily van der Meer
Senior Land Officer
A duly authorised delegate of the Minister
under the current Land Act (Ministerial) Delegation

Scale 1:12500 at A3

0 500 1,000 Metres

GDA 1994 MGA Zone 56

Legend

- Study Area (16,758 Ha)
- Project Site (Development Corridor - 1975 Ha)
- Participating Properties
- Local Government Area (LGA)
- Lot 1 RL5827
- Property Boundaries
- Profit à Prendre (030RN72)
- Consent Request Area

Proposed Project Infrastructure

- Access and Overhead / Underground Cabling
- Permanent Met Masts
- Temporary Met Masts
- Turbines

FIGURE 1.1

Mount Hopeful Wind Farm
Department of Resources
Owners Consent Request

NB. Layout is Indicative Only

Image Source: ESRI Basemap (2021) Data source: QLD Spatial (2021)

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 29147176
Search Date: 20/07/2018 16:06

Title Reference: 50466365
Date Created: 11/11/2003

Previous Title: 40039254

REGISTERED OWNER

Dealing No: 718664658 29/03/2018

HARRY WALKER TREELOPPING PTY LTD A.C.N. 104 480 962

ESTATE AND LAND

Estate in Fee Simple

LOT 21   CROWN PLAN RN1345
Local Government: BANANA

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 40039254 (Lot 21 on CP RN1345)

2. MORTGAGE No 718664662 29/03/2018 at 14:15
RURAL BANK LIMITED A.C.N. 083 938 416

ADMINISTRATIVE ADVICES - NIL
UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH

NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 28909711

Search Date: 20/06/2018 17:09 | Title Reference: 30632132

Date Created: 18/11/1992

REGISTERED OWNER

Dealing No: 718664658 29/03/2018

HARRY WALKER TREELOPPING PTY LTD A.C.N. 104 480 962

ESTATE AND LAND

Estate in Fee Simple

LOT 23   CROWN PLAN RN25
Local Government: BANANA

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30632132 (Lot 23 on CP RN25)

2. MORTGAGE No 718664662 29/03/2018 at 14:15
   RURAL BANK LIMITED A.C.N. 083 938 416

ADMINISTRATIVE ADVICES - NIL
UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 29141834
Search Date: 20/07/2018 10:43

Title Reference: 50466366
Date Created: 11/11/2003

Previous Title: 40039250

REGISTERED OWNER

Dealing No: 718664658 29/03/2018

HARRY WALKER TREELOPPING PTY LTD A.C.N. 104 480 962

ESTATE AND LAND

Estate in Fee Simple

LOT 24   CROWN PLAN RN34
Local Government: BANANA

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 40039250 (Lot 24 on CP RN34)

2. MORTGAGE No 718664662 29/03/2018 at 14:15
RURAL BANK LIMITED A.C.N. 083 938 416

ADMINISTRATIVE ADVICES - NIL
UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 35821337
Search Date: 15/12/2020 13:38
Title Reference: 18831040
Date Created: 21/04/1995

REGISTERED OWNER

Dealing No: 713851921 13/05/2011

LTH GRAZING PTY LTD A.C.N. 133 601 046
TRUSTEE
UNDER INSTRUMENT 713851921

ESTATE AND LAND

Estate in Fee Simple

LOT 21   CROWN PLAN RN46
Local Government: ROCKHAMPTON

For exclusions / reservations for public purposes refer to
Plan CP RN46

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 18831040 (Lot 21 on CP RN46)

2. MORTGAGE No 717224546 04/05/2016 at 10:14
   STACKS MANAGED INVESTMENTS LIMITED A.C.N. 085 843 125

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271879	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:22	CURRENT
712600277	RESTORATION VEGETATION MANAGEMENT ACT 1999	16/07/2009 16:17	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 35821336
Search Date: 15/12/2020 13:38
Title Reference: 30149097
Date Created: 21/07/1926

REGISTERED OWNER

Dealing No: 713851921 13/05/2011

LTH GRAZING PTY LTD A.C.N. 133 601 046
TRUSTEE
UNDER INSTRUMENT 713851921

ESTATE AND LAND

Estate in Fee Simple

LOT 2039   CROWN PLAN RAG4056
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30052152 (POR 2039)

2. MORTGAGE No 717224546 04/05/2016 at 10:14
   STACKS MANAGED INVESTMENTS LIMITED A.C.N. 085 843 125

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271879	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:22	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 35821335
Search Date: 15/12/2020 13:38 Title Reference: 30166206
Date Created: 16/07/1931

Previous Title: 30052151

REGISTERED OWNER

Dealing No: 713851921 13/05/2011

LTH GRAZING PTY LTD A.C.N. 133 601 046
TRUSTEE
UNDER INSTRUMENT 713851921

ESTATE AND LAND

Estate in Fee Simple

LOT 1933 CROWN PLAN RAG4058
Local Government: ROCKHAMPTON

For exclusions / reservations for public purposes refer to
Plan CP RAG4058

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 30052151 (POR 1933)

2. MORTGAGE No 717224546 04/05/2016 at 10:14
STACKS MANAGED INVESTMENTS LIMITED A.C.N. 085 843 125

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271879	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:22	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 35821334
Search Date: 15/12/2020 13:38 Title Reference: 30487077
Date Created: 21/10/1981

Previous Title: 30052150

REGISTERED OWNER

Dealing No: 713851921 13/05/2011

LTH GRAZING PTY LTD A.C.N. 133 601 046
TRUSTEE
UNDER INSTRUMENT 713851921

ESTATE AND LAND

Estate in Fee Simple

LOT 2057 CROWN PLAN RAG4059
Local Government: ROCKHAMPTON

For exclusions / reservations for public purposes refer to
Plan CP RAG4059

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30052150 (POR 2057)

2. MORTGAGE No 717224546 04/05/2016 at 10:14
   STACKS MANAGED INVESTMENTS LIMITED A.C.N. 085 843 125

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271879	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:22	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 35821333
Search Date: 15/12/2020 13:38 Title Reference: 30540062
Date Created: 26/03/1985

Previous Title: 30507168

REGISTERED OWNER

Dealing No: 713851921 13/05/2011

LTH GRAZING PTY LTD A.C.N. 133 601 046
TRUSTEE
UNDER INSTRUMENT 713851921

ESTATE AND LAND

Estate in Fee Simple

LOT 15 CROWN PLAN RN1089
Local Government: ROCKHAMPTON

For exclusions / reservations for public purposes refer to Plan CP RN1089

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 30507168 (Lot 15 on CP RN1089)

2. EASEMENT IN GROSS No 602651953 (C519224) 03/07/1986
BURDENING THE LAND
TO THE COMMISSIONER OF MAIN ROADS
OVER EASEMENT A ON RP616362

3. MORTGAGE No 717224546 04/05/2016 at 10:14
STACKS MANAGED INVESTMENTS LIMITED A.C.N. 085 843 125

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271879	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:22	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

CURRENT TITLE SEARCH

NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 35821338

Search Date: 15/12/2020 13:38

Title Reference: 30550225

Date Created: 07/01/1986

REGISTERED OWNER

Dealing No: 713851921 13/05/2011

LTH GRAZING PTY LTD A.C.N. 133 601 046

TRUSTEE

UNDER INSTRUMENT 713851921

ESTATE AND LAND

Estate in Fee Simple

LOT 25   CROWN PLAN RN25

Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 30550225 (Lot 25 on CP RN25)
2. MORTGAGE No 717224546 04/05/2016 at 10:14
   STACKS MANAGED INVESTMENTS LIMITED A.C.N. 085 843 125

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271879	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:22	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

Queensland Titles Registry Pty Ltd
ABN 23 648 568 101

Current Title Search

Title Reference:	**51178666**	**Search Date:**	17/05/2023 19:36
Date Title Created:	29/03/2019	**Request No:**	44448886
Previous Title:	40076377		

ESTATE AND LAND

Estate in Fee Simple

LOT 30 CROWN PLAN RN72
Local Government: BANANA

REGISTERED OWNER

Dealing No: 719333971 29/03/2019

BRETT STEWART CHRISTIE
RENEE MICHELLE CHRISTIE JOINT TENANTS

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 40076377 (Lot 30 on CP RN72)
2. MORTGAGE No 716905671 24/11/2015 at 12:11
   NATIONAL AUSTRALIA BANK LIMITED A.B.N. 12 004 044 937
3. PROFIT A PRENDRE No 718920068 09/08/2018 at 10:19
   THE STATE OF QUEENSLAND
   (REPRESENTED BY DEPARTMENT OF AGRICULTURE AND FISHERIES)
4. COVENANT No 721063756 02/09/2021 at 14:30
   restricts dealings over
   LOT A ON AP2337,
   LOT 1 ON SP127210,
   LOT 2 ON RN33,
   LOT 3 ON RN34,
   LOT 30 ON RN72
5. CAVEAT No 721632379 20/04/2022 at 16:23
   NEOEN AUSTRALIA PTY LTD A.C.N. 160 905 706

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711239485	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	04/12/2007 13:07	CURRENT
712151809	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	09/01/2009 10:21	CURRENT

UNREGISTERED DEALINGS

NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested by: D-ENQ CITEC CONFIRM

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 31153980
Search Date: 07/05/2019 13:25 — Title Reference: 50884388
Date Created: 27/06/2012

Previous Title: 30304095
30304096

REGISTERED OWNER

Dealing No: 714520760 20/06/2012

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 33   CROWN PLAN DT40123
Local Government: ROCKHAMPTON

For exclusions / reservations for public purposes refer to
Plan CP DT40123

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30141066 (POR 33V)

2. MORTGAGE No 714520804 20/06/2012 at 12:12
   SUNCORP-METWAY LTD A.B.N. 66 010 831 722

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 31153977
Search Date: 07/05/2019 13:25 | Title Reference: 50884386
Date Created: 27/06/2012

Previous Title: 30304089
30304090

REGISTERED OWNER

Dealing No: 714520760 20/06/2012

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 50 CROWN PLAN DT40144
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 30134058 (POR 50V)

2. MORTGAGE No 714520804 20/06/2012 at 12:12
SUNCORP-METWAY LTD A.B.N. 66 010 831 722

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
QUEENSLAND TITLES REGISTRY PTY LTD

Request No: 37807438
Search Date: 08/07/2021 15:43

Title Reference: 50884382
Date Created: 27/06/2012

Previous Title: 30304081
30304082

REGISTERED OWNER

Dealing No: 714520760 20/06/2012

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 38   CROWN PLAN DT40131
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30134204 (POR 38V)

2. MORTGAGE No 714520804 20/06/2012 at 12:12
   SUNCORP-METWAY LTD A.B.N. 66 010 831 722

3. MORTGAGE No 720868421 17/06/2021 at 09:37
   REGIONAL INVESTMENT CORPORATION

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ DYE & DURHAM

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 31153982
Search Date: 07/05/2019 13:25 Title Reference: 51099413
Date Created: 16/06/2017

Previous Title: 40073621

REGISTERED OWNER

Dealing No: 718089668 16/06/2017

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 100 SURVEY PLAN 289441
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30092085 (POR 2120)

2. EASEMENT IN GROSS No 601605527 (C358089) 12/09/1977
   BURDENING THE LAND
   TO THE CAPRICORNIA REGIONAL ELECTRICITY BOARD
   OVER EASEMENT A ON RP12717

3. MORTGAGE No 714520804 20/06/2012 at 12:12
   SUNCORP-METWAY LTD A.B.N. 66 010 831 722

4. EASEMENT IN GROSS No 715724791 17/04/2014 at 15:57
   burdening the land
   ERGON ENERGY CORPORATION LIMITED A.C.N. 087 646 062
   over
   EASEMENT B ON SP262817

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 28909700
Search Date: 20/06/2018 17:08 Title Reference: 50884381
Date Created: 27/06/2012

Previous Title: 30304079
30304080

REGISTERED OWNER

Dealing No: 714520760 20/06/2012

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 148 CROWN PLAN DS151
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
Deed of Grant No. 30203084 (POR 148)

2. MORTGAGE No 714520804 20/06/2012 at 12:12
SUNCORP-METWAY LTD A.B.N. 66 010 831 722

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH

NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 31153978

Search Date: 07/05/2019 13:25

Title Reference: 50884383

Date Created: 27/06/2012

Previous Title: 30304083
30304084

REGISTERED OWNER

Dealing No: 714520760 20/06/2012

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 2345   CROWN PLAN DT4077
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by Deed of Grant No. 30068106 (POR 2345)

2. MORTGAGE No 714520804 20/06/2012 at 12:12
SUNCORP-METWAY LTD A.B.N. 66 010 831 722

3. MORTGAGE No 718008941 09/05/2017 at 12:17
QRAA

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

Requested By: D-ENQ SAI GLOBAL

CURRENT TITLE SEARCH
NATURAL RESOURCES, MINES AND ENERGY, QUEENSLAND

Request No: 28909116
Search Date: 20/06/2018 16:28

Title Reference: 50884385
Date Created: 27/06/2012

Previous Title: 30304087
30304088

REGISTERED OWNER

Dealing No: 714520760 20/06/2012

BRETT ANDREW MCCAMLEY

ESTATE AND LAND

Estate in Fee Simple

LOT 2420   CROWN PLAN DT4077
Local Government: ROCKHAMPTON

EASEMENTS, ENCUMBRANCES AND INTERESTS

1. Rights and interests reserved to the Crown by
   Deed of Grant No. 30057128 (POR 2420)

2. MORTGAGE No 714520804 20/06/2012 at 12:12
   SUNCORP-METWAY LTD A.B.N. 66 010 831 722

ADMINISTRATIVE ADVICES

Dealing	Type	Lodgement Date	Status
711271914	VEG NOTICE VEGETATION MANAGEMENT ACT 1999	13/12/2007 15:25	CURRENT

UNREGISTERED DEALINGS - NIL

CERTIFICATE OF TITLE ISSUED - No

Caution - Charges do not necessarily appear in order of priority

** End of Current Title Search **

From: Maxime Forster
To: Renee Brozovich
Subject: FW: Mount Hopeful Wind Farm (2109-24892 SDA) - Project Changes and Relevant Purpose Determination
Date: Thursday, 18 May 2023 11:17:34 AM
Attachments: image002.png
image004.png
image001.png
230125_Umwelt_TWilliamson_DesignData_Transfer.zip

---

*This message originated from outside of Umwelt - **BE CAUTIOUS** opening any link or attachment.*

Hi Renee,

This is the email Mitch forwarded me to confirm that no RPD was required for our DA Change.

Kind regards,

Maxime Forster
Senior Project Manager

____

NEOEN

Level 21 – 570 George Street, Sydney NSW 2000
M. +61 (0) 476 762 382
https://www.neoen.com/en/

From: Mitchell King <mking@umwelt.com.au>
Sent: Tuesday, February 7, 2023 3:56 PM
To: Maxime Forster <Maxime.Forster@neoen.com>
Subject: FW: Mount Hopeful Wind Farm (2109-24892 SDA) - Project Changes and Relevant Purpose Determination

Hi Maxime

Great news – no change to the RPD necessary!

Thanks
Mitch

Mitchell King, MPIA
Principal Urban and Environmental Planner

Umwelt (Australia) Pty Limited
Phone: 1300 793 267
Mobile: 0402 859 036

www.umwelt.com.au

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From: Reneta Pope <Reneta.Pope@resources.qld.gov.au>
Sent: Tuesday, 7 February 2023 1:54 PM
To: Mitchell King <mking@umwelt.com.au>
Cc: Angela Mason <Angela.Mason@resources.qld.gov.au>
Subject: RE: Mount Hopeful Wind Farm (2109-24892 SDA) - Project Changes and Relevant Purpose Determination

Hi Mitch,

As discussed, I have reviewed the information you provided, including the attached shapefile and have determined that the proposed changes remain for a relevant purpose in line with the existing relevant purpose determination (reference number 2021/000825).

This confirmation has been made as:

- the existing relevant purpose determination (RPD) has not yet expired;
- the clearing required for the proposed changes will be for relevant infrastructure that was considered as part of the existing RPD;
- the infrastructure is necessary for the proposed development and the development has already been confirmed as 'necessary' infrastructure in the existing RPD confirmation; and;
- the clearing within the category B area has been reduced due to changes in design that has increased the development footprint within the category X area.

Please ensure that the attached shapefile is submitted with the change application.

If you have any further questions, please don't hesitate to contact me.

Regards

Queensland Government

Reneta Pope
A/Senior Natural Resource Management Officer
Vegetation Management | Natural Resource Operations
Department of Resources

P: 07 4447 9160 **M:** 0467 770 460
E: reneta.pope@resources.qld.gov.au
A: Level 9, 445 Flinders street, Townsville | PO Box 5318, Townsville Qld 4810
W: www.resources.qld.gov.au
Pronouns: She/Her

From: Mitchell King <mking@umwelt.com.au>
Sent: Monday, 6 February 2023 12:19 PM
To: Reneta Pope
Subject: FW: Mount Hopeful Wind Farm (2109-24892 SDA) - Project Changes and Relevant Purpose Determination

Good morning Reneta

I hope you had a great weekend.

The client has asked me for an update on the status of the Project Changes as it relates to the s22A process. I've mentioned that I discussed this over the phone with you last week, and just wanted to check to see if you could let me know when to expect your advice?

Please feel free to call if you'd like to discuss.

Thanks
Mitch

Mitchell King, MPIA
Principal Urban and Environmental Planner

Umwelt (Australia) Pty Limited
Phone: 1300 793 267
Mobile: 0402 859 036

www.umwelt.com.au

From: Mitchell King
Sent: Friday, 27 January 2023 9:13 AM
To: veg.development@resources.qld.gov.au
Cc: Angela Mason <Angela.Mason@resources.qld.gov.au>
Subject: Mount Hopeful Wind Farm (2109-24892 SDA) - Project Changes and Relevant Purpose Determination

Good morning

Please find attached correspondence relating to Project changes for the Mount Hopeful Wind Farm (2109-24892 SDA) and the current s22A for the Project.

Please contact me on the below should you wish to discuss in any further detail.

Thank you

Mitchell King, MPIA
Principal Urban and Environmental Planner

Umwelt (Australia) Pty Limited
Phone: 1300 793 267
Mobile: 0402 859 036

www.umwelt.com.au

Change application form

Planning Act Form 5 (version 1.2 effective 7 February 2020) made under Section 282 of the Planning Act 2016.

This form is to be used for a change application made under section 78 of the *Planning Act 2016*. It is important when making a change application to be aware of whether the application is for a minor change that will be assessed under section 81 of the *Planning Act 2016* or for an other change that will be assessed under section 82 of the *Planning Act 2016*.

An applicant must complete all parts of this form, and provide any supporting information that the form identifies as being required to accompany the change application, unless stated otherwise. Additional pages may be attached if there is insufficient space on the form to complete any part.

Note*: All terms used in this form have the meaning given under the Planning Act 2016, the Planning Regulation 2017, or the Development Assessment Rules (DA Rules).*

PART 1 – APPLICANT DETAILS

1) Applicant details	
Applicant name(s) (*individual or company full name*)	Neoen Australia Pty Ltd C/- Umwelt (Australia) Pty Ltd
Contact name *(only applicable for companies)*	Renee Brozovich – Umwelt (Australia) Pty Ltd
Postal address *(P.O. Box or street address)*	GPO PO Box 1570
Suburb	Brisbane
State	QLD
Postcode	4000
Country	Australia
Email address *(non-mandatory)*	0401097387
Mobile number *(non-mandatory)*	rbrozovich@umwelt.com.au
Applicant's reference number(s) *(if applicable)*	7053

2) Owner's consent - Is written consent of the owner required for this change application?
Note*: Section 79(1A) of the Planning Act 2016 states the requirements in relation to owner's consent.*

☒ Yes – the written consent of the owner(s) is attached to this change application
☐ No

PART 2 – LOCATION DETAILS

3) Location of the premises *(complete 3.1) or 3.2), and 3.3) as applicable)*

3.1) Street address and lot on plan

☐ Street address **AND** lot on plan (*all lots must be listed*), ***or***
☐ Street address **AND** lot on plan for an adjoining or adjacent property of the premises *(appropriate for development in water but adjoining or adjacent to land e.g. jetty, pontoon. All lots must be listed).*

a)	Unit No.	Street No.	Street Name and Type	Suburb
			Glengowan Road	Ulogie
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4702	Lot 30	RN72	Banana Shire Council
b)	Unit No.	Street No.	Street Name and Type	Suburb
			Glengowan Road	Ulogie
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4702	Lot 21	RN1345	Banana Shire Council

Queensland Government

c)	Unit No.	Street No.	Street Name and Type	Suburb
			Glengowan Road	Ulogie
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4702	Lot 24	RN34	Banana Shire Council
d)	Unit No.	Street No.	Street Name and Type	Suburb
			Glengowan Road	Ulogie
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4702	Lot 23	RN25	Banana Shire Council
e)	Unit No.	Street No.	Street Name and Type	Suburb
		1682A	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 21	RN46	Rockhampton Regional Council
f)	Unit No.	Street No.	Street Name and Type	Suburb
		1682A	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 25	RN25	Rockhampton Regional Council
g)	Unit No.	Street No.	Street Name and Type	Suburb
		1682A	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 2039	RAG4056	Rockhampton Regional Council
h)	Unit No.	Street No.	Street Name and Type	Suburb
		1682A	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 1933	RAG4058	Rockhampton Regional Council
i)	Unit No.	Street No.	Street Name and Type	Suburb
		1682A	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 2057	RAG4059	Rockhampton Regional Council
j)	Unit No.	Street No.	Street Name and Type	Suburb
		1682A	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 15	RN1089	Rockhampton Regional Council
k)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 148	DS151	Rockhampton Regional Council
l)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 2420	DT4077	Rockhampton Regional Council
m)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 2345	DT4077	Rockhampton Regional Council

n)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 50	DT40144	Rockhampton Regional Council
o)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 33	DT40123	Rockhampton Regional Council
p)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 38	DT40131	Rockhampton Regional Council
q)	Unit No.	Street No.	Street Name and Type	Suburb
		1682	South Ulam Road	Bajool
	Postcode	Lot No.	Plan Type and Number (e.g. RP, SP)	Local Government Area(s)
	4699	Lot 100	SP289441	Rockhampton Regional Council

3.2) Coordinates of premises *(appropriate for development in remote areas, over part of a lot or in water not adjoining or adjacent to land e.g. channel dredging in Moreton Bay)*
***Note**: Place each set of coordinates in a separate row.*

☐ Coordinates of premises by longitude and latitude

Longitude(s)	Latitude(s)	Datum	Local Government Area(s) *(if applicable)*
		☐ WGS84 ☐ GDA94 ☐ Other:	

☐ Coordinates of premises by easting and northing

Easting(s)	Northing(s)	Zone Ref.	Datum	Local Government Area(s) *(if applicable)*
		☐ 54 ☐ 55 ☐ 56	☐ WGS84 ☐ GDA94 ☐ Other:	

3.3) Additional premises

☐ Additional premises are relevant to the original development approval and the details of these premises have been attached in a schedule to this application
☒ Not required

PART 3 – RESPONSIBLE ENTITY DETAILS

4) Identify the responsible entity that will be assessing this change application
***Note**: see section 78(3) of the Planning Act 2016*

PART 4 – CHANGE DETAILS

5) Provide details of the existing development approval subject to this change application

Approval type	Reference number	Date issued	Assessment manager/approval entity

☒ Development permit ☐ Preliminary approval	2109-24892 SDA	17 June 2022	Department of State Development, Infrastructure, Local Government and Planning as represented by the State Assessment and Referral Agency
☐ Development permit ☐ Preliminary approval			

6) Type of change proposed
6.1) Provide a brief description of the changes proposed to the development approval *(e.g. changing a development approval for a five unit apartment building to provide for a six unit apartment building)*:
Smaller Project that now incorporates up to 63 turbines and ancillary infrastructure as opposed to 97 turbines and ancillary infrastructure.
6.2) What type of change does this application propose?
☒ Minor change application – proceed to Part 5 ☐ Other change application – proceed to Part 6

PART 5 – MINOR CHANGE APPLICATION REQUIREMENTS

7) Are there any affected entities for this change application		
☒ No – proceed to Part 7 ☐ Yes – list all affected entities below and proceed to Part 7 ***Note***: *section 80(1) of the Planning Act 2016 states that the person making the change application must give notice of the proposal and the details of the change to each affected entity as identified in section 80(2) of the Planning Act 2016.*		
Affected entity	Pre-request response provided? (*where a pre-request response notice for the application has been given, a copy of the notice must accompany this change application)*	Date notice given *(where no pre-request response provided)*
	☐ No ☐ Yes – pre-request response is attached to this change application	
	☐ No ☐ Yes – pre-request response is attached to this change application	
	☐ No ☐ Yes – pre-request response is attached to this change application	

PART 6 – OTHER CHANGE APPLICATION REQUIREMENTS

Note: *To complete this part it will be necessary for you to complete parts of DA Form 1 – Development application details and in some instances parts of DA Form 2 – Building work details, as mentioned below. These forms are available at https://planning.dsdmip.qld.gov.au.*

8) Location details - Are there any additional premises included in this change application that were not part of the original development approval?

☐ No
☐ Yes

9) Development details

9.1) Is there any change to the type of development, approval type, or level of assessment in this change application?

☐ No
☐ Yes – the completed Sections 1 and 2 of Part 3 (Development details) of *DA Form 1 – Development application details* as these sections relate to the new or changed aspects of development are provided with this application.

9.2) Does the change application involve building work?

☐ No
☐ Yes – the completed Part 5 (Building work details) of *DA Form 2 – Building work details* as it relates to the change application is provided with this application.

10) Referral details – Does the change application require referral for any referral requirements?

Note: *The application must be referred to each referral agency triggered by the change application as if the change application was the original development application including the proposed change.*

☐ No
☐ Yes – the completed Part 5 (Referral details) of *DA Form 1 – Development application details* as it relates to the change application is provided with this application. Where referral is required for matters relating to building work the Referral checklist for building work is also completed.

11) Information request under Part 3 of the DA Rules

☐ I agree to receive an information request if determined necessary for this change application
☐ I do not agree to accept an information request for this change application

Note: *By not agreeing to accept an information request I, the applicant, acknowledge:*

- *that this change application will be assessed and decided based on the information provided when making this change application and the assessment manager and any referral agencies relevant to the change application are not obligated under the DA Rules to accept any additional information provided by the applicant for the change application unless agreed to by the relevant parties*
- *Part 3 of the DA Rules will still apply if the application is an application listed under section 11.3 of the DA Rules.*

Further advice about information requests is contained in the DA Forms Guide: Forms 1 and 2.

12) Further details

☐ Part 7 of *DA Form 1 – Development application details* is completed as if the change application was a development application and is provided with this application.

PART 7 – CHECKLIST AND APPLICANT DECLARATION

13) Change application checklist

I have identified the: • responsible entity in 4); and • for a minor change, any affected entities; and • for an other change all relevant referral requirement(s) in 10) ***Note****: See the Planning Regulation 2017 for referral requirements*	☒ Yes
For an other change application, the relevant sections of *DA Form 1 – Development application details* have been completed and is attached to this application	☐ Yes ☒ Not applicable
For an other change application, where building work is associated with the change application, the relevant sections of *DA Form 2 – Building work details* have been completed and is attached to this application	☐ Yes ☒ Not applicable
Supporting information addressing any applicable assessment benchmarks is attached to this application ***Note****: This includes any templates provided under 23.6 and 23.7 of DA Form 1 – Development application details that are relevant as a result of the change application, a planning report and any technical reports required by the relevant categorising instrument(s) (e.g. the local government planning scheme, State Planning Policy, State Development Assessment Provisions). For further information, see DA Forms Guide: Planning report template.*	☒ Yes
Relevant plans of the development are attached to this development application ***Note****: Relevant plans are required to be submitted for all relevant aspects of this change application. For further information, see DA Forms Guide: Relevant plans.*	☒ Yes

14) Applicant declaration

☒ By making this change application, I declare that all information in this change application is true and correct.

☒ Where an email address is provided in Part 1 of this form, I consent to receive future electronic communications from the responsible entity and any relevant affected entity or referral agency for the change application where written information is required or permitted pursuant to sections 11 and 12 of the *Electronic Transactions Act 2001*.

Note*: It is unlawful to intentionally provide false or misleading information.*

Privacy – Personal information collected in this form will be used by the responsible entity and/or chosen assessment manager, any relevant affected entity or referral agency and/or building certifier (including any professional advisers which may be engaged by those entities) while processing, assessing and deciding the change application.

All information relating to this change application may be available for inspection and purchase, and/or published on the assessment manager's and/or referral agency's website.

Personal information will not be disclosed for a purpose unrelated to the *Planning Act 2016*, Planning Regulation 2017 and the DA Rules except where:

- such disclosure is in accordance with the provisions about public access to documents contained in the *Planning Act 2016* and the Planning Regulation 2017, and the access rules made under the *Planning Act 2016* and Planning Regulation 2017; or
- required by other legislation (including the *Right to Information Act 2009*); or
- otherwise required by law.

This information may be stored in relevant databases. The information collected will be retained as required by the *Public Records Act 2002*.

PART 8 – FOR COMPLETION OF THE ASSESSMENT MANAGER – FOR OFFICE USE ONLY

Date received:		Reference number(s):	

QLeave notification and payment *Note: For completion by assessment manager if applicable*			
Description of the work			
QLeave project number			
Amount paid ($)		Date paid (dd/mm/yy)	
Date receipted form sighted by assessment manager			
Name of officer who sighted the form			